2018 Electric System Reliability Performance Report

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Executive Summary

This report describes the Snohomish County PUD's (District) electric system reliability from January 1, 2018, through December 31, 2018.

In 2018, the District retired the legacy Outage Reporting System (ORS) as the system of record when the new Outage Management System (OMS) was put into service. In conjunction with the adoption of OMS as the system of record, several significant changes occurred.

The number of outages recorded in 2018 and beyond increased as compared to previous years because outage records are automatically generated in OMS, rather than the manual process required by ORS. IEEE recognizes this phenomenon as typical, and provides a calculation method for an 'uplift factor', described in IEEE Standard 1782, as a means of allowing more accurate comparison of records prior to an OMS implementation, to post-OMS data. This 'uplift factor' has been applied to the previous five years' average data. Appendix C provides additional data on historical performance without the uplift factor applied.

Before OMS, manually tracking outages in ORS was suspended during declared major events, and high-level estimates of outages were used. With the ability to record all outages in OMS, the District has adopted the IEEE defined term, Major Event Day (MED). This allows outages occurring during non-routine conditions to be differentiated from daily operations. MEDs are defined in IEEE Guideline 1366 "Guide for Electric Power Distribution Reliability Indices."

In addition to tracking outages during non-routine conditions, the District now tracks planned outages, although neither planned outages nor those occurring on MEDs will be included in the District's SAIDI, SAIFI and CAIDI system indices, and are listed separately. This will allow these reliability indices to reflect reliability experienced under routine conditions to better reveal trends in daily operation, which could be skewed by major events or construction.

District customers lost power for an average of 92.9 minutes (SAIDI) in 2018 during routine operation. This is lower than the adjusted five-year average of 123.8 minutes. The average length of time required to restore power after an outage was 102.3 minutes (CAIDI) in 2018 during routine operation. This is higher than the adjusted five-year average of 99.1 minutes. District customers lost power an average of 0.91 times (SAIFI) in 2018 during routine operation. This is lower than the adjusted five-year average of 1.25 interruptions.

There were three MEDs (any day greater than 16.37 SAIDI) for the year, which occurred on February 18, December 14, December 20.

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1 Background

1.1 Introduction

Understanding the causes of outages and developing methods or programs to reduce their rate of occurrence are two of the most important goals in the operation of any electric utility. This report identifies the causes of the outages in 2018 and their impacts on system reliability.

The District receives power from the Bonneville Power Administration (BPA) at three delivery points, the BPA Murray, SnoKing, and Snohomish substations. Transmission lines from those substations deliver power at 115 kV to 90 (including Jackson Hydro) distribution substations and switching stations in the District's service area. A typical distribution substation has four 12.47 kV circuits and serves an average of 4,000 customers. The District's service territory includes long circuits in the eastern and northern areas of the county, with high tree exposure through rural areas. These circuits experience relatively more outages. The urban and suburban areas in Everett and the south county area typically have shorter circuits and fewer outages.

1.2 Statistical indicators used

The District measures electric system reliability using indices defined by the Institute of Electrical and Electronics Engineers (IEEE). The definitions come from the current revision of IEEE Standard 1366- IEEE Guide for Electric Power Distribution Reliability Indices. The standard defines these indices as "sustained interruption indices," meaning a loss of service to one or more customers for more than five minutes. At present the District defines an outage as a loss of service for one or more minutes.

SAIDI (System Average Interruption Duration Index)

This index measures the total duration of interruption for the average customer during a predefined period of time. It is commonly measured in customer minutes of interruption. Mathematically, this is calculated using the following equation:

$$\text{SAIDI} = \frac{\sum \text{Customer Interruption Durations}}{\text{Total Number of Customers Served}}$$

SAIDI can be calculated for any defined set of customers, such as all customers served from a specific circuit, all customers served from a specific substation, or for all District customers.

CAIDI (Customer Average Interruption Duration Index)

This index represents the average time required to restore service to customers after an interruption. Mathematically, this is calculated using the following equation:

$$\text{CAIDI} = \frac{\sum \text{Customer Interruption Durations}}{\text{Total Number of Customers Interrupted}}$$

CAIDI can also be calculated for any defined set of customers.

SAIFI (System Average Interruption Frequency Index)

This index indicates how often the average customer experiences a sustained interruption over a predefined period of time. Mathematically, this is calculated using the following equation:

$$\text{SAIFI} = \frac{\sum \text{Total Number of Customers Interrupted}}{\text{Total Number of Customers Served}}$$

Similar to SAIDI and CAIDI, SAIFI can be calculated for any defined set of customers.

MED (Major Event Day)

A Major Event Day is used to define a 24-hour period during which SAIDI exceeds a threshold, separating these statistics from those for typical day-to-day operations. This will prevent exceptional days from skewing statistics, allowing reliability analysis to be based on typical days. The SAIDI threshold to distinguish a day as a MED is calculated using the equation:

$$\text{MED} = e^{(\alpha + 2.5\beta)}$$

Where α is the average of the logarithms of the daily non-zero SAIDI and β is the log-standard deviation of the daily SAIDI.

MAIFI (Momentary Average Interruption Frequency Index)

This index indicates how often the average customer experiences a momentary interruption over a predefined period of time. Mathematically, this is calculated using the following equation:

$$\text{MAIFI} = \frac{\sum \text{Total Number of Customers Experiencing a Momentary Interruption}}{\text{Total Number of Customers Served}}$$

Because OMS uses breaker status change information, a portion of the momentary outages that customers experience can now be tracked as well. Similar to SAIDI and CAIDI, MAIFI can be calculated for any defined set of customers.

2 Outage Data Collection

2.1 Record-keeping

Until February 2017, the District used a computerized Outage Reporting System (ORS) to manually record information on outages occurring during routine operations. The District's practice was not to record outages that occurred during major events. This was done to alleviate the need for time spent recording outages, so that efforts could be focused on restoration.

Starting in February 2017, the District switched to using an Outage Management System (OMS). OMS automatically creates outage records based on customer calls, prediction rules and switching operations regardless of a major event, on all days of the year. The purpose of this change is to be more consistent and comprehensive in outage information recording. The effect of implementing this new system has been an increase in recorded SAIDI and SAIFI, as all customer outages are now accounted for automatically.

2.2 Change in record-keeping during non-routine operations

The District will no longer exclude outages during major events declared by the Incident Commander from reliability calculations. Moving forward the MED threshold will be used to determine which outages will be excluded from routine-operation statistics. MEDs will be included in their own category for record keeping.

3 System Reliability Statistics

3.1 Data for 2018

The tables below show the statistical data for outages in 2018, as well as average data for the five previous years. Refer to Section 1 for definitions of the terms SAIDI, CAIDI, and SAIFI.

The 2018 system SAIDI and SAIFI values were higher than the five-year averages. November 13th was the only MED that occurred in 2018. Outages that occurred during an MED, prearranged/planned and outages caused by another utility were excluded from these numbers but are shown in their own row for reference.

Table 3 - 1: General Descriptive Data

Year	2018
System Customers	358,110
Area Served	2,200 square miles

Table 3 - 2: Outage Data for 2018

(Sustained Outage > 1 Minute)

	SAIDI	CAIDI	SAIFI	Customer Outages
Distribution	87.4	105.9	0.83	293,765
Transmission	5.5	66.7	0.08	29,589
Overall	92.9	102.3	0.91	323,354
Planned, MED, or External	177.9	239.5	0.74	264,436
Total	270.8	164	1.65	587,790

Table 3 - 3: Five-Year Average Annual Outage Data for the Period 2013-2017 (Pre-OMS)

(Sustained Outage > 1 Minute)

	SAIDI	CAIDI	SAIFI	Customer Outages
Distribution	77.2	105.1	0.73	262,555
Transmission	14.7	69.6	0.21	75,394
Overall	91.9	97.1	0.95	337,949
Planned, MED, or External	9	160	0.06	19,956
Total	101	100.7	1	357,905

Table 3 - 4: Five-Year Average Annual Outage Data for the Period 2013-2017 adjusted for OMS increase

(Sustained Outage > 1 Minute)

	SAIDI	CAIDI	SAIFI	Customer Outages
Distribution	103.5	107.1	0.97	345,614
Transmission	20.6	72.3	0.28	101,165
Overall	124.1	99.2	1.25	446,779
Planned, MED, or External	9.2	159.7	0.06	20,254
Total	133.3	101.8	1.31	467,033

3.2 Effect of Major Event Days on the District

MEDs are days in which the daily system SAIDI exceed a calculated threshold. These are independent of declared major events, which had been used in the past to separate extreme outage days. MEDs are identified to allow study of the system's daily operation, without being influenced by a few large events.

Beginning in 2017, the District implemented OMS, which captures all outage information, including Major Event Days.

Table 3 - 5: 2018 Major Event Days

Date	SAIDI	SAIFI	MAIFI	CAIDI	Customers Affected (Sustained) - Distribution	Customers Affected (Sustained) - Transmission
2018-02-18	30.3	0.1	0.08	295	35,086	1,402
2018-12-14	55.4	0.23	0.12	245.8	74,807	5,789
2018-12-20	84.9	0.37	0.15	228.4	92,993	39,423

4 The Transmission System

4.1 Introduction

For consideration as a transmission outage, an outage must involve the operation of a 55 kV or 115 kV protective device, such as those operating circuit switcher or power circuit breaker. Transmission system outages usually have an impact on a significant number of customers, as all substations fed by that portion of the system are affected.

4.2 Outages

Of the 28 transmission system operations in 2018, the District experienced 13 sustained outages and 15 momentary outage events, resulting in a total of 1,881,904 customer outage minutes. Table 4-1 provides summary information for each transmission or substation operation during 2018.

Table 4 - 4 - 1: Transmission Outages

Outage Number	Date	Line or Device	Substation	Cause	Customer Minutes
1	1/15/2018	Jackson-BPA Snohomish North Loop	Three Lakes, Lake Chaplain	Unknown	Momentary
2	1/27/2018	Beverly Park-Paine Field Line	Casino, Picnic Point, Harbour Pointe, Mukilteo	Unknown	Momentary
3	2/08/2018	Wallace River transformer bank #1	Wallace River	Animal	37,343
4	2/18/2018	East Arlington-Oso 55 kV Line	Oso	Tree	0
5	3/6/2018	Beverly Park-Paine Field Line	Casino, Picnic Point, Harbour Pointe, Mukilteo	Unknown	Momentary
6	3/8/2018	Delta-Stimson (D-M) Line	North Marysville, Central Marysville, Kellogg Marsh	Tree	1,282,739
7	5/24/2018	Olivia Park transformer bank #1	Olivia Park	Insulator failure caused by water leak	453,622
8	6/05/2018	Lake Goodwin-North Stanwood Line		Unknown	Momentary
9	6/10/2018	Everett-Scott-Navy Line		Unknown	Momentary

Outage Number	Date	Line or Device	Substation	Cause	Customer Minutes
10	6/10/2018	BPA Snoking-North Creek Line	Clearview, Cascade, Murphy's Corner, North Creek	Unknown	Momentary
11	6/29/2018	Portage transformer bank #1	Portage	Animal	108,200
12	8/1/2018	Jackson U4	Jackson	Inadvertent generator lockout relay operation	0
13	9/3/2018	Navy-Delta Line	Norton	Unknown	Momentary
14	9/6/2018	Delta-Stimson (D-M) Line	North Marysville, Central Marysville, Kellogg Marsh	Unknown	Momentary
15	10/3/2018	Jackson North Loop	Three Lakes, Lake Chaplain	Failed insulator	Momentary
16	10/3/2018	Jackson North Loop	Three Lakes, Lake Chaplain	Failed insulator	0
17	10/10/2018	Jackson Hydro Project 115kV Bus	Jackson	Inadvertent breaker failure operation	0
18	12/1/2018	Everett-Scott-Navy Line		Failed Insulator caused by bird contact	0
19	12/4/2018	Jackson North Loop	Three Lakes, Lake Chaplain	Unknown	Momentary
20	12/14/2018	Halls Lake-Snoking #1 Line	Brier, Thrashers Corner	Trees	0
21	12/14/2018	Beverly Park-Cottage Brook Line	Hilton Lake, Olympic Pipeline	Unknown	Momentary
22	12/20/2018	Beverly Park-Cottage Brook Line	Hilton Lake, Olympic Pipeline	Unknown	Momentary
23	12/20/2018	Stimson Crossing-Camano Line	North Stanwood, Camano, Sunset, South Camano	Unknown	Momentary
24	12/20/2018	Stimson Crossing-Camano Line	North Stanwood, Camano, Sunset, South Camano	Unknown	Momentary

Outage Number	Date	Line or Device	Substation	Cause	Customer Minutes
25	12/20/2018	Halls Lake-Brightwater Line	Esperance, Alderwood, North Alderwood, Floral Hills, York, Turner's Corner	Trees	0
26	12/20/2018	Stimson Crossing-Eagle Creek Line	Lake Goodwin, Portage	Unknown	Momentary
27	12/20/2018	BPA Murray-Snohomish Line	Granite Falls, Hartford, East Marysville, Frontier, Lake Stevens, Bunk Foss	Tree	0
28	12/23/2018	Stimson Crossing-Eagle Creek Line	Lake Goodwin, Eagle Creek	Misoperation caused by tree fault	0

Following is additional information pertaining to each outage listed in Table 4.1.

1. Jackson-BPA Snohomish North 115kV line. The line tripped at around 19:10:27 on 01-15-2018 due to a temporary LL (A-C) fault located about 3.3 miles from the Jackson terminal. Jackson PCB 1836 and BPA Snohomish PCB B-1699 both tripped and reclosed as designed. The root cause of the fault remains unknown.
2. Beverly Park-Paine Field 115kV line. The line tripped at 12:50 PM on 01-27-2018 due to a temporary LL (A-C) fault located about 8.6 miles from Paine Field; PCB 5293 at Beverly Park and PCB 1892 at Paine Field both tripped and reclosed as designed and the Picnic Point auto-sectionalizing scheme also operated as designed to restore the loop. The root cause of the fault remains unknown.
3. Wallace River Transformer Bank #1. The transformer was tripped offline by its SEL-787 differential relay at around 12:45AM on 02-08-2018. The root cause of the fault was a rat that was found near the 12kV main bus.
4. East Arlington-Oso 55kV line. The line tripped at around 03:53 AM on 02-18-2018 due to a permanent LL (B-C) fault caused by a fallen tree. PCB-1514 at East Arlington which was placed on non-reclose remained locked open and was closed at around 02:17 PM on 02-22-2018 by ECC to restore the line.
5. Beverly Park-Paine Field 115kV line. The line tripped at around 3:17 PM on 03-06-2018 due to a temporary SLG (C-G) fault located about 3.5 miles from Beverly Park; PCB 5293 at Beverly Park and PCB 1892 at Paine Field both tripped and reclosed as designed and the Picnic Point auto-sectionalizing scheme also operated as designed to restore the loop. The root cause of the fault remains unknown.
6. Delta-Stimson Crossing (D-M) 115kV line. The line initially tripped to lockout at around 1:13 AM on 03-08-2018 due to a permanent SLG (B-G) fault caused by a fallen tree about 3.8 miles from

Stimson Crossing. Both the Stimson Crossing and Delta terminals each tripped once during attempts by ECC to restore the loop that same day. The faulted line section was eventually isolated between Switches 1752 and 1666 and Switch 1708 which had previously been opened by the Kellogg Marsh auto-transfer scheme, allowing North Marysville and Central Marysville to be radially fed from Stimson Crossing and Delta respectively.

The Stimson Crossing terminal tripped one more time the following day (03-09-2018) during additional switching performed by ECC to attempt to restore the loop, which ECC was able to do at around 10:20PM that day.

7. Olivia Park Transformer Bank #1. The transformer was tripped offline by its SEL-787 differential relay at around 07:09AM on 05-24-2018. The root cause of the fault was a water leak in the switchgear that led to an insulator failure.

8. Lake Goodwin-North Stanwood 115kV line. The line tripped at around 08:03:53 AM on 06-05-2018 due to a temporary SLG (B-G) fault located about 4.8 miles from Lake Goodwin. Lake Goodwin PCB 3015 tripped and reclosed as designed. The line was in its radial configuration: open-ended at North Stanwood and not carrying any load at the time of the event. The root cause of the fault remains unknown.
9. Everett-Scott-Navy 115kV line. The line tripped at around 2:35 PM on 06-10-2018 due to a temporary 2LG fault (AB-G) located about 1.0 mile from Everett. All breakers at all three terminals tripped and reclosed as designed; the root cause of the fault remains unknown.
10. BPA Snoking-North Creek 115kV line. The line tripped at around 16:54 on 06-10-2018 due to a temporary 3LG fault. BPA Snoking PCB B-1582 tripped and reclosed as designed; the root cause of the fault remains unknown.
11. Portage Transformer Bank #1. The transformer was tripped offline by its SEL-787 differential relay at around 05:29AM on 06-29-2018. The root cause of the fault was a crow that made contact with the 12kV roof bushings and the 12kV main bus.
12. Jackson Hydro Project Unit 4. Jackson Unit 4 tripped off line at around 17:32 on 08-01-2018 due to an operator error. A Jackson Electrical Technician was inspecting a network switch in the Unit 4 governor cabinet. The switch had a loose wire that accidentally touched the grounded governor cabinet. The grounded wire caused the Unit 4 lockout relay to operate, tripping the unit off line.
13. Navy-Delta 115kV line. The line tripped at around 4:25 AM on 09-03-2018 due to a temporary SLG fault (B-G) located about 1.85 miles from Navy; PCB-1889 at Navy and PCB-2953 and PCB-2947 at Delta all tripped and reclosed as designed. As a result of these operations the Norton substation experienced a momentary outage. The root cause of the outage remains unknown.
14. Delta-Stimson Crossing 115kV line. The line tripped at around 12:16 AM on 09-06-2018 due to a temporary SLG (C-G) fault located about 7.4 miles from Stimson Crossing; PCB-2949 and PCB-2951 at Delta and PCB-3001 and PCB-2996 at Stimson all tripped and reclosed as designed. As a result of these operations the North Marysville, Central Marysville, and Kellogg Marsh substations all experienced a momentary outage. The cause of the outage remains unknown.
15. Jackson-BPA Snohomish North 115kV line. The line tripped at around 00:12 AM on 10-03-2018 due to a temporary LL (A-B) fault located about 2.2 miles from Jackson Hydro Project. Both the Jackson PCB 1836 and the BPA Snohomish PCB B-1699 tripped and reclosed as designed to restore the line back to service. The line tripped to lockout later on that same morning due to a failed insulator stack at Pole SP-TL 1/18. Given that the relays reported almost exactly the same fault

location on both occasions, it is reasonable to assume this temporary fault was also caused by the same failed insulator stack at pole SP-TL 1/18.

16. Jackson-BPA Snohomish North 115kV line. The line tripped at around 06:29 AM on 10-03-2018 due to a permanent SLG (A-G) fault caused by a failed insulator stack at Pole SP-TL 1/18 located 2.17 miles from Jackson Hydro Project. The Jackson PCB 1836 tripped to lockout but the BPA Snohomish PCB B-1699 was able to reclose and restore service to Three Lakes Substation after the Three Lakes auto-sectionalizing scheme isolated the BPA Snohomish-Three Lakes line section from the fault. ECC remotely opened Switch 1851D at Lake Chaplain and closed Jackson PCB 1836 to restore service to Lake Chaplain about 15 minutes after the initial trip. The North Loop was fully restored the next morning.
17. Jackson 115kV Bus. The Jackson Unit 1 was placed under a lock-out-tag-out order (LOTO) to perform periodic maintenance on 10-10-2018. The maintenance included performing NERC required relay testing, maintenance on the bearings, and circuit breaker 115-1776 maintenance. There were essentially three separate crews working concurrently to perform the maintenance. During the Unit 1 bearing maintenance work, a mechanic dropped the unit's oil level; this rolled the unit's 86EP lockout relay (LOR), which was not a problem because the unit was under a LOTO. After the unit's lockout relay rolled, the electrical technician performing the unit circuit breaker maintenance closed the circuit breaker as part of the testing and maintenance procedure at around 11:37AM. Closing the circuit breaker triggered the breaker failure scheme in the Unit's SEL-387 differential relay; the 115kV bus lockout relays 86BP and 86BB tripped as a result of this inadvertent breaker failure trip operation. These LOR's subsequently tripped all the Jackson 115kV breakers, the 15kV unit breakers for Units 3&4, and generator Unit 2 off-line.
18. Everett-Scott-Navy 115kV line. The line tripped to lockout at around 10:34 AM on 12-01-2018 due to a SLG (B-G) fault caused by a bird contacting an insulator at Pole S-E3 5/12 (1.58 miles from Everett) and causing it to fail. There is no load tapped off of the Everett-Scott/Navy Line so no outage minutes occurred as a result of this extended outage.
19. Jackson-BPA Snohomish North 115 kV line. The line tripped at around 16:49 on 12-04-2018, due to a temporary LL (A-C) fault located around 2.6 miles from the Jackson terminal; both the Jackson and BPA Snohomish terminals' breakers tripped and reclosed as designed to restore the line back to service. The root cause of the fault remains unknown.
20. Halls Lake-Snoking #1 115kV line. The line tripped at around 18:28 on 12-14-2018 during that day's wind event due to a permanent LL (B-C) tree fault near Pole SK-HL#1 4/6 located 2.3 miles from Halls Lake. The Thrashers Corner auto-sectionalizing scheme operated as designed, allowing the Snoking PCB B-1581 to reclose and restore service at Thrashers Corner after a momentary interruption. ECC made several attempts to close the Halls Lake breakers while performing switching to restore service at Brier; a second fallen tree was later discovered right outside that substation.
21. Beverly Park-Cottage Brook 115kV line. The line tripped and reclosed at around 18:59 on 12-14-2018, during the day's wind event; the Hilton Lake auto-sectionalizing scheme started timing as designed and also reset as designed once the line got re-energized.
22. Beverly Park-Cottage Brook 115kV line. The line tripped and reclosed at around 11:16 AM on 12-20-2018, during the day's wind event; the Hilton Lake auto-sectionalizing scheme started timing as designed and also reset as designed once the line got re-energized.
23. Stimson Crossing-Camano 115kV line. The line tripped at around 11:21 AM on 12-20-2018 during the day's wind event due to a temporary 3LG fault located about 24.2 miles from the Stimson

Crossing terminal. The Stimson Crossing breakers tripped and reclosed as designed and the root cause of the fault remains unknown.

24. Stimson Crossing-Camano 115kV line. The line tripped a second time at around 12:05 PM on 12-20-2018 during the day's wind event due to a temporary LL (C-A) fault located about 23.8 miles from the Stimson Crossing terminal. The Stimson Crossing breakers tripped and reclosed as designed and the root cause of the fault remains unknown.

25. Halls Lake-Brightwater 115kV line. The line first tripped at around 11:44 AM on 12-20-2018 during that day's wind event due to a permanent LL (B-C) fault caused by a fallen cedar tree at Pole SC-BW 1/8 located 8.0 miles from Brightwater. The Floral Hills auto-transfer scheme operated as designed to transfer that substation onto the adjacent Beverly Park-Snoking line. The North Alderwood auto-sectionalizing scheme also operated as designed, allowing the Halls Lake breakers to reclose and restore service at Esperance, Alderwood and North Alderwood after a momentary interruption. ECC was able to restore service to Turner's Corner after opening Switch 3589C to isolate the fault, then closing the Brightwater breakers about 12 minutes after the line had tripped. Service was also restored to York Substation radially from Brightwater after additional switching was performed to further isolate the fault.

    The Brightwater terminal of the line which was radially feeding York and Turners Corner Substations tripped two additional times that same day. The first time at around 12:59:50 due to a SLG (C-G) fault and a second time at around 13:00:09, about 6 seconds after the Brightwater breakers had reclosed and re-energized the line, due to a second SLG (C-G) fault. The root cause of these two faults was another fallen tree at Pole SC-BW 7/10, located about 2.5 miles from Brightwater. Service was restored again to Tuners Corner following a second 5 minute outage after ECC re-opened Switch 3589C and closed the Brightwater breakers. Service was eventually restored to York and the whole loop was restored later the same day.

26. Stimson Crossing-Eagle Creek 115kV line. The line tripped at around 12:39 PM on 12-20-2018 during the day's wind event due to a temporary LL (B-C) fault located about 9.7 miles from the Eagle Creek terminal, west of the Sills Corner Junction. The Stimson Crossing and Eagle Creek breakers all tripped and reclosed as designed and the root cause of the fault remains unknown.

27. BPA Murray-Snohomish 115kV line. The line tripped at around 11:56 AM on 12-20-2019 during that day's wind event due to a permanent LL (A-C) fault caused by a fallen tree 31.4 miles from BPA Snohomish. The East Marysville auto-sectionalizing scheme operated as designed, allowing PCB B-1700 at BPA Snohomish to reclose and restore service to East Marysville, Frontier, Lake Stevens and Bunk Foss substations while PCB B-1749 at BPA Murray tripped to lockout. ECC was able to restore service at Hartford and Granite Falls through remote switching while the tree was being removed. A malfunction of the Granite Falls Transformer Bank #2's circuit switcher (CS 4817E) which was discovered during the switching process further extended restoration times for customers fed from that bank and required a clearance for an outage of that bank to perform repairs that same day.

    Stimson Crossing-Eagle Creek 115kV line. The line tripped to lockout at around 13:06 on 12-23-2018 following a misoperation of the Stimson Crossing and Eagle Creek line relays when a permanent SLG (A-G) tree fault occurred on Navy's East Arlington-Jim Creek line. Due to the ongoing East Arlington rebuild project, the Jim Creek line was being tapped off of the Stimson Crossing-Eagle Creek line at the time of the event; that temporary configuration resulted in a miscoordination between the PUD's relays at Stimson Crossing and Eagle Creek and the Navy's relays for the Jim Creek line (PCB B-1751), causing the misoperation.

5 The Distribution System

5.1 Introduction

This section describes outages on the District 12.47 kV distribution system. These outages are more frequent and involve fewer customers per event than most transmission system outages. While the number of the outages are somewhat balanced between trees, animals, and equipment failures, most of the outage minutes are due to outages caused by trees and motor vehicle accidents. Animal and equipment failures often involve distribution transformers and affect a small number of customers. Damage caused by trees and motor vehicles is less discriminating and can affect infrastructure such as feeders and large branch circuits, which have larger customer impacts.

5.2 System Performance

5.2.1 Outage Causes

Figures 5-1 and 5-2 show the count of distribution outages by cause for 2018 and average for the five-year period of 2013-2017. In 2018, 2,208 distribution outages were recorded during routine operation, compared to the five-year average of 1,713 annual outages. The percentages shown in Figures 5-1 and 5-2 are percentages of these total number of outages in each period. The District started tracking planned outages in 2017.

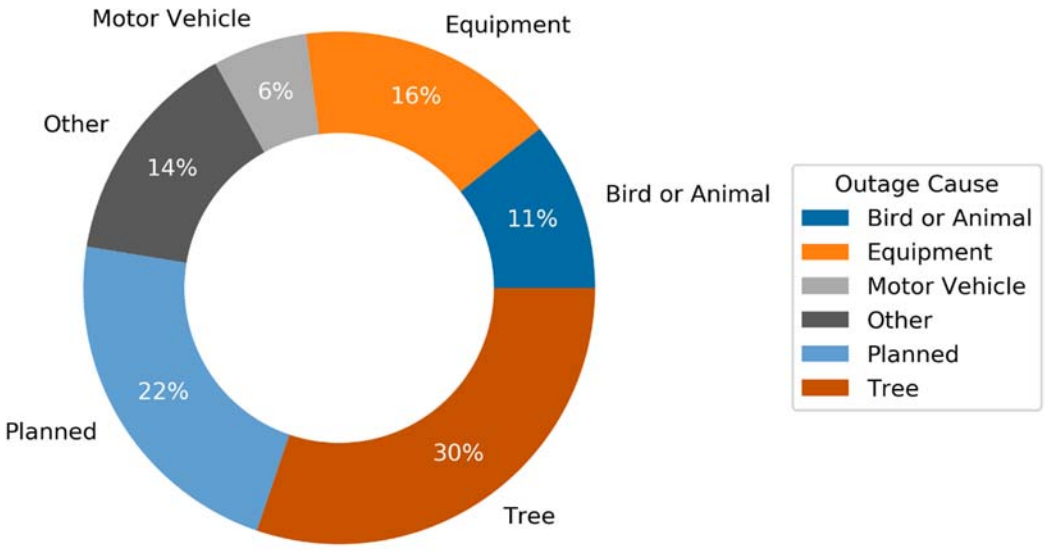

Figure 5 - 1: 2018 Distribution Outages by Cause

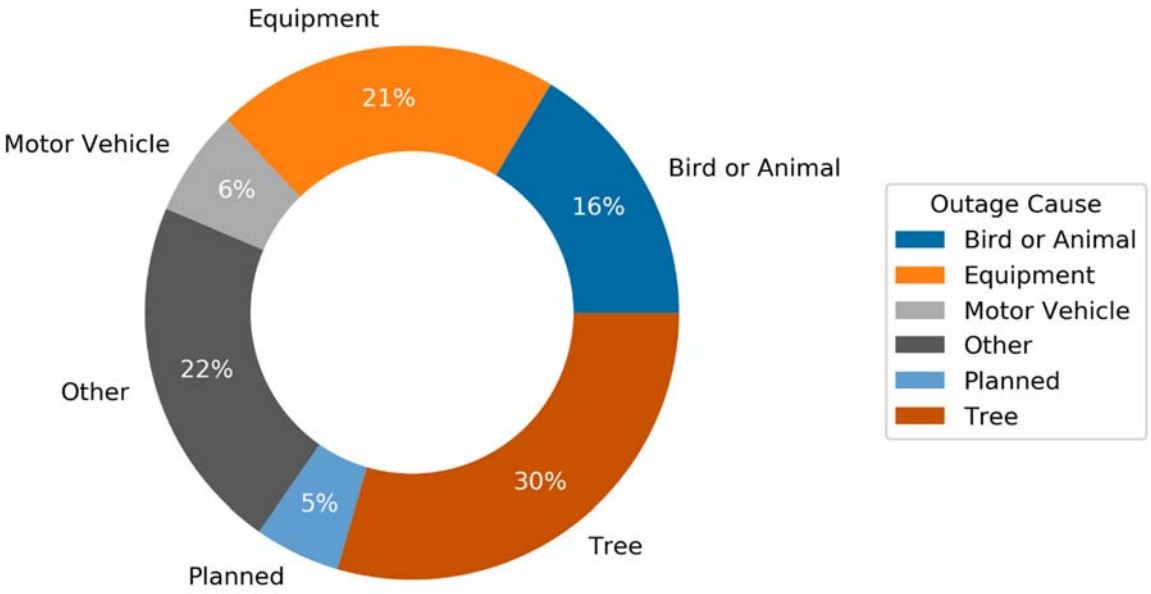

Figure 5 - 2: Five-Year Average Distribution Outages by Cause (2013-2017)

Figures 5-3 and 5-4 show the 2018 and five-year average percent of customer outage minutes by cause. District customers lost power for a combined total of 30,976,326 minutes in 2018 due to distribution outages, compared to the five-year average of 27,540,590 uplifted minutes. Both the number of outages and the customer minutes of outage are important parameters for planning effective outage impact reduction measures.

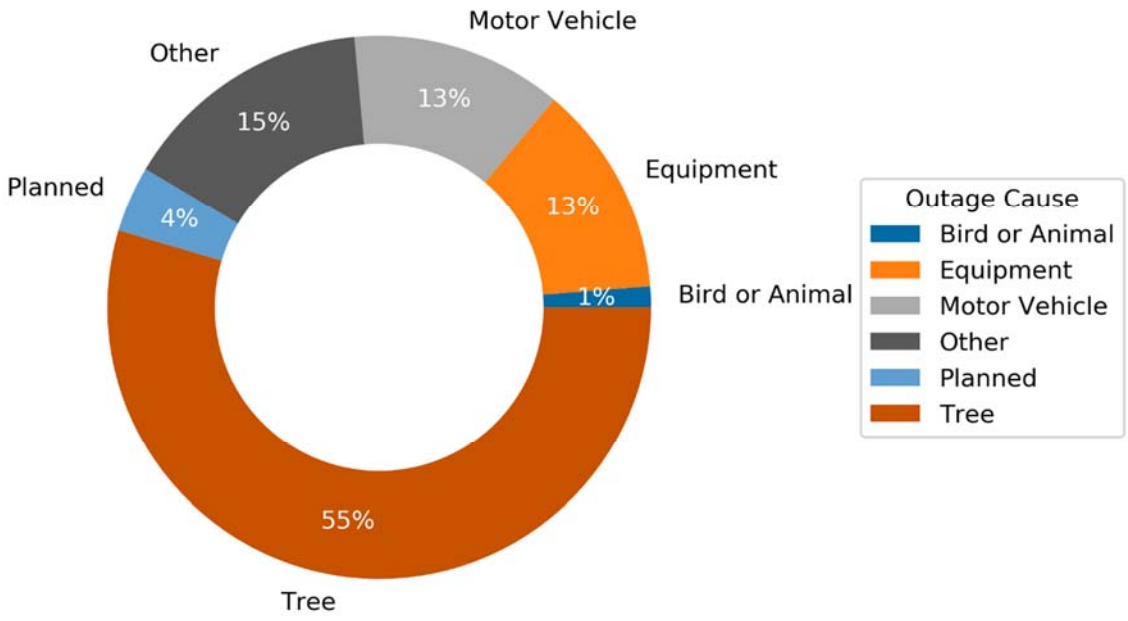

Figure 5 - 3: 2018 Distribution Outage Minutes by Cause

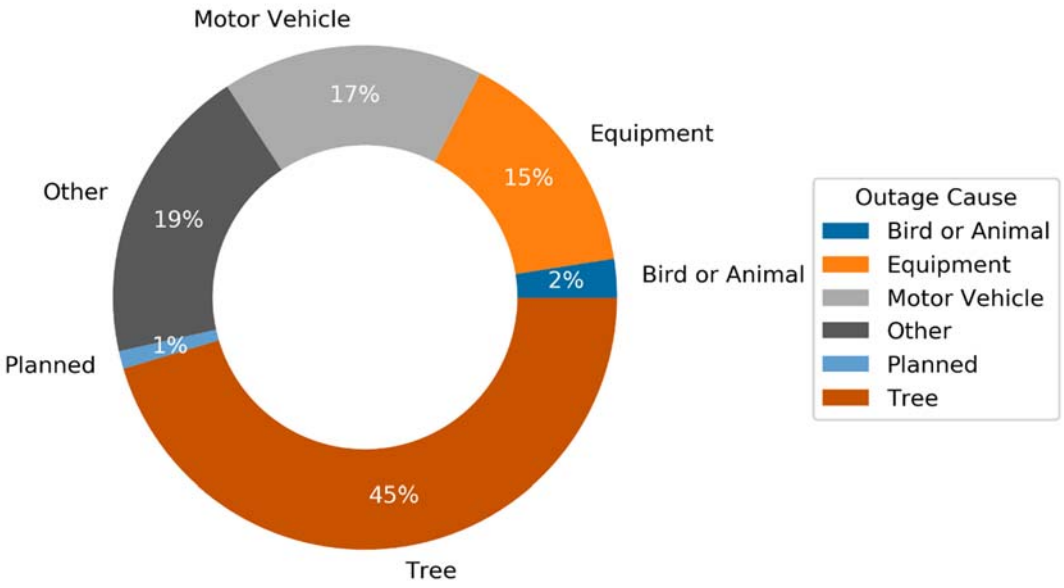

Figure 5 - 4: Five-Year Average Distribution Outage Minutes by Cause (2013-2017)

5.2.2 Explanation of Equipment Failure Category

Equipment failures may include any component of the distribution system, from substation breakers or primary overhead conductor, to fuses, transformers, insulators, and secondary service conductors. Figure 5-5 shows the number of recorded equipment failures by category during 2018. The ten most common types of equipment failure accounted for 465 outages in 2018. For comparison, Figure 5-6 shows the five-year average of the number of equipment failures for each category.

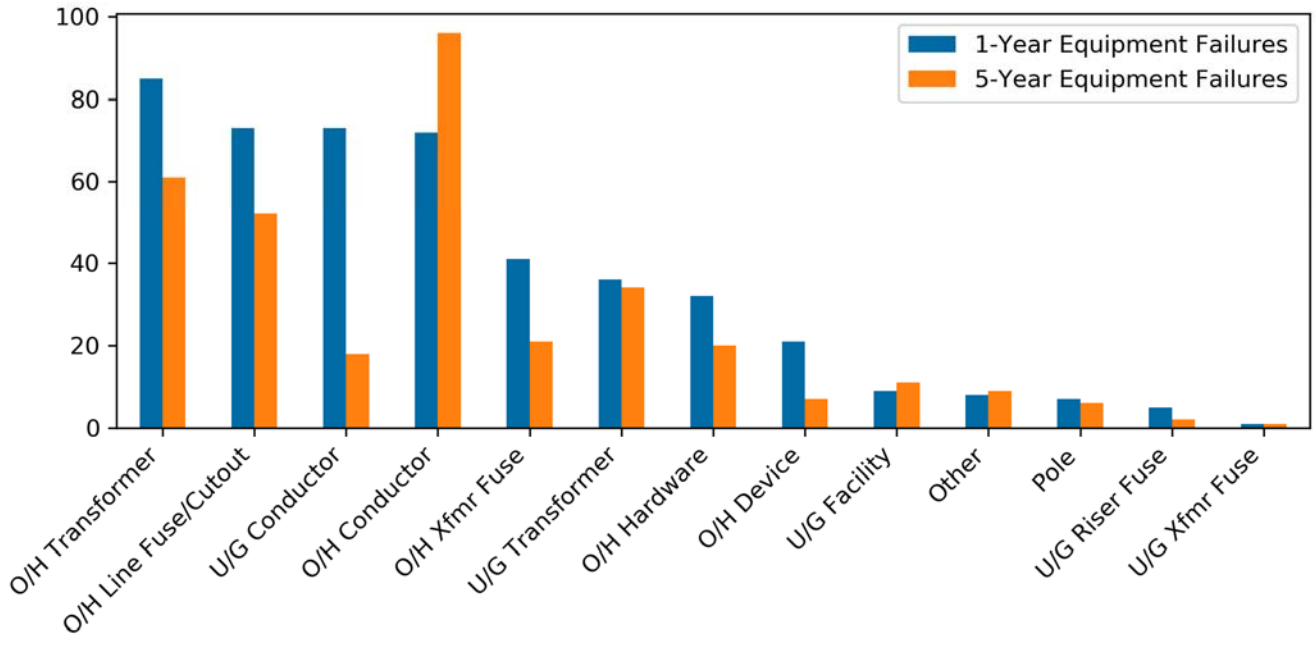

Figure 5 - 5: 2018 Equipment Failures

5.3 Urban, Suburban, Rural Classifications

IEEE Standard 1782 defines circuits as urban (greater than 150 customers per mile), suburban (between 150 and 50 customers per mile) and rural (less than 50 customers per mile). Classifying circuits gives an indication of how susceptible those circuits are to having an outage. Shorter circuits are less likely to have an outage, due to less available exposure to faults. Conversely, longer circuits have more conductor, and thus are more likely to be damaged. To compare similar circuits, circuits are identified by performance based on circuit length.

Table 5 - 1: Circuit Classification

Classification	Average Circuit Length	Average number of customers	Customers per Mile	Average number of outages
Urban	7.3 miles	1,382	204.0	2
Suburban	12.7 miles	1,156	95.5	3
Rural	26.1 miles	720	25.6	7

5.4 Reliability Improvement Priority

Before 2017, the System Planning and Protection department used the "20 Worst Circuits" annually to target circuits for reliability improvements. This method had flaws. Typically, the same circuits would show up year after year due to their circuit length, rather than their relative reliability. There were also circuits on the list that had experienced no distribution outages, with all outage minutes caused by transmission outages. While valuable to know, that measure was irrelevant, as no distribution improvements would improve reliability for the circuit. In 2017, an objective metric to help prioritize feeders for reliability work was developed comparing SAIDI normalized by circuit length and SAIFI. The metric is based on distribution outages only, allowing results to guide engineers to help decide which distribution changes should be prioritized to improve reliability. For this list, the circuit SAIDI and SAIFI were based on the number of customers on their original circuit. The OMS system has a design flaw when counting CMI for outages that involve multiple circuits. This happens when a breaker opens while a circuit is picking up a second circuit. This causes highly inaccurate reliability statistics for circuits with this type of outage. This should reduce the impact of the OMS design flaw on our reliability statistics.

$$rank(d,f) = \frac{d - \mu_d}{\sigma_d} + \frac{f - \mu_f}{\sigma_f}$$

Where 'd' is the circuit SAIDI divided by the circuit length, 'f' is the circuit SAIFI, 'μ' is the mean, and 'σ' is the standard deviation

Table 5 - 2: Circuit Reliability Improvement Priority

	Feeder	Substation	Length	SAIFI	SAIDI	Incident Count	Customers
1	12-1533	South Camano	35	5.78	1265.7	35	1016
2	12-3503	Portage	6.7	1.21	489.2	6	257
3	12-4114	Bunk Foss	16.9	4.52	572.7	12	352
4	12-0810	Granite Falls	38.6	5.15	958.6	34	1051
5	12-2726	20th Ave	6.6	2.97	227.8	6	342
6	12-0185	52nd St	12.7	3.27	407.5	7	709
7	12-1811	Woods Creek	28.9	4.94	385.8	21	1140
8	12-5208	Sunset	39.4	5.09	419.9	18	1298
9	12-0232	Richmond Park	9.6	2.05	301.9	6	804
10	12-0986	Eagle Creek	9.4	2.81	235.7	7	1086
11	12-0101	Everett	1.7	1.01	69.1	2	235
12	12-0688	Esperance	6.7	2.48	167.4	10	1142
13	12-1596	Sultan	7.4	1.01	252.9	4	620
14	12-0507	Tulalip	32.7	2.45	697.9	19	1037
15	12-0311	Casino	9.8	1	328.1	2	1202
16	12-2036	Lake Chaplain	27.9	3.58	302.4	12	463
17	12-1532	South Camano	37.8	2.28	813.2	18	1545
18	12-1530	South Camano	27.9	2.86	454.7	16	650
19	12-2062	Floral Hills	14	2.45	242.4	14	1163
20	12-0261	Ballinger	7.9	1	224.2	2	1363

Appendix A

District Outage Management System

These tables include outages that occurred on both the transmission system and on the distribution system. They do not include outages that occurred during declared major events and do not have an uplift factor applied to previous years.

Table A - 1: Substation Metrics

This table shows the substation reliability metrics for 2018 and the previous five year average.

Substation	Period	Customers	Outages	CMI	SAIDI	SAIFI	CAIDI
20th Ave	2018	2442	9	79891	32.7	1.09	30
20th Ave	2013-2017	2461	8.4	90414	36.7	0.45	82.3
52nd St	2018	3439	17	325341	94.7	0.99	95.7
52nd St	2013-2017	3524	15	146468	41.2	0.44	94.6
Alderwood	2018	4494	12	261813	58.2	0.78	74.9
Alderwood	2013-2017	4059	15.6	289343	73.4	0.74	98.7
Ballinger	2018	3668	14	329112	89.8	0.69	130.9
Ballinger	2013-2017	3674	13.4	59003	16.1	0.31	51.3
Brier	2018	5746	26	845466	147.1	1.89	77.8
Brier	2013-2017	5768	18.6	376953	65.2	0.84	77.4
Bunk Foss	2018	2207	30	221658	100.3	0.93	108.4
Bunk Foss	2013-2017	2306	11.8	63789	26.9	0.37	71.9
Canyon Park	2018	5018	14	208304	41.6	0.35	117.2
Canyon Park	2013-2017	4999	26.8	264705	53	0.6	87.8
Cascade	2018	9559	7	323054	34	0.38	90.6
Cascade	2013-2017	9911	9.8	452255	46.4	0.64	72.9
Casino	2018	3794	7	680950	179.9	1.12	161
Casino	2013-2017	3865	9.2	136548	35.5	0.28	124.9
Central Marysville	2018	5309	16	76195	14.3	0.08	174.4
Central Marysville	2013-2017	5389	14	147493	27.1	0.26	106.3
Clearview	2018	4684	76	673163	143.7	1.88	76.4
Clearview	2013-2017	5909	59.4	1007808	176.4	2	88.3
Delta	2018	1006	7	9033	9	0.1	90.3
Delta	2013-2017	1044	5.6	23923	22.5	0.2	114.7
Eagle Creek	2018	8537	141	2162563	253.4	2.97	85.4
Eagle Creek	2013-2017	8869	74.8	1385769	153.9	1.2	128.2

Substation	Period	Customers	Outages	CMI	SAIDI	SAIFI	CAIDI
East Marysville	2018	10569	23	609213	57.7	0.33	174.8
East Marysville	2013-2017	10393	20.4	450039	43.4	0.53	82.1
Edgecomb	2018	3427	27	122968	35.9	0.42	85.1
Edgecomb	2013-2017	3438	14.4	187555	54.7	0.63	87
Esperance	2018	5918	22	364136	61.5	0.72	85.4
Esperance	2013-2017	5801	15.8	98494	17.2	0.14	119.1
Everett	2018	4955	16	329144	66.4	0.85	78.5
Everett	2013-2017	4920	16.8	151258	30.3	0.3	102.3
Fitzgerald	2018	1043	1	32280	30.9	0.77	40
Fitzgerald	2013-2017	897	0.2	91	0.1	0.03	4
Five Corners	2018	5482	16	19829	3.6	0.04	80.9
Five Corners	2013-2017	5502	19.8	275581	50	0.59	84.3
Floral Hills	2018	8328	31	427320	51.3	0.48	106.5
Floral Hills	2013-2017	7864	31	835015	106.2	1.26	84.6
Fobes	2018	4495	21	219514	48.8	0.7	69.6
Fobes	2013-2017	4562	21.8	181146	39.7	0.28	140.7
Frontier	2018	7383	28	262268	35.5	1.25	28.4
Frontier	2013-2017	7060	15.2	220372	31.5	0.9	35.2
Gibson	2018	6653	19	431716	65	1.21	53.6
Gibson	2013-2017	6493	20	325687	50.2	0.74	67.9
Glenwood	2018	5538	13	164166	29.6	0.87	34
Glenwood	2013-2017	5537	18.6	270425	48.9	0.73	66.8
Goldbar	2018	2699	55	1554307	575.8	1.86	309.9
Goldbar	2013-2017	2804	39.4	1107952	392.1	1.7	230.1
Granite Falls	2018	6361	108	2038053	319.5	1.75	182.7
Granite Falls	2013-2017	6638	80.2	1463202	218.6	1.52	143.5
Harbour Pointe	2018	5032	3	10614	2.1	0.01	196.5
Harbour Pointe	2013-2017	5078	5.4	28099	5.6	0.13	41.6
Hardeson	2018	0	0	0	0	0	0
Hardeson	2013-2017	44	0.4	347	7.9	0.21	36.9
Hartford	2018	3949	71	550239	139.5	1.22	114.8
Hartford	2013-2017	4696	42.4	527116	114.1	1.03	110.4
Hilton Lake	2018	6523	15	228947	35.1	0.45	78.8
Hilton Lake	2013-2017	6513	12.4	260932	40	0.33	119.5
Kellogg Marsh	2018	5248	24	495845	94.5	1.38	68.5
Kellogg Marsh	2013-2017	5265	10	86704	16.4	0.09	176
Lake Chaplain	2018	565	13	141906	251.3	3.96	63.4
Lake Chaplain	2013-2017	581	13.2	190197	329.9	2.7	122
Lake Goodwin	2018	5024	80	666095	132.5	1.07	123.3
Lake Goodwin	2013-2017	5336	47.6	730391	136.7	1.19	114.6
Lake Serene	2018	6014	12	28795	4.8	0.04	115.1
Lake Serene	2013-2017	6026	11.4	144087	24	0.38	63.1

Substation	Period	Customers	Outages	CMI	SAIDI	SAIFI	CAIDI
Lake Stevens	2018	6749	38	437483	64.9	0.71	91.6
Lake Stevens	2013-2017	6501	27	409171	63.7	0.58	110.4
Lynnwood	2018	4923	18	79181	16.1	0.09	179.2
Lynnwood	2013-2017	4997	21.6	98408	19.7	0.22	88.6
Maplewood	2018	4357	19	115139	26.5	0.57	46.1
Maplewood	2013-2017	4238	15.2	118520	28.4	0.45	63.2
Mariner	2018	4904	6	44603	9.1	0.04	246.4
Mariner	2013-2017	4858	9.6	227718	46.8	0.13	349.1
Martha Lake	2018	5677	28	551485	97.4	0.51	190.1
Martha Lake	2013-2017	5137	17.4	402134	83.9	0.94	89.6
Meadowdale	2018	4866	18	236257	48.6	1.05	46.3
Meadowdale	2013-2017	4863	19.2	75659	15.6	0.12	124.8
Mountlake	2018	6969	36	139120	20	0.41	48.4
Mountlake	2013-2017	6896	32.2	253049	36.8	0.5	74.1
Mukilteo	2018	4293	10	43960	10.2	0.23	44.1
Mukilteo	2013-2017	4306	11.6	157554	36.6	0.3	121.7
Murphy'S Corner	2018	4600	5	3190	0.7	0	177.3
Murphy'S Corner	2013-2017	4555	11	391361	85.8	0.74	116.6
North Alderwood	2018	724	1	715	1	0.02	65
North Alderwood	2013-2017	734	1.4	2565	3.5	0.1	35.2
North Camano	2018	2860	34	298031	104.2	1.08	96.3
North Camano	2013-2017	2840	24.4	228696	81.7	0.87	93.8
North Creek	2018	6957	14	150223	21.6	0.3	73.1
North Creek	2013-2017	6827	11.4	330380	48.9	0.33	150
North Marysville	2018	2780	12	65446	23.5	0.15	161.8
North Marysville	2013-2017	2838	7.8	80324	28.4	0.26	111.1
North Mountain	2018	1851	51	708810	383.2	2.34	164.1
North Mountain	2013-2017	1990	41.8	885725	441.9	2.72	162.3
North Stanwood	2018	6567	96	1701270	259.3	1.31	197.3
North Stanwood	2013-2017	6774	56	1118582	164.3	1.54	106.9
Norton Ave	2018	3123	8	36323	11.6	0.02	526.4
Norton Ave	2013-2017	3241	7.2	34833	10.7	0.2	53
Olivia Park	2018	4544	10	27659	6.1	0.05	112
Olivia Park	2013-2017	4658	10.8	179723	38.3	0.49	78.2
Oso	2018	323	12	90970	281	5.75	48.9
Oso	2013-2017	393	10	60361	148.4	1.11	133.9
Paine Field	2018	8540	19	501292	58.5	0.29	204
Paine Field	2013-2017	8591	12.4	102002	11.8	0.25	47.7
Park Ridge	2018	4591	20	53409	11.6	0.28	41.1
Park Ridge	2013-2017	5350	27.6	248658	45.4	0.3	149.4
Perrinville	2018	4391	17	60912	13.9	0.21	66
Perrinville	2013-2017	4351	18.8	188641	43.4	0.56	77.4

Substation	Period	Customers	Outages	CMI	SAIDI	SAIFI	CAIDI
Picnic Point	2018	3744	22	152939	40.8	0.62	66.3
Picnic Point	2013-2017	3752	27.2	610921	162.9	1.25	130.2
Pinehurst	2018	6724	26	78214	11.6	0.05	223.5
Pinehurst	2013-2017	6808	28.6	357905	52.5	0.88	59.9
Polaris	2018	3970	7	60214	15.2	0.38	39.9
Polaris	2013-2017	3781	8.4	175718	46.3	0.87	53.2
Portage	2018	2589	28	288173	111.3	1.51	73.8
Portage	2013-2017	2715	16.8	149525	54.3	0.63	86.2
Quil Ceda	2018	2822	24	272289	96.6	0.82	117.4
Quil Ceda	2013-2017	2934	18	366167	124	0.96	129.6
Richmond Park	2018	3020	18	428391	141.9	0.86	165.2
Richmond Park	2013-2017	2845	11	91835	32.6	0.23	140.4
Silver Lake	2018	6111	25	232236	37.9	0.79	48.3
Silver Lake	2013-2017	6069	15.6	168181	27.9	0.31	90.6
Smokey Point	2018	3692	11	146020	39.5	1.15	34.3
Smokey Point	2013-2017	3355	9	370677	121.5	0.43	282.2
Snohomish	2018	3065	36	166269	54.2	1.14	47.7
Snohomish	2013-2017	3202	22.2	161140	50.7	0.9	56.5
South Camano	2018	3689	73	2865159	777.3	3.56	218.5
South Camano	2013-2017	3746	40.2	679945	181.1	1.37	132.2
Stimson Crossing	2018	1831	26	228120	124.7	1.37	91
Stimson Crossing	2013-2017	2040	21.2	201207	100.7	1.11	90.4
Sultan	2018	3435	39	716058	208.8	1.89	110.6
Sultan	2013-2017	3680	39.6	696708	188	1.55	121
Sunset	2018	3852	53	751796	195.2	2.31	84.4
Sunset	2013-2017	4056	32.2	827456	205	2.14	95.6
Tenth Street	2018	4094	14	263213	64.2	0.84	76.3
Tenth Street	2013-2017	4207	10	110154	25.9	0.34	76.9
Thrashers Corner	2018	6214	10	111779	18	0.19	95.2
Thrashers Corner	2013-2017	6609	8.8	94174	13.3	0.15	90.8
Three Lakes	2018	4138	80	610248	147.8	1.43	103.1
Three Lakes	2013-2017	4357	63	1153538	265.2	2.59	102.3
Tulalip	2018	2293	29	850597	371.2	2.38	156.2
Tulalip	2013-2017	2388	13.8	257764	105.8	0.8	133
Turners Corner	2018	2454	41	478497	195	1.07	182.7
Turners Corner	2013-2017	2910	37.4	398006	130.7	0.87	150.8
Village	2018	2068	23	82301	39.8	0.05	815.1
Village	2013-2017	2207	16.6	187522	83.4	0.77	108.3
Wallace River	2018	908	7	84363	94.8	0.71	133.3
Wallace River	2013-2017	622	10.8	54027	87.7	1.09	80.8
Waterfront	2018	3034	8	69034	22.8	0.42	54.8
Waterfront	2013-2017	3120	6.6	87378	27.5	0.45	61.5

Substation	Period	Customers	Outages	CMI	SAIDI	SAIFI	CAIDI
West Monroe	2018	7089	36	217281	30.7	0.37	83.5
West Monroe	2013-2017	7067	29.8	297961	34.3	0.42	82.4
Westgate	2018	4055	12	38868	9.6	0.04	249.1
Westgate	2013-2017	4446	18.2	293545	63.4	0.52	121.5
Woods Creek	2018	5494	81	1240674	225.8	2.15	105
Woods Creek	2013-2017	5570	60.8	1789715	317.2	1.9	167.1
York	2018	5791	28	433186	74.7	0.87	85.8
York	2013-2017	5696	10.2	153125	26.8	0.45	59.8

Table A - 2: Circuit Metrics

This table shows the circuit reliability metrics for 2018 and the previous five year average.

Substation	Circuit	Period	Customers	Outages	CMI	SAIDI	SAIFI	CAIDI
20th Ave	12-1493	2018	29	0	0	0	0	0
20th Ave	12-1493	2013-2017	29	0.2	400	13.8	0.2	69
20th Ave	12-1494	2018	4	0	0	0	0	0
20th Ave	12-1494	2013-2017	4	0.2	40	10	0.2	50
20th Ave	12-1495	2018	18	0	0	0	0	0
20th Ave	12-1495	2013-2017	26	0.8	1256	69.8	0.8	87.2
20th Ave	12-1496	2018	24	1	70	3	0.09	35
20th Ave	12-1496	2013-2017	10	1.4	8802	580.3	3.45	168.2
20th Ave	12-2723	2018	596	2	738	1.3	0.01	122.2
20th Ave	12-2723	2013-2017	588	2.2	14906	24.6	0.62	39.9
20th Ave	12-2724	2018	404	0	0	0	0	0
20th Ave	12-2724	2013-2017	401	0.2	33	0.1	0	164
20th Ave	12-2725	2018	971	0	0	0	0	0
20th Ave	12-2725	2013-2017	993	2.2	58630	59.2	0.52	114
20th Ave	12-2726	2018	389	6	79083	230.3	7.19	32
20th Ave	12-2726	2013-2017	402	1.2	6346	15.8	0.32	49.6
52nd St	12-0183	2018	591	6	29672	50.8	1.74	29.2
52nd St	12-0183	2013-2017	657	1.6	7728	11.8	0.2	59.1
52nd St	12-0184	2018	1202	3	1097	0.9	0.02	47.7
52nd St	12-0184	2013-2017	1193	2.8	8105	6.8	0.02	332.9
52nd St	12-0185	2018	719	7	293344	414.5	3.32	124.7
52nd St	12-0185	2013-2017	748	6	111024	147.8	1.28	115.6
52nd St	12-0186	2018	914	1	1228	1.3	0	307
52nd St	12-0186	2013-2017	950	4.6	19611	20.6	0.45	45.7
Alderwood	12-0116	2018	606	0	0	0	0	0
Alderwood	12-0116	2013-2017	612	2.6	3256	5.3	0.03	178.9
Alderwood	12-0117	2018	1266	1	76	0.1	0	76
Alderwood	12-0117	2013-2017	769	2.6	23652	29.3	0.47	62.8
Alderwood	12-0132	2018	1550	6	253152	172.2	2.36	72.8
Alderwood	12-0132	2013-2017	1540	6.6	236279	154	1.28	120.6
Alderwood	12-0141	2018	960	5	8585	8.9	0.02	444.2
Alderwood	12-0141	2013-2017	902	3.8	26156	28	0.63	44.1
Ballinger	12-0258	2018	485	5	6861	14.7	0.32	45.5
Ballinger	12-0258	2013-2017	483	2.6	8198	16.9	0.26	66.1
Ballinger	12-0259	2018	710	4	13537	19.5	1.08	18
Ballinger	12-0259	2013-2017	692	1.4	13406	19.3	0.43	44.7
Ballinger	12-0260	2018	1102	3	3082	2.8	0.2	13.9
Ballinger	12-0260	2013-2017	1109	5.4	35113	31.7	0.64	49.8

Substation	Circuit	Period	Customers	Outages	CMI	SAIDI	SAIFI	CAIDI
Ballinger	12-0261	2018	1371	2	305632	224.2	1.02	219.7
Ballinger	12-0261	2013-2017	1380	4	2287	1.7	0.02	100.3
Brier	12-0501	2018	1770	7	201738	114.2	2.3	49.7
Brier	12-0501	2013-2017	1798	4.4	50448	28.1	0.61	46
Brier	12-0502	2018	1097	6	173715	158.9	1.22	130.7
Brier	12-0502	2013-2017	928	3.2	19343	18.1	0.21	86.6
Brier	12-0503	2018	1455	7	206517	141.3	2.32	60.9
Brier	12-0503	2013-2017	1432	5.8	278873	189.3	1.96	96.4
Brier	12-0504	2018	1412	6	263496	186.6	1.49	125.6
Brier	12-0504	2013-2017	1407	5.2	28289	20	0.46	43.6
Bunk Foss	12-4111	2018	767	4	4691	6.4	0.02	427.7
Bunk Foss	12-4111	2013-2017	773	4	48083	61.5	0.67	91.2
Bunk Foss	12-4112	2018	652	6	3118	4.8	0.04	124.8
Bunk Foss	12-4112	2013-2017	699	2.2	1977	2.8	0.19	14.9
Bunk Foss	12-4113	2018	446	9	43341	100.5	0.51	197
Bunk Foss	12-4113	2013-2017	479	2	6490	13.3	0.06	205.2
Bunk Foss	12-4114	2018	360	11	170508	484.7	5.08	95.3
Bunk Foss	12-4114	2013-2017	401	3.6	7239	18.9	0.5	38
Canyon Park	12-1093	2018	901	9	9734	10.4	0.22	46.7
Canyon Park	12-1093	2013-2017	1162	5.6	31942	29.7	0.27	108.3
Canyon Park	12-1094	2018	1177	0	0	0	0	0
Canyon Park	12-1094	2013-2017	1201	7	39653	33.1	0.31	106.5
Canyon Park	12-1095	2018	1433	3	186957	129	1.01	127.6
Canyon Park	12-1095	2013-2017	1404	9.2	78587	54.5	0.84	65.1
Canyon Park	12-1096	2018	1067	1	10197	9.5	0.09	103
Canyon Park	12-1096	2013-2017	1042	4.2	109107	103.8	1	103.5
Canyon Park	12-3488	2018	391	1	1416	3.6	0.01	354
Canyon Park	12-3488	2013-2017	104	0.8	5417	15.1	0.23	66.1
Cascade	12-2087	2018	1786	2	2851	1.5	0.01	259.2
Cascade	12-2087	2013-2017	1303	1.8	10363	7.3	0.47	15.7
Cascade	12-2088	2018	2798	3	319959	114.2	1.27	90.1
Cascade	12-2088	2013-2017	3383	3.8	104868	29.3	0.44	66.8
Cascade	12-2089	2018	1915	0	0	0	0	0
Cascade	12-2089	2013-2017	1903	0.8	1266	0.7	0	301.5
Cascade	12-2090	2018	2918	2	244	0.1	0	122
Cascade	12-2090	2013-2017	2876	3.2	86002	29.6	0.22	136.9
Casino	12-0308	2018	1027	3	1399	1.4	0.01	127.2
Casino	12-0308	2013-2017	1042	2.8	18938	18.1	0.21	84.9
Casino	12-0309	2018	374	1	61	0.2	0	61
Casino	12-0309	2013-2017	400	1	29401	77.9	0.36	216.1
Casino	12-0310	2018	1199	1	108	0.1	0	54
Casino	12-0310	2013-2017	1031	3	63425	52.8	0.19	279.8

Substation	Circuit	Period	Customers	Outages	CMI	SAIDI	SAIFI	CAIDI
Casino	12-0311	2018	1258	2	679382	571.4	3.55	161.1
Casino	12-0311	2013-2017	1223	2.4	24784	19.6	0.4	49.1
Central Marysville	12-1419	2018	1146	2	1525	1.3	0	500.6
Central Marysville	12-1419	2013-2017	1187	2.6	8391	7.1	0.21	33.7
Central Marysville	12-1420	2018	1260	2	1794	1.4	0	299
Central Marysville	12-1420	2013-2017	1312	3.4	100804	78.4	0.61	128.7
Central Marysville	12-1421	2018	1590	8	71467	45.4	0.27	171.2
Central Marysville	12-1421	2013-2017	1644	3.8	3907	2.4	0.02	122.1
Central Marysville	12-1422	2018	1328	4	1409	1.1	0.01	141
Central Marysville	12-1422	2013-2017	1286	4.2	34391	26.6	0.25	105.5
Clearview	12-0584	2018	319	5	344	1.1	0.02	57.4
Clearview	12-0584	2013-2017	1779	5.8	143274	115.3	1.26	91.6
Clearview	12-0585	2018	1119	18	53079	47.9	0.64	74.7
Clearview	12-0585	2013-2017	1250	9.6	82270	70.2	0.7	100
Clearview	12-0586	2018	1521	26	433314	285.1	2.72	104.6
Clearview	12-0586	2013-2017	1676	19	165430	99.4	1.23	80.9
Clearview	12-0587	2018	1692	27	186426	108.8	2.3	47.2
Clearview	12-0587	2013-2017	1779	25	616834	352.2	3.99	88.3
Delta	12-3653	2018	78	5	8883	116.5	1.25	93.4
Delta	12-3653	2013-2017	98	2.8	4315	45.7	0.34	135.8
Delta	12-3654	2018	15	0	0	0	0	0
Delta	12-3654	2013-2017	18	0	0	0	0	0
Delta	12-3655	2018	210	2	150	0.8	0.03	28.1
Delta	12-3655	2013-2017	210	0.6	107	0.5	0.01	89.8
Delta	12-3656	2018	699	0	0	0	0	0
Delta	12-3656	2013-2017	739	2.2	19500	26.4	0.24	109.5
Delta	12-3657	2018	0	0	0	0	0	0
Delta	12-3657	2013-2017	0	0	0	0	0	0
Eagle Creek	12-0986	2018	1109	7	467478	430.5	7.15	60.2
Eagle Creek	12-0986	2013-2017	1152	1.8	12543	10.7	0.2	53.2
Eagle Creek	12-0987	2018	671	2	51456	73.2	2.27	32.2
Eagle Creek	12-0987	2013-2017	627	0.6	10652	16.4	0.24	69.9
Eagle Creek	12-0988	2018	1500	28	647016	433.2	4.49	96.6
Eagle Creek	12-0988	2013-2017	1688	19.2	217574	134.2	1.56	86.2
Eagle Creek	12-0989	2018	944	7	63230	69.2	1.19	58
Eagle Creek	12-0989	2013-2017	974	1.8	12926	13.2	0.28	46.5
Eagle Creek	12-2617	2018	1456	33	519651	354.4	3.04	116.7
Eagle Creek	12-2617	2013-2017	1582	24.8	731248	463.3	2.34	198.1
Eagle Creek	12-2618	2018	1041	43	365297	352.3	2.74	128.6
Eagle Creek	12-2618	2013-2017	1183	17.8	246746	212.6	2.04	104
Eagle Creek	12-2619	2018	1463	20	48258	32.9	0.53	61.9
Eagle Creek	12-2619	2013-2017	1553	7.8	126826	84	0.83	100.6

Substation	Circuit	Period	Customers	Outages	CMI	SAIDI	SAIFI	CAIDI
Eagle Creek	12-2620	2018	412	1	177	0.5	0	177
Eagle Creek	12-2620	2013-2017	411	1	27256	66.1	0.61	108.6
East Marysville	12-0002	2018	663	11	13306	20.1	0.08	260.5
East Marysville	12-0002	2013-2017	1637	6	96581	165.3	0.92	179.8
East Marysville	12-0037	2018	1642	4	89982	54.2	1.02	53.1
East Marysville	12-0037	2013-2017	1521	3.8	37453	23.1	0.41	56.1
East Marysville	12-0038	2018	1582	2	1653	1	0	236.1
East Marysville	12-0038	2013-2017	1586	4	198030	123.8	1.29	95.9
East Marysville	12-0070	2018	2021	1	138	0.1	0	46
East Marysville	12-0070	2013-2017	1992	2	56511	28.2	0.26	109.8
East Marysville	12-0115	2018	1379	2	2887	2.2	0.01	320.8
East Marysville	12-0115	2013-2017	2087	0.6	266	0.2	0	443.5
East Marysville	12-5203	2018	1487	0	0	0	0	0
East Marysville	12-5203	2013-2017	1489	0.8	33721	22.6	0.44	51.6
East Marysville	12-5204	2018	1717	3	501247	290.6	1	290.9
East Marysville	12-5204	2013-2017	1721	3.2	27476	16	0.6	26.5
Edgecomb	12-4831	2018	200	1	352	1.8	0.01	176
Edgecomb	12-4831	2013-2017	225	0.4	125	0.6	0	122.6
Edgecomb	12-4832	2018	1437	8	30937	21.1	0.03	703.2
Edgecomb	12-4832	2013-2017	1279	4.8	19364	13.3	0.64	20.7
Edgecomb	12-4833	2018	1340	2	455	0.4	0	227.5
Edgecomb	12-4833	2013-2017	1209	3.6	98212	73.7	0.66	111
Edgecomb	12-4834	2018	415	16	91224	219.3	3.36	65.3
Edgecomb	12-4834	2013-2017	477	5.6	69854	159.6	0.75	212.4
Esperance	12-0687	2018	1684	5	3971	2.4	0.01	220.5
Esperance	12-0687	2013-2017	1631	4.6	22989	13.8	0.05	279.6
Esperance	12-0688	2018	1163	10	192401	168.1	2.57	65.4
Esperance	12-0688	2013-2017	1192	2.8	46605	39.4	0.26	153.9
Esperance	12-0689	2018	1243	4	155962	127.3	1.02	124.4
Esperance	12-0689	2013-2017	1257	4.4	27029	21.4	0.34	63.4
Esperance	12-1597	2018	1839	3	11802	6.3	0.04	161.6
Esperance	12-1597	2013-2017	1599	4	1871	1.1	0.01	114.2
Everett	12-0100	2018	379	1	25125	69.6	1.05	66.1
Everett	12-0100	2013-2017	406	2.4	1252	3.1	0.21	14.8
Everett	12-0101	2018	252	2	17264	73.5	1.08	68.2
Everett	12-0101	2013-2017	218	1.2	6883	27.5	0.6	45.7
Everett	12-0112	2018	830	7	235426	260.6	3.24	80.4
Everett	12-0112	2013-2017	856	3.8	11616	13.6	0.24	55.6
Everett	12-0113	2018	362	0	0	0	0	0
Everett	12-0113	2013-2017	411	2.8	20622	53.7	1.05	51.1
Everett	12-0118	2018	1324	2	4383	3.5	0.03	106.3
Everett	12-0118	2013-2017	1163	1.6	75739	55.7	0.19	288.7

Substation	Circuit	Period	Customers	Outages	CMI	SAIDI	SAIFI	CAIDI
Everett	12-0119	2018	1101	2	14182	13.2	0.18	75
Everett	12-0119	2013-2017	1154	3	2341	2	0.02	105.7
Everett	12-0121	2018	262	1	10256	32.6	0.23	144.5
Everett	12-0121	2013-2017	225	1.2	18124	80.2	0.37	216.2
Everett	12-0122	2018	329	1	22508	69.7	1.02	68
Everett	12-0122	2013-2017	446	0.8	14679	36.1	0.6	60.2
Everett	12-3700	2018	0	0	0	0	0	0
Everett	12-3700	2013-2017	0	0	0	0	0	0
Everett	12-3701	2018	0	0	0	0	0	0
Everett	12-3701	2013-2017	0	0	0	0	0	0
Everett	12-3702	2018	0	0	0	0	0	0
Everett	12-3702	2013-2017	0	0	0	0	0	0
Fitzgerald	12-5508	2018	790	1	32280	40.8	1.02	40
Fitzgerald	12-5508	2013-2017	780	0	0	0	0	0
Fitzgerald	12-5509	2018	9	0	0	0	0	0
Fitzgerald	12-5509	2013-2017	10	0	0	0	0	0
Fitzgerald	12-5510	2018	220	0	0	0	0	0
Fitzgerald	12-5510	2013-2017	167	0.2	91	0.8	0.2	4
Fitzgerald	12-5511	2018	4	0	0	0	0	0
Fitzgerald	12-5511	2013-2017	4	0	0	0	0	0
Five Corners	12-1282	2018	1066	4	1126	1.1	0.1	11.1
Five Corners	12-1282	2013-2017	1064	4	4319	4	0.04	91.6
Five Corners	12-1283	2018	1755	6	8850	5	0.04	121.2
Five Corners	12-1283	2013-2017	1729	4.6	187449	106.9	1.23	87
Five Corners	12-1284	2018	869	0	0	0	0	0
Five Corners	12-1284	2013-2017	882	2.8	73430	82.3	1.11	73.9
Five Corners	12-1285	2018	1771	6	9853	5.6	0.04	138.8
Five Corners	12-1285	2013-2017	1780	8.4	10383	5.8	0.04	148.8
Floral Hills	12-2062	2018	1163	14	282828	243.3	2.49	97.7
Floral Hills	12-2062	2013-2017	1138	9.8	234376	200.3	2.8	71.5
Floral Hills	12-2063	2018	2643	14	144073	52.8	0.41	130.2
Floral Hills	12-2063	2013-2017	2207	9.4	350038	140.6	1.5	93.9
Floral Hills	12-2064	2018	1669	3	419	0.2	0	83.8
Floral Hills	12-2064	2013-2017	1596	7.4	225459	139.3	1.42	98.3
Floral Hills	12-2065	2018	2695	0	0	0	0	0
Floral Hills	12-2065	2013-2017	2316	4.4	25142	9.7	0.22	44.8
Fobes	12-0398	2018	1851	6	711	0.4	0	79
Fobes	12-0398	2013-2017	1774	5.4	13797	7.5	0.21	35.6
Fobes	12-0399	2018	948	5	138299	149	2.09	71.4
Fobes	12-0399	2013-2017	1018	5.4	15578	15.8	0.09	183.9
Fobes	12-0400	2018	1175	7	79507	67.8	1.02	66.5
Fobes	12-0400	2013-2017	1180	7.2	138832	116.6	0.63	184.4

Substation	Circuit	Period	Customers	Outages	CMI	SAIDI	SAIFI	CAIDI
Fobes	12-0401	2018	510	3	997	2	0.02	99.5
Fobes	12-0401	2013-2017	543	3.8	12940	24.8	0.1	240.2
Frontier	12-0533	2018	1673	10	126478	71.2	1.22	58.6
Frontier	12-0533	2013-2017	1236	3.6	13094	10.5	0.21	48.9
Frontier	12-0534	2018	1470	9	33351	22.9	4.64	4.9
Frontier	12-0534	2013-2017	2279	3.8	49474	33.2	0.62	53.9
Frontier	12-0535	2018	2475	7	8667	3.5	0.01	288.9
Frontier	12-0535	2013-2017	2429	4	62389	24.7	0.83	30
Frontier	12-0536	2018	1646	2	93772	56.9	0.11	506.9
Frontier	12-0536	2013-2017	1543	3.8	95415	58.5	1.84	31.9
Gibson	12-2897	2018	2800	4	391040	139.2	2.01	69.2
Gibson	12-2897	2013-2017	2603	8.6	142271	52.4	0.8	65.8
Gibson	12-2898	2018	1513	5	8737	5.6	0.04	138.3
Gibson	12-2898	2013-2017	1449	4.8	122066	80.9	1.18	68.6
Gibson	12-2899	2018	987	2	1984	2	1	2
Gibson	12-2899	2013-2017	942	1.4	676	0.7	0	242
Gibson	12-2900	2018	1274	8	29955	24	1.08	22.2
Gibson	12-2900	2013-2017	1317	5.2	60674	47	0.66	71.3
Glenwood	12-0592	2018	1082	5	35551	33.2	1.02	32.6
Glenwood	12-0592	2013-2017	1094	6	167300	154	1.49	103.2
Glenwood	12-0593	2018	1033	3	32479	31.5	1.01	31.1
Glenwood	12-0593	2013-2017	1045	5.6	28912	27.7	0.43	64.3
Glenwood	12-0594	2018	2415	4	82651	33.9	1.06	32
Glenwood	12-0594	2013-2017	2450	7	74212	30.6	0.81	37.6
Glenwood	12-0595	2018	977	1	13485	13.8	0.11	128.4
Glenwood	12-0595	2013-2017	968	0	0	0	0	0
Goldbar	12-0554	2018	1957	40	1447422	738.5	2.34	315.3
Goldbar	12-0554	2013-2017	2093	29	1024317	497.9	1.92	259.5
Goldbar	12-0555	2018	737	15	106885	147.9	0.58	252.8
Goldbar	12-0555	2013-2017	781	10.4	83636	109.7	1.13	97.3
Granite Falls	12-0808	2018	521	13	6535	12.6	0.15	85.2
Granite Falls	12-0808	2013-2017	564	9.6	78079	136.6	0.84	163
Granite Falls	12-0809	2018	1239	14	487870	396.8	2.01	197
Granite Falls	12-0809	2013-2017	1353	15.4	258877	194.7	2.03	95.8
Granite Falls	12-0810	2018	1049	34	1007008	958.6	5.15	186.1
Granite Falls	12-0810	2013-2017	1414	22.2	596147	453.3	2.16	209.4
Granite Falls	12-0811	2018	855	9	66447	79.9	0.22	366.2
Granite Falls	12-0811	2013-2017	899	5	19223	21.9	0.15	143.6
Granite Falls	12-4612	2018	452	1	425	1	0.01	85
Granite Falls	12-4612	2013-2017	488	2.8	31594	65.2	0.49	134.2
Granite Falls	12-4613	2018	592	10	111506	162.4	2.06	78.9
Granite Falls	12-4613	2013-2017	638	8.8	94729	143.9	1.25	114.8

Substation	Circuit	Period	Customers	Outages	CMI	SAIDI	SAIFI	CAIDI
Granite Falls	12-4614	2018	260	3	13382	49.8	1.1	45.2
Granite Falls	12-4614	2013-2017	80	0.4	585	2.2	0.02	91.4
Granite Falls	12-4615	2018	1158	24	344880	264.9	0.99	267.4
Granite Falls	12-4615	2013-2017	1334	16	383967	293.2	2.29	128.1
Harbour Pointe	12-2277	2018	1270	1	10350	11.1	0.05	207
Harbour Pointe	12-2277	2013-2017	1177	0.8	2571	2	0.02	97.1
Harbour Pointe	12-2278	2018	620	0	0	0	0	0
Harbour Pointe	12-2278	2013-2017	621	0.2	6760	10.9	0.06	178.8
Harbour Pointe	12-2279	2018	558	2	264	0.5	0.01	66
Harbour Pointe	12-2279	2013-2017	569	1.6	5365	9.4	0.21	45.5
Harbour Pointe	12-2280	2018	634	0	0	0	0	0
Harbour Pointe	12-2280	2013-2017	629	0.8	1470	2.3	0.2	11.5
Harbour Pointe	12-4674	2018	826	0	0	0	0	0
Harbour Pointe	12-4674	2013-2017	824	0.2	1069	1.3	0	334
Harbour Pointe	12-4675	2018	327	0	0	0	0	0
Harbour Pointe	12-4675	2013-2017	289	0	0	0	0	0
Harbour Pointe	12-4676	2018	0	0	0	0	0	0
Harbour Pointe	12-4676	2013-2017	0	0	0	0	0	0
Harbour Pointe	12-4677	2018	858	0	0	0	0	0
Harbour Pointe	12-4677	2013-2017	858	1.8	10864	12.6	0.42	30.2
Hardeson	12-4556	2018	0	0	0	0	0	0
Hardeson	12-4556	2013-2017	0	0	0	0	0	0
Hardeson	12-4557	2018	1	0	0	0	0	0
Hardeson	12-4557	2013-2017	1	0	0	0	0	0
Hardeson	12-4558	2018	14	0	0	0	0	0
Hardeson	12-4558	2013-2017	15	0	0	0	0	0
Hardeson	12-4559	2018	28	0	0	0	0	0
Hardeson	12-4559	2013-2017	28	0.4	347	12	0.32	36.9
Hartford	12-3117	2018	931	35	245094	264.5	1.39	190.9
Hartford	12-3117	2013-2017	948	13.4	210526	221	2.1	105.1
Hartford	12-3118	2018	590	9	162483	422	7.34	57.5
Hartford	12-3118	2013-2017	999	4.8	13144	20	0.11	185.7
Hartford	12-3119	2018	798	10	74416	93.7	0.21	453.8
Hartford	12-3119	2013-2017	904	6	16182	19.1	0.05	351.2
Hartford	12-3120	2018	1234	15	56312	45.5	0.3	151.3
Hartford	12-3120	2013-2017	1889	17	285895	187.4	1.69	111.1
Hartford	12-3327	2018	561	2	11934	21.5	0.26	84
Hartford	12-3327	2013-2017	554	1.2	1369	2.4	0.03	73.8
Hilton Lake	12-0497	2018	1405	7	222314	158.4	1.49	106.3
Hilton Lake	12-0497	2013-2017	1333	4.6	123651	88.1	0.63	140.8
Hilton Lake	12-0498	2018	786	2	5383	6.9	1.06	6.5
Hilton Lake	12-0498	2013-2017	751	1	20848	26.8	0.41	65.1

Substation	Circuit	Period	Customers	Outages	CMI	SAIDI	SAIFI	CAIDI
Hilton Lake	12-0499	2018	2255	3	378	0.2	0	75.6
Hilton Lake	12-0499	2013-2017	2237	3.4	45510	20.2	0.21	95.9
Hilton Lake	12-0500	2018	2096	3	872	0.4	0	174.4
Hilton Lake	12-0500	2013-2017	2042	3.4	70924	34.1	0.25	138.8
Kellogg Marsh	12-0904	2018	1137	2	5204	4.6	0.04	113
Kellogg Marsh	12-0904	2013-2017	1154	1.8	18220	15.8	0.09	177.3
Kellogg Marsh	12-0905	2018	2036	13	269589	132.7	3.21	41.4
Kellogg Marsh	12-0905	2013-2017	1953	4.2	35616	17.2	0.06	284.6
Kellogg Marsh	12-0906	2018	1166	7	146386	125.8	0.39	318.9
Kellogg Marsh	12-0906	2013-2017	1197	2.8	15219	12.7	0.07	190.7
Kellogg Marsh	12-0907	2018	867	2	74666	83.9	0.25	333.3
Kellogg Marsh	12-0907	2013-2017	868	1.2	17648	19.8	0.21	95.8
Lake Chaplain	12-2034	2018	98	1	993	10.2	0.03	331
Lake Chaplain	12-2034	2013-2017	100	1.8	5897	60.2	0.53	113
Lake Chaplain	12-2035	2018	2	0	0	0	0	0
Lake Chaplain	12-2035	2013-2017	1	0.2	901	900.6	15.8	57
Lake Chaplain	12-2036	2018	460	12	140913	304	4.82	63
Lake Chaplain	12-2036	2013-2017	465	11.2	183399	385.7	3.13	123.1
Lake Goodwin	12-0379	2018	978	19	229871	237.2	1.34	177
Lake Goodwin	12-0379	2013-2017	1080	10	278876	264.9	1.44	183.4
Lake Goodwin	12-0380	2018	1140	17	173490	147.8	0.23	636.9
Lake Goodwin	12-0380	2013-2017	1241	11.6	150930	123.6	1.64	75.6
Lake Goodwin	12-0381	2018	975	8	114226	117.3	1.04	113
Lake Goodwin	12-0381	2013-2017	1082	5.4	100764	98.1	0.86	113.5
Lake Goodwin	12-0382	2018	894	13	122113	136	3.08	44.1
Lake Goodwin	12-0382	2013-2017	944	8.8	94691	98.6	1.09	90.3
Lake Goodwin	12-0383	2018	991	23	26395	26.4	0.05	488.3
Lake Goodwin	12-0383	2013-2017	1100	11.8	105130	97.6	0.84	115.5
Lake Serene	12-0337	2018	1208	2	10689	9	0.07	132
Lake Serene	12-0337	2013-2017	1227	3.2	39061	31.9	0.63	50.2
Lake Serene	12-0338	2018	1276	0	0	0	0	0
Lake Serene	12-0338	2013-2017	1177	1.4	15176	12.7	0.21	60.3
Lake Serene	12-0339	2018	1168	3	3017	2.6	0.03	97.3
Lake Serene	12-0339	2013-2017	1208	2.4	18021	15	0.22	67.8
Lake Serene	12-0340	2018	2336	7	15089	6.5	0.06	108.8
Lake Serene	12-0340	2013-2017	2383	4.4	71829	30.5	0.42	72.7
Lake Serene	12-5205	2018	0	0	0	0	0	0
Lake Serene	12-5205	2013-2017	0	0	0	0	0	0
Lake Stevens	12-0124	2018	1764	22	406019	227	2.61	86.9
Lake Stevens	12-0124	2013-2017	1874	16.6	242964	131.3	1.13	116.2
Lake Stevens	12-0125	2018	2441	13	30920	12.7	0.04	303.1
Lake Stevens	12-0125	2013-2017	2425	6.6	149775	61.1	0.62	98.3

Substation	Circuit	Period	Customers	Outages	CMI	SAIDI	SAIFI	CAIDI
Lake Stevens	12-0273	2018	379	2	374	0.8	0	186.4
Lake Stevens	12-0273	2013-2017	284	0.4	1706	5.9	0.2	29.3
Lake Stevens	12-0274	2018	2028	1	170	0.1	0	85
Lake Stevens	12-0274	2013-2017	1526	3.4	14726	8.6	0.02	347.1
Lake Stevens	12-4034	2018	0	0	0	0	0	0
Lake Stevens	12-4034	2013-2017	0	0	0	0	0	0
Lynnwood	12-0724	2018	1623	5	6390	4	0.07	56.4
Lynnwood	12-0724	2013-2017	1665	5.8	50808	30.8	0.47	66.1
Lynnwood	12-0725	2018	821	6	69355	86.2	0.35	244.2
Lynnwood	12-0725	2013-2017	846	6.2	21370	25.2	0.27	92.7
Lynnwood	12-0726	2018	866	1	1600	1.9	0.01	200
Lynnwood	12-0726	2013-2017	920	2.8	17050	19	0.05	390.7
Lynnwood	12-0727	2018	1284	6	1836	1.5	0.03	51
Lynnwood	12-0727	2013-2017	1304	6.6	9141	7	0.05	129.4
Lynnwood	12-4867	2018	339	0	0	0	0	0
Lynnwood	12-4867	2013-2017	302	0.2	39	0.1	0	97
Maplewood	12-0343	2018	1741	3	66260	38.4	1.01	38
Maplewood	12-0343	2013-2017	1389	2.8	38257	25.8	0.56	46.4
Maplewood	12-0344	2018	1112	9	26668	26.1	0.25	104.6
Maplewood	12-0344	2013-2017	1143	5	10129	9.1	0.06	148.8
Maplewood	12-0345	2018	752	4	2844	3.8	0.03	142.2
Maplewood	12-0345	2013-2017	757	3.4	18325	24	0.21	112.2
Maplewood	12-0346	2018	801	3	19367	24.4	0.6	40.4
Maplewood	12-0346	2013-2017	786	4	51809	65.5	1.07	61.1
Mariner	12-3346	2018	250	0	0	0	0	0
Mariner	12-3346	2013-2017	252	0	0	0	0	0
Mariner	12-3347	2018	1135	2	1533	1.2	0	306.9
Mariner	12-3347	2013-2017	1183	2.8	212663	177.9	0.22	826.1
Mariner	12-3348	2018	1340	3	42584	33.7	0.13	250.5
Mariner	12-3348	2013-2017	1342	2.8	10006	7.5	0.04	167.9
Mariner	12-3349	2018	700	0	0	0	0	0
Mariner	12-3349	2013-2017	706	0.6	337	0.5	0.01	76.5
Mariner	12-3391	2018	1375	1	486	0.4	0	81
Mariner	12-3391	2013-2017	1371	3.4	4712	3.4	0.24	14.2
Martha Lake	12-0073	2018	3100	10	56009	17.6	0.07	234.5
Martha Lake	12-0073	2013-2017	1807	6.4	161362	60.5	1.03	58.8
Martha Lake	12-0074	2018	24	0	0	0	0	0
Martha Lake	12-0074	2013-2017	27	0.8	51213	1898.8	7	271.3
Martha Lake	12-0251	2018	1007	3	75564	74.4	1.01	73.9
Martha Lake	12-0251	2013-2017	895	4.6	110990	123.5	0.8	153.6
Martha Lake	12-0466	2018	1335	15	419912	302.4	1.18	256.1
Martha Lake	12-0466	2013-2017	1271	5.6	78569	59	0.63	94

Substation	Circuit	Period	Customers	Outages	CMI	SAIDI	SAIFI	CAIDI
Martha Lake	12-5695	2018	0	0	0	0	0	0
Martha Lake	12-5695	2013-2017	0	0	0	0	0	0
Meadowdale	12-1837	2018	1861	6	73855	40.1	1.01	39.6
Meadowdale	12-1837	2013-2017	1767	7.2	10471	5.7	0.04	149.7
Meadowdale	12-1838	2018	1305	6	85458	65.9	2.05	32.2
Meadowdale	12-1838	2013-2017	1300	2.4	2760	2.1	0.01	142.2
Meadowdale	12-1839	2018	1138	3	329	0.3	0	65.8
Meadowdale	12-1839	2013-2017	1163	6.2	14010	12	0.05	252.7
Meadowdale	12-1840	2018	565	3	76615	139.4	1.07	130.7
Meadowdale	12-1840	2013-2017	560	3.4	48418	85.5	0.82	104.7
Mountlake	12-0133	2018	1477	7	1765	1.2	0.01	93.1
Mountlake	12-0133	2013-2017	1247	7	38495	27.4	0.26	106.8
Mountlake	12-0134	2018	1782	6	11888	6.7	0.3	22.4
Mountlake	12-0134	2013-2017	1734	7.6	58914	33.3	0.85	39
Mountlake	12-0135	2018	1676	9	36649	22	0.13	175.4
Mountlake	12-0135	2013-2017	1652	3	35861	21.5	0.21	100.8
Mountlake	12-0136	2018	2022	14	88818	43.9	1.04	42
Mountlake	12-0136	2013-2017	2022	14.6	119778	58.9	0.58	100.8
Mukilteo	12-0128	2018	1217	0	0	0	0	0
Mukilteo	12-0128	2013-2017	1205	3	51355	42.1	0.3	141.2
Mukilteo	12-0129	2018	958	4	30329	31.9	0.13	241
Mukilteo	12-0129	2013-2017	947	3	27771	28.9	0.08	345.7
Mukilteo	12-0600	2018	1276	1	1344	1.1	0.01	96
Mukilteo	12-0600	2013-2017	1255	2.8	55187	43.4	0.39	110.7
Mukilteo	12-4523	2018	853	5	12287	14.8	1.03	14.4
Mukilteo	12-4523	2013-2017	848	2.8	23241	27.4	0.41	66.3
Murphy'S Corner	12-1748	2018	1922	1	3	0	0	3
Murphy'S Corner	12-1748	2013-2017	1973	4	232925	118	1	117.8
Murphy'S Corner	12-1749	2018	1409	3	2890	2	0.01	206.4
Murphy'S Corner	12-1749	2013-2017	1262	3.2	140198	97.7	0.75	130
Murphy'S Corner	12-1750	2018	673	1	297	0.4	0	99
Murphy'S Corner	12-1750	2013-2017	642	2.2	13121	19.1	0.29	66.9
Murphy'S Corner	12-1751	2018	542	0	0	0	0	0
Murphy'S Corner	12-1751	2013-2017	549	1.6	5117	9.3	0.21	44.5
North Alderwood	12-0509	2018	410	1	715	1.9	0.03	65
North Alderwood	12-0509	2013-2017	407	0.4	708	1.7	0.01	141.7
North Alderwood	12-0510	2018	180	0	0	0	0	0
North Alderwood	12-0510	2013-2017	179	0.4	35	0.2	0.01	19.4
North Alderwood	12-0511	2018	84	0	0	0	0	0
North Alderwood	12-0511	2013-2017	92	0	0	0	0	0
North Alderwood	12-0512	2018	53	0	0	0	0	0
North Alderwood	12-0512	2013-2017	54	0.6	1822	32	1.16	27.5

Substation	Circuit	Period	Customers	Outages	CMI	SAIDI	SAIFI	CAIDI
North Camano	12-0313	2018	876	16	175191	198	2.79	71
North Camano	12-0313	2013-2017	903	6	51200	56.6	0.64	88.2
North Camano	12-0314	2018	100	1	98	1	0.01	98
North Camano	12-0314	2013-2017	124	1.4	664	5.7	0.04	130.1
North Camano	12-0315	2018	476	9	95244	199.2	0.95	210
North Camano	12-0315	2013-2017	333	6.8	76902	208.1	1.39	149.3
North Camano	12-0316	2018	1377	8	27498	19.8	0.12	160.7
North Camano	12-0316	2013-2017	2103	10.2	99931	69.3	0.95	72.6
North Creek	12-1410	2018	1381	2	7188	4.7	0.02	231.9
North Creek	12-1410	2013-2017	1756	3	152855	90.7	0.4	229.4
North Creek	12-1411	2018	1316	1	38003	30.8	0.19	161.7
North Creek	12-1411	2013-2017	1318	2.2	113946	86.4	0.42	207.6
North Creek	12-1412	2018	1482	5	103278	68.7	1.19	57.8
North Creek	12-1412	2013-2017	1461	4.4	60860	40.9	0.68	60
North Creek	12-1413	2018	1633	3	741	0.5	0	246.5
North Creek	12-1413	2013-2017	1373	1.8	2719	1.7	0.02	106.9
North Creek	12-3733	2018	719	3	1013	1.5	0.01	253.3
North Creek	12-3733	2013-2017	620	0	0	0	0	0
North Marysville	12-0142	2018	293	1	108	0.4	0	108
North Marysville	12-0142	2013-2017	263	0.6	6161	21	0.63	33.4
North Marysville	12-0143	2018	800	0	0	0	0	0
North Marysville	12-0143	2013-2017	690	1	20809	27	0.17	161.9
North Marysville	12-0144	2018	1061	4	11619	10.9	0.04	263.4
North Marysville	12-0144	2013-2017	1105	2.4	44377	40.2	0.28	144.7
North Marysville	12-0254	2018	641	7	53719	85.1	0.57	149.6
North Marysville	12-0254	2013-2017	658	3.8	8977	13.5	0.16	82.7
North Mountain	12-2514	2018	1403	38	610272	434.8	2.61	166.7
North Mountain	12-2514	2013-2017	1567	29.2	699822	464.8	2.71	171.6
North Mountain	12-2515	2018	446	13	98538	222.7	1.48	150.2
North Mountain	12-2515	2013-2017	533	11.6	185634	375.4	2.79	134.6
North Mountain	12-2516	2018	2	0	0	0	0	0
North Mountain	12-2516	2013-2017	2	1	268	134.2	1	134.2
North Stanwood	12-0996	2018	232	13	36873	162	0.99	164.1
North Stanwood	12-0996	2013-2017	277	4	57605	211.6	1.4	150.7
North Stanwood	12-0997	2018	672	14	125523	188.6	1.62	116.3
North Stanwood	12-0997	2013-2017	749	7.8	67666	93.7	1.47	63.8
North Stanwood	12-0998	2018	1638	13	65589	39.3	0.11	358.5
North Stanwood	12-0998	2013-2017	1660	11.4	317502	188.8	1.99	94.9
North Stanwood	12-0999	2018	1955	27	953344	487.8	2.59	188.6
North Stanwood	12-0999	2013-2017	2085	15	225767	108.4	1.56	69.5
North Stanwood	12-3204	2018	1945	29	519941	258.8	1.03	251.3
North Stanwood	12-3204	2013-2017	1959	17.8	450042	222.7	1.21	183.7

Substation	Circuit	Period	Customers	Outages	CMI	SAIDI	SAIFI	CAIDI
Norton Ave	12-0588	2018	76	0	0	0	0	0
Norton Ave	12-0588	2013-2017	81	1.2	1037	13.9	0.42	32.8
Norton Ave	12-0589	2018	990	0	0	0	0	0
Norton Ave	12-0589	2013-2017	1033	2.8	27484	26.7	0.42	63.1
Norton Ave	12-0590	2018	1207	4	1296	1.1	0.02	68.2
Norton Ave	12-0590	2013-2017	1266	2.2	1276	1	0.01	122.5
Norton Ave	12-0591	2018	846	4	35027	42	0.06	700.5
Norton Ave	12-0591	2013-2017	885	1	5036	5.7	0.2	28
Olivia Park	12-2576	2018	1414	3	5405	3.9	0.06	64.3
Olivia Park	12-2576	2013-2017	1428	1.6	40516	28.3	0.4	70.1
Olivia Park	12-2577	2018	779	6	21612	28.2	0.21	135.1
Olivia Park	12-2577	2013-2017	805	3.2	40071	49.1	0.41	118.6
Olivia Park	12-2578	2018	1040	0	0	0	0	0
Olivia Park	12-2578	2013-2017	1051	2	49976	47.2	0.46	103.8
Olivia Park	12-2579	2018	1361	1	642	0.5	0	214
Olivia Park	12-2579	2013-2017	1359	4	49160	35.5	0.65	54.7
Oso	12-1309	2018	204	7	37107	188.2	1.69	111.5
Oso	12-1309	2013-2017	226	4.8	31254	135.3	1.09	124.1
Oso	12-1310	2018	136	4	37804	293.3	1.9	154.7
Oso	12-1310	2013-2017	200	5.2	29108	161.8	1.08	150.2
Paine Field	12-0385	2018	266	0	0	0	0	0
Paine Field	12-0385	2013-2017	386	0.2	66	0.2	0	331
Paine Field	12-0386	2018	112	0	0	0	0	0
Paine Field	12-0386	2013-2017	107	0.4	2873	26.6	0.4	66.5
Paine Field	12-0387	2018	1632	8	3171	2	0.02	90.4
Paine Field	12-0387	2013-2017	1652	4.4	24316	14.8	0.41	36
Paine Field	12-0388	2018	615	1	105	0.2	0	105
Paine Field	12-0388	2013-2017	399	1.2	9122	14.9	0.06	243.9
Paine Field	12-1729	2018	1872	3	1496	0.8	0.01	99.8
Paine Field	12-1729	2013-2017	1875	2.2	25995	13.8	0.24	57.4
Paine Field	12-1730	2018	1605	2	342	0.2	0	86
Paine Field	12-1730	2013-2017	1625	2	1049	0.6	0.01	128.2
Paine Field	12-1731	2018	2297	5	496178	214.6	1.04	206.4
Paine Field	12-1731	2013-2017	2321	1.8	38227	16.5	0.4	41.6
Paine Field	12-1732	2018	143	0	0	0	0	0
Paine Field	12-1732	2013-2017	140	0.2	353	2.5	0.01	353
Park Ridge	12-2319	2018	364	2	14348	41.6	1.06	39.1
Park Ridge	12-2319	2013-2017	1239	1.6	72920	80.9	0.65	125.1
Park Ridge	12-2320	2018	778	3	11946	15.4	0.08	202.5
Park Ridge	12-2320	2013-2017	710	7	98414	90.3	0.39	232.2
Park Ridge	12-2321	2018	1502	1	1134	0.7	0.01	63
Park Ridge	12-2321	2013-2017	1653	8	16837	9.4	0.17	54.4

Substation	Circuit	Period	Customers	Outages	CMI	SAIDI	SAIFI	CAIDI
Park Ridge	12-2322	2018	906	12	17431	18.3	0.81	22.6
Park Ridge	12-2322	2013-2017	884	7	4296	4.8	0.04	117.6
Park Ridge	12-4183	2018	893	2	8550	9	0.09	101.8
Park Ridge	12-4183	2013-2017	880	4	56191	62.2	0.33	187.4
Perrinville	12-0092	2018	762	3	30749	41.5	1.04	40
Perrinville	12-0092	2013-2017	746	4	83851	111	1.23	90.6
Perrinville	12-0093	2018	1195	6	11582	9.8	0.05	186.9
Perrinville	12-0093	2013-2017	1195	6	90964	76	0.69	109.9
Perrinville	12-0126	2018	1391	5	1446	1	0.01	85
Perrinville	12-0126	2013-2017	1377	6.6	8617	6.2	0.06	105.2
Perrinville	12-0221	2018	989	3	17135	18.2	0.08	225.5
Perrinville	12-0221	2013-2017	1004	2.2	5209	5.2	0.6	8.6
Picnic Point	12-1414	2018	671	10	86395	130.7	2.37	55.2
Picnic Point	12-1414	2013-2017	683	7.8	263411	378.3	1.85	204.9
Picnic Point	12-1415	2018	1156	9	65257	56.6	0.63	89.3
Picnic Point	12-1415	2013-2017	1169	8.4	213883	182.2	2.2	82.9
Picnic Point	12-1416	2018	1397	3	1287	0.9	0.01	99
Picnic Point	12-1416	2013-2017	1326	8	8639	6.3	0.05	140.6
Picnic Point	12-1417	2018	517	0	0	0	0	0
Picnic Point	12-1417	2013-2017	511	3	124988	243.7	1.49	163.7
Pinehurst	12-0147	2018	736	2	192	0.2	0.01	48
Pinehurst	12-0147	2013-2017	827	2.6	12401	14.9	0.41	36.6
Pinehurst	12-0148	2018	1311	6	9492	7.3	0.04	172.9
Pinehurst	12-0148	2013-2017	1353	4.6	69591	51.6	0.89	58.3
Pinehurst	12-0149	2018	1735	6	1034	0.6	0.01	86.1
Pinehurst	12-0149	2013-2017	1810	6.4	56433	31.9	0.47	67.3
Pinehurst	12-0220	2018	1023	5	60764	58.3	0.17	345.2
Pinehurst	12-0220	2013-2017	1000	4.6	25291	25.1	0.33	76.4
Pinehurst	12-3350	2018	1857	7	6732	3.7	0.06	65.2
Pinehurst	12-3350	2013-2017	1887	10.4	194190	103.5	1.74	59.4
Polaris	12-4500	2018	564	1	44940	151.8	4.34	35
Polaris	12-4500	2013-2017	69	1.2	20501	46.1	0.67	69.4
Polaris	12-4501	2018	1400	3	1662	1.2	0.02	64.5
Polaris	12-4501	2013-2017	1431	3.2	35498	25	0.42	59.8
Polaris	12-4502	2018	1973	3	13612	7	0.1	68.1
Polaris	12-4502	2013-2017	1924	3.8	119556	61.2	1.22	50
Polaris	12-4503	2018	5	0	0	0	0	0
Polaris	12-4503	2013-2017	8	0.2	163	20.4	0.2	102
Portage	12-3502	2018	179	3	445	2.5	0.03	74.1
Portage	12-3502	2013-2017	162	0.4	1538	8.2	0.17	47.1
Portage	12-3503	2018	258	6	125337	489.2	1.22	401.8
Portage	12-3503	2013-2017	259	2.6	20141	77.1	0.27	290.2

Substation	Circuit	Period	Customers	Outages	CMI	SAIDI	SAIFI	CAIDI
Portage	12-3504	2018	980	16	42708	43.5	0.23	193.2
Portage	12-3504	2013-2017	1114	12	126082	113.6	1.45	78.3
Portage	12-3505	2018	1164	3	119683	112.6	3.16	35.6
Portage	12-3505	2013-2017	1184	1.8	1764	1.5	0.01	105.8
Quil Ceda	12-3177	2018	325	1	1380	4.2	0.06	69
Quil Ceda	12-3177	2013-2017	344	0.4	32	0.1	0	79
Quil Ceda	12-3178	2018	1330	16	174517	132.1	0.52	252.5
Quil Ceda	12-3178	2013-2017	1423	13.4	271739	194.2	1.45	133.9
Quil Ceda	12-3179	2018	33	0	0	0	0	0
Quil Ceda	12-3179	2013-2017	32	0.8	1025	31.3	0.61	51.6
Quil Ceda	12-3180	2018	1139	7	96392	85.8	1.43	59.9
Quil Ceda	12-3180	2013-2017	1230	3.4	93371	80	0.66	120.8
Richmond Park	12-0232	2018	806	6	242674	302.2	2.08	145.6
Richmond Park	12-0232	2013-2017	792	2.6	15549	19.1	0.21	89.4
Richmond Park	12-0233	2018	1091	7	71124	66	0.42	156.3
Richmond Park	12-0233	2013-2017	720	3	56578	65.9	0.37	179.5
Richmond Park	12-2048	2018	363	3	499	1.4	0.03	49.8
Richmond Park	12-2048	2013-2017	363	1.6	13958	38.4	0.24	161.8
Richmond Park	12-5217	2018	754	2	114094	152.9	0.61	249.7
Richmond Park	12-5217	2013-2017	740	3.8	5750	7.5	0.07	101.7
Silver Lake	12-0239	2018	1675	2	100991	59.7	1.01	59.1
Silver Lake	12-0239	2013-2017	1600	2.2	6662	4.1	0.03	149.2
Silver Lake	12-0240	2018	1032	6	56096	55.1	1.04	53.2
Silver Lake	12-0240	2013-2017	1077	4.2	30721	28.4	0.43	66.3
Silver Lake	12-0253	2018	1730	14	65420	38	1.11	34.2
Silver Lake	12-0253	2013-2017	1518	7.4	126543	76.6	0.79	96.4
Silver Lake	12-0267	2018	834	1	27	0	0	27
Silver Lake	12-0267	2013-2017	832	1	2056	2.5	0.01	272
Silver Lake	12-0290	2018	846	2	9702	11.8	0.14	81.5
Silver Lake	12-0290	2013-2017	752	0.8	2198	2.6	0.01	189.6
Smokey Point	12-1507	2018	392	1	279	0.8	0	279
Smokey Point	12-1507	2013-2017	440	1.6	46938	112.1	0.21	535.1
Smokey Point	12-1508	2018	881	1	71896	83.2	1.09	76
Smokey Point	12-1508	2013-2017	561	0.8	87096	120.6	0.23	516.6
Smokey Point	12-1509	2018	1373	8	73121	54.2	2.4	22.5
Smokey Point	12-1509	2013-2017	1455	3.8	169060	116	0.42	274.8
Smokey Point	12-1510	2018	961	1	724	0.7	0	724
Smokey Point	12-1510	2013-2017	619	2.8	67583	134.4	0.73	184.7
Smokey Point	12-5696	2018	14	0	0	0	0	0
Smokey Point	12-5696	2013-2017	0	0	0	0	0	0
Smokey Point	12-5697	2018	0	0	0	0	0	0
Smokey Point	12-5697	2013-2017	0	0	0	0	0	0

Substation	Circuit	Period	Customers	Outages	CMI	SAIDI	SAIFI	CAIDI
Smokey Point	12-5698	2018	0	0	0	0	0	0
Smokey Point	12-5698	2013-2017	0	0	0	0	0	0
Smokey Point	12-5699	2018	0	0	0	0	0	0
Smokey Point	12-5699	2013-2017	0	0	0	0	0	0
Snohomish	12-0103	2018	486	3	33351	69.2	0.32	215.2
Snohomish	12-0103	2013-2017	496	3.8	20659	41.1	1.02	40.3
Snohomish	12-0104	2018	550	13	28182	52.5	1.14	46.1
Snohomish	12-0104	2013-2017	606	6.2	102442	176	2.82	62.3
Snohomish	12-0123	2018	1440	8	3353	2.4	0.03	71.4
Snohomish	12-0123	2013-2017	1542	5.2	2136	1.4	0.03	50.2
Snohomish	12-0151	2018	597	11	70401	119	3.06	38.9
Snohomish	12-0151	2013-2017	612	7	35903	58.8	1.06	55.6
South Camano	12-1530	2018	645	16	296188	455.2	2.88	158.2
South Camano	12-1530	2013-2017	759	8.6	87445	137.4	1.29	106.6
South Camano	12-1531	2018	452	4	23065	50.4	0.58	86.3
South Camano	12-1531	2013-2017	548	0.4	9447	20.6	0.4	51.5
South Camano	12-1532	2018	1536	18	1257344	813.2	3.29	247.5
South Camano	12-1532	2013-2017	1569	14.4	195691	124.6	0.84	148.2
South Camano	12-1533	2018	1012	35	1288562	1266.4	5.79	218.6
South Camano	12-1533	2013-2017	1141	16.8	387361	361.9	2.62	138
Stimson Crossing	12-3090	2018	42	1	1722	46.5	1.14	41
Stimson Crossing	12-3090	2013-2017	38	0.8	792	17	0.36	47
Stimson Crossing	12-3091	2018	1277	20	199193	156.5	1.69	92.5
Stimson Crossing	12-3091	2013-2017	1539	15.2	149737	107.7	1.25	86.1
Stimson Crossing	12-3092	2018	253	1	9750	38.5	0.99	39
Stimson Crossing	12-3092	2013-2017	278	1.4	34392	129.2	1.5	85.9
Stimson Crossing	12-3093	2018	261	4	17455	67.1	0.23	290.9
Stimson Crossing	12-3093	2013-2017	1643	3.8	16286	53.5	0.2	261.8
Sultan	12-1593	2018	536	7	107413	199.5	2.2	90.7
Sultan	12-1593	2013-2017	585	8	162272	287.9	2.45	117.3
Sultan	12-1594	2018	362	5	78147	214.9	0.94	229.8
Sultan	12-1594	2013-2017	374	7.6	128448	336.2	1.9	177.4
Sultan	12-1595	2018	2008	22	374586	194.9	2.24	86.9
Sultan	12-1595	2013-2017	2087	19.8	366346	174.7	1.47	118.9
Sultan	12-1596	2018	630	4	155802	252.9	1.05	241.6
Sultan	12-1596	2013-2017	669	3	39154	58.5	0.85	68.8
Sultan	12-5004	2018	1	1	110	110	1	110
Sultan	12-5004	2013-2017	1	1.2	487	487.2	1.4	348
Sunset	12-5208	2018	1284	18	546486	420.8	5.11	82.3
Sunset	12-5208	2013-2017	729	12.2	501406	362.3	3.8	95.4
Sunset	12-5209	2018	677	10	123159	183	1.66	110.5
Sunset	12-5209	2013-2017	651	7.6	130103	182.6	2.59	70.5

Substation	Circuit	Period	Customers	Outages	CMI	SAIDI	SAIFI	CAIDI
Sunset	12-5210	2018	531	4	7634	14.6	0.05	293.8
Sunset	12-5210	2013-2017	518	4.2	19694	32.8	0.3	109.5
Sunset	12-5211	2018	316	9	18908	60.5	0.2	296.4
Sunset	12-5211	2013-2017	313	1.8	5441	16.5	0.21	79.6
Sunset	12-5212	2018	1001	12	55609	55.1	1.05	52.5
Sunset	12-5212	2013-2017	974	6	141591	135.3	0.62	217.3
Tenth Street	12-0298	2018	1017	3	2955	3	0.01	425
Tenth Street	12-0298	2013-2017	971	0.8	374	0.4	0	171.2
Tenth Street	12-0299	2018	1054	3	1286	1.3	0.01	184.2
Tenth Street	12-0299	2013-2017	1093	2	1485	1.4	0.01	189.3
Tenth Street	12-0300	2018	1350	6	229658	171.4	2.03	84.3
Tenth Street	12-0300	2013-2017	1388	5.8	92037	66.7	0.81	82.4
Tenth Street	12-0301	2018	703	2	29314	44.2	1.07	41.3
Tenth Street	12-0301	2013-2017	761	1.4	16258	21.3	0.4	52.7
Tenth Street	12-0327	2018	0	0	0	0	0	0
Tenth Street	12-0327	2013-2017	0	0	0	0	0	0
Thrashers Corner	12-0275	2018	331	0	0	0	0	0
Thrashers Corner	12-0275	2013-2017	389	0.2	4554	13.8	0.2	69
Thrashers Corner	12-0276	2018	1116	3	110340	100.7	1.05	95.4
Thrashers Corner	12-0276	2013-2017	1066	3.4	8266	7.5	0.03	271.2
Thrashers Corner	12-0277	2018	1841	2	113	0.1	0	18.8
Thrashers Corner	12-0277	2013-2017	1754	0.2	30	0	0	152
Thrashers Corner	12-0278	2018	1287	1	186	0.1	0	93
Thrashers Corner	12-0278	2013-2017	1905	2.8	67175	29.6	0.39	76.2
Thrashers Corner	12-3304	2018	0	0	0	0	0	0
Thrashers Corner	12-3304	2013-2017	2	0	0	0	0	0
Thrashers Corner	12-3471	2018	84	0	0	0	0	0
Thrashers Corner	12-3471	2013-2017	5	0.2	37	0.5	0.04	11
Thrashers Corner	12-3472	2018	1478	4	1140	0.7	0.01	113.8
Thrashers Corner	12-3472	2013-2017	1048	1.6	13792	9.3	0.03	339.5
Thrashers Corner	12-3473	2018	28	0	0	0	0	0
Thrashers Corner	12-3473	2013-2017	36	0.4	320	11.8	0.42	28
Thrashers Corner	12-3474	2018	12	0	0	0	0	0
Thrashers Corner	12-3474	2013-2017	16	0	0	0	0	0
Three Lakes	12-1818	2018	709	19	201362	278.5	1.84	151.1
Three Lakes	12-1818	2013-2017	758	13.4	199007	259.6	1.73	150.1
Three Lakes	12-1819	2018	1116	13	38734	34.3	1.03	33.2
Three Lakes	12-1819	2013-2017	1232	13	264658	220.4	2.56	86
Three Lakes	12-1820	2018	1680	35	341046	216.4	2.1	103
Three Lakes	12-1820	2013-2017	1676	25.6	468638	283.2	2.93	96.5
Three Lakes	12-1821	2018	698	13	29106	42.1	0.12	339.7
Three Lakes	12-1821	2013-2017	752	11	221234	290.5	2.62	110.8

Substation	Circuit	Period	Customers	Outages	CMI	SAIDI	SAIFI	CAIDI
Tulalip	12-0505	2018	310	2	598	2	0.02	119.7
Tulalip	12-0505	2013-2017	374	2	8043	24.1	0.27	88.7
Tulalip	12-0506	2018	398	2	51138	130.7	3.1	42.1
Tulalip	12-0506	2013-2017	425	2.2	5896	13.8	0.21	66.1
Tulalip	12-0507	2018	1043	19	723109	697.9	2.46	283.2
Tulalip	12-0507	2013-2017	1077	6.2	204395	192.7	1.39	139.1
Tulalip	12-0508	2018	553	6	75752	139.7	3.08	45.3
Tulalip	12-0508	2013-2017	612	3.4	39430	64	0.47	137.1
Turners Corner	12-1428	2018	162	4	4073	26.6	0.07	407.3
Turners Corner	12-1428	2013-2017	181	3.2	5009	28.7	0.24	119.2
Turners Corner	12-1429	2018	597	10	183944	317	0.71	446.3
Turners Corner	12-1429	2013-2017	1094	9.2	137378	128.3	0.81	159.2
Turners Corner	12-1430	2018	825	15	276783	337.1	2.47	136.2
Turners Corner	12-1430	2013-2017	893	12.4	120186	134.3	1.22	110.4
Turners Corner	12-1431	2018	820	8	13148	16	0.19	86.5
Turners Corner	12-1431	2013-2017	879	11.8	133214	152.6	0.68	225.7
Turners Corner	12-4310	2018	46	4	549	12.1	0.15	78.3
Turners Corner	12-4310	2013-2017	64	0.8	2220	41.8	0.41	101.1
Village	12-4304	2018	395	1	385	1	0	385
Village	12-4304	2013-2017	404	2.8	29403	70	0.46	152.4
Village	12-4305	2018	1650	18	81206	49.3	0.06	864
Village	12-4305	2013-2017	210	12.4	157898	87.5	0.85	102.8
Village	12-4306	2018	5	0	0	0	0	0
Village	12-4306	2013-2017	5	0.6	42	9.5	0.14	68
Village	12-4307	2018	16	4	710	61.3	0.49	125.5
Village	12-4307	2013-2017	17	0.8	180	10.6	0.22	47.5
Wallace River	12-4485	2018	394	4	15407	38.9	1.13	34.2
Wallace River	12-4485	2013-2017	465	8.2	47679	108.9	1.28	85.1
Wallace River	12-4486	2018	1	0	0	0	0	0
Wallace River	12-4486	2013-2017	1	0.2	4	4.4	0.2	22
Wallace River	12-4487	2018	160	3	68956	115.1	0.29	393.7
Wallace River	12-4487	2013-2017	150	2.4	6344	40.8	0.62	65.9
Waterfront	12-1842	2018	1172	2	59917	54.1	1.07	50.6
Waterfront	12-1842	2013-2017	1100	2.2	72624	61.6	0.99	62.6
Waterfront	12-1843	2018	904	0	0	0	0	0
Waterfront	12-1843	2013-2017	944	0.6	3814	4.1	0.01	517
Waterfront	12-1846	2018	412	3	3051	7.8	0.05	152.8
Waterfront	12-1846	2013-2017	538	1.6	3666	8	0.28	28.6
Waterfront	12-1847	2018	601	3	6066	10.1	0.09	108.4
Waterfront	12-1847	2013-2017	638	2.2	7274	11.4	0.21	54.5
West Monroe	12-0631	2018	645	2	11890	18.9	1.04	18.2
West Monroe	12-0631	2013-2017	656	2	2090	3.2	0.02	163.5

Substation	Circuit	Period	Customers	Outages	CMI	SAIDI	SAIFI	CAIDI
West Monroe	12-0632	2018	1411	3	31871	22.9	0.22	103.5
West Monroe	12-0632	2013-2017	1432	2.4	58100	40.6	0.61	66.5
West Monroe	12-0633	2018	761	7	8183	10.2	0.05	194.8
West Monroe	12-0633	2013-2017	820	4.4	31755	41.2	0.26	160.1
West Monroe	12-0634	2018	335	7	96598	295.3	3.37	87.7
West Monroe	12-0634	2013-2017	377	4.6	33477	78.2	0.96	81.4
West Monroe	12-3360	2018	645	6	21639	32.3	0.03	1270.7
West Monroe	12-3360	2013-2017	654	9.8	103966	162.3	1.79	90.6
West Monroe	12-3361	2018	1075	3	31554	29.4	0.27	109.2
West Monroe	12-3361	2013-2017	1021	0.6	51566	0.9	0	265.1
West Monroe	12-3362	2018	1281	5	15115	11.7	0.14	81.7
West Monroe	12-3362	2013-2017	1239	3	16082	12.4	0.25	49
West Monroe	12-3363	2018	856	3	431	0.5	0	107.8
West Monroe	12-3363	2013-2017	831	3	925	1.1	0.02	72.4
Westgate	12-0404	2018	897	3	2042	2.4	0.03	84.4
Westgate	12-0404	2013-2017	915	6.4	106531	118.9	0.85	139.5
Westgate	12-0405	2018	819	2	17788	21.5	0.08	261.6
Westgate	12-0405	2013-2017	1540	4.2	95261	73.2	0.69	105.7
Westgate	12-0406	2018	1324	4	16518	12	0.04	322.4
Westgate	12-0406	2013-2017	1285	3.6	25863	20	0.24	82.1
Westgate	12-0407	2018	991	3	2520	2.6	0.01	193.9
Westgate	12-0407	2013-2017	907	4	65891	67.3	0.6	112.8
Woods Creek	12-1808	2018	1835	28	435879	235.9	2.17	108.6
Woods Creek	12-1808	2013-2017	1957	20.6	542137	278.4	1.93	144.2
Woods Creek	12-1809	2018	1403	28	338642	240.6	1.24	193.9
Woods Creek	12-1809	2013-2017	1473	21.2	422144	284.3	1.67	170.3
Woods Creek	12-1810	2018	1026	4	24078	22.3	0.09	256.1
Woods Creek	12-1810	2013-2017	857	10.4	267243	270	2.15	125.3
Woods Creek	12-1811	2018	1150	21	442075	387.1	5.23	74
Woods Creek	12-1811	2013-2017	1246	8.6	558192	446.9	1.9	235.6
York	12-5392	2018	1512	7	154646	102.3	1.1	93.4
York	12-5392	2013-2017	1526	3.2	19581	12.9	0.21	61.8
York	12-5393	2018	1825	1	338	0.2	0	169
York	12-5393	2013-2017	1828	2.6	30378	16.6	0.41	40.1
York	12-5394	2018	1600	4	80265	47.9	1.04	46.2
York	12-5394	2013-2017	1581	1.2	1861	1.2	0.2	5.9
York	12-5395	2018	725	16	197937	266.8	2.23	119.9
York	12-5395	2013-2017	750	3.2	101305	132.8	1.55	85.9

*Indicates substations that do not have five years of history.

Appendix B

Historical Data: SAIDI, CAIDI, and SAIFI

No uplift factor was applied to these historical metrics.

Table B - 1: SAIDI 1991 - 2018

Year	Distribution	Transmission	Overall	Excluded Outages	Overall (Everything)
1991	68.3	27.7	96	180	276
1992	95.3	5.5	101.4	82.3	183.7
1993	87.4	9.8	97.2	1136.2	1233.5
1994	60.2	41.5	101.7	9.2	110.9
1995	81.6	12.9	94.5	359.5	454
1996	52.1	8.5	60.6	60.7	121.1
1997	47.7	2.8	50.5	43.8	94.3
1998	47.9	24.3	72.2	40.4	112.6
1999	46.2	17.3	63.5	134.1	236.1
2000	52.5	3.1	55.6	147.3	219.4
2001	34.6	14.7	49.3	7.4	88.8
2002	32.4	21.8	54.2	25.5	89.8
2003	31.7	19.9	52.6	105.1	185.9
2004	35.9	4.2	40.1	237.8	287.2
2005	57.3	6.8	64.1	0	74.7
2006	50.6	17.7	68.3	567.2	684.2
2007	38.4	28.8	67.3	188.8	274.8
2008	41.6	8.4	50	33.8	97.2
2009	49.8	15.3	65.1	0	76.4
2010	69.1	10.9	79.9	34.2	114.1
2011	77.2	6.2	83.3	0	83.3
2012	63.2	8.4	71.6	44.2	115.9
2013	63.7	20.8	84.5	0	84.5
2014	90.3	21.8	112	116.9	228.9
2015	64.1	16.9	81	1312.1	1390.1
2016	57.5	2.1	59.6	77	136.6
2017	117.7	11.9	129.6	43.9	173.6
2018	87.4	5.5	92.9	177.9	270.8
5-Year Average (2013-2017)	77.2	14.7	91.9	9	101

Table B - 2: CAIDI 1991 - 2018

Year	Distribution	Transmission	Overall	Excluded Outages	Overall (Everything)
1991	91.0	62.0	80.0	175.0	124.0
1992	100.7	31.6	90.1	235.0	128.0
1993	93.4	38.7	81.7	1001.9	530.7
1994	78.8	163.0	99.9	96.5	99.6
1995	89.9	68.0	86.1	197.7	155.7
1996	81.0	48.7	74.1	84.0	78.7
1997	78.6	23.6	69.5	117.0	85.7
1998	77.8	74.8	76.8	98.8	83.5
1999	73.3	198.0	88.5	155.2	107.9
2000	97.0	44.4	90.9	132.2	118.9
2001	66.5	57.1	63.4	56.2	63.5
2002	66.4	149.8	85.6	94.8	87.4
2003	88.8	88.9	88.8	107.4	106.8
2004	75.1	35.6	67.3	286.5	157.0
2005	83.6	42.5	75.8	0.0	76.5
2006	94.7	54.7	79.7	301.5	217.3
2007	76.2	164.6	99.0	220.9	158.5
2008	86.6	47.0	75.8	148.7	73.0
2009	86.8	51.9	75.0	0.0	74.1
2010	106.4	68.2	98.9	141.4	108.7
2011	112.7	40.6	99.6	0.0	99.6
2012	101.8	33.4	82.0	108.2	190.2
2013	104.3	95.7	102.0	0.0	102.0
2014	117.8	70.4	104.2	338.4	205.8
2015	100.3	79.0	94.9	699.4	509.2
2016	106.2	27.7	96.4	160.4	124.2
2017	98.0	51.7	90.7	168.8	102.1
2018	105.9	66.7	102.3	239.5	164.0
5-Year Average (2013-2017)	105.1	69.6	97.1	160	100.7

Table B - 3: SAIFI 1991 - 2018

Year	Distribution	Transmission	Overall	Excluded Outages	Overall (Everything)
1991	0.75	0.45	1.20	1.03	2.23
1992	0.95	0.17	1.13	0.35	1.48
1993	0.94	0.26	1.19	1.13	2.32
1994	0.76	0.26	1.02	0.10	1.11
1995	0.91	0.19	1.10	1.82	2.92
1996	0.64	0.17	0.82	0.72	1.54
1997	0.61	0.12	0.73	0.37	1.10
1998	0.62	0.32	0.94	0.41	1.35
1999	0.63	0.09	0.72	0.86	2.19
2000	0.54	0.07	0.61	1.11	1.85
2001	0.26	0.52	0.78	0.13	1.40
2002	0.49	0.15	0.63	0.27	1.03
2003	0.37	0.22	0.59	0.98	1.74
2004	0.47	0.12	0.58	0.83	1.52
2005	0.69	0.16	0.85	0.00	0.98
2006	0.53	0.33	0.86	1.88	3.15
2007	0.50	0.18	0.68	1.19	2.13
2008	0.48	0.18	0.66	0.23	1.35
2009	0.57	0.30	0.87	0.00	1.03
2010	0.65	0.16	0.81	0.24	1.05
2011	0.68	0.15	0.84	0.00	0.84
2012	0.62	0.25	0.87	0.41	1.28
2013	0.61	0.22	0.83	0.00	0.83
2014	0.77	0.31	1.08	0.35	1.47
2015	0.64	0.21	0.85	1.88	2.73
2016	0.55	0.08	0.63	0.48	1.11
2017	1.20	0.23	1.43	0.26	1.70
2018	0.83	0.08	0.91	0.74	1.65
5-Year Average (2013-2017)	0.73	0.21	0.95	0.06	1