Puget Sound Energy
Pipeline Replacement Program Plan
June 2015

Docket No. UG-120715

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1. Introduction

On December 31, 2012, the Washington Utilities and Transportation Commission (UTC) issued a policy statement for the accelerated replacement of natural gas pipeline facilities with elevated risk. This policy statement requires each gas company, whether requesting a special pipe replacement cost recovery mechanism (CRM) or not, to file with the Commission a pipe replacement program plan containing the following elements:

1. A "master" plan for replacing all pipes with an elevated risk of failure
2. A two-year plan that specifically identifies the pipe replacement goals for the upcoming two year period
3. A plan for identifying the location of pipe that presents elevated risk of failure

In accordance with this policy statement, Puget Sound Energy (PSE) has prepared the following pipeline replacement program (PRP) plan for pipe that poses an elevated risk of failure. Through PSE's Distribution Integrity Management Program (DIMP), PSE continually analyzes the performance of its distribution system and results show that the distribution system is performing well as a whole. However, detailed analysis indicates some subsets of materials have an elevated risk of failure. These subsets include larger diameter (1-1/4" and larger) DuPont Aldyl "HD" plastic pipe, older vintage wrapped steel mains, and older vintage wrapped steel services.

Sewer cross bores have also been identified as pipe with an elevated risk of failure and is included in the PRP plan. Sewer cross bores are gas installations where the gas pipe was inadvertently installed through an unmarked sewer pipe. These gas pipes are at risk of failure when a blocked sewer line is cleared using a mechanical cleaning device that damages the gas pipe. The identification and correction of these installations is now a priority of PSE's DIMP due to the potential high consequence should damage occur.

2. PSE's PRP Plan Progress

PSE filed its first PRP plan in 2013 and has made substantial progress towards meeting the requirements of the Master Plan. The following materials have been replaced or are pending replacement according to the Master Plan.

Table 1. 2014-2015 Two-Year Plan Progress

Material	2014 Planned Replacement	2014 Actual Replacement	2015 Planned Replacement	2015 Pending Replacement
DuPont Aldyl "HD" Plastic Pipe	10 Miles	10.5 Miles	30 Miles	31.6 Miles
Older Vintage Wrapped Steel Main	4 Miles	4.5 Miles	4 Miles	4 Miles
Older Vintage Wrapped Steel Service	200 Services	187 Services	200 Services	199 Services

Also in the 2013 PRP plan, PSE identified bare steel pipe as a material having an elevated risk of failure. As of December 31, 2014, PSE has completed the replacement of all known bare steel pipe in accordance with the negotiated Settlement to Dockets PG-030080 & PG-030128 between PSE and the UTC.

3. PSE's Distribution Integrity Management Program (DIMP)

As required by the DIMP regulations, PSE analyzes many aspects of system performance including trends on identified system threats. The threats that are identified and evaluated in DIMP include:

- Corrosion
- Natural forces

- Excavation damage
- Other outside force damage
- Material or welds
- Equipment failure
- Incorrect operation

The analysis includes reviewing leak, failure analysis, and system condition data to identify trends, and the results are reported in the Continuing Surveillance Annual Report. A copy of the report is provided to the UTC after each annual update. The analysis provides insight into the risks associated with pipe identified as having an elevated risk of failure that are included in the PRP plan.

PSE continues to increase pipeline safety and system reliability through the continuous improvement of its DIMP. The assessment, prioritization, and mitigation of system risks continue to be refined as new and additional risk knowledge is incorporated into its DIMP through normal O&M and DIMP activities. Activities related to DIMP could include gathering data, conducting targeted inspections, and completing remediation and replacement work associated with integrity management driven programs. Based on additional risk knowledge and the results of the trends analysis, the Master Plan may be modified appropriately to further accelerate or decelerate the pipe replacement schedule. Additionally, PSE is actively monitoring system threats and performance and may identify additional materials that have an elevated risk of failure. Currently, PSE has identified the following materials and components to be emerging system risks that are being further evaluated and may consider including them in the PRP plan at a later date:

- Celcon service tee caps
- Bolt-on service tees

If any material changes are made to the PRP plan, PSE will submit the changes to the Commission as required by the Commission's Policy Statement.

4. DuPont ALDYL "HD" Plastic Pipe

Master Plan

Risk Assessment

Through DIMP, PSE has identified an increased risk of premature, brittle-like cracking of the larger diameter (1-1/4" and larger) Aldyl "HD" plastic pipe manufactured by DuPont. PSE installed this pipe in the 1970s and early 1980s and estimates there to be nearly 400 miles that remain in service.

The brittle-like cracking is due to slow crack growth (SCG) at locations where there is a stress concentration. Based on PSE's experience, the brittle-like cracking is primarily due to rock impingement but also occurs where the pipe has been squeezed or where other stress concentrations have been introduced due to inconsistent joining practices. The failure is referred to as brittle-like cracking because it occurs without any localized plastic deformation. While the failure occurs without plastic deformation, the pipe is not brittle. Even when a failure occurs due to SCG, the PE pipe is still resistant to crack propagation preventing it from becoming a larger crack. A study by GTI (Gas Technology Institute) performed at PSE's request provides additional insight into how installation and operating practices, environmental conditions, and operating pressures impact the life expectancy of the pipe.

Industry Experience

PSE's experience with the larger diameter DuPont Aldyl "HD" material is similar to industry experience with many of the older PE materials. This is highlighted by many of the Safety Recommendations issued by the National Transportation Safety Board (NTSB) on April 30, 1998. These recommendations were based on findings from NTSB's investigation of PE pipe following several natural gas distribution accidents that involved plastic piping that cracked in a "brittle-like" manner. The following summarizes many of the issues identified in the NTSB's investigation that correlate to PSE's experience with the DuPont Aldyl "HD" material:

- Nationally, brittle-like failures represent a frequent failure mode for older plastic piping.
- The procedure used to rate PE materials from the 1960s through the early 1980s may have overrated the materials long term strength and resistance to brittle-like cracking.
- The test methods used at the time did not reveal the susceptibility of many early PE materials to brittle-like cracking.
- Plastic pipe was assumed to perform in a ductile manner; therefore, plastic pipe design focused primarily on stress due to operating pressure. As a result, little consideration was given to stress due to external loading as it was assumed that these stresses would be reduced by localized yielding.
- Experts in gas distribution plastic piping indicate that some of the PE pipe manufactured from the 1960s through the early 1980s has demonstrated poor resistance to brittle-like cracking. There is evidence that some early vintage PE materials have a lower SCG resistance than other PE materials. Newer test methods more accurately predict the pipe's resistance to SCG.

Aldyl "HD" vs Aldyl "A"

In addition to the Aldyl "HD", DuPont also manufactured a medium density PE pipe marketed under the name Aldyl "A". While PSE only purchased and installed the Aldyl "HD" pipe, information on both Aldyl "A" and Aldyl "HD" pipe is included to highlight the similarities and differences in the risks of these two materials. Similar to PSE's experience with Aldyl "HD", the Aldyl "A" pipe has been found to be susceptible to brittle-like cracking.

The Aldyl "A" pipe manufactured from 1970 through early 1972 had a manufacturing issue that resulted in a brittle inside surface also referred to as low ductile inner wall (LDIW). This characteristic resulted in premature failures. In early 1972, DuPont changed the manufacturing process to address the LDIW phenomena.

While only early 1970s vintage Aldyl "A" pipe had the LDIW inner surface, both Aldyl "HD" and later vintage Aldyl "A" have exhibited brittle-like cracking failure characteristics in pipes 1 ¼" and larger in diameter. The smaller diameter piping is more flexible and not as susceptible to the brittle-like cracking experienced in larger diameters.

Both Aldyl "HD" and Aldyl "A" were made with state-of-the-art PE resins at the time of manufacture and met applicable industry standards and complied with federal regulations. However, by today's standards they both have low resistance to SCG and are susceptible to SCG field failures. This is particularly true when these pipes are subjected to secondary loads, such as rock impingement and squeeze-off.

Predictions on the Remaining Useful Life Expectancy

PSE consulted with Gas Technology Institute (GTI) to develop data, information, and predictions on the remaining useful life expectancy based on samples of DuPont Aldyl "HD" plastic pipe extracted from PSE's distribution system. The purpose for the evaluation performed by GTI is to provide additional risk knowledge into the failure mode of DuPont Aldyl "HD" plastic pipe and information on the pipe characteristics, operating conditions, and environmental factors that may impact the material's performance. This study also provides a means to predict the

remaining useful life expectancy of the pipe to validate the current remediation schedule or determine the appropriate remediation timeframe. Based on the testing and analysis performed, the study concludes that the expected useful life is impacted by temperature, operating pressure, and the severity of stress risers.

Based on the evaluation, there may be specific pipelines operating at relatively low pressures that even under extreme stress risers pose minimal risk. These facilities may be deemed to be low risk and not replaced as part of the Master Plan. The overall pipe replacement strategy will continue to prioritize based on the highest risk pipe from historical performance, however may be adjusted considering the new risk knowledge.

DuPont Aldyl "HD" Plastic Pipe Replacement Plan

PSE is actively replacing the larger diameter DuPont Aldyl "HD" plastic pipe that poses an elevated risk of failure. PSE will continue monitor the performance of the larger diameter DuPont Aldyl "HD" pipe through DIMP to determine the appropriate timeframe for replacing the pipe. For pipe currently not identified as having an elevated risk of failure, PSE will continue to incorporate new risk knowledge related to installation and operating practices, environmental conditions, and operating pressures to evaluate whether this population warrants replacement in the future.

Based on current risk knowledge and historical performance, PSE currently plans to replace approximately 190 miles of larger diameter DuPont Aldyl "HD" plastic pipe over 8 years beginning in 2013. The current replacement schedule is provided in Table 2.

Table 2. DuPont Aldyl "HD" Plastic Pipe Replacement Schedule, Miles, and Estimated Expenditures

Program Years	Total Planned Replacement Miles	Estimated Expenditures[1]
1 – 8	190 Miles	$237.5 million

1 Estimated expenditures are in 2015 dollars and do not include AFUDC

The miles of larger diameter DuPont Aldyl "HD" plastic pipe that have already been replaced under the Master Plan are provided in Table 3.

Table 3. DuPont Aldyl "HD" Plastic Pipe Actual Replacement Miles

Program Year	Actual Replacement Miles	Actual Expenditures
2013	6.5 Miles	$6.9 million
2014	10.5 Miles	$10.3 million

Two-Year Plan

The two-year plan is to continue replacing pipe according to the Master Plan. The following table shows the planned replacement miles of DuPont Aldyl "HD" plastic pipe in calendar years 2016 and 2017 and the planned expenditures.

Table 4. Planned Replacement Miles and Expenditures

Program Year	Planned Replacement Miles	Planned Expenditures[1]
2016	30 Miles	$37.5 million
2017	30 Miles	$37.5 million

1 Estimated expenditures are in 2015 dollars and do not include AFUDC

Appendix A provides a list of the DuPont Aldyl "HD" plastic pipe projects that are planned for replacement in the calendar years 2016 and 2017. Adjustments to projects will be made as required while managing to the Master Plan and overall system risk.

Identification Plan

PSE purchased and installed DuPont Aldyl "HD" plastic pipe in the 1970s and early 1980s. During this timeframe, PSE also purchased and installed Phillips Driscopipe M8000 and Plexco pipe. PSE's historical construction records did not capture the pipe manufacturer and only indicated the location of the pipe, material type, pipe size, and date the pipe was installed. As a result, PSE has developed and implemented a plan to identify the manufacturer of larger diameter HDPE pipe installed in the 1970s and early 1980s. The plan focuses only on identifying candidate pipe installations that may pose an elevated risk of failure. The remaining unidentified population will be evaluated to determine if the risk warrants targeted identification.

Identification Plan and Schedule

PSE estimates approximately 400 miles of DuPont Aldyl "HD" plastic pipe remain in service of which PSE has already identified 300 miles. This identification is based on locations of where DuPont Aldyl "HD" plastic pipe has previously failed and post construction reports of pipe manufacturer. PSE had previously captured information on pipe manufacturer on the Exposed Pipe Condition Report and has recently implemented a new PE Pipe Report to continue capturing this information. This information is being recorded in a database and analyzed to identify locations where the pipe manufacturer is already known and areas that may require targeted excavation to determine the manufacturer.

PE pipe manufacturer is currently being identified when the pipe is exposed through normal operations and maintenance activities, confirmation excavations when refining the scope of DuPont Aldyl "HD" pipe replacement projects, and opportunities through other planned pipe replacement projects.

Where the pipe manufacturer remains unconfirmed for candidate pipe installations that may pose an elevated risk of failure, PSE is strategically conducting targeted excavations. The strategy is based on the current risk knowledge and historical performance of DuPont Aldyl "HD" plastic pipe and considers installation and operating practices, environmental conditions, and operating pressures. The need for targeted excavations of candidate pipe installations will continue to be evaluated and adjusted as new risk knowledge is incorporated into the strategy.

According to the current identification plan, PSE plans to complete the identification of the larger diameter Aldyl "HD" plastic pipe locations that pose an elevated risk by the end of 2016. While PSE's methodology prioritizes performing targeted excavations in the vicinity of paving improvements, existing paving moratoriums or significant changes in the number of targeted excavations required could result in a change to this schedule.

Criteria for Targeted Excavations

Targeted excavations are performed in accordance with the following criteria until DuPont Aldyl "HD" is identified. Once DuPont Aldyl "HD" is identified on any installation job, the targeted excavations are complete and the location is prioritized for replacement. If DuPont Aldyl "HD" is not identified on the initial targeted excavation, additional excavations are performed until Aldyl "HD" is identified or all targeted excavations are complete per the following criteria:

- One positive non-DuPont Aldyl "HD" identification is required for each pipe size installed under the same installation job

- More than one positive identification of non-DuPont Aldyl "HD" is required for installation jobs that are greater than 1,000 feet in length
- PE services not off of candidate mains must have at least one positive identification of non-DuPont Aldyl "HD"

The criteria will continue to be evaluated and adjusted if necessary based on the manufacturer data gathered through PE Pipe Reports and the ongoing replacement of the DuPont Aldyl "HD" pipe. The targeted excavations are planned considering factors such as maximizing efficiencies and productivity, minimizing costs, and minimizing impacts to municipalities and the general public.

5. Older Vintage Wrapped Steel Mains

Master Plan

Risk Assessment

PSE has identified through DIMP an increased risk of failure on a subset of older wrapped steel mains. The risks on older vintage wrapped steel mains include:

- Corrosion
- Disbonded pipe coating
- Damaged pipe coating (caused by third party damage)
- Welds
- Equipment including vintage valves

The majority of the wrapped steel system is performing very well. However, ongoing reviews of the wrapped steel system installed prior to 1972 continue to identify areas that have had leaks repaired, are experiencing new leaks, and have reports of corrosion and/or damaged pipe coating. These segments of main and their associated service piping have an elevated risk of failure as indicated by the system performance data. There is approximately 2,300 miles of older vintage wrapped steel main that remain in service.

Older Vintage Wrapped Steel Main Replacement Plan

PSE is actively replacing older vintage wrapped steel main and associated service pipe that poses an elevated risk of failure. PSE will continue monitor the performance of older vintage wrapped steel mains through DIMP to determine the appropriate timeframe for replacing the pipe. For pipe currently not identified as having an elevated risk of failure, PSE will continue to incorporate new risk knowledge and evaluate whether this population warrants replacement in the future.

Based on current risk knowledge and historical performance, PSE currently plans to replace approximately 20 miles of older vintage wrapped steel mains over 5 years beginning in 2013. The current replacement schedule is provided in Table 5.

Table 5. Older Vintage Wrapped Steel Main Replacement Schedule, Miles, and Estimated Expenditures

Program Years	Total Planned Replacement Miles	Estimated Expenditures[1]
1 – 5	20 Miles	$25 million

1 Estimated expenditures are in 2015 dollars and do not include AFUDC

The miles of older vintage wrapped steel main that have already been replaced under the Master Plan are provided in Table 6.

Table 6. Older Vintage Wrapped Steel Main Actual Replacement Miles

Program Year	Actual Replacement Miles	Actual Expenditures
2013	3.2 miles	$3.7 million
2014	4.5 miles	$5.4 million

Two-Year Plan

The two-year plan is to continue replacing pipe according to the Master Plan. The following table shows the planned replacement miles of older vintage wrapped steel main in calendar years 2016 and 2017 and planned expenditures.

Table 7. Planned Replacement Miles and Expenditures

Program Year	Planned Replacement Miles	Planned Expenditures[1]
2016	4 miles	$5 million
2017	4 miles	$5 million

1 Estimated expenditures are in 2015 dollars and do not include AFUDC

Appendix B provides a list of the older vintage wrapped steel main projects that are planned for replacement in the calendar years 2016 and 2017. Adjustments to projects will be made as required while managing to the Master Plan and overall system risk.

Identification Plan

The location of older vintage wrapped steel pipe that presents an elevated risk of failure is continually monitored by reviewing system information that includes leak repairs, active leaks, and exposed pipe condition reports. In conjunction with reviewing system performance data, the new geographic information system (GIS) is now being utilized to proactively identify any new areas that may present an elevated risk of failure.

6. Older Vintage Wrapped Steel Services

Master Plan

Risk Assessment

PSE has identified through DIMP an increased risk of failure on a subset of the older vintage wrapped steel services. The risks on older vintage wrapped steel services include:

- Corrosion
- Disbonded pipe coating
- Inadequate cathodic protection

PSE developed and implemented a program to assess the risks on wrapped steel services installed prior to 1972. Since this program began, more than 10,000 of the original population of approximately 100,000 services have been replaced. The majority of the remaining wrapped steel services are performing very well. However, ongoing review of additional risk factors indicates an elevated risk of failure for some of the services. These risk factors include services in casing where the gas carrying pipe within the casing may not be adequately protected from corrosion, services with buried meters, or services that serve high occupancy structures that increase the total risk.

Older Vintage Wrapped Steel Service Replacement Plan

PSE is actively replacing older vintage wrapped steel services that pose an elevated risk of failure. PSE will continue to monitor the performance of older vintage wrapped steel services through DIMP to determine the appropriate timeframe for replacing the pipe. For pipe currently not identified as having an elevated risk of failure, PSE will continue to incorporate new risk knowledge and evaluate whether this population warrants replacement in the future.

The older vintage wrapped steel services that pose an elevated risk of failure are determined based on current risk knowledge and the results from the risk model. The risk model, which was previously approved by the UTC, is updated annually with new risk knowledge as well as additional risk knowledge that is gained from on-going review of installation records. As a result, PSE currently plans to replace approximately 200 older vintage wrapped steel services each year over the next 5 years beginning in 2013. The current replacement schedule is provided in Table 8.

Table 8. Older Vintage Wrapped Steel Service Replacement Schedule, Units, and Estimated Expenditures

Program Years	Approximate Annual Replacement	Estimated Expenditures[1]
1 – 5	200 Services	$10 million

1 Estimated expenditures are in 2015 dollars and do not include AFUDC

The number of older vintage wrapped steel services that have already been replaced under the Master Plan is provided in Table 9.

Table 9. Older Vintage Wrapped Steel Service Actual Replacement

Program Year	Actual Replacement	Actual Expenditures
2013	163 services	$1.6 million
2014	187 services	$1.9 million

Two-Year Plan

The two-year plan is to continue to replace older vintage wrapped steel services according to the Master Plan. PSE plans to replace approximately 200 older vintage wrapped steel services in both the calendar years 2016 and 2017. A list of these services is identified by October 1st of the year proceeding planned replacement. Adjustments to projects will be made as required while managing to the Master Plan and overall system risk.

Identification Plan

PSE has identified the location of pre-1972 wrapped steel services based on an extensive map review and has recorded this information in a database. While this database is a useful tool for managing these services, PSE is working towards a plan to utilize the new GIS as the data source for the ongoing identification and tracking of these services. Beginning in 2015, the services in the existing database are being migrated into GIS with the plan to complete the migration by early 2016.

Utilizing the GIS will facilitate data integration allowing additional risk information to be analyzed in conjunction with service data. Currently the additional risk information to identify locations where older vintage wrapped steel services have been installed in casing, have buried meters, and serve high occupancy structures is available in multiple locations and requires manual integration with the service location information. Once the GIS is configured, there will be improved risk knowledge and tracking of older vintage wrapped steel services and risks.

7. Sewer Cross Bores

Master Plan

Risk Assessment

Sewer cross bores have been identified through DIMP as having an elevated risk of failure. A sewer cross bore is a gas pipeline that was inadvertently installed through an unmarked sewer pipe. Sewer cross bores occur from the use of trenchless construction which creates inherent risk because sewers are not always located. If there is a sewer cross bore and it causes a blocked sewer, using a machine to clear the blocked sewer could damage the gas line endangering people and property. Sewer cross bores pose an elevated risk of failure due to the high consequence that would result if damage occurs. Based on PSE's experience, it is more likely for plastic service lines in residential urban areas to be cross bored through sewers. Since 2001, more than 660 cross bores have been discovered in PSE's system.

Sewer Cross Bore Replacement Plan

PSE is actively replacing all sewer cross bores as they are discovered. Any sewer cross bore is considered an elevated risk of failure and is immediately scheduled for replacement. PSE will continue to incorporate new risk knowledge to enhance the identification of potential locations of sewer cross bores to further proactively correct such installations. Currently, PSE plans to continue replacing sewer cross bores as they are discovered.

Two-Year Plan

The two-year plan is to continue to replace locations where sewer cross bores are discovered according to the Master Plan.

Identification Plan

PSE is continually improving the identification of sewer cross bores to proactively identify and replace cross bores while not creating new ones. Camera inspections are necessary to identify if there are potential sewer cross bores and also to physically locate sewer main and laterals because municipalities and property owners have poor records or lack records. Beginning in 2013, PSE has increased the public awareness of sewer cross bore safety, started conducting post-construction sewer inspections near new gas trenchless installations, and started inspecting sewers near legacy gas trenchless installations.

PSE has launched a public awareness initiative to publicize PSE's cross bore safety program. The awareness targets plumbers, other utility contractors, municipalities, and customers to call PSE before clearing a blocked sewer. PSE's Gas First Response responds within an hour of the call to determine if there is a potential sewer cross bore. PSE plans to continue improving sewer cross bore public awareness by messaging the intended audience through a variety of mediums.

PSE has contracted with Hydromax USA to be PSE's service provider to conduct sewer inspections near new and legacy gas trenchless installation sites. The sewer inspections include:

- Sewers in proximity to new gas trenchless installations to confirm that new cross bores are not created and also as a cost-effective opportunity to conduct legacy inspections
- At-risk sewers in proximity to legacy trenchless gas installations identified through a historical cross bore study of PSE's installation records between 2001 and 2013

Currently, there are plans to develop and implement a risk model to prioritize legacy inspections to better target at-risk sewers. The risk model will be based on the results from the historical cross bore study, risk knowledge gained through new and legacy inspections conducted to date, and other risk factors. The risk model is planned to be developed in 2015 and implemented in 2016.

8. Public Interest

The pipe replacement plans for the materials that pose an elevated risk of failure included in this PRP plan have been developed considering many factors. These factors include:

- Improving the safety of the distribution system by replacing pipe based on the relative level of risk presented for each material and location
- Minimizing the replacement costs by maximizing efficiencies and productivity
- Minimizing the impacts to municipalities and the general public

9. Rates Impact

PSE filed its first CRM filing in June 2014, with rates effective November 1, 2014. The impact of that rate filing represented an increase in overall customer rates of 0.5%. Consistent with the requested potential rate impact analysis discussed in paragraph 55 of the policy statement, PSE's best estimate at this time, based on the estimated program spending for DuPont Aldyl "HD" plastic pipe, older vintage wrapped steel mains, and older vintage wrapped steel services replacement programs could result in an average annual increase of 0.53% in overall customer rates for the 2015 through 2034 period.

Appendix A

Two-Year Replacement Plan for DuPont Aldyl "HD" Plastic Pipe

Table A-1. 2016 Planned Replacement Projects

Project Description	Planned Retirement Footage
6330 31ST AVE NE, TULALIP	1,374
2713 NE 23RD ST, RENTON	1,350
25306 212TH PL SE, MAPLE VALLEY	1,468
4233 204TH AVE NE, SAMMAMISH	9,104
13513 SE 24TH ST, BELLEVUE	2,032
11320 16TH AVE CT NW, GIG HARBOR	1,779
31604 122ND AVE SE, AUBURN	2,055
26125 189TH CT SE, COVINGTON	5,639
22924 NE 21ST ST, SAMMAMISH	4,412
7401 S CUSHMAN AVE, TACOMA	3,529
7420 N MERCER WAY, MERCER ISLAND	2,955
8200 BRIDGEPORT WAY SW, LAKEWOOD	1,875
8106 10TH AVE S, SEATTLE	10,516
915 1ST AVE S, KENT	577
5715 S 147TH ST, TUKWILA	1,426
11922 SE 251ST ST, KENT	2,962
2820 117TH AVE NE, LAKE STEVENS	2,623
6917 BRIDGLAND LN, TACOMA	1,876
443 ALPINE WAY, KENT	3,306
22503 NE 25TH WAY, SAMMAMISH	4,646
5011 218TH AVE NE, REDMOND	5,049
4927 SW 327TH PL, FEDERAL WAY	4,755
32518 8TH AVE SW, FEDERAL WAY	6,589
15603 94TH AVE E, PUYALLUP	7,000
13712 174TH AVE NE, REDMOND	9,326
32908 6TH AVE SW, FEDERAL WAY	10,463
1815 S LANE ST, SEATTLE	5,306
18516 BLUE RIDGE DR, LYNNWOOD	2,192
31702 124TH PL SE, AUBURN	4,843
2317 SHAW RD, PUYALLUP	820
2300 227TH AVE NE, SAMMAMISH	5,414
117 11TH AVE, KIRKLAND	101
16329 170TH AVE NE, WOODINVILLE	4,478
11813 120TH ST E, PUYALLUP	509
13517 8TH AVE SW, BURIEN	247
2520 E LEE ST, SEATTLE	245
18005 158TH PL SE, RENTON	629
619 84TH AVE NE, MEDINA	407
10215 SE 244TH ST, KENT	697
20035 100TH AVE SE, KENT	864
1930 A ST SE, AUBURN	15
6626 TACOMA MALL BLVD, TACOMA	351

Appendix A

Two-Year Replacement Plan for DuPont Aldyl "HD" Plastic Pipe

Table A-1. 2016 Planned Replacement Projects (Continued)

Project Description	Planned Retirement Footage
3324 LIND AVE SW, RENTON	288
340 UPLAND DR, TUKWILA	1,094
8914 WEDGEWOOD CT SW, LAKEWOOD	348
18410 33RD AVE W, LYNNWOOD	2,615
4020 S 168TH ST, SEATAC	641
3327 SE 17TH ST, RENTON	301
3802 APOLLO ST SE, LACEY	3,440
14319 110TH AVE CT E, PIERCE COUNTY	1,457
7117 32ND AVE SW, SEATTLE	1,669
6108 142ND AVE SE, BELLEVUE	7,799
27112 36TH AVE S, KENT	3,765

Table A-2. 2017 Planned Replacement Projects

Project Description	Planned Retirement Footage
827 SW 316TH CT, FEDERAL WAY	4,713
215 164TH ST SE, BOTHELL	6,546
975 JOHN ST, SEATTLE	18,773
2524 E MARION ST, SEATTLE	27,650
825 14TH AVE, SEATTLE	17,369
6815 S 220th ST, KENT	8,596
709 33RD AVE S, SEATTLE	18,395
13409 NE 136th PL, KIRKLAND	5,033
600 WESTLAKE AVE, SEATTLE	10,625
12109 SE 223RD DR, KENT	6,140
6275 146TH PL SE, BELLEVUE	10,135
1318 BROOKDALE RD E, PIERCE COUNTY	1,230
9306 NORTHWOOD DR SE, OLYMPIA	5,387
12210 WILLOWS RD NE, REDMOND	5,146
1401 12TH AVE, SEATTLE	9,582
11808 SE 225TH ST, KENT	2,920

Appendix B

Two-Year Replacement Plan for Older Vintage Wrapped Steel Main

Table B-1. 2016 Planned Replacement Projects

Project Description	Planned Retirement Footage
4202 S MORGAN ST, SEATTLE	670
1422 S TRENTON ST, SEATTLE	740
4123 NE 19 ST, RENTON	1,941
2442 SW 325 ST, FEDERAL WAY	1,842
20915 124 AVE SE, KENT	6,307
5107 240 PL SW, MOUNTLAKE TERRACE	545
7529 BRAEMAR DR, EDMONDS	1,084
10049 41 AVE NE, SEATTLE	1,765
3901 S 294 ST, AUBURN	2,060
32101 42 PL W, FEDERAL WAY	1,651
1424 NW 201 ST, SEATTLE	2,285

Table B-2. 2017 Planned Replacement Projects

Project Description	Planned Retirement Footage
1145 S 216 ST, DES MOINES	860
23405 76 AVE W, EDMONDS	1,250
19100 44 AVE W, LYNNWOOD	2,870
14828 SE 111 PL, RENTON	500
4101 223 ST SW, MOUNTLAKE TERRACE	1,000
1801 SE 16 PL, BELLEVUE	670
10819 34 AVE SW, SEATTLE	2,670
40 SKAGIT KEY, BELLEVUE	2,485
4503 141 AVE SE, BELLEVUE	2,969
401 W MAIN ST, AUBURN	1,010
7007 55 AVE S, SEATTLE	350
10404 SE 236 PL, KENT	2,320
26503 MANCHESTER AVE, KENT	2,163