
## Special Research Study

# Comparison of Water Pipe Installation Lengths and Costs in Oregon and Washington State: Portland, Bend, Olympia, and Richland/West Richland

## Client: American Chemistry Council


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# EXECUTIVE SUMMARY

The American Chemistry Council (ACC) retained BCC Research to investigate and compare municipal water supply pipe (i.e., pressure main) costs in four communities in Oregon and Washington. Target communities included the cities of Portland, OR and Bend, OR that use a closed competition bid process for pipe and pipeline projects, as well as Olympia and Richland/West Richland, that permit open competition for pipeline projects and pipe procurement.[1] BCC Research collected pipe installation, pipe cost, and pipe material data in each of these communities to compare cost and cost differential among the communities.

BCC Research collected publicly available data from bid documentation, city data, council meeting minutes, contracts, and other available data sources. Primary data collection methods, including phone and/or email interviews, were used as needed to fill gaps or to verify and benchmark available data.

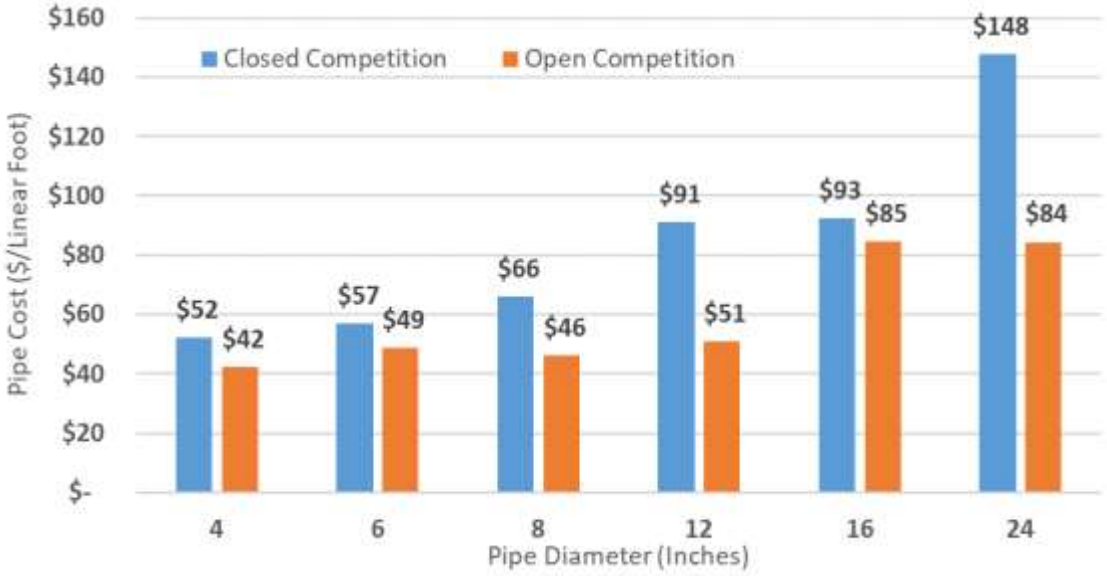


***Figure ES-1: Average Pipe Capital Cost ($/Foot) by Pipe Diameter for Closed (Portland and Bend) and Open Competition (Olympia and Richland/West Richland), 2015 to 2018***

Key project findings indicate that communities with open competition enjoy lower pipe cost, on average, for water main installation or replacement projects, reaching average savings of 24% for 4-inch pipe, 17% for 6-inch pipe, 43% for 8-inch pipe, 78% for 12-inch pipe, 9% for 16-inch pipe, and 75% for 24-inch pipe, in comparison to municipalities employing closed competition practices. Based on these data, for a hypothetical one-mile installation of 12-inch water main pipe, a municipality using a closed competition pipe material selection process would pay approximately $480,099 (for pipe only; does not consider installation costs). In contrast, a municipality using an open competition pipe material selection process would pay approximately $269,883,

[1] Closed competition indicates that a city has standard specifications that limit the material options prior to bidding; open competition indicates that some competition among materials is allowed based on project performance requirements.

for a **cost savings of $210,216 per mile of 12-inch water main purchased**. Figure ES-1 summarizes the closed and open competition pipe cost results shown in Table ES-1.

Furthermore, ductile iron pipe of the same diameter was found to be less costly in open bid cities than in closed bid cities: 12-inch ductile iron pipe cost, on average, $52.89 per foot in Richland and West Richland (open) and $59.25 in Olympia (open), in comparison to $80.34 in Portland (closed) and $79.29 in Bend (closed). Therefore, even when ductile iron is considered by itself, independent of other materials, 12-inch pipe costs in closed bid cities were, on average, $23.74 higher than in open bid cities, equivalent to an average pipe cost inflation of 42%.

***Table ES-1: Average Pipe Capital Cost ($/Foot) by Pipe Diameter (6-inch to 24-inch), for Closed Competition (Portland and Bend) and Open Competition (Olympia and Richland/West Richland) Municipalities, 2015 to 2018***[2]

| Pipe diameter (inches) | Open Competition | Closed Competition | Percent Savings from Open Competition |
|---|---|---|---|
| 4 | $42.2 | $52.2 | 23.5% |
| 6 | $48.6 | $57.0 | 17.2% |
| 8 | $46.3 | $66.2 | 43.0% |
| 12 | $51.1 | $90.9 | 77.9% |
| 16 | $84.8 | $92.5 | 9.1% |
| 24 | $84.4 | $147.8 | 75.2% |

Source: BCC Research

[2] Calculated as average pipe cost for each city and simple average of the open cities and the closed cities to avoid biasing toward larger cities that install more pipe.

# INTRODUCTION

## PURPOSE

The primary objective of this study was to compare municipal water (pressurized) pipe installation and costs in four communities in Oregon and Washington, for open competition and closed competition bid processes. Closed competition indicates that a city has standard specifications that limit the material options prior to bidding; open competition indicates that some competition among materials is allowed based on project performance requirements. The analysis included detailed data collection for the following closed competition cities—Portland, OR and Bend, OR—and the following open competition cities—Olympia, WA and Richland/West Richland, WA. These locations were selected based on size and geographic diversity in Oregon. Because no Oregon cities used open competition bid processes, two cities in Washington State were selected to provide comparison points within the regional economy. Data were gathered to highlight differences between open and closed competition bidding options for the following:

- Amount of pipe installed each year
- Pipe sizing
- Pipe material, where data were available
- Cost comparison and cost differential in the selected communities that follow different options for bidding

## METHODOLOGY

Information was collected through a combination of primary and secondary research methods. For these cities, secondary research methods, including city data, bid documentation, council meeting minutes, contracts, planning documents, water master plans, capital improvement plans, and other available data proved effective as reliable data sources. Primary data sources (phone and/or email-based interviews with City staff) were used as needed to fill gaps and verify/benchmark pipe data.

Public data were collected that included pipe lengths, materials, diameter and published costs. However, some data sources also included extraneous information and costs, beyond simple pipe cost. For example, some pipeline projects are bid out as a cost for construction and completion of the entire project, including pipe as well as appurtenances (vaults, manholes, etc.) and sometimes roadwork and earthwork (pavement, fill, sidewalks, etc.), without breaking out pipe costs explicitly. Data collected for these cities were of high quality. Nonetheless, in some instances, pipe costs were not available. In these cases, average cost per foot was estimated based on average cost for the same diameter pipe in that city during the same year.

Pipe cost, length, and diameter data were available for at least 75% of the data points used and summarized for this study. No complete or otherwise usable data were excluded, with the exception of pipe data for non-standard pipe materials such as stainless steel, used for casings along bridges. These pipe material categories were

excluded from the analysis. In total, over 221 individual pipe installations were considered, from 2015 through 2018, in support of the project.

## CITY OF PORTLAND (CLOSED COMPETITION) PIPE INSTALLATION AND COST DATA

The City of Portland Water Bureau operates and manages the City's water distribution utility, which is responsible for maintaining over 2,250 miles of water conveyance and distribution pipelines. Pipelines are of various ages, and are composed primarily of cast iron and ductile iron. In total, the City seeks to replace and upgrade approximately 10 miles of pipe per year, focusing on the oldest priority segments. The City follows a closed competition process for bids on water pipeline projects and specifies the use of ductile iron (DI) pipe for nearly all (>99%) pressurized water transmission and distribution applications relevant to this study. Data were collected for 2015 through 2018, and a total of 73 pipe cost data points were included in the analysis from that time period. The City relies on contractors to complete a growing fraction of its total annual water line replacements. What it doesn't contract out, however, the City completes in-house. Information / data collected in support of this study indicate that, when the City purchases pipe directly and self-installs, the City saves money, by a margin of at least 10%. Data presented below reflect these savings where relevant, as well as prices charged by contractors.

Data collected in support of this study indicate that the City purchased over 128,000 feet of pipe during 2015 through 2018, at a total purchase price that exceeded $9.3 million. Note, however, that data for all pipe purchases were not available, and total pipe installed during this period was likely at least 150,000 to 175,000 feet. The City purchased pipe fabricated from DI, plus small amounts of pipe fabricated from steel (used for casing), along with one installation that included plastic (HDPE). However, this study tracks cost for DI and plastic pipe only. Bid-level data indicated that no plastic pipe was installed during 2015 to 2017, and only 90 ft of plastic was installed in 2018; therefore nearly 100% of installed pipe tracked by the study was composed of DI.

Data for City pipe procurement costs were collected primarily based on filed bid responses, awarded contracts, and/or purchase orders for pipe purchase and installation by the City. These bid responses were publicly available through public meeting documentation, contract documentation, bid documentation, other city documentation, and/or through direct information request by BCC Research. Data collected were benchmarked against municipal water system data, including total length of in-ground pipe installed each year. Pipeline diameter, length and cost data were available for the City for all identified projects. During the Study period, the City installed pipe diameters including 4-inch, 6-inch, 8-inch, 12-inch, 16-inch, and 24-inch. The City also installed pipe diameters of up to 54 inches. However, these data larger diameter pipes were not tracked because these larger pipe sizes were not extensively installed by other cities.

Table 1 summarizes the length and diameter of pipe installed in Portland during 2015 through 2018. Similarly, Table 2 summarizes total pipe costs by diameter and year, while Table 3 summarizes pipeline cost per foot, and Table 4 summarizes pipe

*materials* by length of pipe installed. Finally, we summarized average pipe costs for Portland over the study period by diameter. These are shown in Table 5.

***Table 1: Portland: Linear Feet of Pipe Installed, 2015-2018***

| Pipe Diameter (inches) | Pipe Length (feet) | | | |
|---|---|---|---|---|
| | 2015 | 2016 | 2017 | 2018 |
| 4 | 1,056 | 1,435 | 2,483 | 2,645 |
| 6 | 11,341 | 10,054 | 15,421 | 17,321 |
| 8 | 4,754 | 3,905 | 14,554 | 14,576 |
| 12 | 1,575 | 2,278 | 5,379 | 7,376 |
| 16 | 563 | 782 | 1,526 | 961 |
| 24 | 726 | 2,240 | 2,326 | 3,190 |
| **TOTAL** | 20,015 | 20,694 | 41,689 | 46,069 |

Source: BCC Research.

***Table 2: Portland: Pipe Cost, 2015-2018***

| Pipe Diameter (inches) | Pipe Cost ($/Year) | | | |
|---|---|---|---|---|
| | 2015 | 2016 | 2017 | 2018 |
| 4 | $51,317 | $77,413 | $131,203 | $140,725 |
| 6 | $661,885 | $620,250 | $933,127 | $1,225,435 |
| 8 | $327,845 | $268,003 | $997,616 | $1,224,039 |
| 12 | $123,137 | $173,490 | $437,156 | $632,508 |
| 16 | $46,334 | $72,714 | $145,336 | $95,764 |
| 24 | $76,766 | $257,094 | $250,060 | $378,741 |
| **TOTAL** | $1,287,284 | $1,468,964 | $2,894,498 | $3,697,212 |

Source: BCC Research.

***Table 3: Portland: Pipe Cost per Foot***

| Pipe Diameter (inches) | Pipe Cost ($/Foot) | | | |
|---|---|---|---|---|
| | 2015 | 2016 | 2017 | 2018 |
| 4 | $48.62 | $53.94 | $52.84 | $53.21 |
| 6 | $58.36 | $61.69 | $60.51 | $70.75 |
| 8 | $68.96 | $68.63 | $68.55 | $83.97 |
| 12 | $78.18 | $76.16 | $81.27 | $85.75 |
| 16 | $82.27 | $92.96 | $95.24 | $99.61 |
| 24 | $105.71 | $114.76 | $107.50 | $118.73 |

Source: BCC Research.

### *Table 4: Portland: Pipe Materials (Percent of Annual Total)*

| Pipe Materials | Percent of Total Annual Pipe Length Installed | | | |
|---|---|---|---|---|
| | 2015 | 2016 | 2017 | 2018 |
| Ductile Iron | 100.0% | 100.0% | 100.0% | 99.8% |
| Plastic | 0.0% | 0.0% | 0.0% | 0.2% |
| **Total** | 100.0% | 100.0% | 100.0% | 100.0% |

Source: BCC Research.

### *Table 5: Portland: Average Pipe Cost, by Pipe Diameter*

| Pipe Diameter (inches) | Average Pipe Cost ($/ft), 2015-2017 |
|---|---|
| 6 | $52.15 |
| 8 | $62.83 |
| 12 | $72.53 |
| 16 | $80.34 |
| 20 | $92.52 |
| 24 | $111.67 |

Source: BCC Research.

## CITY OF BEND (CLOSED COMPETITION) PIPE INSTALLATION AND COST DATA

Bend, Oregon, follows a closed competition process for water pipeline projects. Based on data collected in support of this study, the City installed only DI pipe for water transmission and distribution during the 2015 to 2018 period.

Data for the City were collected primarily based on filed bid responses and awarded contracts for City pipeline projects, which were publicly available through City Council meeting documentation, contract documentation, bid documentation, and as data made available to BCC Research. Data collected were benchmarked against city municipal water system data, including total length of in-ground pipe each year. Pipeline diameter, length and cost data were available for Bend for all identified projects. During the Study period, the City primarily installed 8-inch, 12-inch, and 24-inch diameter pipe, but also installed smaller amounts of 6-inch and 16-inch diameter pipe.

Note that data were not available for 2015. Therefore, during 2016 through 2018, the City installed over 16,200 linear feet of pipe, totaling over $1.3 million in pipe procurement cost. Pipe installation rates varied from year to year based on specific projects that were completed. Table 6 summarizes the length and diameter of pipe installed in Bend during 2016, 2017, and 2018. Similarly, Table 7 summarizes total pipe costs by diameter and year, while Table 8 summarizes pipeline cost per foot, and Table 9 summarizes pipe *materials* by length of pipe installed. Finally, we summarized average pipe costs for Bend over the study period by diameter. These are shown in Table 10.

***Table 6: Bend: Linear Feet of Pipe Installed, 2015-2018***

| Pipe Diameter (inches) | Pipe Length (feet) | | | |
|---|---|---|---|---|
| | 2015 | 2016 | 2017 | 2018 |
| 4 | N/A | - | - | - |
| 6 | N/A | 39 | 175 | 262 |
| 8 | N/A | 911 | 2,400 | 6,363 |
| 12 | N/A | 480 | 1,420 | 1,332 |
| 16 | N/A | 868 | - | 597 |
| 24 | N/A | - | - | 1,384 |
| **TOTAL** | - | 2,298 | 3,995 | 9,938 |

Source: BCC Research.

### Table 7: Bend: Pipe Cost, 2015-2018

| Pipe Diameter (inches) | Pipe Cost ($/Year) | | | |
|---|---|---|---|---|
| | 2015 | 2016 | 2017 | 2018 |
| 4 | N/A | N/A | N/A | N/A |
| 6 | N/A | $1,632 | $10,492 | $13,476 |
| 8 | N/A | $47,780 | $161,772 | $380,602 |
| 12 | N/A | $30,040 | $119,279 | $121,588 |
| 16 | N/A | $76,113 | N/A | $68,859 |
| 24 | N/A | N/A | N/A | $232,474 |
| **TOTAL** | N/A | $155,565 | $291,543 | $816,999 |

Source: BCC Research.

### Table 8: Bend: Pipe Cost per Foot

| Pipe Diameter (inches) | Pipe Cost ($/Foot) | | | |
|---|---|---|---|---|
| | 2015 | 2016 | 2017 | 2018 |
| 4 | N/A | N/A | N/A | N/A |
| 6 | N/A | $41.84 | $59.96 | $51.43 |
| 8 | N/A | $52.45 | $67.41 | $59.81 |
| 12 | N/A | $62.58 | $84.00 | $91.28 |
| 16 | N/A | $87.69 | N/A | $115.34 |
| 24 | N/A | N/A | N/A | $167.97 |

Source: BCC Research.

### Table 9: Bend: Pipe Materials (Percent of Annual Total)

| Pipe Materials | Percent of Total Annual Pipe Length Installed | | | |
|---|---|---|---|---|
| | 2015 | 2016 | 2017 | 2018 |
| Ductile Iron | 100.0% | 100.0% | 100.0% | 100.0% |
| Plastic | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total** | 100.0% | 100.0% | 100.0% | 100.0% |

Source: BCC Research.

***Table 10: Bend: Average Pipe Cost, by Pipe Diameter***

| Pipe Diameter (inches) | Average Pipe Cost ($/ft), 2015-2018 |
|---|---|
| 6 | N/A |
| 8 | $51.08 |
| 12 | $59.89 |
| 16 | $79.29 |
| 20 | $101.51 |
| 24 | $167.97 |

Source: BCC Research.

## CITY OF OLYMPIA (OPEN COMPETITION) PIPE INSTALLATION AND COST DATA

Olympia, Washington, follows an open competition process overall for water pipeline projects. Pipe material data were available for all pipe installed during the study period. Nonetheless, data available for pipe installed in the City during 2015 through 2018 were almost exclusively DI, within the size ranges considered here, based on publicly available data. The City manages approximately 289 miles of installed water distribution pipe overall. Of this amount, approximately 40% is PVC, 17% DI, with the remainder being a combination of older asbestos-concrete and cast iron.

Data for the City were collected primarily based on filed bid responses and awarded contracts for City pipeline projects, which were publicly available through City Council meeting documentation, contract documentation, bid documentation, and as data made available to BCC Research. Data collected were benchmarked against city municipal water system data, including total length of in-ground pipe, when available. Pipeline diameter, length and cost data were available for Olympia for at least 80% of all identified projects. During the Study period, the City installed pipe having all diameters tracked within this study, except for 24-inch pipe.

In total, the City installed over 56,600 linear feet of pipe during 2015 through 2018, for a total cost of over $3.5 million. Table 11 summarizes the length and diameter of pipe installed in Olympia during 2015, 2016, 2017, and 2018. Similarly, Table 12 summarizes total pipe costs by diameter and year, while Table 13 summarizes pipeline cost per foot, and Table 14 summarizes pipe *materials* by length of pipe installed. Finally, we summarized average pipe costs for Olympia over the study period by diameter. These are shown in Table 15.

***Table 11: Olympia: Linear Feet of Pipe Installed, 2015-2018***

| Pipe Diameter (inches) | Pipe Length (feet) | | | |
|---|---|---|---|---|
| | **2015** | **2016** | **2017** | **2018** |
| 4 | 156 | 415 | 10 | - |
| 6 | 400 | 365 | 703 | 458 |
| 8 | 2,746 | 2,287 | 1,494 | 2,963 |
| 12 | 13,500 | 5,889 | 9,221 | 6,104 |
| 16 | 4,350 | 1,785 | 2,173 | 1,655 |
| 24 | - | - | - | - |
| **TOTAL** | 21,152 | 10,741 | 13,601 | 11,180 |

Source: BCC Research.

*Table 12: Olympia: Pipe Cost, 2015-2018*

| Pipe Diameter (inches) | Pipe Cost ($/Year) | | | |
|---|---|---|---|---|
| | 2015 | 2016 | 2017 | 2018 |
| 4 | $6,708 | $17,693 | $447 | N/A |
| 6 | $28,800 | $21,313 | $39,310 | $23,314 |
| 8 | $153,776 | $110,100 | $81,301 | $156,041 |
| 12 | $830,055 | $312,102 | $560,183 | $376,108 |
| 16 | $324,212 | $144,660 | $195,937 | $148,088 |
| 24 | N/A | N/A | N/A | N/A |
| **TOTAL** | $1,343,551 | $605,868 | $877,178 | $703,551 |

Source: BCC Research.

*Table 13: Olympia: Pipe Cost per Foot*

| Pipe Diameter (inches) | Pipe Cost ($/Foot) | | | |
|---|---|---|---|---|
| | 2015 | 2016 | 2017 | 2018 |
| 4 | $43.00 | $42.63 | $44.68 | N/A |
| 6 | $72.00 | $58.39 | $55.95 | $50.86 |
| 8 | $56.00 | $48.15 | $54.42 | $52.67 |
| 12 | $61.49 | $53.00 | $60.75 | $61.61 |
| 16 | $74.53 | $81.02 | $90.17 | $89.50 |
| 24 | N/A | N/A | N/A | N/A |

Source: BCC Research.

*Table 14: Olympia: Pipe Materials (Percent of Annual Total)*

| Pipe Materials | Percent of Total Annual Pipe Length Installed | | | |
|---|---|---|---|---|
| | 2015 | 2016 | 2017 | 2018 |
| Ductile Iron | 99.7% | 100.0% | 100.0% | 100.0% |
| Plastic | 0.3% | 0.0% | 0.0% | 0.0% |
| **Total** | 100.0% | 100.0% | 100.0% | 100.0% |

Source: BCC Research.

*Table 15: Olympia: Average Pipe Cost, by Pipe Diameter*

| Pipe Diameter (inches) | Average Pipe Cost ($/ft), 2015-2018 |
|---|---|
| 4 | $43.44 |
| 6 | $59.30 |
| 8 | $52.81 |
| 12 | $59.21 |
| 16 | $83.81 |
| 24 | N/A |

Source: BCC Research.

## CITY OF RICHLAND/WEST RICHLAND (OPEN COMPETITION) PIPE INSTALLATION AND COST DATA

Richland and West Richland, Washington, follow an open competition process for water pipeline projects. Pipe material and project cost data were available for all identified projects during 2015 through 2018. Pipe cost data were available for over 95% of all pipe installation projects. Although it operates under an open competition model, the vast majority of pipe projects in this target area are DI—at least 75% on an annual basis. During 2017, 94% of installed pipe was DI. The remaining installed pipe was plastic (PVC).

Data for the Cities were collected based on filed bid responses and awarded contracts for City pipeline projects, which were publicly available through City Council meeting documentation, contract documentation, bid documentation, and as data made available to BCC Research. Data collected were benchmarked against city municipal water system data including total system length and typical replacement rates, for both cities. During the Study period, the Cities installed pipe of various sizes; however, 8-inch and 12-inch pipe were the most commonly installed diameters.

In total, the Cities collectively installed over 81,595 linear feet of pipe during 2015 through 2018, for a total cost of over $4.6 million. Table 16 summarizes the length and diameter of pipe installed in Richland/West Richland during 2015, 2016, 2017, and 2018. Similarly, Table 17 summarizes total pipe costs by diameter and year, while Table 18 summarizes pipeline cost per foot, and Table 19 summarizes pipe *materials* by length of pipe installed. Finally, we summarized average pipe costs for Richland/West Richland over the study period, by diameter. These are shown in Table 20.

***Table 16: Richland/West Richland: Linear Feet of Pipe Installed, 2015-2018***

| Pipe Diameter (inches) | Pipe Length (feet) | | | |
|---|---|---|---|---|
| | **2015** | **2016** | **2017** | **2018** |
| 4 | - | - | 163 | - |
| 6 | 160 | 256 | 325 | 229 |
| 8 | 1,951 | 2,834 | 3,170 | 2,171 |
| 12 | 448 | 15,380 | 11,856 | 28,575 |
| 16 | 3,500 | - | - | 2,154 |
| 24 | - | - | 8,423 | - |
| **TOTAL** | 6,059 | 18,470 | 23,937 | 33,129 |

Source: BCC Research.

***Table 17: Richland/West Richland: Pipe Cost, 2015-2018***

| Pipe Diameter (inches) | Pipe Cost ($/Year) | | | |
|---|---|---|---|---|
| | 2015 | 2016 | 2017 | 2018 |
| 4 | N/A | N/A | $6,683 | N/A |
| 6 | $4,720 | $7,562 | $12,825 | $12,158 |
| 8 | $71,919 | $81,567 | $115,834 | $123,811 |
| 12 | $14,135 | $480,729 | $364,443 | $2,243,691 |
| 16 | $173,530 | N/A | N/A | $262,729 |
| 24 | N/A | N/A | $710,876 | N/A |
| **TOTAL** | $264,304 | $569,858 | $1,210,661 | $2,642,389 |

Source: BCC Research.

***Table 18: Richland/West Richland: Pipe Cost per Foot***

| Pipe Diameter (inches) | Pipe Cost ($/Foot) | | | |
|---|---|---|---|---|
| | 2015 | 2016 | 2017 | 2018 |
| 4 | N/A | N/A | $41.00 | N/A |
| 6 | $29.50 | $29.54 | $39.46 | $53.09 |
| 8 | $36.86 | $28.78 | $36.54 | $57.03 |
| 12 | $31.55 | $31.26 | $30.74 | $78.52 |
| 16 | $49.58 | N/A | N/A | $121.97 |
| 24 | N/A | N/A | $84.40 | N/A |

Source: BCC Research.

***Table 19: Richland/West Richland: Pipe Materials (Percent of Annual Total)***

| Pipe Materials | Percent of Total Annual Pipe Length Installed | | | |
|---|---|---|---|---|
| | 2015 | 2016 | 2017 | 2018 |
| Ductile Iron | 87.3% | 84.4% | 94.3% | 73.4% |
| Plastic | 12.7% | 15.6% | 5.7% | 26.6% |
| **Total** | 100.0% | 100.0% | 100.0% | 100.0% |

Source: BCC Research.

***Table 20: Richland/West Richland: Average Pipe Cost, by Pipe Diameter***

| Pipe Diameter (inches) | Average Pipe Cost ($/ft), 2015-2018 |
|---|---|
| 4 | $41.00 |
| 6 | $37.90 |
| 8 | $39.80 |
| 12 | $43.02 |
| 16 | $85.78 |
| 24 | $84.40 |

Source: BCC Research.

## SUMMARY FINDINGS AND CONCLUSIONS

Key findings of this project indicate that municipalities employing open competition practices for the selection of municipal water pipe (force main) materials drive lower pipe cost, on average, for the majority of water main projects. As shown in Table 21, open competition resulted in a pipe cost savings for all pipe diameters considered here, with average savings ranging from 9% for 16-inch to nearly 78% for 12-inch diameter pipe. Based on these data, for a hypothetical one-mile installation of 12-inch municipal water force main pipe, a municipality utilizing a closed competition bid selection process would pay approximately $480,099 in pipe capital costs. In contrast, a municipality utilizing an open competition bid selection process would pay only $269,883, for a cost savings of $210,216 per mile of 12-inch water pipe. Figure 1 visually summarizes the closed and open competition pipe cost results shown in Table 21.

***Table 21: Average Pipe Capital Cost ($/Foot) by Pipe Diameter (6-inch to 24-inch), for Closed Competition (Portland and Bend) and Open Competition (Olympia and Richland/West Richland) Municipalities, 2015 to 2018***

| Pipe diameter (inches) | Open Competition | Closed Competition | Percent Savings from Open Competition |
|---|---|---|---|
| 4 | $42.2 | $52.2 | 23.5% |
| 6 | $48.6 | $57.0 | 17.2% |
| 8 | $46.3 | $66.2 | 43.0% |
| 12 | $51.1 | $90.9 | 77.9% |
| 16 | $84.8 | $92.5 | 9.1% |
| 24 | $84.4 | $147.8 | 75.2% |

Source: BCC Research.

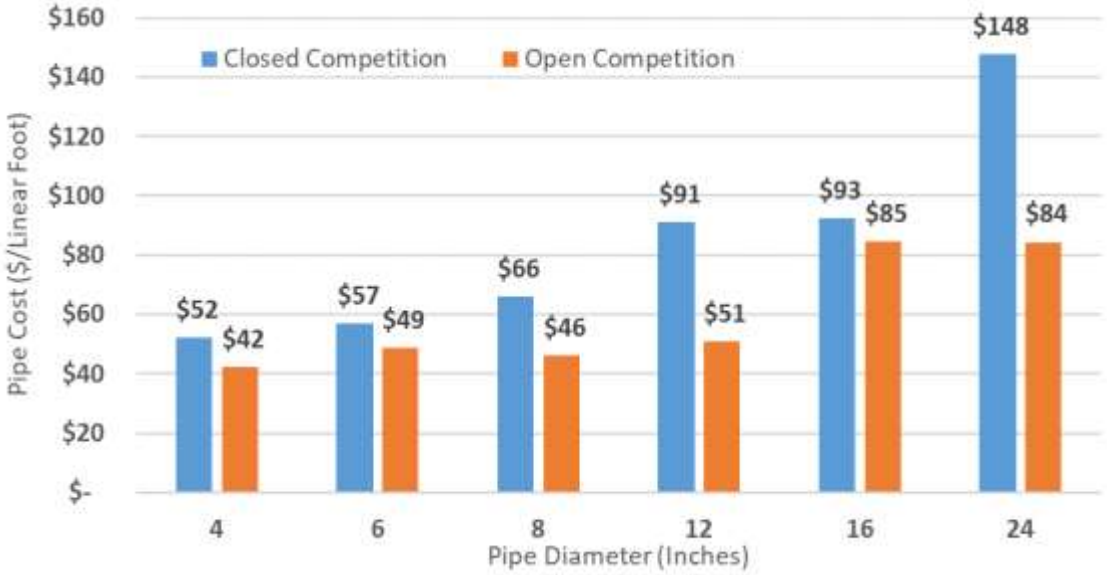


***Figure 1: Average Pipe Capital Cost ($/Foot) by Pipe Diameter for Closed (Portland and Bend) and Open Competition (Olympia and Richland/West Richland), 2015 to 2018***