BEFORE THE

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION, Complainant, v. NORTHWEST NATURAL GAS COMPANY, Respondent.	Docket UG-__________

NORTHWEST NATURAL GAS COMPANY

Direct Testimony of Joe S. Karney

CAPITAL PROJECTS

Exh. JSK-1T

December 31, 2018

DIRECT TESTIMONY OF JOE S. KARNEY

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I. INTRODUCTION AND SUMMARY

Q. Please state your name and position with Northwest Natural Gas Company ("NW Natural" or "the Company").

A. My name is Joe Karney. My business address is 220 NW Second Avenue, Portland, Oregon 97209. I am the Engineering Director for NW Natural. I am responsible for design, construction, operation, and maintenance of the gas distribution system and utility storage plants, and operations support services including work management functions, mapping and compliance.

Q. Please describe your education and employment background.

A. I graduated from the University of Illinois at Urbana-Champaign with a B.S. in Mechanical Engineering, and I am a registered Professional Engineer in the State of Oregon. Before assuming my current position at NW Natural in 2017, I was the Senior Manager of Code Compliance for the Company, and managed the regulatory compliance department and represented the Company during safety audits performed by the Washington Utilities and Transportation Commission ("Commission") and Public Utility Commission of Oregon. I also reviewed and ensured NW Natural's compliance with pending regulatory changes from the U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration ("PHMSA"). Prior to holding this position, I managed the Construction and System Operations groups. I started my career at the Company with the Integrity Management group and worked on the development and implementation of the Transmission Integrity Management Program ("TIMP") and the Distribution Integrity Management Program

("DIMP"). Before joining NW Natural, I worked as an Integrity Management Engineer for Colonial Pipeline Company for four years.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to describe and support the Company's plant and non-plant capital additions that have occurred since the Company's last rate case and which are providing a benefit to Washington customers.

Q. Please summarize your testimony.

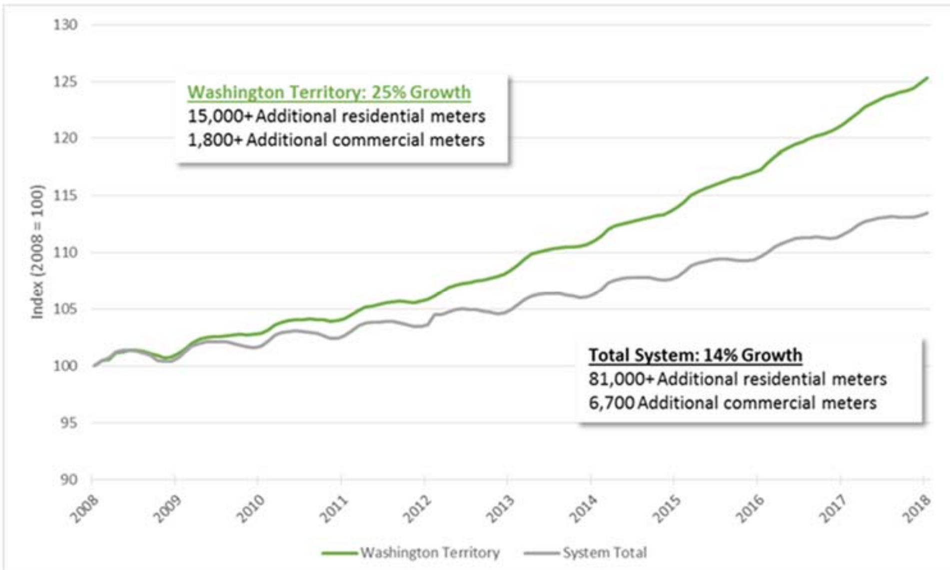
A. First, I provide context for the Company's Washington projects by describing growth in the Company's Washington service territory. Next, I provide an overview of the Company's major capital projects serving Washington customers that have been completed on NW Natural's system since the last rate case, as well as those that are currently in progress and expected to be in service by the rate effective date in this case. I also describe the projects that have been completed since the last rate case at the Company's storage facilities that are located in Oregon and partially allocated to Washington customers and describe the Company's post-test year plant additions that are expected to be in service and providing a benefit to Washington customers in early 2019. Finally, I discuss the early stages of a plan to retrofit excess flow valves ("EFVs") on service lines.

II. GROWTH IN NW NATURAL'S WASHINGTON SERVICE TERRITORY

Q. Please describe the rate of growth in the Company's Washington service territory.

A. Growth in NW Natural's Washington territory has solidly outpaced nearly all other areas of our system over the last decade (Figure 1, below). Strong commercial and residential development in Clark County has benefitted from – and helped fuel – the economic and population boom of the larger Portland-Vancouver-Hillsboro metropolitan area throughout the recovery, which has in turn driven customer growth for the Company. The figure and narrative below summarize the economic and demographic factors contributing to this growth.

Figure 1. NW Natural Customer Growth in Washington, 2008-2018



Q. What factors are driving growth in the greater Vancouver area?

A. As discussed in greater detail below, population growth, business and job growth, and housing development are contributing to overall growth in the Vancouver area.

- **Population Growth.** As in other West Coast metropolitan areas, population growth has long been a key driver of the Portland/Southwest Washington region's economy. Clark County has historically added residents faster than the region as a whole, and much faster than either Washington or Oregon states.
- **Business and Job Growth.** Clark County has outpaced all others in the Portland metropolitan area in terms of job growth, adding over 37,000 to private payrolls (a 29 percent increase from the bottom of the recession in early 2010) and further

establishing the area's own economic center of gravity. New business activity in the area, exemplified by a major redevelopment of Vancouver's waterfront district, has likewise led the region. In total, the three counties in NW Natural's Washington service territory added over 22,000 commercial establishments (14.1 percent growth) between the bottom of the commercial downturn and 2016.

- **Housing Development.** With regard to housing, Clark County holds some distinct advantages over its neighbors in Oregon. First is the prevalence of single family homes. The mix of new building in the area strongly favors single family dwellings (by a factor 5:1 between 2000 and 2008 and 7:1 since then), accounting for approximately 29 percent of those permitted in the 7-county metro area since 2008. Homes have sold at an average 15 percent discount relative to those in Multnomah County in Oregon since the market bottomed out in 2012. Clark County has recovered more of its 2005 building peak than the metro area as a whole and both Washington and Oregon states. As in much of the metro region, multifamily development in Clark County suffered a critical lull in the early years of the economic recovery, leading to rapid rent acceleration. However, a strong (albeit delayed) wave of apartment and townhouse development followed, with the number of units permitted in 2017 more than doubling levels at the peak of the early 2000s.

Q. Has growth in the Company's Washington service area been a major driver for the Company's plant additions in Washington over the last ten years?

A. Yes. Nearly all of the Company's Washington system reinforcement projects were developed to address growth on the Company's system and to allow the Company to continue to provide safe and reliable service.

III. MAJOR WASHINGTON CAPITAL PROJECTS

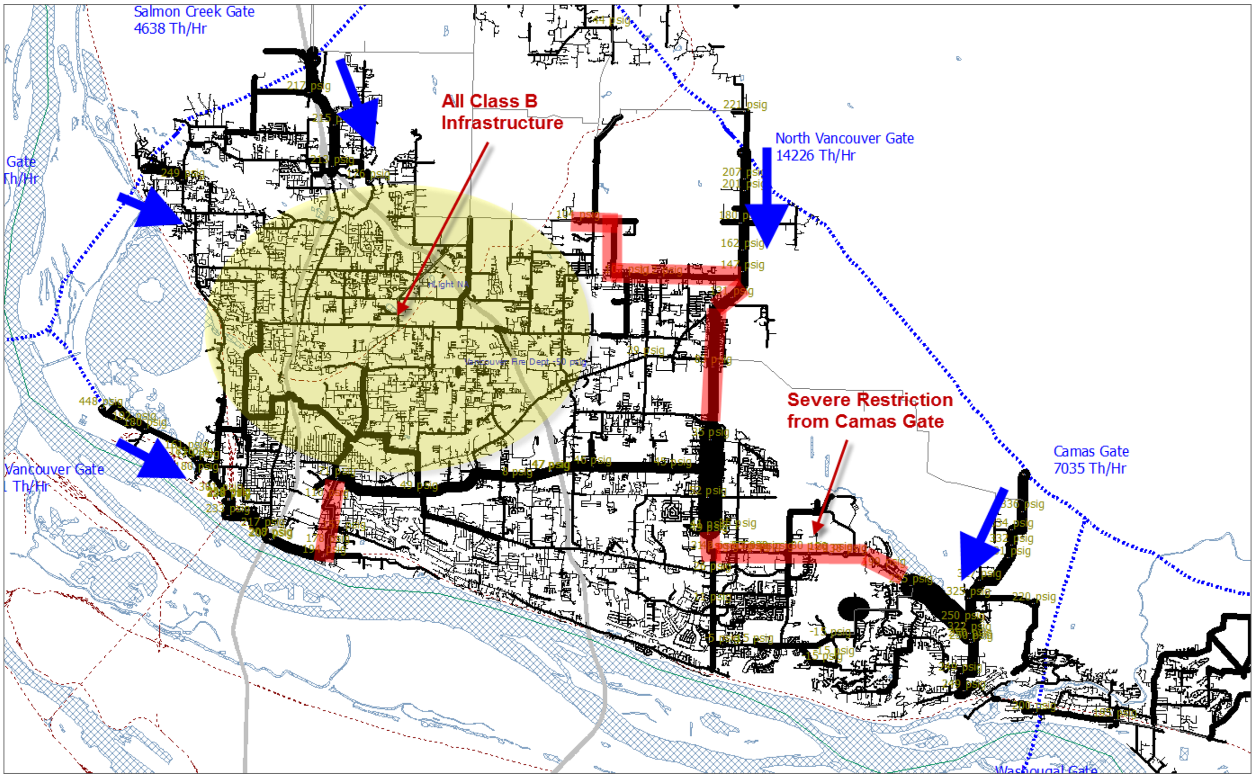
Q. Has the Company previously sought cost recovery for any major capital projects that have been completed since the Company's 2008 rate case (Docket UG-080546)?

A. No.

Q. Please provide a brief overview of the Company's capital projects planning to address growth and reliability issues in the Vancouver and Clark County area.

A. In 2014, NW Natural developed a 20-Year SW Washington Reinforcement Plan (20-Year Plan) for the Vancouver and Clark County service area. At that time, the existing 250 MAOP high pressure pipeline infrastructure had already proven to be inadequate. Under a 44 heating degree day (HDD) condition, we observed inadequate pressures in the Class B system. For reference 53 HDD is the cold weather design day for our system, which corresponds to a temperature of 12 degrees Fahrenheit. The Class B system is the network of pipes operating at 50 psig or less that transports gas from the high pressures pipelines into the neighborhoods and supplies gas to customers. The existing demand coupled with the inadequate high pressure and Class B pipeline infrastructure caused low pressures, impacting a large area in the city of Vancouver as seen in Figure 2 below.

Figure 2. Map of SW Washington highlighting areas of low pressure and pipeline constraints.



Q. What options were considered to address the low pressure problems in the Company's Washington service territory?

A. During the development of the 20-Year Plan, the Company evaluated potential alternatives to installing new pipelines, including additional customer curtailment/demand side management (DSM), the use of compressed natural gas (CNG) and/or liquefied natural gas (LNG) trailers, and satellite LNG, .

Q. Why did the Company determine that pipeline reinforcement and gate capacity expansion would be the best option to address the low pressure issues?

A. Additional large customer curtailment requires the alignment of several factors to be a viable solution for improving areas of low pressure during a cold weather event. The potential customers must have a large gas usage load, typically a large commercial or industrial customer, with the ability to fuel switch or be offline during periods of high demand. Since the low pressure was caused by existing demand coupled with the inadequate high pressure and Class B pipeline infrastructure, the potential customer must be in or near the area of low pressure to be a solution. The Company determined there were inadequate numbers of potential large interruptible customers in SW Washington service territory for this to be a solution. The Company determined it could not secure sufficient conservation with demand side management due to the amount of immediate savings needed.

CNG and LNG trailers were not viable options due to their low injection rate into the system (approximately 300 therms/hour) and their limited storage capacity that would limit injections to potentially 2 hours for CNG and up to 30 hours for LNG trailers, in comparison with the uninterrupted supply that pipelines offer. The low pressures issues in SW Washington would have required multiple trailers with specially trained operators to properly deploy. Additionally the number of trailers, the logistics of filling and siting, and the risk of not being able to move trailers when needed (e.g. due to ice or snow during cold weather events) make it an unacceptable long term solution.

Satellite LNG was not a viable solution to serve the load for SW Washington. For reference, similar satellite LNG are estimated to cost $25 to $30 million to install with approximately $450 thousand in annual O&M costs. There are additional risks with finding a suitable site and obtaining necessary environmental permits for satellite LNG.

As a result, the Company concluded that developing pipeline reinforcement and gate capacity expansion was the best option for addressing this system need in SW Washington.

Q. Please provide a brief description of the major capital projects serving Washington customers that have been completed since the Company's last rate case, and for which the Company is requesting recovery in this case.

A. The Company is requesting recovery for the following significant capital projects serving Washington customers:

- **The Felida Reinforcement Projects.** Between 2010 and 2017, the Company completed three projects in the Felida area:
    - The Felida Gate Reinforcement project was constructed in 2013 (The Felida Gate Project), and consisted of the construction of a new gate station on the Williams Pipeline.
    - The Felida Reinforcement Project involved the installation of approximately one-mile of high pressure 6-inch pipe and a district regulator to allow for injection of gas into an existing 4-inch distribution pipeline on NW 36th Avenue in the Felida area. This project was begun in October 2012 and completed in October 2013.
    - North Vancouver Core Phase 1. The North Vancouver Core Project Phase 1 (North Vancouver Core Project) is a high pressure 6-inch pipeline project which also included installation of a district regulator. The North Vancouver Core Project was initiated in December 2015 and completed in April 2017.

- **Camas Reinforcement.** The Camas Reinforcement Project (Camas Project) is a high pressure 12-inch and 6-inch pipeline system reinforcement project to provide system reliability in a low- pressure area of Camas. The Camas Project was initiated in July 2014 and completed in August 2016.
- **Salmon Creek Area Projects.** Between 2013 and 2018, the Company completed three projects in the Salmon Creek area:
  - **NE 119th Reinforcement.** The NE 119th Reinforcement project (NE 119th Reinforcement Project) involved the installation of approximately 12,000 feet of high pressure 8-inch pipeline and the installation of one District Regulator to improve supply deliverability to the North Vancouver, Washington service territory and to minimize low delivery pressure during cold weather events. The NE 119th Reinforcement Project was initiated in July 2013 and completed in November 2014.
  - **Salmon Creek to 119th.** The Salmon Creek to 119th project (Salmon Creek to 119th Project) involved the installation of approximately 12,000 feet of high pressure 8-inch main for system reinforcement and to improve the reliability of the natural gas system in the Vancouver area. The Salmon Creek to 119th Project was initiated in June 2015 and completed in August 2017.
  - **Salmon Creek Gate Station.** The Salmon Creek Gate Station project (Salmon Creek Gate Station Project) involved rebuilding the Salmon Creek Gate Station to meet increased gate station flow to feed the NE 119th Reinforcement and Salmon Creek to 119th pipeline projects.

- **North Vancouver Gate Station.** The North Vancouver Gate Station project (North Vancouver Gate Project) upgraded the North Vancouver Gate to meet the Company's then-existing and projected future load requirements. The North Vancouver Gate Project was initiated in 2014 and completed in 2016.
- **Washougal Reinforcement.** The Washougal Reinforcement Project (Washougal Reinforcement Project) is a pipeline project designed to address pressure issues in the Washougal area. The Washougal Reinforcement Project was initiated in December 2016 and completed in October 2018.
- **E Mill Plain Blvd Devine to Lieser.** The E Mill Plain Blvd to Lieser project (E Mill Plain Project) is a distribution pipeline replacement project, which replaced bare main with new 6-inchpipeline. The E Mill Plain Project was initiated in November 2012 and completed in November 2014.

These projects are shown in Figure 3, below, and my testimony will describe each of these projects in greater detail.

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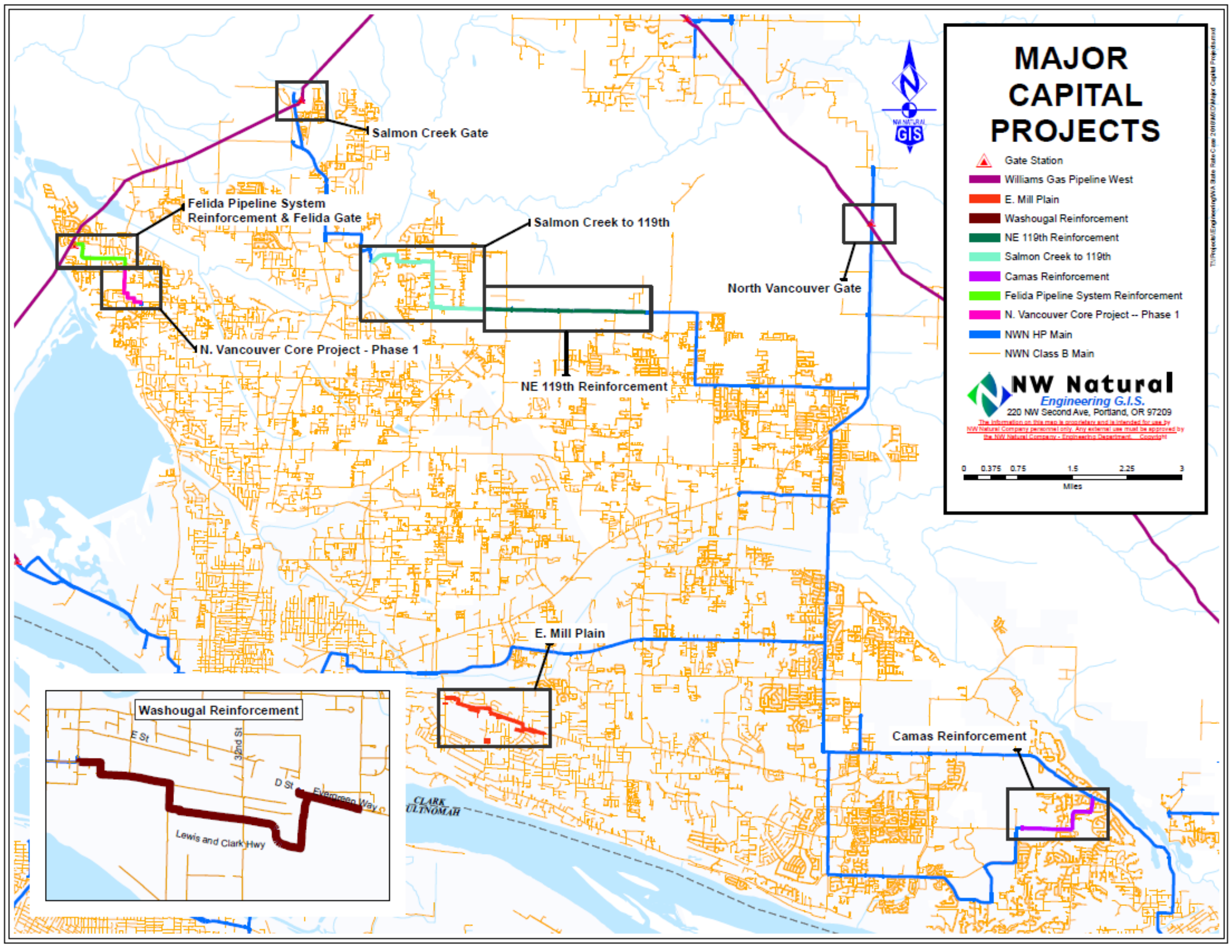
Figure 3. Map of Significant Capital Projects Serving Washington Customers



Q. Were the major Washington capital projects, described above, discussed in the Company's integrated resource plans (IRPs) filed with the Commission?

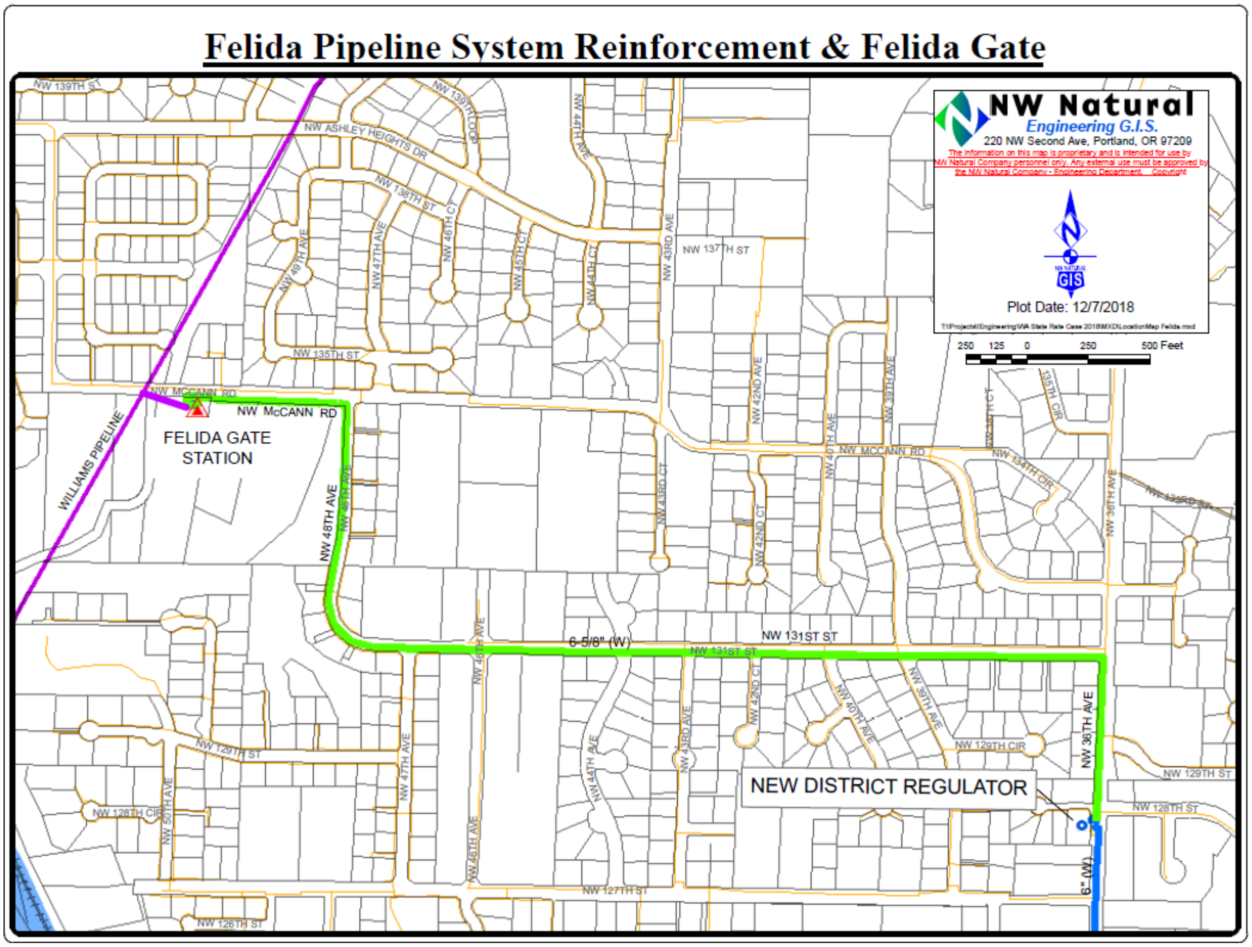
A. Yes. The above projects were presented in NW Natural's 2013 IRP (Docket UG-120417), 2014 IRP (Docket UG-131473), and 2016 IRP (Docket UG-151776), with the exception of the E Mill Plain Project, a bare steel pipeline replacement project.

<u>Felida Area Projects</u>

Q. Did the Company complete several projects in the Felida area?

A. Yes. As described in greater detail below, the Company developed three related projects in the Felida area north of Vancouver, Washington: (1) the Felida Gate Project, (2) the Felida Pipeline Project, and (3) the North Vancouver Core Project.

Figure 4. Map of Felida Area Projects



Felida Gate Project

Q. Please describe the Felida Gate Project.

A. The Felida Gate Project created a new gas source in the Felida area (unincorporated North Vancouver, Washington) as shown in Figure 4. The Felida Gate Project consisted of a new gate station on the Williams Pipeline, which was designed to supply gas into the Felida Pipeline.

Q. Why did the Company develop the Felida Gate Project?

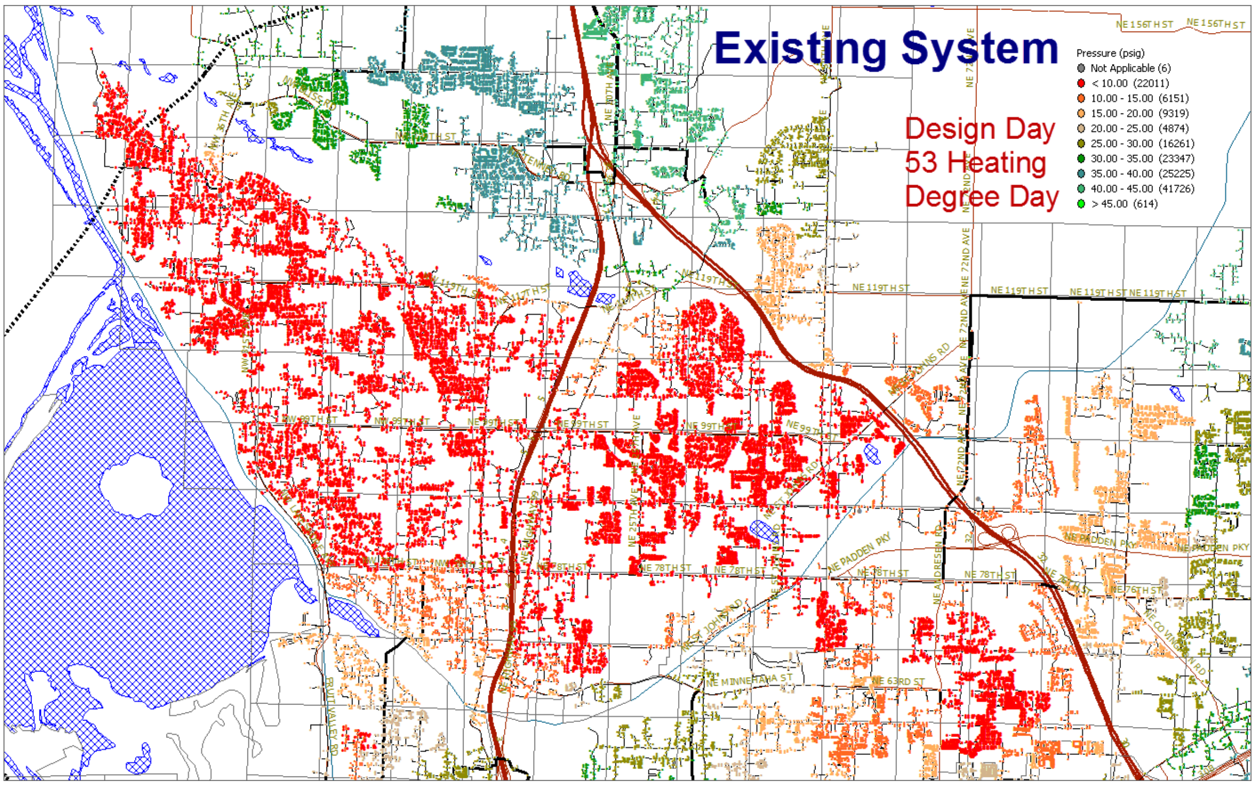
A. Prior to the development of the Felida area projects, the Felida area had a multiple-year history of low pressures in winter. When low temperatures fell below 15 degrees (50 HDD), pressures in the area dropped below 10 psig in the Class B system, which fails NW Natural's System Reinforcement criteria.

NW Natural's System Reinforcement Criteria requires reinforcement when pressures are below 10 psig in the Class B system. Pressures below 10 psig prevent the proper functionality of Excess Flow Valves (EFVs), an important safety device that is installed on service lines to stop the flow of gas in the event of a damage. Additionally, if Class B pressures below 10 psig are observed, the pipe system is delivering near its full capacity. At a design day condition (53 HDD), pressure in the system would be too low to provide gas service in several areas.

As an interim measure to account for this low-pressure issue, NW Natural used a large CNG trailer (approximately 1000 therms total capacity) to provide a boost to the system for a number of years. However, this method was capable of creating sufficient pressure for only a few hours during peak morning demand for a few consecutive days at most, and was not a viable solution for a long-term cold weather event. Additionally, with growth anticipated in the area, low pressure problems were anticipated to increase, necessitating a permanent solution.

Figure 5, below, shows a Synergi model of the Felida area under an observed condition on November 23, 2012. At 42.7 HDD, the red areas highlight those nodes that are under 10 psig, and fail NW Natural's System Reinforcement criteria. At the 52 HDD design day condition, the additional customer load caused by the lower temperatures would cause the pressures to be even lower than illustrated in Figure 5.

Figure 5. Synergi model of Felida area on November 23, 2012



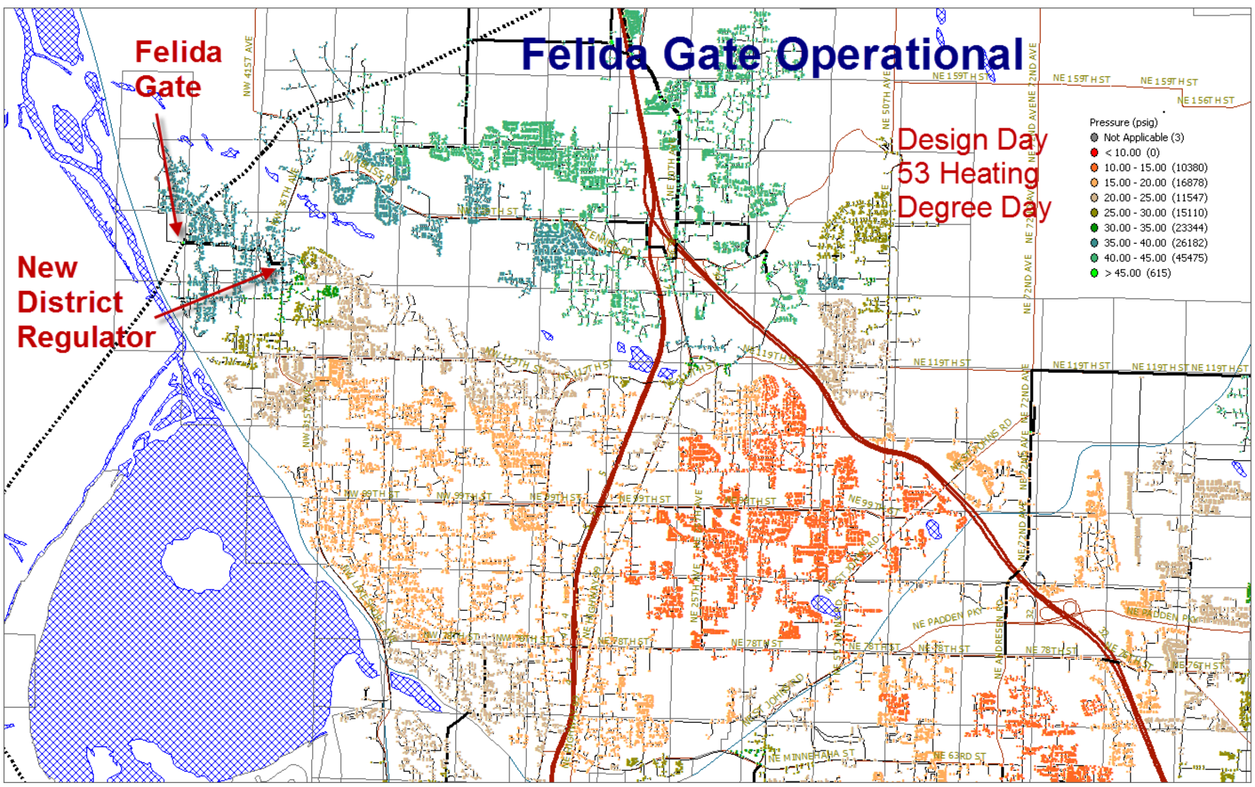
Q. Did the Company consider alternatives to developing the Felida Gate Project?

A. Yes. The Company considered construction of a large diameter Class B pipe or high-pressure pipe. Either pipeline would have to extend approximately five miles from near the Salmon Creek gate to the Felida area. The Company also considered targeted conservation resources and the use of interruptible customers.

Q. Why did the Company select the Felida Gate Project over other alternatives?

A. The Company determined that construction of a high-pressure pipe would be more expensive than construction of a new gate with downstream piping and regulator station. The Company determined that the Felida Gate Project, in combination with the Felida Pipeline Project (discussed below), would provide the most improvement to the pressure problems based on the Company's modeling. The location of the Williams Pipeline, near the low-pressure area of Felida area, made the Felida Gate Project the most logical alternative. Figure 6 below shows the pressure improvements to the Class B system that the Felida Gate and accompanying pipeline provide.

Figure 6. Synergi model of Felida area with proposed Gate and pipeline projects



The Company also determined that neither conservation nor use of interruptible customers were viable solutions. There were no interruptible customers in the area to curtail and the Company determined it could not secure sufficient conservation with demand side management due to the amount of immediate savings needed. As a result, the Company concluded that developing the Felida Gate Project was the best option for addressing this system need.

Q. When was the Felida Gate Project completed?

A. The Felida Gate Project was initiated in 2010 and completed in 2013.

Q. Is the Felida Gate Project currently in service and providing a benefit to Washington customers?

A. Yes.

Q. What was the total cost for the Felida Gate Project?

A. The total cost for the Felida Gate Project was approximately $2.0 million.

Felida Pipeline Project

Q. Please describe the Felida Pipeline Project.

A. The Felida Pipeline Project consisted of installation of approximately one-mile of high-pressure 6-inch 250 MAOP pipe and a district regulator to allow for injection of gas into an existing 4-inch distribution pipeline on NW 36th Avenue, as shown in Figure 4, above.

Q. Why did the Company develop the Felida Pipeline Project?

A. The Company developed the Felida Pipeline Project in conjunction with the Felida Gate Project (discussed above). Together with the new gate station, the new pipeline greatly enhances the supply for the Felida area, which had experienced ongoing low-pressure problems for several years. The pipeline also provides access for future extension on NW 119th Street, reinforcing an area that previously lacked a high-pressure piping network.

Q. Did the Company consider alternatives to developing the Felida Pipeline Project?

A. Yes. As explained above, the Company considered development of a new high-pressure pipeline, increased conservation, or the use of interruptible customers. However, as detailed above, the Company determined that a new high-pressure pipeline would have been substantially more costly, and that there was insufficient opportunity for conservation or the use of interruptible customers to meet the existing system demands and increasing load. While the Company had been using CNG trailers to boost system pressure, these support mechanisms can only be used for limited durations, and could not accommodate substantial additional load growth and the resulting low-pressure periods.

Q. When was the Felida Pipeline Project complete?

A. The Felida Pipeline Project was initiated in December 2012 and completed in October 2013.

Q. Is the Felida Pipeline Project currently in service and providing a benefit to Washington customers?

A. Yes.

Q. What was the total cost for the Felida Pipeline Project?

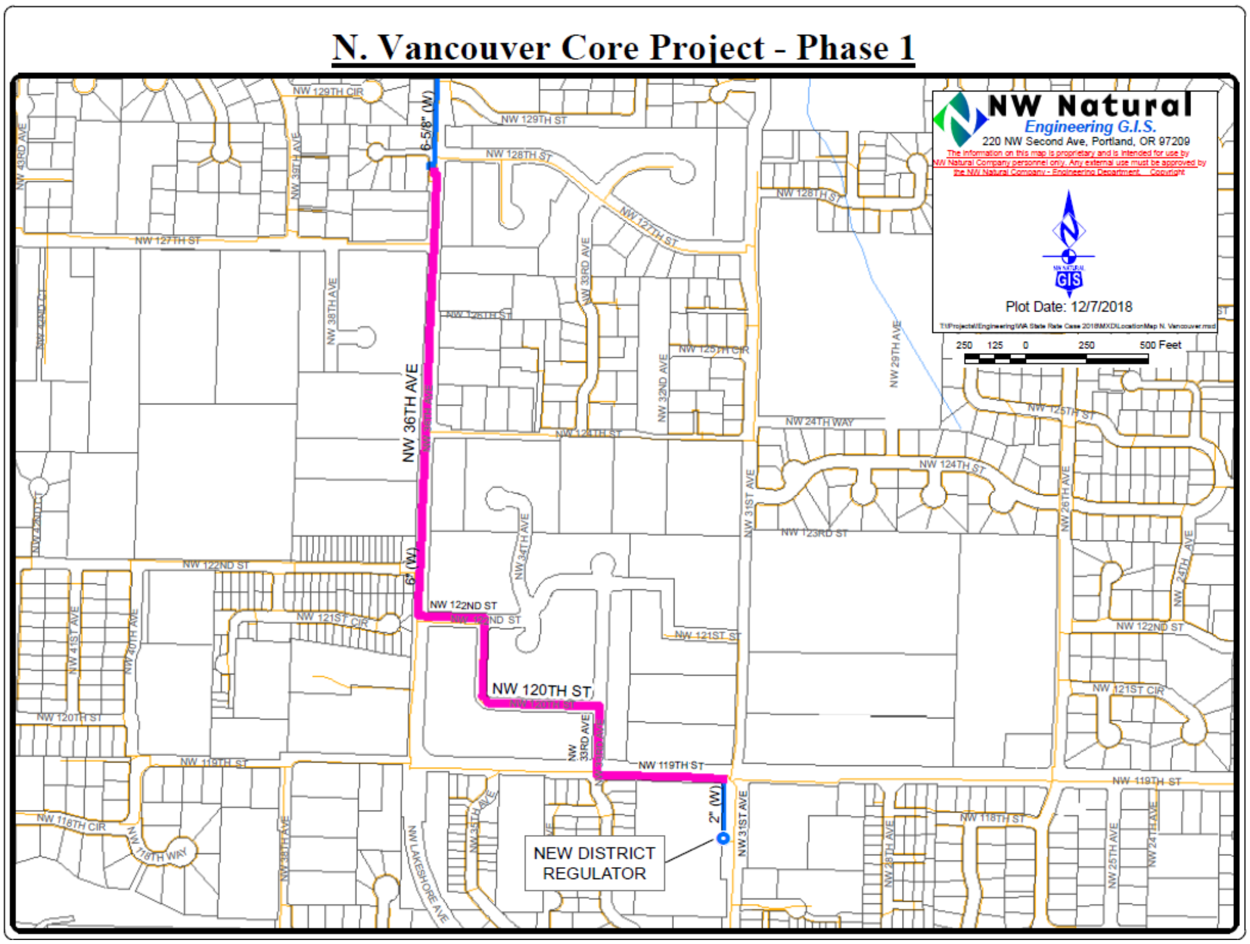
A. The total cost for the Felida Pipeline Project was approximately $1.4 million.

North Vancouver Core Project

Q. Please describe the North Vancouver Core Project.

A. The North Vancouver Core Project is located in the Felida area, and included the installation of approximately 3,700 feet of high pressure 6-inch steel pipeline tested to Class D requirements and a district regulator. Phase 1 of the project involved the installation of approximately 3,700 feet of 6-inch high-pressure main at an estimated cost of $1.3 million. Phase 2 of the project will include several smaller projects to address the existing issues directly east of the Phase 1 project's location, but the Company does not anticipate completing all of these smaller projects until 2022. Phase 1 of the North Vancouver Core Project is shown in Figure 7, below.

Figure 7. Map of the North Vancouver Core Project



Q. Did the Company consider alternatives to the North Vancouver Core Project?

A. Yes. As explained above, the Company considered the continued use of CNG and LNG trailers, increased conservation, or the use of interruptible customers. As explained above, use of the CNG and LNG trailers would not provide a durable, long-term solution, and there were insufficient opportunities for conservation or the use of interruptible customers. Accordingly, the Company determined that developing the North Vancouver Core Project was the best option.

Q. When was the North Vancouver Core Project completed?

A. The North Vancouver Core Project was initiated in December 2015 and completed in June 2016.

Q. Is the North Vancouver Core Project currently in service and providing a benefit to Washington customers?

A. Yes.

Q. What was the total cost for the North Vancouver Core Project?

A. The total cost for the North Vancouver Core Project was approximately $1.3 million.

<u>Camas Reinforcement Project</u>

Q. Please describe the Camas Project.

A. The Camas Project consisted of installation of approximately 7,500 feet of 12-3/4 inch high pressure main and 4,300 feet of 6-5/8 inch high pressure main with a designed maximum operating pressure of 250 psig through existing residential streets and City of Camas roads, and the installation of two district regulators to support the surrounding distribution systems. Figure 8 below shows the route of the Camas Project.

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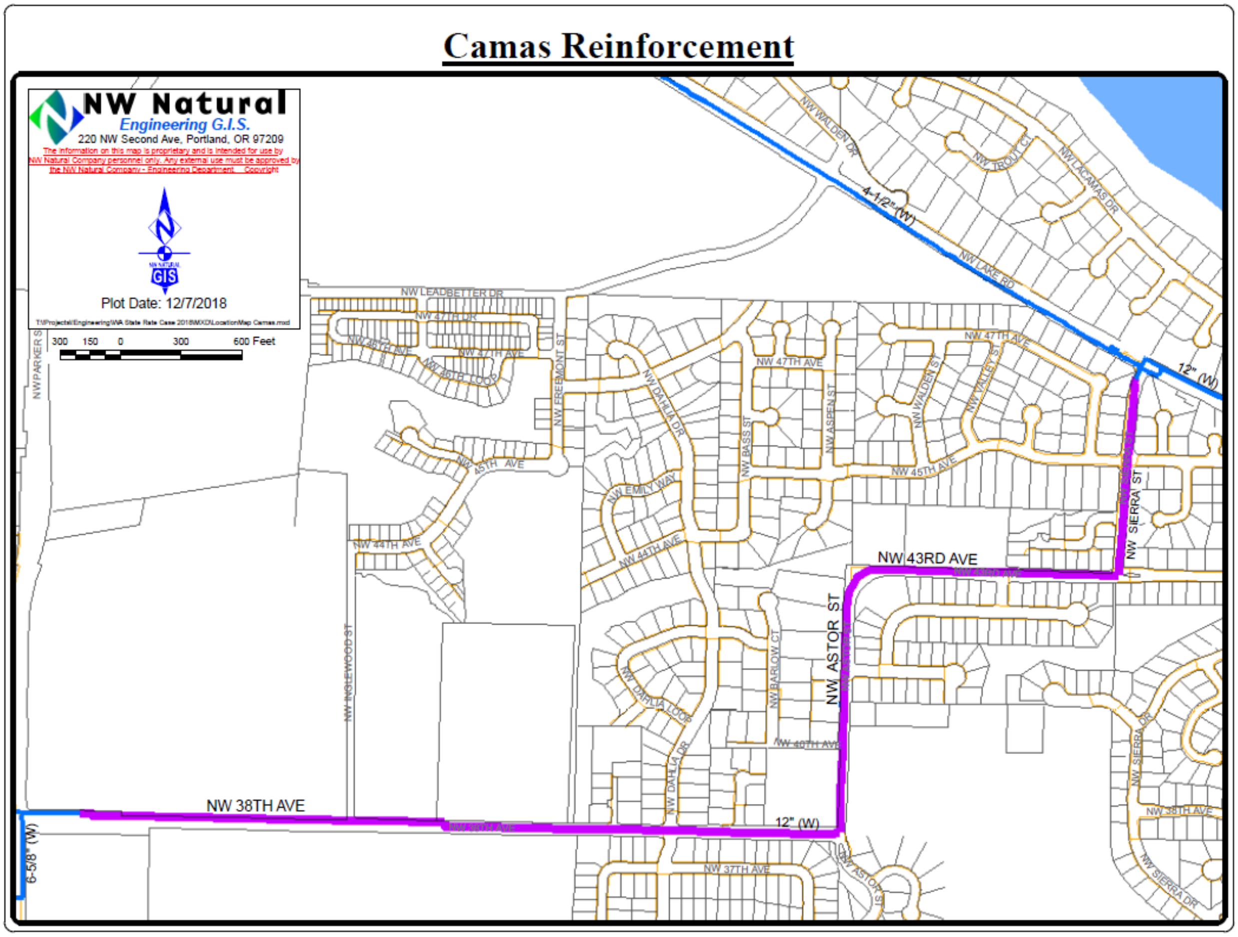
Figure 8. Camas Project



Q. Why did the Company develop the Camas Project?

A. The Camas Project is a system reinforcement project to provide system reliability in a low- pressure area of Camas. NW Natural experienced low inlet pressures in this area during cold weather events and needed to increase the volume of product availability to the growing Camas service territory. Figure 9 below shows a model of the Vancouver distribution system for the 2016-2017 winter with expected growth without the Camas Project. The areas in red show pipelines with less than 10 psig, which fails NW Natural's system reinforcement standard.

Figure 9. Vancouver Distribution System for the 2016-2017 Winter without the Camas Project

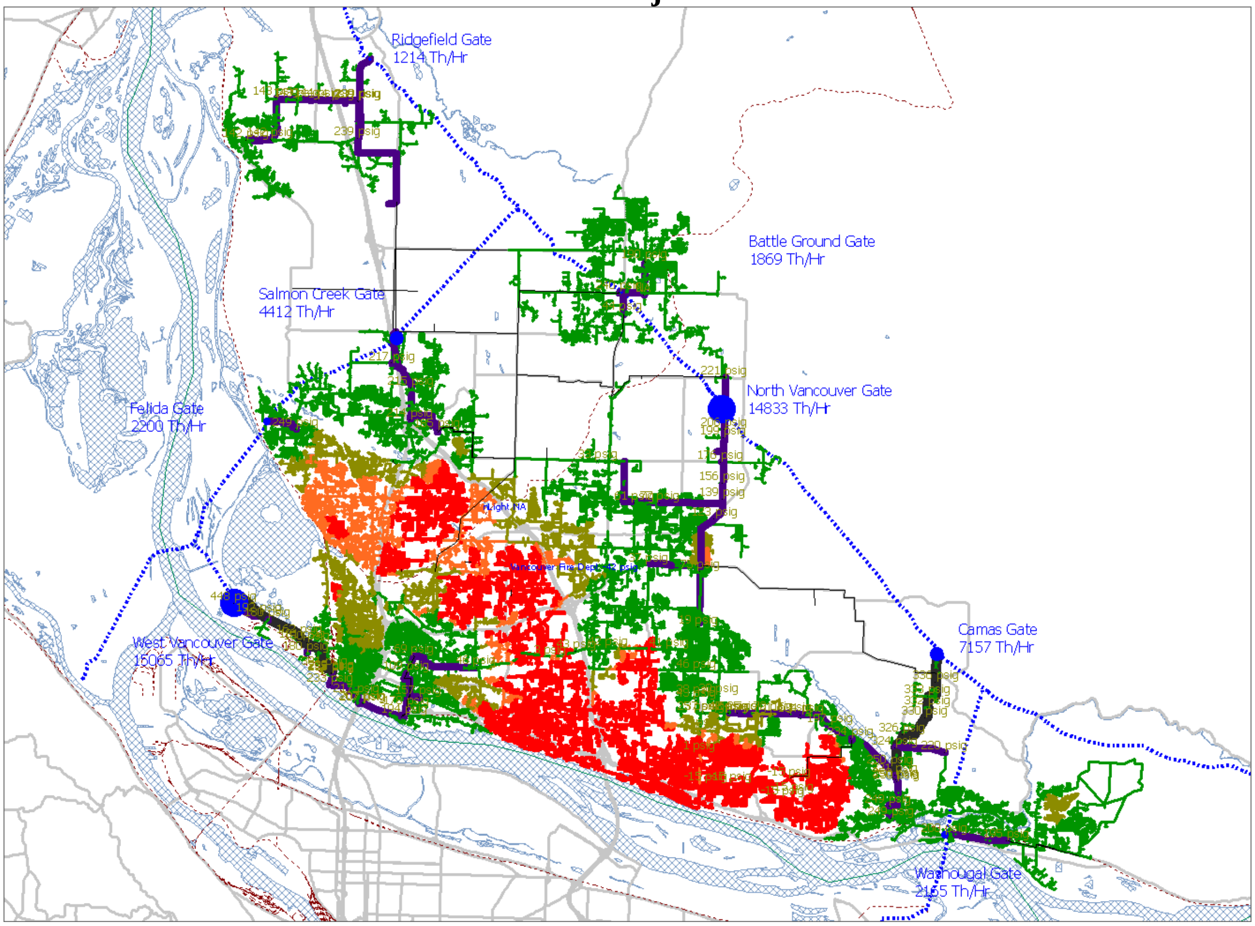
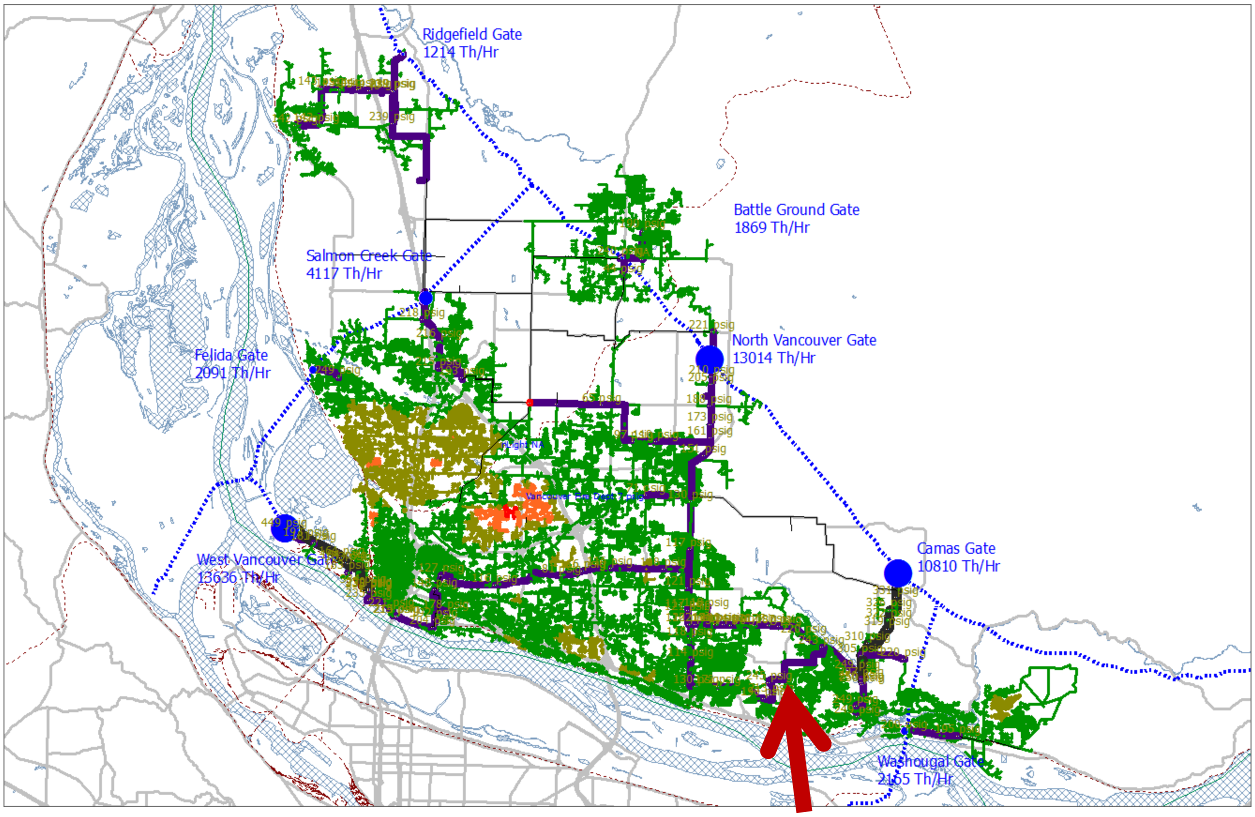


Figure 10 below shows the Vancouver distribution system for the 2016-2017 winter with the Camas Project. As shown in Figure 10, the addition of the Camas Project has a major impact improving system reliability in all areas of Vancouver. The Camas Project also allows significantly increased feed from Camas Gate into Vancouver and raises pipeline pressures in the areas that failed NW Natural's system reinforcement standard without the added pipeline.

Figure 10. Vancouver Distribution System for the 2016-2017 Winter with the Camas Project.



Q. Did the Company consider alternatives to the Camas Project?

A. As explained above, the Company considered the continued use of CNG and LNG trailers, increased conservation, or the use of interruptible customers. As explained above, use of the CNG and LNG trailers would not provide a durable, long-term solution, and there were insufficient opportunities for conservation or the use of interruptible customers. Accordingly, the Company determined that developing the Camas Project was the best option.

Q. When was the Camas Project completed?

A. The Camas Project was initiated in July 2014 and completed in August 2016.

Q. Is the Camas Project currently in service and providing a benefit to Washington customers?

A. Yes.

Q. What was the total cost for the Camas Project?

A. The total cost for the Camas Project was approximately $6.3 million.

<u>Salmon Creek Area Projects</u>

Q. Please describe the Salmon Creek Area Projects.

A. Between 2013 and 2018, the Company completed three projects in the Salmon Creek area:

- **NE 119th Reinforcement.** The NE 119th Reinforcement project (NE 119th Reinforcement Project) involved the installation of approximately 12,000 feet of high pressure 8-inch pipeline and the installation of one District Regulator to improve supply deliverability to the North Vancouver, Washington service territory and to minimize low delivery pressure during cold weather events. The NE 119th Reinforcement Project was initiated in July 2013 and completed in November 2014.
- **Salmon Creek to 119th.** The Salmon Creek to 119th project (Salmon Creek to 119th Project) involved the installation of 12,000 feet of high pressure 8-inch main for system reinforcement and to improve the reliability of the natural gas system in the Vancouver area. The Salmon Creek to 119th Project was initiated in June 2015 and completed in August 2017.
- **Salmon Creek Gate Station.** The Salmon Creek Gate Station project (Salmon Creek Gate Station Project) involved rebuilding the Salmon Creek

Gate Station to meet increased demand and planned system improvement projects in the Vancouver area. The Salmon Creek Gate Station Project was initiated in May 2017 and was completed in March 2018.

NE 119th Reinforcement Project.

Q. Please describe the NE 119th Reinforcement Project.

A. The NE 119th Reinforcement project (NE 119th Reinforcement Project) is located in Clark County, Washington and involved the installation of approximately 12,000 feet of high pressure 8-inch pipeline on NE 119th Street from NE 65th Avenue to NE 111th Avenue. The project also included the installation of one District Regulator. See Figure 11 below for the location of the new pipeline.

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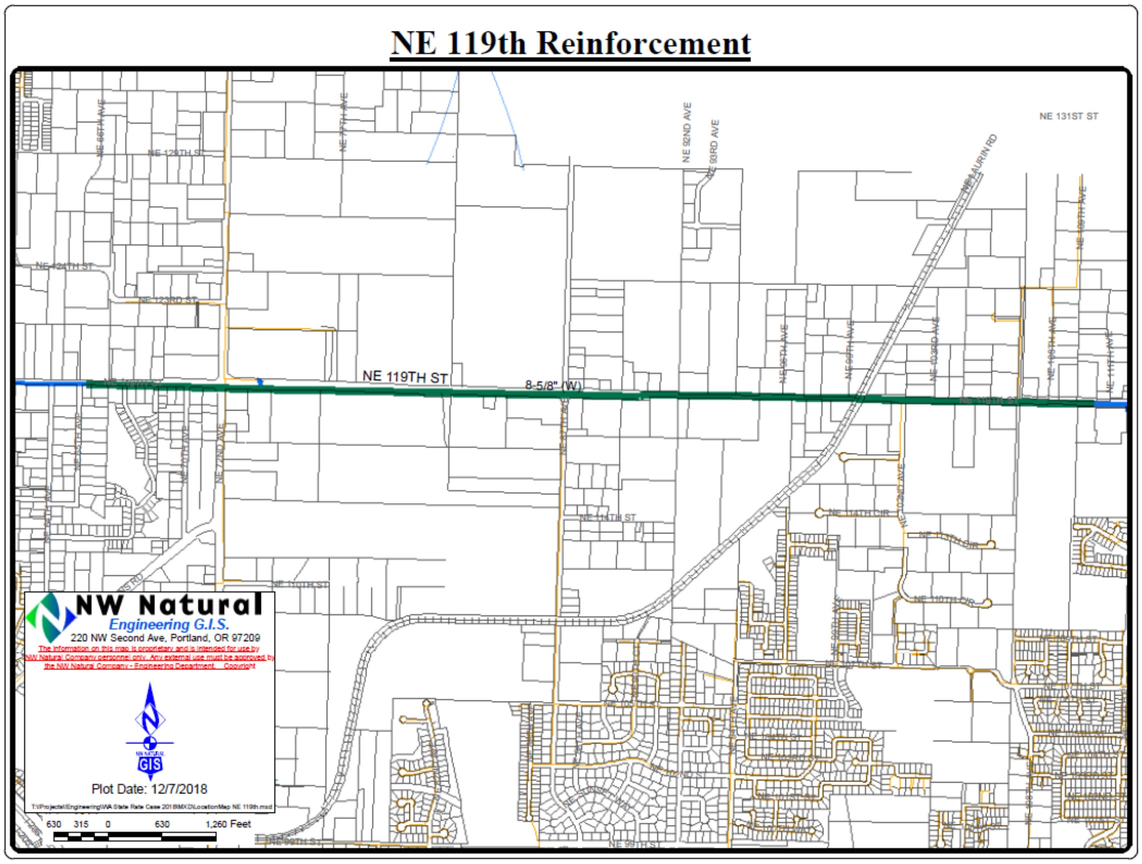
Figure 11. Map of the NE 119th Reinforcement Project



Q. Why did the Company develop the NE 119th Reinforcement Project?

A. The main purpose of the project is to improve supply deliverability to the North Vancouver, Washington service territory and to minimize low delivery pressure during cold weather events. During the 2008-09 heating season, there was an extreme cold weather event. Five district regulators had to be manually bypassed by field crews as a result of inadequate capacity on the high pressure pipeline system for the regulators to properly function. Additionally the Company had to use CNG and LNG trailers to support supply for the distribution system during peak morning demand. The Company again experienced inadequate high pressure pipeline capacity resulting in inadequate

Class B pressures, requiring the Company to use CNG trailers to feed into the system during a subsequent cold weather event in the 2012-13 heating season. The NE 119th Reinforcement was installed to improve high pressure pipeline capacity in the area.

Figure 12 - System pressure prior to the installation of the NE 119th Reinforcement

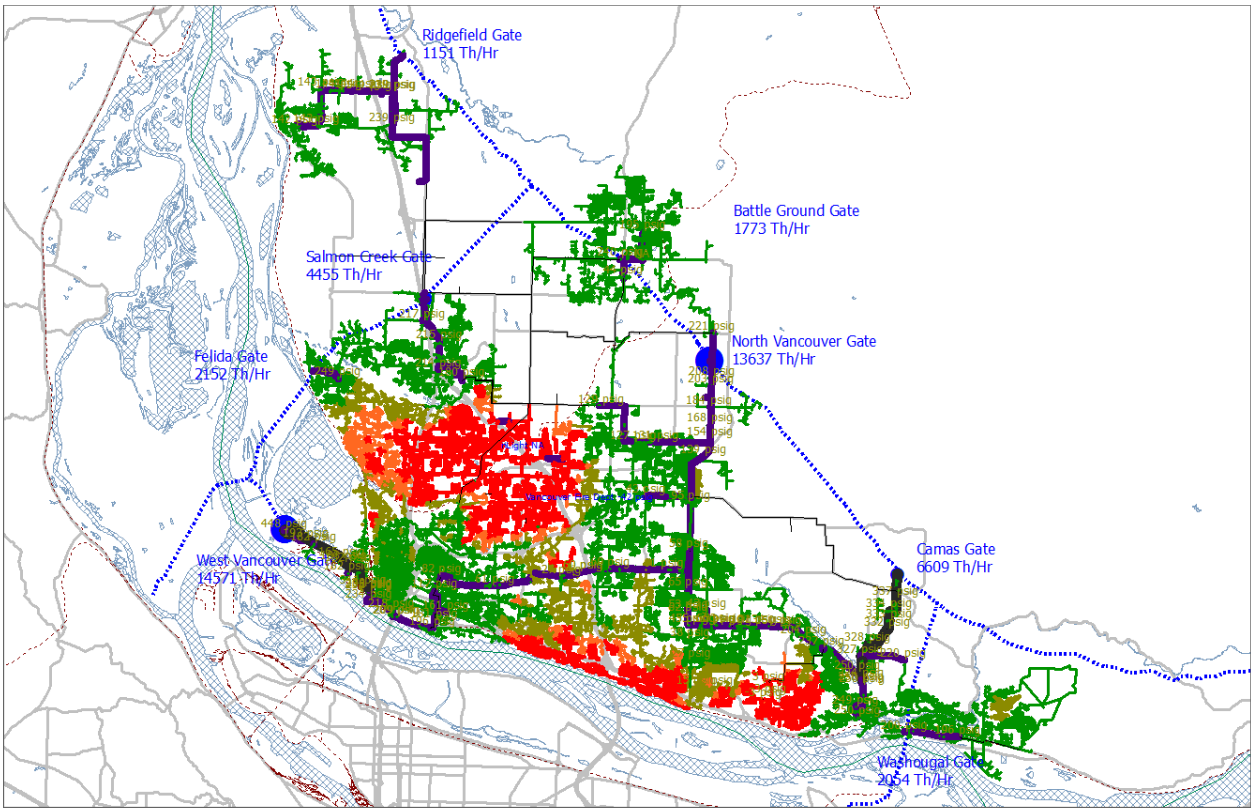


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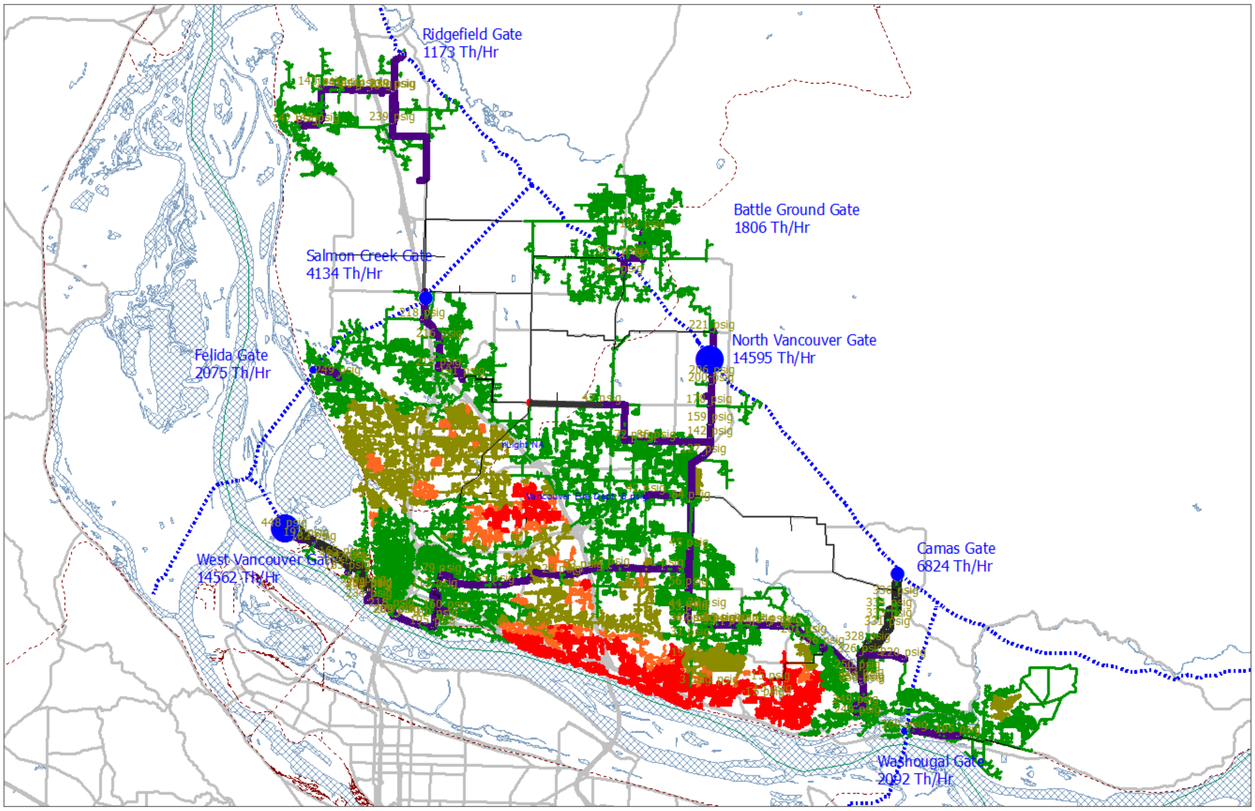
Figure 13 – Modeled Pressure Increases with the Installation of the NE 119th Reinforcement.



Q. Did the Company consider alternatives to developing the NE 119th Reinforcement Project?

A. The Company also considered developing a pipeline along NE 99th St. That route, however, ran through residential neighborhoods and was determined to be more costly due to existing development, existing utilities in the area, and rocky areas which make drilling more difficult. That route would also need cross State Road (SR) 503, which may not have been permitted by Washington State Department of Transportation (WSDOT).

Q. Why did the Company select the NE 119th Reinforcement over the other alternatives?

A. The route along NE 119th St, on the other hand, was the most direct route with the least impact to local residences and existing infrastructure. Because the area along NE 119th is primarily farm land with some commercial businesses, the drilling conditions were more favorable and less costly than the alternative route along NE 99th St.

Q. When was the NE 119th Reinforcement Project completed?

A. The NE 119th Reinforcement Project was initiated in July 2013 and completed in November 2014.

Q. Is the NE 119th Reinforcement Project currently in service and providing benefits to customers?

A. Yes.

Salmon Creek to 119th Project

Q. Please describe the Salmon Creek to 119th Project.

A. The Salmon Creek to 119th Project included the installation of approximately 12,000 feet of 8-inch wrapped high-pressure distribution main through existing Clark County right of ways in Vancouver, Washington, with a design MAOP of 720 psig and an operation MAOP of 250 psig. This project was an extension of the 8-inch pipeline that had been installed as part of the NE 119th Reinforcement Project in 2014. See Figure 14 below for the pipeline route.

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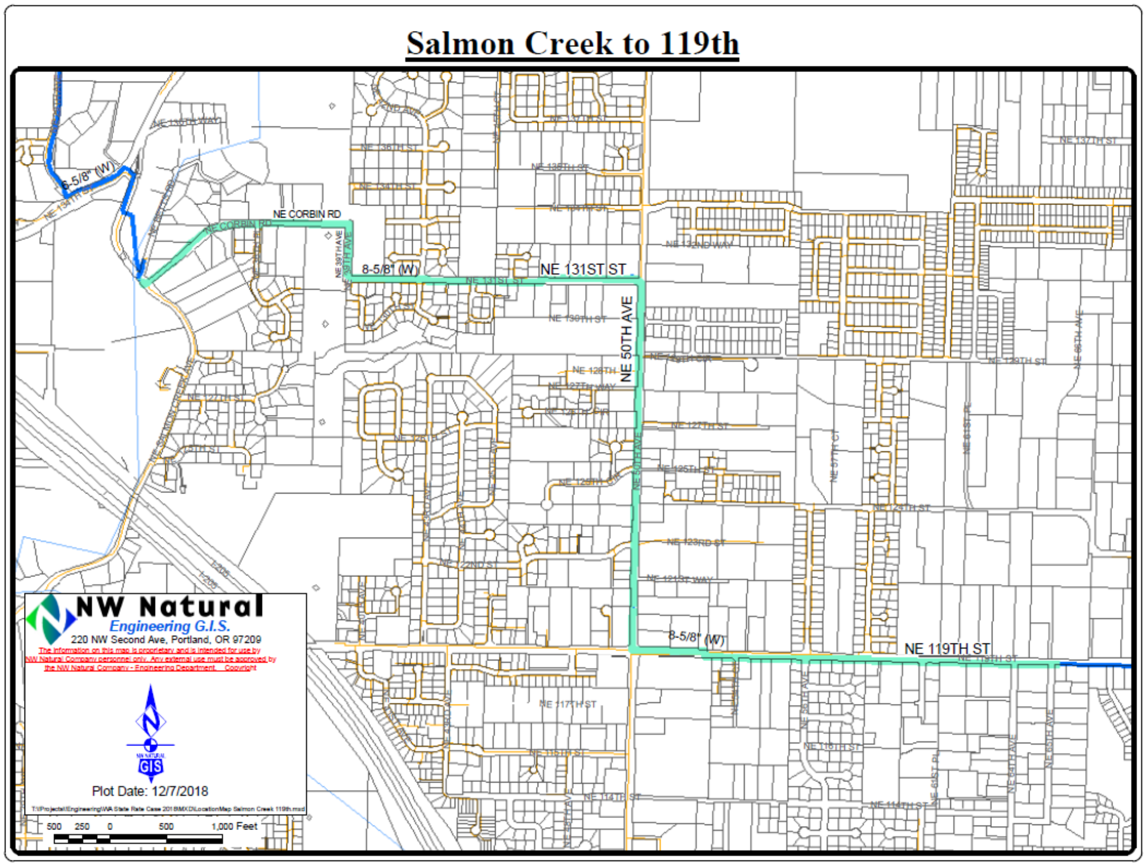
Figure 14. Map of the Salmon Creek to 119th Project



Q. Why did the Company develop the Salmon Creek to 119th Project?

A. The Company developed the Salmon Creek to 119th Project to provide system reinforcement and improve the reliability of the natural gas system in the Vancouver area.

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Figure 15. Vancouver Distribution System for the 2016-2017 Winter without the Salmon Creek to 119th Project.

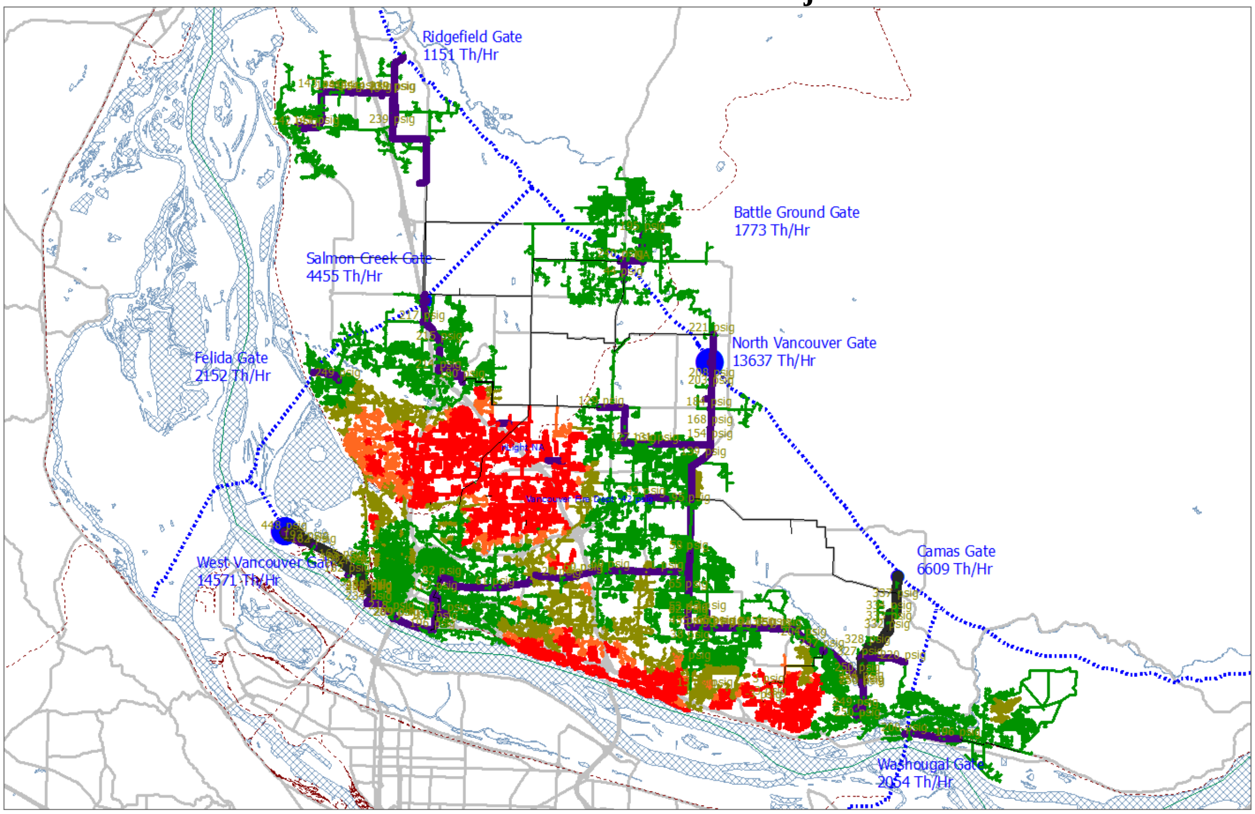

Figure 15 shows a model of the Vancouver distribution system for the 2016-2017 winter with expected growth without Salmon Creek to 119th Project. The areas in red show pipelines with less than 10 psig, which fails NW Natural's system reinforcement standard.

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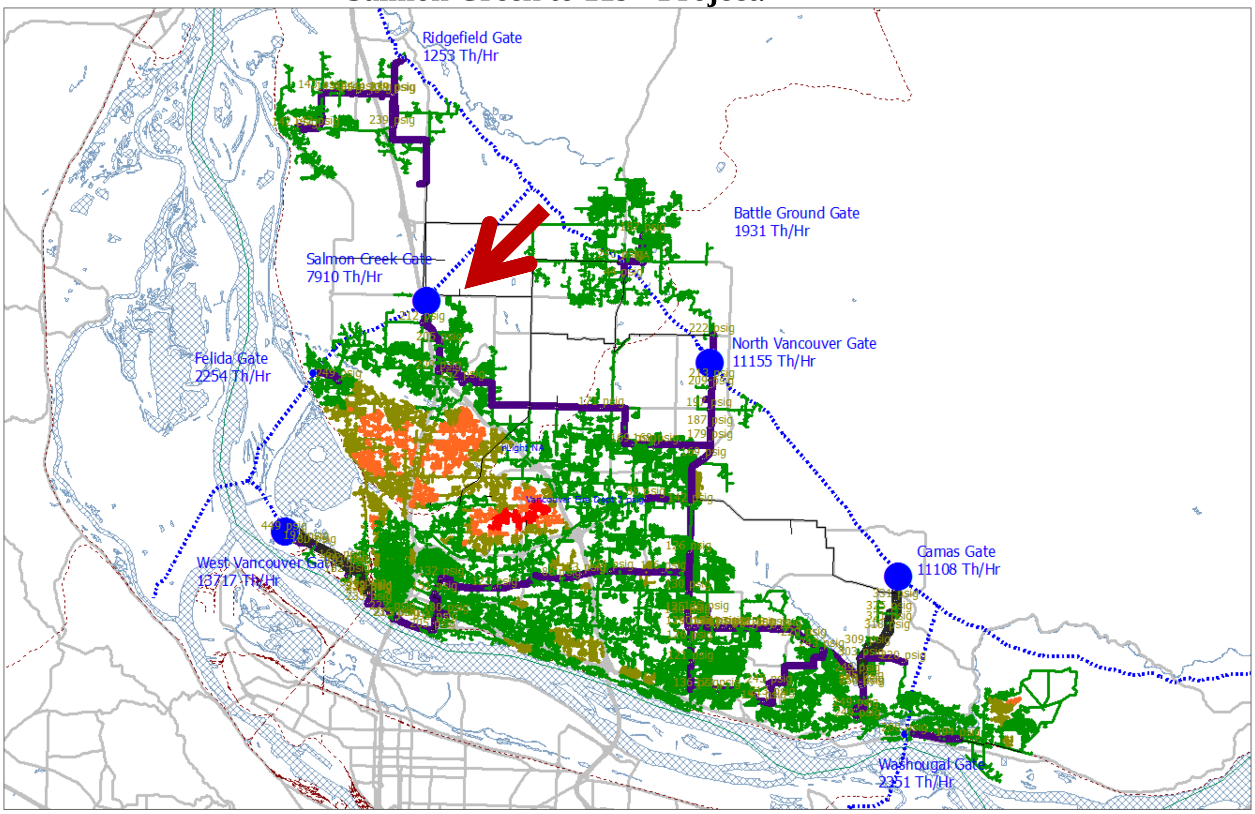
Figure 16. Vancouver Distribution System for the 2017-2018 Winter with the Salmon Creek to 119th Project.



As shown in Figure 16, the Salmon Creek to 119th Project allows significant feed from Salmon Creek gate into North Vancouver. This, combined with the previous NE 119th Reinforcement Project, become a major feed for expected growth in the Salmon Creek and Battleground area.

Q. Did the Company consider alternatives to the Salmon Creek to 119th Project?

A. As explained above, the Company considered the continued use of CNG and LNG trailers, increased conservation, or the use of interruptible customers. As explained above, use of the CNG and LNG trailers would not provide a durable, long-term solution, and there were insufficient opportunities for conservation or the use of interruptible customers. Accordingly, the Company determined that developing the Salmon Creek to 119th Project was the best option.

Q. When was the Salmon Creek to 119th Project completed?

A. The Salmon Creek to 119th Project was initiated in June 2015 and completed in August 2017.

Q. Is the Salmon Creek to 119th Project currently in service and providing benefits to Washington customers?

A. Yes.

Q. What was the total cost for the Salmon Creek to 119th Project?

A. The total cost for the Salmon Creek to 119th Project was approximately $5.1 million.

Salmon Creek Gate Station

Q. Please describe the Salmon Creek Gate Station Project.

A. The Salmon Creek Gate Station project (Salmon Creek Gate Station Project) involved rebuilding the Salmon Creek Gate Station to meet increased demand and planned system improvement projects in the Vancouver area. The location of the Salmon Creek Gate is show in Figure 17 below.

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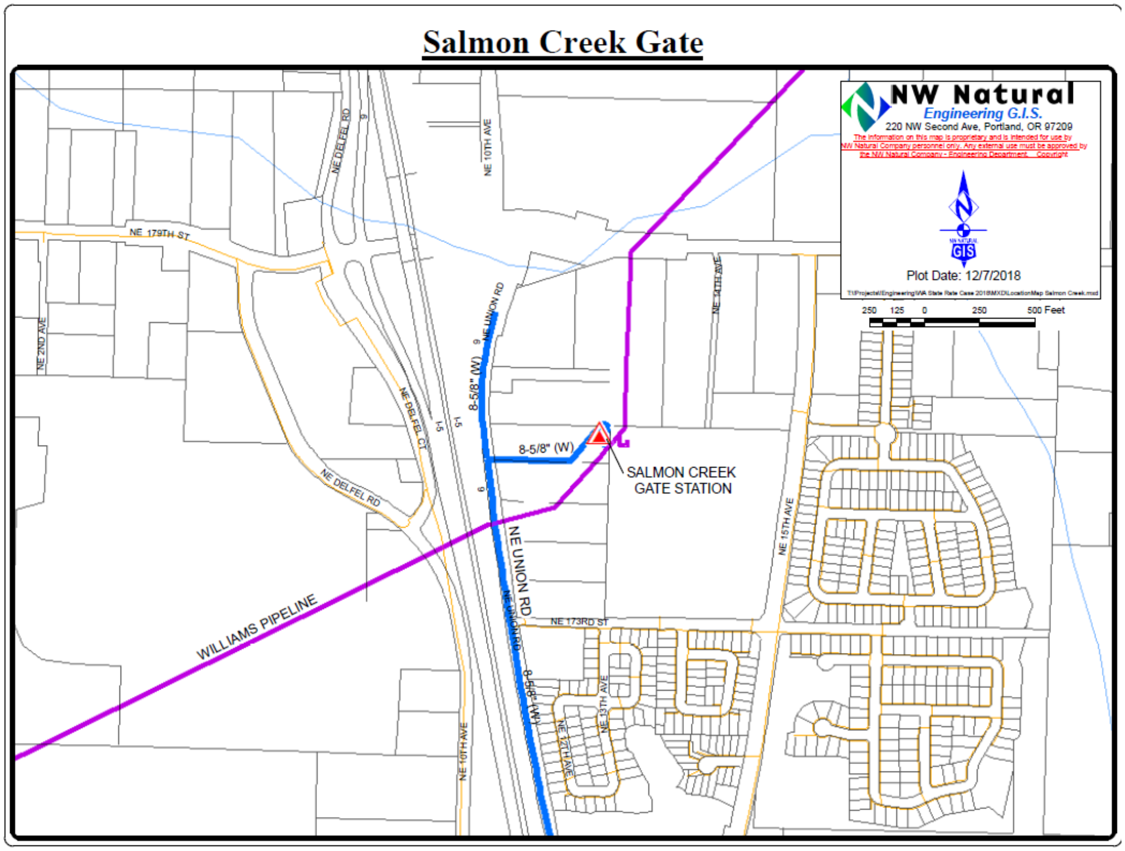
Figure 17: Map of the Salmon Creek Gate Project



Q. Why did the Company develop the Salmon Creek Gate Station Project?

A. The Company developed the Salmon Creek Gate Station Project to address increased demand in the Vancouver area. The existing metering and pressure regulation equipment was undersized and inadequate to serve the increased customer demand. As a result, the Company determined that the gate station had to be rebuilt.

Q. Did the Company consider alternatives to the Salmon Creek Gate Station Project?

A. Yes. The Company considered instead constructing an additional gate station near the existing undersized gate station to serve increased demand. This option, however, was determined to be an ineffective alternative due to the length of time necessary for land acquisition and permitting, and the high project cost.

Q. When was the Salmon Creek Gate Station Project completed?

A. Work on the project began in May 2017 and was completed in March 2018.

Q. Is the Salmon Creek Gate Station Project in service and providing a benefit to Washington customers?

A. Yes.

Q. What was the total cost of the Salmon Creek Gate Station Project?

A. The total project cost was $1.7 million.

North Vancouver Gate Project

Q. Please describe the North Vancouver Gate Project.

A. The North Vancouver Gate Project upgraded the undersized North Vancouver Gate to meet the Company's then-existing and projected future load requirements. The North Vancouver Gate Project is shown in Figure 18 below.

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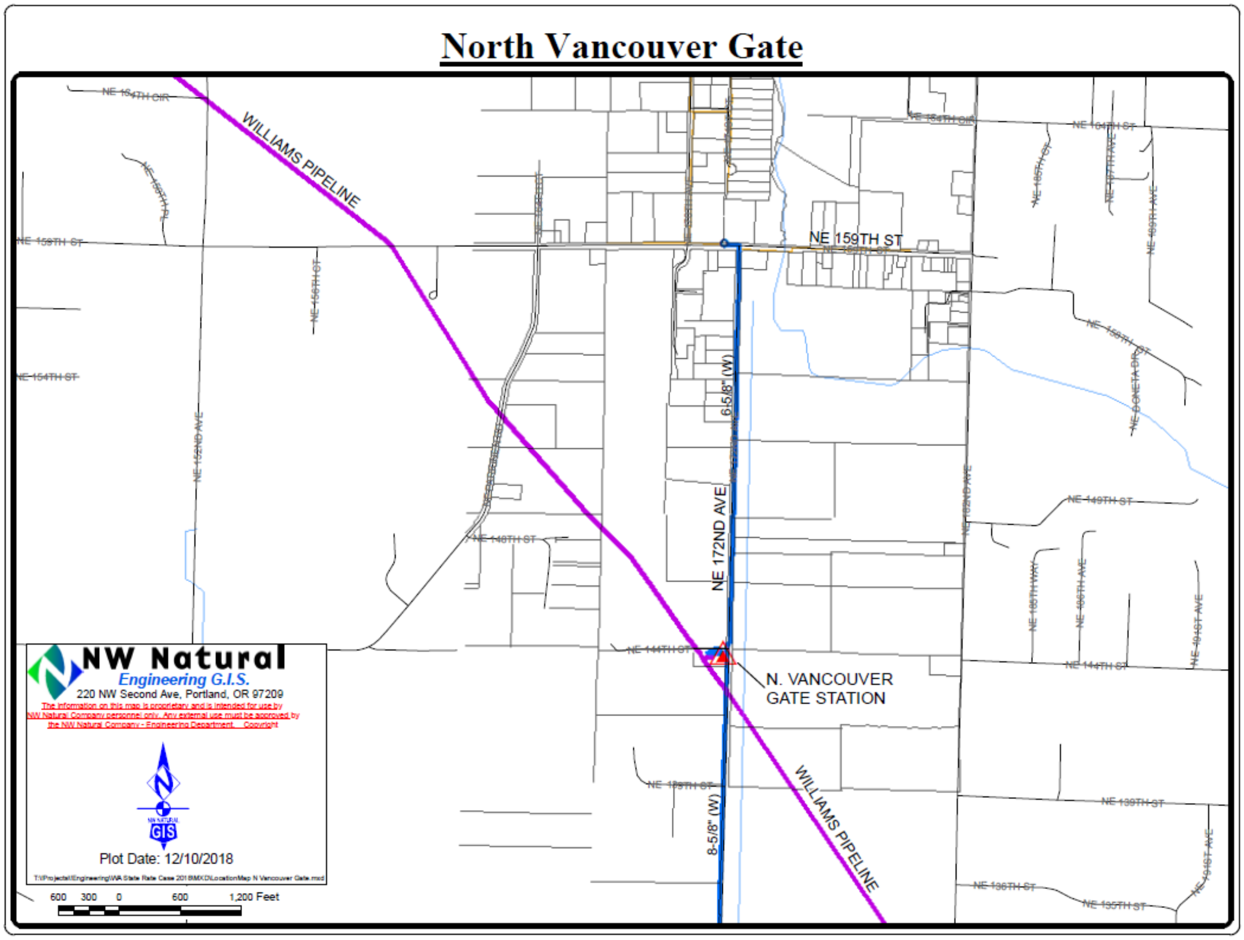
Figure 18. Map of the Vancouver Gate projects



Q. Why did the Company develop the North Vancouver Gate Project?

A. Prior to development of the North Vancouver Gate Project, the North Vancouver gate station components including metering and pressures regulating equipment was undersized for the Company's then-current loads and was not expected to be able to accommodate expected future growth and tie-ins to new pipeline projects.

Q. Did the Company consider alternatives to the North Vancouver Gate Project?

A. Yes. The Company also considered installation of a new gate station at an alternate location. However, the Company rejected this alternative due to the increased cost of a new gate, which would be significantly more expensive, and would have increased the timeline to construct due to having to secure land in an appropriate location.

Q. When was the North Vancouver Gate Project completed?

A. The North Vancouver Gate Project was initiated in 2014 and completed in 2016.

Q. Is the North Vancouver Gate Project currently in service and providing a benefit to Washington customers?

A. Yes.

Q. What was the total cost for the North Vancouver Gate Project?

A. The total cost for the North Vancouver Gate Project was approximately $1.8 million.

Washougal Reinforcement Project

Q. Please describe the Washougal Reinforcement Project.

A. The Washougal Reinforcement Project is located in the Washougal core area and involved the construction of a high pressure 6-inch pipeline, as well as a district regulator and associated distribution main to connect new high-pressure main to the existing Class B system and joint trench with distribution main for future customers. A map of the Washougal Reinforcement Project is shown below in Figure 19.

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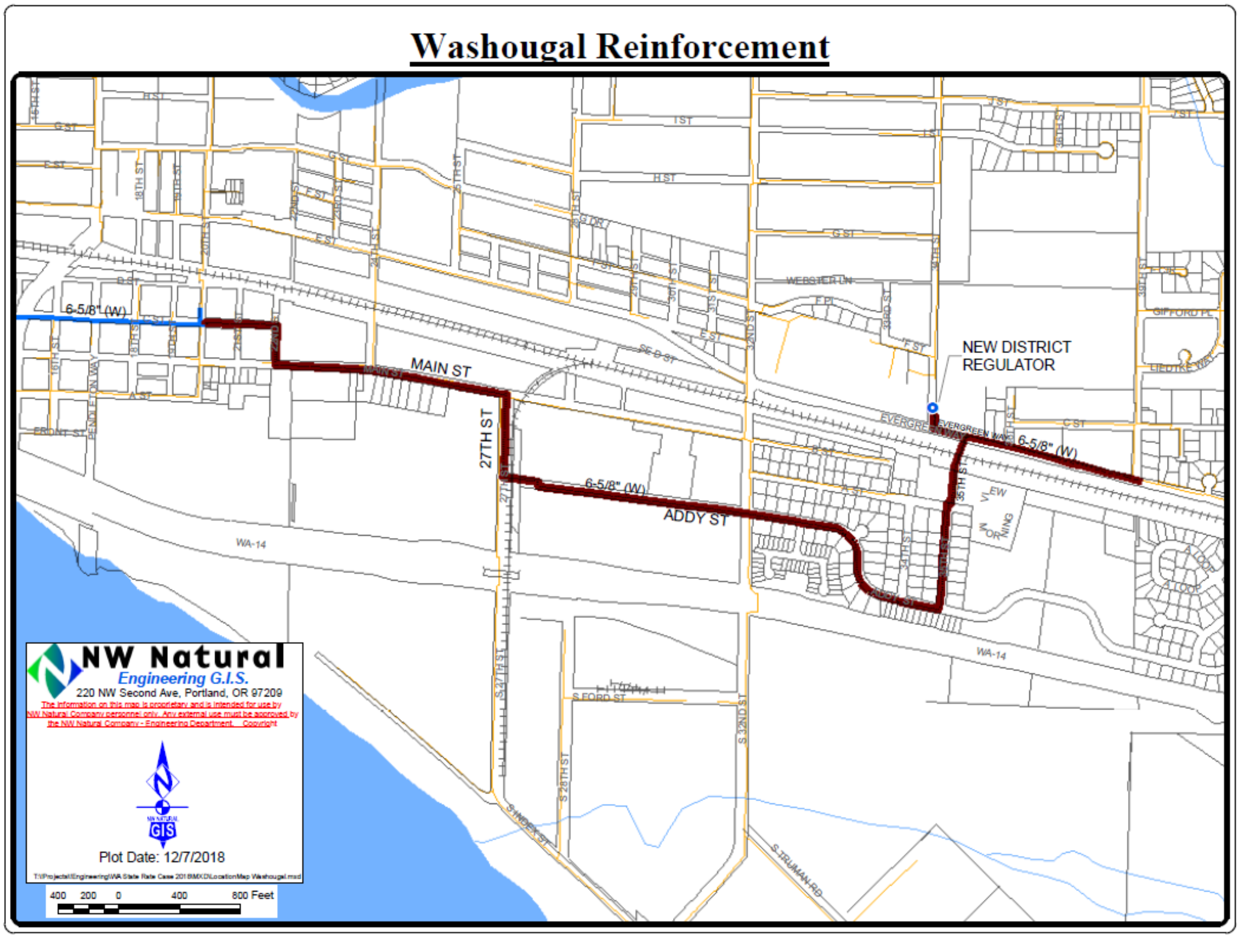
Figure 19. Map of the Washougal Reinforcement Project



Q. Why did the Company develop the Washougal Reinforcement Project?

A. The Washougal Reinforcement Project was designed to address pressure issues in the Washougal area which, if not resolved in the near-term, would increase in magnitude over time. Figure 20 below shows that the Company's modeling indicated that much of the eastern half of Washougal would operate below 10 psi (55 HDD) (the manufacturer's recommended limit for excess flow valves) on a peak day with existing demand. Additionally, because the Washougal area was growing relatively quickly, increased customer load in the future was expected to pose a larger issue which had to be addressed to ensure reliability of service to existing and future firm service customers.

Figure 20. Peak Day Class B System Pressures before the Washougal Reinforcement Project

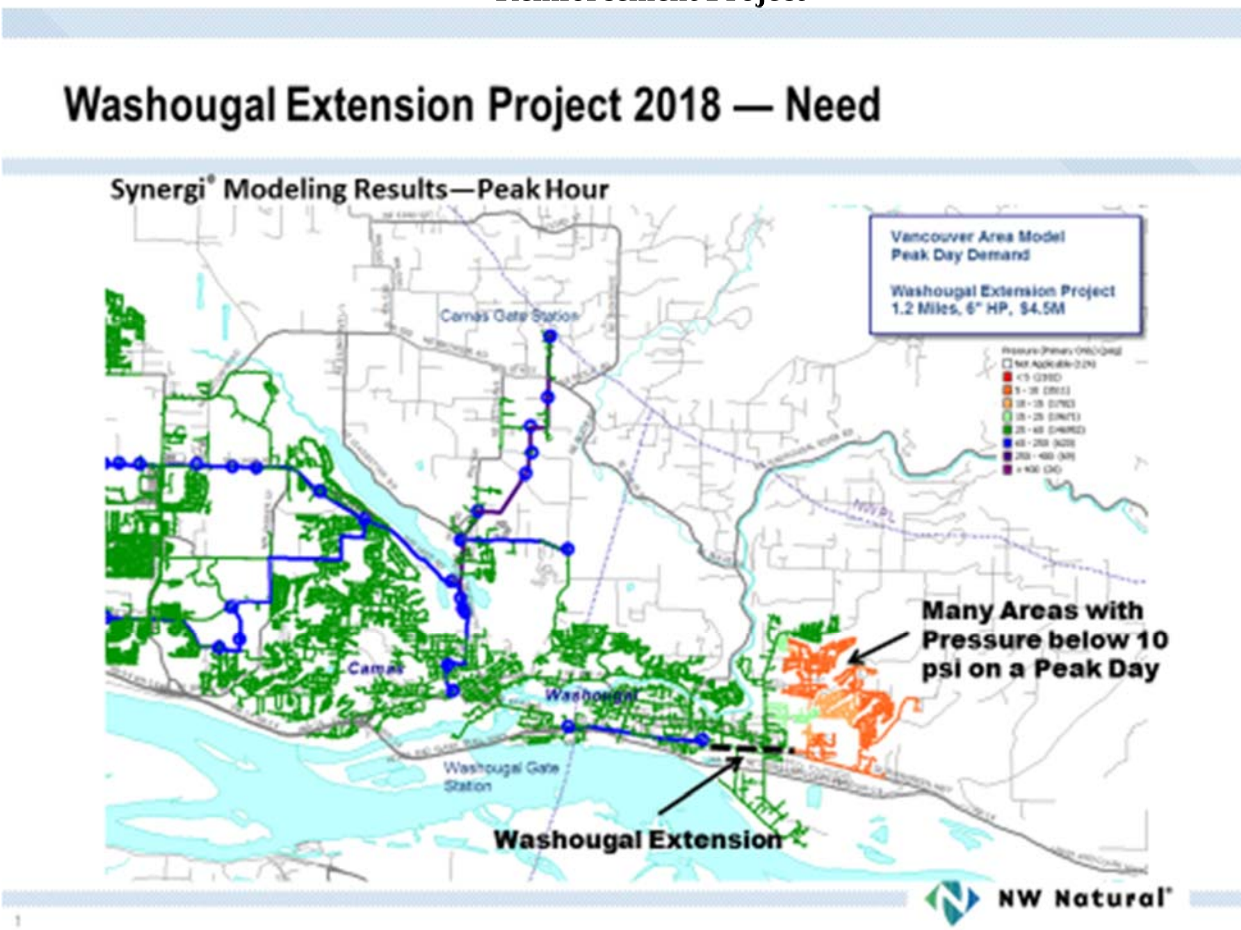


Figure 21 below shows the Washougal area on a Peak Day with the Washougal Reinforcement Project. The addition of the Washougal Reinforcement resolved our reliability issues in this area.

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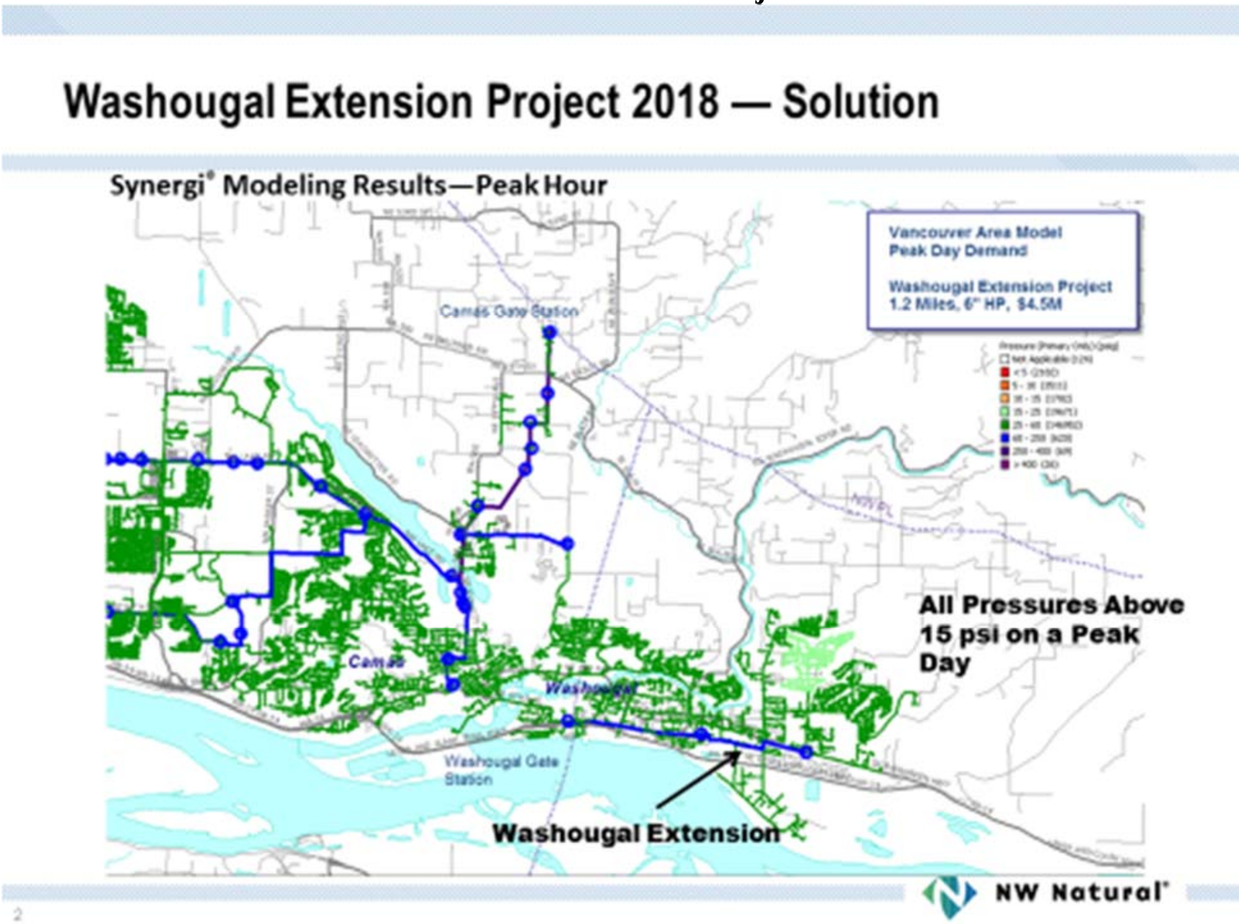
Figure 21. Peak Day Class B System Pressures after the Washougal Reinforcement Project



Q. Did the Company consider alternatives to the Washougal Reinforcement Project?

A. Yes, NW Natural considered using CNG trailers, developing a satellite LNG facility, and increasing use of DSM. However, both of the Company's two CNG trailers would be required to support the Washougal demand on a peak day under current conditions, with near-term growth expectations requiring acquisition of an additional CNG trailer, as well as new compression facilities. While this would entail lower initial cost, the support-period for these trailers is quite limited at less than 3 hours per trailer. Thus, either a long-term weather event or increased customer load could overwhelm these trailers' ability to support the Washougal system. As a result, the Company concluded that trailer acquisition was not a reliable long-term alternative in this case.

The Company also concluded that neither creation of a satellite LNG facility nor the increased use of DSM provided viable alternatives. A satellite LNG facility would entail significantly higher initial and long-term costs as well as significant siting challenges. There were no customers of appropriate size with firm service that could adequately reduce demand for the Washougal area. The pipeline extension provided the most reliable and least-cost gas supply for customers.

Q. Was the Washougal Reinforcement Project completed during the Test Year?

A. The Washougal Reinforcement Project was initiated in December 2016 and completed in October 2018, one month after the end of the Test Year (twelve months ended September 2018).

Q. Is the Washougal Reinforcement Project currently in service and providing a benefit to Washington customers?

A. Yes.

Q. What was the total cost for the Washougal Reinforcement Project?

A. The total cost for the Washougal Reinforcement Project was approximately $6.7 million.

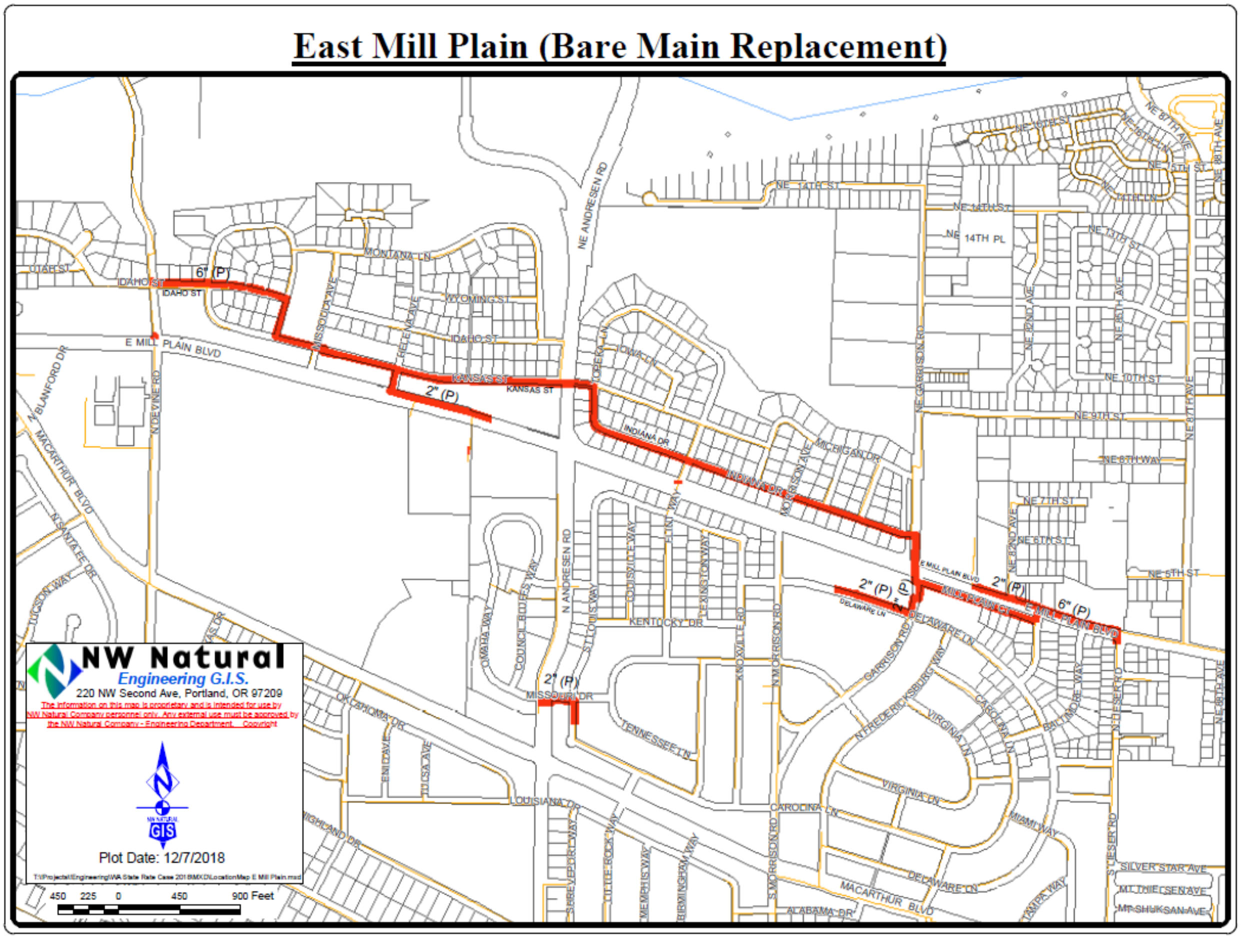
E Mill Plain Project

Q. Please describe the E Mill Plain Project.

A. The E Mill Plain Project is located in Vancouver, Washington on E Mill Plain Blvd. between Devine Road and Lieser Road and consists of installation of approximately

8,400 feet of 6 inch pipeline, 180 feet of 4 inch pipeline, and 2,500 feet of 2 inch pipeline. A map of the E Mill Plain Project is shown below in Figure 22.

Figure 22. Map of the E Mill Plain Project



Q. Why did the Company develop the E Mill Plain Project?

A. The purpose of the project was to replace bare steel pipelines with new modern pipelines.

Q. Why is it necessary to replace bare steel pipelines?

A. Bare steel pipelines were installed prior to the 1950s. The pipelines did not have a protective coating on the pipeline and over time were susceptible to corrosion which created a risk of pipeline leaks and safety risks to the public. The accelerated replacement of bare steel pipelines with new modern pipelines is an industry best practice and NW Natural had a company initiative to proactively replace all of its bare steel pipelines. The Company's bare steel pipeline replacement initiative was completed in 2015.

Q. Did the Company consider alternatives to the E Mill Plain Project?

A. Pipeline replacement programs completed for safety reasons cannot be evaluated similar to system reinforcement projects. The pipeline being removed from service must be replaced to continue service to existing customers.

Q. Did the Company consider the E Mill Plain Project in its integrated resource plan?

A. No. Pipeline replacements completed to improve public safety were not included in the integrated resource plan.

Q. When was the E Mill Plain Project completed?

A. The E Mill Plain Project was initiated in 2012 and completed in 2015.

Q. Is the E Mill Plain Project currently in service and providing a benefit to Washington customers?

A. Yes.

Q. What was the total cost for the E Mill Plain Project?

A. The total cost for the E Mill Plain Project was approximately $2.2 million.

IV. OREGON STORAGE PROJECTS

Q. Are any Oregon capital projects allocated to both Oregon and Washington?

A. Yes. The Company allocates gas storage projects that are located in Oregon to both states. Gas acquisition, including both capacity and commodity costs, has historically been accomplished on a system basis, with customers in both states providing recovery of pipeline capacity and storage costs proportionally, even though gas from the storage facilities in Oregon is not physically deliverable to Washington. In that sense, storage is considered as a substitute for pipeline capacity, and the lower cost of storage as compared to pipeline demand is shared among the customers in both states.

Q. How are storage projects allocated to Washington customers?

A. The storage plants located in Oregon are allocated to Washington and Oregon customers on the basis of firm volumes. The Washington allocation factor for firm volumes is currently 10.42 percent.

Q. Has the Company completed any major projects at its storage facilities since the Company's last Washington rate case?

A. Yes. The Company has completed the following projects:

- **Newport LNG Projects.** The Newport LNG Projects include the Newport H-2 Vaporizer Replacement, the Newport Refurbishment Project, and three additional projects that were identified during the process of completing the Newport Refurbishment Project. The Newport Refurbishment Project was comprised of several projects that which were designed to extend the life of the Newport LNG facility for 25 to 30 years. All of the projects associated with the Newport Refurbishment Project have been completed.
- **Mist Storage Projects.** The Mist Storage Projects include the Mist Control Building and Control System, Mist 500 Compressor Rebuild, Mist Standby Generator, and Mist Fiber Network. These projects were designed to replace equipment and facilities that had reached the end of their useful life and to promote the integrity and reliability of the Mist Storage Facility.

- **Portland LNG Projects.** The Portland LNG Projects include the Portland LNG Containment Basin Project, the Portland LNG Vaporizer Replacement, and Portland LNG Regen Gas Heater Salt Bath. These projects were designed to replace equipment that had reached the end of its useful life or that needed upgrades to address safety and environmental concerns.

Q. Were the major storage projects, described above, discussed in the Company's IRPs?

A. Yes, many of the improvements at Newport LNG, Mist, and Portland LNG were discussed in NW Natural's 2013IRP (Docket UG-120417), 2014 IRP (Docket UG-131473), and 2016 IRP (Docket UG-151776).

<u>Newport LNG Projects</u>

Q. Please describe the Company's Newport LNG facility.

A. The Newport LNG facility is a peak shaving facility located in Newport, Oregon and consists of a 1,000,000 Dth capacity storage tank, liquefaction facilities capable of processing about 5,500 Dth/day, and vaporization capacity of up to 100,000 Dth/day. This facility was constructed by Chicago Bridge and Iron, and commissioned in 1977.[1]

Q. What projects have been completed at the Newport LNG site since the Company's last rate case?

A. The projects completed at the Newport LNG site include the Newport H-2 Vaporizer Replacement, the Newport Refurbishment Project, and two additional projects that

[1] Because the Company's pipeline system limits Newport to serving the central coast and Salem market areas, the full 100,000 Dth/day vaporization rate is not achievable. Instead, 60,000 Dth/day is the effective limit on vaporization at Newport.

were identified during the process of completing the Newport Refurbishment Project – the E-3 and E-5 exchanger replacement projects.

Vaporizer H-2 Project

Q. Please describe the Newport LNG Vaporizer H-2 Replacement Project ("Vaporizer H-2 Project").

A. The Vaporizer H-2 Project involved the installation of a 48 million standard cubic feet per day (MMSCFD) LNG vaporizer unit to replace an existing vaporizer at the Newport LNG Plant.

Q. Why did the Company replace the existing vaporizer?

A. The existing vaporizer was original equipment to the plant, constructed in 1976. The materials used in construction of this vaporizer had reached the end of their useful life. Due to the deterioration of materials in the heat exchanger, the scope of work for the project included replacing the heat exchanger tube bundle and re-building the vaporizer in place using existing valving and piping. At the same time, the Company updated burners, pilots and some controls to modernize the vaporizer system.

Q. When did the Company complete the Vaporizer H-2 Project?

A. The Vaporizer H-2 Project was completed and in service on June 1, 2010.

Q. What was the total cost of the Vaporizer H-2 Project?

A. The total cost of the Vaporizer H-2 Project was $0.9 million.

Newport Refurbishment Project

Q. Please describe the Newport Refurbishment Project.

A. The Newport Refurbishment Project involves plant upgrades designed to extend the operating life of the Newport LNG facility by addressing significant issues with the

Company's liquefaction and vaporization processes. The Newport Refurbishment Project activities include: construction and installation of the carbon dioxide (CO_2) remediation system, liquefaction improvements, solar turbine modification, vaporization replacement, control building and system upgrades, and piping improvements.

Q. Why did the Company undertake the Newport Refurbishment Project?

A. The Company undertook the Newport Refurbishment Project to address several serious problems it was experiencing at the Newport LNG facility—related to its age. That facility was initially commissioned in 1977, with a nominal 25 to 30-year life. Beginning in approximately 2004, the facility began experiencing problems with the liquefaction process, including removal of CO_2 from the incoming natural gas stream, which was very gradually collecting in the tank and settling on its floor in solid form (commonly known as "dry ice"). To address the dry ice issue, the Company was required to reduce the maximum quantity of LNG to be stored there from 1,000,000 Dth down to 900,000 Dth.

In 2012, the Company initiated the Newport LNG Reliability Study to review all plant equipment and infrastructure at Newport and identify any issues that would affect safety, regulatory compliance, reliability, and productivity over the next 25 to 30 years. That study identified several projects–collectively referred to as the Newport Refurbishment Project—intended to address the liquefaction process issues, and to enhance reliability, reduce maintenance cost, and extend the operational life expectancy an additional 25 to 30 years. These projects included the Newport LNG CO_2 Remediation Project, the Newport LNG Solar Turbine Modification Project, the

Vaporizer H-1 Project, the construction of a new control building, updating the Newport Plant Control System, and Newport LNG Glycol Piping.

Q. Please describe the Newport LNG CO_2 Remediation Project.

A. The Newport LNG CO_2 Remediation Project was selected as the preferred solution to the dry ice issues in the Newport tank. Specifically, this solution was to install a new molecular sieve system for dehydration and CO_2 removal in the pre-treatment system. The new molecular sieve system replaced the existing CO_2 and dehydration systems at the plant and resulted in a reduction of the amount of CO_2 present in the LNG produced, which is stored in the LNG storage tank. Over time, this low-CO_2 LNG will dilute the solid CO_2 in the tank and reduce the amount of CO_2 collected in the storage tank. The project also included a design, replacement, and/or upgrades of other components of the liquefaction system, including two compressors.

Q. Has the Company completed the replacement of the Newport LNG CO_2 Remediation Project?

A. Yes. The Company finished the Newport LNG CO2 Remediation Project in July 2017. Commissioning and startup of the new system commenced in August 2017.

Q. What was the total cost for the Newport LNG CO_2 Remediation Project?

A. The total actual cost associated with the Newport LNG CO2 Remediation Project was $13.0 million.

Q. Please describe the Newport LNG Solar Turbine Modification Project.

A. This project updated the existing solar turbine at the Newport LNG Plant, which is used to compress refrigerant as a part of the “Mixed Refrigerant Loop” process. There are five main systems which were updated: the wet seal system was upgraded to a dry seal system, the control system was updated with a modern version, the starter/fuel gas system was upgraded, the combustion air inlet was replaced, and the fire and gas detection/suppression systems were upgraded to meet current code. The compressor was overhauled to factory specifications during the dry seal conversion.

Q. Why did the Company perform the Newport LNG Solar Turbine Modification Project?

A. The Newport LNG Reliability Study identified the existing Solar Turbine as a key component of the liquefaction cycle, which is required to liquefy natural gas into LNG. The control system on the unit is classified by the vendor as "not supported/some limited support available," and the computer running the system was an early 1990s vintage, with no spare parts available. The gas seal system was also identified as a source of contaminants in the refrigeration process, that could plug or freeze the heat exchangers that process LNG. Conversion of this system to a dry gas seal system reduced carryover contaminants into the process, and reduced refrigerant losses during LNG production. Thus, the outdated control system and wet gas seal system presented a risk of failure that would prevent the Newport LNG facility from serving firm customer demand during a peak day event.

Q. Has the Company completed the Newport LNG Solar Turbine Modification Project?

A. Yes. The Company finished the Newport LNG Solar Turbine Modification Project in July 2017. Major work on the compressor was completed with the overhauled unit returned and on site construction complete in November 2015. Startup and commissioning coincided with completion of the Newport LNG CO_2 Remediation

Project, which was completed in July 2017. Final completion of the project occurred after the liquefaction season in December 2017.

Q. What was the total cost for the Newport LNG Solar Turbine Modification Project?

A. The total actual cost associated with the Newport LNG Solar Turbine Modification Project was $2.3 million.

Q. Please describe the Vaporizer H-1 Project at the Newport LNG facility.

A. The Newport LNG Reliability Study identified that the Submerged Combustion Vaporizer (Vaporizer H-1) had reached its life expectancy. The overall scope of the project was to isolate the vaporization equipment, replace the mechanical components and burners on Vaporizer H-1, modify the building, replace the inlet/outlet piping and upgrade the controls on vaporizer H-1. The vaporizers are necessary for the plant to meet customer demand on a peak day.

Q. Has the Company completed the replacement of the Newport Vaporizer H-1 Project?

A. Yes. The Company finished the Newport Vaporizer H-1 Project in July 2017.

Q. What was the total cost for the Newport Vaporizer H-1 Project?

A. The total actual cost associated with the Newport Vaporizer H-1 Project was $3.4 million.

Q. Are customers currently receiving benefits from the Newport LNG CO_2 Remediation Project, Newport LNG Solar Turbine Modification Project, and the Newport Vaporizer H-1 Project?

A. Yes. Starting in August 2017, the Company used the new CO_2 remediation system and turbine at Newport to make an average of 71,000 gallons per day of LNG, for a total of 5.5 million gallons of LNG that the company used during the winter of 2017-2018 to meet firm customer demand during a peak winter day event. The LNG generated during this time period had a significantly lower CO_2 content, by dissolving the existing solid CO_2, and lowering the amount in the storage tank. The new Vaporizer H-1 was successfully tested in July 2017 and allowed Newport to meet its supply requirements during the 2017-2018 heating season as a peak shaving LNG facility.

Q. Did the Company consider alternatives to the Newport LNG CO_2 Remediation Project, the Newport LNG Solar Turbine Modification Project, and the Newport Vaporizer H-1 Project?

A. Yes, NW Natural evaluated potential alternatives in its 2014 IRP. The Newport LNG facility is specifically used for peak shaving, and NW Natural therefore requires high availability, reliability, and productivity from the facility. As a potential alternative to proceeding with the Newport Refurbishment Project, NW Natural considered keeping the facility operational until the Company could acquire an alternative supply source for 60,000 Dth/day firm peaking supplies. The Company evaluated two options for alternative supply: (1) contract with Northwest Pipeline ("NWP") for additional pipeline capacity from Sumas south to city gates on NWP's Grants Pass Lateral, or (2) construct a 25-mile high pressure transmission facility between Newberg and the Central Coast Feeder, coupled with additional Mist Recall.

Q. Were the alternative options less expensive than the Newport Refurbishment Project?

A. No, both alternative options were more expensive than the Newport Refurbishment Project.

Q. Did the Company perform any modeling to determine whether the Company should pursue the Newport Refurbishment Project or the 25-mile high-pressure transmission pipeline?

A. Yes, NW Natural used the SENDOUT® optimization model to determine whether the Company should refurbish the Newport LNG facility or pursue development of the high pressure transmission facility. NW Natural's analysis showed that the Newport Refurbishment Project was significantly less expensive than the high pressure transmission pipeline.

Q. Please describe the new control building at the Newport LNG facility.

A. The Company designed and completed construction of a new control building at the Newport LNG facility. The new control building is located farther away from potential hazards and electrical equipment. Additionally, the new control building is safer and more resilient, with modern seismic and blast designs.

Q. Did the Company consider any alternatives to constructing a new control building?

A. Yes, the Company considered remodeling the existing control building. The Company determined that performing a remodel of the existing control building would potentially be less expensive than constructing a new control building, but would not fully address the safety concerns regarding the proximity of plant operators to liquefaction and vaporization processes, would not provide blast resistance or seismic reinforcement, would be more disruptive to day-to-day operations, and would not provide as much space. Additionally, the Company considered the possibility of doing nothing, and continuing to use the existing control building as-is, but rejected this option due to safety concerns. After considering alternatives, the Company determined that building a new control building would best meet the Company's objectives from the Newport LNG Reliability Study.

Q. When was the work on the new control building completed?

A. Work on the control building began in January 2016 and was completed in December 2016.

Q. What was the total cost for the new control building?

A. The total actual cost for the new control building was $3.1 million.

Q. Are customers currently receiving benefits from the new control building?

A. Yes. The new control building provides a blast-resistant, purpose-built control room for operators to manage the plant, and NW Natural's plant operators have been using the new control building since May 2017.

Q. Is the Company still using the previous control building?

A. Yes. The old control room components were removed, the interior was brought up to current fire code, and was modified to house updated medium- and low-voltage electrical switchgear, the upgraded UPS system, and a new data center within which to locate components of the updated Control System. The Company plans to make siding and roofing repairs in 2019.

Q. Please describe the Newport Plant Control System Project.

A. The Newport LNG Reliability Study identified risks attributable to the age of existing plant control system. Specifically, the study concluded that the control system was obsolete, and that the manufacturer of the system no longer provides support or replacement parts. The Company initiated the Newport Plant Control System Project to replace the plant control system with a new model, which will allow the plant to continue operating for at least another 20 years.

Q. Has the Company completed the Newport Plant Control System Project?

A. Yes. The Company has been using the new control system since May 2017 and finished the Newport Plant Control System Project in December 2017.

Q. Are customers currently receiving benefits from the Newport Plant Control System Project?

A. Yes. The Newport Plant Control System was integral to startup of the CO2 Remediation Project and allows plant operators to have accurate, up to date information about the plant status. The modern control system allows for rigorous cybersecurity measures and has enhanced the ability of plant operators to manage plant processes in a safe and timely manner.

Q. What was the total cost for the Newport Plant Control System Project?

A. The total actual cost associated with the Newport Plant Control System Project was $3.2 million.

Q. Were any of the Newport Refurbishment Projects completed after the Test Year in this case?

A. Yes. The Newport LNG Glycol Piping Project was completed in October 2018, just one month after the end of the Test Year.

Q. Please describe the Newport LNG Glycol Piping Project and total costs for this project.

A. Newport LNG uses a glycol-water cooling system to provide cooling capacity to components in the liquefaction, CO_2 Remediation and boil-off systems. The glycol system is used to provide cooling to the compressors and heat exchangers integral to these processes. The glycol system at the Newport facility was installed more than 40 years ago, and underground piping was constructed from PVC materials. After the Newport LNG Reliability Study was complete, and during design of the CO_2 Remediation project, plant operators noted that the PVC piping was at end of life and required replacement. The Newport LNG Glycol Piping Project replaced the underground PVC glycol piping with above-ground welded steel piping to improve reliability and accessibility of the piping system. The total cost of the Newport LNG Glycol Piping Project, including trailing charges after completion, is expected to be $1.4 million.

Q. Is the Newport LNG Glycol Piping Project currently in service and providing benefits to Washington customers?

A. Yes. The Newport LNG Glycol Piping Project was completed in October 2018, and is currently in service for the benefit of our customers.

Q. What was the total capital cost of the investment in the Newport Refurbishment Project?

A. The costs for each of the projects included in the Newport Refurbishment Project are as follows:

- Newport LNG CO_2 Remediation Project - $13.0 million
- Newport LNG H-1 Vaporizer Replacement - $3.4 million
- Newport LNG Solar Turbine Modification - $2.3 million

- Newport Control Building - $3.1 million
- Newport Plant Control Systems - $3.2 million
- Newport LNG Glycol Piping - $1.3 million

The total capital cost of the investment in the Newport Refurbishment Project was $26.3 million.

Newport LNG E-3 and E-5 Exchanger Replacement Projects

Q. Were any additional projects identified as a result of completing work on the Newport Refurbishment Project?

A. Yes. While completing the activities associated with the Newport Refurbishment Project, the Company identified the need to replace the E-3 and E-5 exchangers that were at the end of their useful life. Both are air-driven heat exchangers are used in plant processes to cool process fluids using fans to drive air across finned tubes in which the process fluids are flowing. E-3 exchanger is used as a condenser to cool refrigerant after being compressed in the Plant's liquefaction system. After startup of the CO_2 Remediation system, E-3 was identified as not performing cooling duties adequately, and required a water spray to ensure enough cooling capacity in the liquefaction system. E-5 exchanger is used to cool the glycol water cooling system, and was identified as at end of life during design of the Glycol System Replacement project.

Q. What was the total cost of the Newport LNG E-3 and E-5 Exchanger Replacement Projects?

A. The total cost for the E-3 Exchanger Replacement Project was $1.8 million and the total cost for the E-5 Exchanger Replacement Project was $1.6 million.

Q. Are the Newport LNG E-3 and E-5 Exchanger Replacement Projects currently in service and providing benefits to Washington customers?

A. Yes. The Newport LNG E-3 and E-5 Exchanger Replacement Projects were completed in October 2018—just one month after the Test Year—and are currently in service and providing benefits to customers.

<u>Mist Storage Projects</u>

Q. Please describe the Mist gas storage site and Miller Station.

A. NW Natural operates the Mist Gas Storage Site located in Mist, Oregon which features a natural gas storage field consisting of seven (7) different underground pools and a total of 21 storage wells. Miller Station is the compressor station within the Mist Gas Storage Site that contains the operations and controls facility as well as the process equipment for conveying natural gas between the wells and utility pipelines. The natural gas compression and dehydration systems for the site are both located at Miller Station.

Q. Please describe the Company's recent study of its facility at the Mist gas storage site.

A. On June 10, 2016, the Company completed an engineering facility assessment of the Mist Storage Facility ("Mist Storage Facility Assessment") and identified a number of needed improvements to the facility to improve site reliability, resulting in the Mist Reliability Program. Without many of the suggested upgrades, Miller Station and the Mist Storage operation will likely experience equipment failures, increased O&M costs, cyber threats, and other risks over the next 25 years.

Q. Has the Company completed any projects to address the recommendations in the Mist Storage Facility Assessment?

A. Yes. As described in greater detail below, the Company has completed projects to replace the Mist control building and upgrade the instruments and controls in the control building.

Q. What projects have been completed at Mist since the Company's last rate case?

A. The Mist projects that have been completed include the Mist Control Building and Control System, and Mist 500 Compressor Rebuild.

Q. Is the Company working on any additional projects at Mist?

A. Yes. The Company is also working on the Mist Standby Generator Project and Mist Fiber Network Project. These projects will not be complete until spring 2019.

Mist Control Building Project

Q. Please describe the Company's replacement of the control building at the Mist site ("Mist Control Building Project").

A. The Mist Control Building Project involved the design and construction of a new control building at Miller Station at the Mist Storage Facility. The new control building consists of a control room for the operators to run and monitor the plant, as well as a data center to house all of the new equipment installed as part of the Mist instrument and controls replacement project, which is described in greater detail below.

Q. Has the Company completed the Mist Control Building Project?

A. Yes. The Company began work on the new control building in April 2017. The building was completed in September 2017 and the installation of furniture, security systems, and power/lighting were completed by the end of 2017. However, the migration of the control systems and addition of new network systems housed within the new control building were completed as part of the Mist Instrument and Controls Project in May 2018, once the new controls were online.

Q. What was the total cost for the Mist Control Building Project?

A. The total cost for the project was $2.2 million.

Q. Is the new Mist control building being used at this time?

A. Yes. The Mist Control Building was completed in December 2017 and became used and useful once the new controls were installed and the Mist Instruments and Controls Project was completed.

Mist Instruments and Controls Project

Q. Did the Company also upgrade the instruments and controls at the Mist facility?

A. Yes. Similar to the control system at the Newport LNG facility, the control system at Mist was beyond the end of its design life, and as of July 2017, the manufacturer no longer provided support or replacement parts.

Q. Why did the Company undertake the Mist Instruments and Controls Project?

A. The Mist Instruments and Controls Project was part of the Mist Reliability Program, replacing the existing obsolete plant control system at Miller Station with a new model designed to provide another 20 years of service. Operator controls were updated to include new high-performance HMI systems with fewer failure points, better visualization of plant processes, and increased IT network security.

Q. Did the Company consider alternatives to the Mist Instruments and Controls Project?

A. The Company considered continuing to operate the Mist Storage Facility without changes to the control room systems, but determined that this option presented significant risk of equipment failure due to the aged components. Additionally, because the outdated control software is no longer supported by the manufacturer, and new parts are no longer available, repairs would be more difficult and it would likely take more time to source replacement parts. The outdated controls and IT network equipment also presented security and communications issues.

Q. What is the current status of the Mist Instruments and Controls Project?

A. The Company completed the Mist Instruments and Controls Project in September 2018.

Q. What was the total cost for the Mist Instruments and Controls Project?

A. The total cost for the project was $4.0 million.

Mist 500 Compressor Rebuild Project

Q. Please describe the Company's Mist 500 Compressor Rebuild Project.

A. The Mist 500 compressor is a gas turbine driven centrifugal gas compressor at Miller Station. The unit is one of three compressor systems at Miller Station used in concert to inject and withdraw gas to / from the Mist gas wells. The Mist 500 Compressor Rebuild Project was designed to extend the life of the 500 compressor for an additional ten years before a major maintenance servicing may be required.

Q. Why did the Company develop the Mist 500 Compressor Rebuild Project?

A. The Mist Gas Storage facility experienced a failure of the Mist 500 turbine compressor hot section. The hot section of the compressor is the portion of the gas turbine driver side of the unit where combustion occurs to produce power for the unit. This power from the gas turbine turns a shaft which drives a centrifugal gas compressor where natural gas is compressed heading to / from the site wells. The equipment is critical to Mist gas injection and withdrawal.

During an inspection of the Mist 500 compressor in May 2017 while working on operational problems with the machine, we discovered a cracked second stage turbine blade. This could result in catastrophic failure of the turbine blade, which in turn would cause severe damage to the overall turbine. Loss of a turbine blade would render the gas turbine inoperable resulting in a loss of driven power to the accompanying centrifugal gas compressor and thus loss of compression capacity for Miller Station. After discovering the cracked turbine blade, the Company accelerated the completion of this project to December 2017 for the winter withdrawal season.

Q. When did the Company complete the Mist 500 Compressor Rebuild Project?

A. The Company finished the Mist 500 Compressor Rebuild Project in December 2017.

Q. What was the total cost for the Mist 500 Compressor Rebuild Project?

A. The total cost for the Mist 500 Compressor Rebuild Project was $1.3 million.

Mist Standby Generator

Q. Please describe the Mist Standby Generator Project.

A. The Mist Standby Generator Project involves the installation of a 625-kilowatt (kW) natural gas standby generator at Miller Station to serve as the primary backup power option in case of utility power loss at site. Fuel for the new generator will come from a 4-inch line off of the North Mist Feeder.

Q. Why did the Company develop the Mist Standby Generator Project?

A. Miller Station at the Mist storage facility requires backup power to maintain operations 24 hours a day, seven days a week, and 365 days per year. Accordingly, the Company requires reliable backup power systems to be in place should grid power be lost. The Mist Storage Facility Assessment concluded that the existing 400-kW standby generator at Miller Station, which was installed in 2001 and has an estimated 20-year useful life, should eventually be replaced due to age. Control and data center upgrades in 2017 / 2018 further increased facility loads by another 100-kW putting total max site power usage at around 425-kW, making the existing 400-kW generator inadequate.

Q. Did the Company consider alternatives to installing the Mist Standby Generator?

A. Yes. Because the on-site power demands now exceed the capacity of the existing generator, the Company determined that some sort of upgrade would be required. The Company considered replacing the existing generator with a 625-kW diesel generator, but determined that using diesel would have greater air quality impacts, would be a more expensive fuel source, may have fuel delivery challenges during the winter months, and would be more expensive than the natural gas generator option. The Company also considered using a lithium ion battery backup, but determined this option was not viable because due to the remoteness of Miller Station, outages could last for extended periods (beyond the capacity of the battery), and this option would require additional shelter space which is not viable on the existing site.

Q. Why did the Company ultimately select the 625-kW natural gas generator option for the Mist Standby Generator Project?

A. The 625-kW natural gas generator is adequately sized to accommodate the load profile of Miller Station and will provide the Company the ability to continuously power Miller Station for an extended period in the event grid power is lost. The generator will rely on natural gas as a fuel source, which is abundant and readily available on-site.

Additionally, the 625-kW natural gas generator will fit within the existing footprint without impact to other operations at Miller Station. The natural gas option is a reliable and proven technology, and will have less emissions in comparison with the diesel alternative.

Q. When does the Company expect to complete the Mist Standby Generator Project?

A. The Company anticipates that the Mist Standby Generator Project will be completed in spring 2019.

Q. What is the Company's most recent cost estimate for the Mist Standby Generator Project?

A. The Company's most recent cost estimate for the Mist Standby Generator Project is $1.3 million.

Mist Fiber Network

Q. Please describe the Mist Fiber Network Project.

A. The Mist Fiber Network Project involves the installation of a new fiber network from Miller Station to telemetry and control systems at Bruer and Flora wells at the Mist gas storage facility. The fiber to the Flora wells will be placed in existing underground conduits. The new fiber network to the Bruer wells will require the construction of new underground conduits and vaults.

Q. Why is the Company performing the Mist Fiber Network Project?

A. The work in this project was initially included as part of the Mist Instrument and Controls Upgrade project. As part of the Mist Instruments and Controls Upgrade Project, the Company determined that it was necessary to install a fiber optic network to augment unreliable radio communications at Bruer and Flora wells. The tree heights around those wells had reached a level such that they interfere with radio communications, and NW Natural does not control the land with the trees and thus cannot perform vegetation maintenance that would be required to allow for improved radio communication. The Company determined that adding a fiber optic network for the northern wells will provide a redundant communications system and eliminate communication issues due to tree growth. The southern wells already have a fiber optic network in place for communication.

Q. Why did the Company break off the Mist Fiber Network Project as a separate project from the Mist Instruments and Controls Upgrade?

A. During the planning phase for that project, the Company determined that the construction of new underground conduits may require environmental analysis and approval by the Oregon Department of Energy (ODOE) – Energy Facility Siting Council (EFSC) that issued the site certificate for the Mist gas storage facility, potentially requiring additional time and effort to meet the ODOE-EFSC permitting requirements. Therefore, a new project was created to track and manage the fiber network project.

Q. When does the Company expect to complete the Mist Fiber Network Project?

A. The Company anticipates that the Mist Fiber Network Project will be completed in spring 2019.

Q. What is the Company's most recent cost estimate for the Mist Fiber Network Project?

A. The Company's cost estimate for the Mist Fiber Network Project is $1.2 million.

Portland LNG Projects

Q. Please describe the Portland LNG site.

A. The Portland LNG facility is a peak shaving facility located in Portland, Oregon and consists of a 600,000 Dth capacity storage tank, liquefaction facilities capable of processing about 2,150 Dth/day and vaporization capacity of up to 120,000 Dth/day. This facility was constructed by Chicago Bridge and Iron, and commissioned in 1969.

Q. What projects have been completed at the Portland LNG site since the Company's last rate case?

A. The major projects that have been completed at the Portland LNG site include the Portland LNG Vaporizer Replacement, Portland LNG Regen Gas Heater Salt Bath, and the Portland LNG Containment Basin Project.

Q. Please describe the Company's recent assessment and reliability study for the Portland LNG facility.

A. NW Natural completed a facility assessment and reliability study of the Portland LNG Peak shaving facility on February 25th, 2015. This assessment identified several projects reflecting necessary improvements to the facility for reliability, safety and operational readiness. The company has undertaken projects as part of the Portland LNG Reliability Program as well as follow-on studies ("Liquefaction System Study"). Specifically, the Portland LNG Vaporizer Replacement and Portland LNG Regen Gas Heater Salt Bath projects were both identified in the Portland LNG Reliability Program.

Portland LNG Vaporizer Replacement

Q. Please describe the Portland LNG Vaporizer Replacement project.

A. The Portland LNG Vaporizer Replacement Project involved replacing Vaporizer H-6, associated plumbing, electrical, structural and controls to allow the Portland LNG plant to deliver peak day supply.

Q. Why did the Company develop the project?

A. The facilities and major process components of the Portland LNG plant were designed for a nominal 25 to 30 year lifespan, and at the time the Company decided to replace the vaporizer, the Portland LNG Plant had been in service for 47 years. Accordingly, the H-6 Heater at Portland LNG reached its life expectancy and required replacement. At the time the Company decided to develop the project, the asset was not available for regular use and reduced the Company's ability to deliver peak day supplies by 25 percent.

Q. Did the Company consider alternatives to the project?

A. As the Vaporizer is required to meet the Plant peak day supply capacity, there was no viable alternative to replacement.

Q. When was the project completed?

A. The project was initiated in first quarter 2016, and was completed in third quarter 2017.

Q. Is the project in service and providing a benefit to customers?

A. Yes.

Q. What was the total cost of the project?

A. The total project cost was $3.0 million.

Portland LNG Regen Gas Heater Salt Bath

Q. Please describe the project.

A. The Portland LNG Regen Gas Heater Salt Bath Project involved replacing the existing Salt Bath Heater located at the Portland LNG Plant with a new Oil Bath Heater. The new heater was also designed to be more efficient and to be capable of shutting down when the plant is not liquefying, saving on fuel gas costs and reducing emissions. Additionally, the Company determined that certain related piping needed to be replaced and for related electrical equipment to be moved to ensure compliance with federal seismic code, 49 CFR § 193. Finally, the project also involved updating the containment system for the heater to ensure proper functioning.

Q. Please explain the role of the heater in the LNG liquefaction process?

A. The salt bath heater was used to heat gas to regenerate the system used to filter CO_2 and water out of the gas prior to liquefying. Portland LNG uses a molecular sieve dehydration and CO2 removal system. Two pressure vessels are used to remove water and two vessels are used to remove CO2 from the inlet gas prior to being liquefied. The molecular sieve media adsorbs the water or CO2 from the gas stream. Once the media is at capacity, it needs to be heated to release water, gas odorant and CO2 into a waste gas stream which is blended with the local distribution system to pipeline quality gas. The regeneration heater provides the heat for this system to regenerate the CO2 and Dehydrator vessels.

Q. Why did the Company develop the project?

A. The heater reached the end of its design lifetime and needed to be replaced to ensure continued availability and reliability of the liquefaction system at Portland LNG. Additionally, the existing salt bath heater was leaking molten salt while running.

Q. Did the Company consider alternatives to the project?

A. Because the heater reached the end of its useful life, there were no alternatives to replacement. The Company discussed potential replacement alternatives with vendors, and was discouraged from selecting a replacement in-kind due to potential lead times. In addition, the third-party LNG engineering firm, Braemar Engineering, recommended a thermal fluid heater design for safety and reliability. Based on these recommendations, the Company determined a thermal fluid heater would be the preferred alternative that meets our needs and the operating characteristics make it the safest, most environmentally friendly and fuel efficient alternative.

Q. When was the project completed?

A. The project was initiated in October 2014, and was completed in March 2017.

Q. Is the project in service and providing a benefit to customers?

A. Yes, it was successfully installed and operated during the 2016-2018 liquefaction seasons, ensuring LNG production at the Portland LNG plant is running on schedule.

Q. What was the total cost of the project?

A. The total project cost was $1.7 million.

Portland LNG Containment Basin Project

Q. Please describe the Portland LNG Containment Basin Project.

A. The Portland LNG Containment Basin Project involves raising the grade of the Portland LNG tank secondary containment area, which needs to be above typical groundwater elevations in order to prevent surface water from co-mingling with contaminated groundwater. The project also included installation of an impermeable liner that will prevent the co-mingling of rainwater with contaminated groundwater, and installation of a mechanism including swales and/or drains to separate water runoff from previously contaminated surfaces from making contact with the new impoundment surface.

Q. Why did the Company perform the Portland LNG Containment Basin Project?

A. The Company discovered that there is an additional amount of contaminated water generated at the Portland LNG/Gasco facility, due to rainwater comingling with contaminated groundwater in the storage tank secondary containment basin. The lowest elevation in the containment basin is 20 feet, and groundwater in this area that is contaminated with volatile and semi-volatile organic compounds such as benzene and other constituents of concern is regularly at 22 to 25 feet. The combination of typical seasonal rain events along with the increase in groundwater levels results in a large volume of contaminated standing water in the containment area. The existing onsite water treatment facility was designed and constructed to pump and treat contaminated groundwater from recovery wells. This system, as currently designed, does not have the capacity to treat the continuous volume of water generated from the tank containment area. The Portland LNG Containment Basin Project will eliminate future rainwater contamination in the containment basin.

Q. Are there specific reasons why NW Natural may not leave the contaminated water in the containment area?

A. Yes. The existence of water in the tank secondary containment will result in a flash rate (acceleration) of vapor dispersion in the event of a material breach of the LNG tank and related appurtenance. Moreover, 49 CFR § 193, requires LNG tank secondary containment basins be free of or minimize standing water in the impoundment. Finally, standing water in the basin creates a hazard habitat for wildlife.

Q. Did the Company consider alternatives to the Portland LNG Containment Basin Project?

A. Yes. The Company considered either constructing a new water treatment system or adding capacity to its existing water treatment system to treat the contaminated water. This option would minimize the potential impact on the existing containment area, but would require significant work in new construction, and would require additional staff onsite and ongoing O&M costs. Additionally, this option would result in a significantly higher cost that the Portland LNG Containment Basin, with costs for construction in the range of $12 million to $15 million, and plus an additional $2.5 million to $3 million in ongoing O&M expense. This option was rejected because it was the highest cost to construct, would result in unnecessary generation of contaminated water, and result in additional ongoing O&M expenses.

The Company also evaluated the costs and risks of performing no upgrades to the facility. While this option would result in no immediate up front capital costs, this option was rejected because it would result in an increase in risk because the existence of water in the tank secondary containment will result in a flash rate (acceleration) of vapor dispersion in the event of a material breach of the LNG tank and related appurtenances, may result in regulatory violation of 49 CFR § 193, which requires LNG tank secondary containment basins be free of or minimize standing water in the impoundment, and environmental impacts because the standing water in the basin creates a hazard and nuisance habitat for wildlife.

Q. Were there any additional alternatives considered by the Company that were determined to not be viable?

A. Yes. The Company also considered raising the outside impoundment berm elevation by 2 feet and the lowest level of impoundment by 8 feet. This option was rejected because the Company's consultant, CH-IV (LNG specialist) identified that this modification would very likely jeopardize regulatory compliance with Pipeline and Hazardous Materials Safety Administration (PHMSA) for the tank siting. The Portland LNG facility is not required to meet all current regulatory code requirements, but is grandfathered under historical applicable codes. If the elevation of the berm were modified, then it would constitute major modifications to the existing facility design, and would require vapor and thermal dispersion modeling. Due to the new stringent regulatory requirements, this dispersion model would conclude that the Portland LNG facility does not meet current siting code requirements. Additionally, this design would interrupt the readiness of the facility since work would require changes to the tank pump out area.

As an additional alternative, the Company considered developing temporary storage tanks, however, this option was rejected because the Company had already previously attempted this pre-pre-treatment approach in 2016 and 2017, and was not successful. Based on its prior experience, the Company determined that the sustained volume of recharge of groundwater and storm water from the basin greatly exceeds any feasible pre-pre-treatment and storage capacity. Additionally, the presence of on-site storage of a large volume of contaminated water presents regulatory compliance risk, and the Company would continue to incur additional costs for treatment of water.

Q. When was the Portland LNG Containment Basin Project completed?

A. The Portland LNG Containment Basin Project was completed in October 2018.

Q. What was the total actual cost of the Portland LNG Containment Basin Project?

A. The costs of the Portland LNG Containment Basin Project is $5.0 million.

Q. Is the Portland LNG Containment Basin Project currently in service and providing benefits to customers?

A. Yes.

V. POST-TEST YEAR PLANT ADDITIONS

Q. Please describe your understanding of the Commission's standard for including post-test year capital additions in rates.

A. My understanding, based on several recent Commission orders and a recent appellate case, is that the Commission does not use a bright-line rule for including post-test year pro forma capital additions in rate base; instead the Commission exercises its discretion and applies its informed judgment on a case-by-case basis.[2] However, any post-test year capital addition must meet the "used and useful" and "known and measurable" standards in order to be included in rates.

Q. What is your understanding of what it means for a capital investment to be "used and useful"?

A. To be used and useful, a resource must provide "quantifiable" benefits to Washington customers during the rate year.[3]

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[2] *Wash. Utils. & Transp. Comm'n v. PacifiCorp*, Docket UE-130043, Order 05 ¶ 199 (Dec. 3, 2013) ("The Commission requires flexibility in most cases to exercise its informed judgment in ways that respond adequately and appropriately to the dynamic economic and financial circumstances that are characteristic of the utility industry and the general economy.").

[3] *Wash. Utils. & Transp. Comm'n v. PacifiCorp*, Docket UE-140762, Order 08 ¶ 166 (Mar. 25, 2015).

Q. What is your understanding of what it means for a capital investment to be "known and measurable"?

A. To be known and measurable, a capital investment must be in-service during, or reasonably soon after, the test year and must remain in-service during the rate year.[4] And the actual amount of the change must be measurable; therefore the "amount typically cannot be an estimate, a projection, the product of a budget forecast, or some similar exercise of judgment – even informed judgment – concerning future revenue, expense or rate base."[5]

Q. Are you aware of any recent court opinions modifying or clarifying the "used and useful" standard?

A. Yes. The Washington Court of Appeals recently emphasized that rate base can include only resources that are used and useful for public service at the time the inquiry as to rates is made.[6] Nonetheless, the court's decision appears to be consistent with allowing capital additions in rates where the resources are in-service prior to the time rates take effect. The court did not disturb the Commission's prior conclusion that a resource must provide quantifiable benefits to Washington customers to be used and useful or provide any dicta suggesting that the Commission's quantifiable benefit framework is contrary to RCW 80.04.250.

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[4] Order 08 ¶ 167.

[5] Order 08 ¶ 167.

[6] *Wash. Attorney General's Office, Pub. Counsel Unit v. Wash. Utilities and Transportation Comm'n and Avista Corp.*, 4 Wn.App.2d 657 (2018).

Q. Does the Company propose to include any post-test year capital additions in this case?

A. Yes. The Company proposes to include the following projects:

- Washougal Reinforcement
- Newport LNG Glycol Piping Replacement
- Newport LNG Exchanger E-3 Replacement
- Newport LNG Exchanger E-5 Replacement
- Mist Standby Generator
- Mist Fiber Network
- Portland LNG Containment
- Lacamas Regional Gate Station
- Sherwood Testing Building
- Eagle Wireless Upgrade Project
- ECM Implementation
- NCS Tech Refresh
- NCS Tech Refresh Microwave

Q. When does the Company expect that these projects will be used and useful?

A. Many of these projects were completed just after the end of the Test Year in this case, and are already in service and used and useful. Specifically, the Washougal Reinforcement, Newport LNG Glycol Piping Replacement, Newport LNG Exchanger E-3 and E-5 Replacement, Portland LNG Containment, Sherwood Testing Building, and ECM Implementation were completed as of October 2018. The remainder of these post-Test Year projects are all expected to be in service before the rate effective date, which will allow the stakeholders that participate in this case ample time to review and vet the prudence of these projects and related costs.

Q. Are the costs for these projects known and measureable?

A. As explained above, many of these projects have been completed already, and their actual costs are known at the time of filing this case. The Company expects to be able to provide actual costs for the remaining projects rather than budget estimates before parties file their response testimony, and thus the costs will be known and measureable and parties will have adequate time to evaluate these projects.

Q. Have you discussed these projects earlier in your testimony?

A. I have described several of these projects in earlier sections of my testimony. Specifically, I described the Washougal Reinforcement in my discussion of major Washington projects, and the Newport LNG Glycol Piping Replacement and Newport LNG Exchanger E-3 and E-5 Replacements, and the Mist Standby Generator and Mist Fiber Network in the discussion of Oregon storage projects partially allocated to Washington. The rest of my testimony in this section will describe the other post-Test Year projects not previously discussed above.

Lacamas Regional Gate Station

Q. Please describe the Lacamas Regional Gate Station project (Lacamas Project).

A. The Lacamas Project is being developed to meet increased demand and to improve safety and operability. The project includes rebuilding the station, relocating the electric meter, replacing the structure, the actuator, the perimeter fence, the antenna pier, as well as related site work.

Q. Why did the Company decide to develop the Lacamas Project?

A. The Lacamas Gate Station was in a state of disrepair, and work at this station is necessary to support the pipeline projects in Clark County and move gas to needed supply locations. Specifically, the Lacamas Gate Station will be a critical component of the Company's piping network when the Camas Reinforcement tie-in project is completed.

Q. When does the Company expect to complete the Lacamas Project?

A. The Company expects that the Lacamas Project will be completed in January 2019.

Q. What is the Company's most recent cost estimate for the Lacamas Project?

A. The Company's most recent cost estimate for the Lacamas Project is $238 thousand.

<u>Eagle Wireless Upgrade Project</u>

Q. Please describe the Eagle Wireless Upgrade Project.

A. This project will convert approximately 600 Eagle Advance Automated Meter Reading (AAMR) devices from analog phone lines to wireless technology (cellular or satellite). The Eagle AAMR devices provide hourly interval usage data for the Company's largest commercial and industrial customers.

Q. Why is the Company performing the Eagle Wireless Upgrade Project?

A. Due to a series of Federal Communications Commission (FCC) rulings in 2014 and 2015 allowing for the elimination of analog phone lines in favor of digital technology, the Company expects that analog lines will be phased out after local telecommunications companies switch to digital infrastructure, which was anticipated to begin as early as 2017. Once the conversion to digital technology is complete, the

Company's Eagle AAMR devices would suffer data impairment and ultimately stop functioning if no upgrade were performed.

Q. Did the Company consider alternatives to performing the Eagle Wireless Upgrade Project?

A. Yes. Because the Eagle AAMR devices would cease to function properly after the conversion to digital lines is complete, the Company determined that it was necessary to either upgrade or replace the devices. The Company evaluated upgrading the existing units and replacing the units, and determined that performing the upgrade would be the less expensive and less complicated solution.

Q. When does the Company expect to complete the Eagle Wireless Upgrade Project?

A. The Company expects that the Eagle Wireless Upgrade Project will be completed in March 2019.

Q. What is the total estimated cost for the Eagle Wireless Upgrade Project?

A. Based on actuals to date and the Company's forecast budget for the remainder of the project, the Company estimates the total cost will be $5.4 million.

Q. Of that amount, how much of the total cost will be allocated to Washington customers?

A. The amount of the project allocable to Washington is $609.4 thousand.

<u>Sherwood Testing Building</u>

Q. Please describe the Company's Sherwood facility.

A. In 2012, the Company acquired a property in Sherwood, Oregon in order to construct a multi-purpose facility to meet three functional business needs: (1) an integrated operations facility, (2) a field and inside training center, and (3) a business continuity center. This allowed NW Natural to consolidate our Tualatin and South Center facilities to avoid the retrofitting of both facilities and eliminate flooding issues the Company had experienced at the South Center location.[7]

Q. Why did NW Natural decide to develop the Sherwood Testing Building?

A. The primary objective of the Sherwood Testing Building is to provide a safe facility for pipe and component high-pressure testing, x-ray testing, and sand-blasting at the Sherwood facility.

Q. What type of testing will be performed at the Sherwood Testing Building?

A. High-pressure pipe and valve assemblies constructed in the Weld Shop are required to be pressure tested and x-rayed. Pressure testing involves increasing the pressure, within a pipe assembly, up to 3000 psi. This work must be performed in a separate building, because if the assembly being tested were to fail, it would put employees in neighboring shops at risk and could cause tremendous damage to the building. Additionally, x-ray testing emits radiation requiring all personnel to be removed from the surrounding area during the procedure. Additionally, pipe assemblies are required to be sand-blasted, and the Sherwood Testing Building provides a safe location for sand-blasting.

Q. Does the Sherwood Testing Building include any special safety features?

A. Yes. Blast-proof panels will be located over and around the test chamber. Flashing beacons will notify employees when testing is occurring at the Sherwood Testing Building to alert them to remain a safe distance away from the building. And, sand-

[7] The Company later sold the Tualatin and South Center locations.

blasting will take place within the building in a separate enclosed booth for employee safety and environmental compliance.

Q. Please describe the sand-blasting that will occur at the Sherwood Testing Building.

A. Sand-blasting enables the paint or other coating to bond to the steel surface, reducing future corrosion and expensive maintenance costs.

Q. What is the current status of the Sherwood Testing Building?

A. Research and design on the Sherwood Testing Building began in June 2016, and construction was completed in October 2018.

Q. How does the Sherwood Testing Building benefit Washington customers?

A. The Sherwood Testing Building supports all customers, including Washington customers. Pressure testing, x-ray, sand-blasting and other associated construction work performed at Sherwood Testing Building supports pipe work performed in Washington for Washington customers.

Q. What was the total cost of the Sherwood Testing Building?

A. The total cost of the Sherwood Testing Building is $3.9 million.

Q. How much of the total cost for the Sherwood Testing Building is allocated to Washington customers?

A. The amount of the project allocable to Washington is $435 thousand.

Enterprise Content Management (ECM) Implementation

Q. Please describe the Company's ECM Implementation.

A. The purpose of the ECM Implementation is to establish the governance framework, business processes, and technology platform to effectively manage NW Natural's business information throughout its lifecycle in order to protect this asset, reduce the Company's risk, and improve employee productivity.

Q. Why did the Company decide to implement the ECM Program?

A. NW Natural previously used a records management system, TRIM, which reached the end of its useful life and was no longer supported by the vendor. In addition to TRIM, NW Natural records are also being kept in a variety of other systems such as SharePoint, SAP and shared drives which present a number of business and compliance challenges with respect to record identification, location/retrieval and retention and proper disposition under federal, state and regulatory requirements.

Q. Please describe the benefits of the ECM Program, in addition to the need to replace TRIM.

A. The ECM Program provides a comprehensive content and records keeping management tool that provides a useable solution for all needs around content and records management, and provides greater consistency for content management practices. The ECM Program better allows the Company to comply with legal and regulatory requirements for document management and retention. The ECM Program will provide the following benefits:

- **Reduction in risk**. ECM Implementation will: 1) Ensure transparency and regulatory/legal compliance; 2) Ensure content, including personally identifiable information and confidential information, is properly secured; 3) Improve decision making through accuracy and availability of information; 4) Enhance business continuity.

- **Improvement in employee and operational efficiencies.** ECM Implementation will: 1) Increase responsiveness and reduce cycle time for information requests 2) Allow employees to focus on value added tasks 3) Reduce employee time spent finding and validating content; 4) Reduce redundant content; 5) Slow down increase in storage needs; 6) Consolidate and leverage systems with redundant functionality.

The project is being implemented in five phases, with Phase I through IV completed as of October 31, 2018. Phase I through IV are currently in service and provide the following functionality: ECM technical platform, intranet/portal for employee communication, workflows to automate certain paper processes, record center to house records from existing records management system (TRIM), workspaces for managing documents for individual employees, departmental/team content management and collaboration sites for a number of departments inclusive of training.

Q. What is the total cost for Phase I through IV of the ECM Program?

A, The total project cost is $4.9 million.

Q. How much of the total cost for the ECM Program is allocated to Washington customers?

A. The amount of the project allocable to Washington is $546.5 thousand.

<u>Network Control Systems Technology Refresh (NCS Tech Refresh)</u>

Q. What are network control systems?

A. The Company's network control systems provide communications capability enabling monitoring and controlling of the Company's pipeline system and information technology (IT) offices.

Q. What is the NCS Tech Refresh project?

A. The NCS Tech Refresh project includes the replacement, installation, and configuration of capital technology assets according to a planned schedule based upon the estimated useful life of the asset and the manufacturer's support availability. As part of this the NCS Tech Refresh Project, the Company has replaced routers, switches, and firewalls, and has added cabling as needed.

Q. Why is the Company performing the NCS Tech Refresh project?

A. The Company is performing the NCS Tech Refresh project because certain essential network equipment and its supporting infrastructure have passed or are approaching the end of their estimated useful life, and are no longer supported by the manufacturers/vendors. Additionally, the Company is updating certain outdated technology to respond to the Company's increasing needs for additional bandwidth as the Company's business systems have become increasingly reliant on network facilities for transport. Finally, the NCS Tech Refresh project will provide enhanced features providing visibility into network traffic, simplify management, and prevent unauthorized access through enhanced security.

Q. Did the Company consider alternatives to the NCS Tech Refresh Project?

A. Yes. Because the equipment and related infrastructure that was replaced as part of the NCS Tech Refresh Project had reached or soon will reach the end of its useful life, the Company had to replace the equipment, and thus considered whether to continue to work with incumbent vendors or alternative vendors. The Company considered the products offered by incumbent and alternative vendors, and in most cases the incumbent vendor was selected in order to provide continuity of operations and support, compatibility with existing systems, integration with current network architecture, and because of the manufacturer's position as a market leader. However, in some network segments alternate manufacturers were selected to replace incumbent vendor's products.

Q. When does the Company expect to complete the NCS Tech Refresh Project?

A. The work associated with the NCS Tech Refresh Project has been performed on a rolling basis throughout 2018 as labor has been available to complete project activities, availability. The Company has prioritized work on this project based on lifecycle status for particular equipment, potential for synergies to be realized, and corporate/departmental project roadmaps. The NCS Tech Refresh Project will be completed by March 31, 2019.

Q. What is the Company's most recent cost estimate for the NCS Tech Refresh Project?

A. The Company's most recent cost estimate for the NCS Tech Refresh Project is $1.3 million.

Q. Of this amount, how much will be allocated to Washington customers?

A. The amount of the project allocable to Washington is $146.8 thousand.

NCS Tech Refresh Microwave

Q. Please describe the NCS Tech Refresh Microwave Project.

A. The NCS Tech Refresh Microwave Project includes the replacement, installation, and configuration of capitol technology assets, including microwave radios and antennae that are approaching the end of their useful lives.

Q. Why is the Company performing the NCS Tech Refresh Microwave Project?

A. Similar to the NCS Tech Refresh Project, the Company needed to replace outdated equipment that was no longer supported by the manufacturer. Additionally, the project will increase bandwidth available for communications, and will optimize O&M expenditures by minimizing the use of leased facilities for communications transport.

Q. Did the Company consider alternatives to the NCS Tech Refresh Microwave Project?

A. The Company considered options provided by different vendors, and ultimately selected a microwave system from a reputable, stable vendor, and that provides the Company with superior technology in comparison with competing vendors. Additionally, the system the Company selected meets the Company's growing needs for additional bandwidth.

Q. When does the Company expect to complete the NCS Tech Refresh Microwave Project?

A. The NCS Tech Refresh Microwave Project will be completed by March 31, 2019.

Q. What is the Company's most recent cost estimate for the NCS Tech Refresh Microwave Project?

A. The Company's most recent cost estimate for the NCS Tech Refresh Microwave Project is $1.8 million.

Q. Of this amount, how much will be allocated to Washington customers?

A. The amount of the project allocable to Washington is $201.8 thousand.

VI. EXCESS FLOW VALVES

Q. What are excess flow valves ("EFVs") and how do they work?

A. An EFV is a device installed in a service line near the point of connection to the gas main. EFVs will "trip" and stop the flow of gas if there is a full line failure, such as a damaged or severed service line.

Q. Why is the installation of EFVs important to increase safety?

A. In the event of a damaged or severed service line, EFVs are effective in mitigating the escape of gas.

Q. How does NW Natural currently approach installation of EFVs?

A. Consistent with federal pipeline safety requirements, NW Natural includes EFVs on all newly installed and fully replaced service lines to single family residences. In addition, we install EFVs on multifamily residences and small commercial customers served by a single service line with a known customer load not exceeding 5,000 SCFH (50 therms/hr). For customers with larger known loads, a shut-off valve, instead of an EFV, is installed on the service.

Q. What is the Company's policy with respect to EFV retrofits on existing service lines?

A. NW Natural provides notice to its customers of their right to request EFV installation, and they are currently installed at the requesting customer's cost. The Company provides this notice to customers via its website, annual safety notifications, and new customer welcome packets.

Q. Is the Company prioritizing any particular areas for EFV retrofitting?

A. EFV retrofits will be prioritized by risk using the Distribution Integrity Management Program (DIMP) risk model. Factors that will be included in the DIMP risk model are population density, service size, service material, business districts and seismic data.

Q. Does the Company anticipate requesting cost recovery for EFV retrofitting?

A. Yes, we raise this issue now because we believe that the EFVs provide an important safety function to our customers and the surrounding areas. EFVs are described in the DIMP and provide a clear benefit. However, historically, retrofitted EFVs have not been recovered in base rates of our customers. The Company intends to develop a prioritization plan for retrofitting EFVs and seek inclusion of those costs in rates. We look forward to working with the parties on this issue to continue our proactive approach to maintaining a safe distribution system.

Q. Will the Company provide additional information to the Commission about these safety-related projects as they move forward?

A. Yes, the Company will keep the Commission informed as the plans become more definite and NW Natural identifies a timeline for moving forward.

VII. CONCLUSION

Q. Does this conclude your testimony?

A. Yes.