NW Natural's 2022 IRP Update
Docket No. LC 79
Filed August 2, 2024

Contents

Introduction

Northwest Natural Gas Company (NW Natural or the Company) filed its 2022 Integrated Resource Plan (IRP) on September 23, 2022.[1] The Public Utility Commission of Oregon (OPUC or Commission) issued Order 23-281 on August 2, 2023. The Commission stated that:

> *We acknowledge NW Natural's near-term action plan, except for Action Item 5 but otherwise do not acknowledge the preferred portfolio developed through NW Natural's long-term portfolio analysis.*[2]

NW Natural submits this update in compliance with Oregon Administrative Rule (OAR) 860-027-0400(11). This update does not seek Commission acknowledgement of any additional Action Items within this update. This filing is for informational purposes only.

Update on Previously Acknowledged Action Items

Table 1: 2022 IRP Action Items

	#	Action Item Description	Status
System Capacity Resources	1	Acquire 20,000 Dth/day of deliverability from either recalling Mist, a city gate deal, or a combination of both for the 2023-24 gas year. Based upon updated load forecast in upcoming IRP updates recall Mist capacity as required for the 2024-25 and 2025-26 gas years.	After confirming it was still needed, NW Natural signed a city gate deal for 20,000 Dth/day of deliverability to meet design peak demand for the 2023-2024 winter. Updates to the peak day forecast and firm resource stack show another design day deficit of 20,000 Dth/day for the 2024-2025 winter. NW Natural recalled 20,000 Dth/day of Mist deliverability to meet this deficit for this upcoming winter.
	2	Replace the Cold Box at the Portland liquified natural gas (LNG) facility for a targeted in-service date of 2026 at an estimated cost of $7.5 to $15 million.	The Company is awaiting the results of the facility seismic vulnerability assessment, required by the new DEQ Fuel Tank Seismic Stability Rules, before proceeding forward with the cold box replacement.
	3	Scope a residential and small commercial demand response program to supplement our large commercial and industrial programs and file by 2024.	NW Natural is in the process of contracting with a Distributed Energy Resource Management System (DERMS) service provider to enable a "bring your own thermostat" (BYOT) demand response program to begin enrollment this coming Fall

[1] NW Natural also filed a supplemental application on October 21, 2022.
[2] OPUC Order 23-281.

	#	Action Item Description	Status
			of 2024. See more detail on the BYOT program in the System-wide Residential and Small Commercial Demand Response Program section.
Oregon Emissions Compliance	4	Working through Energy Trust of Oregon, acquire 5.7 – 7.8 million therms of first year savings in 2023 and 6.7 – 8.9 million therms of first year savings in 2024, or the amount identified by the Energy Trust board.[3]	The Energy Trust of Oregon (Energy Trust) acquired 5.5 million therms of first year savings in 2023 in Oregon. 1.5 million therms of first year savings have been achieved through Q1 of 2024.
	5	In Oregon, to achieve SB 98 targets, seek to acquire 3.5 million Dths of renewable natural gas (RNG) in 2024 and 4.2 million Dths of RNG in 2025, representing 5% and 6% of normal weather sales load in 2024 and 2025.	The Commission did not acknowledge this action item.
	6	Work with Energy Trust of Oregon, the Alliance of Western Energy Consumers and other stakeholders to develop energy efficiency programs for transportation schedule customers by 2024.	NW Natural filed its proposed program tariff on December 18, 2023. Shortly after the filing, the Climate Protection Program (CPP) was invalidated. The invalidation of the CPP required NW Natural to revise the funding structure of the transportation energy efficiency program, which in turn reduced the scope and scale of the program. On May 10, 2024, NW Natural filed a replacement program tariff and a related deferral request. See the Transportation Customer Energy Efficiency Programs section for additional details on stakeholder engagement and an overview of the program.
	7	In Oregon, purchase Community Climate Investments representing any additional Climate Protection Plan (CPP) compliance needs for years 2022 and 2023 in Q4 2023 and for year 2024 in Q4 2024 based upon actual emissions to ensure compliance with the 2022-2024 compliance period.	The CPP was invalidated in December of 2023.

[3] These numbers in the action item included total energy efficiency forecasted by Energy Trust, with therm savings from updating building codes and market transformation. Energy Trust forecasted 5.4 million therms as claimable savings from Energy Trust for 2024.

	#	Action Item Description	Status
Distribution System	8	In Oregon, uprate the Forest Grove Feeder (also known as the McKay Creek Feeder) to be in service for the 2025 gas year at an estimated cost of $3.0 to $7.0 million.	The Company is in the planning phase and construction is scheduled for completion in Q3 of 2026.

Policy Changes (OR and WA) since filing the 2022 IRP

There have been several changes in policy and building codes in both Oregon and Washington since filing the 2022 IRP that have impacted resource planning. Regardless of state policy, NW Natural continues to pursue decarbonized resources, energy efficiency, and other carbon reduction technology, such as carbon capture, as part of our company goals and commitment to effectively address climate change.

Oregon Climate Protection Program

Since the 2022 IRP filing, changes have occurred to the Oregon Department of Environmental Quality's (DEQ) Climate Protection Program (CPP). In December 2023, the Court of Appeals invalidated the CPP. In March 2024, the DEQ initiated a rulemaking process to reinstate a carbon program. At this time, the rulemaking process is still ongoing. NW Natural is participating as a member of the rule advisory committee (RAC), which concluded the last of three meetings on June 25, 2024. DEQ distributed formal draft rules on July 30th and is requesting formal comments on the draft rules be submitted by August 30th. Rule adoption is expected to occur at the November 2024 Environmental Quality Commissions (EQC) meeting. If the rulemaking follows this schedule, the CPP will take effect January 1st with 2025 being the first compliance year.

Oregon Consumer Privacy Act – (OPCA)

The new Oregon Consumer Privacy Act (OCPA) went into effect on July 1, 2024. Among other rights and requirements, the OCPA gives Oregon residents new rights related to their data when it is controlled or processed by companies that are subject to the law. To the extent they apply to NW Natural, OCPA's requirements may impact the collection of customer data and administration of various NW Natural programs such as **Geo**graphically **T**argeted **E**nergy **E**fficiency (GeoTEE) and **Geo**graphically targeted **D**emand **R**esponse (GeoDR). The extent that the OCPA could impact program administration is still uncertain. NW Natural will need to continue to evaluate OCPA requirements on this data collection, including technical systems to allow us to comply with the new law.

Oregon Building Codes

The current (2023) Oregon Residential Specialty Code (ORSC) became mandatory in April 2024. It is based on the 2021 International Residential Code and is fuel neutral. The next residential code cycle will begin in 2025 with the code coming into effect Fall 2026.

The current (2021) Oregon Commercial Energy Efficiency Specialty Code (OEESC) became mandatory in October 2021. It is based on ASHRAE Standard 90.1 – 2019 and is also fuel neutral. The next update to the OEESC is anticipated in 2024 (date TBD) with a 6-month phase in period and will be based on ASHRAE 90.1 – 2022. The Building Codes Division plans to base the OEESC on ASHRAE Standard 90.1 for the foreseeable future.

Washington Climate Commitment Act

Since filing the 2022 IRP, the Washington Department of Ecology completed the rulemaking process for the Climate Commitment Act (CCA). 2023 was the first year of compliance for the program and NW Natural factors compliance and associated costs into our utility planning. Compliance tools available to the utility include the purchase of allowances at auction, reduced consumption (energy efficiency), offsets, and increased use of renewable fuels. In 2023, NW Natural participated in the CCA auctions as a purchaser and consigner of allowances. The State of Washington is currently undertaking rulemaking associated with the CCA to allow for linkage to the California and Quebec Cap and Invest programs. In November 2024, Washingtonians will vote on ballot initiative 2117, which seeks to repeal the CCA.

Washington Ballot Initiative 2066

Washingtonians will also vote on ballot initiative 2066 in November. Ballot initiative 2066 would require Washington cities and counties to ensure natural gas is available to businesses and residents as an energy choice and prevent state energy code, localities, and other state agencies from penalizing the use of natural gas or restricting access to natural gas services. It would repeal parts of chapter 321, Laws of 2024, which were establish by Washington House Bill 1589 last March.

Washington Building Codes

New energy codes for residential and commercial construction became effective in March of this year. The Washington State Building Code Council adopted new provisions that compare space and water heating appliances based on a site energy consumption basis that excludes upstream energy losses associated with electric generation. This approach does not account for total energy and creates an artificially larger efficiency differential between natural gas appliances and equivalent electric heat pump options. The codes allow for the installation of gas-fired appliances but not without also installing additional higher efficiency building improvements and/or additional onsite renewable energy sources.

These changes only pertain to space and water heating appliances in new buildings. Existing gas space heating and water heating appliances may be replaced with like-in-kind of the same or less heating capacity.

Equity Considerations

While specific guidelines regarding the integration of equity considerations in natural gas IRPs are still evolving, the Company recognizes that equity in the utility sector should ensure that all stakeholders—whether they are customers, shareholders, or communities— have equitable access to the advantages provided by natural gas infrastructure. At the same time, these benefits should be balanced with opportunities to mitigate the social and economic burdens on those who may have been historically harmed by the energy system.

As an early step to advancing energy equity at NW Natural—and a step overwhelmingly endorsed by members of our Community and Equity Advisory Group (CEAG)— the Company is establishing a common framework for understanding the language and concepts of equity, along with its various dimensions. This approach positions our audience to engage more meaningfully in the IRP process, as well as promotes transparency and consistency in decision-making. It also lays the foundation for setting equity targets and establishing best practices, while being mindful that language should remain flexible and contextual and that multiple definitions can exist without invalidating each other. NW Natural also recognizes the ongoing, iterative process this important work entails. NW Natural refers to the Department of Energy[4] and other[5] resources, such as Commission Orders,[6] to define its working energy justice terms and concepts. These terms and definitions include:

- Energy Burden: Refers to the expense of energy expenditures relative to overall household income.

- Energy Equity: Refers to the goal of achieving a fair distribution of the benefits and burdens of energy production and consumption to all levels of society. It emphasizes access to affordable and reliable energy, with a key aim to reduce energy burden.

- Energy Justice: While energy equity and energy justice are closely related concepts, and often used interchangeably, they each have distinct areas of focus. Energy justice is a broader concept, referring to achieving equity in both the social and economic participation in the energy system. Energy justice explicitly centers the concerns of marginalized communities.

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[4] U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy. *See also* U.S. Department of Energy. "How Energy Justice, Presidential Initiatives, and Executive Orders Shape Equity at DOE." Office of Energy Justice Policy and Analysis, 2023.

[5] *See generally* "Learn About Environmental Justice." U.S. Environmental Protection Agency, 22 Jan. 2024, (https://www.epa.gov/environmentaljustice/learn-about-environmental-justice#definitions), "Environmental Justice Working Definitions." Oregon Environmental Council, 2023 (www.oeconline.org/our-people/partners/environmental-justice-working-definitions/), "The Energy Justice Workbook" Initiative for Energy Justice, 2024, (https://iejusa.org/section-1-defining-energy-justice/1), National Conference of State Legislatures. "Energy Justice and the Energy Transition." NCSL, 2023.

[6] WUTC Docket UG-210755, Final Order 09.

Updates to the upcoming 2025 IRP center on strengthening inclusive and meaningful public engagement in the development of the IRP process—core elements of procedural justice and equity. Steps to improve public participation and equity considerations in the IRP were heavily informed by direct feedback from the Company's CEAG[7]. A high-level snapshot of activities and outputs include:

Strategic Activities/Actions [broad, longer-term approaches that will guide the overall direction of the process]

- Drafting a catalogue of equity-centered definitions and concepts
- Defining short- and long-term equity goals, and setting clear, actionable objectives
- Establishing milestones and benchmarks to measure progress and ensure accountability
- Enhancing outreach, accessibility, and public participation opportunities
- Partnering with trusted community organizations to host events that present IRP content in accessible, non-technical language

Tactical Outputs/Deliverables [tools to help us achieve the above]

- New and updated content on **NW Natural web pages** dedicated to the IRP informed by feedback from our CEAG
- An **IRP toolkit** designed to improve awareness and engagement among non-technical audiences
- Data, findings, and recommendations from the upcoming **Energy Burden Analysis**, to be completed fall 2024
- Data, findings, and recommendations from external public data sources
- Dedicating a chapter in the upcoming 2025 IRP to discuss equity considerations and analysis

Enhanced Public Participation

The Company's upcoming 2025 Integrated Resource Plan (IRP) aims to foster a more engaging and accessible public participation process. Efforts the Company is actively employing and/or exploring are summarized below. Appendix A provides more information on specific activities.

- **Enhanced Engagement Opportunities:** Building upon previous efforts, the Company will be adding new engagement opportunities to the IRP development process such as hosting IRP fair events in partnership with community organizations, hosting an open-house with the intention to meet the IRP team and develop interpersonal relationships, and including a series of community webinars in addition to the more technical workshop series.
- **Accessibility:** The Company is committed to providing accessible engagement opportunities. Examples of efforts to fulfill this commitment include offering translation and interpretation

[7] Direct feedback was provided over the course of several meetings on various topics related to Company operations and processes including the meeting held on February 22, 2024, specific to the topic of Energy Justice and the IRP.

services upon request for stakeholder meetings, incorporating plain language reviews, and ensuring all virtual platforms and in-person meeting spaces support accessibility features. The IRP team will utilize accessibility best practices and expertise provided by partner organizations, and, additionally, is intending to work with a third-party participation consultant and facilitator.

- **Communication and Feedback:** The Company will utilize multiple outreach channels to provide regular progress updates, create and disseminate meeting summaries, and share how stakeholder feedback is being incorporated into the IRP process. Additional steps the Company will be exploring include preparing materials and informational content specifically designed to help new participants understand and engage comfortably and effectively in the process.

Transportation Customer Energy Efficiency Programs

Transportation customers are NW Natural customers that purchase their own natural gas wholesale and pay NW Natural for the transportation of the commodity to their site via the Company's distribution system. Historically customers with this service have not been eligible for natural gas energy efficiency programs.

In the 2022 IRP, NW Natural included transportation customer energy efficiency forecasts but did not have a formal program established to achieve natural gas savings. Since the 2022 filing, NW Natural has conducted stakeholder engagement and worked to develop low-cost energy efficiency program options for this customer class in a changing policy landscape.

Stakeholder Engagement

NW Natural held two public stakeholder meetings to share information and gather feedback on a prospective transportation energy efficiency program. The first meeting, held on July 10, 2023, focused on providing context around transportation customers and began initial discussions around program structure, cost-effectiveness, and incentive considerations.

After the meeting, NW Natural sent a survey out to transportation customers as an efficient method to gather feedback from customers on their priorities. The survey responses indicated a strong desire for technical assistance and incentives to complete energy efficiency projects. Feedback from the first stakeholder meeting and the customer survey were used to develop a program proposal for Oregon.

NW Natural and Energy Trust presented the proposal for a joint program structure at the second public meeting held on August 28, 2023. There was general support for the program with emphasis on using Energy Trust to provide synergy for customers that are already receiving Energy Trust services on the electric side. The initially proposed funding structure would have spread program costs to all customers as furtherance of carbon compliance under the Climate Protection Program.

On October 31, 2023, NW Natural presented an update on the transportation program development to the Public Utility Commission of Oregon. The update included an overview of the proposed program, the status of contracting and data transfer agreements, and an expected timeline for program roll-out.

NW Natural filed its proposed program tariff on December 18, 2023. Shortly after the filing, the CPP was invalidated. The invalidation of the CPP required NW Natural to revise the funding structure of the transportation program, which in turn reduced the scope and scale of the program.

In 2024, NW Natural held several meetings with the Alliance of Western Energy Consumers, Energy Trust, and Commission Staff to come to agreement on an interim program. On May 10, 2024, NW Natural filed its replacement program tariffs and a related deferral request.

Oregon Program Updates

The new transportation energy efficiency program is a limited time offer effective from June 12 to December 31, 2024. All transportation customers will have the opportunity to participate in Energy Trust's Standard Track incentive program. The Standard Track is one of Energy Trust's offerings in which customers may submit project applications to receive incentives for specific energy efficiency measures which are assigned deemed savings. The list of eligible measures is maintained on Energy Trust's website.[8] In 2024, costs of this program will be capped at $700,000 and will be available on a first-come, first-served basis.

Lawrence Berkley National Lab (LBNL)- 50001 Ready Cohort

In addition to pursuing an incentive-based energy efficiency program for industrial customers, NW Natural also worked to recruit customers to participate in an LBNL 50001 Ready Cohort. ISO 500001 is an international performance standard for energy management systems. 500001 Ready is a program offered by the U.S. Department of Energy to help facilities with the implementation of ISO 500001.

The program operated similarly to Strategic Energy Management programs in which customers engaged with coaches to create a framework for managing a site's energy. No incentives were provided, but customers were able to access guidance through the federally funded program. Five customers participated in the cohort.

Washington Industrial Audits

NW Natural offered a pilot program to industrial sales and transportation customers in Washington in which customers received high-level energy audits from industry professionals. The audit pilot program concluded in 2024 and will be used to create a formal program for Washington customers in 2025.

[8] https://www.energytrust.org/industry-agriculture/industry-equipment-incentives/

System-wide Residential and Small Commercial Demand Response Program

For the 2022 IRP, OPUC issued Order 23-281 on August 2, 2023, in docket LC 79, acknowledging Action Item 3 to:

> *"Scope a residential and small commercial demand response program to supplement our large commercial and industrial programs and file by 2024".*

The intention of demand response (DR) is to reduce peak demand at the system level to mitigate or avoid service disruptions when extreme weather events occur, gas prices in the market are extremely high, or facilities serving system supply fail. The Company already relies upon substantial DR resources in the form of interruptibility to manage peak loads and save capacity resource costs on its distribution system, where roughly 2-9 percent of the would-be peak load can be interrupted from large commercial and industrial customers during peak events. The exploration of residential and small commercial DR programs will provide the Company with information about cost-effective technologies and program concepts for these customers, as well as the cost and timing of DR as an alternative non-pipeline solution for system-wide resource and distribution capacity planning. It is worth noting that DR resources can be leveraged to reduce load demand to mitigate or avoid service disruptions at both the system level and a specific area when there is such a need in extreme events.

Bring Your Own Thermostat (BYOT) Program

Upon receiving OPUC's acknowledgement on Action Item 3 regarding a residential and small commercial demand response program scoping, the Company started working on the development of the DR program plans. By the end of October 2023, the Company completed a DR program plan in which the scope, objectives, DR offerings, deliverables and timing for system-wide programs were developed. While several DR pathways were explored, a bring your own thermostat (BYOT) program was identified as the best opportunity to create a demand response program that targets residential and small commercial customers.

BYOT programs as a DR offering have been recently employed by several natural gas utilities.[9] BYOT programs focus on residential and small commercial customers that have installed Wi-Fi-connected smart thermostats in their premises. During peak gas demand hours on cold winter days, BYOT participating customers' smart thermostats are remotely adjusted via the thermostat manufacturers' management systems to a lower temperature set point (typically by two to four degrees Fahrenheit), effectively reducing residential and small commercial gas demand for space heating. This approach helps shift and reduce gas demand on event days, contributes to overall gas savings, and supports system reliability. A one-time enrollment incentive will be provided to customers when they opt in and enroll into the program. An

[9] See SoCalGas Smart Thermostat program for an earlier example (https://www.calmac.org/publications/SoCalGas_2019_DR_Evaluation_Report_-_PUBLIC_FINAL.pdf) and National Grid Firm Gas DR for a more recent example (https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7B6D99A55B-2B48-4281-BA10-960B6EE9790D%7D).

annual performance-based incentive will be provided to customers if they participate in 50 percent or more of the DR events during a DR season. Beyond the incentives paid to customers, there are costs associated with program implementation and fees charged by the DERMS service vendor and the thermostat manufacturers for providing this service. Cost-effectiveness tests will be calculated by comparing these costs against the benefits measured based on avoided costs.

BYOT Program Progress to Date

The Company is pursuing a three-year system-wide bring-your-own-thermostat (BYOT) DR program from 2024 through 2026-2027 winter season. By the end of 2027, NW Natural will evaluate the success and cost-effectiveness of the program and will extend the program into the future as applicable. Data provided by Energy Trust shows that over 61,000 smart thermostats have already been installed across NW Natural's service territory via Energy Trust's various energy efficiency programs. Also, according to the 2022 Residential Building Stock Assessment (RBSA) Findings Report by Northwest Energy Efficiency Alliance (NEEA) published in April 2024, about 14 percent of single-family homes in the northwest region have installed certain types of smart thermostats.[10] Prospective customers for BYOT DR participation could be as many as 84,000 for single-family homes alone.[11] Given so many smart thermostats are already installed in NW Natural's service territory, the enrollment goal of the BYOT program is set to be 20,000 to 30,000 customers by the end of the three-year program period.

In November 2023, the Company engaged in preliminary discussions with four major DR implementation service providers in the industry and issued a request for proposal (RFP) for the BYOT program in February 2024. All four DR service providers were invited to participate in the bidding and all of them submitted their proposals in March. The Company hosted multiple rounds of interview sessions for each of the implementation vendors during the RFP selection process from late March to May 2024 and eventually identified a winner to negotiate a scope of work (SOW) and contract in July 2024. It is anticipated that the selected vendor will start to set up the BYOT program in their distributed energy resource management system (DERMS) in August 2024 and is expected to be completed by the end of November 2024, at which point the program will start to enroll eligible customers. The first DR season will start as soon as the program is ready and end by March 31, 2025, during which DR events are expected to be dispatched once weather and load meet event dispatch criteria.

In addition to the RFP for the BYOT implementation services, the Company also issued an Evaluation, Measurement and Verification (EM&V) RFP for the DR program in March 2024, seeking a qualified third-party EM&V service vendor to conduct an independent EM&V analysis of the BYOT program. Five EM&V service vendors submitted their proposals. The Company has

[10] See Page 23 in the 2022 RBSA Findings Report: 2022-Residential-Building-Stock-Assessment.pdf (neea.org).
[11] Given a total of about active 667,000 single -family accounts served by the Company and assuming 90 percent of them using gas for space heating.

completed the proposal evaluation process for the EM&V RFP and is currently negotiating the SOW with the finalist with the EM&V service contract expected to be signed in August 2024.

The major efforts and activities related to the BYOT DR program to date are summarized in Table 2.

Table 2: DR Activities

DR Activity	Note
Acknowledgement of DR Scoping	OPUC Order 23-281
DR Plan Development	System-wide DR
Initial DERMS service provider screening	Contacted the major DERMS service providers with virtual and in person meetings
BYOT DR RFP and proposal evaluation	Multiple rounds of interviews and DERMS service provider selected
EM&V RFP for DR and proposal evaluation	Multiple rounds of interviews and EM&V service provider selected
Demand response program cost deferral filing	Filed with OPUC to defer costs associated with DR program development, implementation, and evaluation
BYOT DR SOW and contract negotiation and finalizing	Ongoing
DR EM&V SOW and contract negotiation and finalizing	Ongoing
BYOT program setup in DERMS and DR customer enrollment	Once contract with DERMS service vendor is finalized and approved
DR EM&V activities	Once contract with EM&V service vendor is finalized and approved

BYOT as GeoDR for distribution system planning

Staff Recommendation 5 from the 2022 IRP, recommended the following:

> *"Staff recommends the Commission acknowledge Action Item 3 for residential and commercial demand response subject to the condition that the Company includes in its demand response filing a discussion of how the Company's residential and commercial demand response program will interact with and support any future locational demand response program."*

Establishing a system-wide BYOT program is the first step to enable a geographically targeted BYOT program as a non-pipeline alternative for distribution system planning. Once the system-wide program is up and running, NW Natural can take targeted steps towards boosting BYOT enrollment in constrained areas. These targeted efforts could include:

- Targeted marketing of the BYOT program

- Increased enrollment incentives
- Increased participation incentives

Targeted efforts will be successful as a non-pipeline alternative if the targeted program can boost customer enrollment, increase participation during events, and increase retention of participants for customers located in constrained areas of our distribution system.

The number of eligible participants for targeted incentives will be relatively small in scale compared to the system-wide program. Therefore, the incremental costs of adding a targeted program should be relatively small. Since there are fixed setup costs associated with the DERMS platform and original equipment manufacturers (OEMs), a large-scale program is more likely to be cost-effective. Due to this scale imbalance between a system-wide program and a targeted program, the system-wide program is likely necessary for a targeted program to exist cost-effectively. NW Natural intends to evaluate a targeted BYOT program as non-pipeline alternative within the 3-year BYOT program contract once the system-wide program is established. More details on the **Geo**graphically targeted **D**emand **R**esponse (GeoDR) as a non-pipeline alternative are discussed in the next section on Distribution System Planning.

Behavioral GeoDR Proof-of-Concept

NW Natural ran a proof-of-concept effort from 2023 into 2024 that focused on a localized geographical demand response engagement in our Eugene area with a small subsection of our customer base. The Company partnered with a third-party vendor, Copper Labs, to enable our customers to see their current energy usage and receive notifications encouraging conservation during peak load times. Customers' usage data was available on both a customer app and a utility portal. Copper Lab's app allowed customers and NW Natural to see, in detail, their energy consumption patterns, peaks and valleys. The utility portal allowed NW Natural to send out notifications through the app during peak load times to customers encouraging them to reduce their usage.

The proof-of-concept ran for six months and proved out the concept that these kinds of devices and phone apps can work to engage our customers in demand response initiatives. Additional data, measurement, and verification is required to assess the impact of targeted behavioral demand response. NW Natural is also exploring other applications for these devices to compliment other demand response programs to help improve measurement and verification of demand reductions.

Distribution System Planning

System Reinforcement Standards

NW Natural's system reinforcement criteria establish thresholds in which traditional supply-side investments are required to maintain reliable service to customers. Non-pipeline alternatives can be implemented in advance to avoid or delay reaching these thresholds. NW Natural also

sets guideline criteria for system modeling to identify areas to be considered under investigation.

System Reinforcement Criteria:

- Exceeds system design capacity.
- High pressure or transmission pipeline systems experience or are modeled to have at least a 40% pressure drop.
- High pressure or transmission systems pressures do not satisfy required regulator inlet pressures to properly function.
- Class B pipeline systems (60 MAOP or less) experience or are modeled, to have pressures of 10 psig or less.

System Areas for Investigation Criteria:

- Approaching system design capacity.
- High pressure or transmission systems where incremental consumption may lead to a 40% pressure drop.
- Experience, and/or model, minimum Class B distribution pressures of 15 psig or less, or where incremental consumption may cause the distribution pressures to drop to 10 psig or less.

Forward Looking Plan

NW Natural has identified five areas on the Company's distribution system that do not currently violate system reinforcement criteria but are areas where the gas distribution system is either approaching these thresholds and/or is showing evidence of growth in demand that drive the need for a system reinforcement. Table 3 lists these areas and Appendix C provides the full detailed forward-looking plan.

Table 3: Areas for Investigation

Dallas Feeder
Creswell Feeder
Lebanon Feeder
Hillsboro Industrial District Feeder
McMinnville Feeder

In the past, distribution system planning was conducted as just-in-time planning, where traditional pipeline solutions were not developed until areas of the system became constrained. While this type of planning has long benefited customers, it does not allow for the lead time needed for non-pipeline alternatives. Forward-looking planning is necessary to evaluate and implement non-pipeline alternatives such as GeoDR and **Geo**graphically **T**argeted **E**nergy

Efficiency (GeoTEE), which could be cost-effective but build slowly over time. These options may delay or avoid the need for a traditional system reinforcement project. Now that they are identified, NW Natural will be evaluating non-pipeline options for these five areas and will discuss them in the next IRP.

GeoDR

GeoDR has the potential to be a resource to reduce peak demand, improve service reliability, and avoid or defer the need for distribution system expansion in areas where the distribution system capacity is constrained. As discussed in the System-wide Residential and Small Commercial Demand Response Program section, a system-wide BYOT program is the first step to enable a GeoDR BYOT program as a non-pipeline alternative for distribution system planning. Only 14 percent of single-family homes have a smart thermostat on average in the Northwest region[12] and other GeoDR options may be required to achieve peak load savings needed for the distribution capacity constrained areas. The other GeoDR options that are currently under assessment include:

(1) Behavioral demand response (BDR) could leverage the Copper Labs technology that has been concept-proved as described in the previous section.[13] When a BDR event is scheduled for a GeoDR area, the Company would send event notifications with energy saving tips through the Copper Labs' app 24 hours before the event to participating customers in that area, to encourage them to reduce their usage during the event period. Since participating customers' high-resolution energy usage data is recorded with the Copper Labs technology, incentives could be provided to the customers based on their event performance.

(2) Direct load control (DLC), with smart thermostats being the enabling technology, could leverage the same DERMS platform and resources set up for the system-wide BYOT program. This DLC offering could be made available to residential and small commercial customers in the GeoDR areas who do not currently have a smart thermostat, and therefore cannot enroll in the BYOT program. The Company could provide participants with an upfront incentive for the installation of the devices and a performance-based incentive for their participation in DR events by the end of each DR season. A DLC program works very similarly to a BYOT program by lowering the thermostat setpoint typically by two to four degrees.

[12] 2022 RBSA Findings Report: 2022-Residential-Building-Stock-Assessment.pdf (neea.org).

[13] Contracting with Bidgely, the Company is currently running a behavioral energy efficiency (BEE) program. Different from a behavioral GeoDR program that focuses on achieving peak hour load savings in distribution capacity constrained areas, the BEE program aims to help customers save energy system-wide and year-round.

GeoTEE

GeoTEE is a non-pipeline solution to distribution capacity constraints.[14] GeoTEE is specifically designed to achieve incremental peak hour savings from distinctive energy efficiency (EE) offerings to customers in a targeted area where the distribution system is expected to be constrained in the near future. GeoTEE is a non-pipeline alternative that can either delay or avoid a traditional supply-side project that would be required to serve growing localized peak demand. As detailed in the 2016 IRP, energy and load savings from GeoTEE can be obtained with (1) measures not currently being offered in other areas of the state or (2) by intensifying/accelerating the deployment of current measures available elsewhere through increased marketing or incentive offerings. Such a more intensified effort in a GeoTEE area can be economically justifiable because avoided costs in a constrained area of the system are higher than the state-wide average avoided costs used to evaluate the cost-effectiveness of the statewide programs.

With the OPUC's acknowledgement of the GeoTEE action item in Order No. 17-059 dated February 21, 2017,[15] on April 17, 2019, NW Natural filed an update to its 2018 Integrated Resource Plan that included its GeoTEE pilot filing. It also noted at that time that while the filing of the pilot was delayed, the actual pilot was still implemented as planned with a primary objective of:

> *Developing the data and ability needed to construct a peak hour energy efficiency supply curve for any given geographic area so that it can be compared for cost-effectiveness against other distribution system capacity options.*[16]

To achieve the objective, the pilot was conducted in Cottage Grove and Creswell, Oregon in three sequential implementation phases, with Phase One featuring increased marketing and outreach, Phase Two increased incentives and new delivery but still within the current cost-effective parameters, and Phase Three incentives increased even further by applying representative local avoided costs values for cost effectiveness screening. Upon completion of the three implementation phases, project reporting and evaluation began. The phases and timing are shown in Figure 1.

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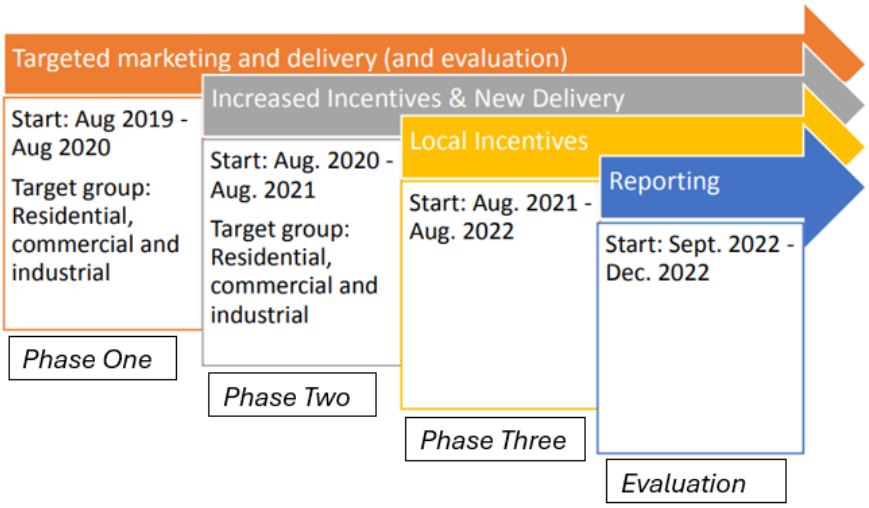
[14] Please refer to NW Natural's 2016 IRP, Chapter 6, Section 7, for an early initiative on geographically targeted demand side management (DSM) as a non-pipeline alternative to address weaknesses in the NW Natural gas distribution system (https://www.nwnatural.com/about-us/rates-and-regulations/resource-planning), and the 2022 IRP, Chapter 8, Section GeoTEE for a more recent update, lc79haa174551.pdf (state.or.us).

[15] The Washington Utilities and Transportation Commission does not acknowledge specific action plans but did acknowledge that NW Natural's 2016 IRP compliance with WAC 480-90-238 in their letter dated December 19, 2016.

[16] 2018 IRP Update filing, see https://edocs.puc.state.or.us/efdocs/HAH/lc71hah134047.pdf.

Figure 1: GeoTEE Phases and Timing



The three phases of the GeoTEE pilot were carried out as scheduled and concluded by the summer of 2022. Upon completion of each of the three phases of the pilot, Energy Trust, the implementor of the GeoTEE pilot, provided NW Natural with a phase summary report along with an Excel data file detailing the specific energy efficiency measures installed and incentives paid to the individual customers enrolled in that phase of the pilot. The summary reports by Energy Trust provide phase-level statistics including measure counts by measure group, project gross therm savings and calculated peak hour therm savings by sector (residential vs. commercial), incentives by measure group and sector, etc. After the completion of Phase Three of the GeoTEE pilot, Energy Trust contracted Apex Analytics to conduct a process evaluation of Phase Three, and to provide a Phase Three summary report to NW Natural.[17] Apex Analytics concluded that the pilot generated the data needed to accomplish what NW Natural's 2018 IRP Update describes as its primary objective, developing a peak hour energy efficiency supply curve to compare the cost-effectiveness of targeted energy efficiency against other system capacity options for any geography. The experience of this pilot helped to prepare both organizations for future geographically targeted efforts.

It is worth noting that the annual gross and peak hour therm savings reported by Energy Trust are the pre-determined deemed savings estimates, which are estimated based on standardized assumptions.[18] Such estimates are useful for energy efficiency program planning, however, they are not sufficient for distribution system planning. For distribution system planning, the realized savings are needed, which can be measured and verified using an EM&V approach and therm usage data collected from the pilot areas before and after the implementation of the pilot.

[17] For the final evaluation report: Geographically Targeted Energy Efficiency (GeoTEE) Phase Three Process Evaluation - Energy Trust of Oregon.

[18] Peak hour therms are calculated using peak hour factors NW Natural developed by end-use based on system-wide data and are detailed in the 2018 and 2022 IRPs.

Measured and verified savings are critical for distribution system planning as there is minimal flexibility to meet peak demand in constrained areas on our distribution system during the coldest days when consequences of gas outages are the greatest.

It is also important to note that observations during cold weather days are required to estimate the peak hour impacts. Therefore, with the passage of two winter seasons after the completion of the GeoTEE pilot (i.e., November 2022 – March 2023 and November 2023 – March 2024), in April 2024, the NW Natural IRP team downloaded the hourly load data at the city gates of Cottage Grove and Creswell from January 1, 2009 to March 31, 2024. The hourly load data at the city gates of the pilot areas is arguably the most desirable because load data at this time resolution enables a direct measure of the aggregate peak hour therm savings that were achieved by the pilot in these two pilot areas. NW Natural developed an econometric model and used the hourly load and temperature data to estimate the realized peak hour load reduction achieved by the GeoTEE pilot. Detailed model specification and estimation results are presented in Appendix B GeoTEE Pilot Project Update and indicate two separate findings for each town.

For the Cottage Grove area, the results suggest that under design peak hour weather conditions, the GeoTEE pilot reduced peak hour demand considerably more than the pre-determined deemed savings estimates found in the summary phase reports. However, for the Creswell area, the potential peak hour therm savings are unable to be measured and verified using the same model and the hourly load data collected in the Creswell area. This is likely because the peak hour therm savings achieved by the GeoTEE pilot are too minimal relative to the peak load to be econometrically detected in this area.[19] This statistical analysis concludes that Cottage Grove saw more savings than the calculated pre-determined peak savings, whereas, Creswell did not have measurable results.

Having a null result in the Creswell area still provides useful information about GeoTEE as a non-pipeline solution. The contrast between these two areas demonstrates the large uncertainty associated with GeoTEE efforts regarding whether they can provide a firm reduction in demand for a localized area. This uncertainty underscores the need for best available measurement and verification methods for any area where GeoTEE is implemented as a non-pipeline alternative to ensure reliable service is still being supplied to an area. Pressure recordings and cold weather monitoring of constrained areas will be critical to measuring the success of GeoTEE and other demand-side efforts to reduce or shift peak hour demand.

Finally, it is worth mentioning that GeoTEE is complementary to the GeoDR effort discussed earlier. NW Natural will work with Energy Trust to develop cost projections and estimated technical and achievable potential for peak hour therms that can be saved by GeoTEE for the distribution capacity constrained areas as identified in the Forward-Looking Plan.

[19] The pre-determined deemed peak hour therm savings of the GeoTEE pilot are 4 therms for Creswell per Energy Trust's phase reports, only 0.7 percent of the maximum hourly load of 621 therms recorded in the area.

Compressed Natural Gas (CNG) and Liquified Natural Gas (LNG) Trailers and Satellite LNG

The Company is in the process of onboarding an engineering consulting firm to prepare a study for satellite and trucking of CNG and LNG supply. A purpose of this study is to inform the Company at which threshold satellite or trucking of CNG and LNG could be feasible for our system as a supply-side non-pipeline alternative.

Distribution System Cold Day Contingency Planning

Targeted customer load curtailments (a.k.a. targeted interruptions) for customers on interruptible service rates is a demand-side management strategy (i.e., demand response) to decrease load in targeted areas on the distribution system. A targeted demand response option aims to reduce demand from interruptible customers during times of high demand to improve system reliability to firm service customers.

The system modeling team at NW Natural is responsible for issuing a targeted demand response event to interrupt natural gas service to targeted interruptible customers. This targeted demand response option includes both interruptible sales and interruptible transportation customers who receive a discounted rate of service for being on these interruptible rates. Targeted interruptions will commonly be associated with extremely cold weather; however, the system modeling team may issue targeted customer interruptions for reasons other than cold weather (e.g., force majeure events or planned maintenance).

Prior to each heating season, the system modeling team develops a localized peak load management plan for areas of concern to determine the Heating Degree Day (HDD) threshold for which targeted customer interruptions are necessary to avoid low pressures in a given load center. Utilizing Synergi Gas, the system modeling team models cold weather scenarios to identify unique HDD thresholds for each load center to identify the HDD when the system cannot maintain adequate pressure to reliably serve firm core customers. The HDD thresholds for Load Centers may be modified each year based on the following:

1. New customers or customers detaching from the local distribution system
2. Construction of localized system reinforcements
3. Abandonment of facilities
4. Maximum Allowable Operating Pressure (MAOP) changes
5. Customer rate schedule transitions
6. Recorded pressure data exposes new information regarding system health
7. Additional demand side management strategies

The system modeling team will track the 7-day weather forecast for every load center to identify potential pressure concerns before an expected cold weather event. Targeted interruptions will be implemented if the day-ahead forecasts meet or exceed the specified HDD threshold identified in the localized peak load management plan.

Mist Compression Project

NW Natural plans to replace the GC500 turbine compressor unit (GC500) in 2025 and the GC600 turbine compressor unit (GC600) in 2026. The Company will replace the GC500 unit first because it is the older unit and will use the GC600 unit to support injection operations during this time. During the next injection season (2026), the Company will replace the GC600 unit and will use the replacement GC500 unit to support operations during this time.

The existing compressor units have exceeded their operational lives, are no longer supported by the OEM, and failures and outages are occurring more frequently. NW Natural also experienced five record setting Mist withdrawal gas delivery days during severe winter weather in January 2024, further highlighting the need for reliable natural gas storage to serve our customers.

On March 15, 2024, NW Natural filed an application to amend its current site certificate to allow for the replacement of the compressor units. Due to NW Natural's commitment to expediting this project and the need to complete this project as expeditiously as possible, NW Natural has already procured the GC500 compressor replacement and performed the final engineering in advance of site certificate approval. The replacement GC500 compressor will not be installed until the site certificate is approved.

Until the replacement compressor units are installed, NW Natural will rely on spare compressor units that it has acquired. Given the long lead-time of acquiring replacement compressors, including receiving approval for their installation, these spare units are crucial in ensuring the immediate reliability of Mist, but are not a lasting solution. As stated above, the OEM no longer supports the existing units and they have already exceeded their operational lives. Therefore, the existing GC500 and GC600 units must be replaced to maintain Mist storage reliability for NW Natural customers and the region.

RNG Procurement

2024 Request For Proposals (RFP) RNG Procurement

The RFP issued on March 29, 2024, was for offtake opportunities only (RNG and green hydrogen), the same scope as the 2023 RFP. Short-listed respondents were notified in early June and the NW Natural team is currently evaluating those proposals. Table 4 summarizes the 2024 RFP responses.

Table 4: 2024 RFP Response Summary

Total Responses	53
Weighted Average Contract Term[20]	13 years
Average Annual Volume of Resource	715,000 Dth/year

[20] Contract terms are weighted by average annual volume.

Bundled vs. Unbundled[21]	38% / 62%
Total Average Annual Volumes	37,970,000 Dth/year
Total Volume	491,690,000 Dth

RFP proposals in the past were scored on various categories and had a risk-adjusted calculated incremental cost. Proposals outside of the RFP were not scored by category but also had a risk-adjusted incremental cost calculated.

As the RNG market matures, potential RNG opportunities are increasingly brought forward to NW Natural by vendors the NW Natural team has communicated with in the past while the RFP often attracts companies that are relatively new to the industry. For these reasons, NW Natural evaluates potential resources that result from the RFP process and compares them to other available opportunities identified outside of the RFP process. In addition, NW Natural evaluates both offtake and development opportunities throughout the year outside of the RFP evaluation window.

In the 2024 RFP, the scoring categories were eliminated, and a risk-adjusted incremental cost was calculated for each individual proposal. Risks may include bidder experience, maturity of project, volume variability and contract remedies. This process mirrors the evaluation of available resources identified outside of the RFP.

The availability of RNG continues to increase. In 2022, the RNG market grew by 20% and the number of RNG projects doubled in the last five years. In 2023, the American Biogas Council (ABC) estimates that the market grew again, with over 60 new projects coming online and biogas producers investing about $1.8 billion. For 2024, the ABC expects the market to grow by 10–40%, likely closer to the higher end of that range.

Opportunity Portfolio Evaluation

NW Natural maintains a portfolio of available opportunities that is updated when opportunities are identified, rejected, or updated. The portfolio maintains and updates the incremental cost estimates for potential resources, which allows the NW Natural team to evaluate the combination of costs and risks for varying opportunities. Based on the incremental cost estimates, assessed risk, and the volumes needed, opportunities are prioritized and pursued for the benefit of our customers.

Although the incremental cost model incorporates a risk assessment, as noted in the section above, the NW Natural team uses an additional risk scoring mechanism, similar to that used in previous RFPs. This additional scoring is beneficial for the evaluation of offtake opportunities and creates more consistency for the risk assessment across opportunities.

[21] A bundled product consists of both the Renewable Thermal Certificates (RTCs) as well as the gas commodity while an unbundled product is the RTCs only.

An additional risk scoring mechanism is currently being developed. Draft risk categories include financial, constructability, counterparty risk, marketability, contract remedies, interconnect/feedstock/gas rights, and bidder experience. Each category will be scored based on the refined criteria to arrive at a total risk score. This score will be considered along with the results of the incremental cost model to identify those offtakes that will provide the greatest benefit to customers.

RNG Evaluation Methodology

OPUC docket UM 2030 outlined NW Natural's methodology to evaluate the cost-effectiveness of low-carbon gas supply resources based on the all-in costs to serve energy. NW Natural has been using this methodology to evaluate the incremental cost of potential resources and as the Company has gained experience, improvements have been made to the methodology and the tool. NW Natural is updating the avoided costs in the model on an annual basis to stay current with infrastructure, commodity costs, and environmental compliance data. In addition, NW Natural has incorporated a scenario analysis tool to look at scenario parameters that are beyond the limitations of the risk modeling parameters. NW Natural is also working on a new version of the incremental cost model which breaks out the main types of projects (e.g., on system bundled resource) in order to simplify many of the inputs, functions, and outputs of the model.

Volumetric Targets

The 2022 IRP outlined the Company's long-term plan to procure RNG to meet the voluntary targets specified in SB 98 legislation. Specifically, the quantity of RNG procurement for 2024 and 2025 to meet SB 98 targets was outlined by Action Item #5. At the time of the 2022 IRP deliberation, the CPP was still in effect and Action Item #5 was not acknowledged by the OPUC. Given the Commission's decision to not acknowledge the action item and the ongoing uncertainty of compliance with a DEQ program intended to reduce emissions, NW Natural slowed its RNG procurement. The Company does not expect to achieve the voluntary target of 5% outlined in SB 98 by the end of 2024. The risk from policy and regulatory uncertainty, and not RNG availability, has limited NW Natural's efforts to making faster progress toward Oregon's SB 98 RNG voluntary targets. RNG availability continues to grow throughout the country and NW Natural is still engaging in these markets.

Hydrogen Overview

Low-carbon hydrogen is gaining attention as a crucial component of efforts to decarbonize various sectors such as transportation, industry, and heating. There are several sources of low-carbon hydrogen, each with its own production method and associated costs. These include green hydrogen, blue hydrogen, pink hydrogen, and turquoise hydrogen.

1. **Green Hydrogen**: Produced through the process of electrolysis, using renewable energy sources such as wind or solar power to split water into hydrogen and oxygen. Green hydrogen is considered the most environmentally friendly option as it produces zero

carbon emissions during production. However, it currently tends to be more expensive than other forms of hydrogen due to the high cost of renewable energy sources.

2. **Blue Hydrogen**: Produced through a process called steam methane reforming (SMR) or autothermal reforming (ATR) coupled with carbon capture and storage (CCS). This process captures the carbon emissions produced during hydrogen production, effectively reducing the carbon footprint of the hydrogen. Blue hydrogen is often more cost-effective than green hydrogen, but the cost largely depends on the availability and cost of carbon capture and storage infrastructure.
3. **Pink Hydrogen**: Produced through a combination of electrolysis and nuclear power. This method utilizes nuclear energy to power electrolysis, producing hydrogen with minimal carbon emissions. Pink hydrogen has the potential to be cost-competitive with blue hydrogen, but its widespread adoption depends on the acceptance and expansion of nuclear power generation.
4. **Turquoise Hydrogen**: Produced through the pyrolysis of methane[22] coupled with CCS. Similar to blue hydrogen, turquoise hydrogen captures and stores the carbon emissions generated during production in the form of solid carbon. This method has the advantage of utilizing existing natural gas infrastructure and does not require CO2 sequestration geology, potentially making it more cost-effective and nimbler than other forms of low-carbon hydrogen.

In the Pacific Northwest, the costs of these different sources of low-carbon hydrogen can vary depending on factors such as renewable energy availability, carbon capture infrastructure, and regulatory policies. Currently, green hydrogen tends to be more expensive due to the region's relatively high cost of firm electricity compared to other regions in the country (e.g., ERCOT). Although the region does enjoy some of the lowest electricity costs in the nation, it is still too high to make green hydrogen competitive with conventional natural gas and other forms of hydrogen in most applications. Curtailed electricity generation may enable lower costs in the future if it is coupled with lower cost electrolyzers and adequate transmission capacity. Curtailed generation from hydroelectric facilities varies from year to year and wind and solar generation is increasing but is also variable. Lower cost electrolyzers are needed to address the lower utilization factors that are inevitable with these variable generation sources.

Blue and turquoise hydrogen may be more feasible options given the existing natural gas infrastructure and potential for carbon capture projects in the area. In the United States, the lowest cost areas for low-carbon hydrogen production are typically regions with abundant

[22] Methane Pyrolysis is a process where methane (a gas found in natural gas) is heated up. This makes the methane breaks apart into two things:

1. Hydrogen gas (H_2): This can be used in fuel cells or to power things like cars.
2. Solid carbon ©: Think of this like charcoal

Using methane pyrolysis, one can make hydrogen without releasing carbon dioxide (CO_2) into the air.

renewable energy resources or existing natural gas infrastructure suitable for CCS projects. For example, states like Texas and California have significant potential for both green and blue hydrogen production due to their ample renewable energy capacity and established oil and gas infrastructure.

Gas utilities across the country are increasingly looking to integrate hydrogen into their decarbonization plans, recognizing its potential to reduce carbon emissions in sectors traditionally reliant on natural gas. Blending trials are underway to assess the feasibility of blending hydrogen into existing gas networks, with some utilities aiming for system-wide blending of up to 20% hydrogen by volume. 100% hydrogen dedicated systems are also being explored for industrial processes that are hard to electrify. Additionally, utilities are exploring opportunities for "book and claim" arrangements, where they purchase hydrogen produced from renewable sources to offset their carbon footprint. The U.S. Department of Energy's (DOE) hydrogen hubs initiative aims to drive down the costs of hydrogen production and increase its availability through research, development, and deployment efforts. These hubs are expected to play a crucial role in advancing low-carbon hydrogen technologies and infrastructure, ultimately making hydrogen more competitive with other low-carbon gas resources such as renewable natural gas (RNG).

Appendix A- Public Engagement Features

Table A. 1: 2025 IRP Public Engagement Process Features

Feature	Description	Change from previous IRP
Dedicated Resource Planning Webpage	Contains past and present IRPs, workshop details, archived materials, and contact info. The Company is actively reviewing and amending these tools to be more accessible and informative.	Enhanced
Dedicated Contact	The IRP team can be contacted directly via IRP@nwnatural.com. Email is also utilized to send out IRP related announcements and activities.	No change
Feedback Form and Summary Report	Implementing a more standardized approach to collecting and responding to feedback. This form will be available to all stakeholders. Feedback will be made available to the public via a summary report.	New
Open House Workshop	Serves as an IRP 101 for the 2025 IRP, introducing the IRP team and process to stakeholders. Open to all.	Enhanced
IRP Fairs Community Events	In-person events with subject matter experts at tables for stakeholders to explore at their own pace, focusing on resource planning information and education. Open to the public- family friendly. The concept of the IRP Fair received very positive feedback from the CEAG to replace the previously hosted meeting for the public.	New
Community Webinars – *Exploring Energy Planning*	Series of webinars which are intended to explore IRP topics at a more general level and be more accessible to those without technical expertise in resource planning. These will be interspersed into the traditionally held Technical Working Groups (TWGs) series schedule. To be facilitated by a third-party.	New
Technical Working Groups (TWGs)	Modified structure with 12, 3-hour sessions focused on technical content and discussion. Application process to be employed to facilitate necessary technical discussion with room to be made available for observers. To be facilitated by a third-party.	Enhanced
TWG Participant Application	The Company will work with an independent third-party to determine the appropriate mix of expertise, group size, and application process. The selected applicants	New

Feature	Description	Change from previous IRP
	collectively will be known as the technical working group advisors.	
Workpapers Workshop	Workshop to be held once the IRP and workpapers are filed with the Commission. Open to all stakeholders. This workshop was first featured in the 2022 IRP process and was appreciated greatly by stakeholders.	No change
IRP Office Hours	NW Natural will host open office hours, as needed, during the IRP process.	No change
Outreach for Commission-led Process(es)	NW Natural will include outreach to provide information on how and/or when to get involved in the Commission-led part of the IRP process.	New

Appendix B – GeoTEE Pilot Project Update

Background

GeoTEE stands for **Geo**graphically **T**argeted **E**nergy **E**fficiency and is a non-pipeline solution to distribution capacity constraints.[1] GeoTEE is specifically designed to achieve incremental peak hour savings from distinctive energy efficiency offerings to customers in a targeted area where the distribution system is expected to be constrained in the near future. GeoTEE is a non-pipeline alternative that can either delay or avoid a traditional supply-side project that would be required to serve growing localized peak demand. As detailed in the 2016 IRP, energy and load savings from GeoTEE can be obtained with (1) measures not currently being offered in other areas of the state or (2) by intensifying/accelerating the deployment of current measures available elsewhere through increased marketing or incentive offerings. Such a more intensified effort in a GeoTEE area can be economically justifiable because avoided costs in a constrained area of the system are higher than the state-wide average avoided cost used to evaluate the cost-effectiveness of the statewide programs.

Therefore, as part of our 2016 IRP, NW Natural proposed the following action item:

> *Work with Energy Trust of Oregon to further scope a geographically targeted DSM pilot via accelerated and/or enhanced offerings ("Targeted DSM" pilot) to measure and quantify the potential of demand-side resources to cost-effectively avoid/delay gas distribution system reinforcement projects in a timely manner and make a Targeted DSM pilot filing with the Oregon Public Utility Commission in late 2017 or early 2018.*

The Public Utility Commission of Oregon (OPUC) acknowledged this item in Order No. 17-059 dated February 21, 2017.[2]

On April 17, 2019, NW Natural filed an update to its 2018 Integrated Resource Plan[3] that included its GeoTEE pilot filing. It also noted at that time that while the filing of the pilot was delayed, the actual pilot was still implemented as planned with a primary objective of:

(1) Developing the data and ability needed to construct a peak hour energy efficiency supply curve for any given geographic area so that it can be compared for cost-effectiveness against other distribution system capacity options.

To achieve the objective the pilot was being conducted in Cottage Grove and Creswell, Oregon in three sequential implementation phases, with Phase One featuring increased marketing and

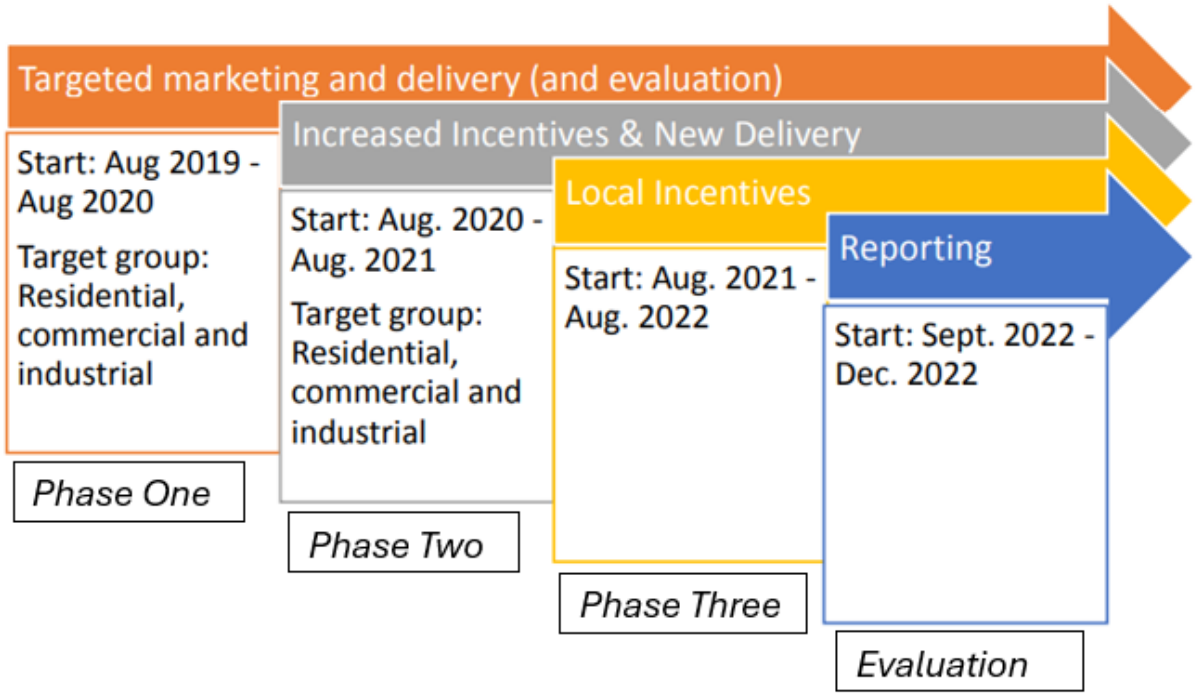
[1] Please refer to NW Natural's 2016 IRP, Chapter 6, Section 7, for an early initiative on geographically targeted demand side management (DSM) as a non-pipeline alternative to address weaknesses in the NW Natural gas distribution system (https://www.nwnatural.com/about-us/rates-and-regulations/resource-planning), and the 2022 IRP, Chapter 8, Section GeoTEE for a more recent update, lc79haa174551.pdf (state.or.us).

[2] The Washington Utility and Transportation Commission does not acknowledge specific action plans but did acknowledge that NW Natural's 2016 IRP compliance with WAC 480-90-238in their letter dated December 19, 2016.

[3] For the 2018 update filing, see https://edocs.puc.state.or.us/efdocs/HAH/lc71hah134047.pdf.

outreach, Phase Two increased incentives and new delivery but still within the current cost-effective parameters, and Phase Three incentives increased even further by applying local avoided costs values for cost effectiveness screening. Upon completion of the three above implementation phases, project reporting and evaluation were followed. The phases and timing are shown in Figure B.1:

Figure B. 1: GeoTEE Phases and Timing



The three phases of the GeoTEE pilot were carried out as scheduled and concluded by the summer of 2022. Energy Trust completed reports on measure adoption in the pilot areas after each of the three phases. In addition to measure adoption, NW Natural collected both monthly billing data from customers in the pilot area along with hourly aggregate flow into the pilot area to estimate the impact of GeoTEE efforts. It is important to note that observations during cold weather days are required to estimate the peak hour impacts. Therefore, the results presented in section 3 were recently completed in the spring of 2024 to leverage load data from two full winter seasons post GeoTEE implementation.

Evaluation and Reporting by Energy Trust of Oregon

Upon completion of each of the three phases of the pilot, Energy Trust of Oregon (Energy Trust), the implementor of the GeoTEE pilot, would provide NW Natural with a phase summary report along with an Excel data file detailing the specific energy efficiency measures installed and incentives paid to the individual customers enrolled in that phase of the pilot. The summary report provides phase-level statistics including measure counts by measure group, project gross therm savings and calculated peak hour therm savings by sector (residential vs. commercial), incentives by measure group and sector, etc. The gross and peak hour therm savings achieved in

each phase were also compared to corresponding baseline savings, which represent an average of savings and projects during the five years preceding the pilot period, to check if the enhanced GeoTEE efforts delivered a higher than baseline level of savings. Note that the project gross and peak hour demand therm savings provided by Energy Trust in its phase summary reports as well as the support Excel data files were pre-determined deemed savings estimates through an ex-ante process that estimates the potential energy savings for each specific EE measure before it is installed based on predictions of typical operating conditions and baseline usage. Such estimates are usually obtained from engineering estimation and compared to a baseline standard through Energy Trust's measure approval documentation. Additional measurement and verification (M&V) approach based on the before and after installation can help confirm or update the estimated therms saved using energy usage data.

After the completion of Phase Three of the GeoTEE pilot, in addition to a Phase Three summary report to NW Natural, Energy Trust contracted Apex Analytics to conduct a process evaluation of the Phase Three of the GeoTEE pilot.[4] Apex Analytics completed the evaluation with a final evaluation report submitted to Energy Trust and NW Natural on June 5, 2023. Apex Analytics' evaluation activities included: 1) review of the documents related to the pilot design and outcomes; 2) interviews with staff members of Energy Trust, NW Natural, program management contractors, and trade allies involved in the pilot design and delivery; and 3) analysis of the measure uptake and therm savings data tracked by Energy Trust in the pilot areas from 2015 to 2022. Apex Analytics confirmed that the pilot increased uptake of gas efficiency measures in the pilot areas and achieved peak therm savings in the pilot areas in all three phases relative to the average of the prior five years in pilot areas, with residential retrofits driving the bulk of these savings. Apex Analytics concluded that the pilot generated the data needed to accomplish what NW Natural's 2018 IRP update describes as its primary objective, developing a peak hour energy efficiency supply curve to compare the cost-effectiveness of targeted energy efficiency against other system capacity options for any geography and the experience of this pilot helped to prepare both organizations for future geographically targeted efforts.

Table B.1 summarizes the peak hour therm savings, annual gross therm savings, and total costs by phase and area of the pilot.[5] Table B.2 provides the pre-determined deemed annual and peak hour therm savings by measure and pilot phase used by Energy Trust to estimate the savings as reported in Table B.1.

[4] For the final evaluation report: Geographically Targeted Energy Efficiency (GeoTEE) Phase Three Process Evaluation - Energy Trust of Oregon.

[5] Energy Trust tracked the incentives paid by pilot area per phase but not the total costs per phase. The total costs reported in Table B.1 by pilot area were obtained by multiplying the percentage of incentive spend in total incentives per phase in an area with the total expenditures for the phase, which gave the cost allocation by area per phase.

Table B. 1: GeoTEE Summary Statistics[6]

	Cottage Grove			Creswell		
	Peak Hour Therm Savings	Annual Gross Therm Savings	Total Costs	Peak Hour Therm Savings	Annual Gross Therm Savings	Total Costs
Phase 1	1.08	2,218.54	$130,707.65	0.18	268.01	$17,273.35
Phase 2	10.85	10,870.83	$116,795.14	1.24	1,265.04	$45,134.86
Phase 3	7.54	7,256.00	$260,534.48	2.71	2,714.55	$148,555.52
Total	**19.47**	20345.37	$508,037.27	4.14	4247.60	$210,963.73

Table B. 2: Pilot Area Savings by Measure and Phase[7]

Sector	Measure Type	Phase 1		Phase 2		Phase 3	
		Annual Gross Therms	Peak Hour Therms	Annual Gross Therms	Peak Hour Therms	Annual Gross Therms	Peak Hour Therms
Commercial	Ceiling insulation	0	0.00	0	0.00	1914	2.35
	Custom insulation	0	0.00	6,055	7.45	0	0.00
	Gas furnace	0	0.00	0	0.00	232	0.29
	Tanked water heater	0	0.00	1,036	0.27	0	0.00
	Food equipment	1,047	0.12	481	0.05	388	0.04
	Faucet aerator	0	0.00	306	0.08	0	0.00
	Custom Operations & Maintenance	0	0.00	0	0.00	194	0.24
Residential	Ceiling insulation	0	0.00	206	0.21	323	0.33
	Floor insulation	0	0.00	0	0.00	137	0.14
	Windows	231	0.24	203	0.21	309	0.32
	Gas furnace	346	0.35	2,411	2.46	5,854	5.97
	Gas fireplace	627	0.32	200	0.10	109	0.06

[6] Data source: detailed phase reports in Excel files provided by Energy Trust.
[7] Data source: detailed by phase measure data in Excel files provided by Energy Trust.

	Thermostat	213	0.22	1,233	1.26	79	0.08
	Clothes washer	5	0.00	5	0.00	0	0.00

Evaluation Effort by NW Natural

As pointed out earlier on, the annual gross and peak hour therm savings reported by Energy Trust and summarized in the previous section are the pre-determined deemed savings estimates, which are estimated based on standardized assumptions and useful for energy efficiency program planning but the realized savings can be measured and verified using an M&V approach and therm usage data collected from the pilot areas before and after the implementation of the pilot. Measured and verified savings are critical for distribution system planning as there is minimal flexibility to meet peak demand in constrained areas on our distribution system during the coldest days when consequences of gas outages are the greatest.

With the passage of two winter seasons after the completion of the GeoTEE pilot (i.e., November 2022 – March 2023 and November 2023 – March 2024), in April 2024, the NW Natural IRP team downloaded the hourly load data at the citygates of Cottage Grove and Crewell from January 1, 2009 to March 31, 2024.[8] Recall that the primary objective of the GeoTEE pilot is to develop data and ability to evaluate DSM programs as a non-pipeline solution in comparison with the conventional engineering distribution system capacity options and therefore, how much therms saved at the peak hour and at what cost are two key indicators to measure the effectiveness of such geographically targeted DSM efforts. For this purpose, the hourly load data at the citygates of the pilot areas seem to be most desirable because load data at this time resolution provide a possibility to directly measure the aggregate peak hour therm savings that were achieved by the pilot in these two pilot areas.

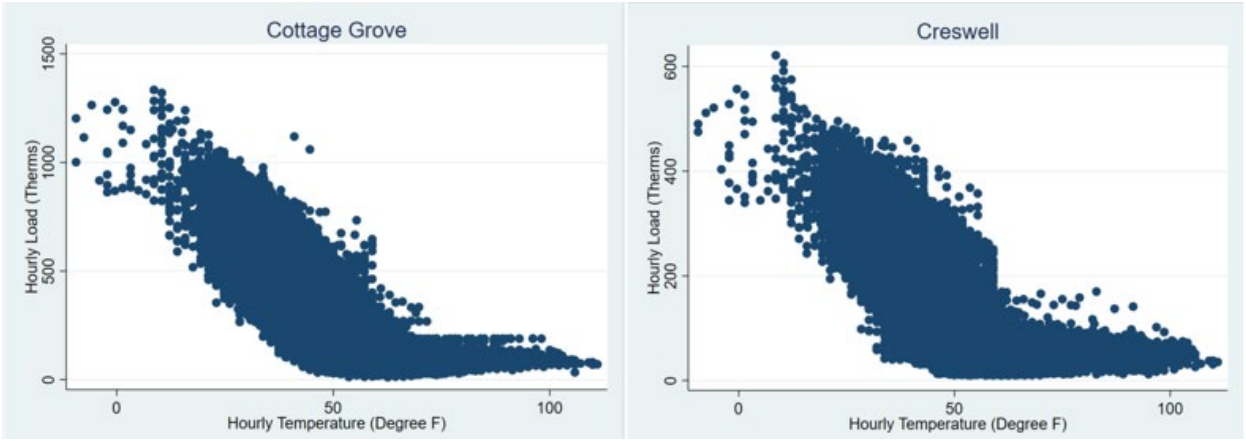
Table 3 presents some high-level summary statistics of the data on hourly firm sales load, temperature, and customer counts by sector in the Cottage Grove and Creswell pilot areas. while the graphs in Figure B.2 depicts the hourly load and temperature relationship from January 2009 to March 2024 for the two areas, respectively. It can be seen from the Table 3 that residential customers account for around 90 percent of the total customers in the pilot areas with the remaining mostly being commercial customers. With such a customer composition, as shown in Figure B.2, it is not surprising that hourly loads in the pilot areas are highly temperature-driven, exhibiting a clear and negative linear relationship with temperature.

[8] Note that the existing metering system deployed by NW Natural does not support hourly therm usage data collection at the customer premise level, although since 2013, NW Natural has gradually installed encoder receiver transmitters (ERT) to collect customers' daily therm usage data in its service territory. But to date, ERT devices have been installed to only about 40 percent of the NW Natural customers. Conventional monthly billing data collected from individual GeoTEE participating customers would make an M&V evaluation for peak hour savings more methodologically challenging, if not impossible.

Table B. 3: Summary Statistics of Hourly Load, Temperature and Customer Counts[9]

Variables	Cottage Grove			Creswell		
	Mean	Min	Max	Mean	Min	Max
Hourly Load, therms	265.2	11.5	1,334.2	120.2	10.0	621.4
Hourly Temp, °F	53.2	-9.4	111	53.1	-9.4	111
Res Customers, #	2,244.6	2,131	2,348	1,187.9	1,088	1,308
Com Customers, #	309.3	297	325	109.5	96	127
Ind Customers, #	3.0	2	4	1	1	1
Total Customers, #	2,557.1	2,434	2,664	1,298.4	1,192	1,432
# of Observations	133,014			129,045		

Figure B. 2: Hourly Firm Sales Load and Temperature



As reported in Table B.2, the annual gross and calculated peak hour therm savings from energy efficiency measures installed via the GeoTEE pilot are mostly temperature dependent and achieved during the winter season when space heating is needed.[10] Therefore, the potential impact of the GeoTEE pilot on the hourly load and temperature relationship is illustrated in Figure B.3: before the pilot, the hourly load and temperature relationship can be described as

$$Load = a + b*Temperature,$$

while after the pilot,

$$Load = c + d*Temperature,$$

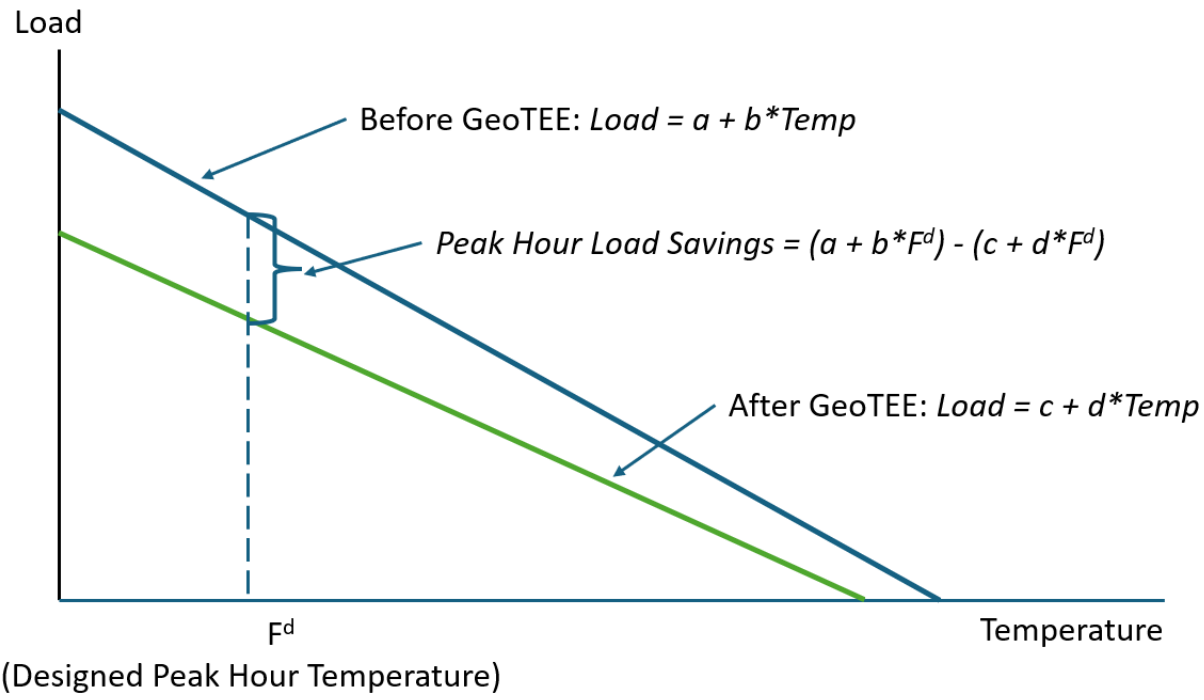
where a > c (a higher intercept term before the pilot) and b < c (a steeper slope before the pilot).

[9] Outliers in the load data due to power outages or bad meter events have been removed from the dataset.
[10] Therm savings from faucet aerators and clothes washers can be achieved year-round but these savings are only a neglectable fraction of the total therm savings at the pilot level.

Peak hour load savings can be obtained from the difference between the two load-temperature lines at the designed peak load hour temperature (F^d) as shown in Figure B.3:

$$\textit{Peak Hour Load Savings} = (a + b*F^d) - (c + d*F^d).$$

Figure B. 3: Potential GeoTEE Impact on Load and Temperature Relationship



To estimate the load and temperature relationship before and after the pilot as depicted in Figure B.3, we use the time series data on hourly load and temperature in the pilot areas described in Table B.3. A dummy variable econometric model allows for different intercepts and slopes pre and post the GeoTEE pilot is specified as follows:

$$Load_t = (\alpha + \delta_1 \times GeoTEE) + (\beta_1 + \delta_2 \times GeoTEE) \times Temp_t + \beta_2 \times Trend_t + \beta_3 \times Covid + \mu_t$$

where,

- $Load_t$ denotes firm sales hourly load at hour t, therms;
- *GeoTEE* denotes the GeoTEE dummy variable, which is constructed to take a value between 0 and 1 to reflect the GeoTEE effort intensity based on the pre-determined deemed savings at each phase of the pilot. For instance, this GeoTEE dummy for Cottage Grove is defined as:

$$GeoTEE = \begin{cases} 0, \ before\ GeoTEE\ pilot; \\ 0.03, during\ Phase\ 1; \\ 0.33, during\ Phase\ 2; \\ 0.81, during\ Phase\ 3; and \\ 1, \ \ after\ Phase\ 3. \end{cases}$$

- $Temp_t$ denotes hourly temperature at hour *t*, F degrees;
- $Trend_t$ denotes a time trend variable at hour *t* to capture the effect of variables not being controlled for in the model on hourly load such as customer count and energy usage behavior changes over time;
- *Covid* denotes the Covid19 dummy variable, which is constructed to take a value between 0 and 1 to reflect the severity of the Covid19 pandemic on load due to work and life activity changes based on the severity of the pandemic:

$$Covid = \begin{cases} 0, before\ Covid19\ pandemic\ breakout, March\ 12, 2020; \\ 1, Covid\ severe\ period: March\ 12, 2020 - June\ 30, 2021; \\ 0.5, Covid\ less\ severe\ period: July\ 1, 2021 - Dec.\ 31, 2021; and \\ 0.2, \ \ Covid\ persistent\ impact\ period\ after\ Jan.\ 1, 2022. \end{cases}$$

- α and δ_1 are intercept parameters to be estimated;

  β_1, β_2, β_3, and δ_2 are slope parameters to be estimated;

- μ_t is the error term.

Using the hourly load and temperature data collected from Cottage Grove and Creswell, the model is estimated separately for the two pilot areas. As shown in Figure B.2, the down slope relationship between load and temperature clearly exists when temperature is low and space heating is needed. Therefore, observations with a daily every temperature of 55 F degrees or lower are used to estimate the model, generating 54,562 observations for Cottage Grove and 53,455 for Creswell, respectively. The estimation results for Cottage Grove are reported in Table B.4.

Table B. 4: Model Estimation Results for Cottage Grove

Coefficient	Variable	Coeff Estimate	Std. Error	t Statistic	P> |t|
α	Intercept	1010.38	3.61	280.07	0.000
δ_1	GeoTEE Dummy	-37.26	7.88	-4.73	0.000
β_1	Temperature	-13.95	0.08	-185.77	0.000
δ_2	GeoTEE Dummy and Temperature Interaction	0.55	0.17	3.30	0.001
β_2	Hour Trend	0.00032	0.00002	15.30	0.000
β_3	Covid Dummy	13.91	2.00	6.95	0.000

As shown in Table B.4, all coefficient estimates are highly statistically significant with a *p*-value being 0.001 or less. Also, the estimates of the constant and the coefficients on GeoTEE dummy, temperature, and the interaction between GeoTEE dummy and temperature bear an expected sign. A coefficient estimate of 0.00032 on the trend variable suggests that hourly load in Cottage Grove increases by 0.00032 therms per hour or 2.8 therms per year, likely being driven by the increase in customers over time. A positive coefficient estimate on the covid dummy suggests that as stay-at-home mandates during the pandemic and hybrid work schedules after the pandemic were implemented, hourly therm usage/load increased in Cottage Grove in the winter space heating season. This is not surprising given 88 percent of the customers in the area being residential as revealed in Table B.3. The estimated relationships between hourly load and temperature for Cottage Grove before and after the GeoTEE pilot as illustrated in Figure B.3 can be obtained by setting the GeoTEE dummy equal to 0 or 1 while assuming other factors being equal. Specifically, letting the GeoTEE dummy be 0, the before GeoTEE load-temperature equation simply becomes:

$$Load_{before\text{-}GeoTEE} = (\alpha + \delta_1 \times GeoTEE) + (\beta_1 + \delta_2 \times GeoTEE) \times Temp$$

$$= \alpha + \beta_1 \times Temp$$

$$= 1010.38 - 13.95 \times Temp$$

And letting the GeoTEE dummy be 1, the after GeoTEE load-temperature equation then becomes:

$$Load_{after\text{-}GeoTEE} = (\alpha + \delta_1 \times GeoTEE) + (\beta_1 + \delta_2 \times GeoTEE) \times Temp$$

$$= 1010.38 - 37.26 + (-13.95 + 0.55) \times Temp$$

$$= 973.12 - 13.40 \times Temp$$

Assuming a designed peak hour temperature of 10 F degrees, the estimated peak hour therm savings can be obtained:

$$\text{Peak Hour Therm Savings} = Load_{before\text{-}GeoTEE} - Load_{after\text{-}GeoTEE} \,|[at\ Temp = 10\ °F]$$

$$= (1010.38 - 13.95 \times 10) - (973.12 - 13.40 \times 10)$$

$$= 31.76 \text{ therms}$$

The above peak hour therm savings is higher than the pre-determined deemed total calculation of 19.47 therms for Cottage Grove, suggesting that the pre-determined deemed savings might be an underestimate of the performance of the GeoTEE pilot at least for Cottage Grove. Given a total cost of $508,037 spent in the Cottage Grove area over the three phases of the pilot (see Table B.1), the unit cost per peak hour therm savings then is $508,037/31.76 peak hour therm = $15,996/ peak hour therm. For comparison, the state-wide average avoided distribution

capacity cost for Oregon filed in the 2022 IRP was $410 per peak hour therm on average[11]. This result is to be expected as a localized effort will necessarily cost more per peak hour therm to achieve incremental peak savings in a localized area. Despite be the higher costs, GeoTEE efforts may still be a cost-effective non-pipeline alternative to avoid or delay a specific distribution system project.

As mentioned above, the equation was also estimated using hourly load and temperature data collected from Creswell. However, no explainable results have been obtained. A plausible reason for this is that the potential peak hour therm savings achieved through the GeoTEE pilot in Creswell is too minimal to detect from the load data at the area level given the pre-determined deemed peak hour therm savings being only 4.14 therms, about 0.7 percent of the maximum hourly load of 621.4 therms recorded in the area. Changes in behavior from a few large customers in the area could also drown out the signal of targeted energy efficiency measures in the area from the aggregate demand.

The contrast between these two areas demonstrates the large uncertainty associated with GeoTEE efforts regarding whether or not they provide a firm reduction in demand for a localized area. Cottage Grove saw more savings than the calculated pre-determined peak savings, whereas, Creswell did not have measurable results. This uncertainty underscores the need for best available measurement and verification methods for any area where GeoTEE is implemented as a non-pipeline alternative. Pressure recordings and cold weather monitoring of constrained areas will be critical to measuring the success of GeoTEE and other demand-side efforts to reduce load.

Thus far, we've only collected only two winters of post GeoTEE pilot data for analysis. Our evaluation of the pilot does not conclude with this IRP update. Additional analysis can help refine and improve the analysis presented here.

Future Implementation of GeoTEE as Non-pipeline Alternative

This pilot has provided very useful information and lessons learned that can be applied to other areas of NW Natural's service territory. However, each constrained area on our system will present different types of customers and technical energy efficiency potentials, different costs, and different economies of scale. In other words, this pilot covered a small area of about 4,000 NW Natural customers. The cost per peak hour therm may vary depending on the size of the impacted area.

NW Natural will work with Energy Trust to develop cost projections and estimated technical and achievable potential for peak hour therms saved for constrained areas on NW Natural's distribution system. When implemented key metrics will need to be reevaluated each year to determine if additional targeted efforts are still feasible and cost-effective. These metrics include but are not limited to:

[11] See Table C.1. in Appendix C in the 2022 IRP report: lc79haa174551.pdf (state.or.us).

- projected future costs;
- costs incurred;
- projected peak hour therm savings in future years;
- realized incremental peak hours therm savings;
- capacity requirement headroom in the area
- cost of supply-side alternative

Uncertainty in customer behavior, weather, GeoTEE participation, and demand growth will impact the decision to continue with targeted efforts in an area. For example, if demand declines and an area becomes no longer constrained, we would not continue to offer targeted incentives in that area or, vice versa, if large, unexpected growth occurs in the area, a traditional pipeline solution may be required earlier than expected.

2024 Forward Looking Plan

System Reinforcements
Planning Documentation

Contents

Scope

NW Natural completes a comprehensive review of the distribution system to identify areas for further investigation during a peak Heating Degree Day (HDD). Heating Degree days are the difference between 65°F and the daily temperature mean, (high temperature plus low temperature divided by two). Peak design HDD values are different for each geographic area within our service territory, as shown in the table below:

Weather Zone	HDD
Clark County	57.4
Columbia River Gorge	66.8
Portland	57.0
Astoria	49.4
Salem	54.8
Lincoln City	45.7
Albany	54.5
Eugene	56.2
Coos County	41.9

This Forward Looking Plan identifies areas for investigation and monitoring on NW Natural's system that may require a large system reinforcement or non-pipeline alternative effort to provide reliable service to firm sales and transportation customers. Areas for investigation do not currently violate system reinforcement criteria but are areas where the gas distribution system is approaching these thresholds and/or is showing evidence of growth in demand that could reach system monitoring thresholds. NW Natural updates and reviews the Forward Looking Plan annually.[1]

The systems identified for investigation in the Forward Looking Plan are continuously being evaluated by a mixed-method approach using a combination of modeling results and actual field recorded pressure data to verify system modeling behavior. Peak day modeling is accomplished using the DNV Synergi GasTM software with the following configurations:

1. Interruptible Customers Disabled
2. Peak HDD Customer Demands Based on CMM Data & Peak HDD's for Zone
3. Williams Gas Energy Content – 1040 BTU/SCF
4. Mist Gas Energy Content – 1040 BTU/SCF
5. LNG Gas Energy Content – 1080 BTU/SCF

Field recorded pressure data may be observed and documented by:

1. SCADA Data pressure logs.
2. Electronic Portable Pressure Recorders (EPPR's) temporarily sited in the field.
3. Cold Weather Survey Points that are manually read by NW Natural Technicians.

[1] In previous years, these were often referred to as 10-year plans but have been renamed *forward looking plans*.

Synergi GasTM is a hydraulic modeling software used to analyze natural gas networks. The software helps predict and identify operational challenges such as low-pressure areas and supply constraints. Synergi GasTM modeling results are used to design system reinforcements, evaluate non-pipeline alternatives, and to aid in operational decisions.

Beginning in 2021, NW Natural's Synergi GasTM modeling began transitioning from a customer class average Usage Per Customer (UPC) forecasting methodology, to utilizing DNV's Customer Management Module (CMM). The legacy UPC method assumed the same peak demand for residential and small commercial customers located in the same geographic areas, which could cover a diverse set of customer types. Using a link to NW Natural's Customer Information System (CIS), CMM calculates usage using each individual customer's historical billing and weather conditions to determine a predicted demand for each customer for a given HDD. In addition to improved demand modeling, the connection to the CIS system allows NW Natural to quickly identify and incorporate customers who have disconnected or connected to the system into the models. The previous method required manual identification of former and new customers and then revision of the model a single customer at a time.

Relative to the previous customer class UPC methodology, the improved modeling results from CMM have both revealed areas on NW Natural's system that are at greater risk, and areas that are at less risk of experiencing low pressure during cold weather events. Newly modeled low-pressure areas are typically high-density commercial areas, neighborhoods with large homes, and areas that have experienced significant growth. Due to the lack of integration between GIS and CIS systems, legacy models did not incorporate all demand growth on the system. The low pressures revealed by the CMM modeling for these areas with large homes and high-density commercial customers can be attributed to the UPC model under forecasting demands, for these customers who tend to use more gas than the average of a larger geographic area. On the other hand, the improved CMM modeling results revealed some areas that were previously thought weak (i.e., high risk), are now healthy (i.e., low risk).

Distribution System Evaluations

NW Natural's system reinforcement criteria establishes thresholds in which traditional supply-side investments are required to maintain reliable service to customers. Non-pipeline alternatives can be implemented in advance to avoid or delay reaching these thresholds. NW Natural also sets guideline criteria for system modeling to identify areas to be considered under investigation.

System Reinforcement Criteria:

- Exceeds system design capacity.
- High pressure or transmission pipeline systems experience or are modeled to have at least a 40% pressure drop.
- High pressure or transmission systems pressures do not satisfy required regulator inlet pressures to properly function.
- Class B pipeline systems (60 MAOP or less) experience or are modeled, to have pressures of 10 psig or less.

System Areas for Investigation Criteria:

- Approaching System Design Capacity.
- High Pressure or Transmission Systems where incremental consumption may lead to a 40% pressure drop.
- Experience, and / or model, minimum Class B distribution pressures of 15 psig or less, or where incremental consumption may cause the distribution pressures to drop to 10 psig or less.

System Areas for Investigation

The proposed pipeline solutions in this section address areas of the gas distribution system that may reach design capacity because of demand growth. This plan and any future forward looking plan may include further validation of pressure data to confirm system modeling, conceptual design of system reinforcement projects, evaluation of any on-going or potential non-pipeline solutions, and any other potential alternatives required to maintain reliable service for the area as specified by design criteria. The distribution systems provided in this section are identified because they would violate our system reinforcement criteria if there were increased consumption in the area over time. Non-pipeline alternatives for these areas are being evaluated for these areas in the next IRP.

Dallas Feeder Uprate

- The 15-mile Dallas Feeder is a 175 MAOP 6”(W) and 4”(W) High Pressure pipeline that serves the town of Dallas, OR. This pipeline is fed from two sources, one from Perrydale from the Central Coast Feeder and another from Rickreall which is fed by the Mid-Willamette Valley Feeder.
- Industrial load interest along with incremental growth can lead to capacity constraints on the 175 MAOP system.
    - Lowest modeling pressure: 113 psig at 54.8 HDD (31.5% Pressure Drop)
    - Recorded System Low Pressures
        - Pressure measurements were not recorded on this system.
        - An EPPR will be sited at Dallas during the 24/25 Heating Season.
    - Refer to Figure C.1 for impact area image.
- Pipeline solution
    - Refer to Figure C.2 for project area image.
    - Pipeline Replacement and Uprate system from 175 MAOP to 300 MAOP.
        - Replace approximately 1,100’ of 4”(W) High Pressure with 6”(W) High Pressure.
        - Uprate the 15 miles of 6”(W) from an MAOP of 175 to an MAOP of 300 psig.
- Estimated available capacity on system: 275 Th/hr

Creswell Feeder Uprate

- The Creswell Feeder is a 1.9 mile-long 3-1/2”(W) 150 MAOP High Pressure pipeline servicing the city of Creswell.
- An increase in consumption can lead to capacity constraints on the Creswell Feeder.

    - Lowest modeling pressure: 88.6 psig at 56.2 HDD (31.8% Pressure Drop)
    - Recorded Low Pressures (Without Emerald Forest Product Consumption)
        - 2020/21 – 116.3 psig at 34 HDD (Sun. 12/27/2020)
        - 2021/22 – 113.2 psig at 35 HDD (Sun. 12/26/2021)
        - 2022/23 – 111.5 psig at 38 HDD (Thu. 12/22/2022)
        - 2023/24 – 107.0 psig at 33 HDD (Sun. 1/14/2024)
    - Refer to Figure C.3 for impact area image.
- Pipeline solution
    - Refer to Figure C.4 for project area image.
    - Uprate High Pressure main from 150 MAOP to 300 MAOP.
        - Uprate approximately 1.9 miles of 3”(W) from Creswell Gate Station to the end of High Pressure main adjacent to Emerald Forest Products.
- Estimated available capacity on current system: 65 Th/hr

Lebanon Feeder Uprate

- The Lebanon Feeder is a 23.8 mile-long 200 MAOP pipeline consisting of 8”(W) and 6”(W) High Pressure steel servicing Lebanon and Sweet Home.
- Increased flows on the system can exhaust available capacity.
    - Lowest modeling pressure: 143.0 psig at 54.5 HDD (24.7% Pressure Drop)
    - Recorded Low Pressures (Without Entek Consumption)
        - 2020/21 – 165.6 psig at 21 HDD (Sun. 3/14/2021)
        - 2021/22 – 165.2 psig at 17 HDD (Sun. 3/13/2022)
        - 2022/23 – 160.7 psig at 22 HDD (Sun. 3/12/2023)
        - 2023/24 – 155.2 psig at 47 HDD (Sat. 1/13/2024)[2]
    - Refer to Figure C.5 for impact area image.
- Pipeline solution
    - Refer to Figure C.6 for project area image.
    - Uprate High Pressure main from 200 MAOP to 300 MAOP.
        - Uprate approximately 10.5 miles of 8”(W) from Albany Gate Station to South Lebanon.
        - Construct two new 300 psig to 200 psig regulator stations.
- Estimated available capacity on current system: 1010 Th/hr

Hillsboro Industrial District Feeder Reinforcement

- The Hillsboro Industrial District Feeder is approximately 2.2 miles of 400 MAOP 8”(W) high pressure steel servicing the technology and manufacturing businesses in the Hillsboro Industrial District.
- Technology, manufacturing and backup generation add load may quickly cause capacity constraints.
    - Lowest modeling pressure: 338.6 psig at 57 HDD (13% Pressure Drop)
    - Recorded Low Pressures (With Interruptible customers on)
        - 2020/21 – 352.34 psig at 2 HDD (Wed. 5/13/2021)
        - 2021/22 – 344.68 psig at 15 HDD (Mon. 11/1/2021)

[2] Weather Data Source: https://www.timeanddate.com/weather

        - 2022/23 – 342.92 psig at 23 HDD (Tue. 11/22/2022)
        - 2023/24 – 341.09 psig at 17 HDD (Mon. 4/29/2024)
    - Refer to Figure C.7 for impact area image.
- Pipeline solution
    - Refer to Figure C.8 for project area image.
    - Extend High pressure creating a 400 MAOP bidirectional pipeline connecting to the Rock Creek Feeder.
        - Install approximately 3 miles of 8”(W) 400 MAOP through the Hillsboro Industrial Corridor.
        - Repurpose approximately 3500 ft of 8”(W) from Class B to Class D.
- Estimated available capacity on current system: 11,900 Th/hr

McMinnville Feeder Reinforcement

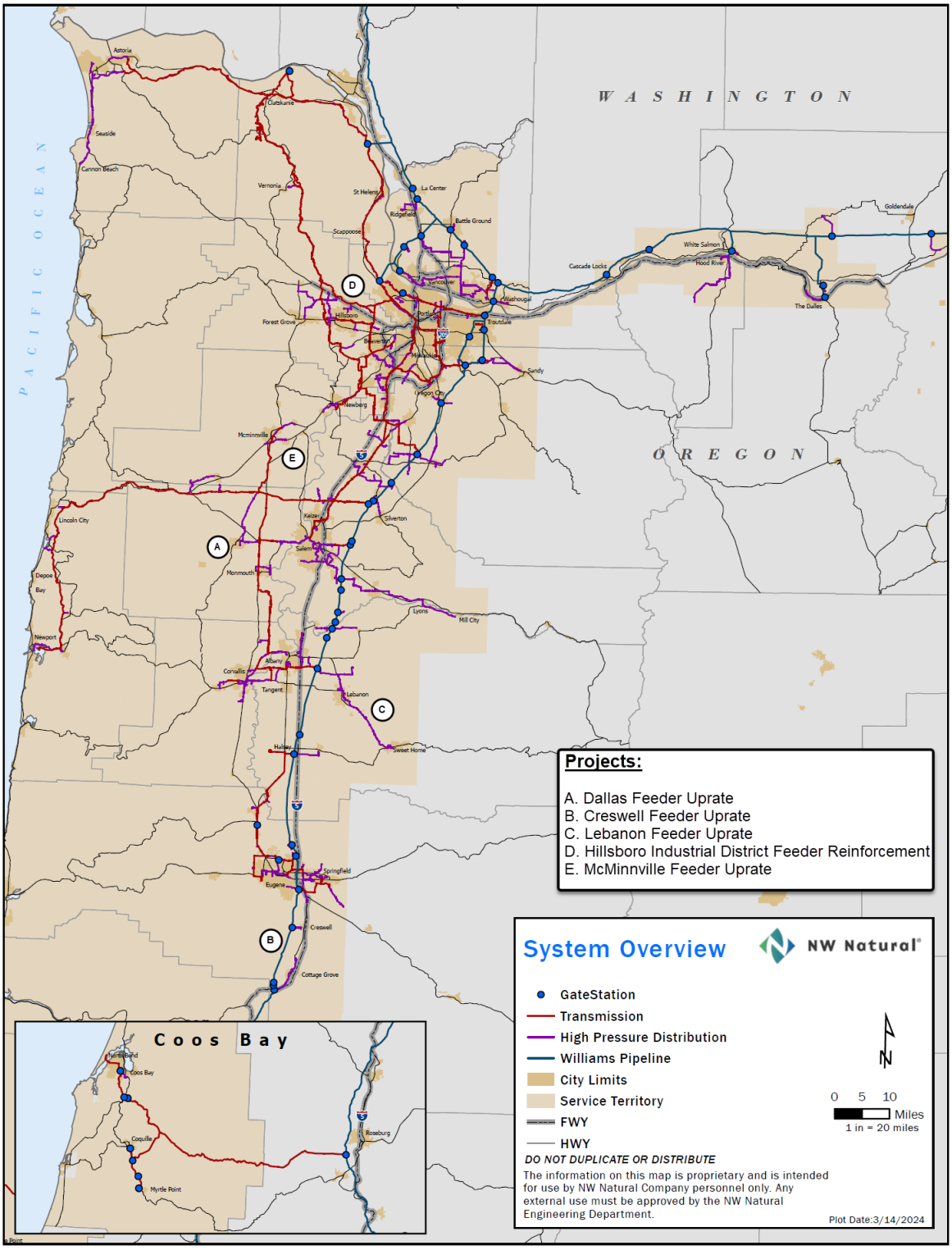
- The McMinnville Feeder is a 400 MAOP 6”(W), 17.2-mile-long pipeline, with two laterals of 4” (W) that have a combined length of roughly 3.9 miles. Servicing Amity, McMinnville and Lafayette.
- Increased flows on the system can exhaust available capacity.
    - Lowest modeling pressure: 234.6 psig at 54.8 HDD (26.8% Pressure Drop, starting pressure 320.4 psig due to distance from sources) with interruptible customers offline.
    - Recorded Low Pressures (with interruptible customers on)
        - 2020/21 – 283.07 at 26 HDD (Tue. 2/9/2021)
        - 2021/22 – 267.39 at 30 HDD (Tue. 2/22/2022)
        - 2022/23 – 147.78 psig at 25 HDD (Thur. 11/10/2022)
        - 2023/24 – 278.23 psig at 25 HDD (Mon. 11/27/2023)
    - Refer to Figure C.9 for impact area image
- Pipeline solution
    - Refer to Figure C.10 for project area image
    - As the pressure on the CCF, where the McMinnville feeder takes off from the CCF, is below the MAOP of the McMinnville Feeder on a peak day, a pressure uprate provides no benefit by itself. Consequently, the options to improve deliverability are:
        - looping or replacing portions of the pipe with a larger diameter pipe, at least 8” in diameter with length and diameter to be determined based on need.
        - Or adding compression either:
            - West of Grand Ronde, which would improve the pressure on the CCF while enabling 100 MMscfd of sendout from Newport LNG. This would require about 6,700 hp. or
            - Compression on the McMinnville Amity Line. Note that uprating the pipe could improve deliverability in conjunction with compression in this option. It is anticipated that the initial likely horsepower requirements would be roughly 300 to 700 hp, depending on many variables, including, but not limited to: MAOP, location of compressor, suction pressure (dependent on

compressor location, flowrate, larger system configuration and constraints), discharge pressure (dependent on MAOP and needed flowrate), desired flow rate capability.

  - Cost Estimate: undeterminable, however expected to be over $5 million when needed, although the added customer may pay a significant portion.
- Estimated available capacity on current system: 530 Th/hr.

System Investigation Locations

The following map shows the system investigation areas identified in this plan.



System Distribution Supply Projects

Supply projects discussed in this section are intended to increase supply side resources by increasing deliverability from NW Natural's existing system storage assets.

Central Coast Feeder Reinforcement

There are two options to provide additional takeaway capacity from the Newport LNG facility to the Albany and Salem load centers. Each option allows for different additional incremental gas supplies to reach the Valley load centers on a design day.

- Option 1: Uprate (increase the Operating Pressure) the existing 12-inch Central Coast Feeder transmission main to an MAOP of 720 psig between the North Lincoln Primary (regional station) and Blowdown 6 (pipe bridal), a distance of approximately 15 miles. Pressure regulation, valve automation, instrumentation and controls will be needed where the new 720 MAOP ends, and the existing 600 MAOP begins, at Blowdown 6. The new station will need a full port ball valve with automation to open the valve when the pressure is below MAOP, and begin regulating pressure before the pressure reaches MAOP. This will allow Newport LNG to vaporize at a maximum rate of about 97 MDTh/d at 860 psig with a 24-hour sendout capability of roughly 91 MDTh instead of the existing 78 MDTh at 844 psig.
- Option 2: The capability to vaporize 100 MMscfd (107+ MDTH/d) requires the installation of a single compressor station west of Grand Ronde to boost the pressure for a flow rate of roughly 84.8 Mscfd from 170 psig (179 psig arrival pressure) to 600 psig (595 psig outlet pressure to CCF) using a compressor of approximately ~6700 hp. Note that Option 2, does not require option 1, nor the uprate of any pipe, as the pressure at Lincoln city primary is below 500 psig when flowing roughly 85 MMscfd east towards the Willamette River Valley.
- Refer to Figure C.11 for Impact area image.
- Refer to Figure C.12 for project area image.

Project Images

Two images are provided for each system investigation area within our gas distribution system. The impact area shows areas of the system where customers could experience low pressure during cold weather events. The project image provides a general area of the proposed pipeline solution provided in this plan.

Figure C.1

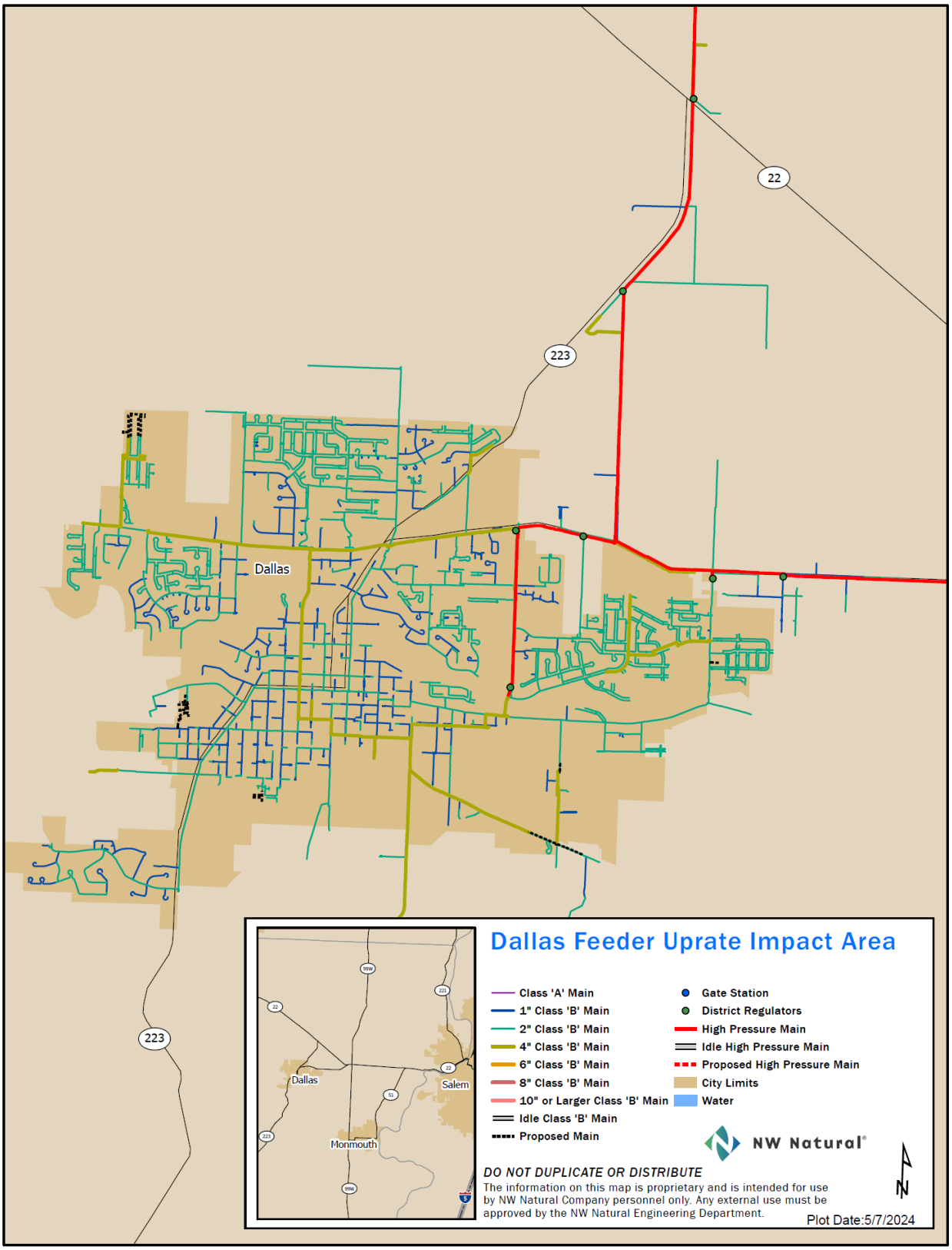
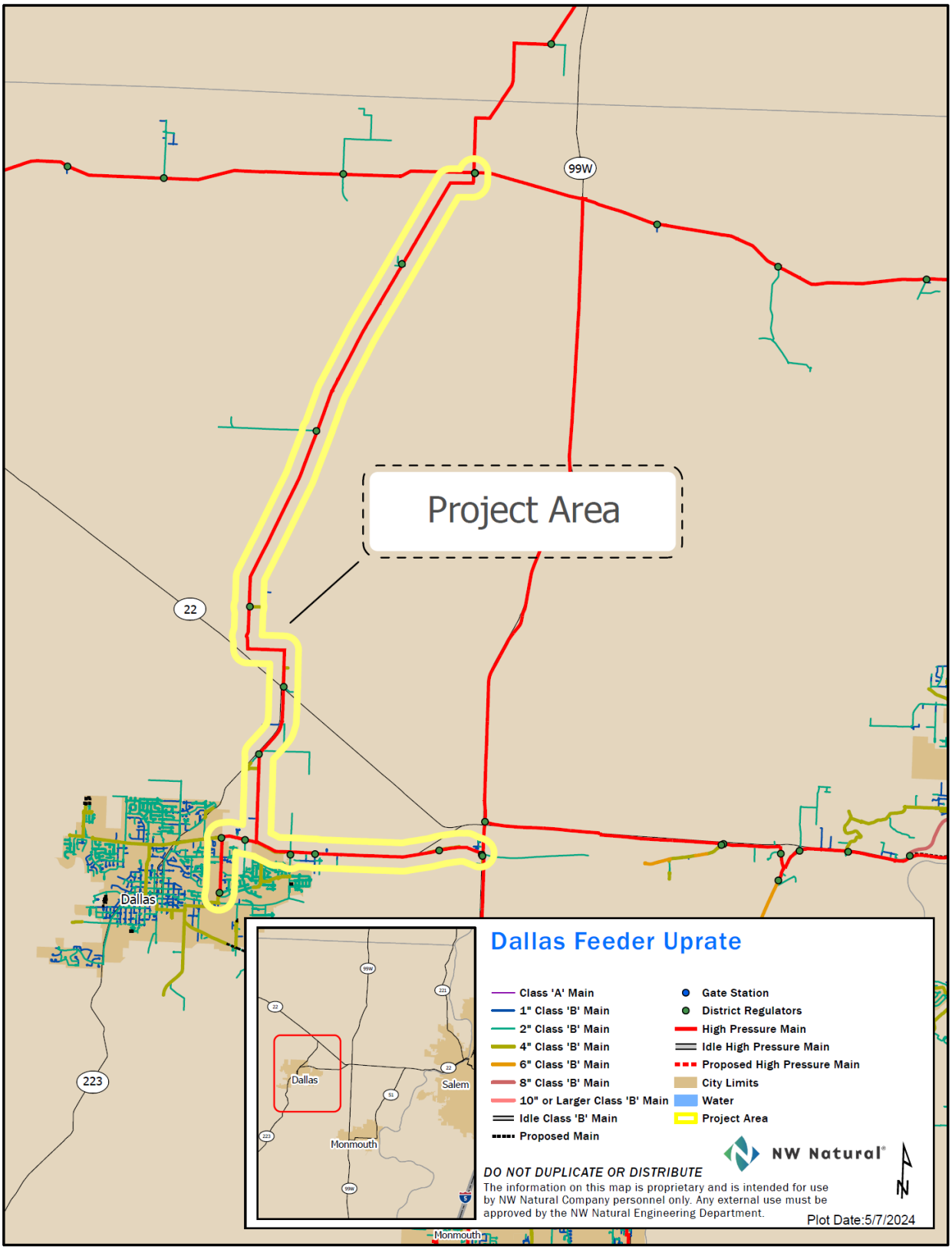

22
223
Dallas
223
Dallas Feeder Uprate Impact Area
Class 'A' Main
1" Class 'B' Main
2" Class 'B' Main
4" Class 'B' Main
6" Class 'B' Main
8" Class 'B' Main
10" or Larger Class 'B' Main
Idle Class 'B' Main
Proposed Main
Gate Station
District Regulators
High Pressure Main
Idle High Pressure Main
Proposed High Pressure Main
City Limits
Water
NW Natural
DO NOT DUPLICATE OR DISTRIBUTE
The information on this map is proprietary and is intended for use by NW Natural Company personnel only. Any external use must be approved by the NW Natural Engineering Department.
Plot Date:5/7/2024
Dallas
Salem
Monmouth

Figure C.2


Project Area
99W
22
223
Dallas
Monmouth
Salem
Dallas Feeder Uprate
Class 'A' Main
1" Class 'B' Main
2" Class 'B' Main
4" Class 'B' Main
6" Class 'B' Main
8" Class 'B' Main
10" or Larger Class 'B' Main
Idle Class 'B' Main
Proposed Main
Gate Station
District Regulators
High Pressure Main
Idle High Pressure Main
Proposed High Pressure Main
City Limits
Water
Project Area
NW Natural
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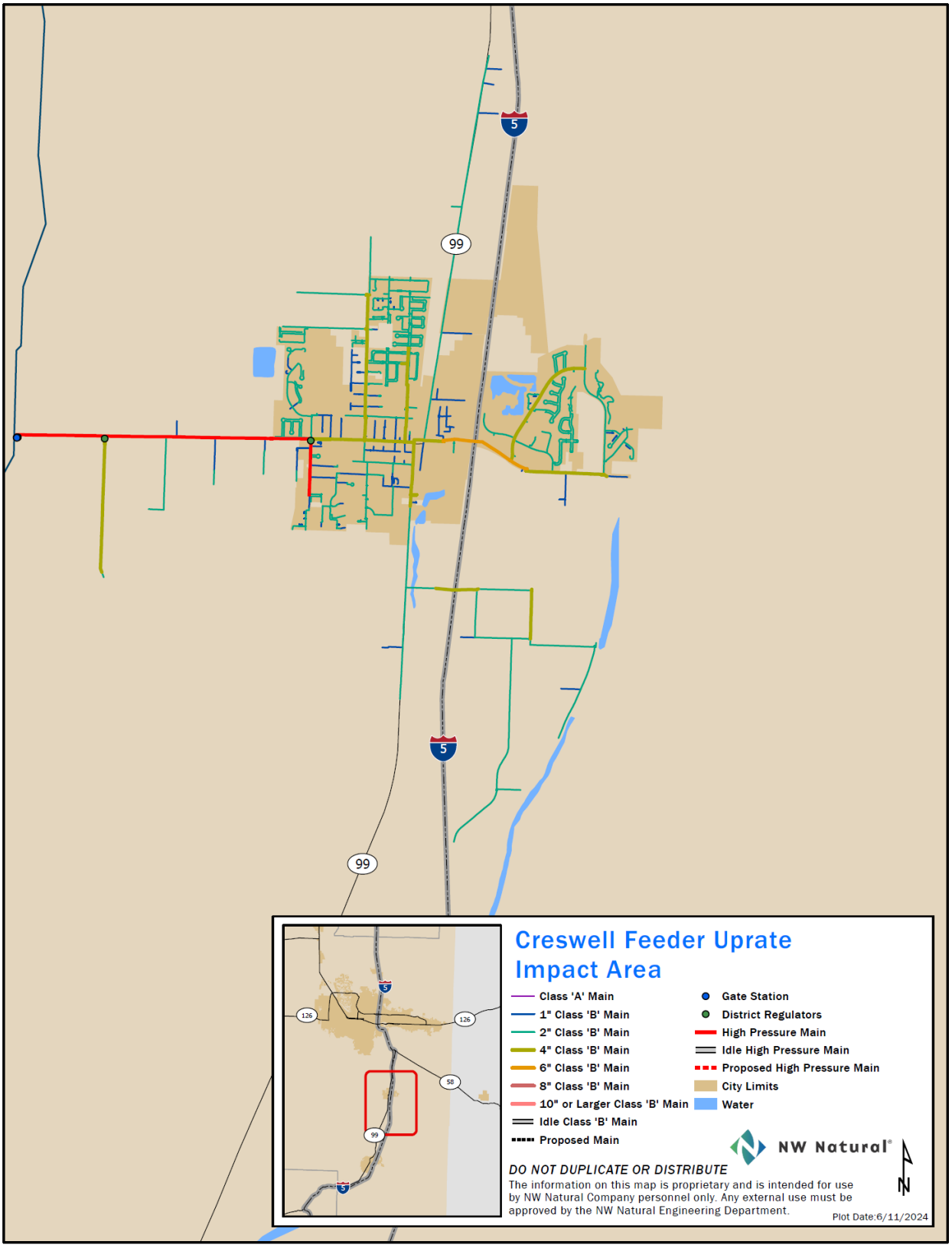
Plot Date:5/7/2024

Figure C.3


5
99
5
99
Creswell Feeder Uprate Impact Area
Class 'A' Main
1" Class 'B' Main
2" Class 'B' Main
4" Class 'B' Main
6" Class 'B' Main
8" Class 'B' Main
10" or Larger Class 'B' Main
Idle Class 'B' Main
Proposed Main
Gate Station
District Regulators
High Pressure Main
Idle High Pressure Main
Proposed High Pressure Main
City Limits
Water
NW Natural
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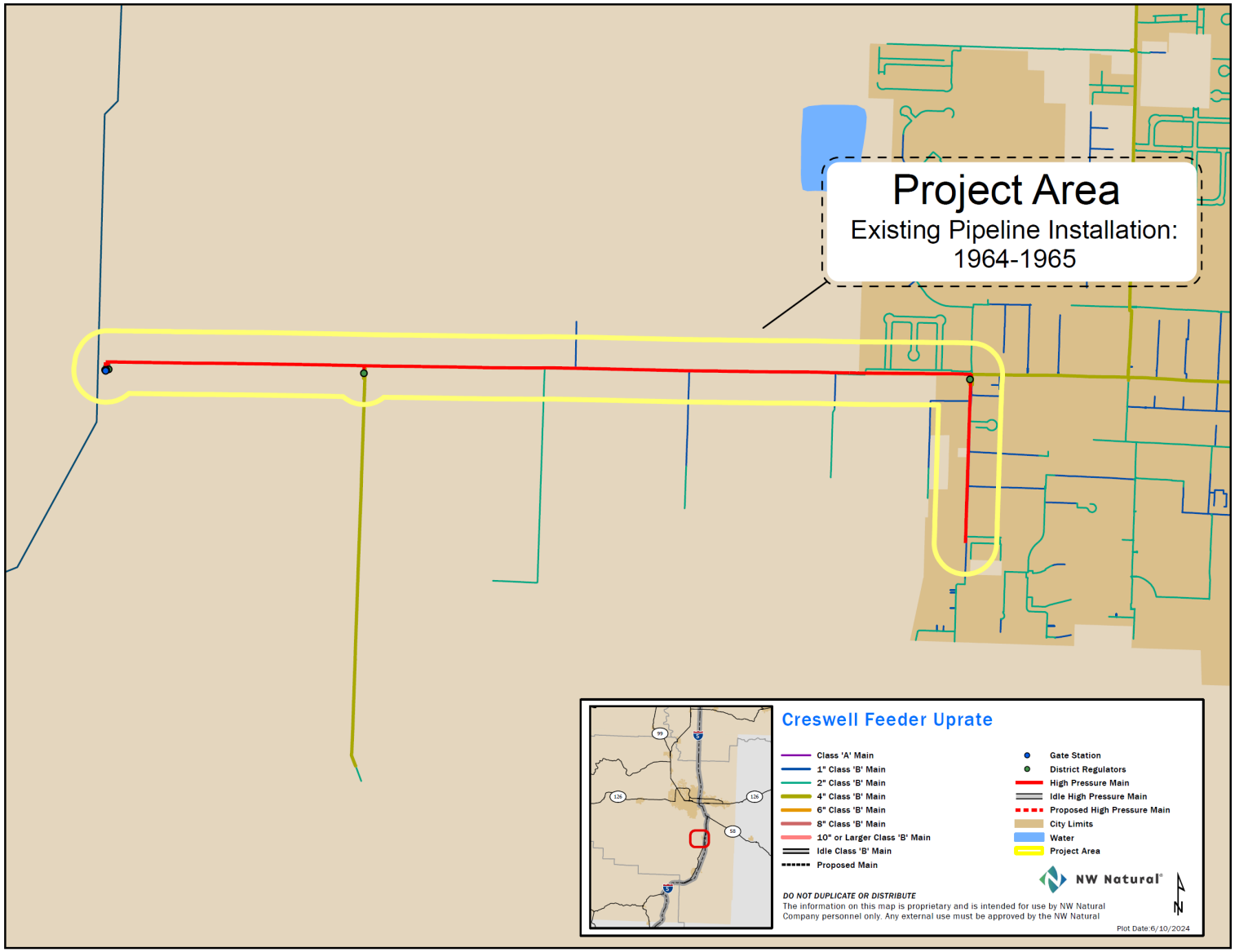
Plot Date:6/11/2024

Figure C.4


Project Area
Existing Pipeline Installation:
1964-1965
Creswell Feeder Uprate
Class 'A' Main
1" Class 'B' Main
2" Class 'B' Main
4" Class 'B' Main
6" Class 'B' Main
8" Class 'B' Main
10" or Larger Class 'B' Main
Idle Class 'B' Main
Proposed Main
Gate Station
District Regulators
High Pressure Main
Idle High Pressure Main
Proposed High Pressure Main
City Limits
Water
Project Area
NW Natural
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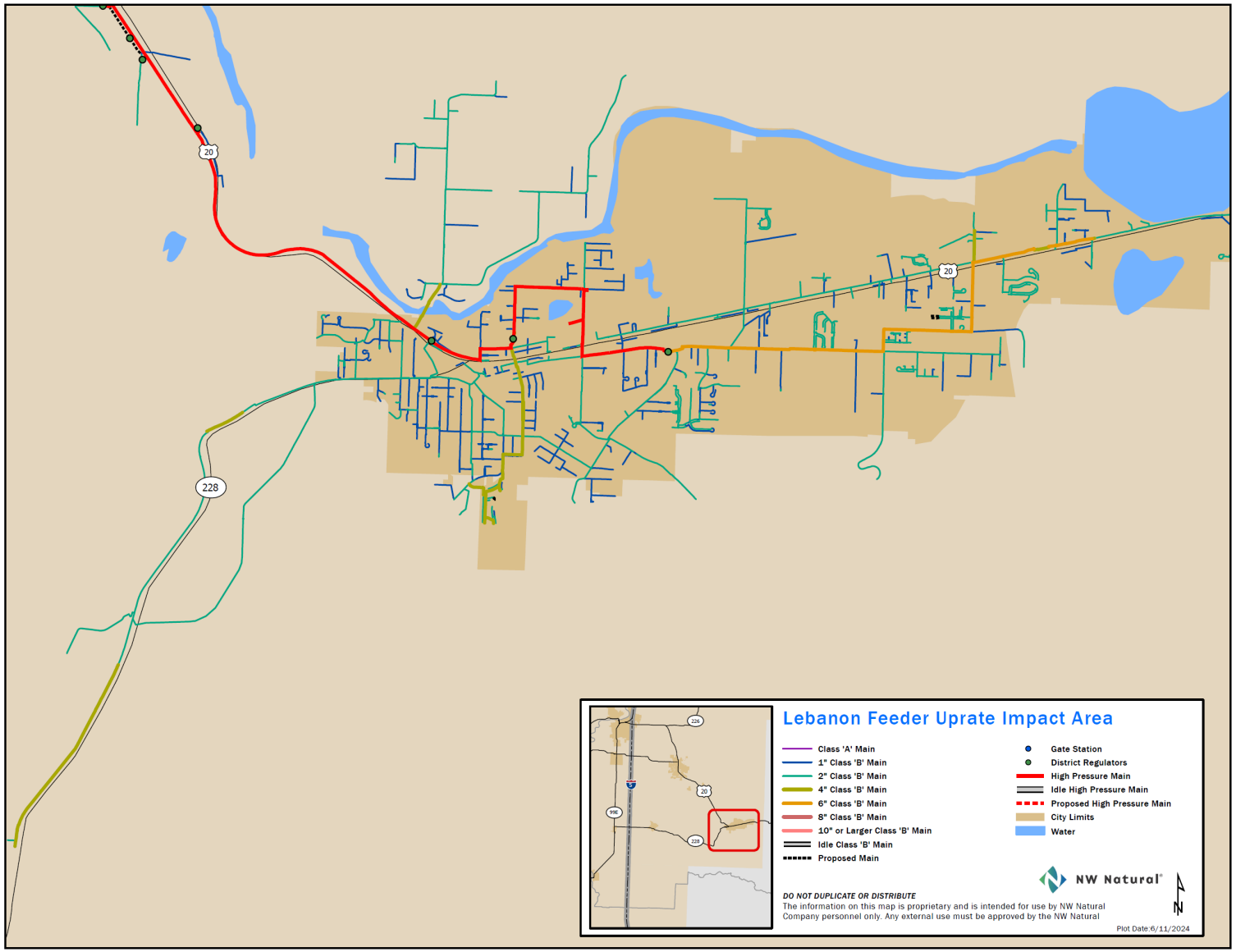
Plot Date:6/10/2024

Figure C.5


20
228
20
Lebanon Feeder Uprate Impact Area
Class 'A' Main
1" Class 'B' Main
2" Class 'B' Main
4" Class 'B' Main
6" Class 'B' Main
8" Class 'B' Main
10" or Larger Class 'B' Main
Idle Class 'B' Main
Proposed Main
Gate Station
District Regulators
High Pressure Main
Idle High Pressure Main
Proposed High Pressure Main
City Limits
Water
NW Natural
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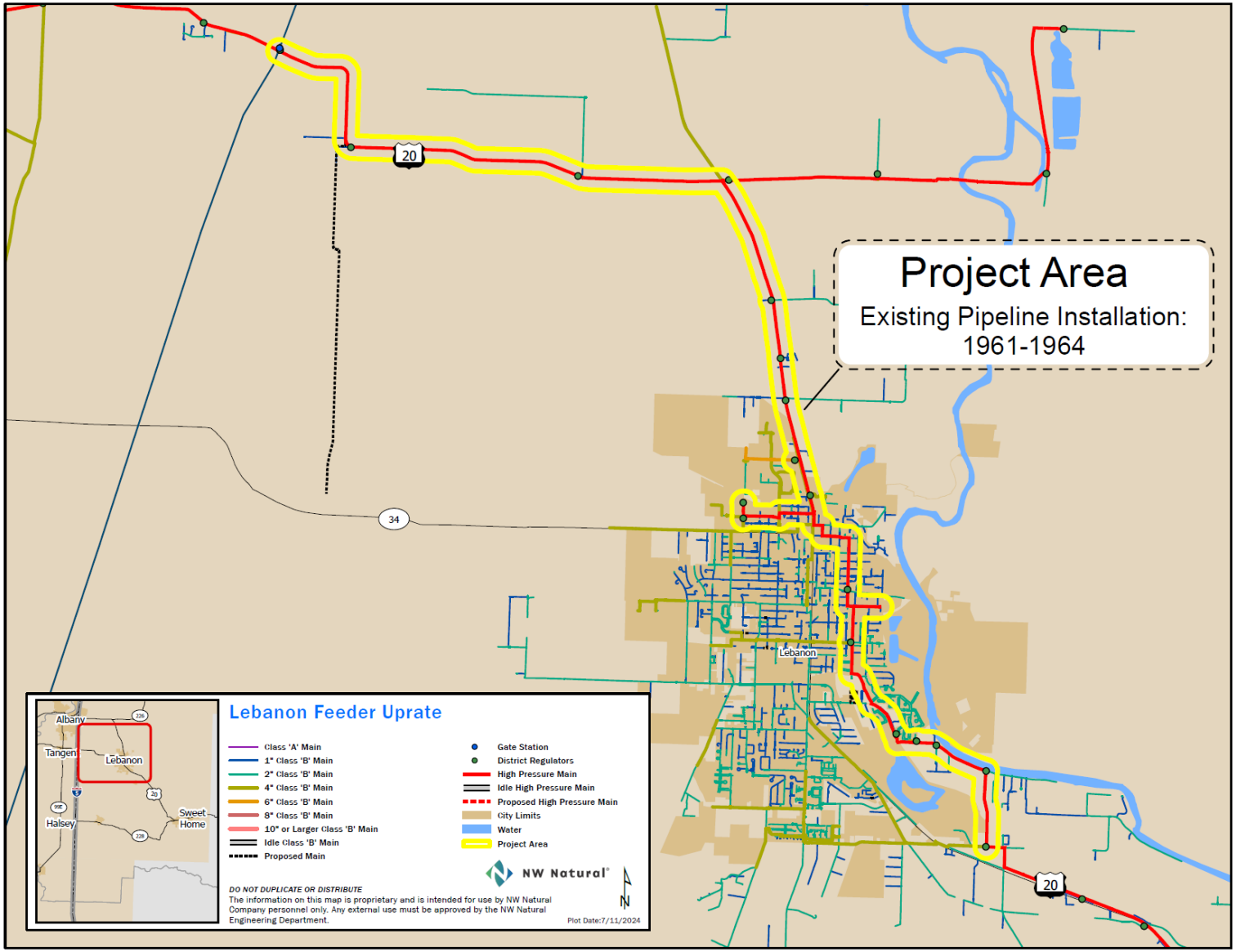
Plot Date:6/11/2024

Figure C.6


Project Area
Existing Pipeline Installation:
1961-1964
20
34
Lebanon
Albany
Tangent
Lebanon
Halsey
Sweet Home
Lebanon Feeder Uprate
Class 'A' Main
1" Class 'B' Main
2" Class 'B' Main
4" Class 'B' Main
6" Class 'B' Main
8" Class 'B' Main
10" or Larger Class 'B' Main
Idle Class 'B' Main
Proposed Main
Gate Station
District Regulators
High Pressure Main
Idle High Pressure Main
Proposed High Pressure Main
City Limits
Water
Project Area
NW Natural
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Plot Date:7/11/2024

Figure C.7

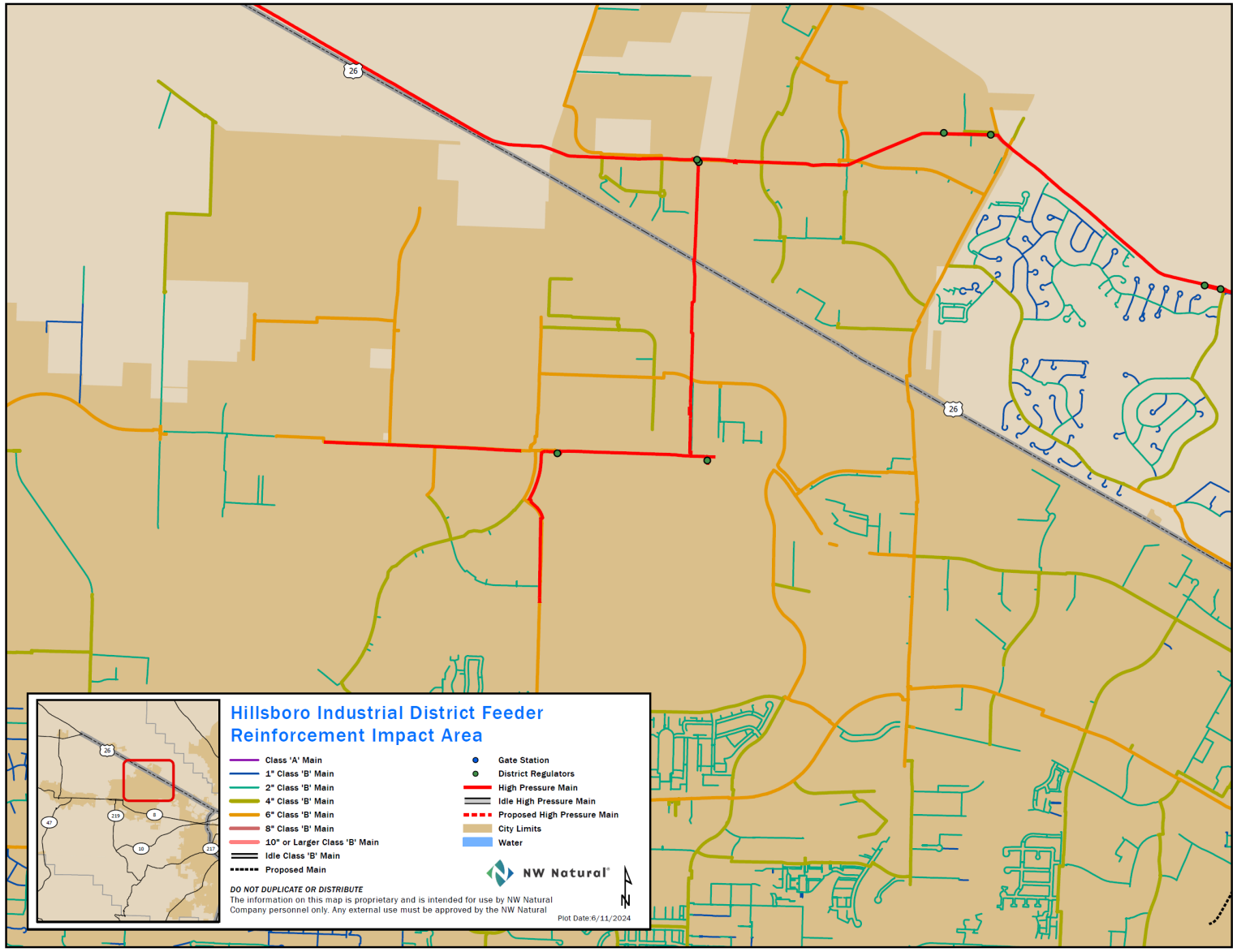
26
26
Hillsboro Industrial District Feeder
Reinforcement Impact Area
Class 'A' Main
1" Class 'B' Main
2" Class 'B' Main
4" Class 'B' Main
6" Class 'B' Main
8" Class 'B' Main
10" or Larger Class 'B' Main
Idle Class 'B' Main
Proposed Main
Gate Station
District Regulators
High Pressure Main
Idle High Pressure Main
Proposed High Pressure Main
City Limits
Water
NW Natural
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Figure C.8

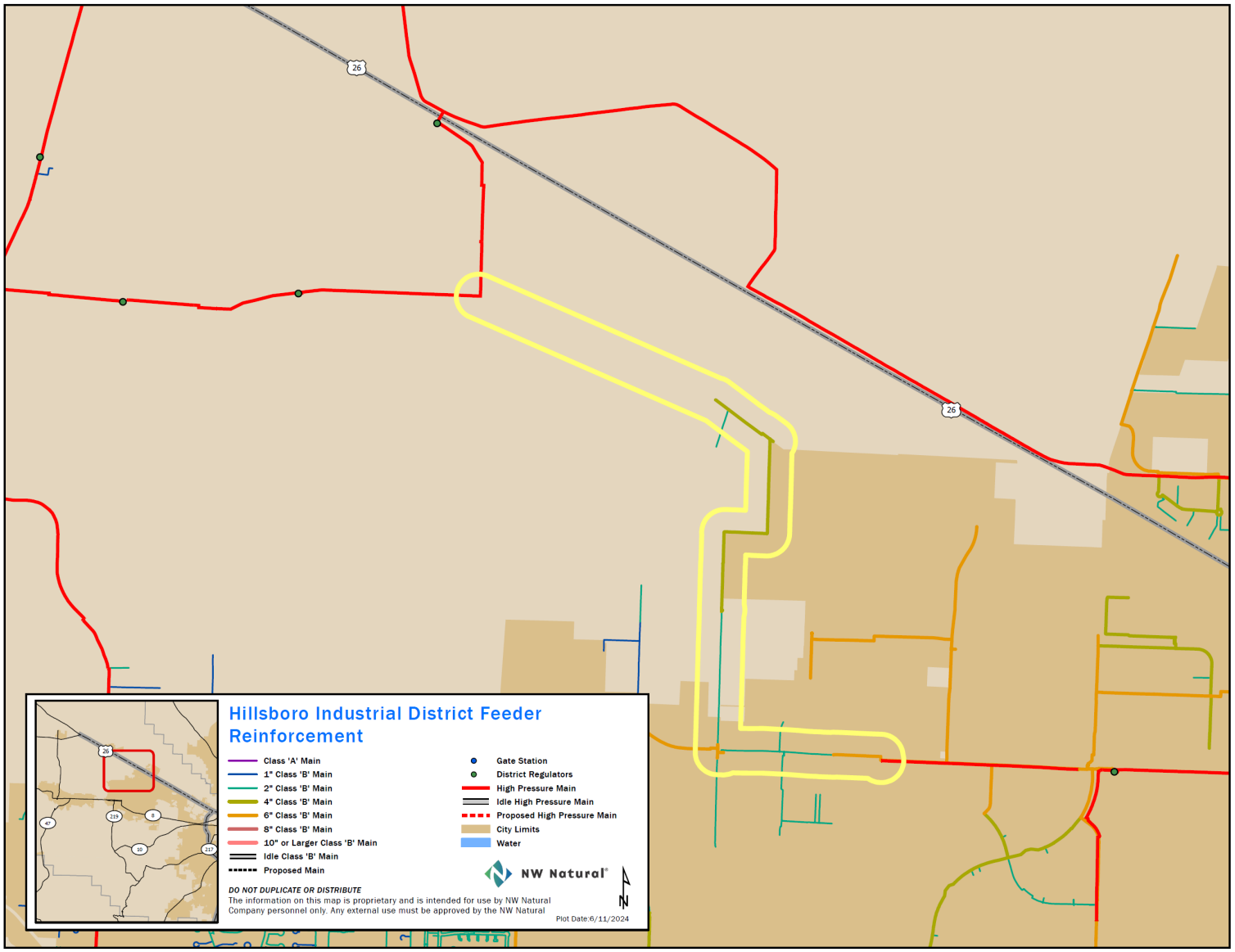
26
26
Hillsboro Industrial District Feeder Reinforcement
Class 'A' Main
1" Class 'B' Main
2" Class 'B' Main
4" Class 'B' Main
6" Class 'B' Main
8" Class 'B' Main
10" or Larger Class 'B' Main
Idle Class 'B' Main
Proposed Main
Gate Station
District Regulators
High Pressure Main
Idle High Pressure Main
Proposed High Pressure Main
City Limits
Water
NW Natural
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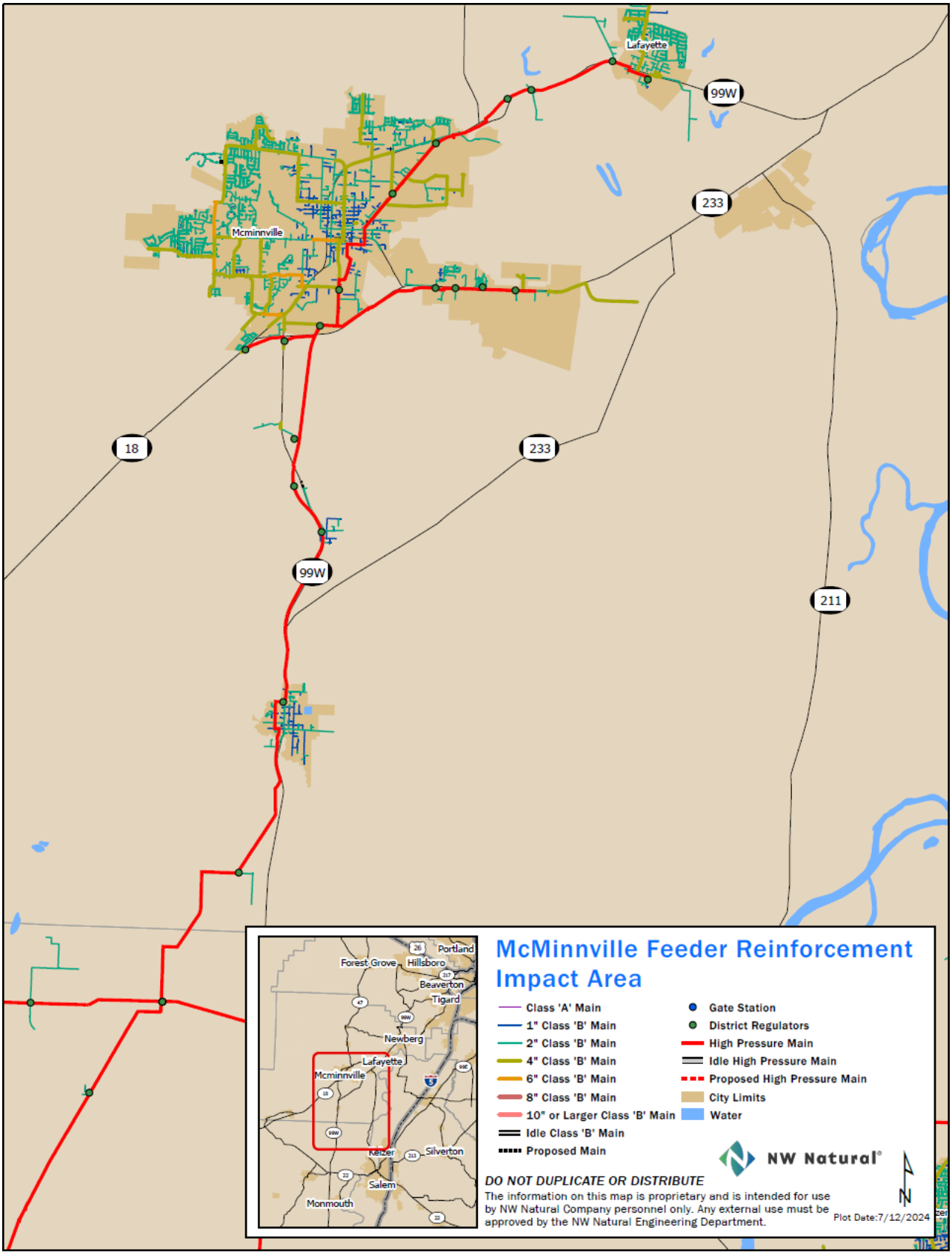
Figure C.9


Lafayette
99W
233
Mcminnville
18
233
99W
211
McMinnville Feeder Reinforcement Impact Area
Class 'A' Main
1" Class 'B' Main
2" Class 'B' Main
4" Class 'B' Main
6" Class 'B' Main
8" Class 'B' Main
10" or Larger Class 'B' Main
Idle Class 'B' Main
Proposed Main
Gate Station
District Regulators
High Pressure Main
Idle High Pressure Main
Proposed High Pressure Main
City Limits
Water
NW Natural
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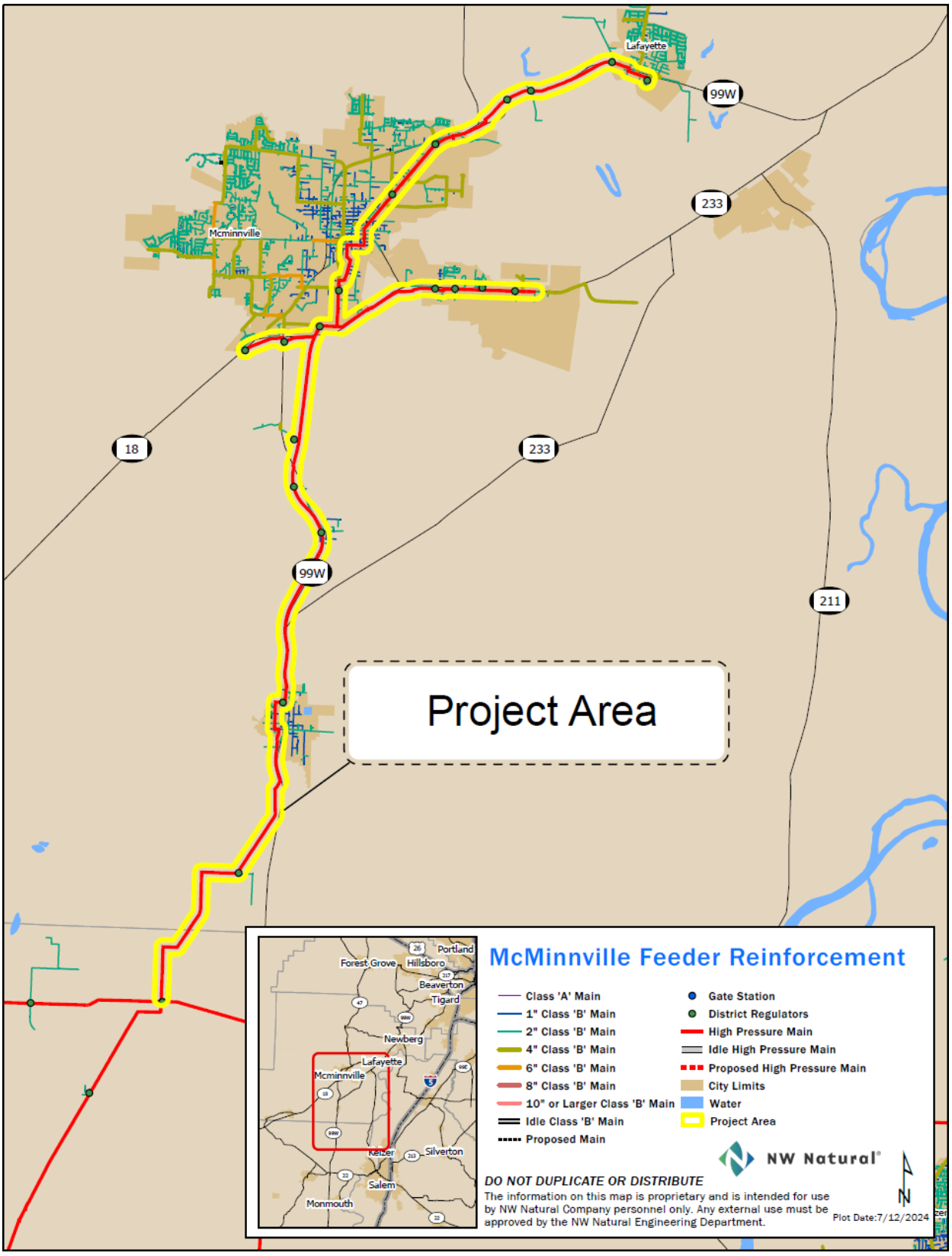
Plot Date:7/12/2024
Portland
Forest Grove
Hillsboro
Beaverton
Tigard
Newberg
Lafayette
Mcminnville
Keizer
Silverton
Salem
Monmouth

Figure C.10


Lafayette
99W
233
Mcminnville
18
233
99W
211
Project Area
McMinnville Feeder Reinforcement
Class 'A' Main
1" Class 'B' Main
2" Class 'B' Main
4" Class 'B' Main
6" Class 'B' Main
8" Class 'B' Main
10" or Larger Class 'B' Main
Idle Class 'B' Main
Proposed Main
Gate Station
District Regulators
High Pressure Main
Idle High Pressure Main
Proposed High Pressure Main
City Limits
Water
Project Area
NW Natural
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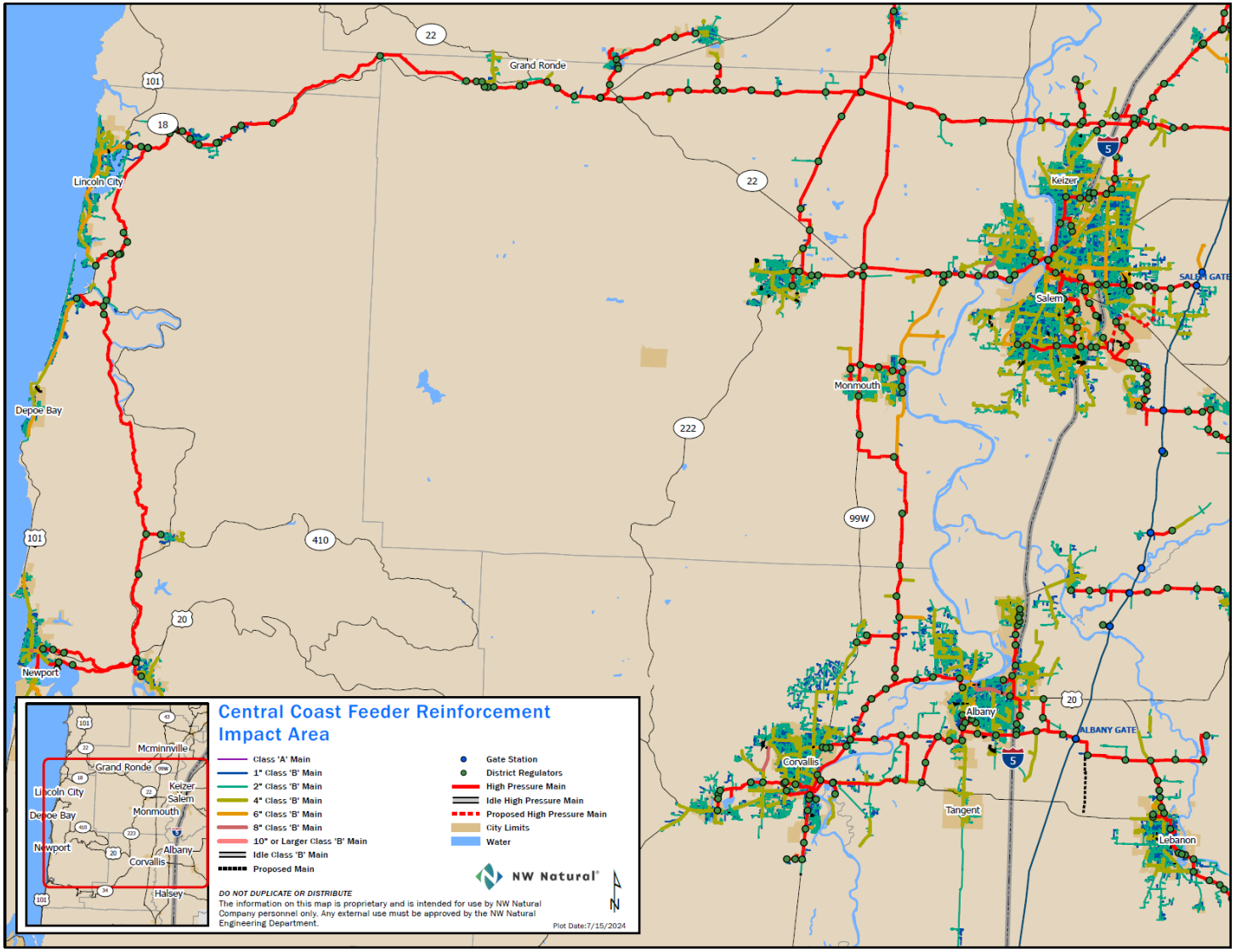
Plot Date:7/12/2024
Portland
Forest Grove
Hillsboro
Beaverton
Tigard
Newberg
Lafayette
Mcminnville
Silverton
Salem
Monmouth

Figure C.11


Central Coast Feeder Reinforcement
Impact Area
Class 'A' Main
1" Class 'B' Main
2" Class 'B' Main
4" Class 'B' Main
6" Class 'B' Main
8" Class 'B' Main
10" or Larger Class 'B' Main
Idle Class 'B' Main
Proposed Main
Gate Station
District Regulators
High Pressure Main
Idle High Pressure Main
Proposed High Pressure Main
City Limits
Water
NW Natural
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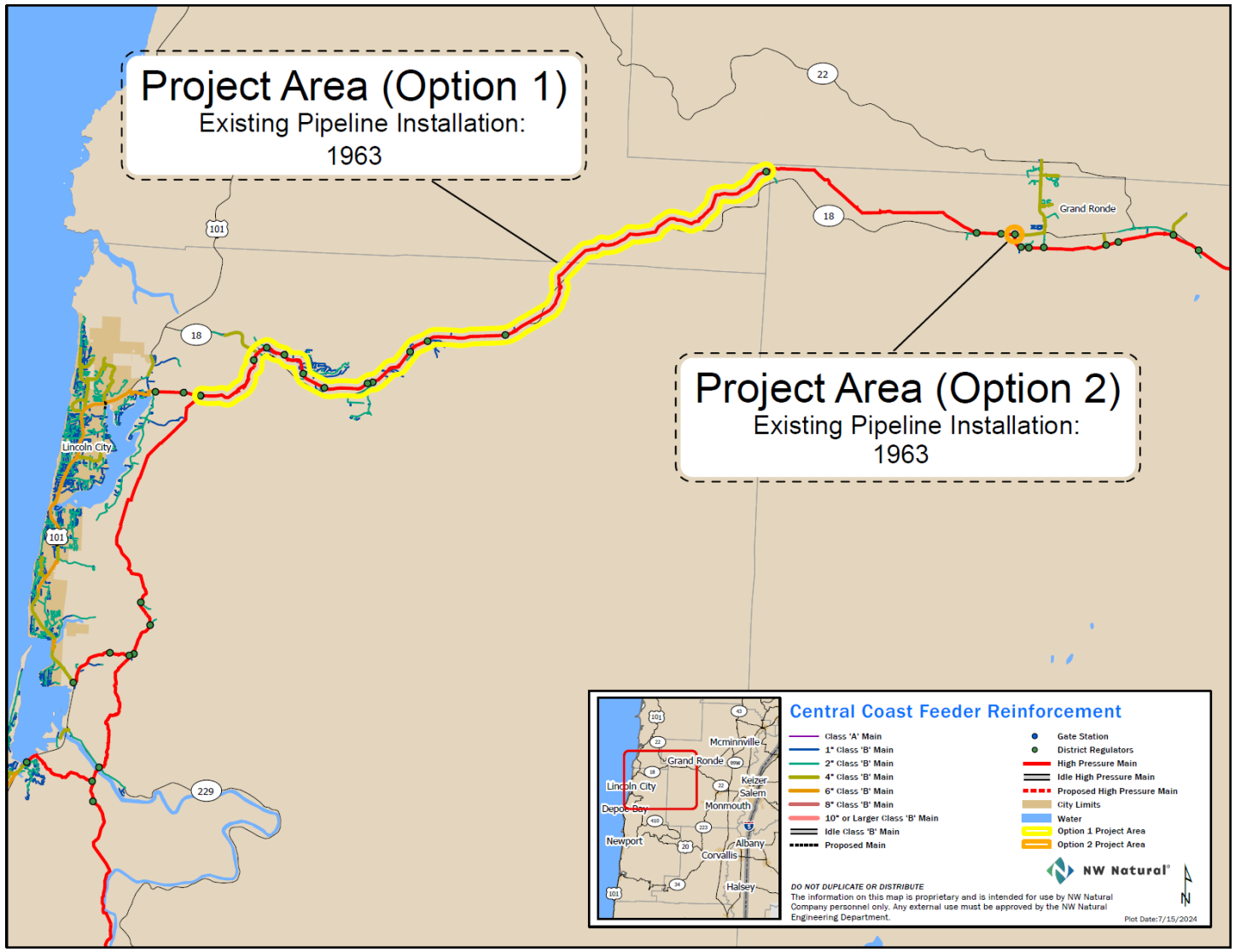
Plot Date:7/15/2024
Grand Ronde
Lincoln City
Depoe Bay
Newport
Keizer
Salem
Monmouth
Albany
Corvallis
Tangent
Lebanon
Mcminnville
Halsey

Figure C.12


Project Area (Option 1)
Existing Pipeline Installation:
1963
Project Area (Option 2)
Existing Pipeline Installation:
1963
Grand Ronde
Lincoln City
Central Coast Feeder Reinforcement
Class 'A' Main
1" Class 'B' Main
2" Class 'B' Main
4" Class 'B' Main
6" Class 'B' Main
8" Class 'B' Main
10" or Larger Class 'B' Main
Idle Class 'B' Main
Proposed Main
Gate Station
District Regulators
High Pressure Main
Idle High Pressure Main
Proposed High Pressure Main
City Limits
Water
Option 1 Project Area
Option 2 Project Area
NW Natural
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