Upper Highlands Water Pressure

OCTOBER 21, 2025 | CITY COUNCIL STUDY SESSION

AGENDA

Part I (15 min)

Introduction & Fire Flow	Sarah R Olson, I-Wen Yang, Deputy Chief Patrick LeDoux

Part II (35 min)

Near- Term Solutions	Carly Joerger, Cody Gray
Long-Term Solutions	I-Wen Yang, Michele Campbell, Dylan Bright

Part III (5 min)

Next Steps

PROJECT TEAM

Julie Underwood, DCM and Interim PW Director

Chris Gavigan, PW Deputy Director - Operations

Sarah R Olson, PW Deputy Director – Engineering & Planning

Patrick LeDoux, Fire Department Deputy Chief

Carly Joerger, Utility Policy Supervisor

Cody Gray, Water and Wastewater Supervisor

I-Wen Yang, PE, Senior Project Engineer

Jason Chappell, Interim Fire Marshal

Kevin Hansen, Senior Assistant City Attorney

Maria Mikulak, Associate Project Engineer

Tom Chriest, Utility Operations Manager

Rob English, PE, CIP Division Manager

RH2 Consultants

Michele Campbell, PE

Dylan Bright

INTRODUCTION

The Bottom Line

- Issue: Upper Highlands Residents dissatisfied with reduction in pressure
- Goals:
  - Increase water pressure in the Upper Highlands Neighborhood
  - Retain zone conversion benefits

- 3 CIP Alternatives:
  - None can be accomplished by summer 2026
  - Costs range from $3.5 - $8.7M
  - Some available funding CIP that could be applied to the projects but at least $2.6M in new revenue or reprioritization will be needed

- Staff recommendation: Adopt Resolution R-5697

Resolution R-5697

1. Include in the proposed 2025 Capital Improvement Program update at least two capital project alternatives for the Upper Highlands to increase water pressure while retaining the system benefits of the 450 pressure zone conversion and to fund the next milestone of engineering design
2. Contract with a water system engineering firm to peer review the alternatives analysis and review the selected capital projects moving forward to design
3. Adapt, expand, and expedite the existing mitigation program for affected residents in Upper Highlands, and identify new funding if needed
4. Implement a targeted outreach and education campaign for water management strategies, particularly during peak demand season when pressures are at their lowest
5. Update the City Council on the progress by April 2026

510 → 450 Zone Conversion Results

Key Benefits

- Fire Flow – over 90% of hydrants now meet LOS standards
- Supply Resiliency – neighborhood no longer relies on one water main
- System Redundancy – system benefits by conveying water through Highlands to other zones
- Water Quality - improved by opening nine new connections for greater circulation

Key Impacts

- Pressure reduced across zone / most impacted at highest elevations and during peak summer season
- Some households were constructed with requirements for fire suppression sprinklers which may not operate properly under the reduced pressures
- Households may need to install a booster pump system to achieve ideal pressures at fixtures

Pressure Gradient Zones

Kirkland has seven active pressure gradient zones:

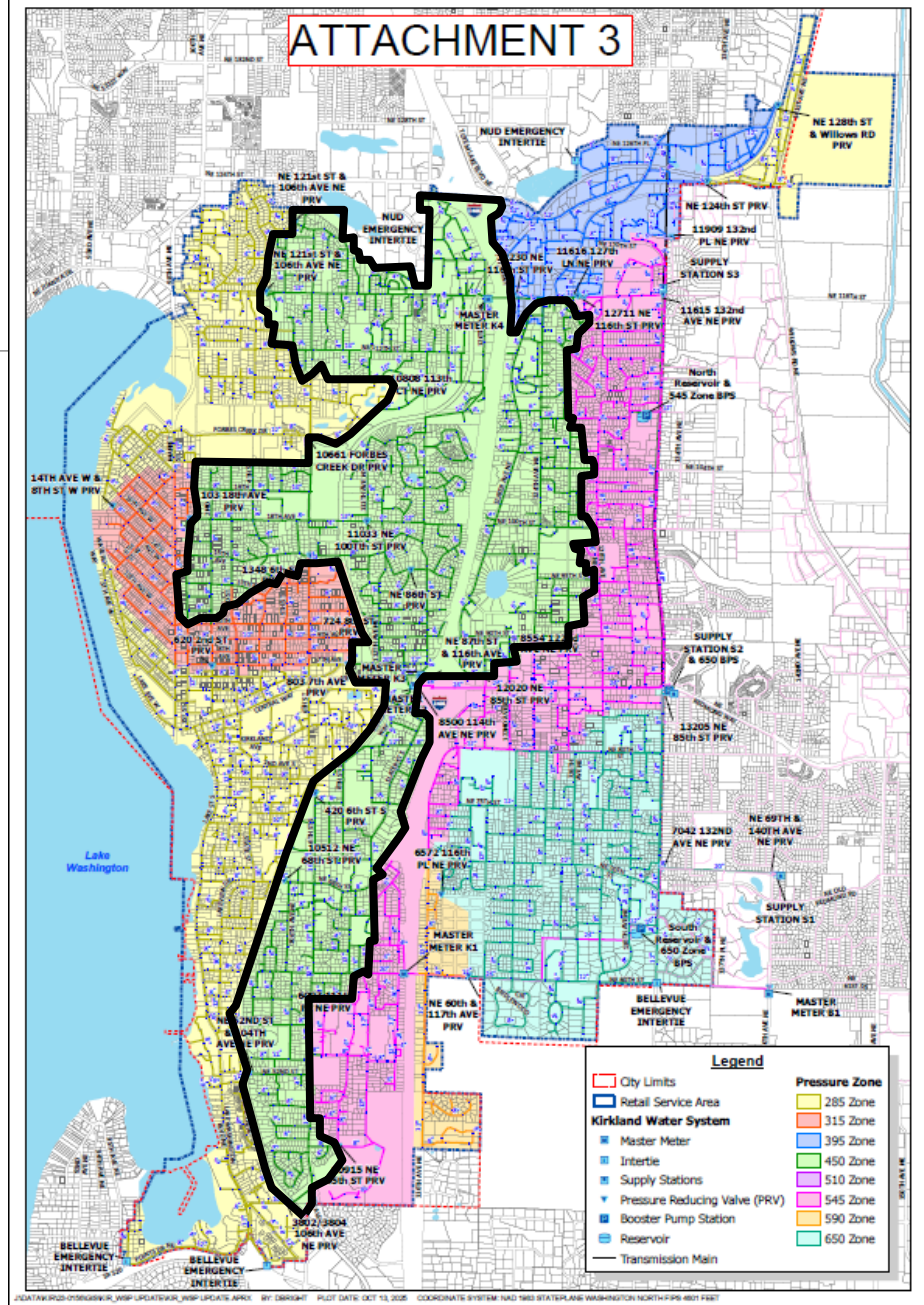
650, 590, 545, 450, 395, 315, 285

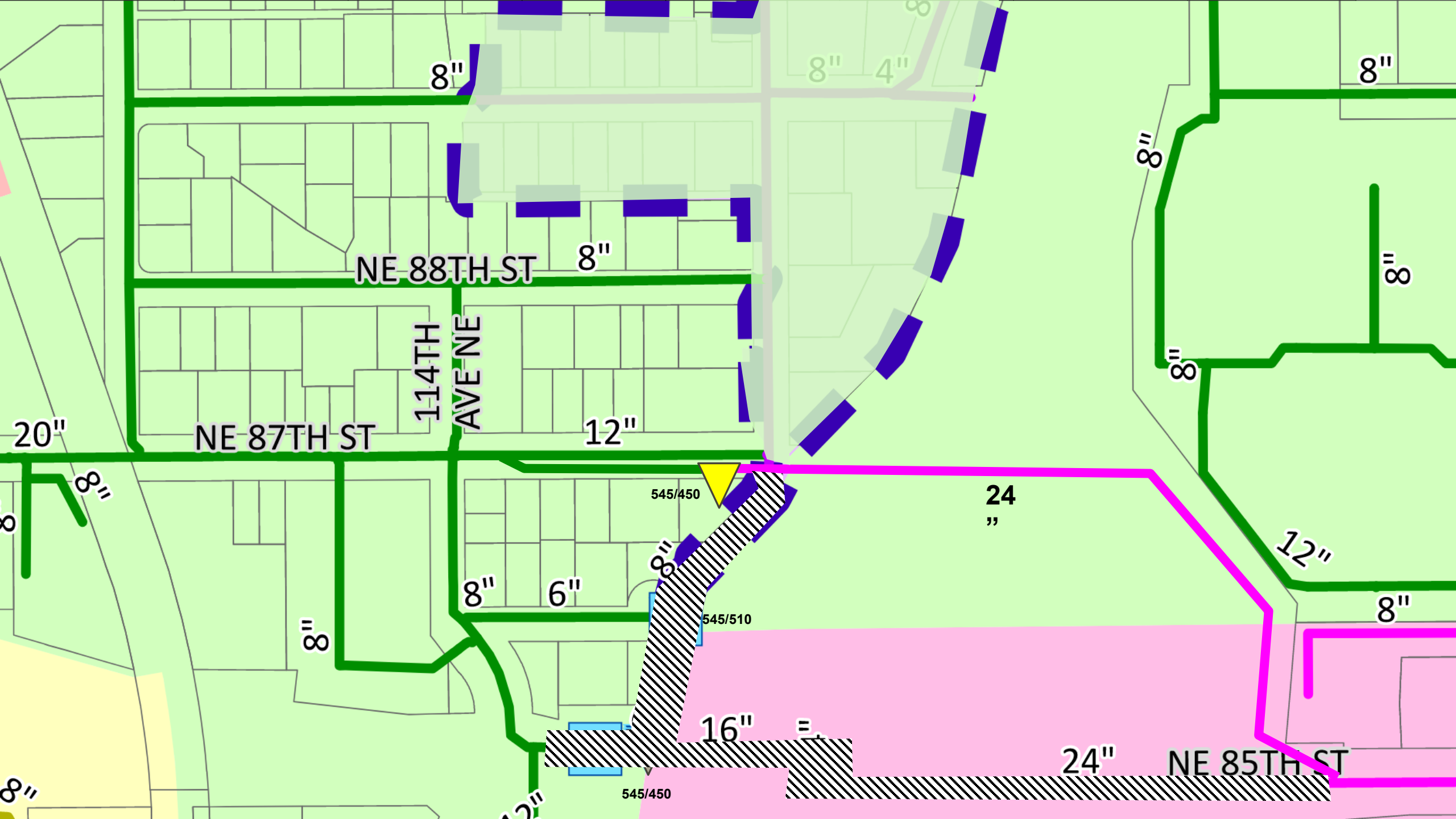
Former 510 Pressure Gradient Zone:

This was an isolated hydraulic island in Upper Highlands which is currently served with the 450 zone.

450 Pressure Gradient Zone:

Improved East-West connection serving downstream zones and essential infrastructure in downtown

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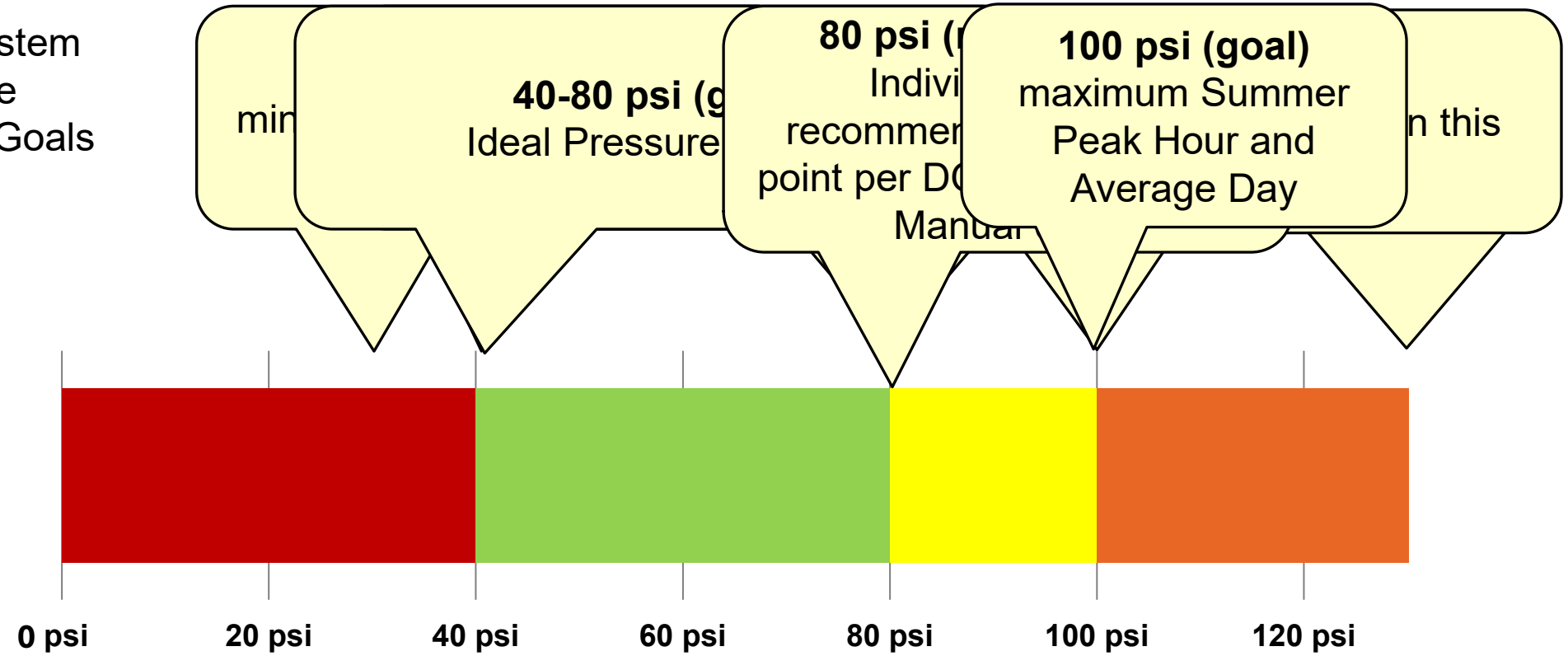
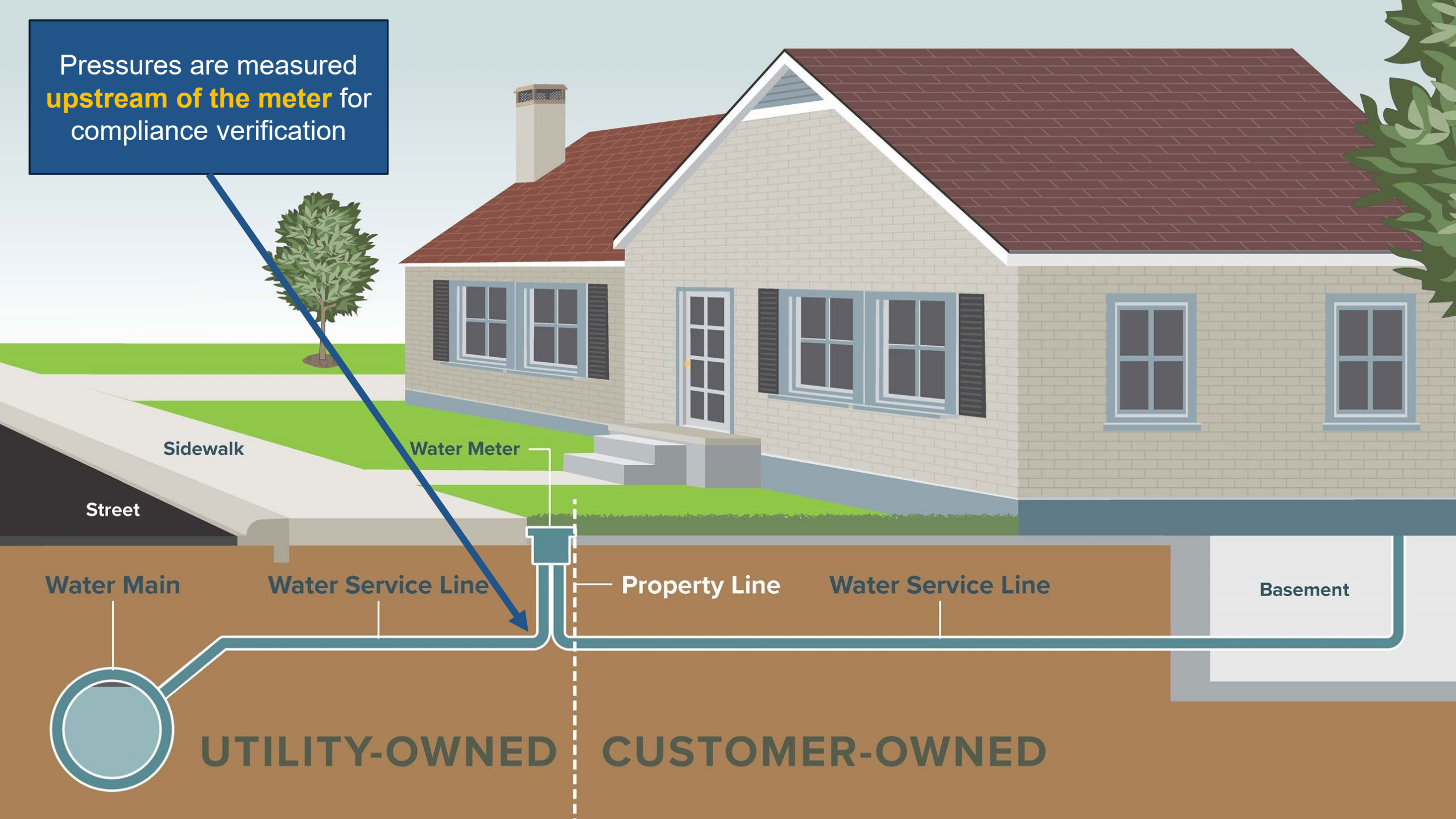
8"
4"
8"
8"
NE 88TH ST
8"
114TH AVE NE
8"
8"
8"
20"
NE 87TH ST
12"
545/450
24"
8"
8"
6"
12"
8"
545/510
8"
16"
24"
NE 85TH ST
545/450
8"

MIN and MAX Pressure Requirements and Goals

2026 Water System Plan Update Proposed LOS Goals



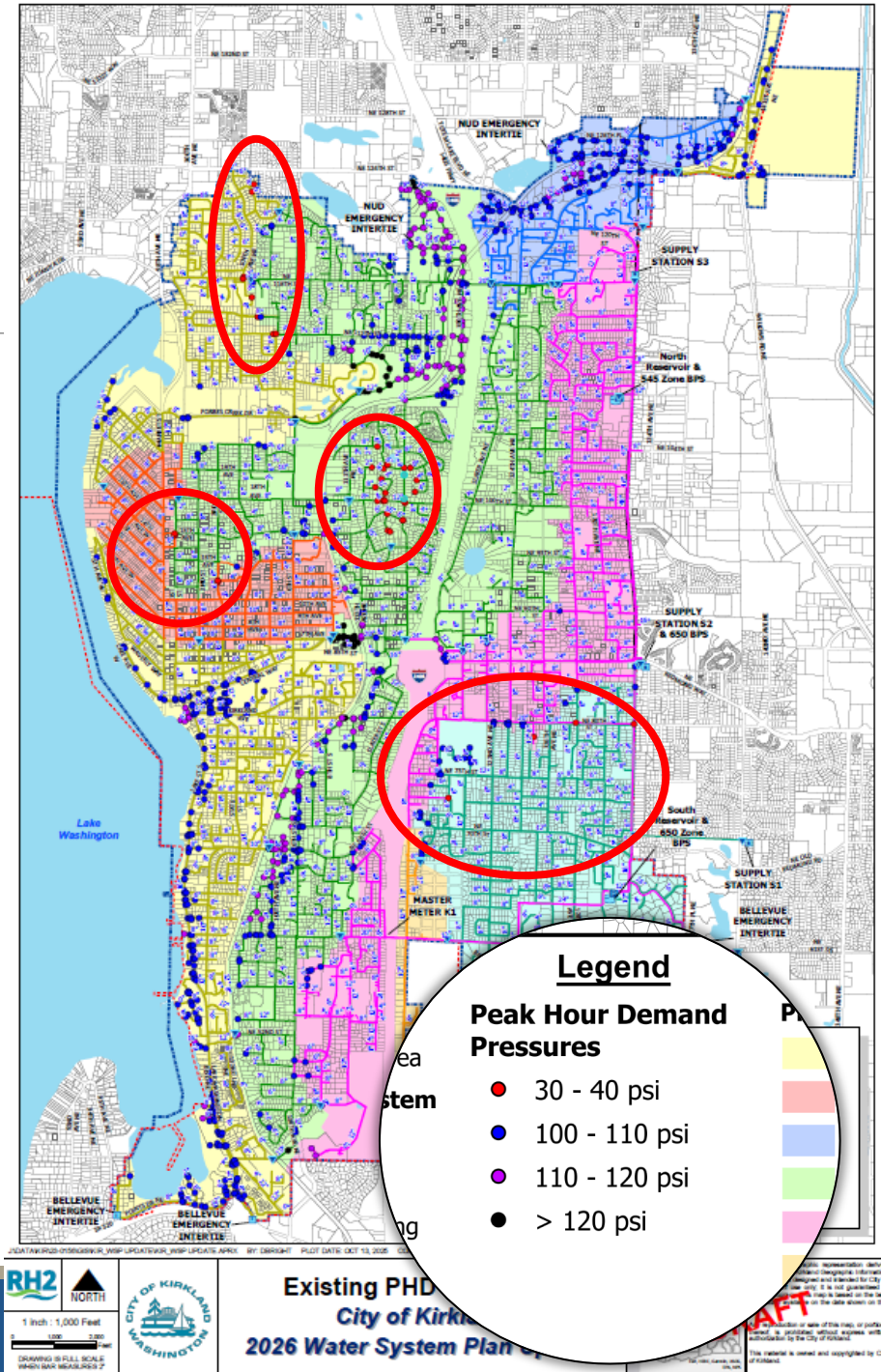

Pressures are measured upstream of the meter for compliance verification
Sidewalk
Water Meter
Street
Water Main
Water Service Line
Property Line
Water Service Line
Basement
UTILITY-OWNED
CUSTOMER-OWNED

Existing Pressure

Peak Hour Demand (PHD): the greatest volume of water in an hour that must be supplied by a water system during any particular time period, such as a year, to meet customer demand, excluding fire flow.

Average Daily Demand (ADD): the average rate of water consumption under normal operating conditions and is used as the baseline for water system sizing.

Peak Daily Demand/Maximum Daily Demand (PDD/MDD): the maximum volume of water used in a single day during the year, accounting for times of extreme use, such as hot summer days, irrigation peaks, or special events.



FIRE FLOW

What is Fire Flow?

Fire Flow is the measure of water quantity (gpm) available from hydrants at 20 psi residual pressure

Flow = quantity

Pressure = force

Minimum Standards:

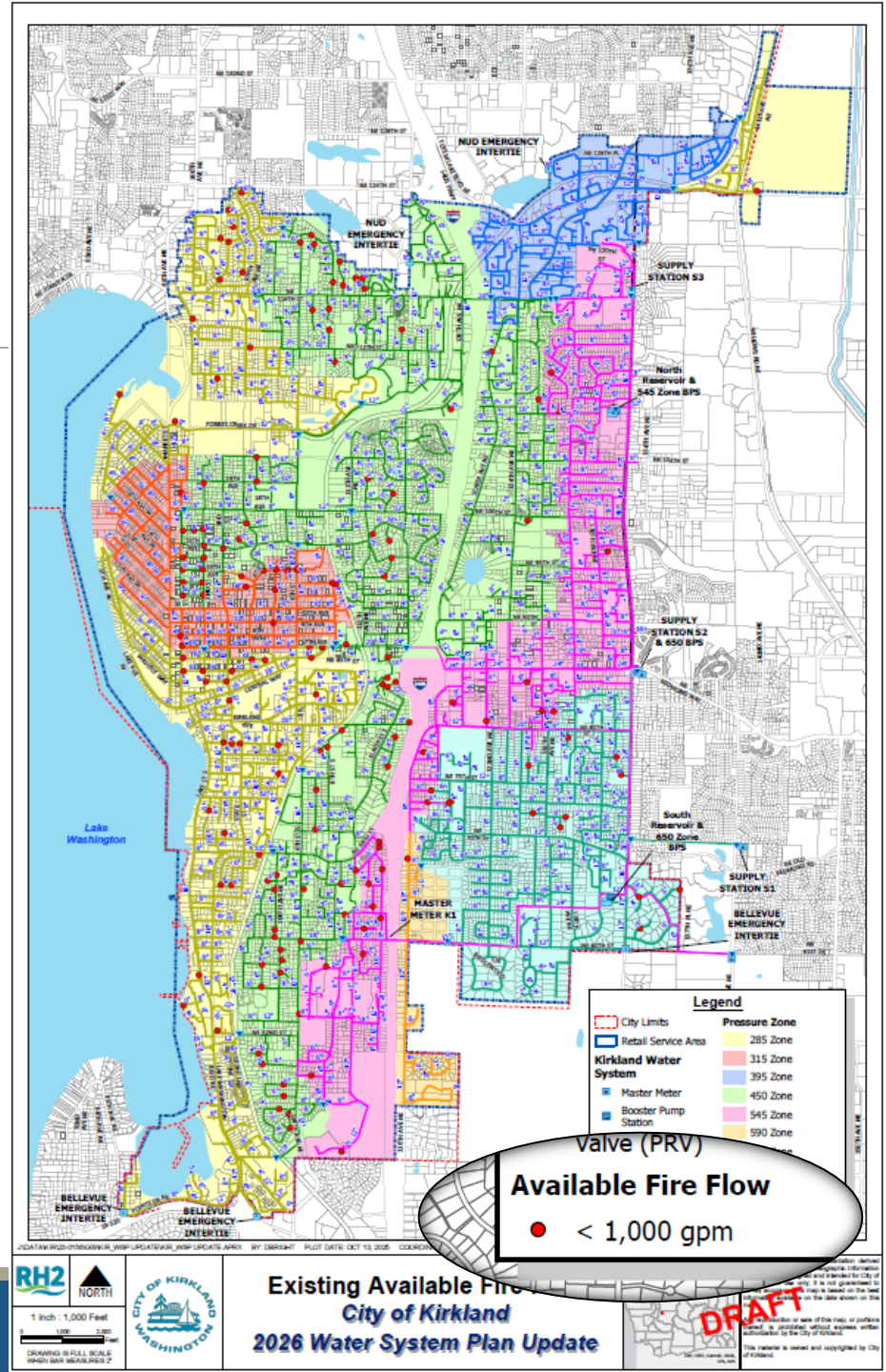
- **1,000 gpm** for ≤3,600 sq ft
- **1,500+ gpm** for larger buildings

Kirkland's Fire Flow

Water Flow: the amount of water delivered over time measured in gallons per minute (GPM). As flow increases, pressure decreases due to friction and energy loss in the pipes.

Fire Flow: the amount of water available for firefighting, measured in GPM at 20 psi residual pressure.

Hydraulic Node: a specific point in a water distribution system where hydraulic parameters, such as pressure, flow and elevation are defined, measured or calculated.



Why Fire Flow Matters

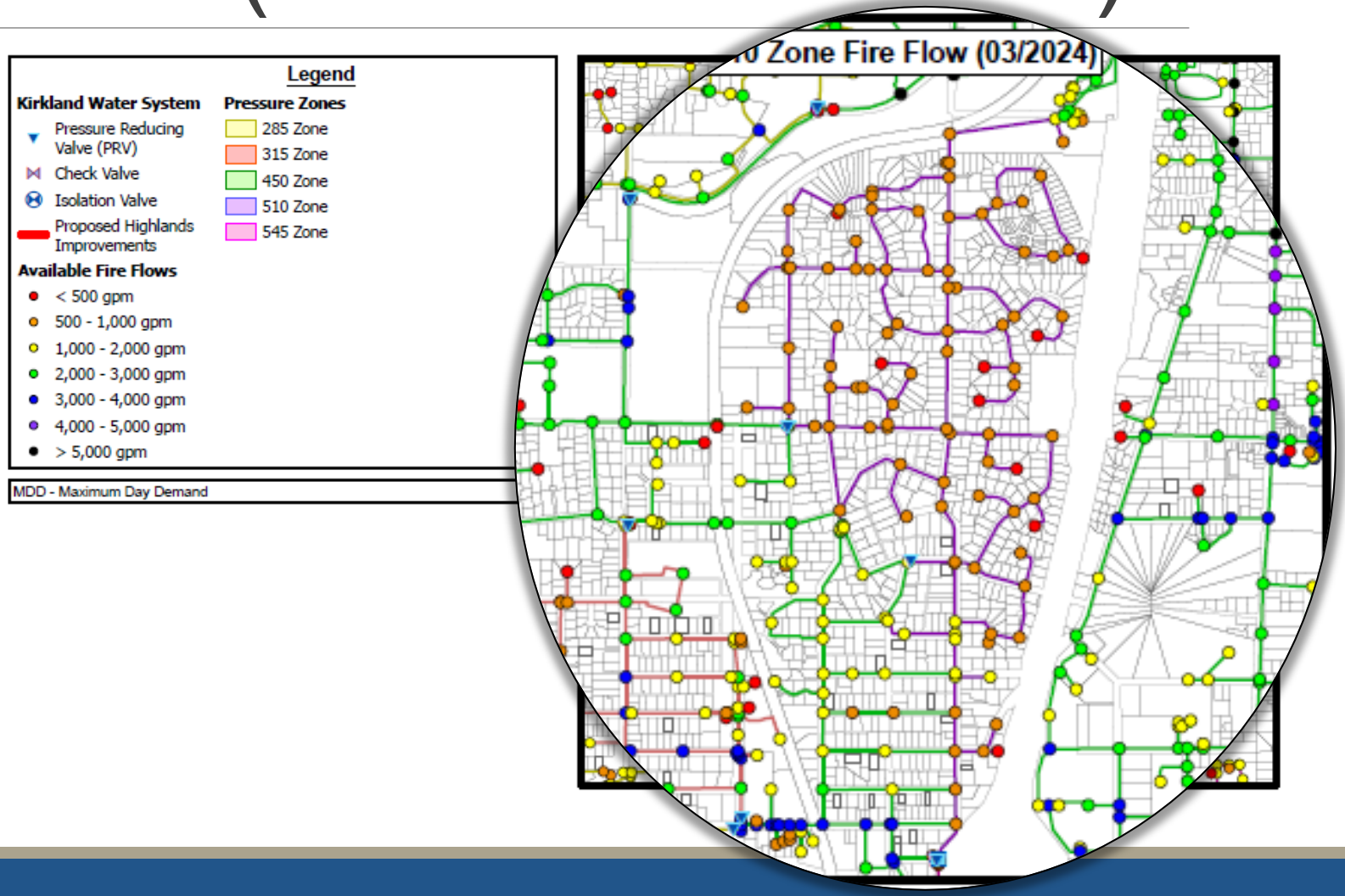
Sustains firefighting ability beyond the water carried on Kirkland fire engines

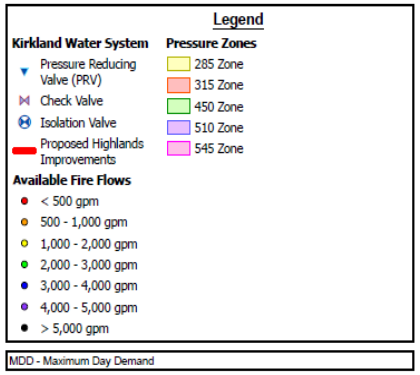
Enables effective suppression and limits spread

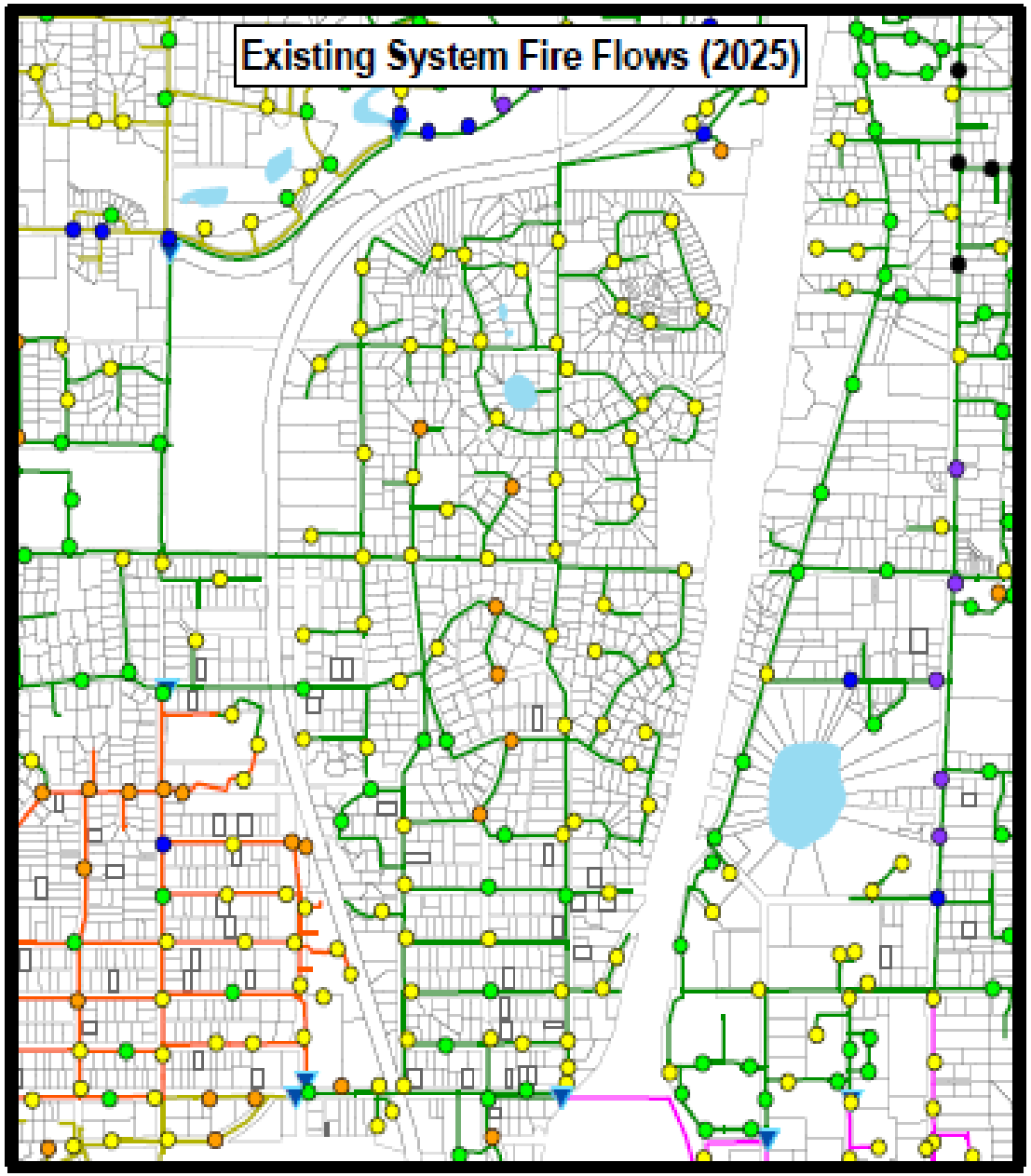
Critical to firefighter and community safety

Upper Highlands (Former 510 Zone)

- Relied on single supply line
- 69% of hydrants <1,000 gpm (below standard)
- Largest low-flow area in Kirkland
- Increased risk to life, property, and firefighters







Fire Flow Improvements

After conversion:

More hydrants available with **>1,000 gpm** to draw supply water from

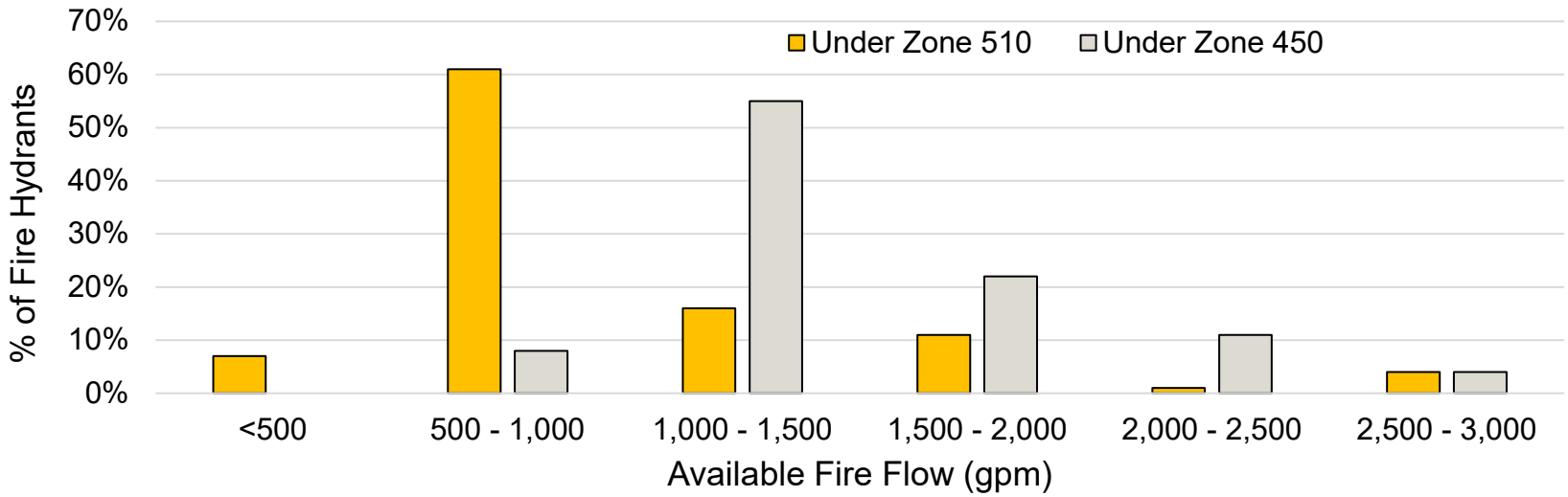
under 8% hydrants **below 1,000 gpm**

Zero hydrants **below 500 gpm**

More reliable water supply meeting the needs for safer firefighting

Pre and Post Zone Conversion

Available Fire Flow



Benefits of Improved Fire Flow

Firefighter gains

- Sustainable supply
- Faster control
- Safer operations

Residents gain

- Better protection
- Reduced loss
- Stronger infrastructure
- New building permits may not require fire suppression sprinklers

Importance of Fire Flow

The California Palisades earlier this year highlighted the importance of adequate fire flow.

Several Kirkland Firefighters responded to assist, where insufficient flow was a contributing factor that hindered firefighting efforts.

Reliable fire flow is vital to control a blaze quickly and stop it from spreading to nearby structures.

Residential Sprinkler Systems

Purpose

Life safety — controls fire until Fire Department arrival and allows residents to escape

Sprinklers Required

-Homes larger than 5,000 sq ft

-Limited access properties

-Low hydrant fire flow areas

Current Status

-130+ homes in former 510 zone have residential sprinkler systems

Fire Suppression Sprinklers

Impacts

Some systems may have become under-pressurized post-conversion

City staff currently evaluating impacts

Mitigation

Bucket test and system recalibration

Booster Pump Mitigation Program

Summary

FIRE FLOW = FIREFIGHTING SUCCESS

2024 UPGRADES = SAFETY MILESTONE

BETTER INFRASTRUCTURE = BETTER PROTECTION

SUPPORTS FASTER SUPPRESSION & RESILIENT NEIGHBORHOODS

COUNCIL DISCUSION & QUESTIONS

INTRODUCTION & FIRE FLOW

UP NEXT:
NEAR AND LONG-TERM SOLUTIONS

PART II

NEAR- AND LONG-TERM SOLUTIONS

NEAR-TERM SOLUTIONS

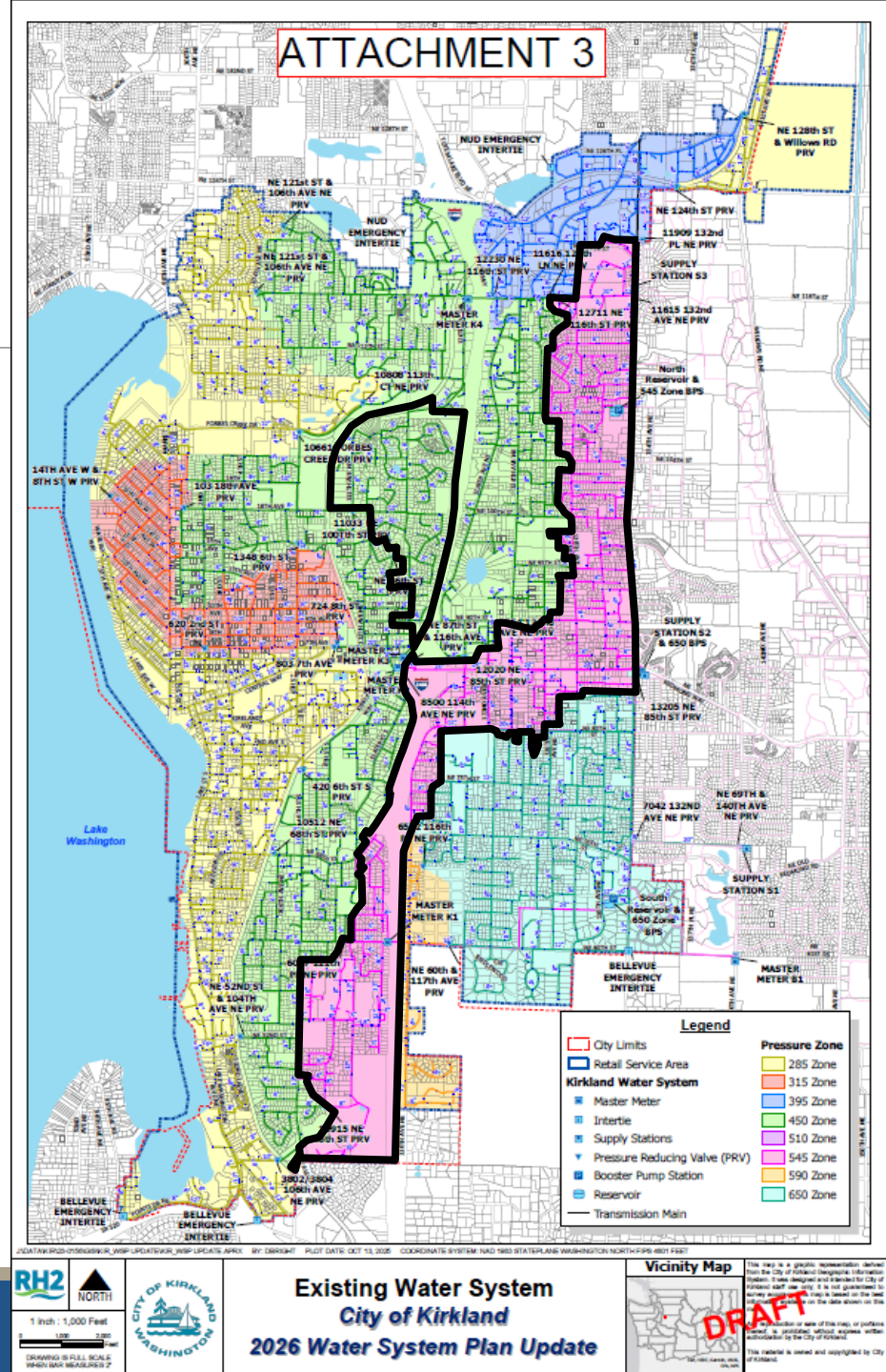
Near-Term Solutions

How can we increase pressure in the Upper Highlands and maintain zone conversion benefits **by Summer 2026**?

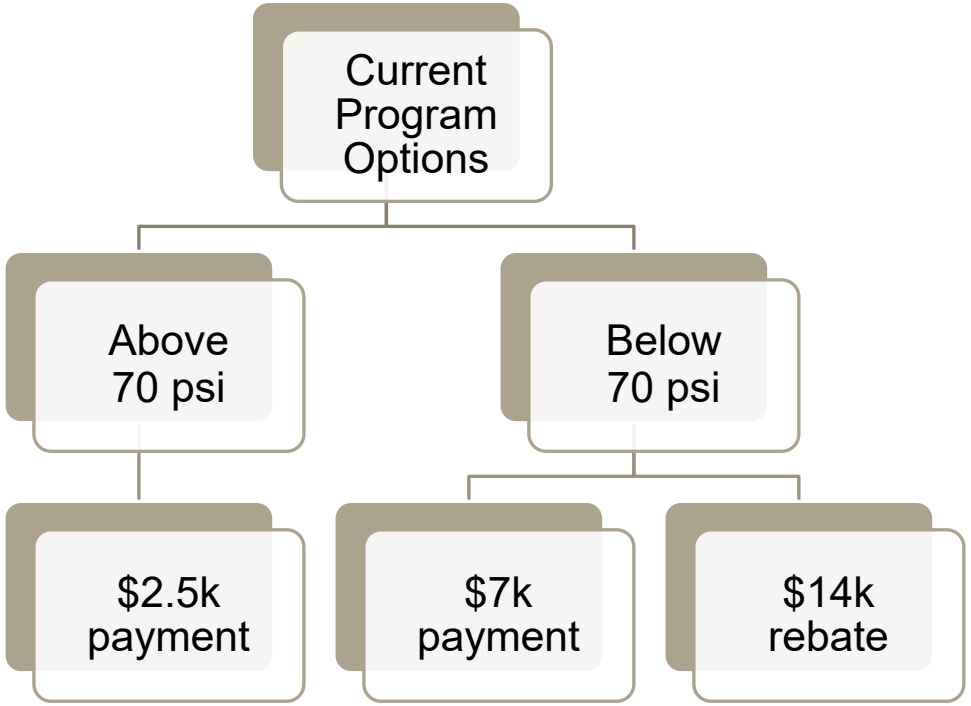
~~Evaluated converting former 510 to equalize with existing, higher 545 zone~~

Expand and adapt the financial assistance mitigation program

Implement water management program to minimize drops in pressure during peak demand



Staff Recommendation: Expand the Financial Assistance Program



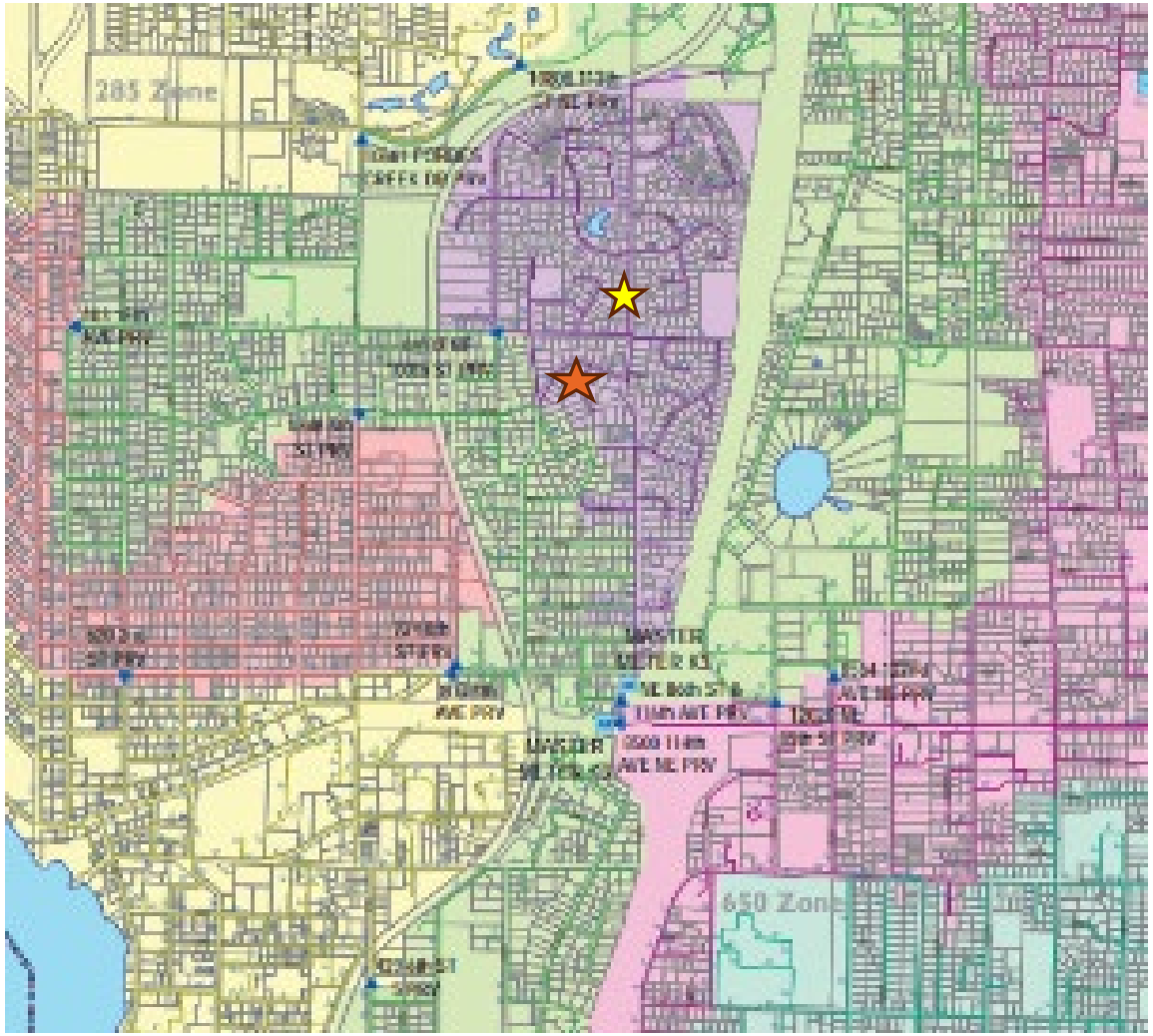
Sign up at www.kirklandwa.gov/highlandswater

City has distributed over $50k in assistance

- **1** has received the **$2.5k** payment
- **7** have received the **$7k** payment
- **1** has requested pre-approval for an estimated **$10k rebate** for a booster pump

Expansion Recommendations in Resolution R-5697

- **Increase** assistance thresholds
  - For residents and home-based businesses
  - Identify additional funding, if needed
- **Add** a rebate for conversion to drip irrigation systems
- **Add** a rebate to address fire suppression sprinklers
- **Streamline** program delivery

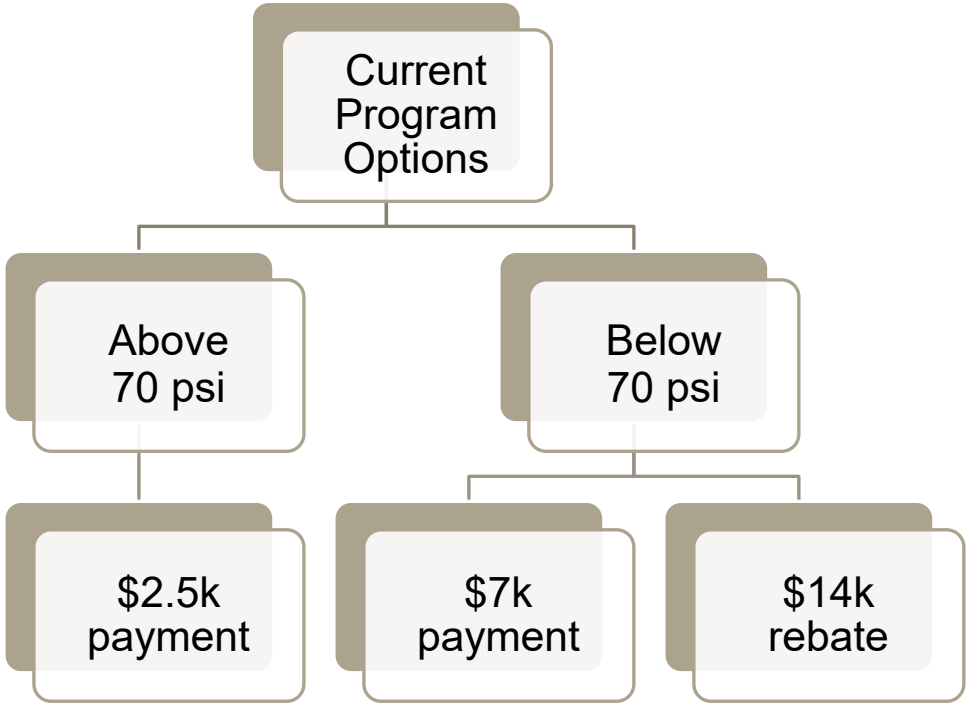


Home-based businesses in Highlands

Approximate locations:

- ★ Angelfish Swim
- ★ Green Knight Nursery

Staff Recommendation: Expand the Financial Assistance Program



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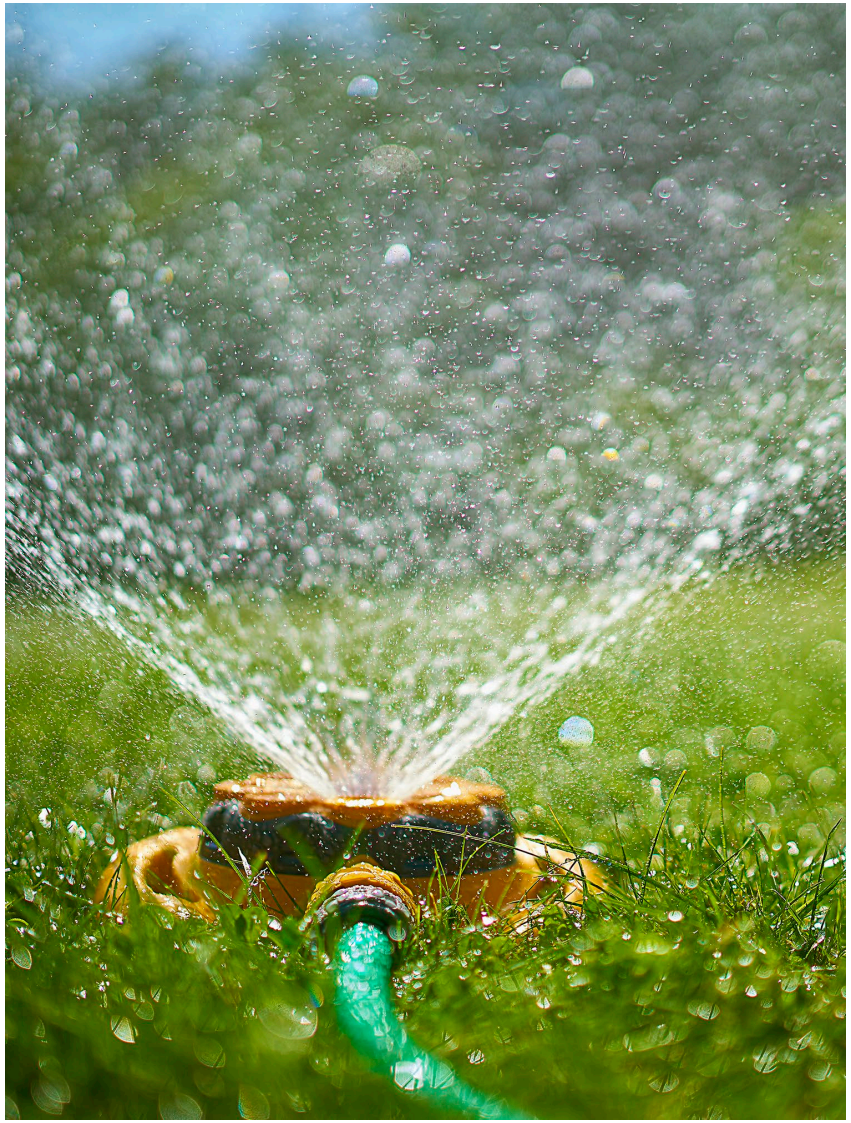
Booster Pumps

- 19"L x 10.5"W x 9.5"H and weigh ~50 pounds
- Reasonably quiet, but not silent
- Disruption can be minimized by installation tips
- Should increase pressure by up to 25-30psi



Staff Recommendation: Water Management Strategies

Targeted outreach and education campaign to reduce drops in pressure during peak demand season

- Designating irrigation schedules to vary days and times of high-water use/pressure drops
- Advertise financial assistance mitigation program, including City's Yard Smart Program
- Information on general water-saving strategies

LONG-TERM SOLUTION:

CIP ALTERNATIVES

Problem Statement

- A portion of the community is dissatisfied with water pressure following the zone conversion
- Pressure improvements must be achieved without compromising **recent system enhancements** with the zone conversion**:**
  - Increased fire flow capacity
  - Improved water quality
  - Enhanced supply redundancy and resilience
  - Strengthened east-west system connectivity across CKC to support city's essential facilities (City Hall EOC, Peter Kirk Community Center, Fire Station 22, etc.)

- The aging main supply line to Highlands is nearing the end of its service life – timely replacement is critical to prevent catastrophic failure

3 Strategic Alternatives to Meet Project Goals

Project Goals	Alternative 1 – Smaller 510 Zone	Alternative 2 – Reinstate Former 510 Zone	Alternative 3 – Reinstate Former 510 Zone (Phased Approach)
Target Pressure LOS to be 40 psi ~ 80 psi (**above 30 psi**)			
93% or more Hydrants with Fire Flow **≥ 1,000 gpm**			
Redundant Supply Connections			
Enhance East-West Connectivity Across CKC for **Essential Services**			
Optimize Circulation for **Water Quality**			
Replacing **End of Service Life Main** to Prevent Catastrophic Failure			

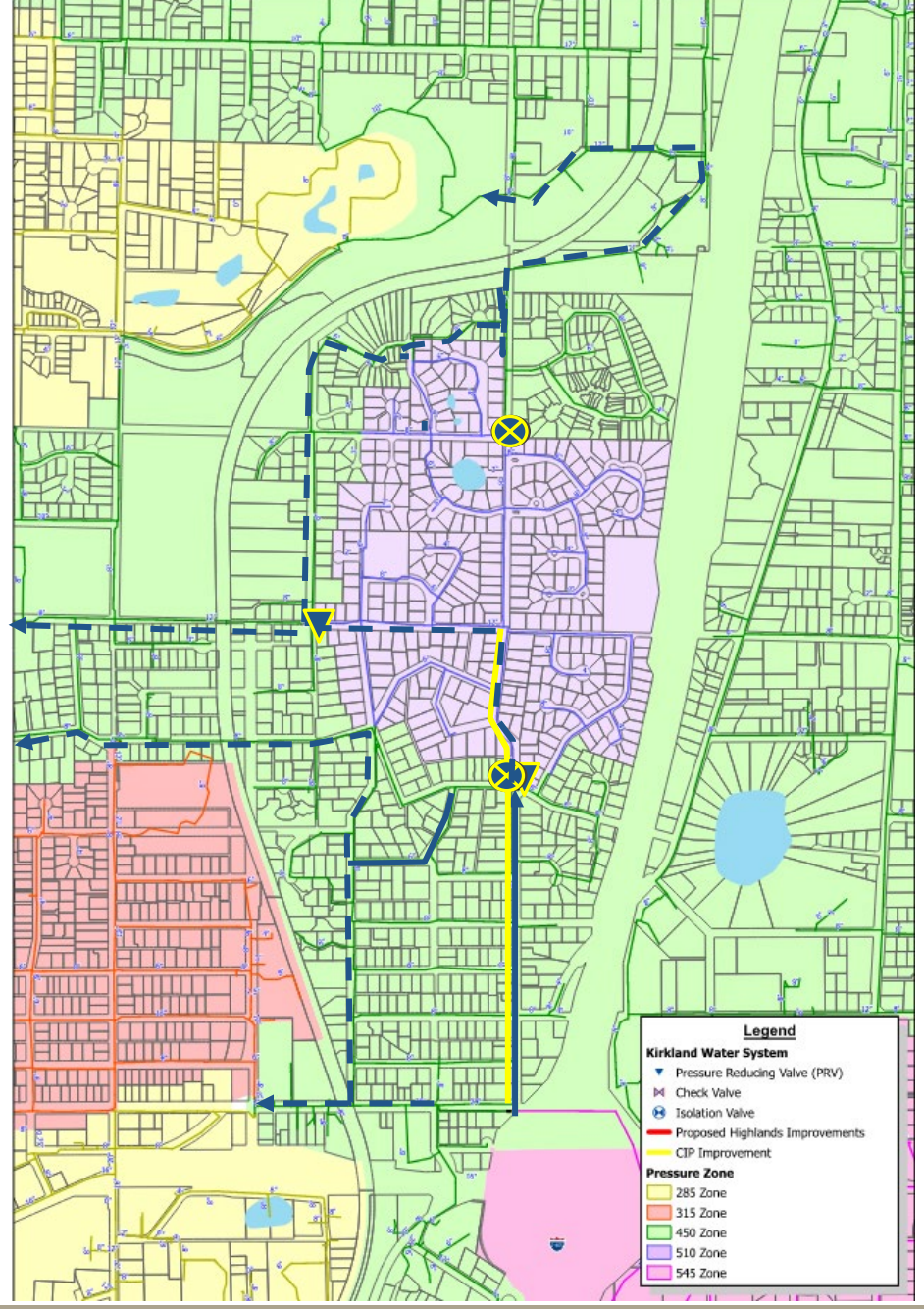
Preferred | Acceptable | Fair | Poor

Alternative 1 Concept

Enhancing Service to Higher Elevation Residents through a **Smaller 510 Zone**

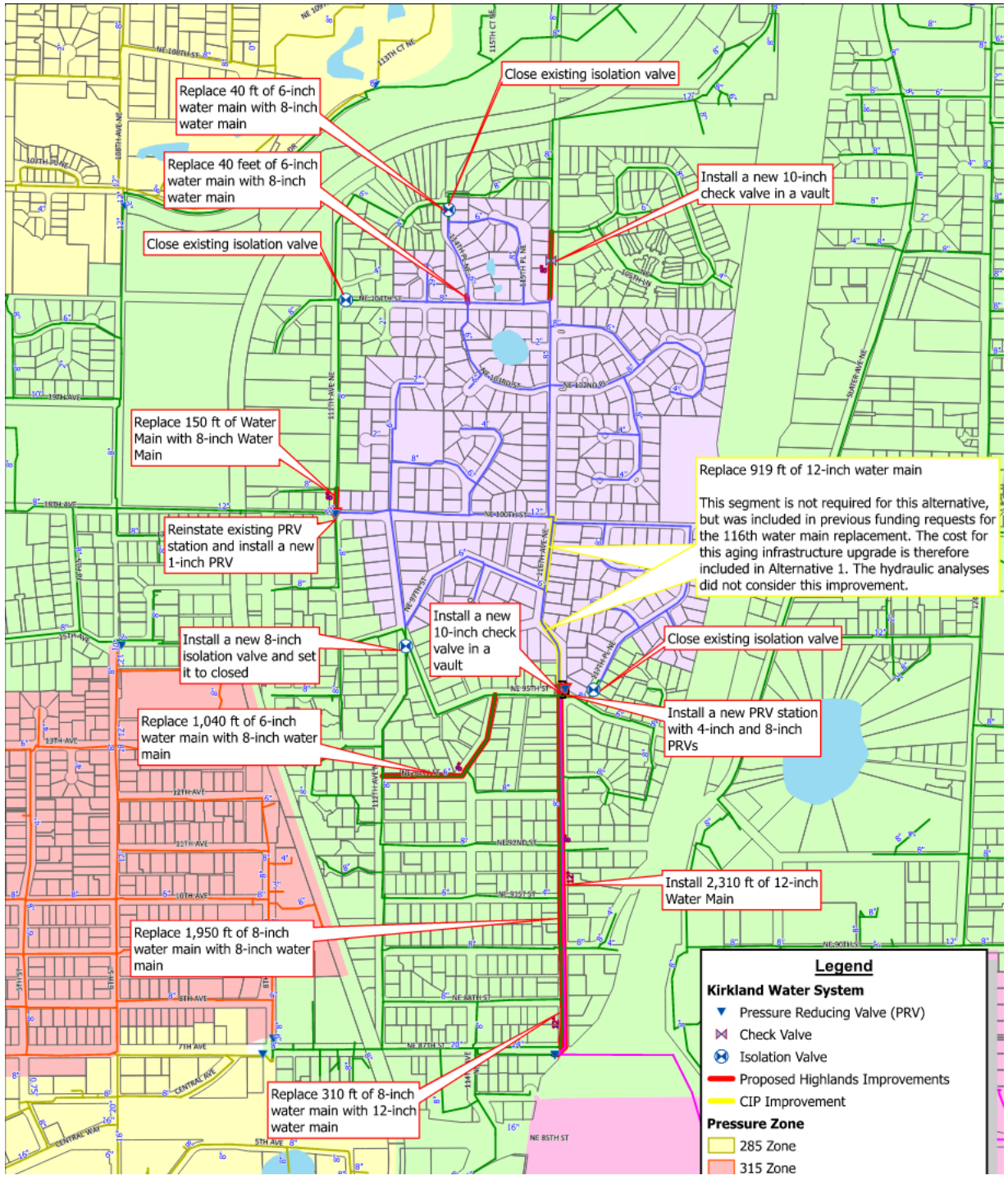
Project Goals	
Target Pressure LOS to be 40 psi ~ 80 psi (**above 30 psi**)	
93% or more Hydrants with Fire Flow **≥ 1,000 gpm**	
Redundant Supply Connections	
Enhance East-West Connectivity Across CKC for **Essential Services**	
Optimize Circulation for **Water Quality**	
Replace **End of Service Life Main** to Prevent Catastrophic Failure	

Preferred | Acceptable | Fair | Poor



Summary of Alternative 1

- Proposed Watermain Installation ~ **6,800 LF**
  - 3,200 lf @ 8”
  - 3,600 lf @ 12”
- Project Cost - $8.7 M
- Project Duration – 24 ~ 30 Months

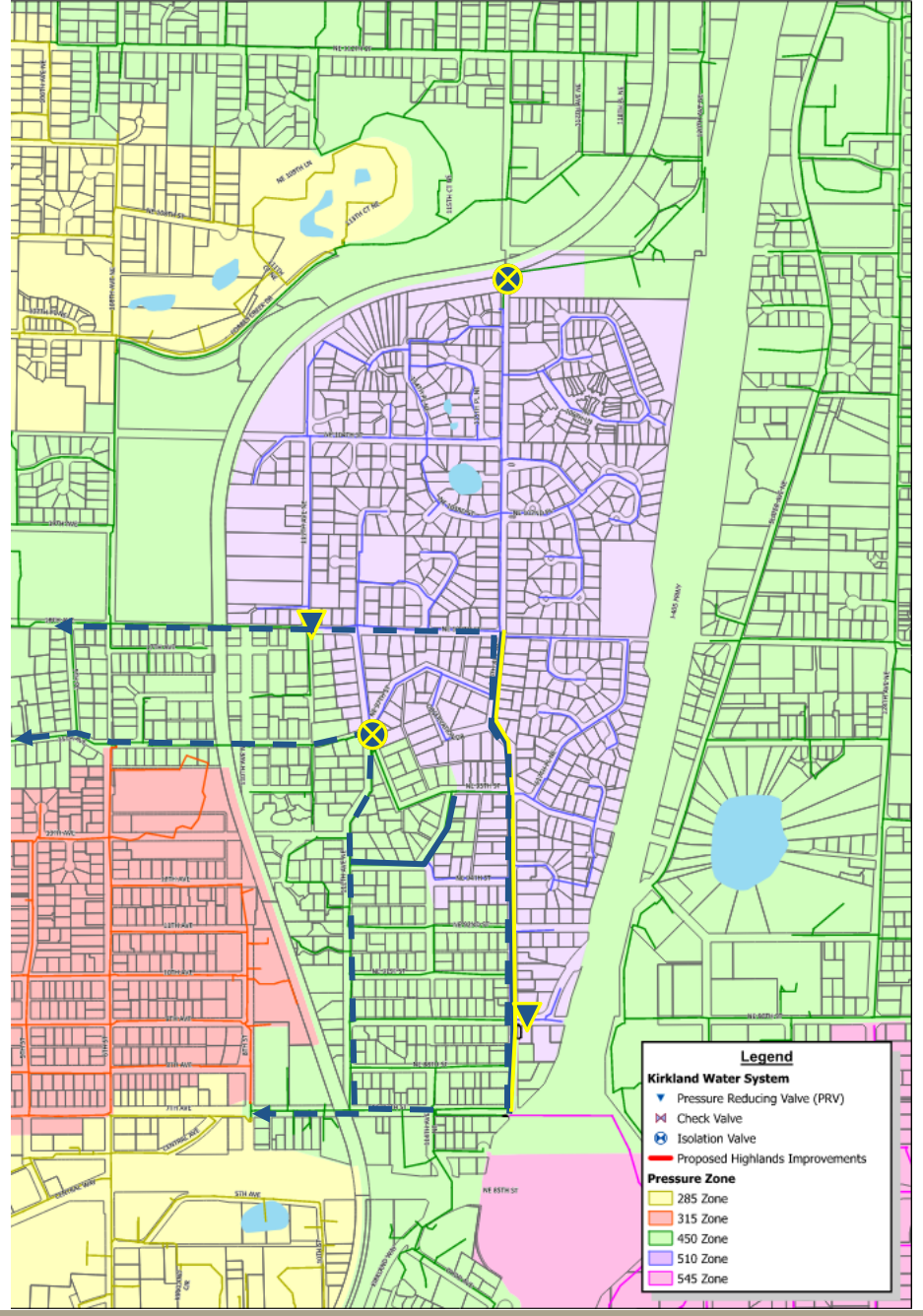


Alternative 2 Concept

Reinstate **Former 510 Zone**

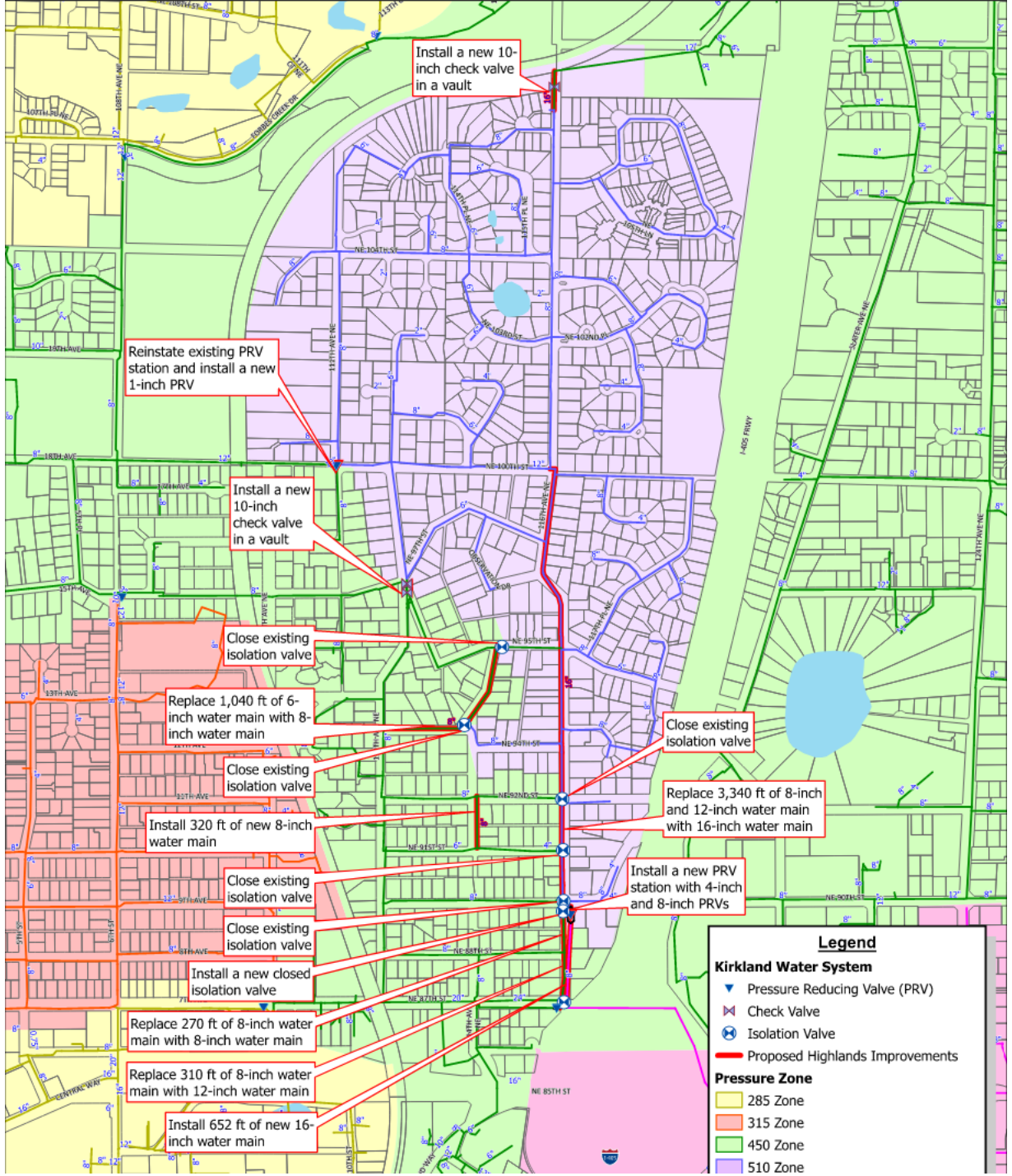
Project Goals	
Target Pressure LOS to be 40 psi ~ 80 psi (**above 30 psi**)	
93% or more Hydrants with Fire Flow **≥ 1,000 gpm**	
Redundant Supply Connections	
Enhance East-West Connectivity Across CKC for **Essential Services**	
Optimize Circulation for **Water Quality**	
Replace **End of Service Life Main** to Prevent Catastrophic Failure	

Preferred | Acceptable | Fair | Poor



Summary of Alternative 2

- Proposed Watermain Installation ~ **5,300 LF**
  - 1,630 lf @ 8”
  - 310 lf @ 12”
  - 3,340 lf @ 16”
- Project Cost - $8.0 M
- Project Duration – 23 ~ 29 Months

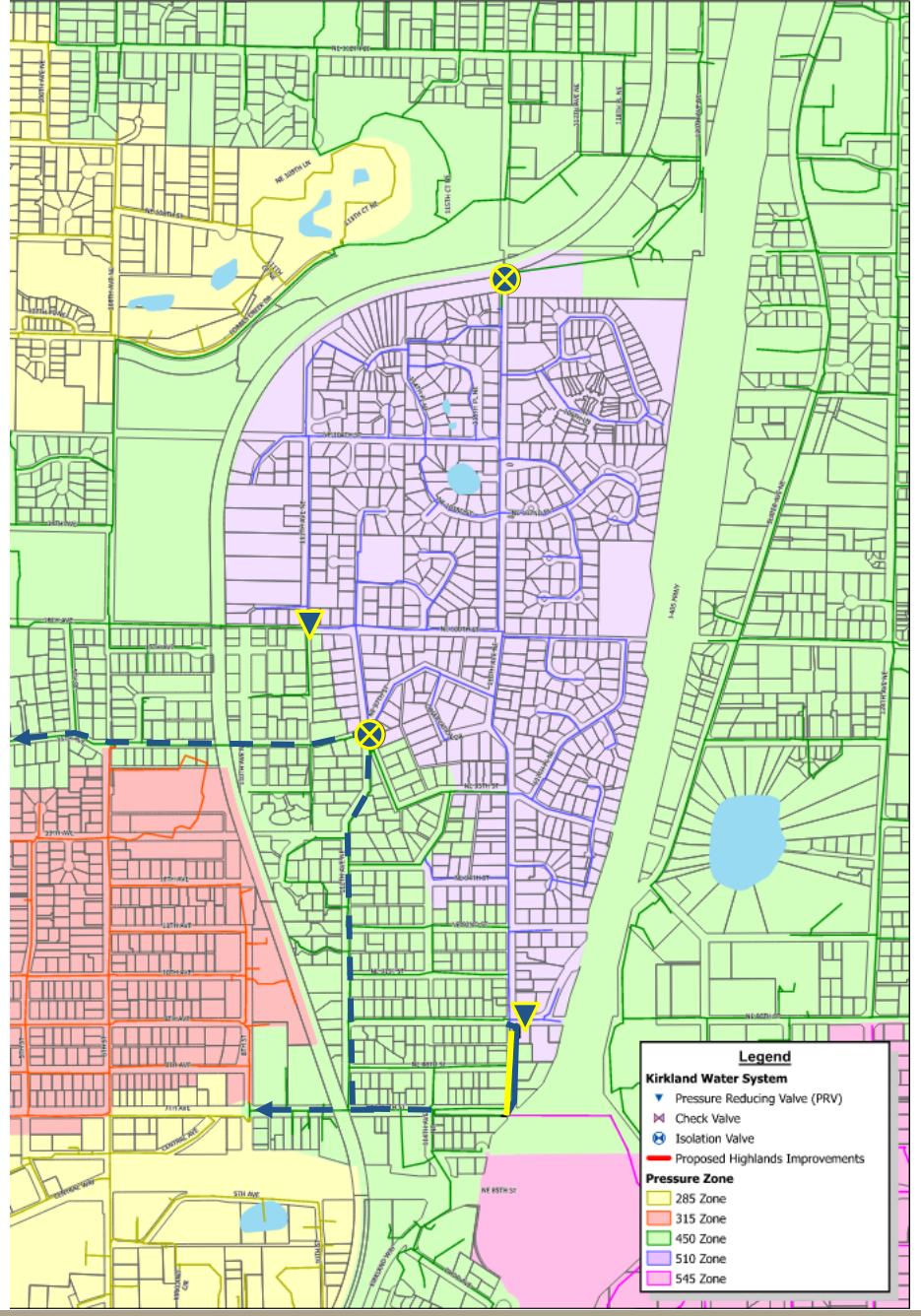


Alternative 3 Concept

Reinstate **Former 510 Zone, Phased Approach**
Does Not Meet LOS

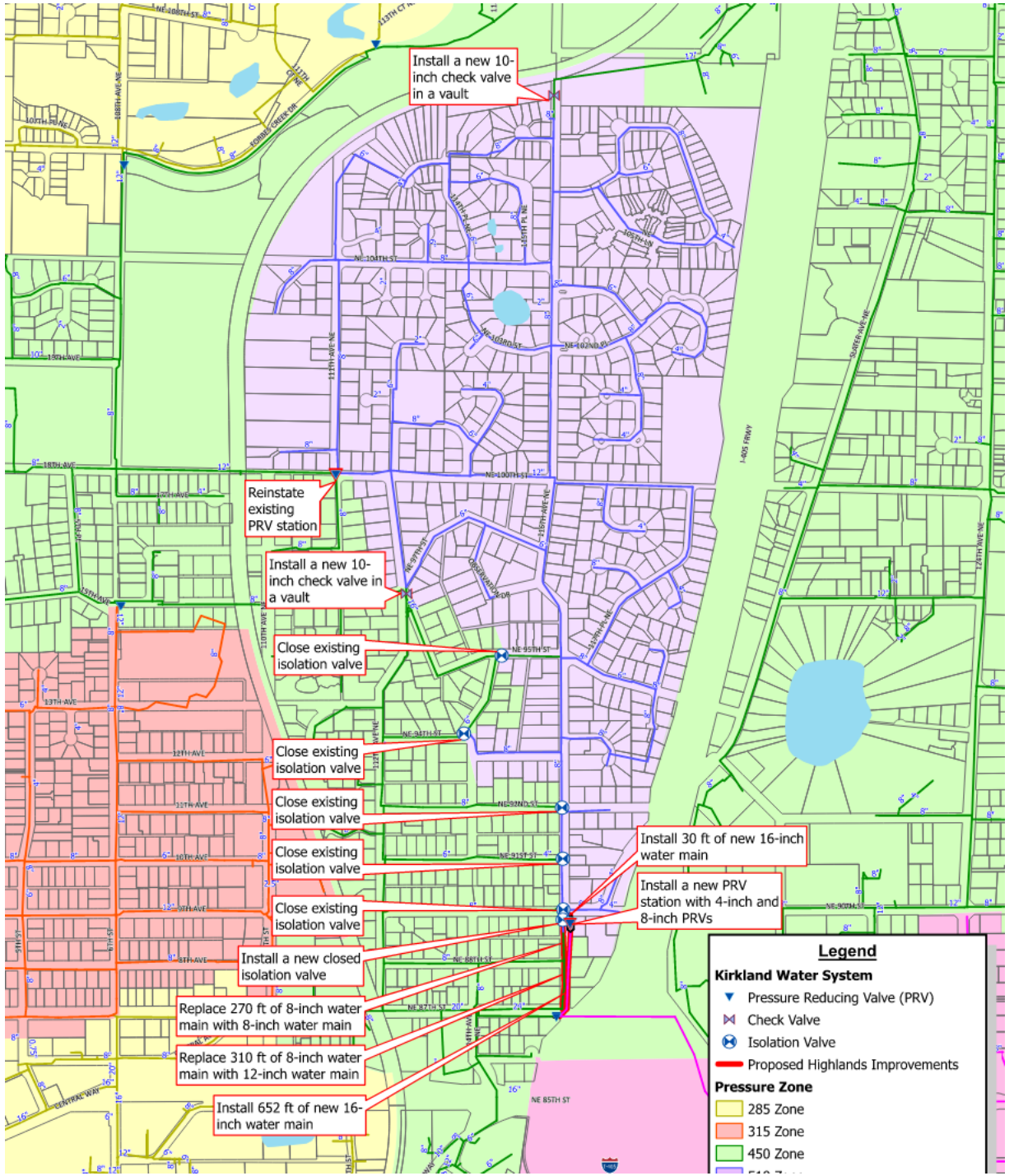
Project Goals	
Target Pressure LOS to be 40 psi ~ 80 psi (**above 30 psi**)	
93% or more Hydrants with Fire Flow **≥ 1,000 gpm**	
Redundant Supply Connections	
Enhance East-West Connectivity Across CKC for **Essential Services**	
Optimize Circulation for **Water Quality**	
Replace **End of Service Life Main** to Prevent Catastrophic Failure	

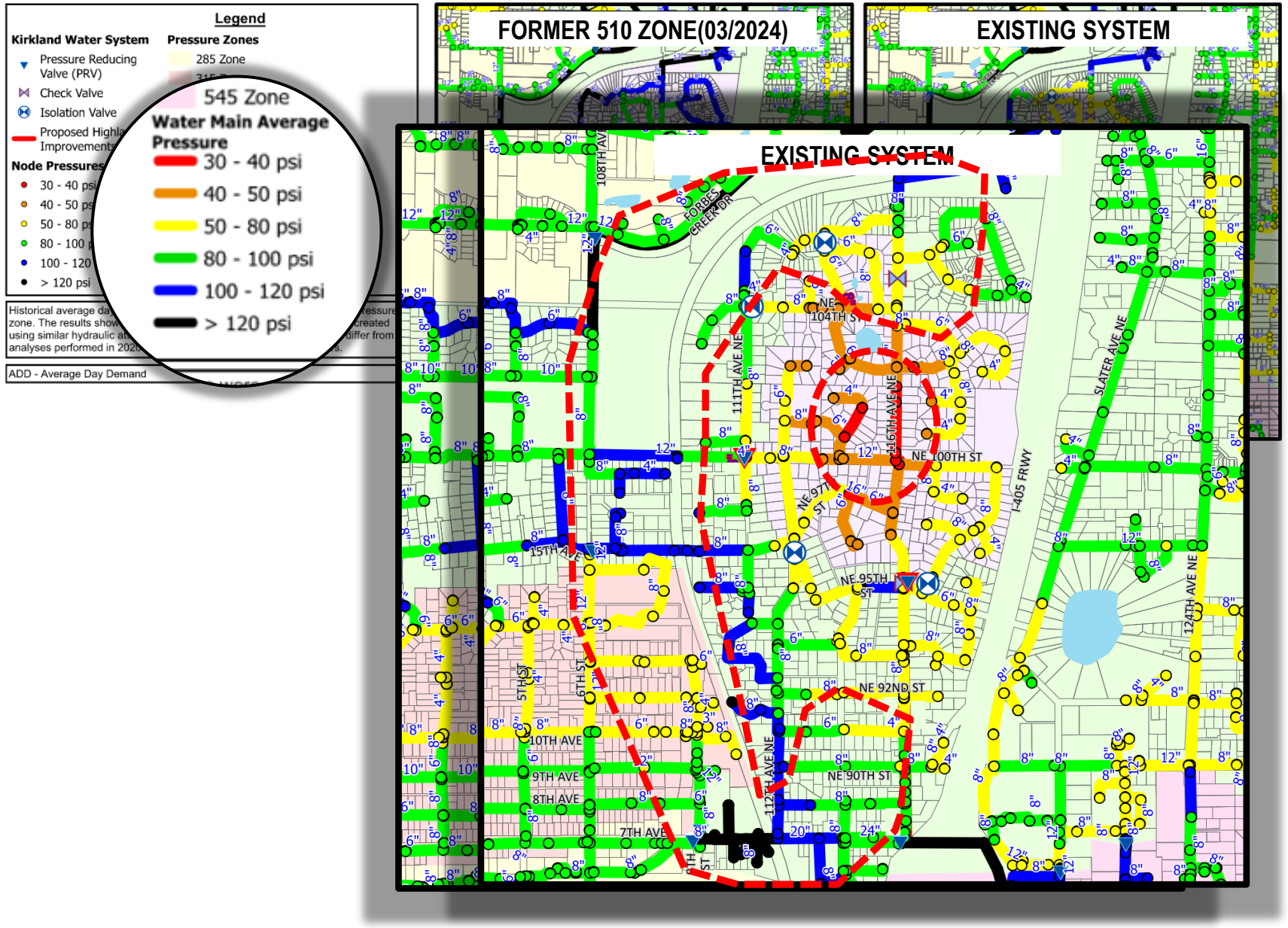
Preferred | Acceptable | Fair | Poor



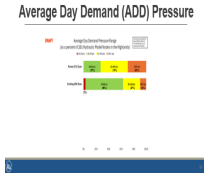
Summary of Alternative 3

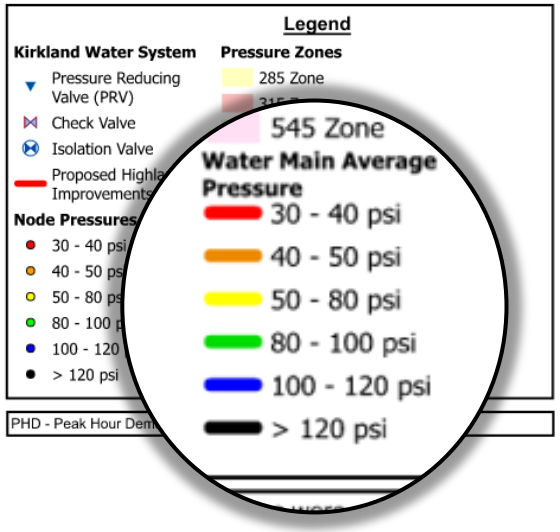
- Proposed Watermain Installation – **1,260 LF**
  - 270 lf @ 8”
  - 310 lf @ 12”
  - 680 lf @ 16”
- Project Cost - $3.2 M
- Project Duration – 16 ~ 21 Months

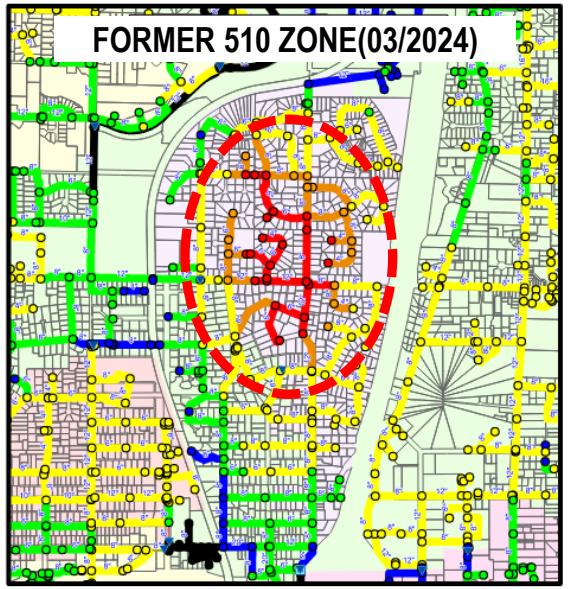


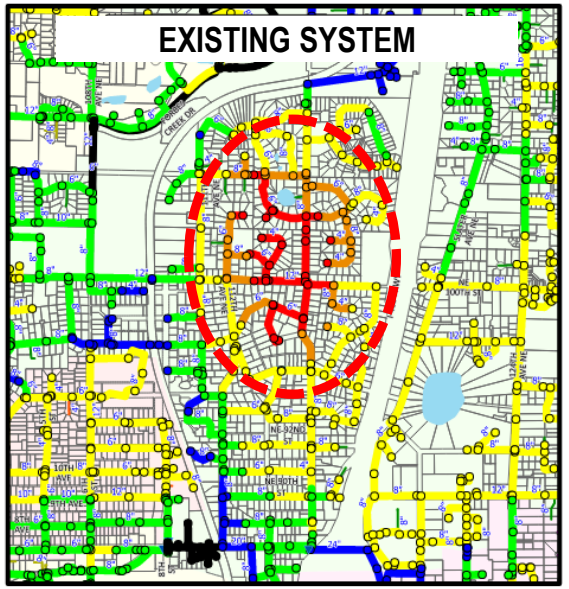


ADD Pressure for Alternatives

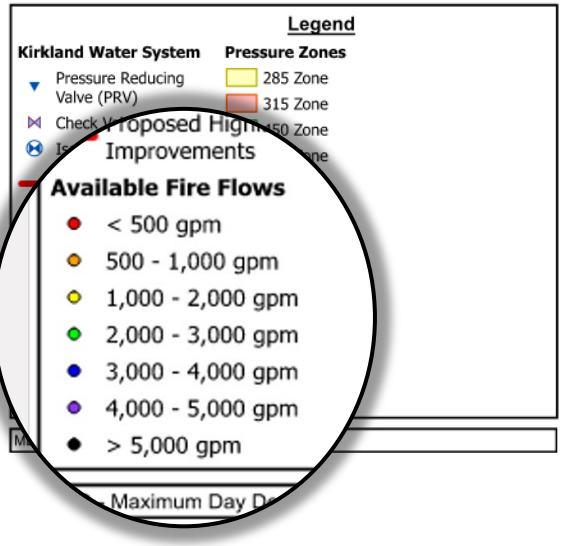


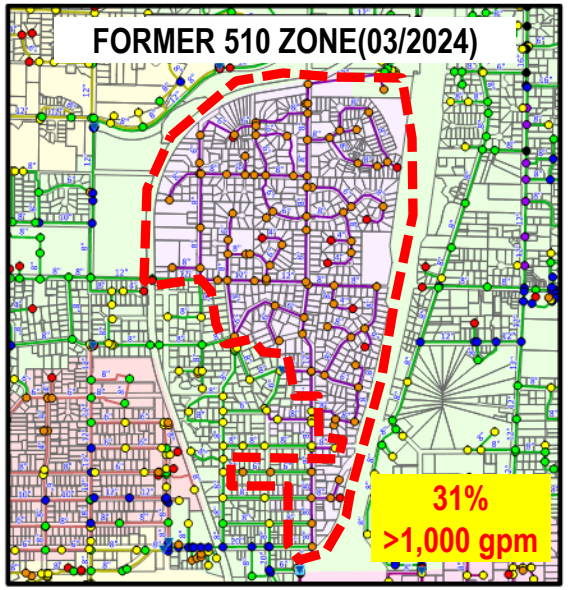


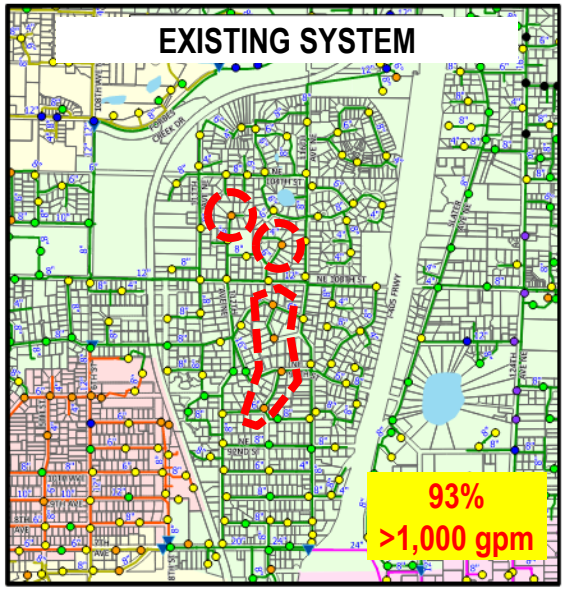




PHD Pressure for Alternatives







Fire Flow for Alternatives

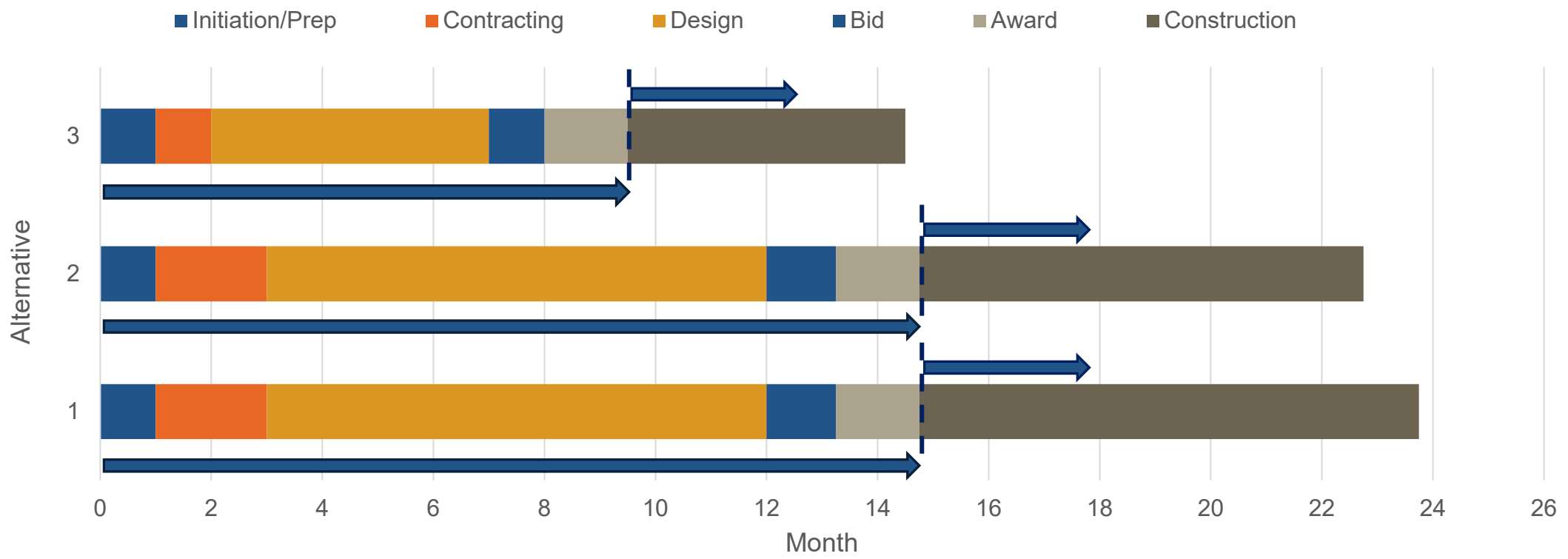
Funding Requirements for Alternatives

	Alternative 1 – Smaller 510 Zone	Alternative 2 – Restore Former 510 Zone	Alternative 3 – Short-term/Phase Improvement
 Project Capital Cost	$8.7 M	$8.0 M	$3.2 M
Allocate Available Funding Designated for Replacing Aging and Failing Water Main on 116th Ave NE	$3.3 M	$3.3 M	$0.56 M
Anticipated Funding Need to Fully Implement the Project	**$5.4 M**	**$4.7 M**	**$2.64 M**

Each additional $1M in funding would require:
- ~6–6.5% rate increase in 2026 (one-time revenue)
- ~0.5–0.75% annual rate increase for 20 years (debt service)

Detailed rate analysis will follow once an alternative is selected.

Implementation Duration for Each Alternative



Alternatives Comparison Summary

Highlands Pressure Zone Scenario	Low Pressures (Summer)	High Pressures (Summer)	Average Day Pressures
Former 510 Zone	<40 psi: 12%	>80 psi: 34%	<40 psi: none >80 psi: 73%
Existing 450 Zone	<40 psi: 14%	>80 psi: 27%	<40 psi: 3% >80 psi: 37%

Legend

- Preferred
- Acceptable
- Fair
- Poor

Updated 10/21/25

COUNCIL DISCUSION & QUESTIONS

NEAR- AND LONG-TERM SOLUTIONS

UP NEXT:
NEXT STEPS

NEXT STEPS

Summary

Benefits of Zone Conversion

- Fire flow
- Supply redundancy
- System redundancy
- Water quality

Near-Term Recommendations

- Adopt R-5697
- Expand mitigation program
- Water Management Strategies campaign

Long-Term Options

- Alt 1 Smaller 510 Zone
- Alt 2 Former 510 Zone
- Alt 3 Phased Approach

Is Council interested in advancing to design?

Resolution R-5697

1. Include in the proposed 2025 Capital Improvement Program update at least two capital project alternatives for the Upper Highlands to increase water pressure while retaining the system benefits of the 450 pressure zone conversion and to fund the next milestone of engineering design
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4. Implement a targeted outreach and education campaign for water management strategies, particularly during peak demand season when pressures are at their lowest
5. Update the City Council on the progress by April 2026

COUNCIL DISCUSION & QUESTIONS

NEXT STEPS