



TUALATIN VALLEY
WATER DISTRICT

Anatomy and Physiology of Your Water Distribution System

Thursday, December 10, 2020

How we deliver water from the source to your home

Pete Boone, PE, PLS – Water Operations Division Manager

Please mute your microphone!
Feel free to type Questions in the Chat.

anatomy

[uh-nat-uh-mee]

SHOW IPA



SEE SYNONYMS FOR *anatomy*

noun, plural **a·nat·o·mies**.

- 1 the science dealing with the structure of animals and plants.
- 2 the structure of an animal or plant, or of any of its parts.
- 3 dissection of all or part of an animal or plant in order to study its structure.
- 4 a plant or animal that has been or will be dissected, or a model of such a dissected organism.
- 5 a skeleton.
- 6 *Informal*. the human body.

physiology

[fiz-ee-ol-uh-jee]

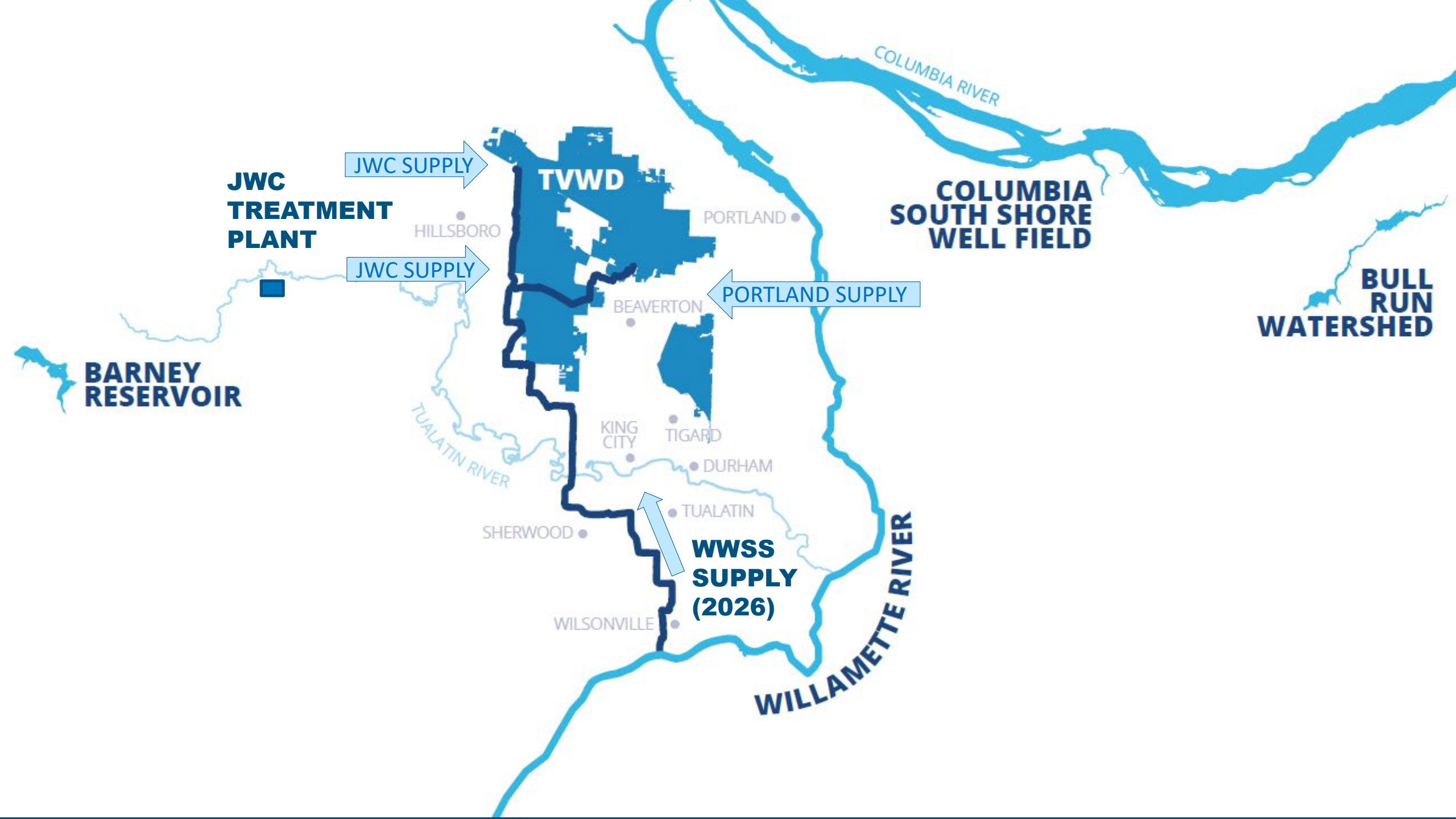
SHOW IPA



SEE SYNONYMS FOR *physiology* ON THESAURUS.COM

noun

- 1 the branch of biology dealing with the functions and activities of living organisms and their parts, including all physical and chemical processes.
- 2 the organic processes or functions in an organism or in any of its parts.



**JWC
TREATMENT
PLANT**

JWC SUPPLY

JWC SUPPLY

TVWD

HILLSBORO

PORTLAND

**COLUMBIA
SOUTH SHORE
WELL FIELD**

PORTLAND SUPPLY

BEAVERTON

**BULL
RUN
WATERSHED**

**BARNEY
RESERVOIR**

TUALATIN RIVER

KING
CITY

TIGARD

DURHAM

TUALATIN

SHERWOOD

**WWSS
SUPPLY
(2026)**

WILSONVILLE

WILLAMETTE RIVER

COLUMBIA RIVER

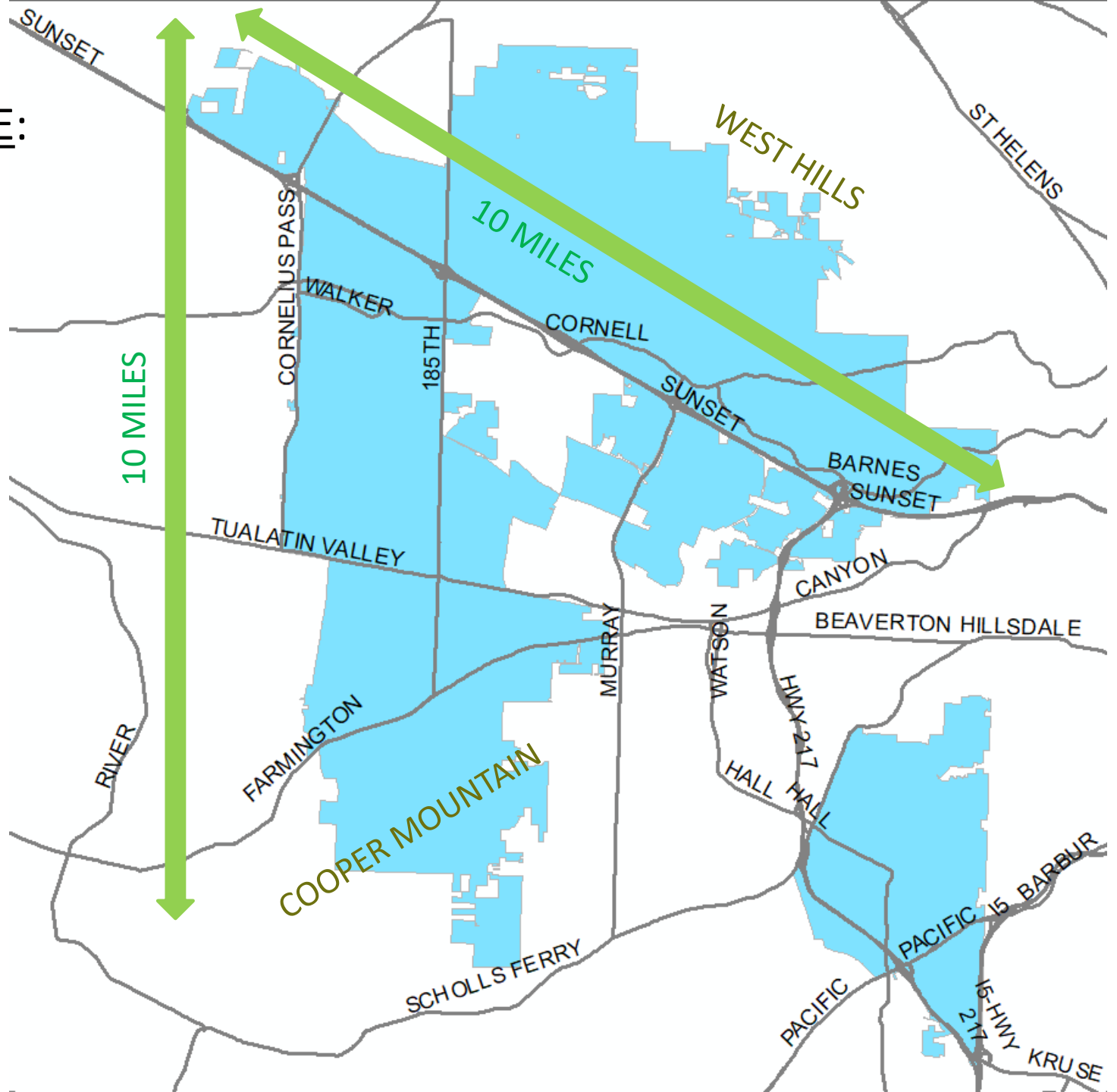
TVWD SERVICE AREA AT A GLANCE:

Area served: 45 square miles

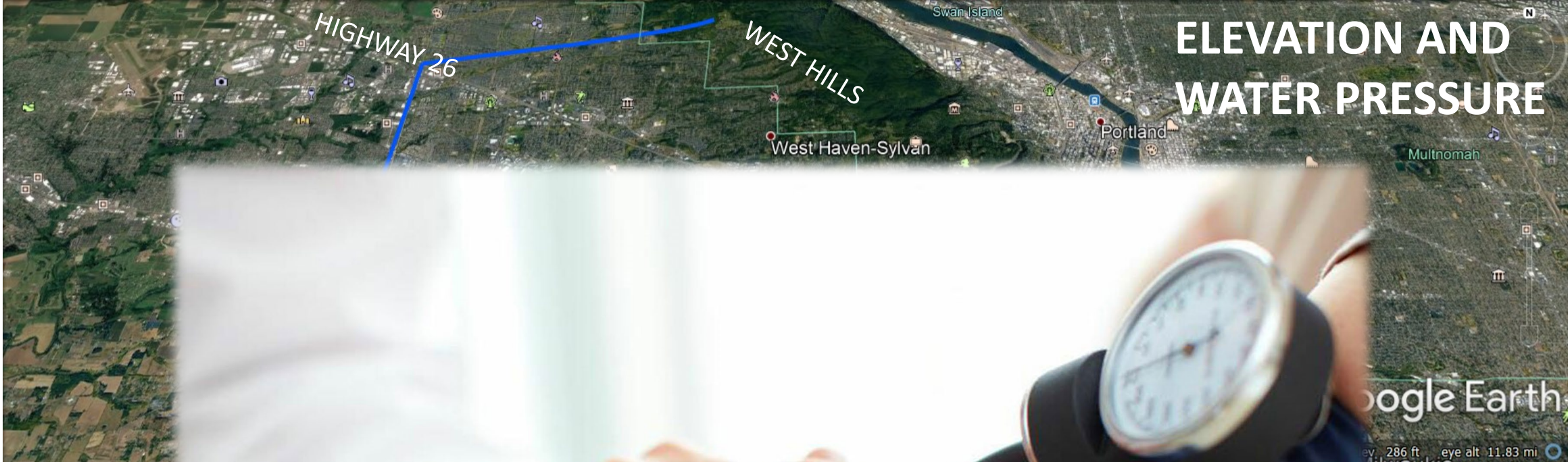
Population served: 230,000

Service connections: 60,000

95% residential



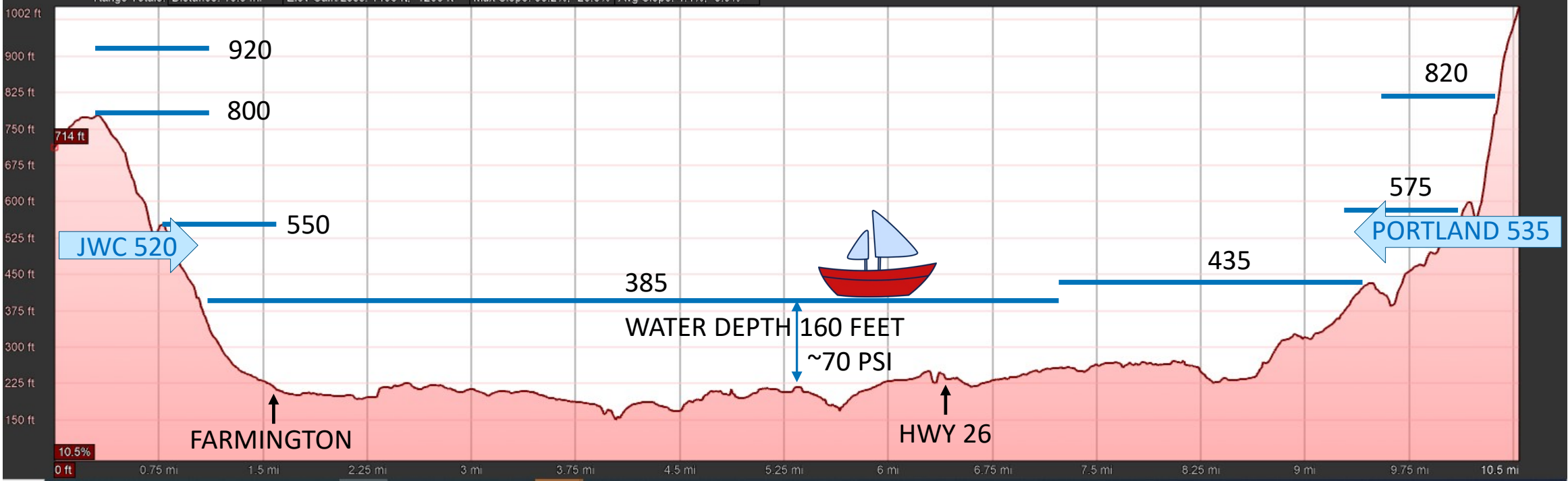
ELEVATION AND WATER PRESSURE

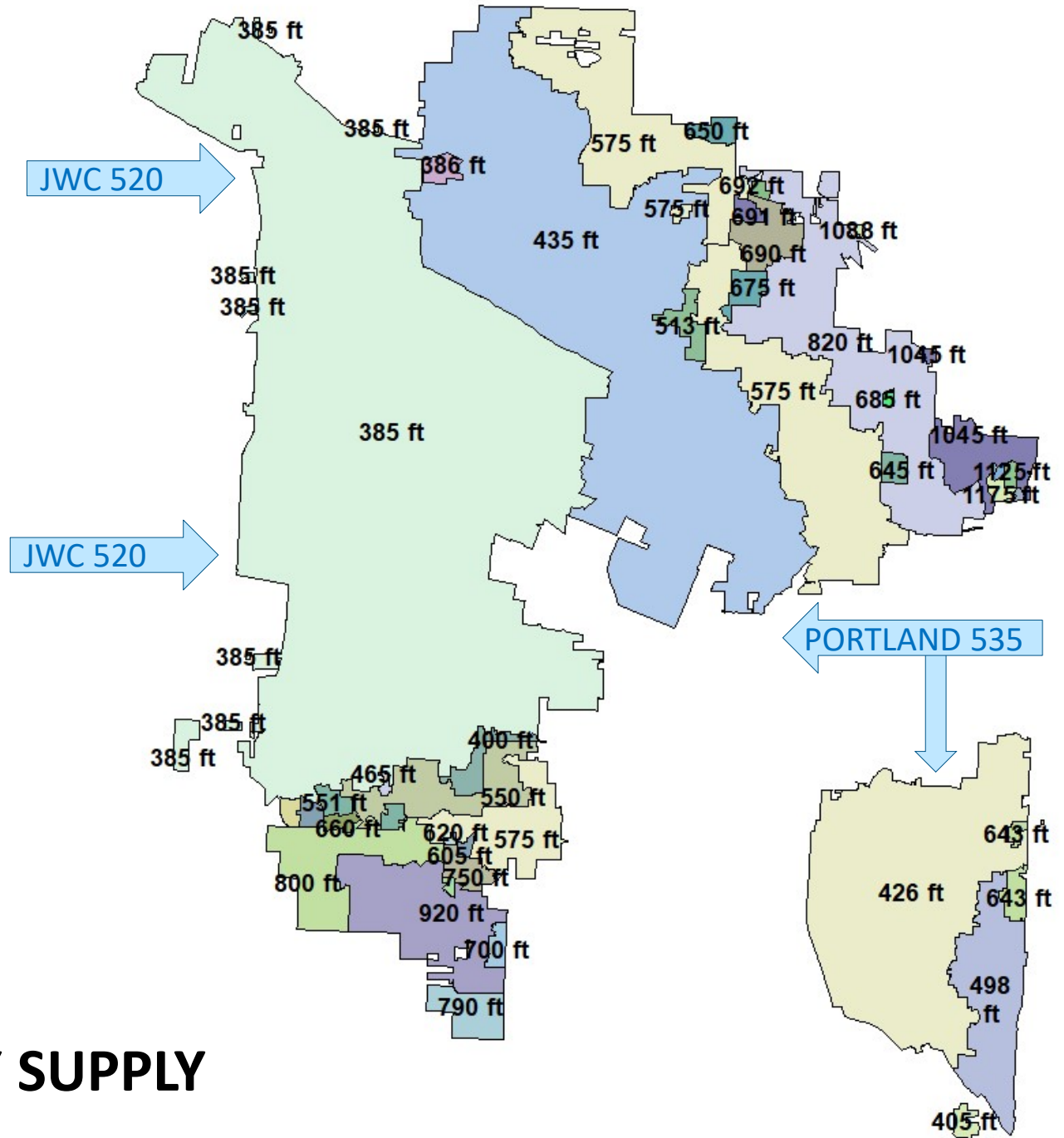


ELEVATION AND PRESSURE ZONES

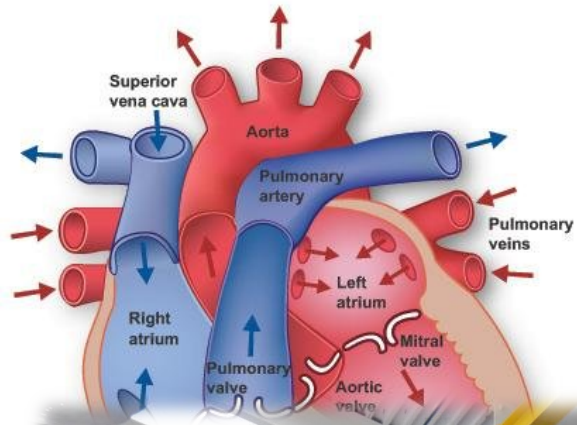


Graph: Min, Avg, Max Elevation: 150, 309, 1002 ft
 Range Totals: Distance: 10.5 mi Elev Gain/Loss: 1496 ft, -1208 ft Max Slope: 38.2%, -23.8% Avg Slope: 4.4%, -3.9%

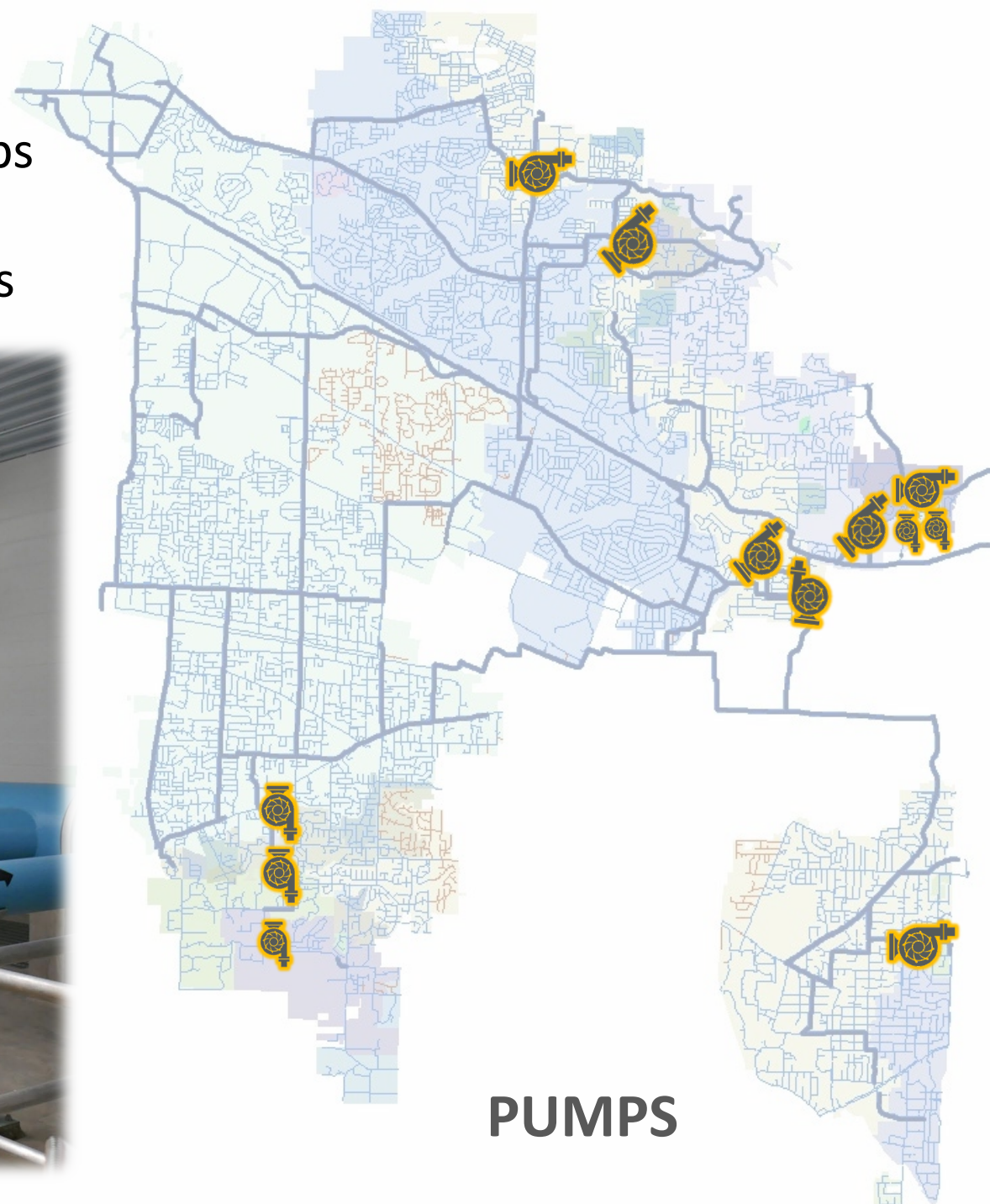




PRESSURE ZONES & GRAVITY SUPPLY



13 pump stations
Most with multiple pumps
Driven by electricity
Backup power generators



PUMPS

23 STORAGE RESERVOIRS



125,000 gallons to 10 million gallons

67 million gallons total storage

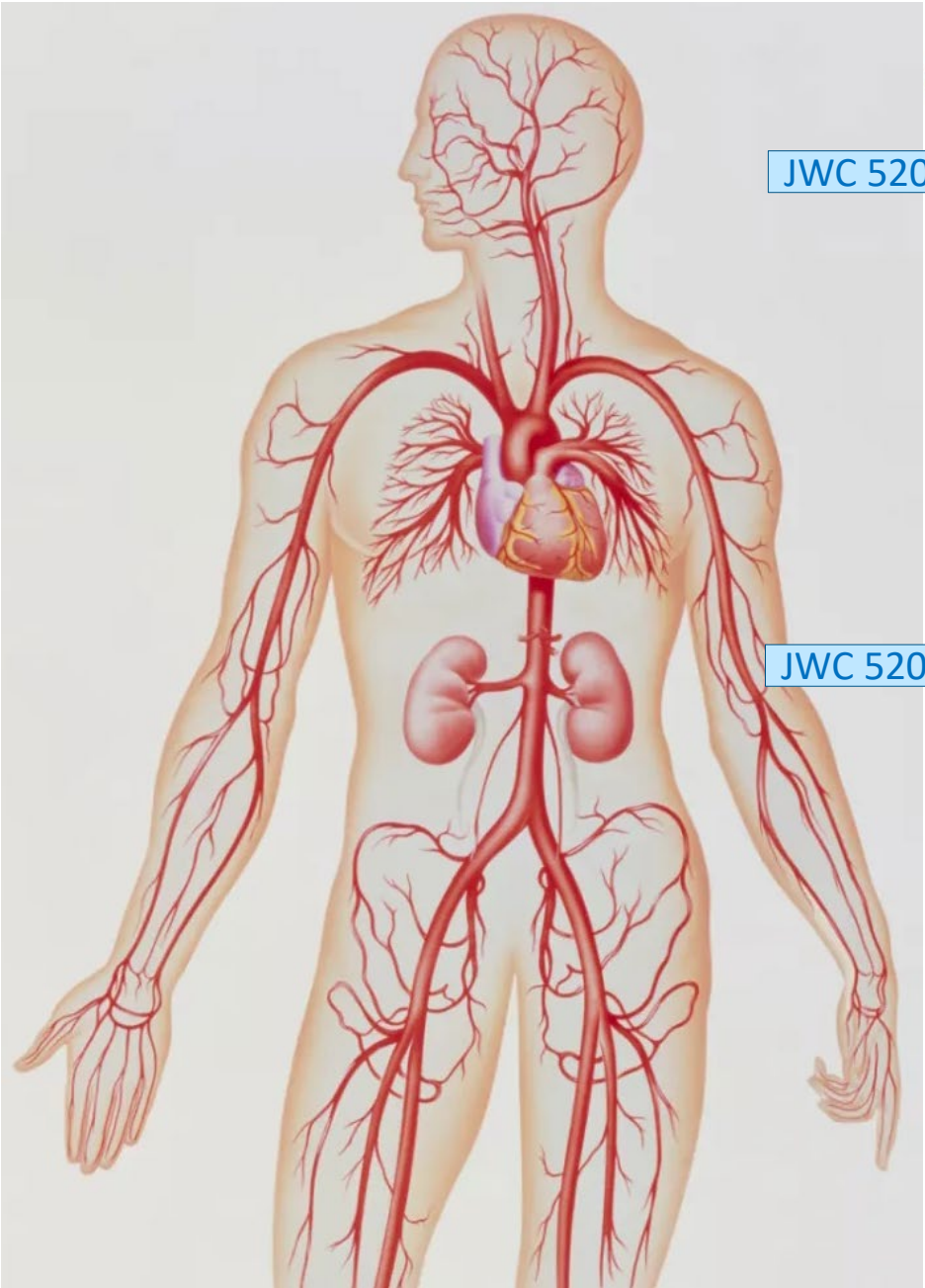
Bigger is not necessarily better



TVWD storage
67 million gallons

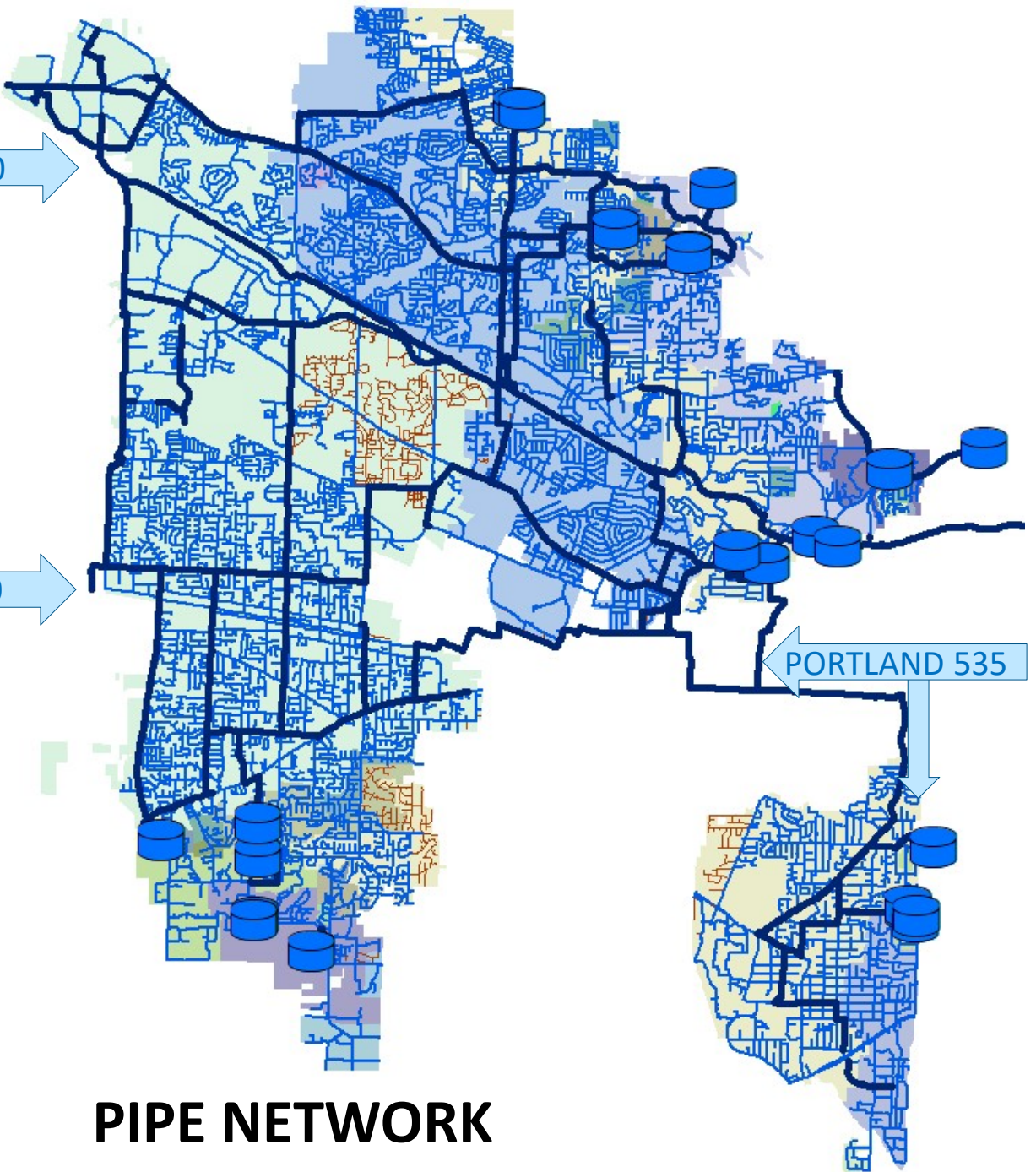
MODA Center
200 million gallons





JWC 520

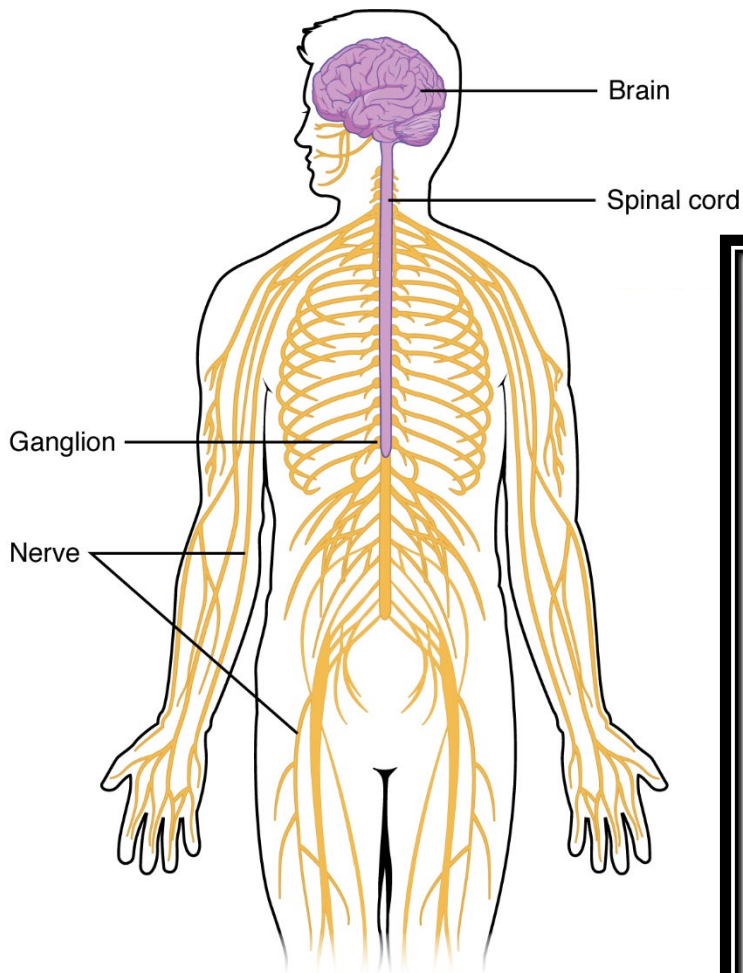
JWC 520



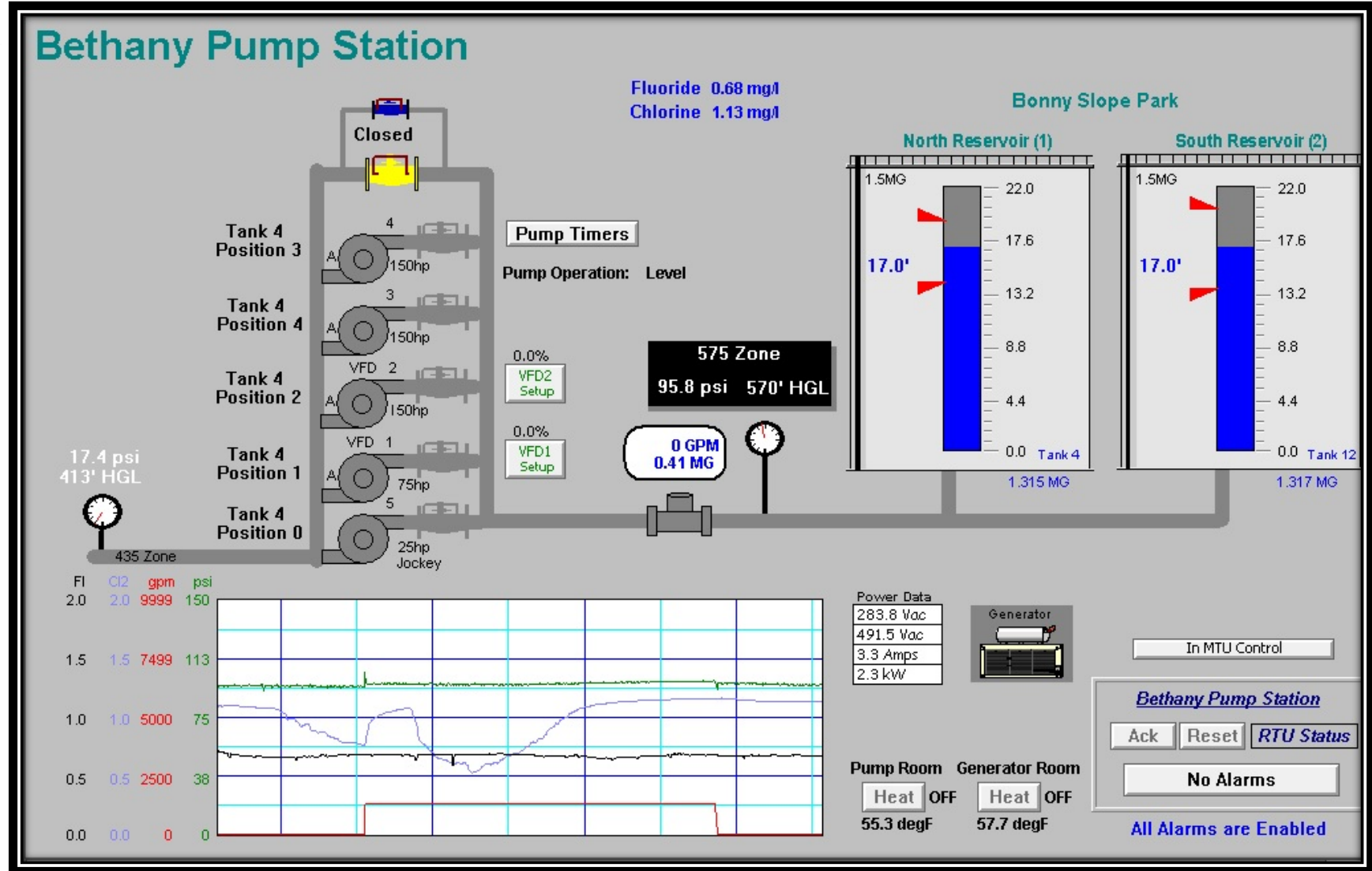
PORTLAND 535

PIPE NETWORK

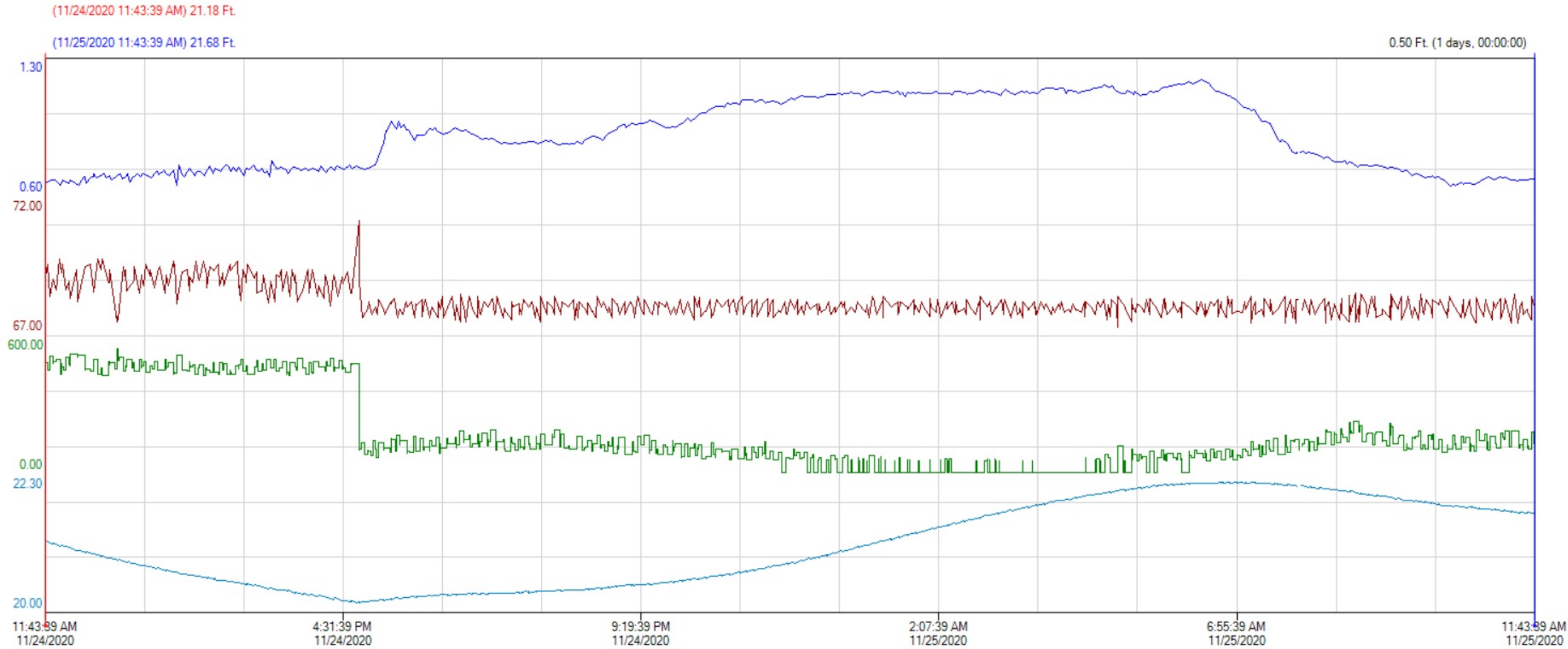
SCADA - monitoring, control, automation



**SUPERVISORY
CONTROL
AND
DATA
ACQUISITION**

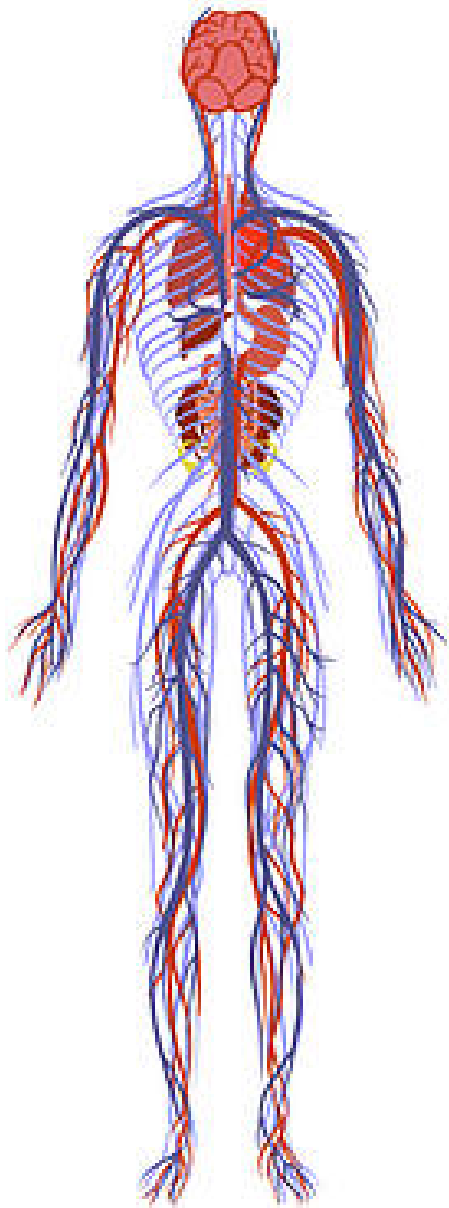


SCADA



10.3.5.232:Cooper_Level1 [BestFit - 00 00:07:47.451]

Tag Name	Description	Color	Number	Units
<input checked="" type="checkbox"/> Cooper_CI2	Cl2 Residual	Blue	1	mg/l
<input checked="" type="checkbox"/> Cooper_Mt_PSI	Pump Discharge Pressure	Red	2	psi
<input checked="" type="checkbox"/> Cooper_Mt_Flow	Pump Flow to closed zone	Green	3	GPM
<input checked="" type="checkbox"/> Cooper_Level1	Reservoir Level	Cyan	4	Ft.



SYSTEM SUMMARY (anatomy)

Supply

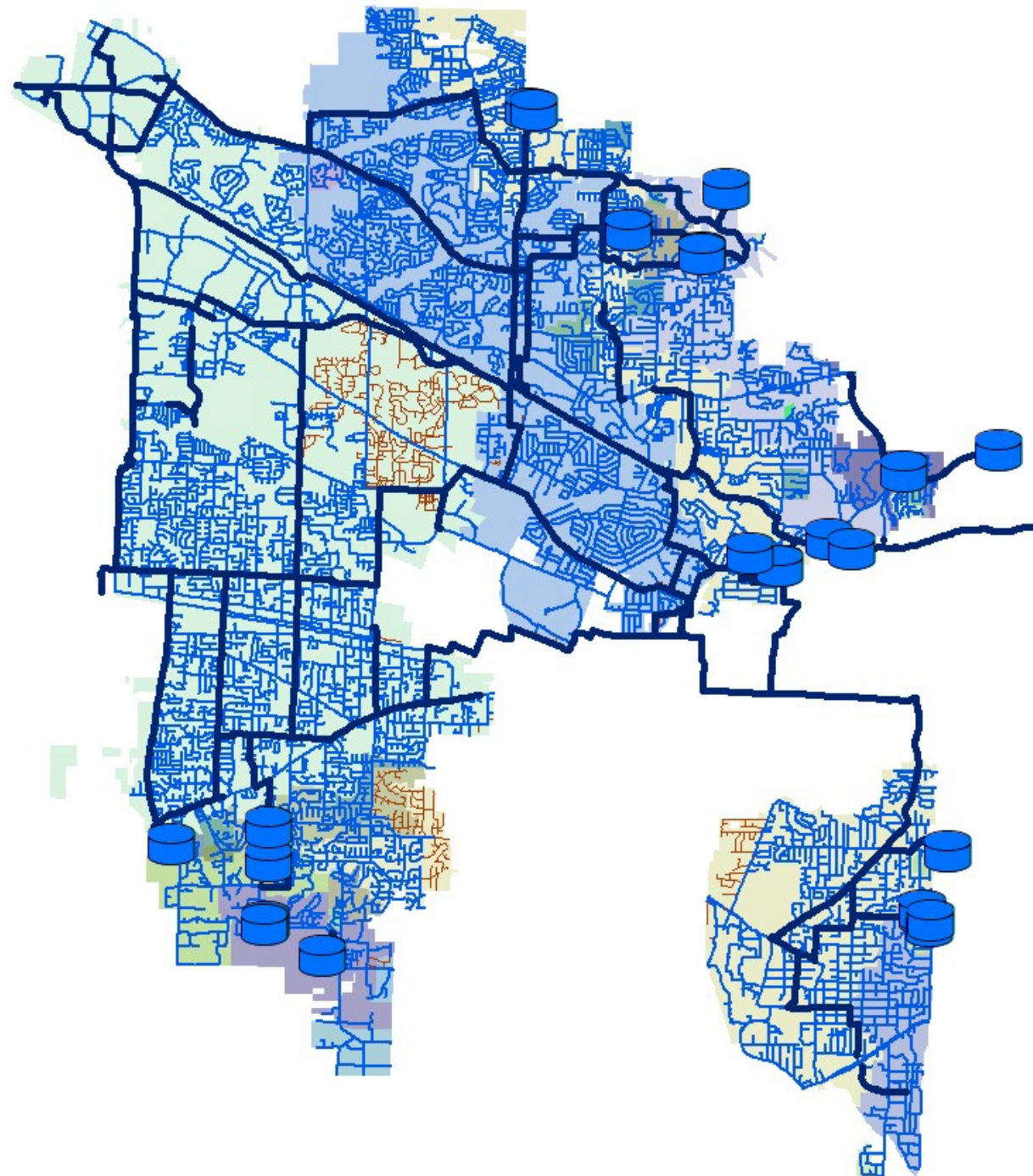
Storage

Pumping

Pressure zones

Pipe network

SCADA



OPERATIONAL STRATEGY (physiology)

1. Manage supply to meet demand
2. Maintain adequate pressure
3. Maintain water quality
 - chlorine residual
 - water age
 - aesthetics
4. Minimize service disruptions



DAILY DEMAND AND WATER AGE

Winter daily demand ~16 million gallons per day (MGD)

Summer daily demand is 35-45 MGD

Temperature, rain, and irrigation are big drivers

Water age tends to increase during low demand

Chlorine residual decreases over time

Remember that 67 MG of storage?



CHLORINE RESIDUAL AND RESPIRATION



Tag Name	Description	Color	Number	Units
<input checked="" type="checkbox"/> Cooper_CI2	Cl2 Residual	Blue	1	mg/l
<input checked="" type="checkbox"/> Cooper_Mt_PSI	Pump Discharge Pressure	Red	2	psi
<input checked="" type="checkbox"/> Cooper_Mt_Flow	Pump Flow to closed zone	Green	3	GPM
<input checked="" type="checkbox"/> Cooper_Level1	Reservoir Level	Cyan	4	Rt.

REACTION AND COMPENSATION

Under exertion, our bodies react and compensate by increasing pulse and breathing

As water system demand changes, tank levels rise and fall to make up differential

SCADA detects these changes and adjusts pumping as needed (automation)

Operators make changes to system settings when warranted (intervention)



ENSURING WATER QUALITY



Flushing to remove sediments and manage water age

ENSURING WATER QUALITY



Sampling for contaminants
Surveillance monitoring

SERVICE DISRUPTIONS



Planned shutdowns for maintenance and construction

Emergency shutdowns for main breaks and repairs

Having multiple ways to deliver water helps minimize the number of impacted customers

Tell us how to contact you!!



Water Mains – How do they break?

Fall and winter is “**leak season**” due to changing soil moisture and temperature

Most of the District’s pipes are made of **ductile iron** or **cast iron**

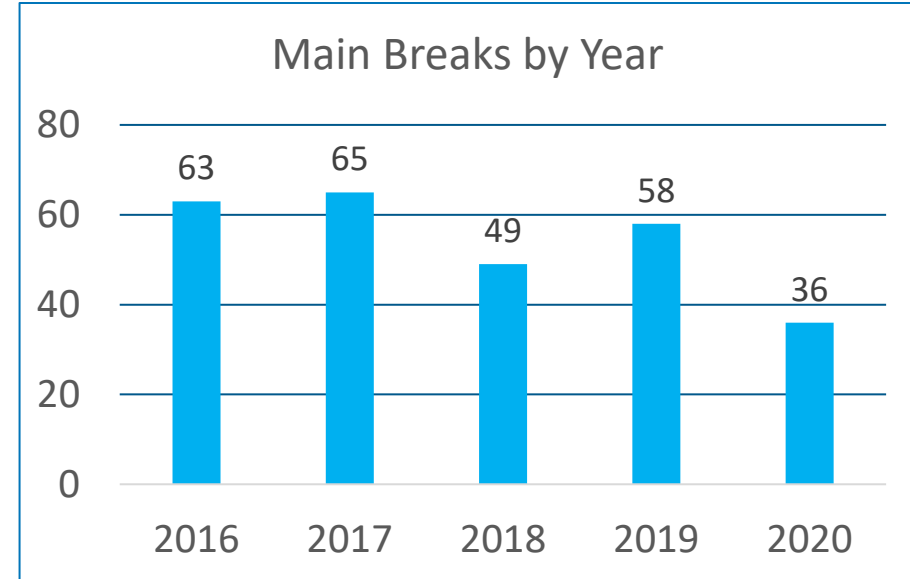
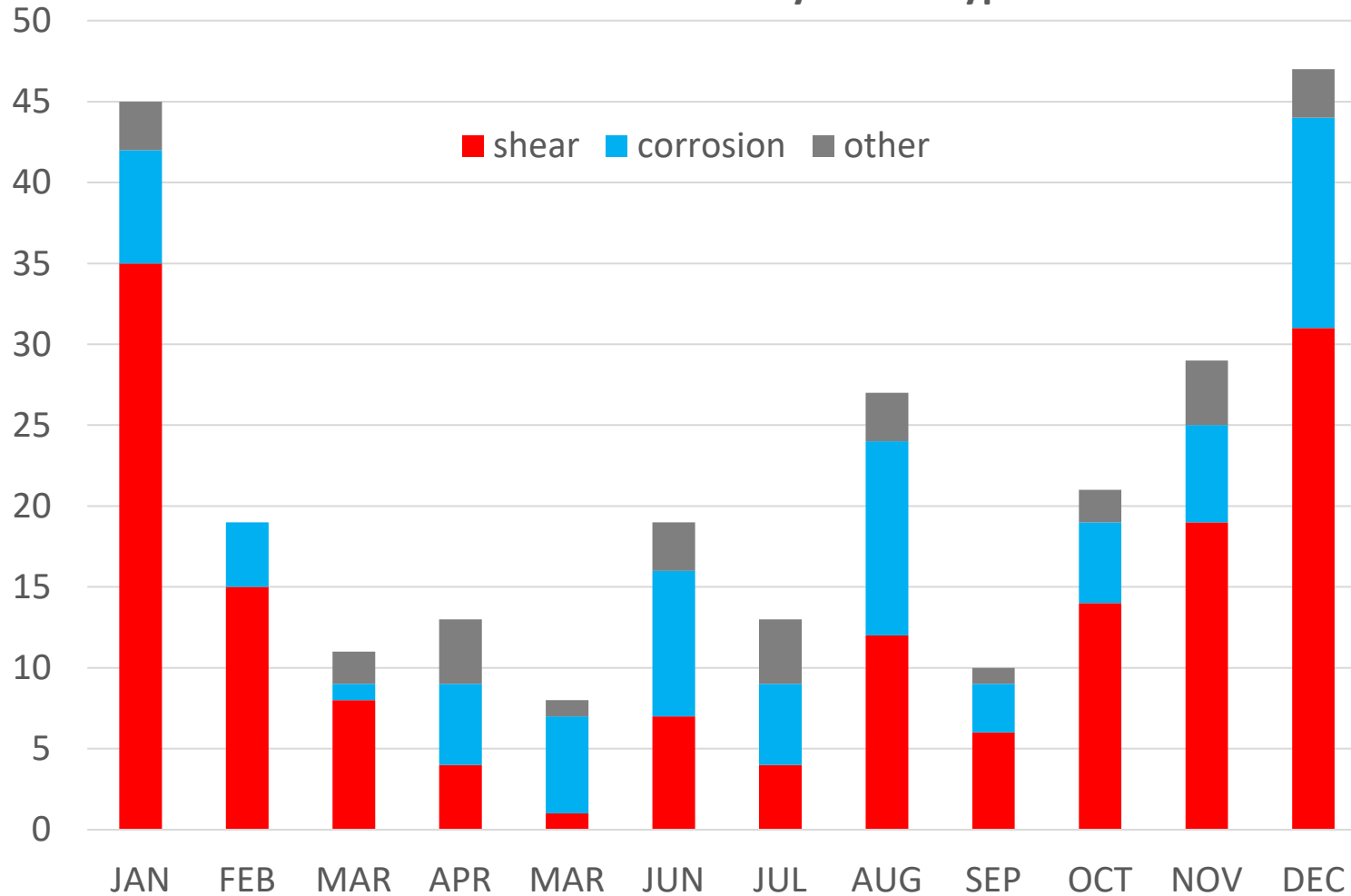
Ductile iron is susceptible to corrosion which can eventually eat holes in the pipe wall

Cast iron is brittle and susceptible to cracking due to shifting soils



Water Mains – When do they break?

2016-2020 main breaks by failure type



SEISMIC RESILIENCY

A Cascadia Subduction Zone earthquake may cause significant damage to the water system.

TVWD continues to make significant investments into resilient infrastructure.

The Willamette Water Supply System will provide a resilient source

Reservoirs

Expected seismic damage	# of tanks	Volume (MG)
Minor	17	59
Moderate	4	5
Major	2	3
total	23	67



Thank you to our dedicated operators!





TUALATIN VALLEY
WATER DISTRICT

Now it's your turn! Any Questions?

How to contact us

Email: Communications@tvwd.org

Phone: Call 503-848-3000

Website: www.tvwd.org