

# Worden-Ballantine Yellowstone County Water & Sewer District

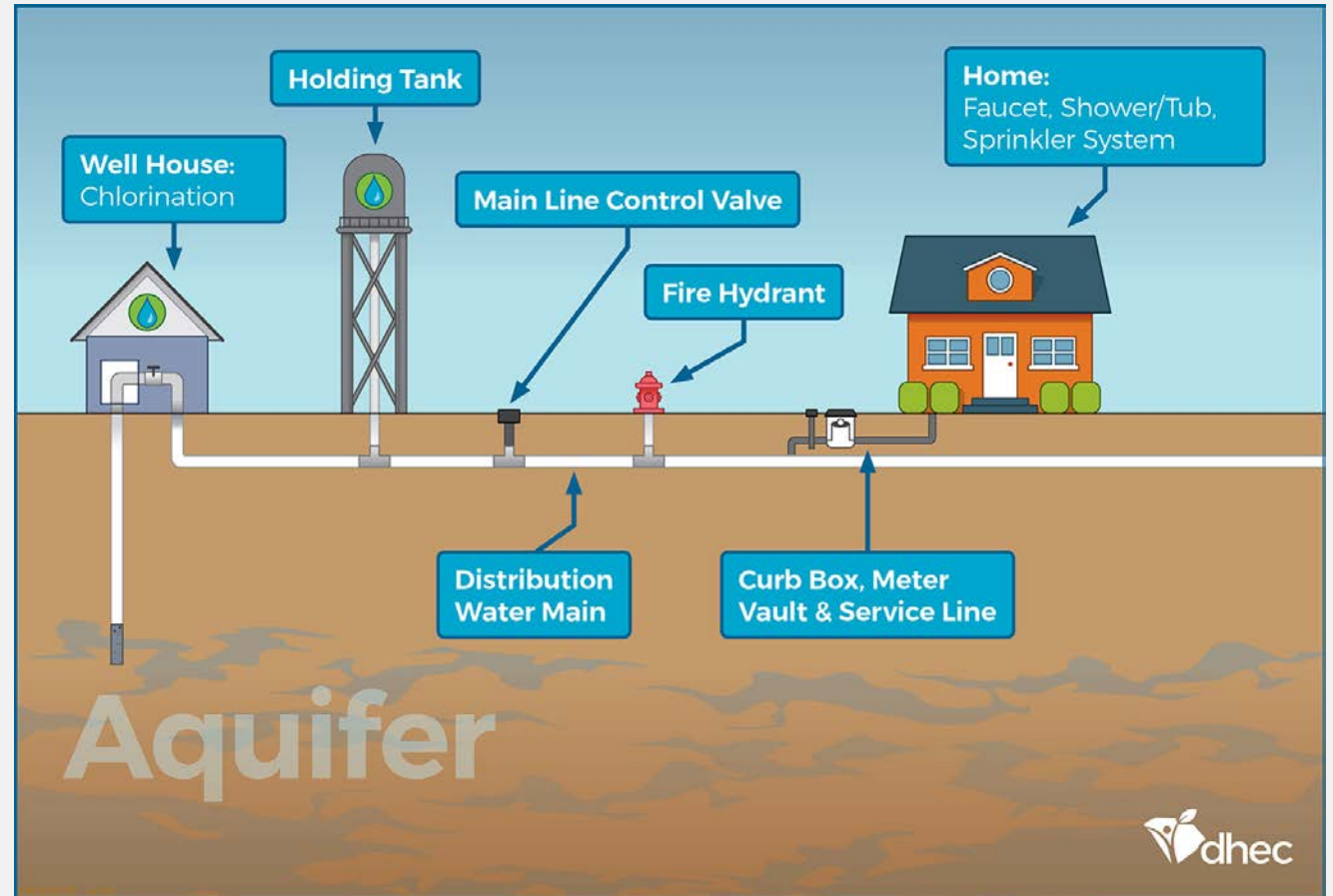
## Water System Preliminary Engineering Report Alternatives Presentation

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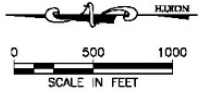
# WHAT IS A PER?

- *Preliminary Engineering Report*
- *Evaluation of entire system for existing and future conditions*
- *Required by grant/loan funding agencies*

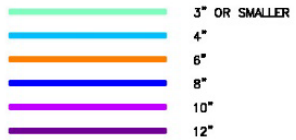


# EXISTING WATER SYSTEM

BALLANTINE



## WATER MAIN LEGEND



V-W41  
H-W25

WORDEN

WELL #2 AND  
WELLHOUSE

V-W40

200,000 GALLON  
BURIED STORAGE  
TANK

40,000 GALLON  
ELEVATED  
STORAGE  
TANK

INFILTRATION GALLERY (DRAIN #2) AND  
WORDEN AND BALLANTINE BOOSTER STA

R 29 E  
R 28 E

# GROWTH/CAPACITY

YEAR	POPULATION	AVERAGE DAY DEMAND		MAXIMUM DAY DEMAND		PEAK HOUR DEMAND
		gpd	gpm	gpd	gpm	gpm
2019	972	80,719	57	161,438	112	224
2042	1175	117,500	82	235,000	163	326

*\* Populations based upon information from the Montana Department of Commerce Census & Economic Center*

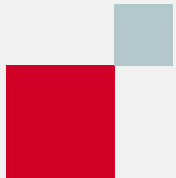
# WATER STORAGE

## (1) 40,000 gallon tower

- Built in 1955
- Adequate condition

## (2) 200,000 gallon buried tank

- Built in 2005
- Good condition
- Meets operational needs & residential fire flow needs
- **Recommendation: Continue good maintenance & regular inspections/cleaning**



# DISTRIBUTION SYSTEM

- Lack of redundancy to Worden
- Very limited fire flow
- Insufficiently spaced fire hydrants
- Undersized water mains (less than 6-inch)
  - >60% in Worden
  - >25% in Ballantine

Pipe Size	Worden		Ballantine		Transmission Mains		Total	
	AC (ft)	PVC (ft)	AC (ft)	PVC (ft)	AC (ft)	PVC (ft)	AC (ft)	PVC (ft)
3"	0	0	888	1185	0	0	888	1185
4"	15,318	528	412	643	3,268	0	18,998	1,171
6"	1,777	5,243	4,383	1,181	5,586	0	11,746	6,424
8"	505	2,030	0	3,416	6,180	119	6,685	5,565
10"	0	0	0	0	0	5265	0	5265
12"	0	0	0	0	2450	0	2450	0
Total	17,600	7,801	5,683	6,425	17,484	5,384	40,767	19,610
	25,401		12,108		22,868		60,377	

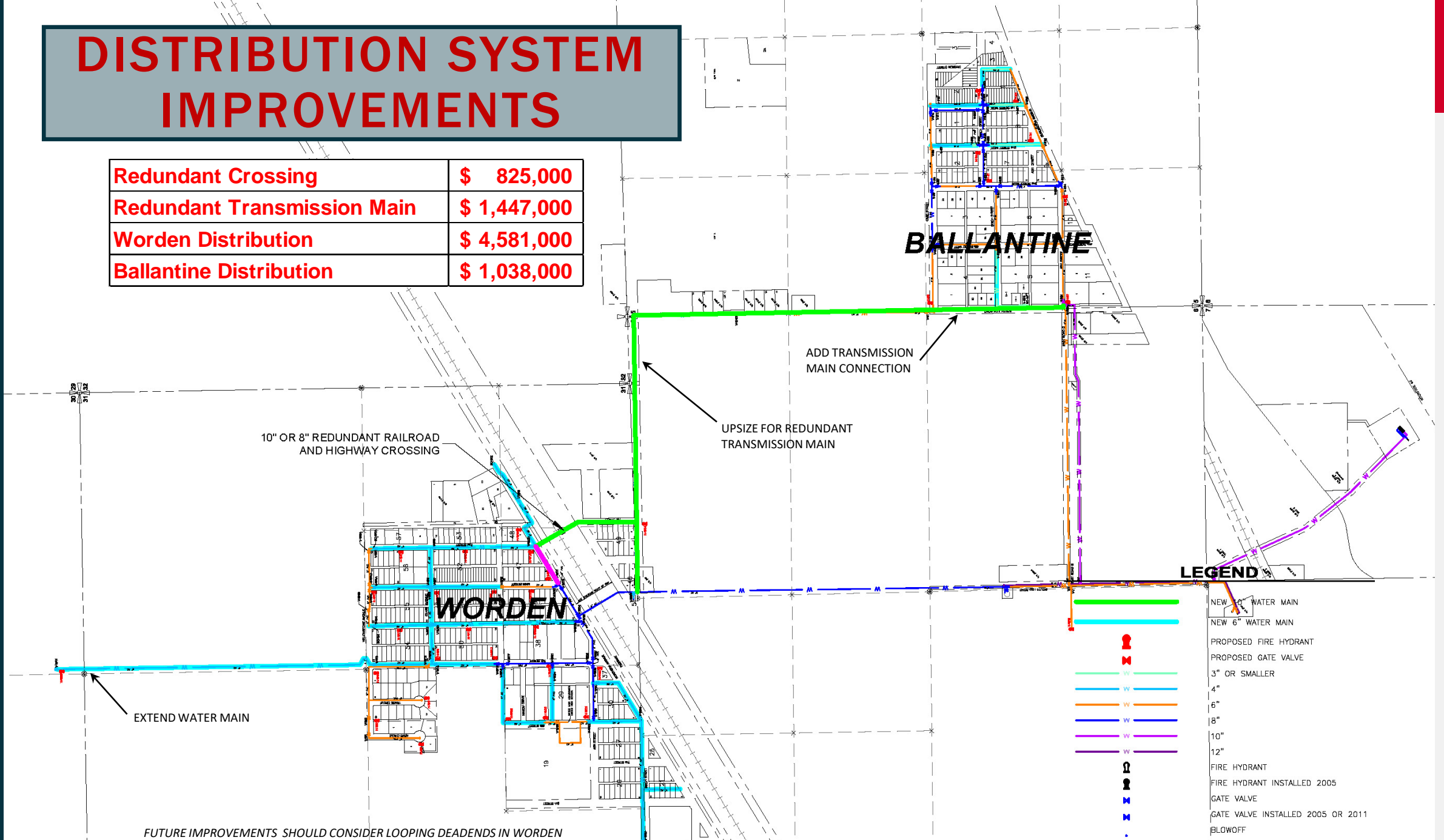
## Recommendations:

- Add redundancy to Worden
- Upsize and connect transmission main from Ballantine to Worden
- Upsize remaining distribution system



# DISTRIBUTION SYSTEM IMPROVEMENTS

Redundant Crossing	\$ 825,000
Redundant Transmission Main	\$ 1,447,000
Worden Distribution	\$ 4,581,000
Ballantine Distribution	\$ 1,038,000



# WATER SUPPLY

## Drain #2 (Infiltration Gallery)

Early 1900's

130-140 gpm

High nitrates

Surface water influence

Treated w/ chlorine

## Well #2

Drilled in 2005

50 gpm

Lower nitrates

High iron, TDS

Treated w/ chlorine

**Drain #2 in violation of EPA's Safe Drinking Water Act, administered by Montana DEQ**

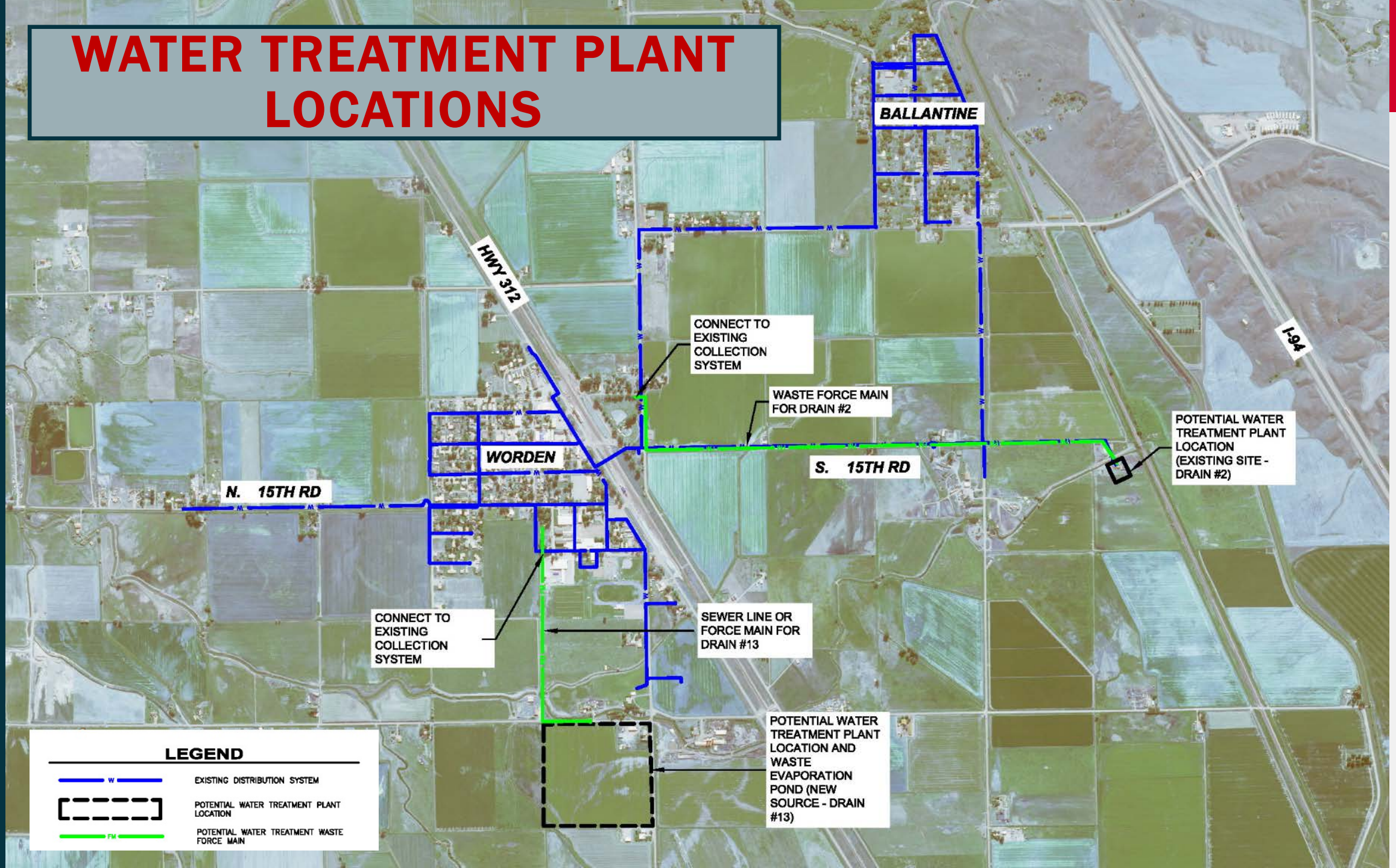


# WATER SUPPLY OPTIONS CONSIDERED

- Alternatives S1: Existing Source
  - Eliminate nitrate source – Not possible
  - Eliminate groundwater influence – Not possible
  - Treat source (Drain #2)
- Alternatives S2: New Groundwater Source
  - Develop new wells
- Alternatives S3: New Surface Water Source
  - Yellowstone River – Too costly
  - Creeks/Streams – Not enough water
  - Other drains (Drain #13)



# WATER TREATMENT PLANT LOCATIONS



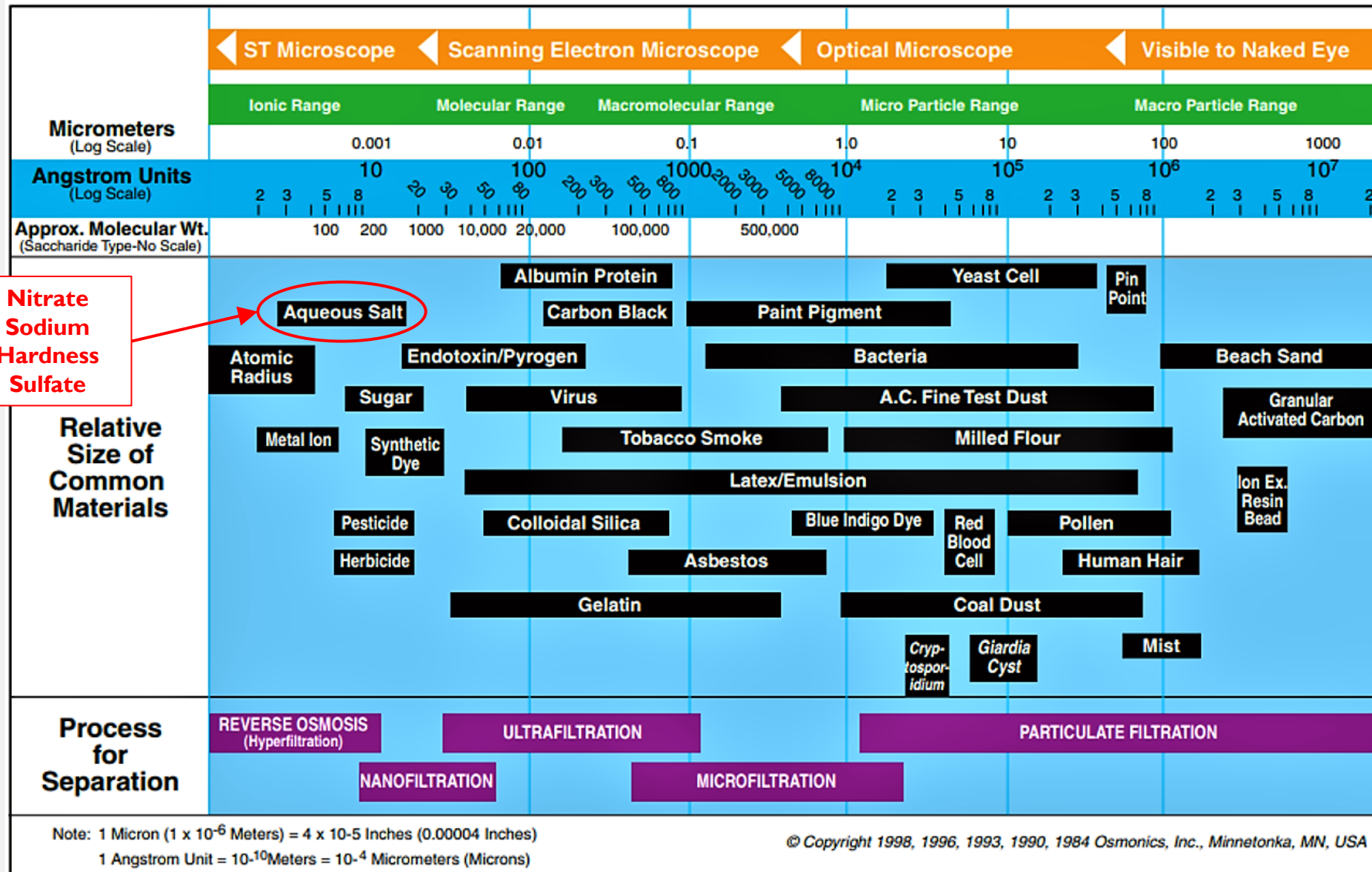
# WATER QUALITY

Parameter	MCL	SMCL	Units	Existing Sources		new Source	Notes
				Drain # 2	Well #2	Drain #13	
Alkalinity	--	--	mg/L	220	375	322	Higher helps regulate pH; too high could cause skin irritation & gastrointestinal issues
Arsenic	0.01	--	mg/L	0.003	0.003	0.002	
Calcium	--	--	mg/L	93	86	97	Contributes to hard water
Chloride	--	250	mg/L	21	18	15	Salty taste
Fluoride	4	2	mg/L	0.7	0.52	0.5	
Hardness	--	--	mg/L	425	400 <sup>1</sup>	434	>180 considered very hard; scale deposits in plumbing and appliances; mineral deposits on dishes; poor soap performance; skin irritation and dryness
Iron	--	0.3	mg/L	ND	3.48	ND	Rusty color; sediment; metallic taste; reddish or orange staining
Magnesium	--	--	mg/L	48	45	46	Contributes to hard water
Manganese	--	0.05	mg/L	0.002	--	0.009	Black to brown color; black staining; bitter
Nitrate	10	--	mg/L	12.4	3.39	2.32	Blue baby syndrome
Nitrite	1	--	mg/L	ND	ND	ND	
Total Organic Carbon (TOC)	--	--	mg/L	4.0	--	4.9	Can contribute to disinfection by-product
pH	--	--	s.u.	7.8	7.6	7.8	
Sodium	--	--	mg/L	82	129	223	May start to have salty taste >200
Total Dissolved Solids (TDS)	--	500	mg/L	775	--	1160	Hardness; deposits; colored water; staining; salty taste
Sulfate	--	250	mg/L	340	250	557	Salty taste
Turbidity	--	--	NTU	0.1	--	0.1	Measures cloudiness of water

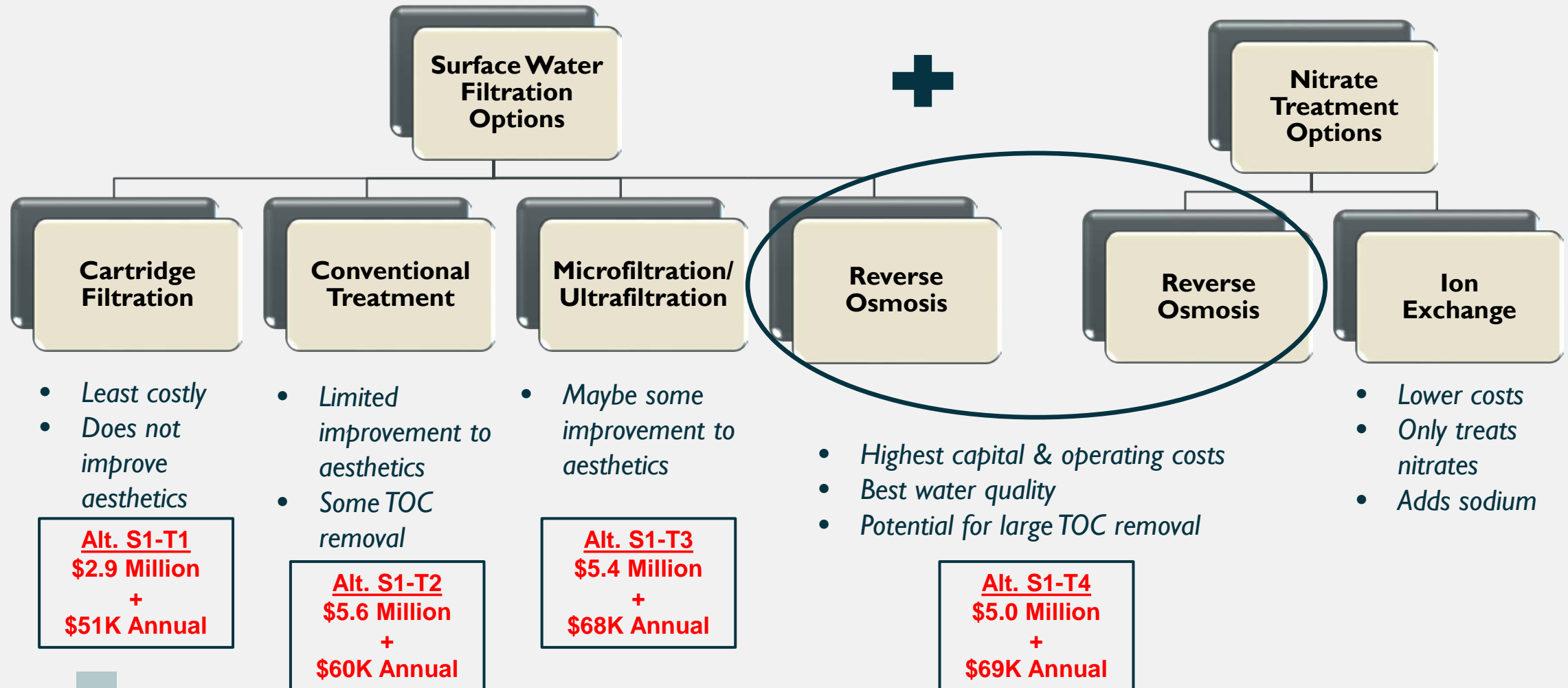
<sup>1</sup> Hardness for Well #2 was calculated based on calcium and magnesium levels



# FILTRATION PROCESSES AND PARTICLE SIZES



# EXISTING SOURCE (DRAIN #2): TREATMENT OPTIONS



**Notes: Pilot Study recommended with any treatment option; Alternatives do not include specific pretreatment for TOC**



# POTENTIAL WELL LOCATIONS

ESTIMATED 4 WELLS  
NEEDED

APPROXIMATE AREAS  
FOR BEST POTENTIAL  
FOR WELLS

BALLANTINE

HWY 312

I-94

S. 15TH RD

WORDEN

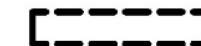
N. 15TH RD

Alt. S2-T1  
\$3.9 Million  
+  
\$15.2K Annual

## LEGEND

— W —

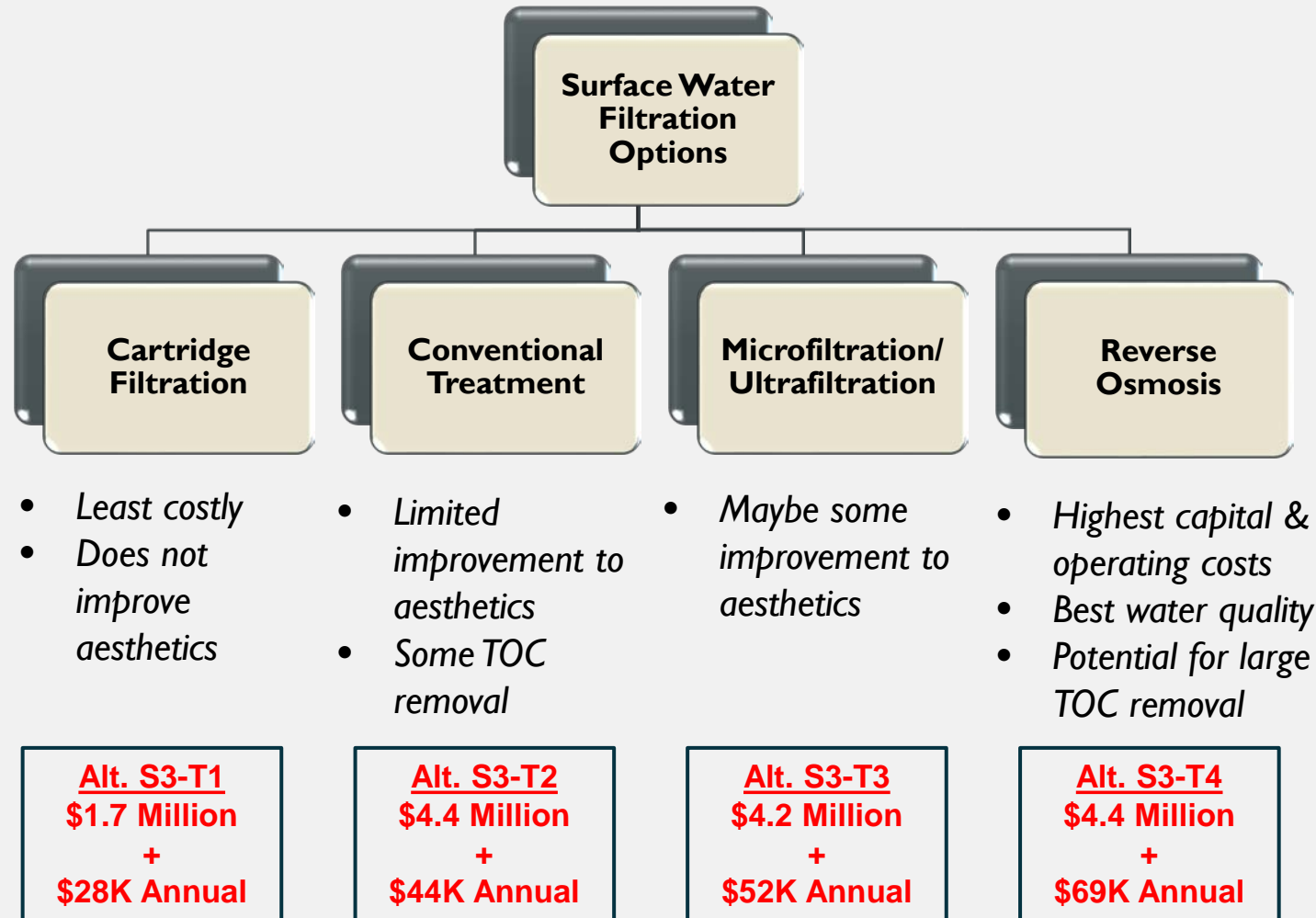
EXISTING DISTRIBUTION SYSTEM



WELL AREA

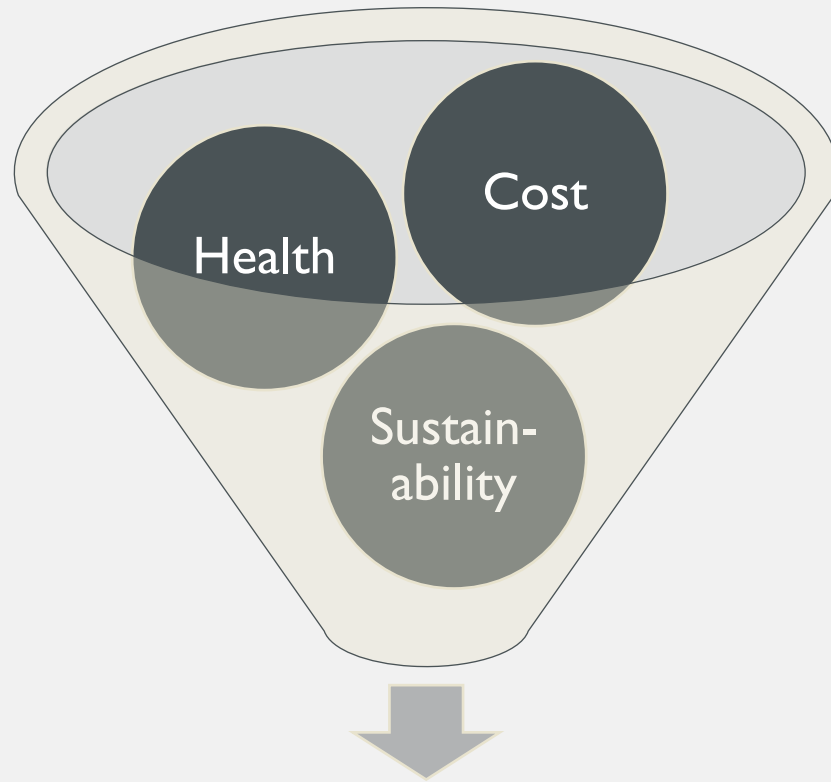


# NEW SOURCE (DRAIN #13): TREATMENT OPTIONS



**Notes: Pilot Study recommended with any treatment option; Alternatives do not include specific pretreatment for TOC**

# SELECTING AN ALTERNATIVE



**Recommended  
Alternative**

DESCRIPTION	WEIGHTING FACTORS
Financial Feasibility/Life Cycle Cost	10
Public Health and Safety	9
Operations and Maintenance	8
Technical Feasibility/Land Acquisition	7
Sustainability/Future Compliance	6
Permitting	6
Social Impacts	5
Environmental Impacts	4

# SELECTING AN ALTERNATIVE

Alternative		Life Cycle Cost		Public Health and Safety		Operational and Maintenance		Technical Feasibility/ Land Acquisition		Sustainability/ Future Compliance		Permitting		Social Impacts		Environmental Impacts		TOTAL	RANK
		Weight:	10	Weight:	9	Weight:	8	Weight:	7	Weight:	6	Weight:	6	Weight:	5	Weight:	4		
		Score	Wtd.	Score	Wtd.	Score	Wtd.	Score	Wtd.	Score	Wtd.	Score	Wtd.	Score	Wtd.	Score	Wtd.		
SUPPLY AND TREATMENT ALTERNATIVES																			
Existing Source w/ Treatment Options																			
S1-T1	Cartridge, Ion Exchange	5.1	51	5.0	45	7.0	56	1.0	7	7.0	42	5.0	30	4.0	20	1.0	4	255	7
S1-T2	Conventional, Ion Exchange	1.7	17	8.0	72	2.0	16	1.0	7	7.0	42	5.0	30	1.0	5	5.0	20	209	9
S1-T3	Ultrafiltration, Ion Exchange	1.7	17	7.0	63	5.0	40	1.0	7	7.0	42	5.0	30	1.0	5	4.0	16	220	8
S1-T4	Reverse Osmosis	2.1	21	10.0	90	6.0	48	1.0	7	10.0	60	5.0	30	2.0	10	2.0	8	274	5
New Well Field																			
S2-T1	New Well Source	4.8	48	8.0	72	10.0	80	4.0	28	5.0	30	1.0	6	7.0	35	7.0	28	327	1
New Source w/ Treatment Options																			
S3-T1	Cartridge	8.3	83	5.0	45	8.0	64	6.0	42	5.0	30	5.0	30	5.0	25	1.0	4	323	2
S3-T2	Conventional	3.2	32	8.0	72	3.0	24	6.0	42	5.0	30	5.0	30	3.0	15	5.0	20	265	6
S3-T3	Ultrafiltration	3.2	32	7.0	63	6.0	48	6.0	42	5.0	30	5.0	30	3.0	15	4.0	16	276	4
S3-T5	Reverse Osmosis	2.6	26	10.0	90	6.0	48	6.0	42	10.0	60	5.0	30	2.0	10	2.0	8	314	3
DISTRIBUTION SYSTEM ALTERNATIVES																			
D1	Add Redundant Line, Upsize to 6"	5.1	51	8.0	72	5.0	40	8.0	56	6.0	36	5.0	30	5.0	25	4.0	16	240	2
D2	Add Redundant Line, Upsize to 8"	4.9	49	10.0	90	5.0	40	8.0	56	7.0	42	5.0	30	3.0	15	4.0	16	252	1

*It is important to note that the above scoring and weighting are subjective. Alternatives that score overall within 15 pts of each other may essentially hold the same degree of preference.*

# NEW GROUNDWATER WELLS

## PROS

- Lowest annual O&M costs
- No change to operations or operator certifications

## CONS

- No guarantee of finding land to drill
- No guarantee land available will yield enough or have low nitrates
- No guarantee that nitrates will not be problematic in future
- No improvement to water quality – will have high hardness, TDS, maybe high iron
- Water rights may be difficult

# PHASING THE PROJECT

- Financial limitations for new wells and all distribution system improvements
- Need to address water supply as soon as possible
- Phased approach allows completion of highest priority improvements in quickest timeframe

## PHASE I

- Drill wells
- Apply for water rights

## PHASE 2

- Complete wells
- Construct wellhouses
- Connect to water system

## PHASE 3 (if funding allows)

- Redundant water line crossing under Railroad and Highway

# TARGET RATES & FUNDING

Description	Used Currently for RD & Previous MDOC Grants 2010 Census			Used Currently for MDOC Grants 2015 ACS		
	Ballantine	Worden	Combined	Ballantine	Worden	Combined
Population	320	577	897	195	749	944
Total Households	136	255	391	146	265	411
Median Household Income	\$14,366	\$26,754	\$22,445	\$18,654	\$69,120	\$51,193
Low & Moderate Income (%)	79%	46%	58%	79%	52%	59%
Percent Poverty	0%	0%	0%	19%	25%	24%

## For Rural Development:

MHI < \$38,205 eligible for up to 75% grant

MHI < \$47,757 eligible for up to 45% grant

SYSTEM	MHI <sup>1</sup>	PERCENTAGE (%)	TARGET RATE	EXISTING RATE
MDOC: Combined Target Rate	\$51,193	2.3%	\$98.12	\$80.10
Percent of Target Rate	---	---	---	81.6%



# FUNDING THE PROJECT

PREFERRED FUNDING SOURCES	AMOUNT	NOTES
RD**	Grant/Loan Combination	- Eligible for up to 75% grant - 40 Year Loan, 1.175% Interest

*\*\* Other funding sources were considered including TSEP, CDBG, DNRC-RRGL, and DWSRF. RD is the most immediate source of funding which could fund entire project, allowing a project completion date in 2021, which could be at least one year sooner than utilizing other funding sources.*

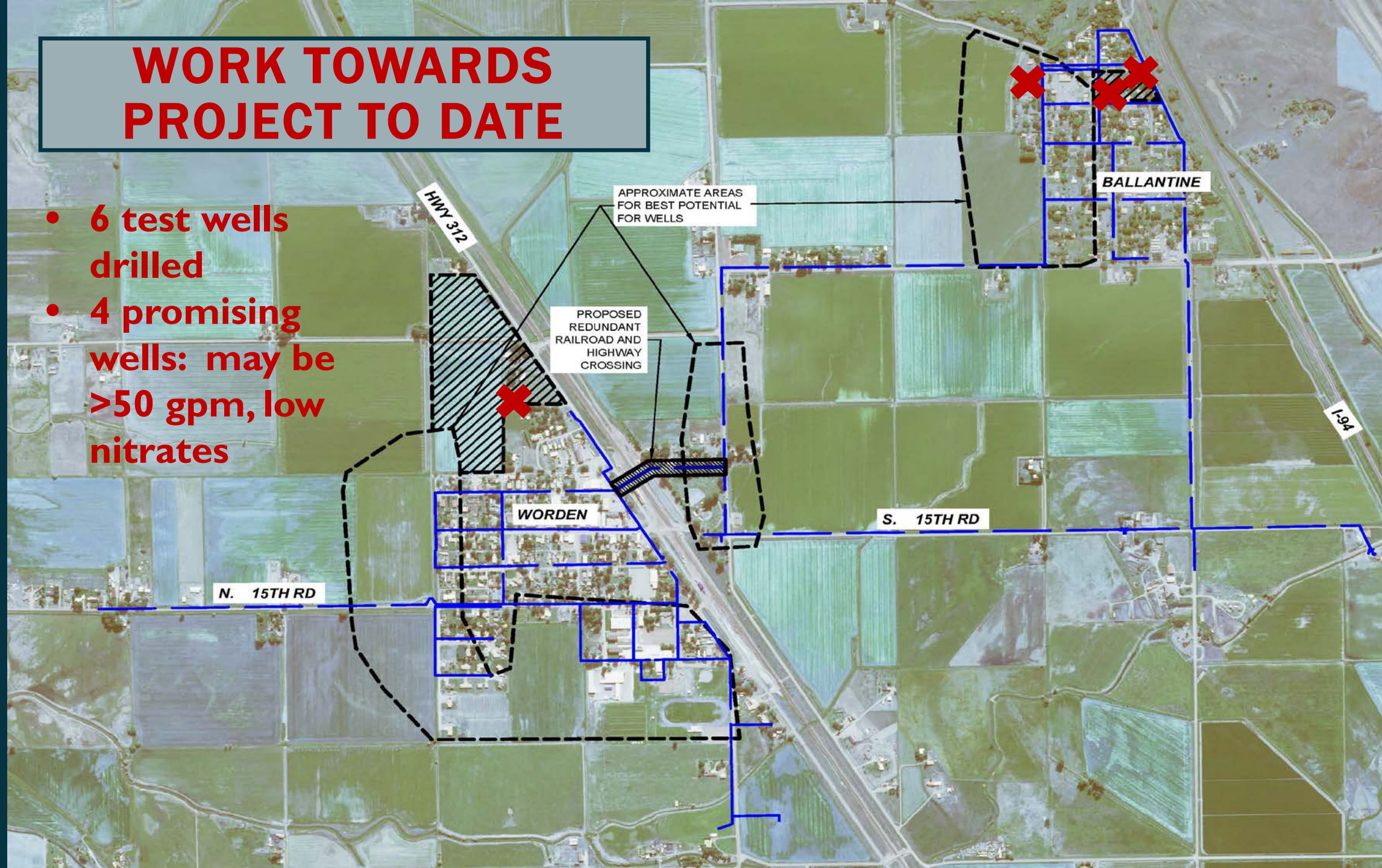
# POTENTIAL IMPACTS TO USER RATES

ITEM	Phase 1 & 2 & 3; RD Only		
	25% Grant	50% Grant	75% Grant
<b>Total Project Cost</b>	<b>\$4,720,000</b>	<b>\$4,720,000</b>	<b>\$4,720,000</b>
RD Loan (40 Years)	\$3,502,500	\$2,335,000	\$1,167,500
RD Grant	\$1,167,500	\$2,335,000	\$3,502,500
<b>Total Loan Amount</b>	<b>\$3,502,500</b>	<b>\$2,335,000</b>	<b>\$1,167,500</b>
Average Annual Loan Payment	\$125,246	\$83,498	\$41,749
Total Loan Payments Over Life of Loan	\$5,009,854	\$3,339,903	\$1,669,951
<b>Total Interest Paid Over Life of Loan</b>	<b>\$1,507,354</b>	<b>\$1,004,903</b>	<b>\$502,451</b>
Average Annual Loan Coverage	\$12,525	\$8,350	\$4,175
<b>TOTAL PROJECT ANNUAL CAPITAL DEBT SERVICE COST</b>	<b>\$137,771</b>	<b>\$91,847</b>	<b>\$45,924</b>
Additional O&M Due To Project	\$15,200	\$15,200	\$15,200
Short Lived Assets	\$15,827	\$15,827	\$15,827
<b>TOTAL PROJECT ANNUAL O&amp;M COST INCREASES</b>	<b>\$31,027</b>	<b>\$31,027</b>	<b>\$31,027</b>
<b>TOTAL PROJECT ANNUAL COST INCREASES</b>	<b>\$168,798</b>	<b>\$122,874</b>	<b>\$76,951</b>
<b>INCREASE IN COST/MO/CONNECTION FOR PROJECT</b>	<b>\$49.01</b>	<b>\$35.68</b>	<b>\$22.34</b>
<b>Less Increase in Cost/Mo/Connection Already Implemen</b>	<b>(\$11.43)</b>	<b>(\$11.43)</b>	<b>(\$11.43)</b>
<b>ACTUAL INCREASE IN COST/MO/CONNECTION NECES</b>	<b>\$37.58</b>	<b>\$24.25</b>	<b>\$10.91</b>



# WORK TOWARDS PROJECT TO DATE

- 6 test wells drilled
- 4 promising wells: may be >50 gpm, low nitrates





QUESTIONS?  
COMMENTS?