
Cave Rock and Skyland Preliminary Engineering Report (PER)

HDR Engineering, Inc. and Douglas County Public Works

March 21, 2017



Overview

1. Why are we here?
2. What is a Preliminary Engineering Report (PER)?
3. Need for Capital Improvements
4. Project Alternatives
5. Prioritized Improvements
6. Conceptual Phasing
7. Questions



Why are we here?

- December 18, 2014
 - Adopted Resolution No. 2014R-099 establishing water rates for the Cave Rock/Uppaway Water System
 - Adopted Resolution No. 2014R-100 establishing water rates for the Skyland Water System
 - Allow time to complete Preliminary Engineering Reports and develop a financing plan to implement future capital improvements
- January 15, 2015 – County awarded a contract with HDR Engineering to prepare Preliminary Engineering Reports
 - Zephyr Water Utility District, March 9, 2017
 - Cave Rock and Skyland, March 21, 2017
 - Uppaway, April 4, 2017
- Present information on the PER findings and recommendations



What is a Preliminary Engineering Report (PER)?

- Outline Follows USDA Bulletin 1780-2
 - Identify water system deficiencies
 - Develop and compare project alternatives to address those deficiencies
 - Identify and evaluate environmental impacts of the project alternatives
 - Prioritize recommended projects
 - Provide preliminary costs



PER - Need for Capital Improvements

- Deficiencies 1-9 - Fire Flow, Pressure, Velocity, Line Size Criteria, Line Leaks, and Pump Stations
- Deficiency 10 - Storage Volume
- Deficiency 11 – Water Treatment Redundancy
- Deficiency 12 – Water Conservation
- Deficiency 13 – Lake Intake Pump Station (*on-hold*)



Deficiencies 1 – 9 Fire Flow, Pressure, Velocity ...

- NAC 445A.6673 Existing systems: Evaluation, justification and design of proposed water project
 - 2. Designed on the basis of historical data or other representative data that complies with accepted engineering judgment and practice, in such a manner that the proposed water project will ***enable the public water system to meet*** average day demand, maximum day demand, peak hour demand and requirements for ***fire flow and fire demand***.



Fire Flow Requirements

- International Fire Code (IFC) Table B105.1
 - Building Size and Construction
 - Fire Flow Calculation Area



0 -3,600 sf
1,500 gpm,
2 hours



3,601 - 4,800 sf
1,750 gpm,
2 hours



4,801 - 6,200 sf
2,000 gpm,
2 hours



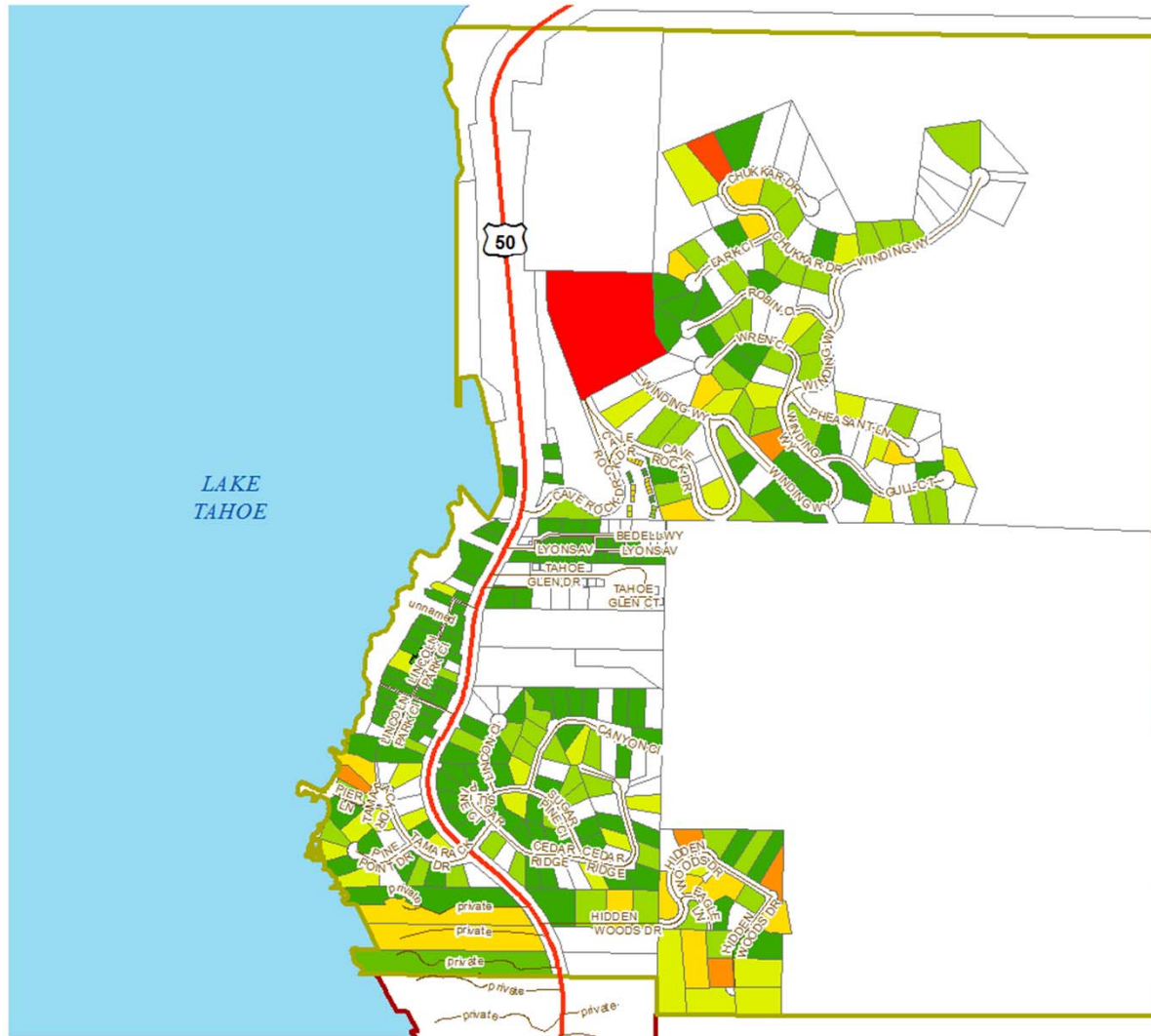
6,201 - 7,700 sf
2,250 gpm,
2 hours



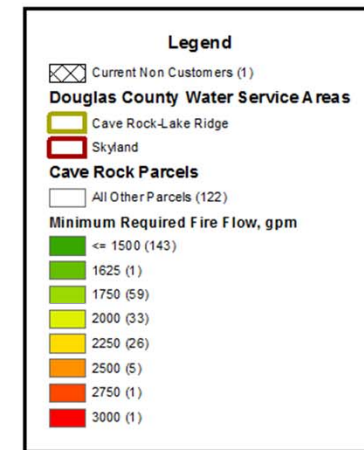
11,301 - 13,400 sf
3,000 gpm,
3 hours



Fire Flow Requirements by Parcel – Cave Rock



**Cave Rock Water System
Minimum Required Fire Flows
(gpm)**

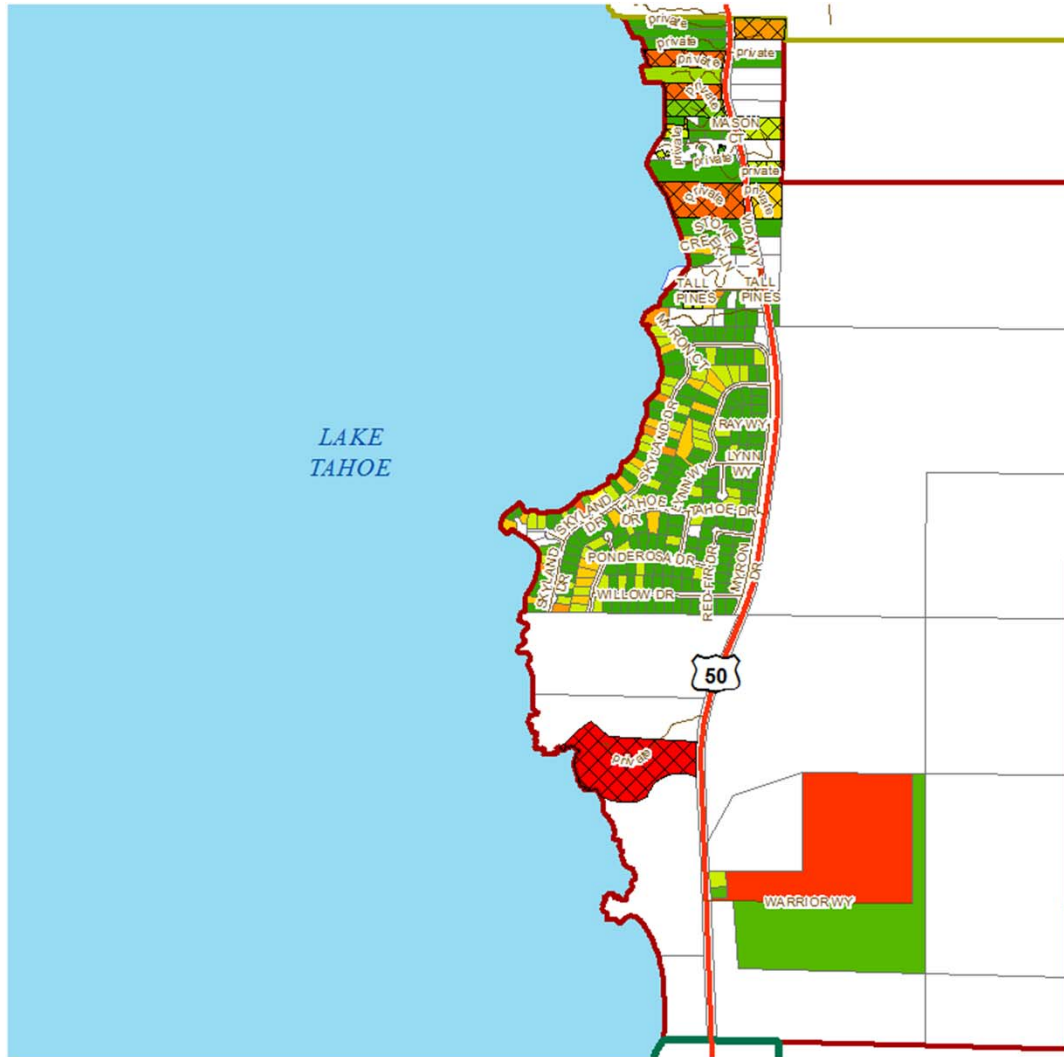


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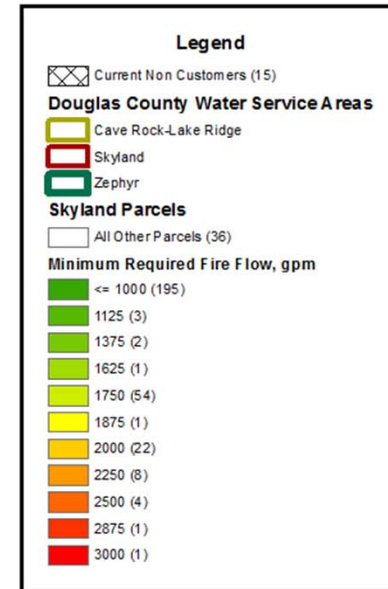
The data contained herein has been compiled on a geographic information system (GIS) for the use of Douglas County. The data does not represent survey delineation and should not be construed as a replacement for the authoritative source, plat maps, deeds, resurveys, etc. No liability is assumed by Douglas County as to the sufficiency or accuracy of the data.



Fire Flow Requirements by Parcel –Skyland



Skyland Water System Minimum Required Fire Flows (gpm)

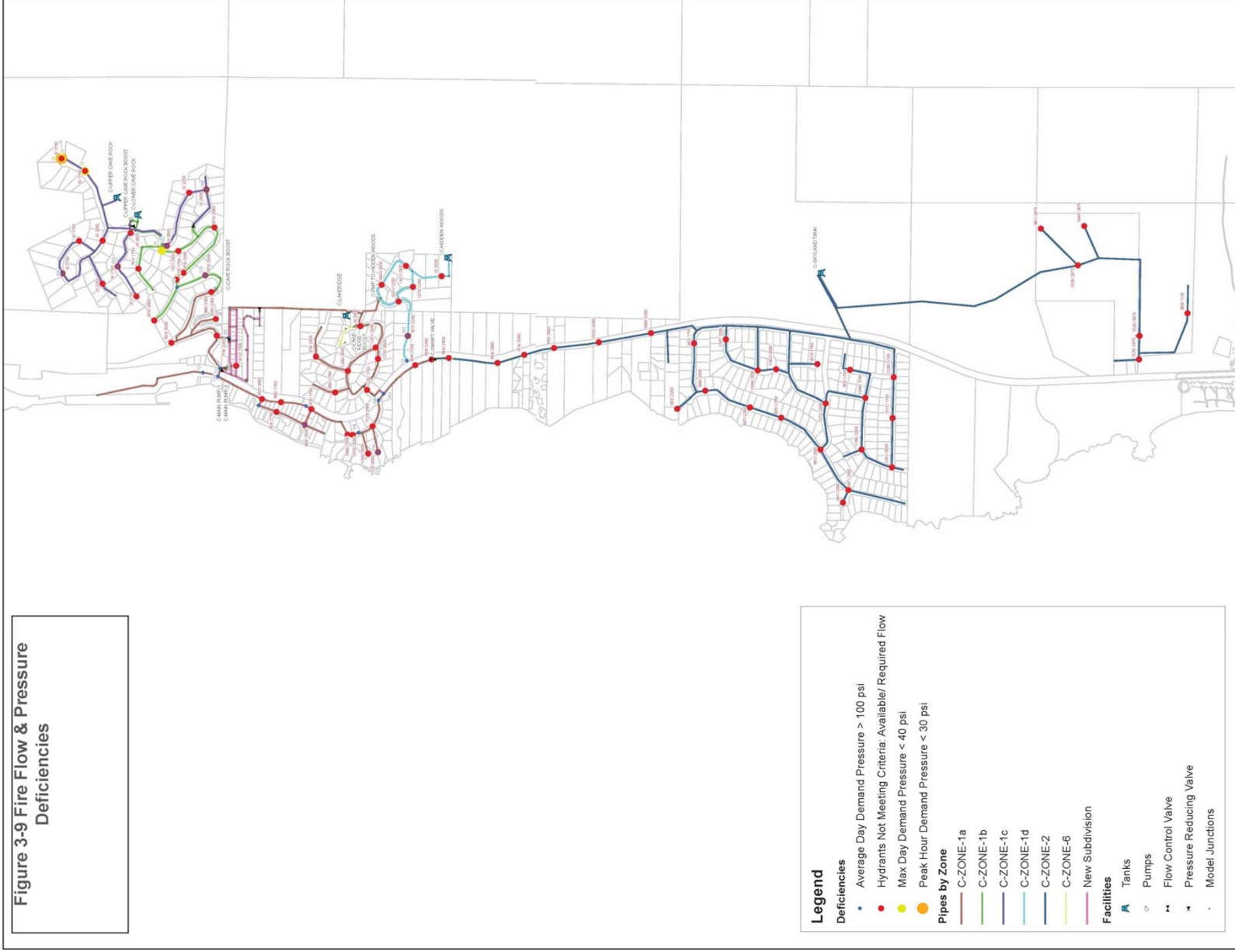


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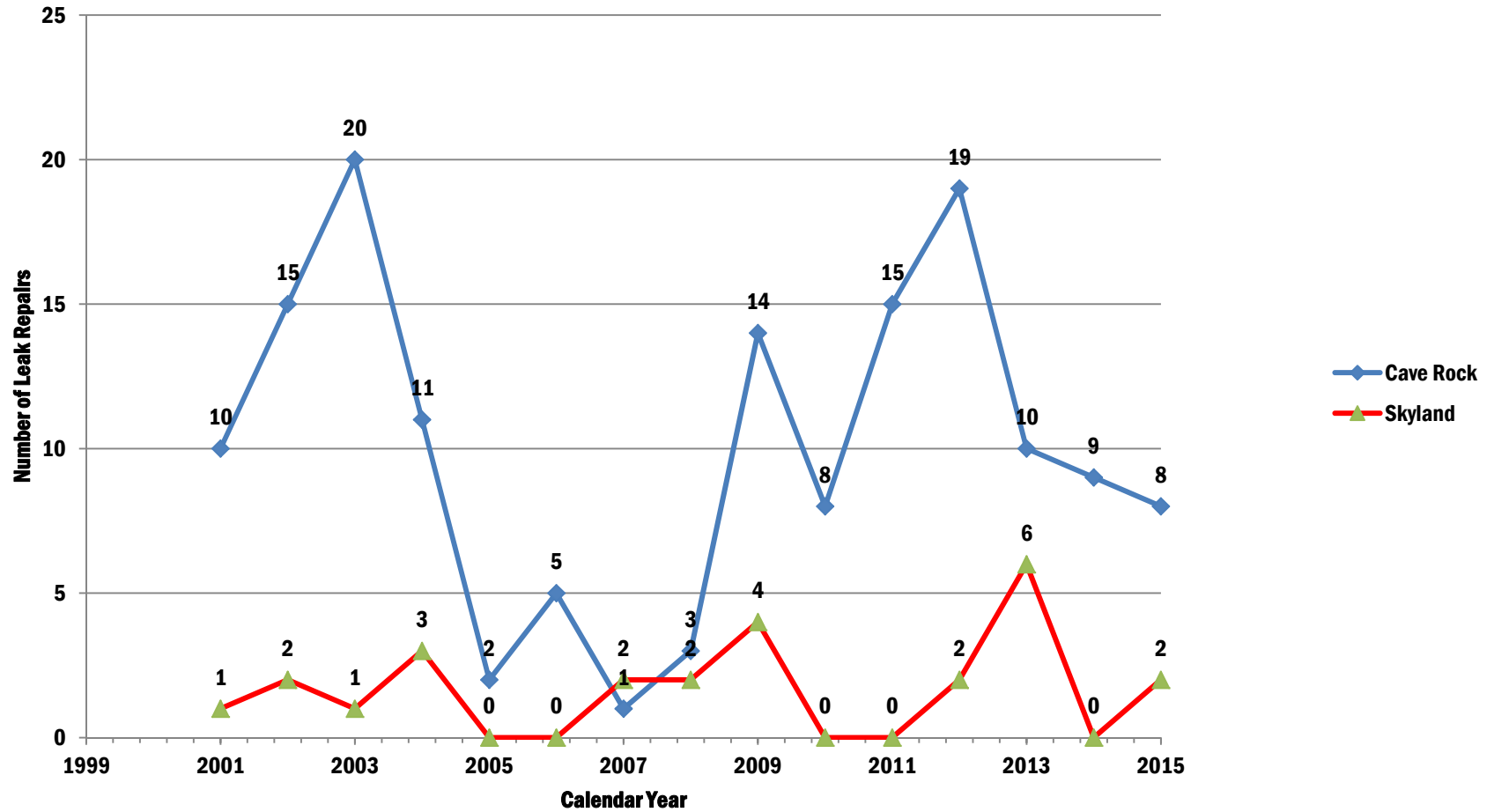


Fire Flow and Pressure Deficiencies



Leak Repairs (through Sept. 2015)

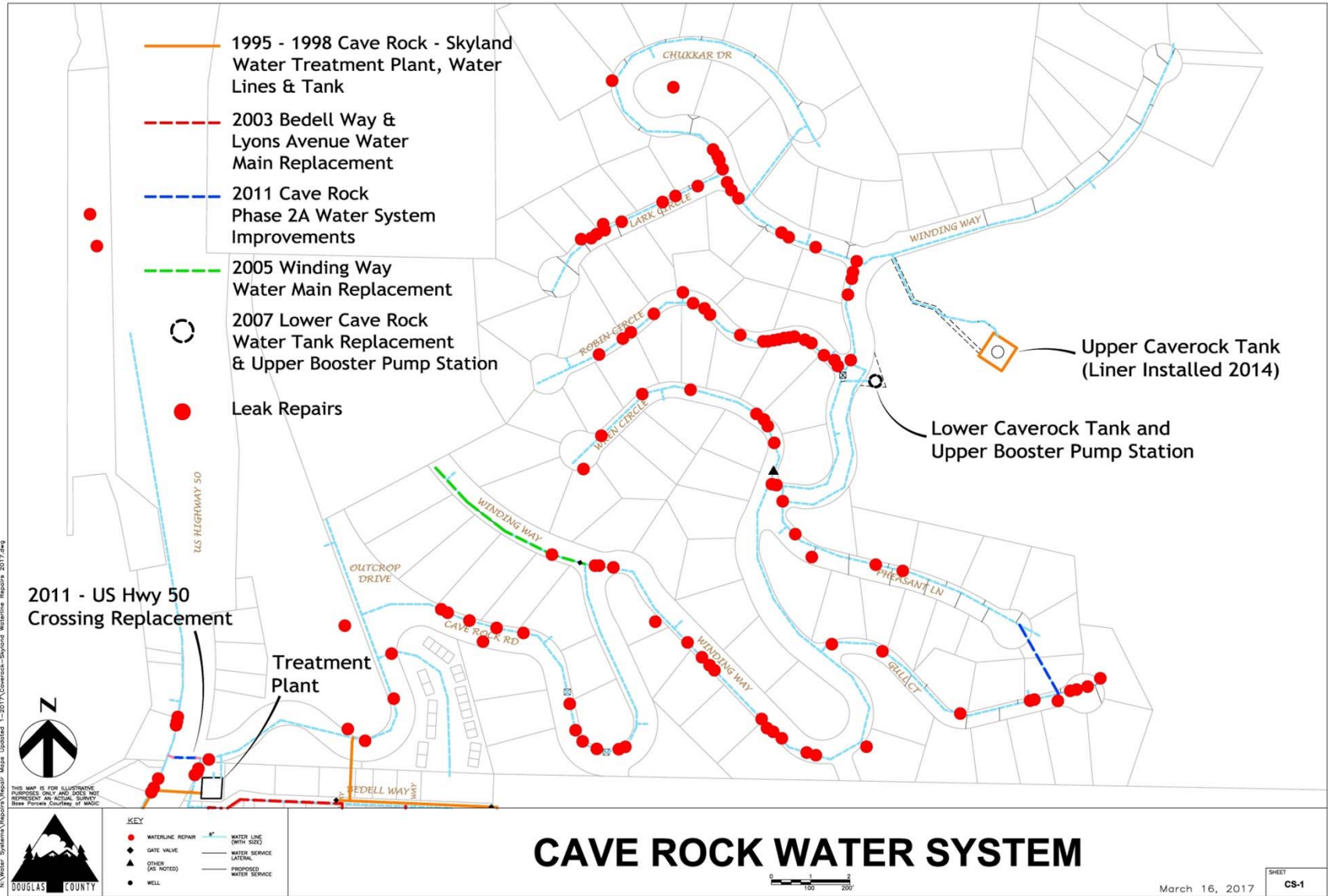
Cave Rock / Skyland Historical Leak Repair Count



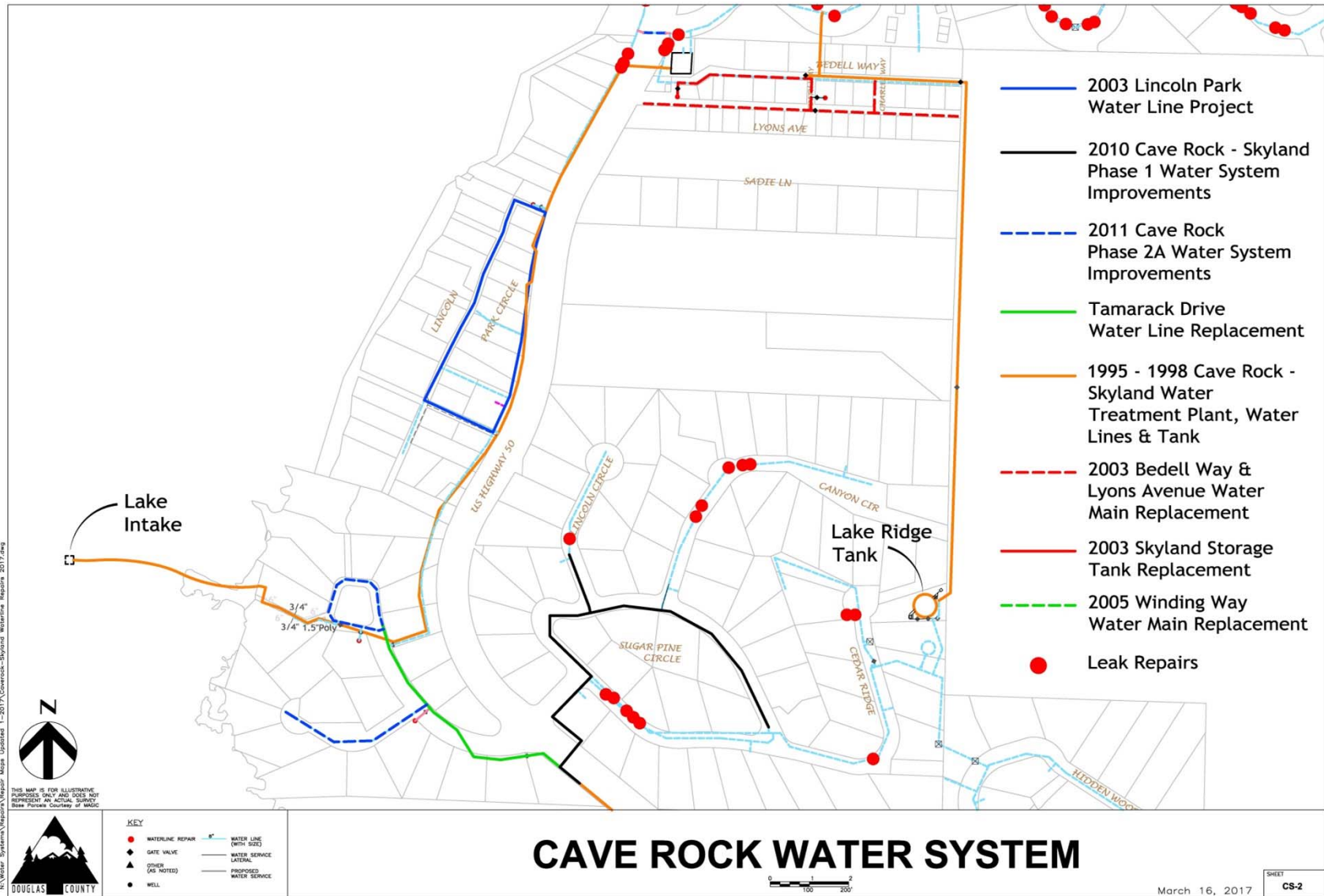
Cave Rock - 83 Leaks
Skyland - 14 Leaks



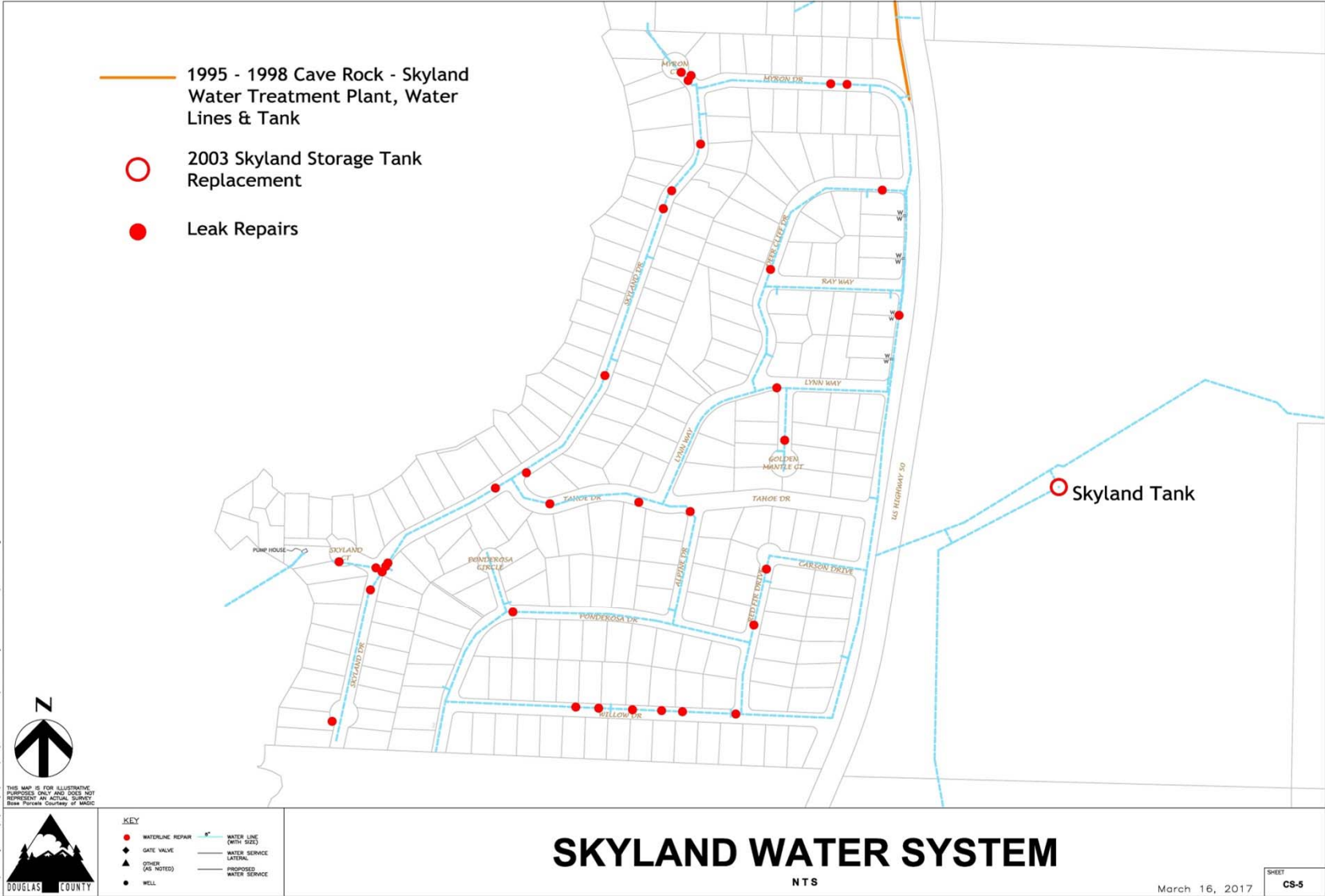
Leak Repair Map – Cave Rock



Leak Repair Map - Lakeridge



Leak Repair Map - Skyland



Pipe Failure Assessment

- Pipe Age
 - Cave Rock 1930's to 1960's – original construction
 - Cave Rock Villas – late 1970's original construction
 - Cave Rock Estates Unit 3 – late 1970's original construction
 - Skyland – late 1950's to 1960's – original construction
- Failures related to original construction methods
 - Bending, crushing, damaged and missing coatings, and dissimilar materials resulting in corrosion
 - Unable to predict the timing and location of these types of failures



Typical Pipe Failures



Pipe Replacement

- Can we replace pipes as money is available/pipes break?
 - Approximately 20,000 LF in each water system
 - Replacement of 100-200 foot sections of pipe as leaks occur is not practical
 - Higher unit cost for piecemeal approach over time
 - Services and Meter Pits installed with pipe replacement



Deficiency 9 – Booster Pumping

- Lower Cave Rock and Hidden Woods Boosters- Underground – Do Not Meet State Regulations for Confined Space, Access Safety, or NEC



Lower Cave Rock Booster



Hidden Woods Booster



Deficiency 9 – Booster Pumping

- Cedar Ridge Pneumatic Tank – Limited Capacity and No Fire Flow



Deficiency 10 – Storage Volume

Table 3-13

Zone/Base EI	Existing Storage	Required Storage ¹	Other Available Storage ²	Surplus/ (Deficit) Without Zone Transfers	Surplus/ (Deficit) With Zone Transfers
Skyland (6,431)	781,914	422,736	238,685	359,178	597,863
Lakeridge (6,531)	355,754	332,070	60,808	23,684	84,492
Hidden Woods (6,596)	121,616	305,080	0	(183,464)	(183,464)
Lower Cave Rock (6,766)	186,824	364,763	98,202	(177,939)	(79,737)
Upper Cave Rock (6,937)	196,403	341,113	0	(144,710)	(144,710)
TOTAL	1,642,511	1,765,761		(123,250)	274,444

All volumes in gallons.

1 – Per Table 3-12

2 – Based on transfer from higher connected zones, assumed half of total potential storage available.



Deficiency 11– Water Treatment

- No Membrane Redundancy (NAC 445A.6678)
- Capacity Limitations at Peak Demand



Main Treatment Skid



Backwash Treatment Skid

Deficiency 12 – Water Conservation

- Peak Summer Water Usage: 900 to 1,000 GPD/EDU
- High water use can lead to need for infrastructure improvements to increase system capacity
- Just 4.7% of services are Metered
- NRS 540.131 Requires a Water Conservation Plan
 - “Metering of all water services is an essential element of a water conservation plan.”



Deficiency 13 – Lake Intake Pump Station

- Pump Cavitation at Low Lake Levels
- Pump Station Flow Limits WTP Max Production
- Current PS Upgrade Project is On Hold

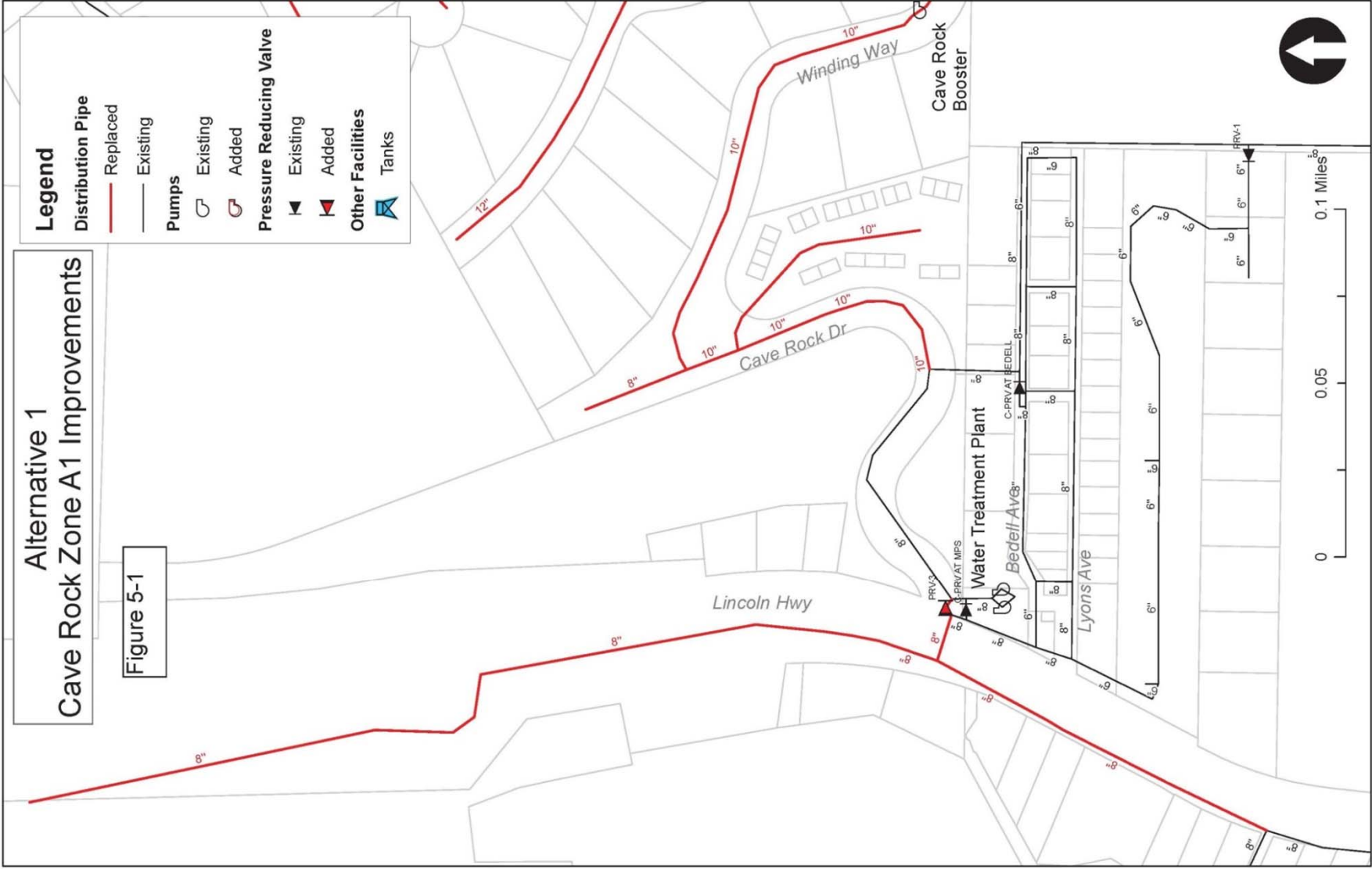


Deficiencies 1-9 Alternative 1 Modified Existing System Configuration

- Replace Lower Cave Rock Booster – Above Grade
- Remove Hidden Woods, & Cedar Ridge Boosters
- New Lakeridge Booster
 - Two sets of pumps: 1 to boost to Hidden Woods Tank, 1 for Cedar Ridge domestic service.
- 9 New PRVs
- 15,900 LF of New Pipe for Line Leaks
- 24,700 LF of New Pipe for Pressure and Velocity Criteria



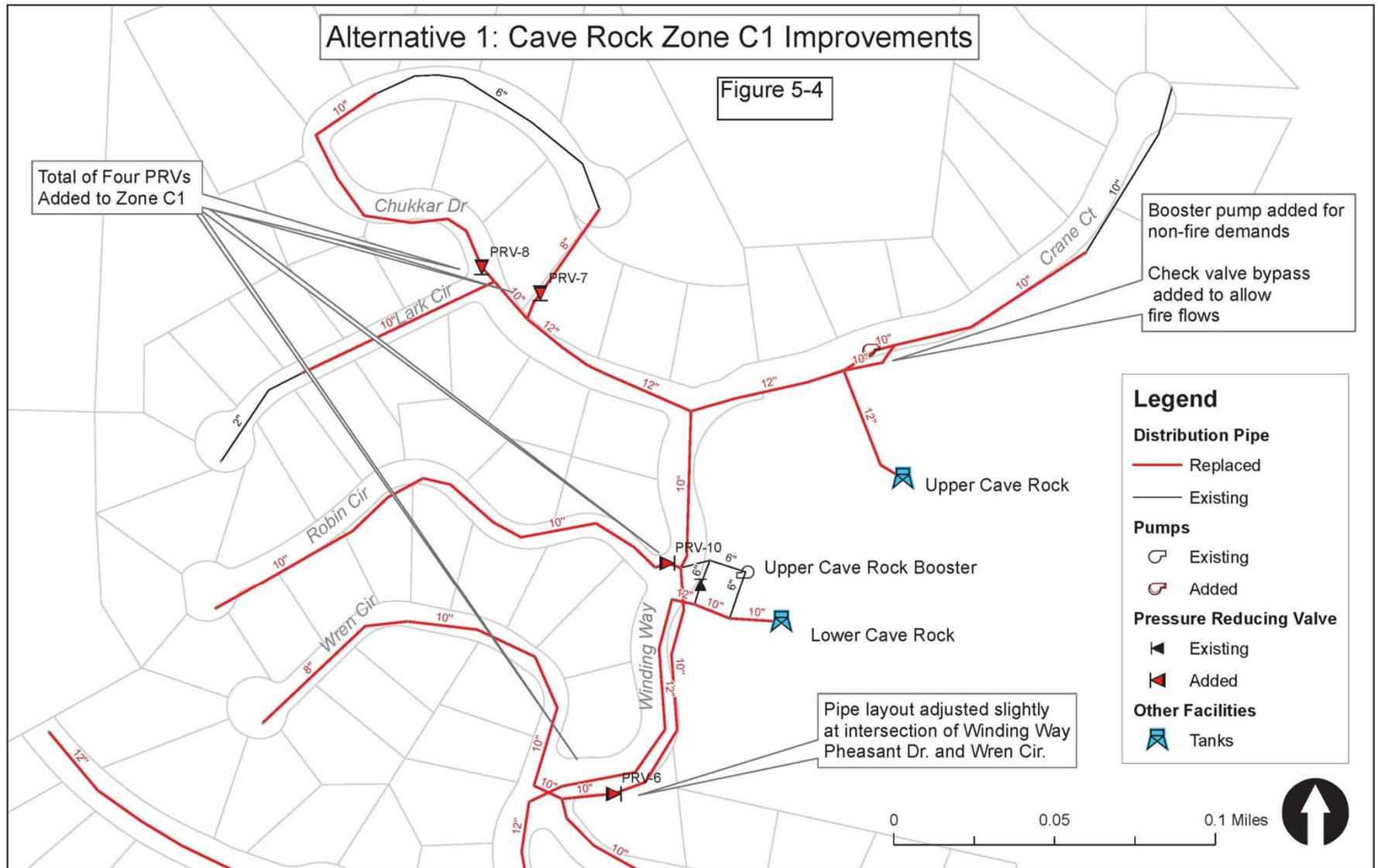
Deficiencies 1-9 Alternative 1 Cave Rock Zone A1 Improvements



Deficiencies 1-9 Alternative 1 Cave Rock Zone A1 Improvements

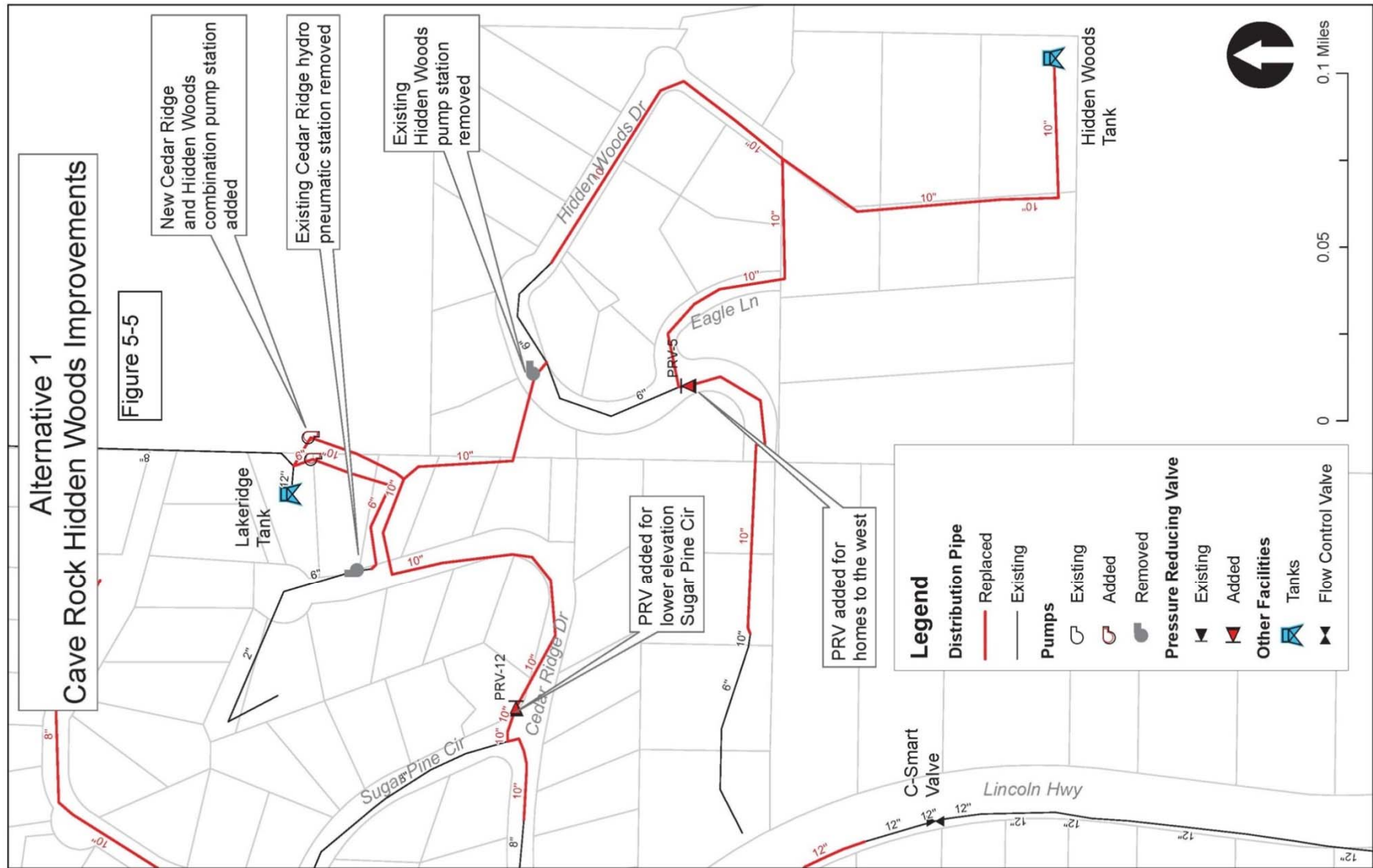


Deficiencies 1-9 Alternative 1 Cave Rock Zone C1 Improvements

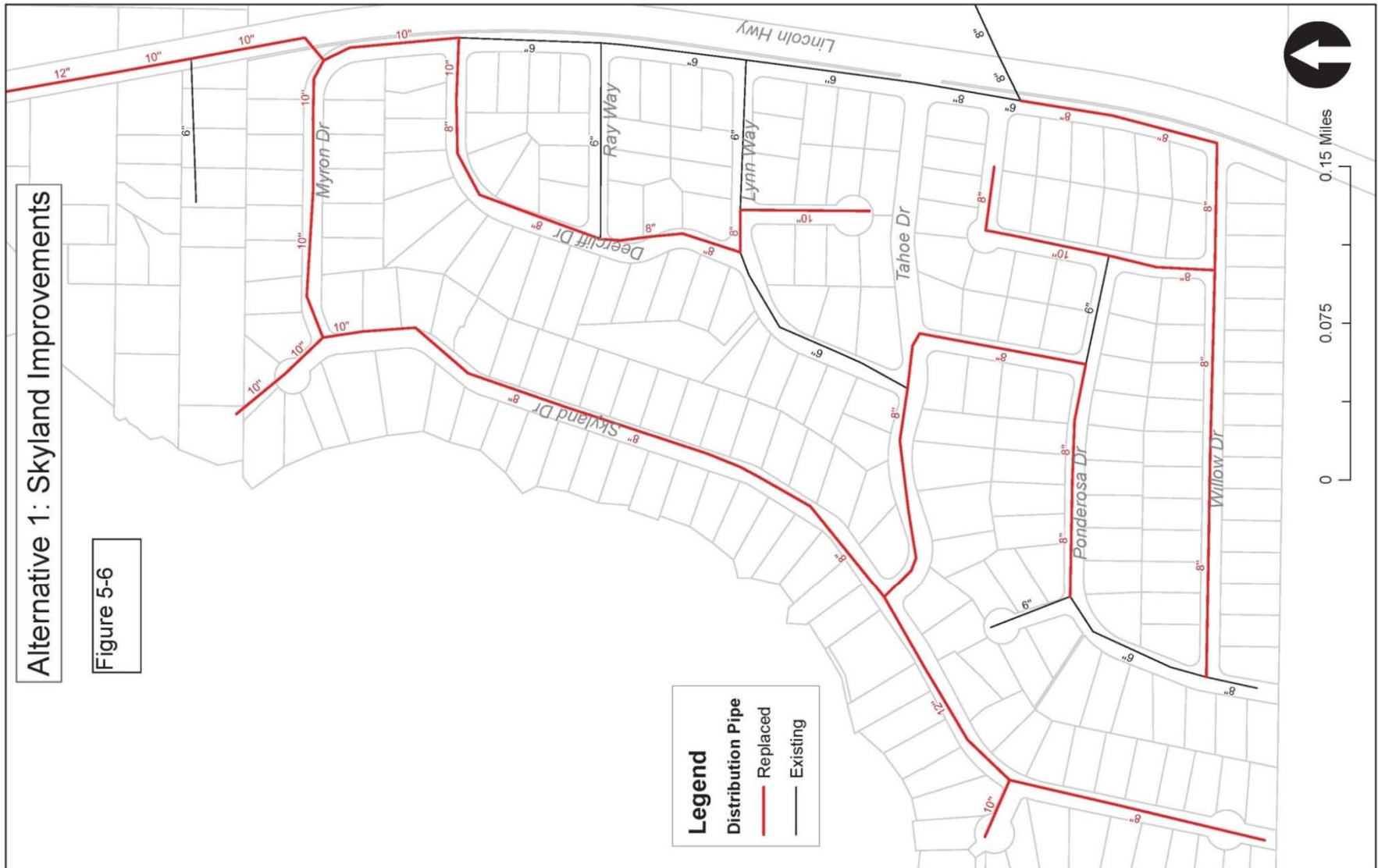


Deficiencies 1-9 Alternative 1

Cave Rock & Hidden Woods Improvements



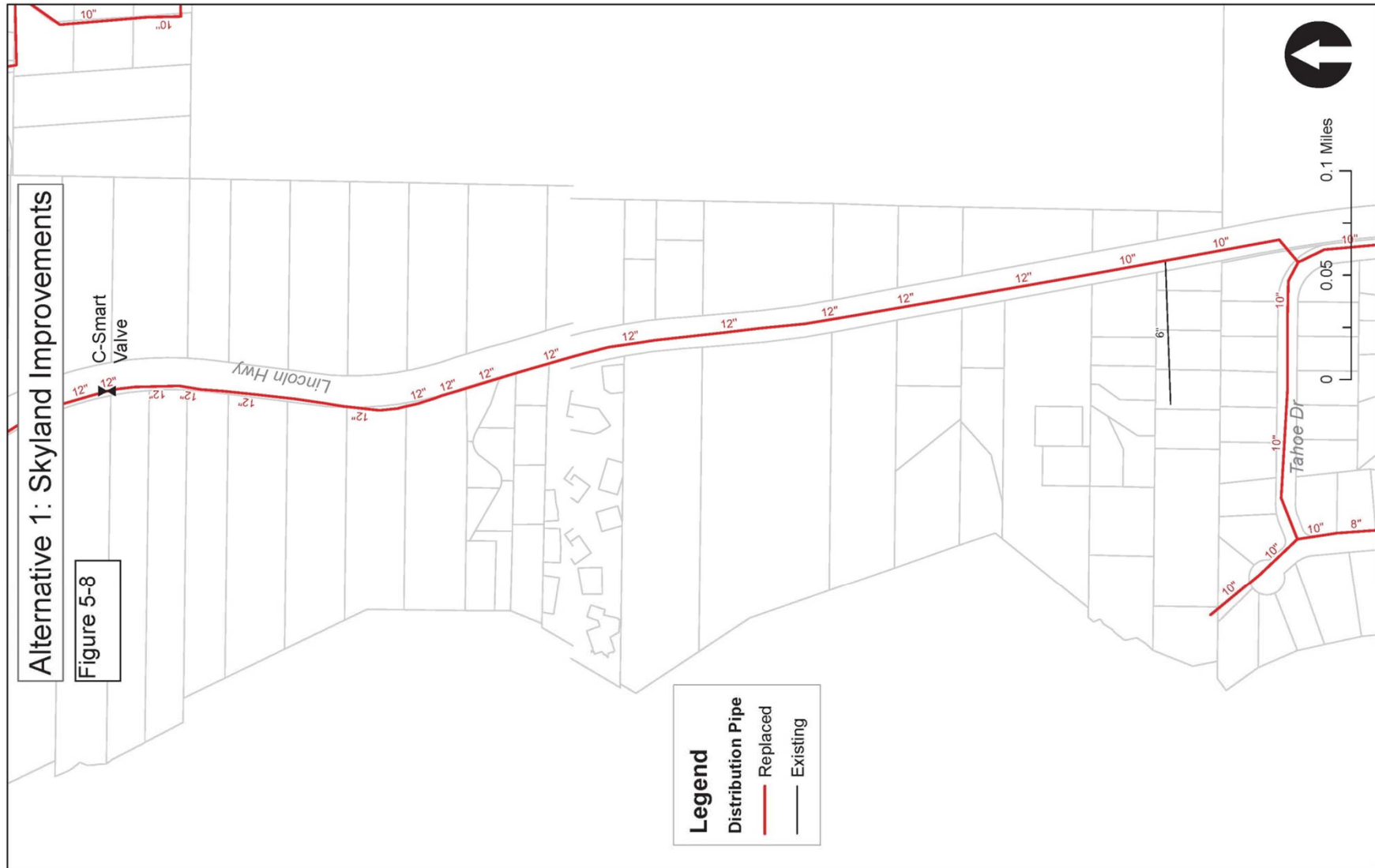
Deficiencies 1-9 Alternative 1 Skyland Improvements



Deficiencies 1-9 Alternative 1 Skyland Improvements



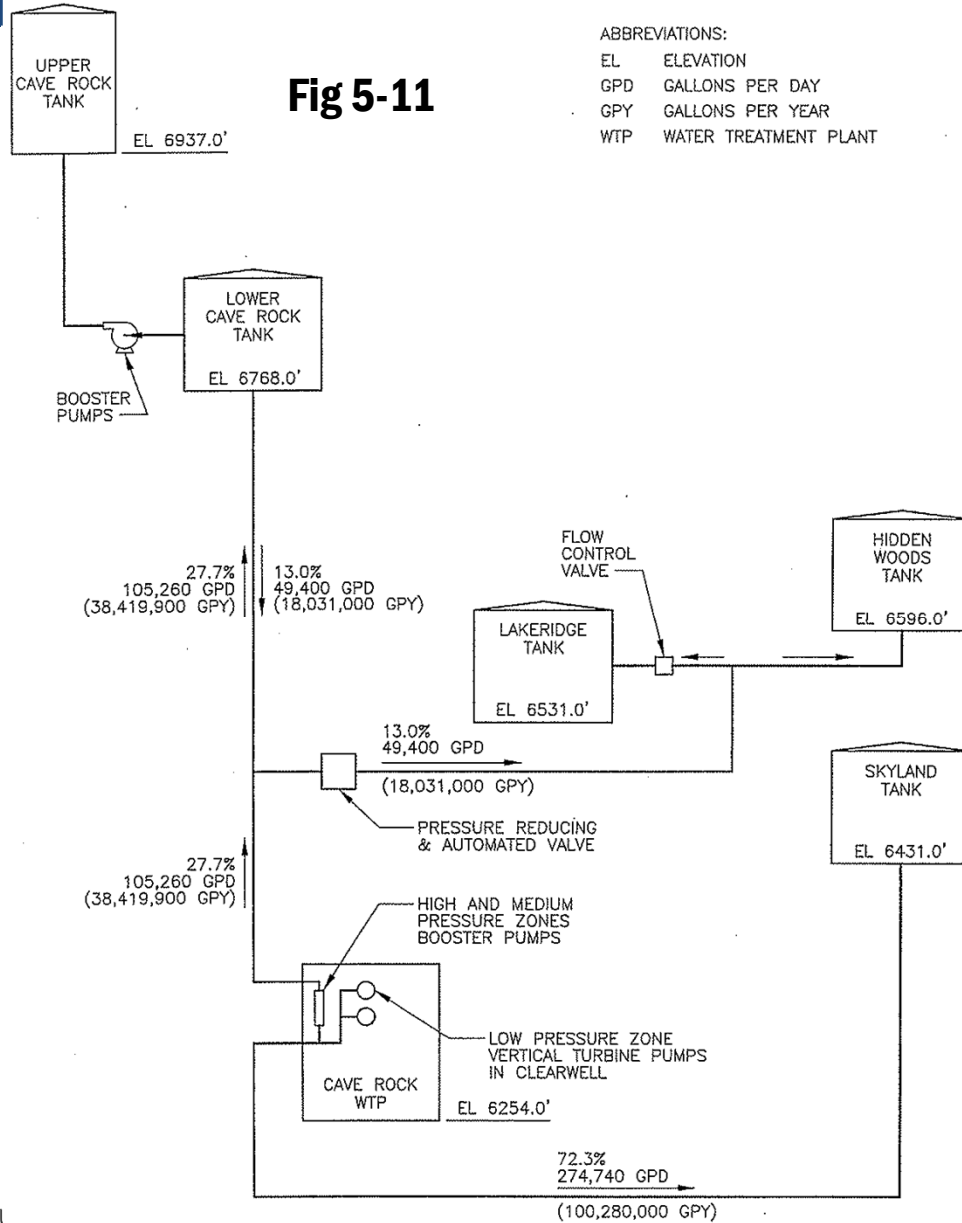
Deficiencies 1-9 Alternative 1 Skyland Improvements



Deficiencies 1-9 Alternative 2 High Pressure Main & Zone Pumping

Fig 5-11

ABBREVIATIONS:
 EL ELEVATION
 GPD GALLONS PER DAY
 GPY GALLONS PER YEAR
 WTP WATER TREATMENT PLANT



Deficiencies 1-9 Alternative 2 Modified WTP Booster Station

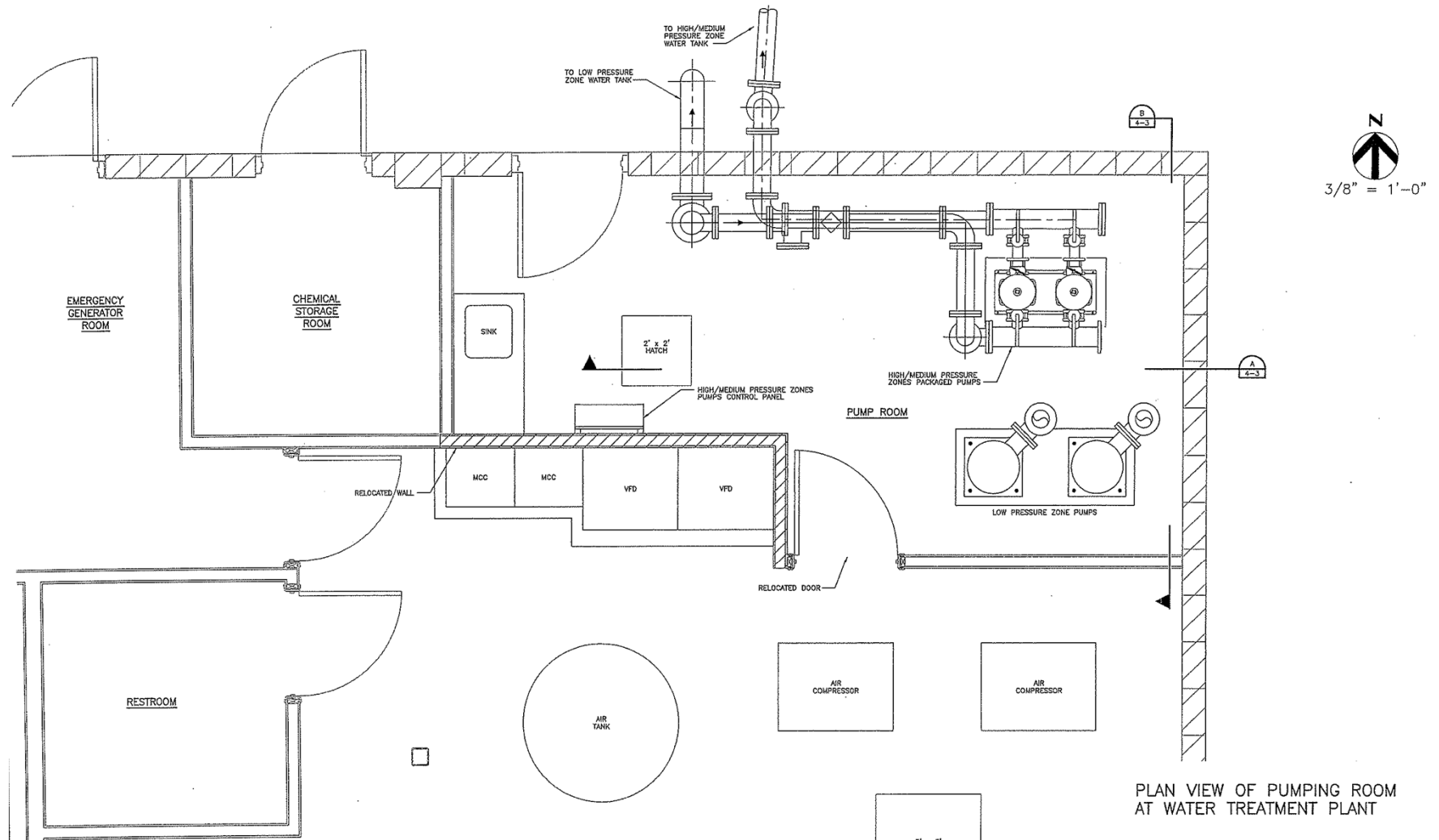
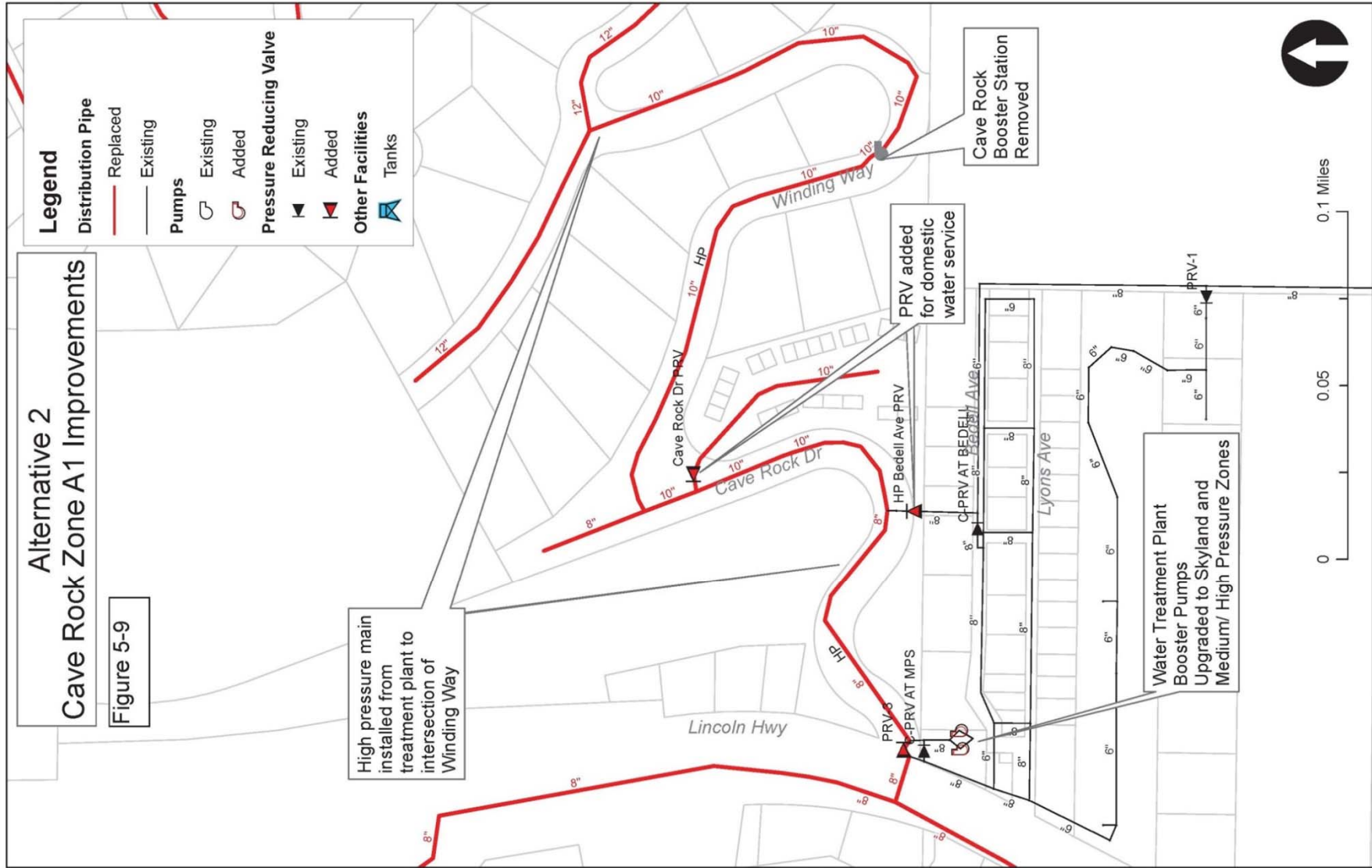
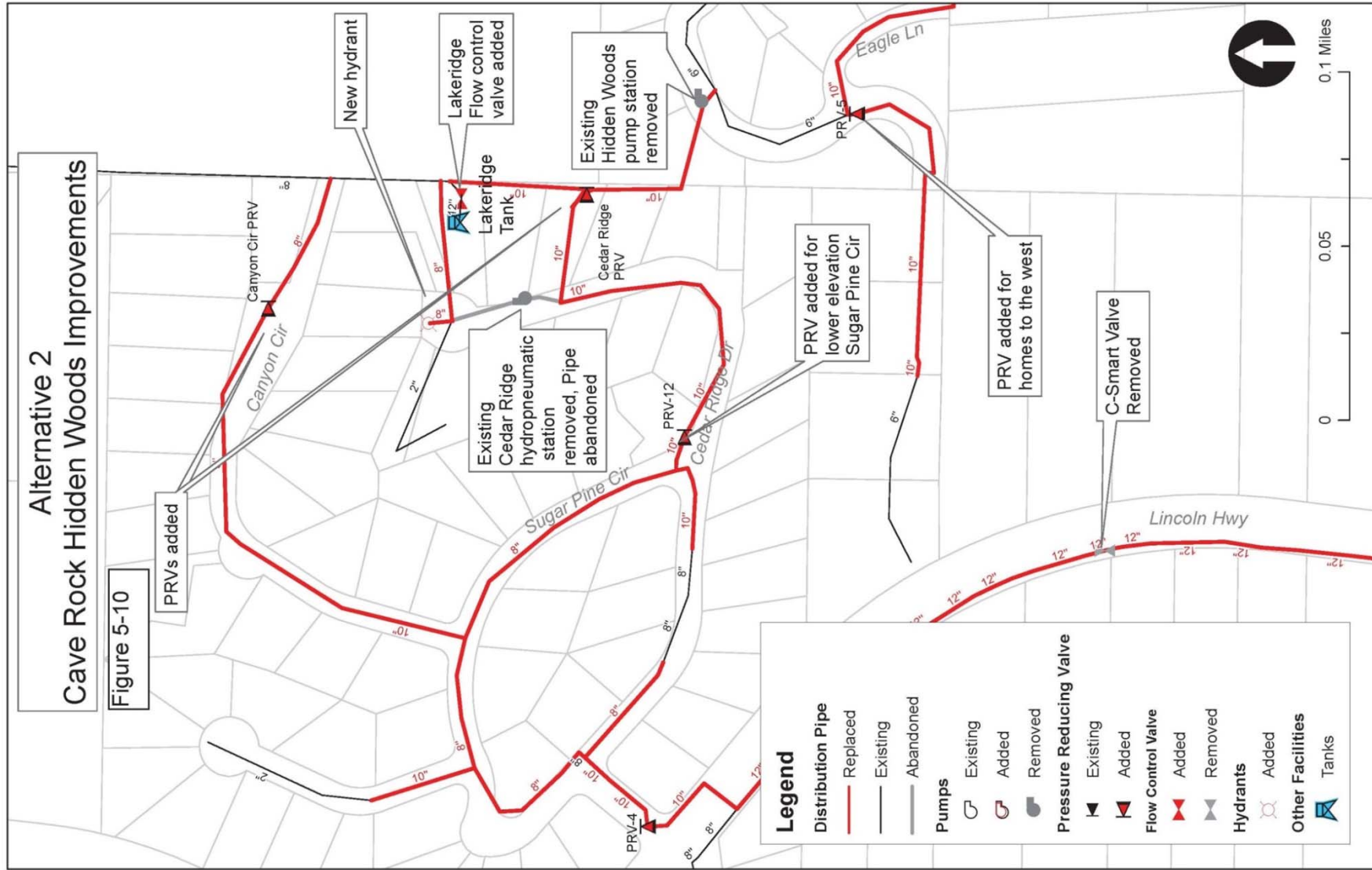


Fig 5-12

Deficiencies 1-9 Alternative 2 Cave Rock Zone 1A Improvements



Deficiencies 1-9 Alternative 2 Hidden Woods Improvements



Deficiency 10 Alternative 1

Upsize Tanks in Existing Locations

Table 5-8

Tank Location	Existing Size (Gal)	Proposed Size (Gal)
Hidden Woods	121,600	306,000
Lower Cave Rock	186,800	267,000
Upper Cave Rock	196,400	342,000



Deficiency 10 Alternative 2 Supplemental Tanks

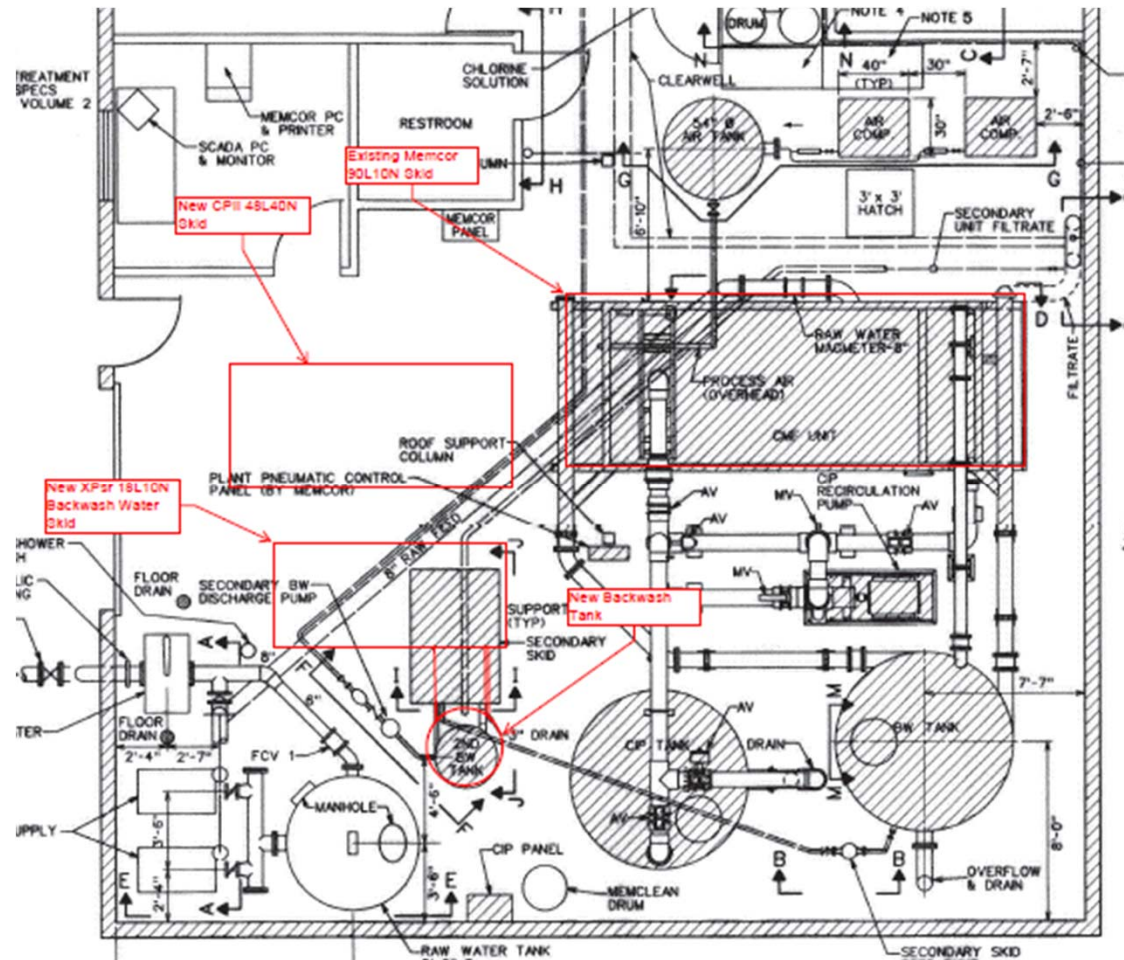
Table 5-10

Tank Location	Proposed Size (Gal)
Hidden Woods (Replacement)	306,000
Lower Cave Rock	80,000
Upper Cave Rock	145,000



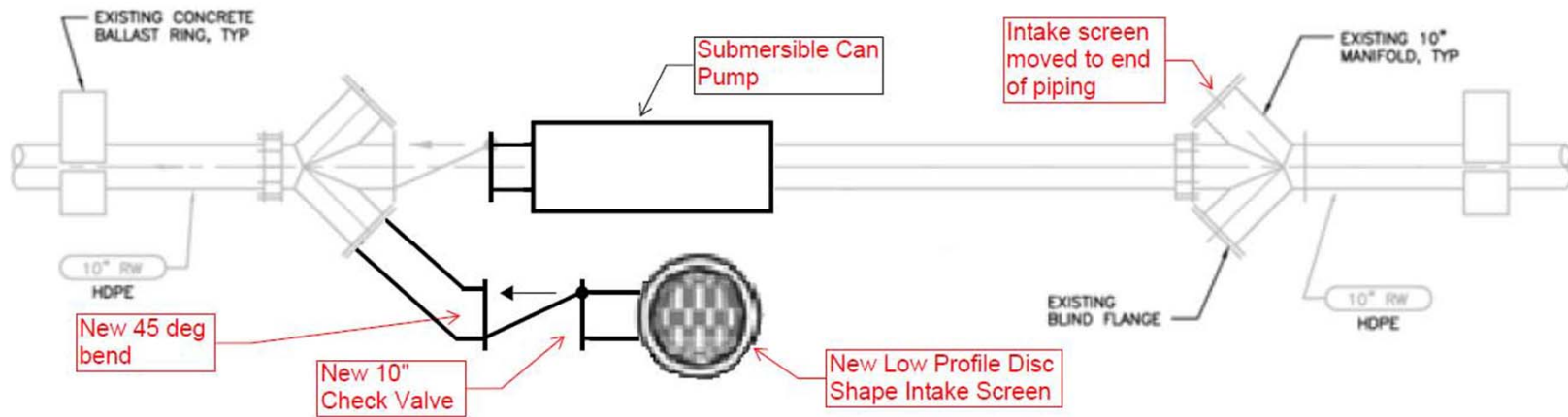
Deficiency 11 Water Treatment Alternative 1 – Redundant/Peak Demand Membrane Skid

Fig 5-14



Deficiency 13 – Lake Intake Pump Station Alternative 3 – Add Booster Pump in Lake

Fig 5-18



Alternative Ranking Criteria

- Implementation (20%)
 - Is the alternative feasible to implement?
 - Is the alternative constructible?
- Reliability (25%)
 - Will the alternative provide reliable results?
- Operation /Maintenance (40%)
 - Does the alternative require a large operator time commitment?
 - Does it require ongoing contract maintenance?
- Environmental / Permitting (15%)
 - Can TRPA thresholds be met?
 - Are there short-term and long-term effects on the environment?
 - Will the alternative be difficult to permit?



Alternative Ranking Summary

Deficiency	Alternative	Score	Rank
1 – 9 Fire Flow, Pressure...	1 – Modified Existing System Configuration	1.2	1
1 – 9 Fire Flow, Pressure...	2 – High Pressure Main and Zone Pumping	1.6	2
10 – Storage Volume	1 – Upsize Tanks in Existing Locations	1.9	2
10 – Storage Volume	2 – Supplemental Tanks	1.0	1
11 – Water Treatment	1 – Redundant/Peak Demand Skid Membrane	-	1
12 – Water Conservation	1 – Installation of Water Meters	-	1
13 – Lake Intake Prime	1 – Lower Pumps by 4 Feet	2.6	2
13 – Lake Intake Prime	2 – Replace Intake Pipe	2.7	3
13 – Lake Intake Prime	3 – Add Booster Pump in the Lake	2.0	1



Project Priorities

- Priority 1
 - Address public health and safety risks.
- Priority 2
 - Address temporary disruption of water service or compliance, but generally minimal public health and safety impacts.
- Priority 3
 - Increase operational efficiencies, but are not likely to cause loss or disruption of service or compliance.
- Priority 4 Projects
 - Provide further gains in efficiency from Priority 3, but are not needed for operations.
 - Represent “wants” more than “needs”.



Note on Cost Estimates

- PER cost estimates are Level 4 or “feasibility/planning” level estimates
 - Typically ranges between +40% and -20%
 - Costs are refined as project development and design progresses
- Construction costs are not static – construction markets subject to fluctuations
- All Project Costs Include 25% for Administrative and Contingencies



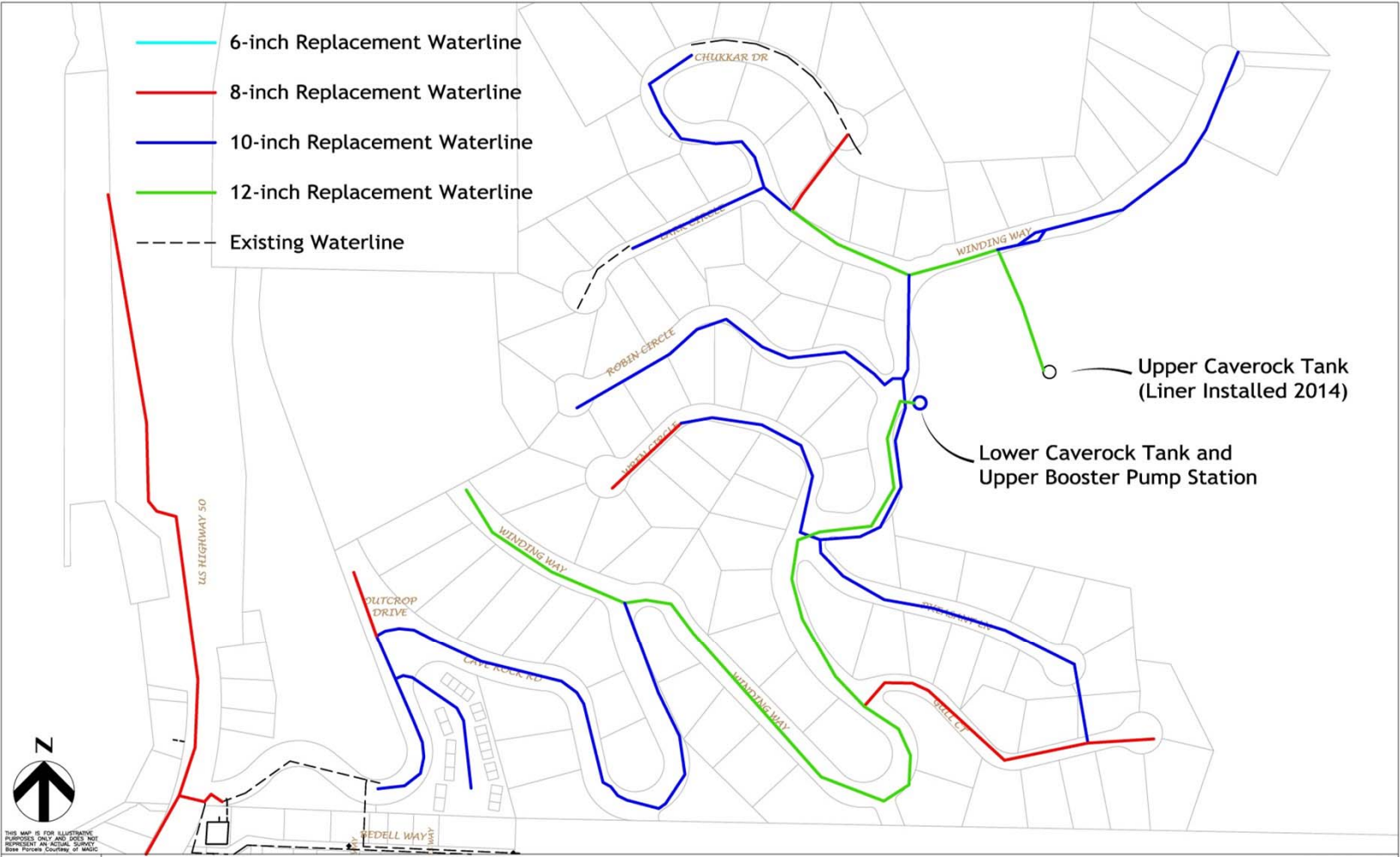
Project Priority Summary and Costs

Table 7-1. Project Priority Summary and Costs

No.	Deficiency Description	Priority	Recommended Alternative	Cave Rock Capital Cost (x\$1,000)	Skyland Capital Cost (x\$1,000)
1-9	Fire Flow, Pressure, Velocity, Leaks, Booster Pumping	1	1 – Modified Existing System	\$ 10,329	\$ 8,849
10	Hidden Woods, Lower and Upper Cave Rock Storage Volume Deficiencies	1	2 – Add Supplemental Tanks	\$ 1,840	\$ 0
11	Water Treatment Plant Redundancy	2	Redundant Treatment Skid	\$ 1,420	\$ 1,420
12	Water Conservation	3	Installation of Water Meters	\$ 920	\$ 770
13	Lake Intake Pump Station	2	3 – Add booster pumps in Lake	\$ 139	\$ 139
Total				\$14,648	\$11,178
Grand Total				\$ 25,826	



Cave Rock Improvements

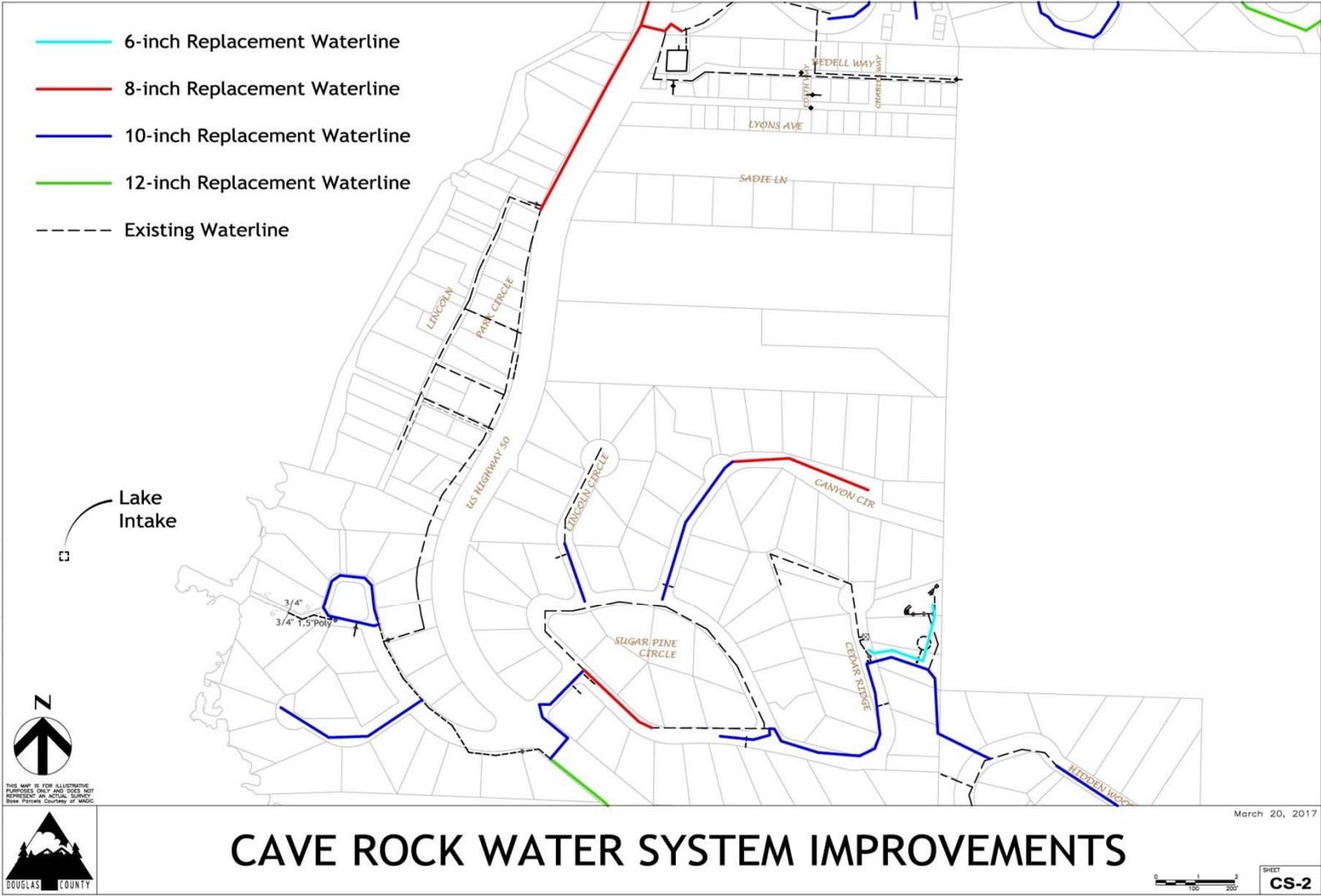


CAVE ROCK WATER SYSTEM IMPROVEMENTS

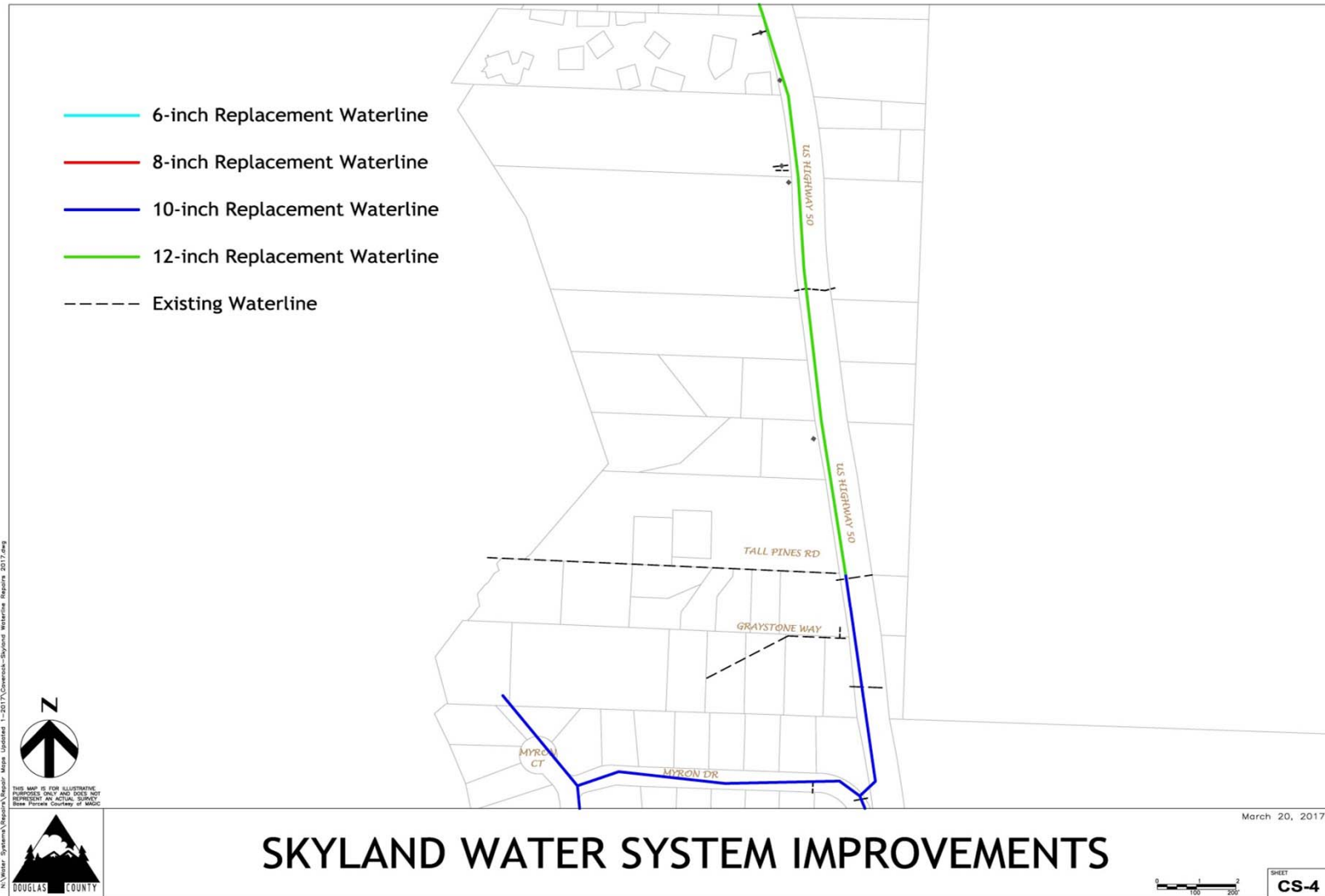
March 20, 2017

SHEET **CS-1**

Cave Rock Improvements



Skyland Improvements



SKYLAND WATER SYSTEM IMPROVEMENTS



Project Priority and Summary Costs

Deficiency No.	Recommended Alternative	Priority	Monthly Rate Per Customer					
			Capital Cost		SRF Loan (20 years)		USDA Loan (40 years)	
			Cave Rock	Skyland	Cave Rock	Skyland	Cave Rock	Skyland
1-9	1- Modified System (Fire Flow, Pressure, Velocity, Leaks, Booster Pumping)	1	\$ 10,329,000	\$ 8,849,000	\$ 207.37	\$ 187.04	\$ 155.87	\$ 140.59
10	2 - Supplemental Tanks (Hidden Woods, Lower and Upper Cave Rock Storage Volume Deficiencies)	1	\$ 1,840,000	\$ -	\$ 36.94	\$ -	\$ 27.77	\$ -
11	Redundant Treatment Skid (Water Treatment Plant Redundancy)	2	\$ 1,420,000	\$ 1,420,000	\$ 28.51	\$ 30.01	\$ 21.43	\$ 22.56
12	Installation of Meters (Water Conservation)	3	\$ 920,000	\$ 770,000	\$ 18.47	\$ 16.28	\$ 13.88	\$ 12.23
13	3 - Add Booster Pumps in Lake (Lake Intake Pump Station)	2	\$ 139,000	\$ 139,000	\$ 2.79	\$ 2.94	\$ 2.10	\$ 2.21
Totals			\$ 14,648,000	\$ 11,178,000	\$ 294.08	\$ 236.27	\$ 221.05	\$ 177.59

Note: Estimated monthly rates are based on customer count and will vary based on customer class (residential, commercial, irrigation) and service size.



Cave Rock Conceptual Phasing

- Water Line Replacement
 - Cave Rock Waterlines and Cave Rock Booster Pump Station
 - Lakeridge Area Waterlines
- Supplemental Tanks
- Water Treatment Plant – Redundant Skid
- Water Conservation – Meters
- Lake Intake Pump Station – Booster Pumps



Cave Rock Conceptual Phasing

Deficiency No.	Recommended Alternative	Priority	Capital Cost	Monthly Rate per Customer	
				SRF Loan (20 years)	USDA Loan (40 years)
1-9	1- Modified System (Fire Flow, Pressure, Velocity, Leaks, Booster Pumping)	1			
	Cave Rock Area	1	\$ 6,913,000	\$ 138.79	\$ 104.32
	Lakeridge Area	1	\$ 3,416,000	\$ 68.58	\$ 51.55
10	2 - Supplemental Tanks (Hidden Woods, Lower and Upper Cave Rock Storage Volume Deficiencies)	1	\$ 1,840,000	\$ 36.94	\$ 27.77
11	Redundant Treatment Skid (Water Treatment Plant Redundancy)	2	\$ 1,420,000	\$ 28.51	\$ 21.43
12	Installation of Meters (Water Conservation)	3	\$ 920,000	\$ 18.47	\$ 13.88
13	3 - Add Booster Pumps in Lake (Lake Intake Pump Station)	2	\$ 139,000	\$ 2.79	\$ 2.10
Totals			\$ 14,648,000	\$ 294.08	\$ 221.05
Annual Debt to Finance				\$ 984,576	\$ 740,068

Note: Estimated monthly rates are based on customer count and will vary based on customer class (residential, commercial, irrigation) and service size.



Skyland Conceptual Phasing

- Water Line Replacement
 - Skyland Subdivision Waterlines
 - US Hwy 50 Waterline and School Waterline
- Water Treatment Plant – Redundant Skid
- Water Conservation – Meters
- Lake Intake Pump Station – Booster Pumps



Skyland Conceptual Phasing

	Recommended Alternative	Priority	Capital Cost	Monthly Rate per Customer	
				SRF Loan (20 years)	USDA Loan (40 years)
1-9	1- Modified System (Fire Flow, Pressure, Velocity, Leaks, Booster Pumping)	1			
	Skyland Subdivision	1	\$ 4,007,000	\$ 84.70	\$ 63.66
	US 50 and School Waterlines	1	\$ 4,842,000	\$ 102.35	\$ 76.93
11	Redundant Treatment Skid (Water Treatment Plant Redundancy)	2	\$ 1,420,000	\$ 30.01	\$ 22.56
12	Installation of Meters (Water Conservation)	3	\$ 770,000	\$ 16.28	\$ 12.23
13	3 - Add Booster Pumps in Lake (Lake Intake Pump Station)	2	\$ 139,000	\$ 2.94	\$ 2.21
Totals			\$ 11,178,000	\$ 236.27	\$ 177.59
Annual Debt to Finance				\$ 751,337	\$ 564,752

Note: Estimated monthly rates are based on customer count and will vary based on customer class (residential, commercial, irrigation) and service size.



Questions

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Public Comments

- Written comments can be submitted to:

publicworks@douglasnv.us

- CR & Skyland PER Available on Public Works website at:

<http://www.douglascountynv.gov/DocumentCenter/View/5932>

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