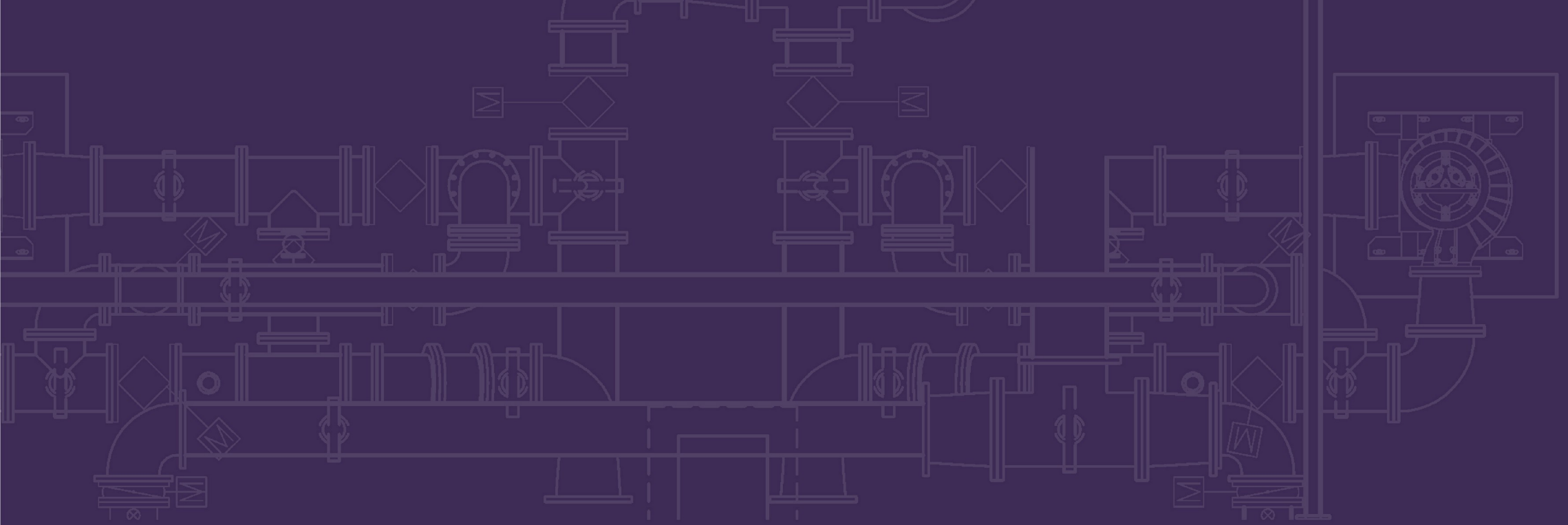


PEAK CHALLENGES WITH PRACTICAL SOLUTIONS: HIGHER LEVEL TREATMENT ON A STEEP ROCKY MOUNTAIN SITE

JVA, Inc. (Engineer): Julie Gustavson and Emily Godi

Doone Brothers Sewer and Septic Services (Contractor): Kellen and Seamus Doone

CONSULTING ENGINEERS

Doone Brothers
Sewer and Septic Services LLC

The materials and opinions presented herein are those of the presenters and do not necessarily reflect the views or opinions of the National Onsite Wastewater Recycling Association (NOWRA) or any other organization.

OUTLINE

- Project Background
- Soil and Terrain
- Final Design and Construction
- Challenges
- Lessons Learned
- Project Outcome

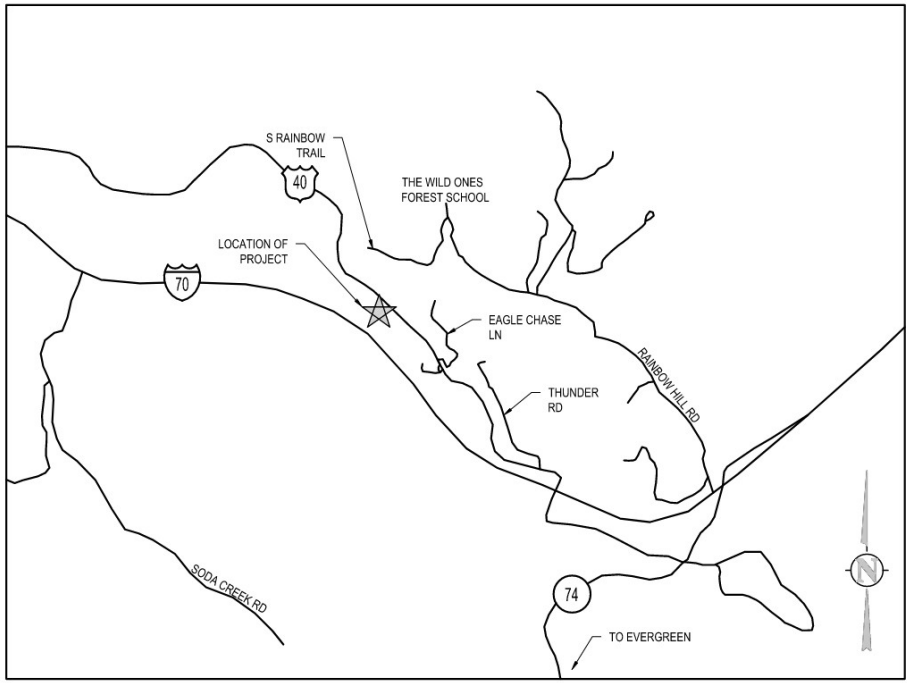


PROJECT BACKGROUND

PROJECT BACKGROUND

Case Study: Juniper Lodge and Treehouses

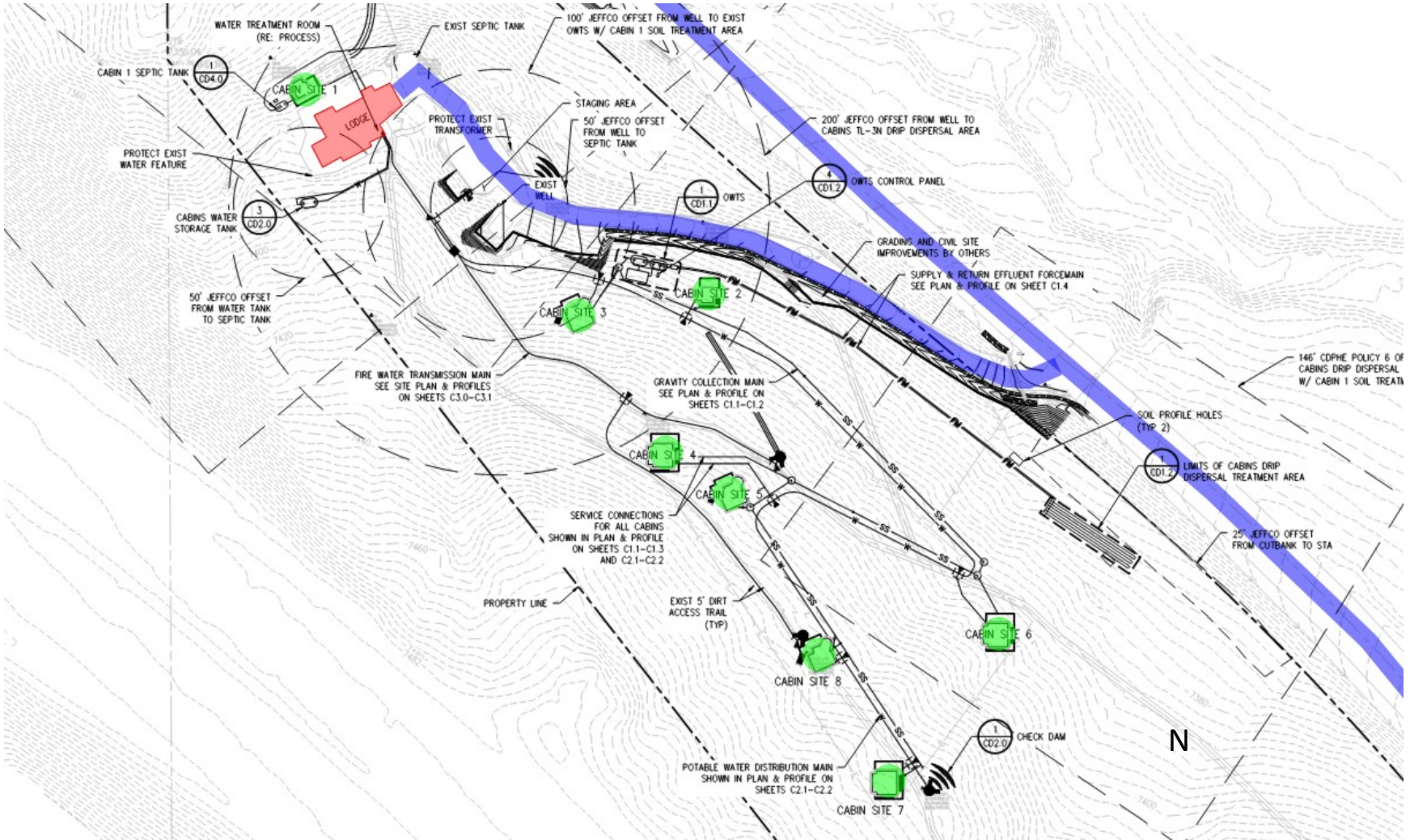
- Evergreen, CO



PROJECT LOCATION MAP



PROJECT BACKGROUND



ROADS

LODGE

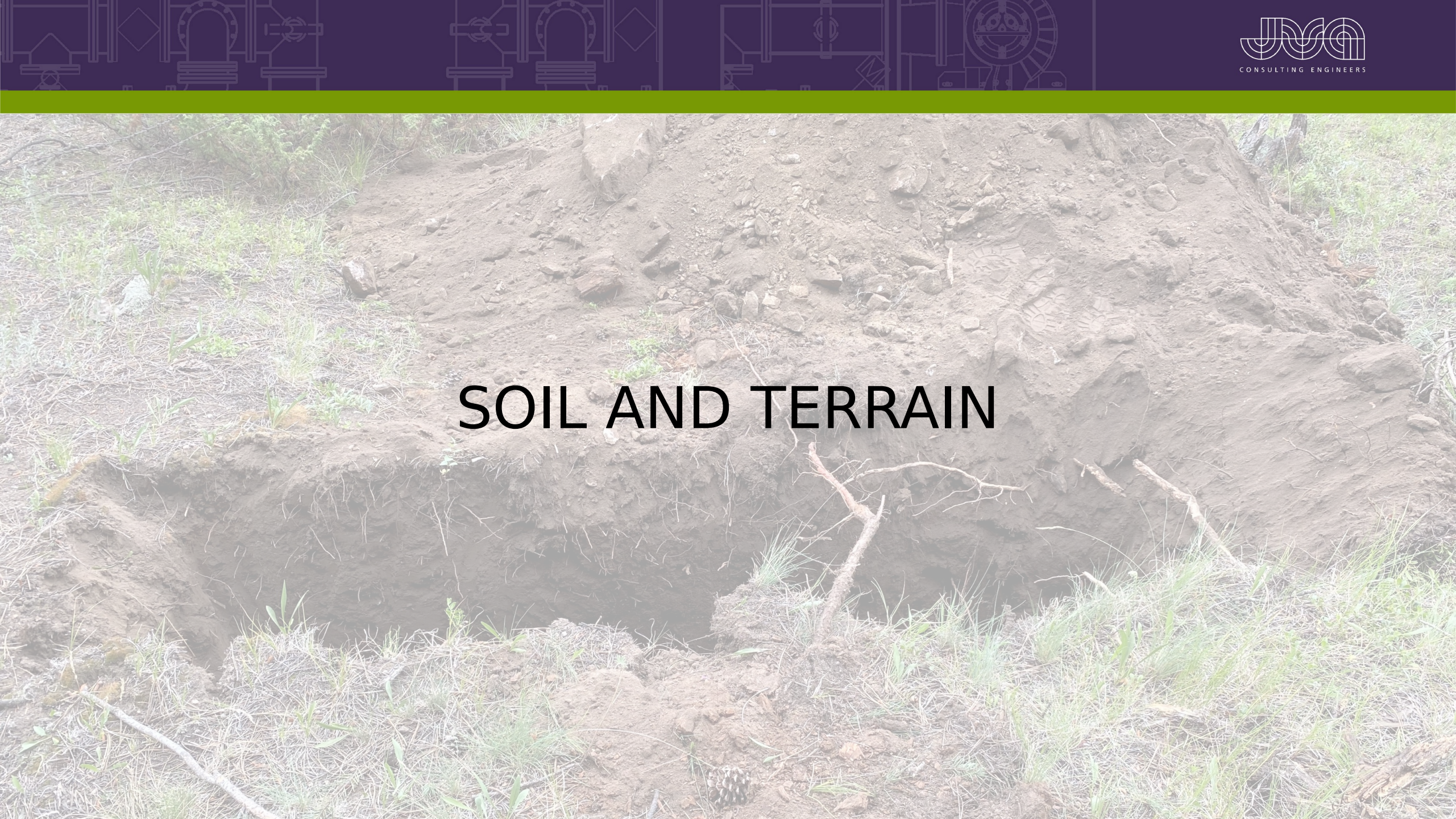
CABINS


JVA 9/8/23: Existing Septic Tank

PROJECT BACKGROUND

- Existing Infrastructure
  1. Private groundwater well
  2. Basement-level water treatment room w/ softening, pressure tank, and distribution pump
  3. 1,800-gallon poly water storage tank
  4. Conventional siphon-fed OWTS for wastewater treatment from the Lodge
     1. ~2,000 gpd system

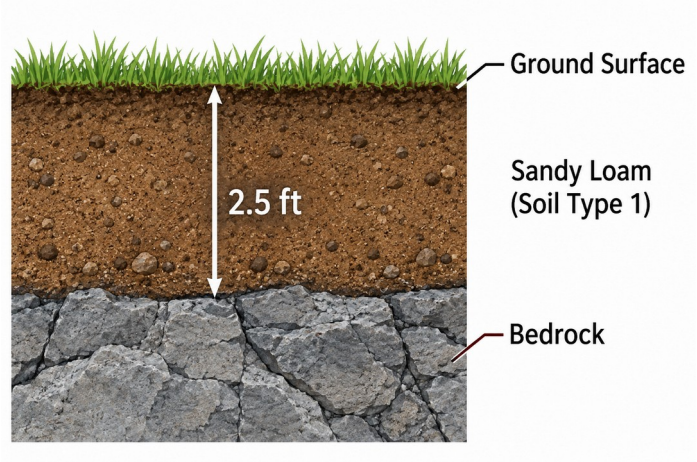
- New OWTS, water treatment improvements, and underground



SOIL AND TERRAIN

SOIL AND TERRAIN

- Forested land with steep, rocky slopes
- Soil Type 1 (Sandy Loam) with bedrock at 2.5 feet
- Challenges:
  - Need 3-4 feet above limiting layer for TL1
  - Goal to preserve natural environment
    - Save the trees!
  - Very few flat or accessible areas



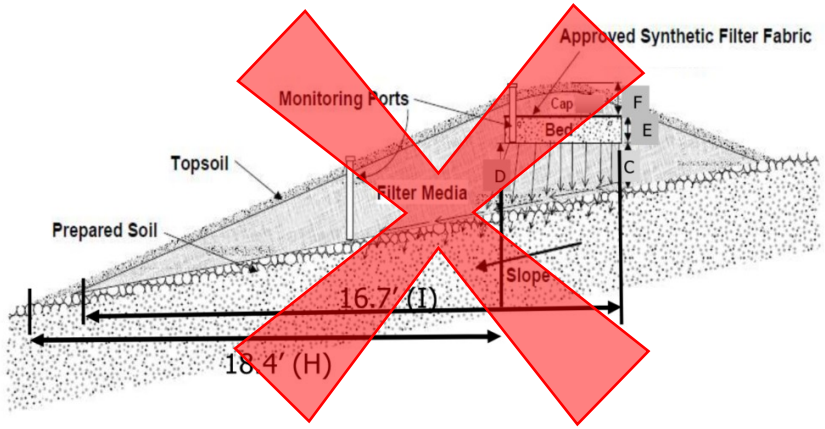


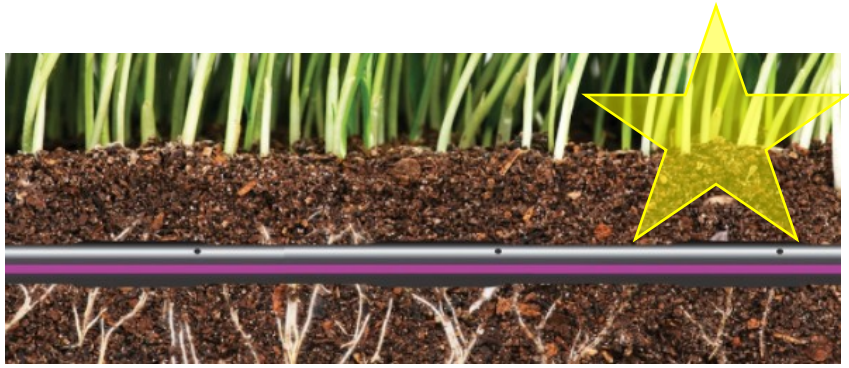


SOIL AND TERRAIN

How the soil and terrain influenced de

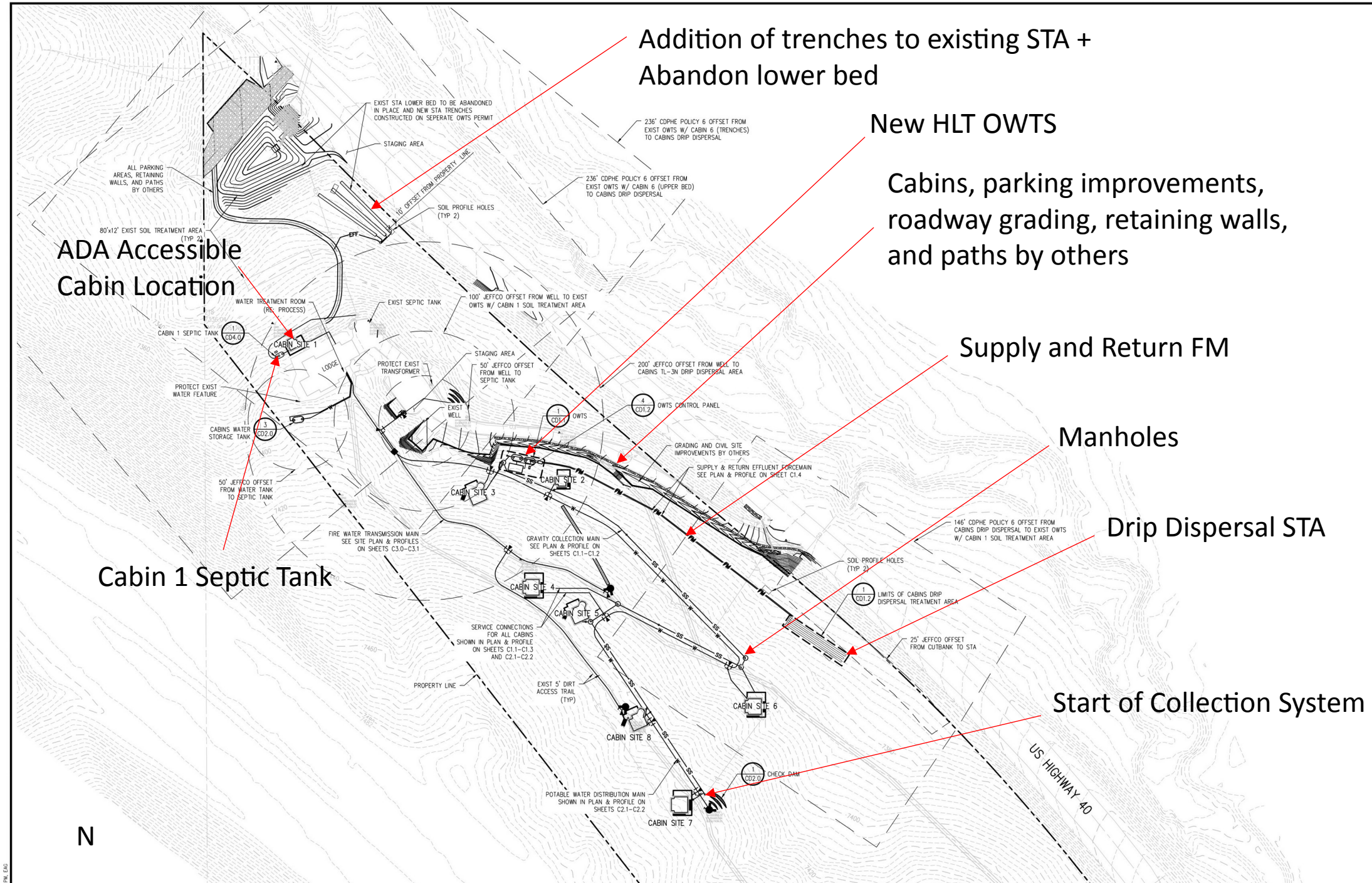
- Mounded OWTS? ☾ Much too large
- Drip Dispersal OWTS ☾ Seems promisir
  - Requires Higher Level Treatment (HLT) TL3N







FINAL DESIGN AND CONSTRUCTION



JVA, Inc. 213 Linden Street, Suite 200
Fort Collins, CO 80524 970.225.9099
www.jvajva.com
Boulder • Fort Collins • Winter Park
Glenwood Springs • Denver

NO.	DATE	DESD	DWN	REVISION DESCRIPTION

DESIGNED BY:	JNG
DRAWN BY:	EAG/LJF
CHECKED BY:	JJM
JOB #:	1161e
DATE:	JANUARY 2025

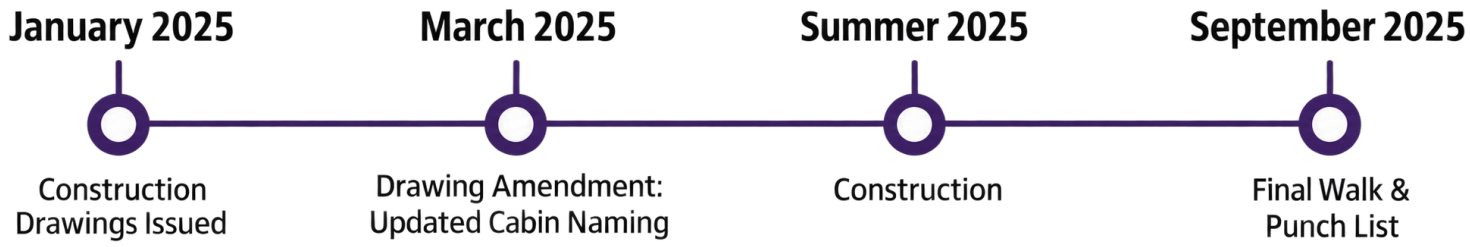
© JVA, INC.

R MOUNTAIN HOUSE
STEWATER IMPROVEMENTS
GREEN, COLORADO

SITE PLAN

FINAL DESIGN AND CONSTRUCTION

- Construction drawings first issued January 2025
  - Amended March 2025 with updated Cabin naming convention
- Construction Summer 2025
- Final Walk and Punch List September 2025



CHALLENGES

CHALLENGE: POLICY 6 FOR MULTIPLE OWTS

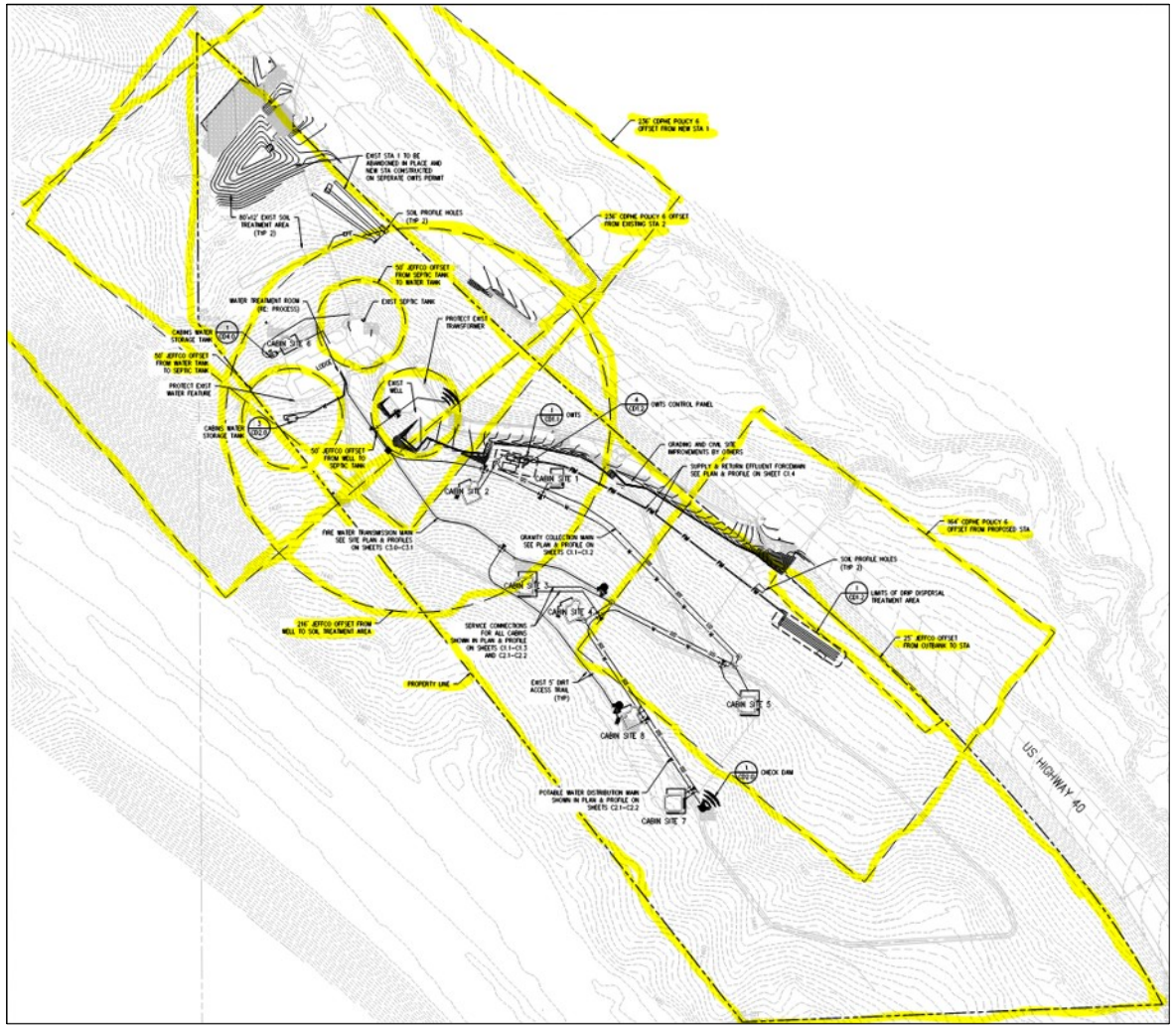
- Colorado's Water Quality Site Application Policy 6
  - Clarifies how state rules apply to properties with multiple OWTS
  - Feasibility of multiple OWTS is defined by Horizontal Influence Areas (HIA)

$$\text{Horizontal Influence Area (in feet)} = 100 + \left[\frac{\text{DF} - 1000}{100}\right] \times 8$$

  - HIA is applied to the STA, and HIAs cannot intersect

CHALLENGE: POLICY 6 FOR MULTIPLE OWTS

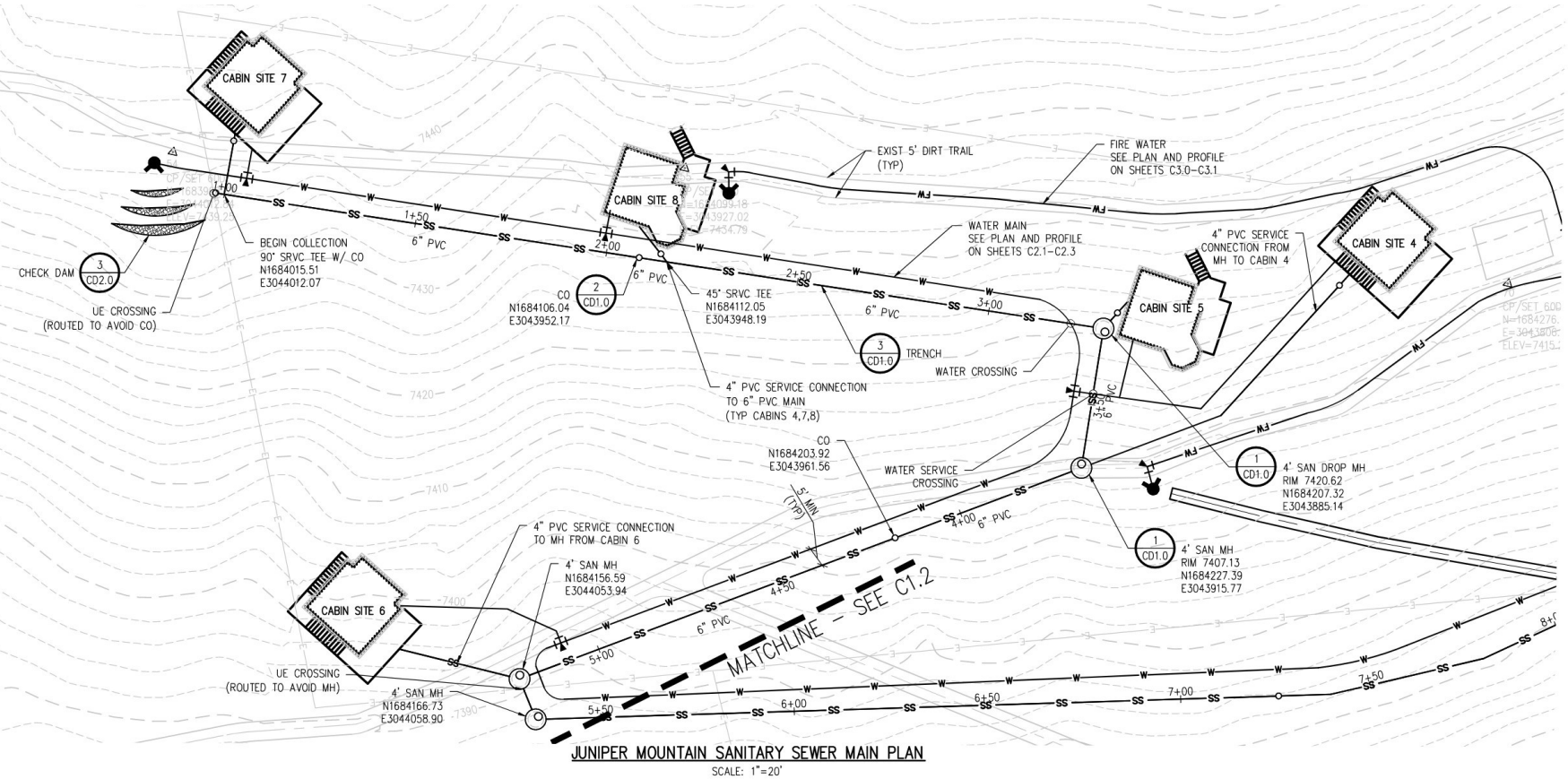
- HIAs from existing upper bed, new trenches, and new drip system
- Jefferson County offsets:
  - Well to drip dispersal
  - Well to septic tanks
  - Well to existing OWTS
  - Water storage tank to septic tanks
  - Property boundaries



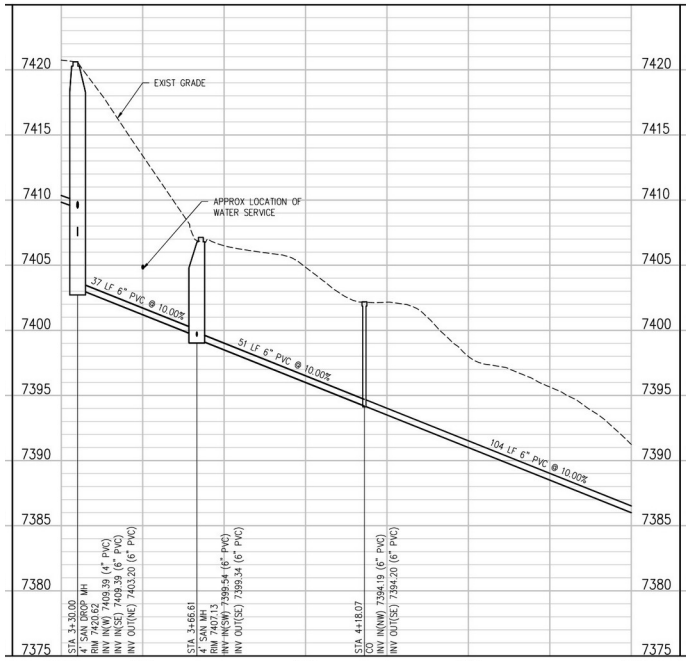
CHALLENGE: STEEP SLOPES AND COLLECTION - DESIGN

- Collection system designed to prevent pipe/manhole erosion and turbulence
  - Maximum slope of 10% for 6” PVC to limit wastewater velocity
- Existing grade was much steeper than 10% from top of hillside to bottom of hillside
  - Multiple drop manholes would need to be too deep and too excessive
- How to design? Switchbacks
  - Switchbacks with 2 manholes at each turn backwards

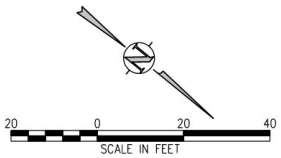
CHALLENGE: STEEP SLOPES AND COLLECTION - DESIGN



JUNIPER MOUNTAIN SANITARY SEWER MAIN PLAN
SCALE: 1"=20'



JUNIPER MOUNTAIN SANITARY SEWER MAIN PROFILE
SCALE: 1"=20' HORIZ
1"=5' VERT



CHALLENGE: STEEP SLOPES AND COLLECTION - CONSTRUCTION

- Existing site and slope were very steep with limited to no access
- Tree removal and building pathways were required throughout the footprint
- The owner wanted no roads left in place



Photo by Doone Brothers



CHALLENGE: MULTIPLE UTILITIES - DESIGN

- Three buried pipe systems on the same constrained site:
  - Drinking water
  - Wastewater collection
  - Fire water transmission (dry)
    - Not a typical requirement. Jefferson County wanted fire hydrants accessible to each cabin. Solution was a dry fire water transmission line that could be filled up and pressurized by fire trucks.
- Collection and Distribution typically 10-ft min. offset
  - Variance given to allow 5-ft min. offset

CHALLENGE: MULTIPLE UTILITIES - CONSTRUCTION

- Required extra wide trench excavation of 8 feet
- Water and sewer required 5 feet of separation
- Utility crossings require double encasement
- Fire water and electrical were installed above the water and sewer



CHALLENGE: DEEP BURIAL REQUIREMENTS AND ROCKY OUTCROPS

- Deep burial requirements associated with cold-climate installation
  - While 4-ft min. bury is standard for WW, water pipes just 5-ft away are 6-ft min. bury
  - Bury depth regularly ~10 feet in some places due to 10% slope restriction
- Deep pipes were installed in bedrock and bedded with ¾" aggregate


JVA 8/18/25: Site Visit

OTHER RELEVANT CHALLENGES

Additional challenges faced included:

1. Preserving mature vegetation
2. Coordinating with other designers and contractors
3. Maintaining business as usual

LESSONS LEARNED

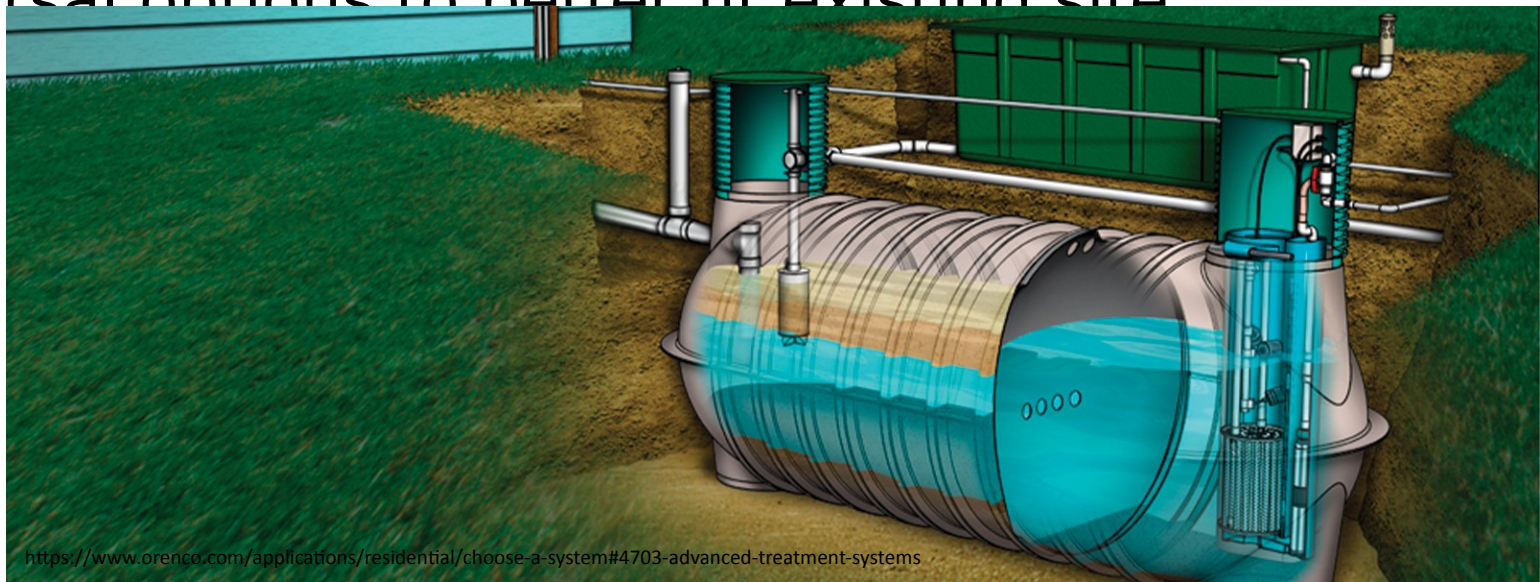
LESSONS LEARNED

- Strong designer-installer communication can make or break a project
  - Weekly CA meetings
  - Regular site visits
  - Real-time trouble-shooting
  - Ask a lot of questions



LESSONS LEARNED

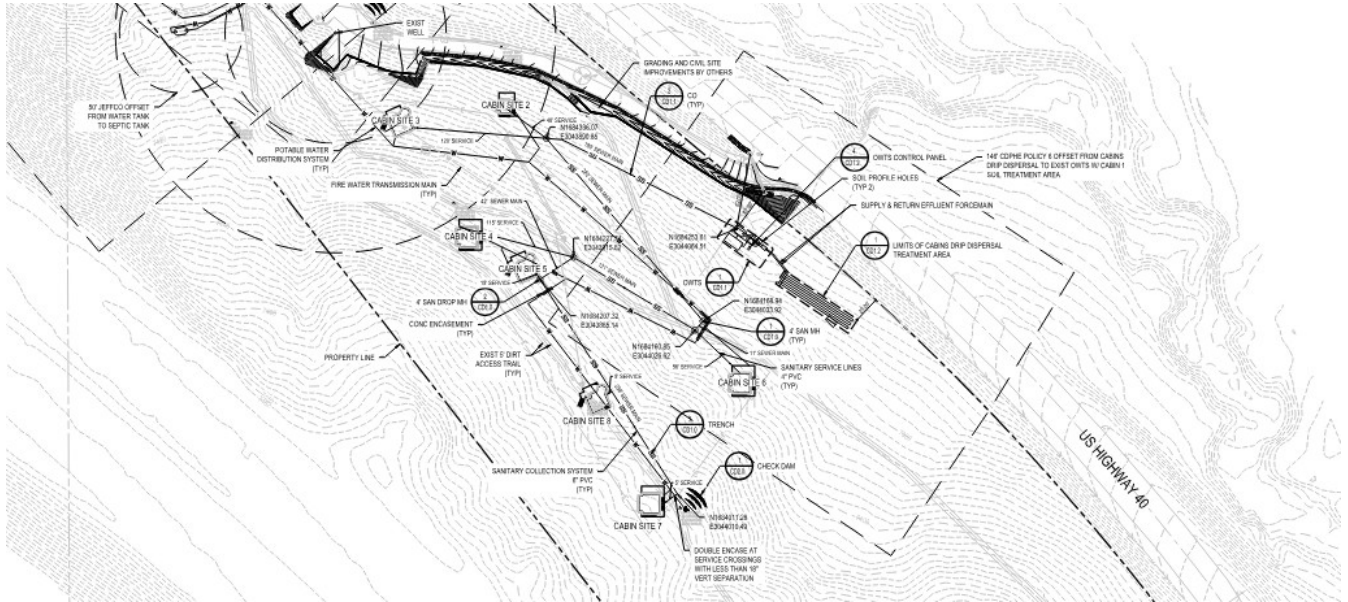
- Advanced treatment systems with drip dispersal can often be the best option for highly constrained mountain properties
  - Provide better end of pipe water quality
  - Provide additional dispersal options to better fit existing site conditions
    - Forested
    - Shallow bedrock
    - Cut banks



https://www.orenco.com/applications/residential/choose-a-system#4703-advanced-treatment-systems

LESSONS LEARNED

- Designer and Installer to keep in mind that record drawings will need to be developed
  - Challenging sites require good notes
  - Record drawings may be much different from construction drawings



PROJECT OUTCOME



- Extended construction schedule due to:
  - Arrival of 4 babies!
  - Additional work Owner asked of Contractor while mobilized
  - Permitting challenges
- Budget:
  - Construction Administration budget was $9,000 or 20% over
  - Construction budget was approximately $20,000 or 3% over
- Overall, the challenging project met performance goals, and high satisfaction is reported with the final installation.


QUESTIONS?