

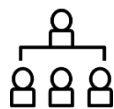
# Water and Sewer Board

Regular Meeting

City Council Chambers – City Center South

1001 11<sup>th</sup> Avenue – Greeley, Colorado

April 20, 2022 at 2:00 p.m.



Regular meetings of the Water and Sewer Board are held **in person** on the 3rd Wednesday of each month in the City Council Chambers, 1001 11<sup>th</sup> Avenue, Greeley, Colorado.



Members of the public may attend and provide comment during public hearings.



Written comments may be submitted by US mail or dropped off at the Water and Sewer office located at 1001 11<sup>th</sup> Avenue, 2nd Floor, Greeley, CO 80631 or emailed to [wsadmin@greeleygov.com](mailto:wsadmin@greeleygov.com). All written



comments must be received by 10:00 a.m. on the date of the meeting.

Meeting agendas and minutes are available on the City's meeting portal at [Greeley-co.municodemeetings.com/](https://greeley-co.municodemeetings.com/)

## IMPORTANT – PLEASE NOTE

This meeting is scheduled as an **in-person session only**. If COVID, weather, or other conditions beyond the control of the City dictate, the meeting will be conducted virtually and notice will be posted on the City's MuniCode meeting portal by 10:00 a.m. on the date of the meeting (<https://greeley-co.municodemeetings.com/>).

In the event it becomes necessary for a meeting to be held virtually, use the link below to join the meeting. Virtual meetings are also livestreamed on YouTube at <https://www.youtube.com/CityofGreeley>.

For more information about this meeting or to request reasonable accommodations, contact the administrative team at 970-350-9801 or by email at [wsadmin@greeleygov.com](mailto:wsadmin@greeleygov.com)





# Water & Sewer Board

**April 20, 2022 at 2:00 PM**

**1001 11th Avenue, City Center South, Greeley, CO 80631**

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## Agenda

1. Roll Call:      \_\_\_\_\_ Chairman Harold Evans      \_\_\_\_\_ Vice Chairman Mick Todd  
                         \_\_\_\_\_ Ms. Cheri Witt-Brown      \_\_\_\_\_ Mr. Fred Otis  
                         \_\_\_\_\_ Mr. Joe Murphy      \_\_\_\_\_ Mr. Tony Miller  
                         \_\_\_\_\_ Mr. Manuel Sisneros      \_\_\_\_\_ Mayor John Gates  
                         \_\_\_\_\_ Mr. Raymond Lee      \_\_\_\_\_ Mr. John Karner
- [2.](#) Approval of Minutes
- [3.](#) Welcome New Employees and Promotions
- [4.](#) Review Updated W&S Criteria, Drawing and Specs
- [5.](#) Review Water Conservation Program Performance
- [6.](#) 2022 State Legislative Update
- [7.](#) Integrated Water Resources Plan Update
- [8.](#) Water Supply Update and Approve of Water Sufficient
- [9.](#) Ratify Participating Agreement with the U.S. Forest Service for Cameron Peak Fire Mitigation and Watershed Recovery
- [10.](#) Approve and Recommend to Council Divestment of the Balmer Farm
- [11.](#) Legal Report
- [12.](#) Director's Report
13. Such Other Business That May Be Brought Before the Board Added to This Agenda by Motion of the Board.
14. Adjournment



*If, to effectively and fully participate in this meeting, you require an auxiliary aid or other assistance related to a disability, please contact the Water and Sewer Department administrative staff at 970-350-9801 or [wsadmin@greeleygov.com](mailto:wsadmin@greeleygov.com)*

**City of Greeley  
Water and Sewer Board  
Minutes of March 16, 2022  
Regular Board Meeting**

Chairman Harold Evans called the Water and Sewer Board meeting to order at 2:00 p.m. on Wednesday, March 16, 2022.

**1. Roll Call**

The Clerk called the roll and those present included:

Board Members:

Chairman Harold Evans, Vice Chairman Mick Todd, Fred Otis, Cheri Witt-Brown, Tony Miller, Manuel Sisneros, Raymond Lee City Manager, and Tammy Hitchens on behalf of Finance Director John Karner

Water and Sewer Department staff:

Director Sean Chambers, Deputy Director Adam Jokerst, Utility Finance Manager Erik Dial, Deputy Director Operations Nina Cudahy, Chief Engineer Adam Prior, Water Resources Administrator II Alex Tennant, Water Resources Administrator III Leah Hubbard, Water Resources Administrator III Cole Gustafson, Water Resource Administrator I Megan Kramer, Civil Engineer II Michael Castillo, Senior Administrative Assistant Crystal Sanchez, Administrative Specialist II Erin Maestes

Legal Counsel:

Counsel to Water & Sewer Board Attorney Jim Noble, Senior Environmental and Water Resources Attorney Jerrae Swanson, and Senior Environmental and Water Resources Attorney Dan Biber

Guests:

Emeritus Board Member Robert Ruyle, President Greeley Chambers of Commerce Jamie Henning

**2. Approval of Minutes**

Chairman Evans made a motion, First by Cheri Witt-Brown seconded by Fred Otis, to approve the February 16, 2022 Water and Sewer Board meeting minutes. The motion carried 7-0.



**3. Approval of and/or Additions to Agenda**

There were no changes to the agenda.

**4. Welcome New Employees and Promotions**

Mr. Chambers provided an introduction of new Water and Sewer Department employees starting this month.

**5. Approve Lowell Property Farm Lease**

In November 2021, the City acquired approximately 135 acres of land located north of Greeley along F Street between 35th and 59th Avenues (Lowell Property), along with 13.4 shares of the Greeley Irrigation Company (GIC) and a two-year obligation after closing to purchase one additional share of GIC. For the past 20 years, the Adams family has been leasing the GIC water and approximately 86 acres of the Lowell Property for grazing and farming. The Adams family has requested to continue leasing this portion of the Lowell Property as well as the 13.4 shares of GIC from Greeley for one more year. The subject Grazing and Farm Lease would allow the Adams family one additional year of farming the property and would terminate on December 31, 2022. The lease amount is \$9,000.00 and would be paid in two installments of \$4,500.00. The lease amount matches the rate paid by the Adams family to the former owner of the Lowell Property.

City staff are evaluating future uses of the Lowell Property, which could include a new Water and Sewer or multi-department shop facility, City-owned natural areas, and trail corridors. Portions of the property may be divested, with the proceeds appropriated for additional water purchases. The subject Grazing and Farm Lease maintains status quo while the city's evaluation proceeds. Staff are satisfied with the Adams family past farming operation, evidenced by their maintenance of the property, and believe a continuation of the lease with a one-year term is in the interest of the Water and Sewer Department. Water and Sewer staff recommends that the Water and Sewer Board approve the enclosed Grazing and Farm Lease Agreement between the City of Greeley and Kurt Adams.

The property's ownership and lease terms were discussed, and thereafter Vice Chairman Todd made a motion, seconded by Mr. Miller, to approve the enclosed lease agreement with Lowell Grazing and Farm Lease. The motion carried 7-0.

**6. Approve Ditch Operations Agreement with the Greeley Irrigation Company**

A key element of the Water and Sewer Department's long-range plan to expand the city's non-potable irrigation system is the construction of the Equalizer Project. The Equalizer Project will involve a series of pipelines and pump stations to deliver lower Cache La Poudre River water supplies to the Greeley Loveland Canal for distribution throughout the city. The Equalizer Project will allow Greeley to maximize use of it Greeley Irrigation Company ("GIC") water, reusable wastewater effluent, water stored in Poudre Ponds, and other lower Poudre River water rights, which will offset and preserve the city's Greeley Loveland Irrigation Company ("GLIC") water in Boyd Lake for potable use.

The Equalizer Project will make use of an "in-ditch exchange" on the Number 3 Ditch ("#3 Ditch"). The in-ditch exchange will operate by diverting water from the #3 Ditch at the existing pump station at 71<sup>st</sup> Avenue (or an alternative nearby location if needed), and replacing the diversions with deliveries from Poudre Ponds downstream at 35<sup>th</sup> Avenue. This operation allows Greeley to make use of water in Poudre Ponds in the Equalizer Project without constructing a pipeline between 35<sup>th</sup> and 71<sup>st</sup> Avenues. The Equalizer Project pipeline between Poudre Ponds and the #3 Ditch at 35<sup>th</sup> Avenue is under construction, thus necessitating the present need for an agreement with the GIC.

The proposed Ditch Operations Agreement ("Agreement") between the GIC and Greeley will authorize the in-ditch exchange. It will also authorize Greeley to introduce "foreign water," that is, water not associated with the city's 3/8 interest or with its GIC water rights, into the #3 Ditch for delivery to the city's non-potable irrigation systems. In addition, the Agreement authorizes Greeley to use GIC's "excess capacity" in the ditch, that is, unused physical space in the #3 Ditch, to deliver foreign water throughout the system and to the Equalizer Project.

The Agreement is perpetual and prescribes various protective terms and conditions for Greeley's future operations of the #3 Ditch. As payment for the in-ditch exchange, the right to introduce foreign water, and the ditch's excess capacity, Greeley will make upfront and annual payments. The upfront payment is in the form of reimbursement to GIC, up to \$100,000, towards construction of two in-ditch measurement structures. GIC, the Water and Sewer Department, and the city's Stormwater Department will all benefit from additional measurement on the #3 Ditch, which will allow better water accounting, more accurate deliveries to shareholders, and safer operations during flood events. The annual payment is \$2,500 per year, adjusted upwards by \$1,000 every ten years.

The Agreement terms were discussed, and thereafter Vice Chairman Todd made a motion, seconded by Ms. Witt-Brown, to approve the enclosed Ditch Operations Agreement with Greeley Irrigation Company. The motion carried 7-0.

## 7. Legal Report

Jim Noble of Welborn, Sullivan, Meck & Tooley recommended the Board not file statements of opposition.

**Statements of Opposition:** Based on our review of the January, 2022 Water Court Resume, staff and water counsel do not recommend that the Water and Sewer Board file statements of opposition to any water court applications that would be due at the end of March, 2022.

## 8. Executive Session

The Chair moved to go into executive session. In the motion for an executive session, the Chair announced following matter(s) to be discussed during the executive session in conformance with 24-6-402(4), C.R.S. and the Greeley Municipal Code.

1. For the purpose of determining positions relative to matters that may be subject to negotiations, developing strategy for negotiations, and instructing negotiators in potential water acquisitions based the current water market.
2. For the purpose of providing the Board legal advice and determining positions relative to matters that may be subject to negotiations, developing strategy for negotiations, and instructing negotiators in a potential water trade with Platte River Power Authority.

Present during the executive session were:

Chairman Harold Evans, Vice Chairman Mick Todd, Manual Sisneros, Tony Miller, Cheri Witt-Brown, Fred Otis, Director Sean Chambers, Deputy Director Water Resources Adam Jokerst, City Manager Raymond Lee, Tammy Hitchens on behalf of Finance Director John Karner, Water Resources Admin. III Leah Hubbard, Water Resources Admin. III Cole Gustafson, Environmental and Water Resources Attorney Jerrae Swanson, Environmental and Water Resources Attorney Dan Biwer, Attorney Jim Noble.

Guest: Emeritus Board Member Robert Ruyle

Crystal Sanchez, Erik Dial, Adam Prior, Nina Cudahy, Megan Kramer, Alex Tennant, Michael Castillo, Erin Maestas and Jamie Henning left the meeting at 2:27 p.m.

This executive session is authorized by Subsection(s) (b) and (e) of Section 24-6-402(4) of the Colorado Revised Statutes, and Subsection(s) (2) and (5) of Section 2-151 (a) of the Greeley Municipal Code.

Executive Session ended at 3:07 p.m.

Crystal Sanchez rejoined the meeting at 3:09 p.m.

**9. Director's Report**

Sean Chambers provided an update to the Board on the following topics

- Media Coverage of Water Conservation
- Rescheduled Windy Gap Firing Project Construction Site Tour
- Greeley Boards and Commissions Reception
- '22 Water Enterprise and Sewer Enterprise Revenue Bonds Update

**10. Such Other Business That May be Brought before the Board and Added to This Agenda by Motion of the Board**

There were no additional items brought before the Board and added to the agenda.

Chairman Evans adjourned the meeting at 3:07 p.m.

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Harold Evans, Chairman

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Raymond Lee, Board Secretary

# Water & Sewer Agenda Summary

Date: April 20, 2022

Key Staff Contact: Sean Chambers

**Title:** Welcome new Water and Sewer employees and recognize department promotions

**Summary:** Cody Pryke – Waste Water Collection – Equipment Operator II  
Efrin Chavez – Meters - Seasonal Meter Technician

**Recommended Action:** Information only

**Attachments:** None

# Water & Sewer Agenda Summary

Date: April 20, 2022

Key Staff Contact: Adam Prior

**Title:** UPDATING W&S DESIGN CRITERIA, DRAWING & SPECIFICATIONS

**Summary:** The City of Greeley Water and Sewer Department is updating the current design criteria from 2008 with new standards to accommodate new technologies, techniques, and materials. As you know, the City of Greeley is growing, and updating the design standards will assist in development and ensure quality utility infrastructure into the future. These updates will also facilitate recent non-potable system requirements adopted by City Council in February of 2022, incorporate the Non-Potable Water, Sanitary Sewer, Transmission & Distributions Master Plans that were completed in 2021, and align with the updated development code completed in 2021. As the City is growing at a rapid pace, these updates will help provide long term infrastructure needs to better prepare and accommodate this growth.

The updated design criteria for the potable water distribution, sanitary sewer collection, non-potable irrigation system, and landscape & irrigation will guide developers and engineers in expanding and connecting to the City's utilities. The larger changes include added lift station criteria, changes to the non-potable system criteria, updated criteria to incorporate the new development code changes, compliance with Subsurface Utility Engineering (SUE) law requirements, and the addition of landscape & irrigation design criteria along with many other smaller changes.

The Water and Sewer Department has worked diligently to coordinate with other departments and engineering development review staff for consistency, a presentation and discussion with the Builders, Realtors, & Developer group in July of 2021, review and input from the Planning Commission in March of 2022, and currently working to receive comments and questions from engineers, developers, and designers throughout Greeley.

**Recommended Action:** Update only, planning to get recommendation to City Council in May Water & Sewer Board meeting

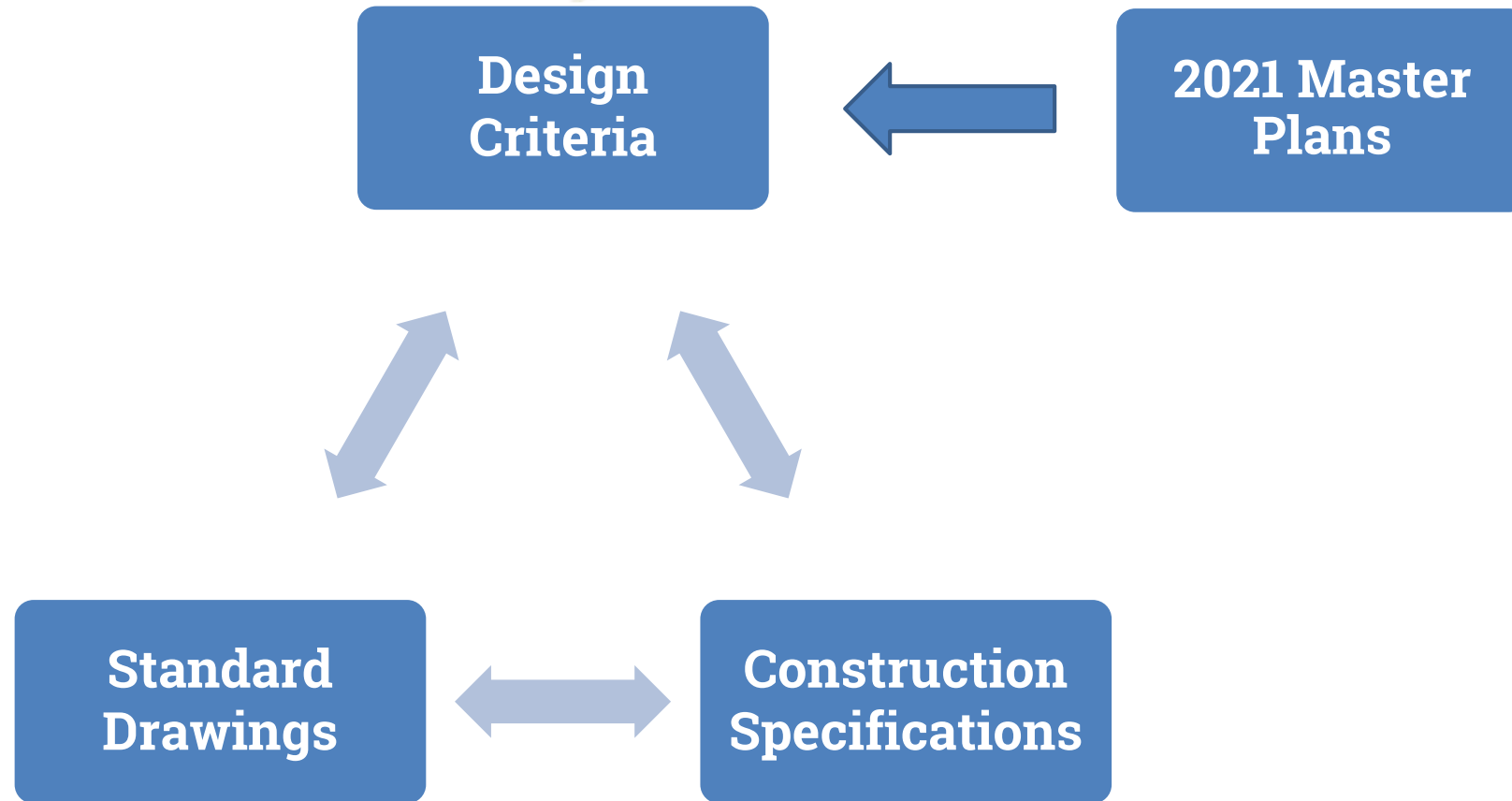
**Attachments:** Draft Design Criteria & Draft Standard Details

# Update Water & Sewer Design Criteria & Standards

**Presented to  
Water & Sewer Board**

**April 20<sup>th</sup>, 2022**

# Process for Updating Water & Sewer Design Criteria & Standards

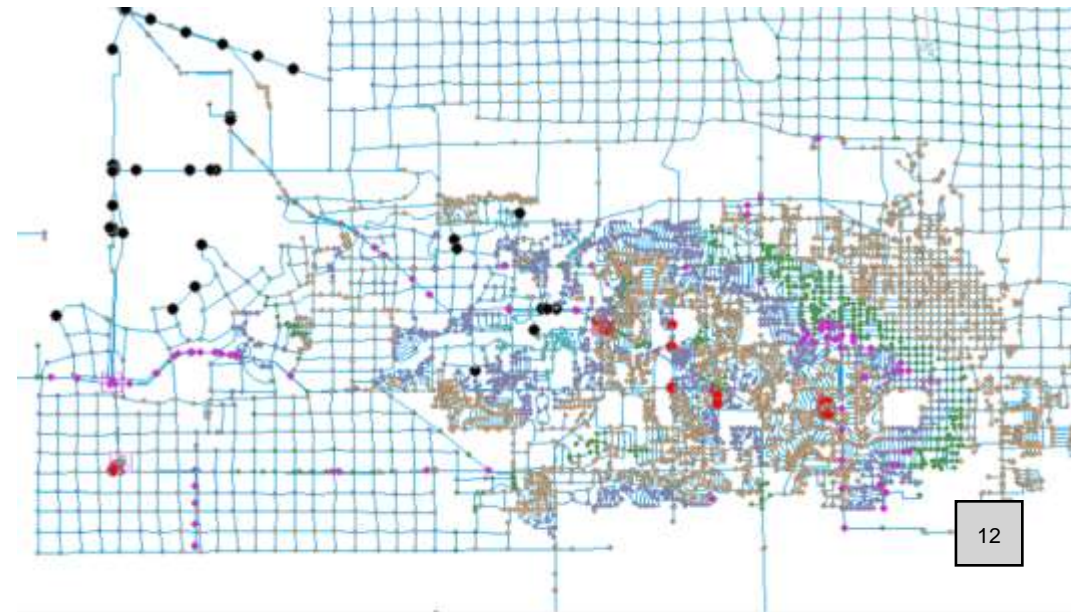




# Design Criteria

## Goals

- **Alignment with W&S master plans published 2021.**
- **Align criteria with current W&S standards**  
**(Updated technology and equipment)**
- **Consistency across standards**
- **Coordination with other departments**
- **Potential for cost savings and reduced frequency**  
**of project RFI's**
- **Conformance to the new statewide Subsurface**  
**Utility Engineering (SUE) Laws**



# Design Criteria: Section 1

## General Requirements of Development

- **There were no substantive changes to this section**
- **Alignment with Engineering Development Review**

# Design Criteria: Section 2

## Submittal Requirements

- **Hydraulic models in a format that can be integrated with the City's overall models – InfoWater & InfoSWMM**
- **Implementing stricter measurement tolerances for survey verifications and as-built drawings**
- **Provided more detail for reimbursement of oversized public infrastructure, particularly sanitary sewer lift stations and non-potable ponds and pump stations.**

# Design Criteria: Section 3

## Potable Water

- Provides guidance for development when assumptions are made on future customers
- Updated future flows more accurately using zoning, acreages, and building footprints
- Provides new criteria to model water flows for:
  - Commercial parcels based on zoning and acreage
  - Industrial parcels based on zoning and acreage
  - Commercial buildings based on use and area.
- Aligns with wastewater for consistency

Residential			
Zoning based on <i>City of Greeley Charter and Code, Chapter 24.401, Zoning District Development Standards.</i>			
Use	Units Per Acre*	Occupancy	Peak Hour Demand
R-E	3	3.1 persons	1.9 gpm/unit
R-L	5	3.1 persons	1.9 gpm/unit
R-M	10	2.7 persons	1.7 gpm/unit
R-H	20	1.7 persons	1.1 gpm/unit
R-MH	15	1.7 persons	1.1 gpm/unit
*Use these unit per acre values unless specific unit counts are known			
Commercial			
Where uses are known, use the specific demand values. Commercial demands based on 1000 ft <sup>2</sup> of building area unless noted otherwise. Otherwise use the appropriate zoning demand values.			
Use	Average Day Demand without Irrigation		
C-L	1500 gpd per acre		
C-H	3000 gpd per acre		
I-L & I-M	1500 gpd per acre		
I-H	3000 gpd per acre		
Use	Average Day Demand		
Restaurant	500 gpd		
Retail/Offices	200 gpd		
Grocery Store	430 gpd		
Laundry, Dry Cleaning	1000 gpd		
Auto Dealer, Repair/Service	115 gpd		
Car Wash with Water Reuse	1500 gpd		
Hospital	380 gpd		
Hotel/Motel	350 gpd		
Retirement & Nursing Home	350 gpd		
School	12 gpd/student without showers 36 gpd/student with showers		
Religious Building	300 gpd		
Warehouse (Non-industrial)	25 gpd		
Irrigation	25 gpm per acre		

# Design Criteria: Section 4

## Sanitary Sewer

- **Defines wastewater flows for:**
  - **Commercial & Industrial customers based on zoning**
- **Provides guidance for development when assumptions are made on future customers**
- **Calculates future wastewater flows more accurately using zoning, acreages and building footprints**
- **Removes underdrains below sanitary sewer lines**
- **Detailed Lift station criteria**
- **Aligns with potable water for consistency**

Residential			
Zoning based on City of Greeley Charter and Code, Chapter 24.401, Zoning District Development Standards			
Use	Units Per Acre	Occupancy	Average Day Wastewater Flows*
R-E	3	3.1 persons	0.22 gpm/unit
R-L	5	3.1 persons	0.22 gpm/unit
R-M	10	2.7 persons	0.19 gpm/unit
R-H	20	1.7 persons	0.12 gpm/unit
Commercial			
Use	Average Day Wastewater Flows*		
C-L (not specified)	1,500 gpd/acre (minimum)		
C-H (not specified)	3,000 gpd/acre (minimum)		
Retail/Offices	200 gpd/1,000 SF		
Hotels/Motels	350 gpd/1,000 SF		
Restaurants	500 gpd/1,000 SF		
Bars and Lounges	300 gpd/1,000 SF		
Neighborhood Stores	200 gpd/1,000 SF		
Department Stores	200 gpd/1,000 SF		
Laundry and Dry Cleaning	1,000 gpd/1,000 SF		
Banks	300 gpd/1,000 SF		
Nursing Homes	350 gpd/1,000 SF		
Warehouses	25 gpd/1,000 SF		
Car Washes	1,500 gpd/1,000 SF		
Auto Dealer/Repair/Service	115 gpd/1,000 SF		
Grocery Store	430 gpd/1,000 SF		
Religious Buildings	300 gpd/1,000 SF		
Factories	800 gpd/1,000 SF		
Hospitals	380 gpd/1,000 SF		
Schools (without showers)	12 gpd/student		
Schools (with showers)	36 gpd/student		
Industrial			
Use	Average Day Wastewater Flows*		
I-L (not specified)	1,500 gpd/acre		
I-M (not specified)	1,500 gpd/acre		
I-H (not specified)	3,000 gpd/acre		

16

\*1cfs = 448.33 gpm

Average day wastewater flow per capita = 60 gpcd



# Non-Potable Water Design Criteria

- **Comprehensive**
  - **Covers every aspect of non-pot system design.**
  - **Updated Standards and References.**
- **Easy to Follow**
  - **Simplified & logical progression.**
- **Aligns with NP Master Plan**
- **Regional Systems/Oversizing**
- **Predesign Meetings w/Stakeholders**



# Design Criteria: Section 6 Landscape and Irrigation

## **New Criteria:**

- **Promotes water conservation**
- **Support attractive and sustainable landscapes**

## **Applicable to:**

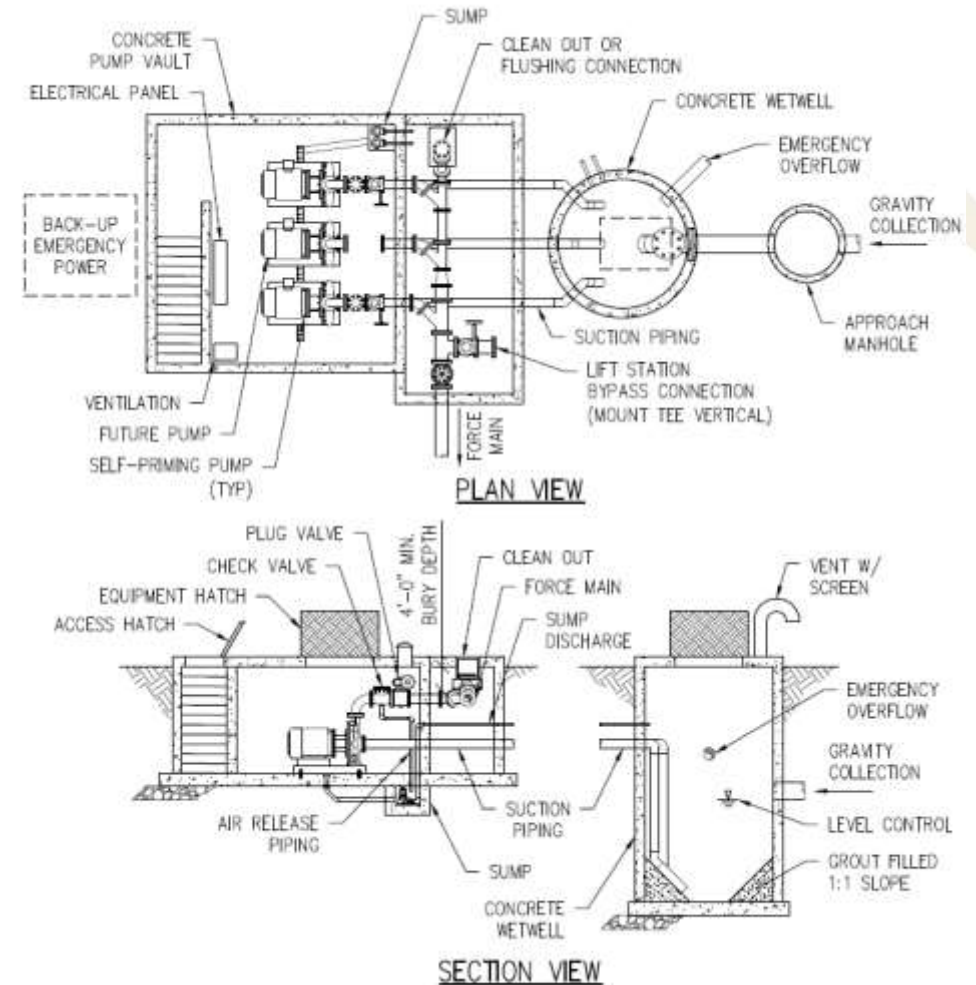
- **Common areas**
- **Right-of-ways**
- **Municipal buildings**
- **Non-residential (commercial/industrial)**
- **Multi-family residential**



# Standard Drawings

## Key Updates

- Updated City Logo
- Condensed meter vault notes across non-potable and potable water meters & added new non-potable meter size drawing
- Added standard lift station drawings to the sanitary sewer subset of standard drawings
- Added “UL” Subset for utility locating details in accordance with the new SUE law in Colorado (SB 18-167)



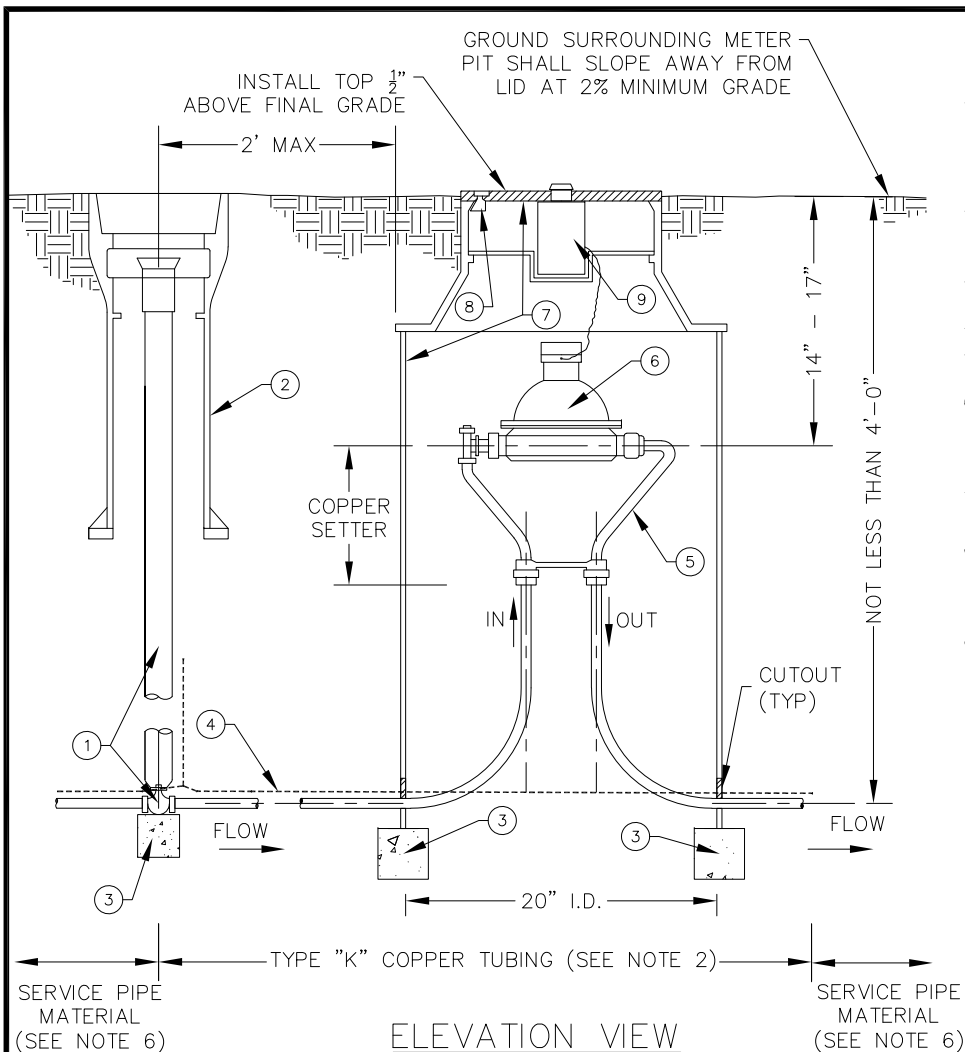


# Engagement & Review

- **Introduced to Builders, Realtors, Developers - July 19, 2021**
- **Reviewed and Coordinated with other City Departments throughout process**
- **Reviewed by Engineering Development Review**
- **Introductory Meetings with Engineers, Developers, Landscape designers, & Community members - March 2<sup>nd</sup> & 3<sup>rd</sup>, 2022**
- **Presented to Planning Commission to get Input and Feedback - March 8th, 2022**
- **Next Steps**
  - **W&S will review all comments and address questions**
  - **Presentations & Approval by City Council**

# Questions?





## NOTES:

1. METER MUST BE PURCHASED THROUGH THE CITY OF GREELEY METER SHOP. NO EXCEPTIONS. CONTRACTOR TO PROVIDE ADDITIONAL PIPING, COUPLINGS, AND ACCESSORIES AS NECESSARY FOR A COMPLETE SYSTEM.
2. COPPER SHALL NOT SHOW ANY VISIBLE SIGNS OF CRIMPING AND SHALL ONLY BE INSTALLED FROM CURBSTOP TO 5 FEET PAST METER PIT.
3. NOT FOR INSTALLATION IN ROADWAYS, DRIVEWAYS, OR PARKING AREAS.
4. NO CONCRETE OR FILL DIRT SHALL BE PLACED IN METER PIT.
5. METER SETTING MUST BE INSPECTED BEFORE BACKFILLING. FOR INSPECTION CALL (970)-350-9264.
6. REFER TO CITY OF GREELEY WATER & SEWER CONSTRUCTION SPECIFICATIONS, LATEST REVISION, FOR PRODUCT AND MANUFACTURER SPECIFICATIONS, REQUIRED MARKINGS, AND COATINGS.
7. ALL APPLICABLE NON-POTABLE NOTES ON RELATED CITY OF GREELEY WATER & SEWER DETAIL NP-2 APPLY TO THIS DETAIL.
8. FOR ADDITIONAL APPLICABLE METER AND METER PIT INSTALLATION NOTES AND REQUIREMENTS, REFER TO CITY OF GREELEY WATER & SEWER DETAIL W-15, CONSTRUCTION SPECIFICATIONS, AND DESIGN CRITERIA, LATEST REVISION OF EACH,
9. FOR CURB STOP DETAILS, REFER TO CITY OF GREELEY WATER & SEWER DETAIL W-9, LATEST REVISION.

LEGEND	
1	CURB STOP VALVE & SERVICE BOX (SEE NOTE 9)
2	UPPER HALF OF STANDARD VALVE BOX (INSTALLED PER SPECIFICATIONS)
3	BRICK SUPPORT (PLACE ON UNDISTURBED SOIL)
4	TRACER WIRE (SEE GENERAL NOTES ON RELATED DETAIL NP-2)
5	COPPER METER SETTER (MFR PER SPECIFICATIONS)
6	METER UNIT (SEE NOTE 1)
7	COMPOSITE DOUBLE LID CONE OR APPROVED EQUAL (MFR PER SPECIFICATIONS)
8	STANDARD FORGED BRASS WATERWORKS PENTAGON HEAD WITH LOCKING SCREW
9	RT UNIT



## OUTSIDE SETTING FOR $\frac{3}{4}$ " & 1" IRRIGATION METER DETAIL NP-1

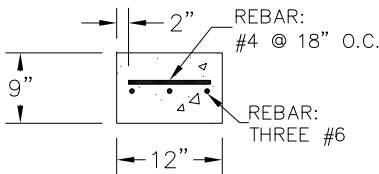
DATE: OCTOBER 2021

SCALE: N.T.S.

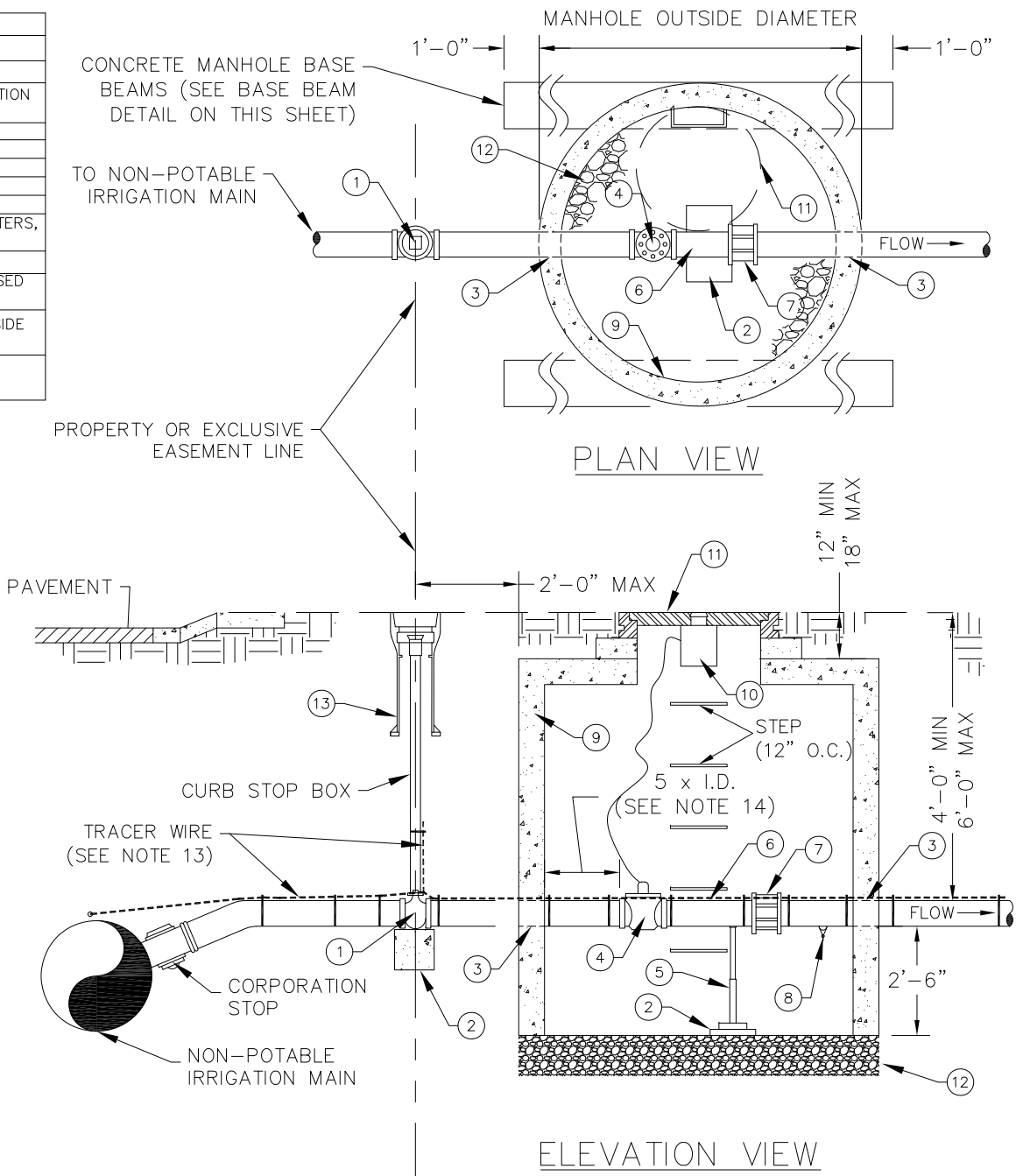
GENERAL NON-POTABLE NOTES:

- METER MUST BE PURCHASED THROUGH THE CITY OF GREELEY METER SHOP. NO EXCEPTIONS. CONTRACTOR TO PROVIDE PIPING, COUPLINGS, AND ACCESSORIES AS NECESSARY FOR A COMPLETE SYSTEM.
- LOCATION OF METER VAULT SHALL BE 2 FT DOWNSTREAM OF THE CURB STOP UNLESS OTHERWISE SPECIFIED BY THE WATER & SEWER DEPARTMENT.
- NO CONCRETE SHALL BE POURED INTO VAULT, UNLESS IN SITUATIONS INVOLVING HIGH GROUND WATER OR OTHERWISE SPECIFIED BY THE CITY. THE WATER & SEWER DEPARTMENT RESERVES THE RIGHT TO REQUIRE A CONCRETE BOTTOM AND BE WATERTIGHT IN AREAS OF HIGH GROUND WATER.
- ALL EQUIPMENT AND PIPING SHALL BE ADEQUATELY SUPPORTED AND ATTACHED TO VAULT WALL WITH STAINLESS STEEL FASTENERS AND BOLTS.
- IF SURFACE IS NOT TO FINAL GRADE AT TIME OF METER INSTALLATION OR GRADE CHANGES AFTER INSTALLATION, OWNER MUST ADJUST VAULT TO MEET SPECIFICATIONS.
- VAULT & MANHOLE COVER SHALL BE RATED FOR HS-20 TRAFFIC LOADINGS.
- VAULT MANHOLE COVER SHALL BE A BOLT DOWN LID. REFER TO WATER & SEWER CONSTRUCTION SPECIFICATIONS, LATEST REVISION, FOR APPROVED MANHOLE COVER MATERIALS, MANUFACTURERS, MARKINGS, AND OTHER REQUIREMENTS.
- VAULT MANHOLE COVER SIZE DEPENDS ON METER SIZE:
  - 24" MIN. MANHOLE COVER FOR 1½" AND 2" METERS
  - 36" MIN. MANHOLE COVER FOR 3" AND LARGER METERS
- METER SETTING MUST BE INSPECTED BEFORE BACKFILLING. FOR INSPECTION CALL (970)-350-9264.
- PLACEMENT OF CURB STOP BOX MAY VARY FROM A MAXIMUM OF 1' OUTSIDE THE PROPERTY LINE TO A MAXIMUM OF 1' INSIDE THE PROPERTY LINE. PLACEMENT OF CURB STOP BOX OUTSIDE THE PROPERTY LINE IS PREFERRED.
- SHUTOFF VALVE SHALL MATCH THE SERVICE PIPE INSIDE DIAMETER. REFER TO WATER & SEWER CONSTRUCTION WATER & SEWER CONSTRUCTION SPECIFICATIONS, LATEST REVISION, FOR ACCEPTABLE MFR AND MODELS.
  - FOR 2" AND SMALLER SERVICE LINES: SHUTOFF VALVE SHALL BE A STANDARD CURB STOP.
  - FOR 4" AND LARGER SERVICE LINES: SHUTOFF VALVE SHALL BE A STANDARD GATE VALVE (SEE DETAIL W-18).
- INSTALL UPPER HALF OF STANDARD VALVE BOX AROUND CURB STOP ACCORDING TO THE WATER & SEWER SPECIFICATIONS, LATEST REVISION.
- INSTALL TRACER WIRE ACCORDING TO CITY OF GREELEY WATER & SEWER SPECIFICATIONS AND W&S UTILITY LOCATING ("UL") DETAILS, LATEST REVISION OF EACH.
- UPSTREAM PIPE SPOOL LENGTH 2X PIPE I.D. OR PER MFR REQUIREMENTS (WHICHEVER YIELDS THE LONGER PIPE LENGTH).
- NO SPRINKLER SYSTEM CONNECTIONS SHALL BE MADE IN THE METER VAULT.
- NO MAJOR LANDSCAPING OR STRUCTURES SHALL BE LOCATED WITHIN 10 FT OF METER VAULT.
- REFER TO CITY OF GREELEY WATER & SEWER CONSTRUCTION SPECIFICATIONS, LATEST REVISION, FOR PRODUCT AND MANUFACTURER SPECIFICATIONS.
- ALL BURIED PIPING SHALL BE RESTRAINED AND INSTALLED IN ACCORDANCE WITH WATER & SEWER DEPARTMENT SPECIFICATIONS, LATEST REVISION.
- SEE WATER & SEWER DETAIL W-15, LATEST REVISION, FOR ADDITIONAL METER AND VAULT INSTALLATION REQUIREMENTS.

LEGEND	
1	SHUTOFF VALVE WITH 2" OPERATING NUT (SEE NOTE 11).
2	CONCRETE PAVER OR APPROVED EQUIVALENT
3	APPROVED RUBBER SEAL ON PIPE BARREL AT WALL PENETRATION PER SPECIFICATION
4	METER UNIT (SEE NOTE 1)
5	ADJUSTABLE STAINLESS STEEL PIPE SUPPORT AND BASE
6	FLG X PE SPOOL PIPE
7	RESTRAINED FLANGED COUPLING ADAPTER
8	1" BALL VALVE DRAIN
9	CONCRETE MANHOLE (48" MIN. DIAMETER FOR 1½" AND 2" METERS, 60" MIN. DIAMETER FOR 3" AND 4" METERS)
10	METER ENDPOINT RADIO TRANSMITTER (RT UNIT)
11	ACCESS FRAME AND APPROVED MANHOLE COVER WITH RECESSED 2" DIAMETER HOLE FOR RT UNIT (SEE NOTES 6, 7, AND 8)
12	6" MIN OF SUBGRADE MATERIAL UNDER GRADE BEAM AND INSIDE VAULT PER SPECIFICATIONS
13	UPPER HALF OF STANDARD VALVE BOX (INSTALLED PER SPECIFICATIONS)



BASE BEAM DETAIL



OUTSIDE SETTING FOR 1½" TO 4" IRRIGATION METER & GENERAL NON-POTABLE NOTES

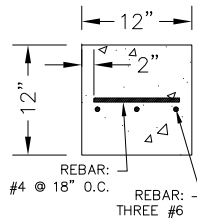
DETAIL NO. NP-2

DATE: OCTOBER 2021

SCALE: N.T.S.

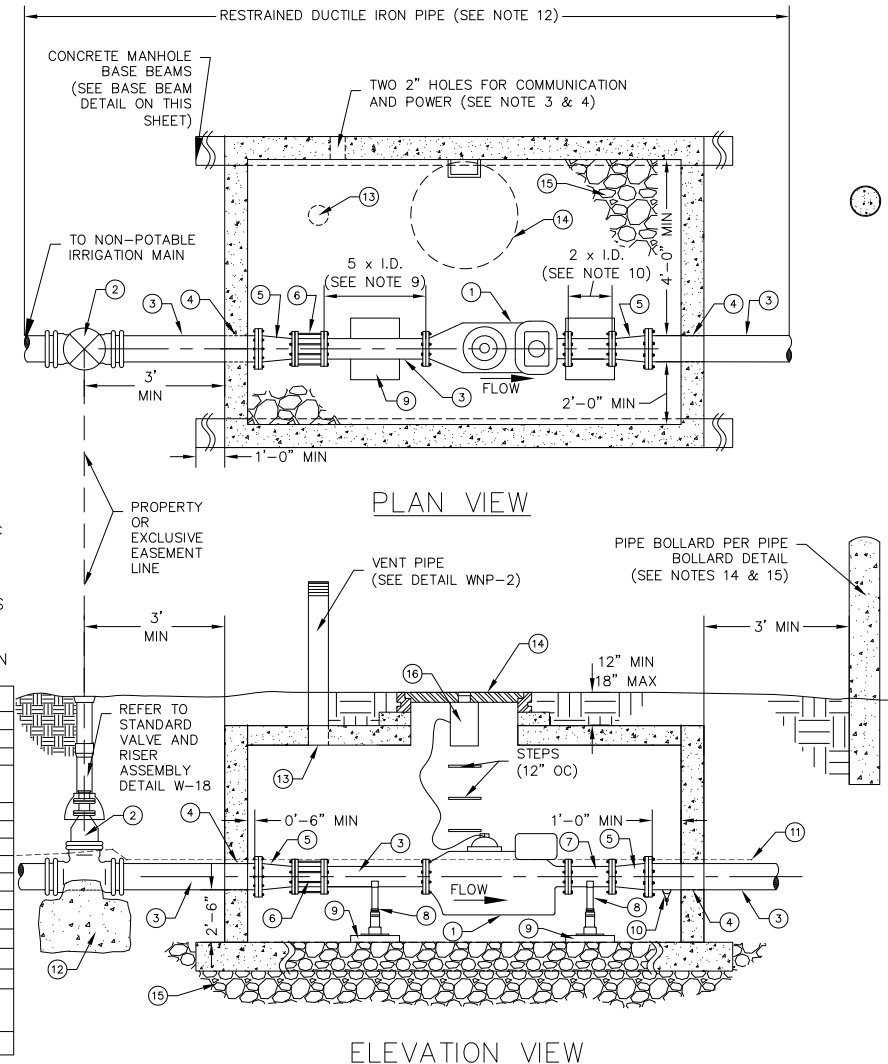
# NOTES:

- METER MUST BE PURCHASED AND/OR COORDINATED THROUGH THE CITY OF GREELEY METER SHOP. NO EXCEPTIONS. CONTRACTOR TO PROVIDE PIPING, COUPLINGS, AND ACCESSORIES AS NECESSARY FOR A COMPLETE SYSTEM.
- ALL NOTES ON RELATED CITY OF GREELEY WATER & SEWER DETAIL NP-2 APPLY TO THIS DETAIL.
- CONTRACTOR IS RESPONSIBLE FOR PROVIDING POWER AND TELEMTRY TO THE METER AND VAULT. TELEMTRY SHALL BE COORDINATED DIRECTLY WITH THE WATER & SEWER DEPARTMENT.
- ELECTRICAL/CONTROL PANEL SHALL BE MOUNTED ABOVE GRADE INSIDE A NEMA 4 ENCLOSURE PER WATER & SEWER SPECIFICATIONS, LATEST REVISION.
- ALL ELECTRICAL WIRE SHALL BE EQUIPPED WITH WATERTIGHT CONNECTIONS ABOVE AND BELOW GRADE.
- VAULT & MANHOLE COVER SHALL BE RATED FOR HS-20 TRAFFIC LOADINGS.
- 36" VAULT COVER SHALL BE A BOLT DOWN LID WITH A RECESSED TWO-INCH DIAMETER HOLE FOR RT UNIT. REFER TO WATER & SEWER SPECIFICATIONS, LATEST REVISION, FOR APPROVED MANHOLE COVER MATERIALS, MANUFACTURERS, MARKINGS, AND OTHER REQUIREMENTS.
- SEE WATER & SEWER DETAIL W-15, LATEST REVISION, FOR ADDITIONAL METER AND VAULT INSTALLATION REQUIREMENTS.
- UPSTREAM PIPE SPOOL LENGTH 5X PIPE I.D. OR PER MFR REQUIREMENTS (WHICHEVER YIELDS THE LONGER PIPE LENGTH).
- DOWNSREAM PIPE SPOOL LENGTH 2X PIPE I.D. OR PER MFR REQUIREMENTS (WHICHEVER YIELDS THE LONGER PIPE LENGTH).
- REFER TO CITY OF GREELEY WATER & SEWER CONSTRUCTION SPECIFICATIONS, LATEST REVISION, FOR PRODUCT AND MANUFACTURER SPECIFICATIONS.
- ALL BURIED PIPING SHALL BE INSTALLED AND RESTRAINED IN ACCORDANCE WITH WATER & SEWER DEPARTMENT SPECIFICATIONS.
- INSTALL TRACER WIRE ACCORDING TO CITY OF GREELEY WATER & SEWER SPECIFICATIONS AND STANDARD DETAILS, LATEST REVISION.
- PIPE BOLLARD MAY BE OMITTED AT THE CITY OF GREELEY WATER & SEWER DEPARTMENT'S DISCRETION.
- IF PIPE BOLLARD IS REQUIRED, BOLLARD SHALL BE INSTALLED IN ACCORDANCE WITH THE WATER & SEWER STANDARD DETAILS AND CONSTRUCTION SPECIFICATIONS, LATEST REVISION OF EACH.



BASE BEAM DETAIL

LEGEND	
1	METER (SEE NOTE 1)
2	MJ X MJ GATE VALVE
3	FLG X PE SPOOL PIECE
4	APPROVED RUBBER SEAL ON PIPE BARREL AT WALL PENETRATION PER SPECIFICATION
5	CONCENTRIC REDUCER (AS REQUIRED)
6	RESTRAINED FLANGED COUPLING ADAPTER
7	FLG x FLG SPOOL PIECE
8	ADJUSTABLE S.S. PIPE SUPPORT
9	CONCRETE PAVER OR APPROVED EQUAL
10	1" BALL VALVE DRAIN
11	TRACER WIRE (SEE NOTE 11)
12	THRUST BLOCK
13	6" HOLE FOR VENT PIPE
14	36" MANHOLE FRAME AND COVER (SEE NOTES 6 & 7)
15	6" MIN OF SUBGRADE MATERIAL UNDER GRADE BEAM AND INSIDE VAULT PER SPECIFICATIONS
16	METER ENDPOINT RADIO TRANSMITTER (RT UNIT)

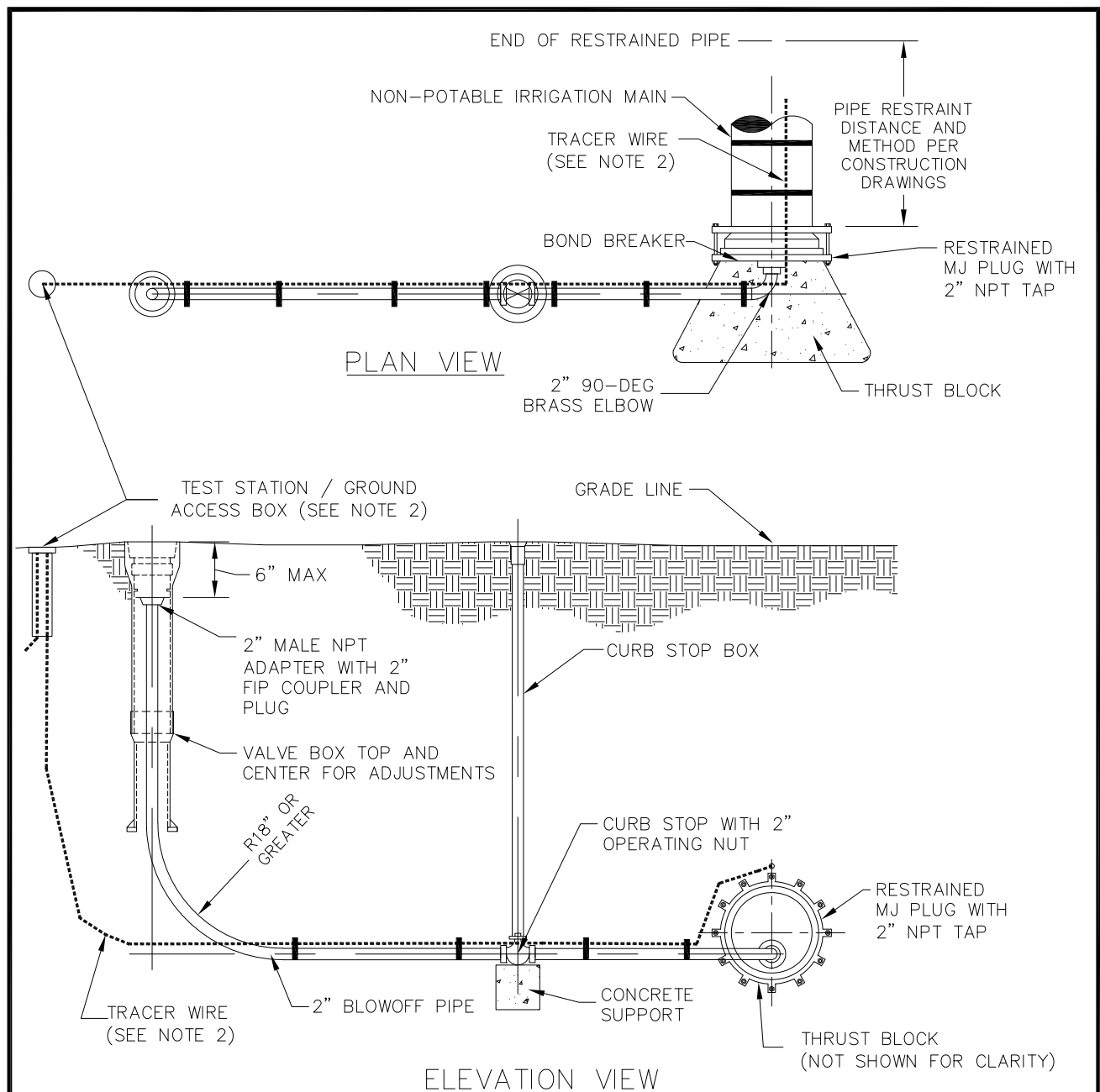


## OUTSIDE SETTING FOR 6" AND LARGER IRRIGATION METER

DETAIL NP-3

DATE: OCTOBER 2021

SCALE: N.T.S.



### NOTES:

1. REFER TO RELATED NON-POTABLE IRRIGATION DETAIL NP-1 AND CONSTRUCTION SPECIFICATIONS, LATEST REVISION OF EACH, FOR ADDITIONAL NON-POTABLE PIPE, CURB STOP, AND MISC. VALVE INSTALLATION REQUIREMENTS.
2. INSTALL TRACER WIRE ACCORDING TO CITY OF GREELEY WATER & SEWER SPECIFICATIONS AND W&S UTILITY LOCATING ("UL") DETAILS, LATEST REVISION OF EACH.
3. ALL BURIED PIPING SHALL BE RESTRAINED AND INSTALLED ACCORDANCE WITH WATER & SEWER DEPARTMENT SPECIFICATIONS, LATEST REVISION.

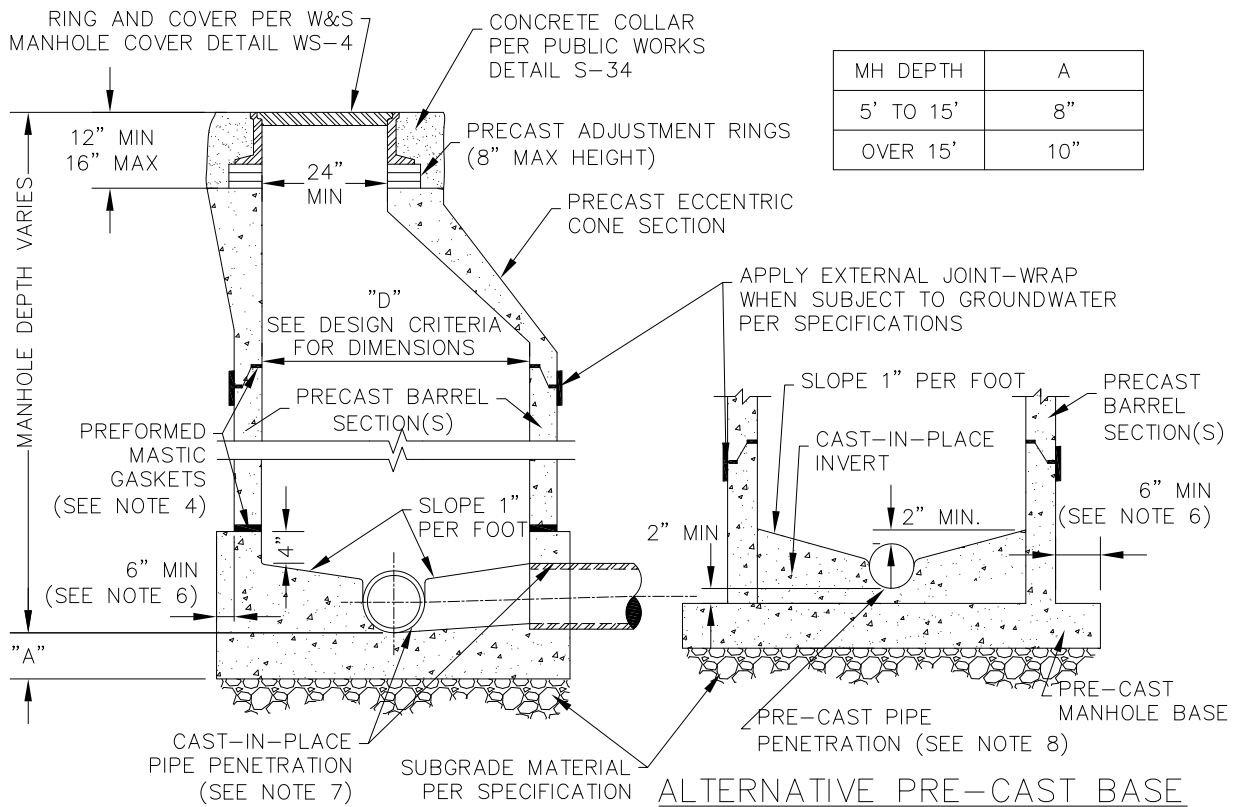


## NON-POTABLE BLOWOFF

DETAIL NO. NP-4

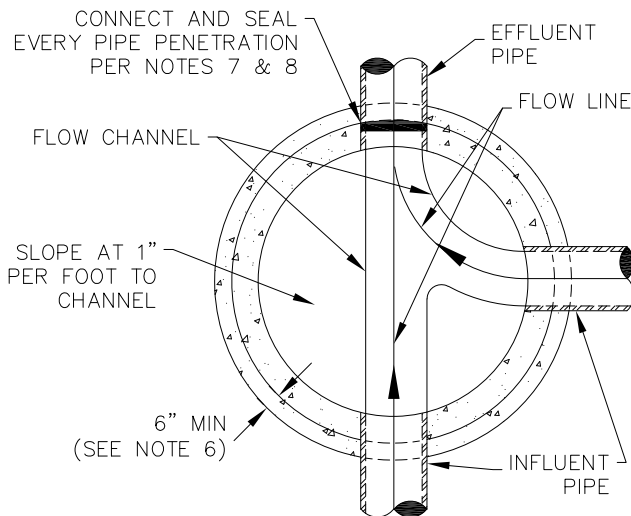
DATE: OCTOBER 2021

SCALE: N.T.S.



#### NOTES:

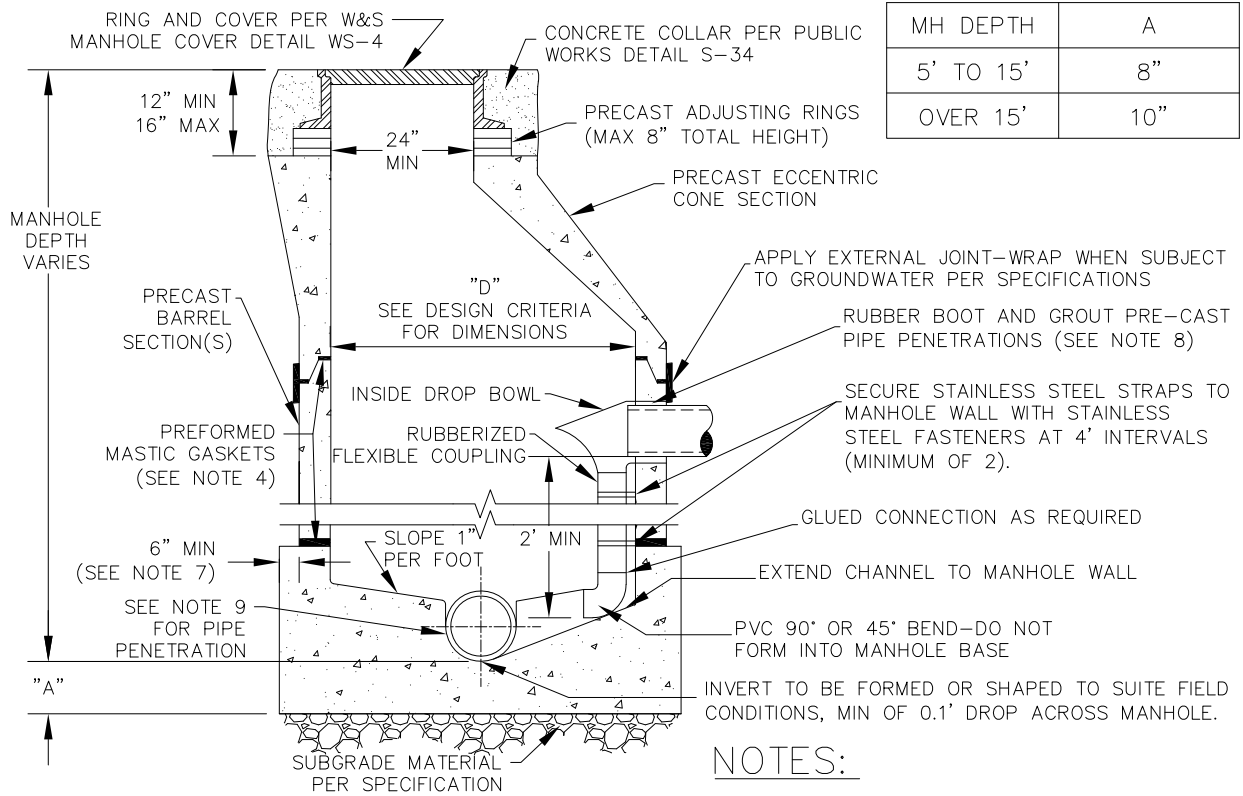
1. REFERENCE CITY OF GREELEY WATER & SEWER DESIGN CRITERIA FOR MINIMUM MANHOLE DIAMETER (D), AND W&S CONSTRUCTION SPECIFICATIONS AND MATERIAL/INSTALLATION REQUIREMENTS.
2. MANHOLES INSTALLED IN GROUNDWATER ABOVE THE BASE SHALL HAVE ALL MANHOLE SECTION JOINTS SEALED PER WATER & SEWER CONSTRUCTION SPECIFICATIONS.
3. ALL WASTEWATER MANHOLES SHALL BE VACUUM TESTED PER SPECIFICATIONS.
4. SEE WATER & SEWER SPECIFICATIONS, LATEST REVISION, FOR ACCEPTABLE MFR FOR PREFORMED MASTIC GASKETS.
5. ALL BURIED PIPING SHALL BE INSTALLED IN ACCORDANCE WITH WATER & SEWER SPECIFICATIONS, LATEST REVISION.
6. BASE SHALL BE AT LEAST 6" WIDER THAN THE BOTTOM PRE-CAST BARREL SECTION AND WIDE ENOUGH TO PREVENT FLOTATION AS DESIGNED BY THE ENGINEER.
7. FOR PIPE PENETRATIONS IN CAST-IN-PLACE BASE, AN APPROVED RUBBER SEAL ON PIPE BARREL SHALL BE USED. SEE SPECIFICATIONS FOR APPROVED MFR AND INSTALLATION REQUIREMENTS.
8. PRE-CAST PIPE PENETRATIONS SHALL BE INSTALLED WITH A-LOK RUBBER BOOT CONNECTORS OR APPROVED EQUAL.
9. INVERT TO BE FORMED OR SHAPED TO SUIT FIELD CONDITIONS, MIN. OF 0.1' DROP ACROSS MANHOLE.



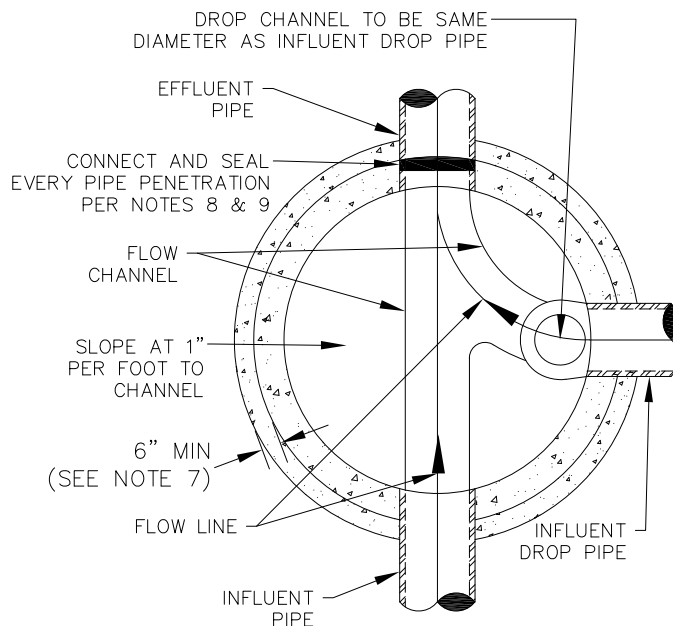
## STANDARD SANITARY SEWER MANHOLE DETAIL SS-1

DATE: OCTOBER 2021

SCALE: N.T.S.



## CAST-IN-PLACE BASE



## NOTES:

1. REFERENCE CITY OF GREELEY WATER & SEWER DESIGN CRITERIA FOR MINIMUM MANHOLE DIAMETER (D), AND CONSTRUCTION SPECIFICATIONS FOR MATERIAL/INSTALLATION REQUIREMENTS.
2. MANHOLES INSTALLED IN GROUNDWATER ABOVE THE BASE SHALL HAVE ALL MANHOLE SECTION JOINTS SEALED PER WATER & SEWER CONSTRUCTION SPECIFICATIONS.
3. ALL WASTEWATER MANHOLES SHALL BE VACUUM TESTED PER SPECIFICATIONS
4. MANHOLE RETROFITS CAN ROUTE DROP EQUIPMENT PIPING INTO INSIDE FLOW LINE CHANNEL.
5. SEE WATER & SEWER SPECIFICATIONS, LATEST REVISION, FOR ACCEPTABLE MFR FOR PREFORMED MASTIC GASKETS
6. ALL BURIED PIPING SHALL BE INSTALLED IN ACCORDANCE WITH WATER & SEWER SPECIFICATIONS, LATEST REVISION.
7. BASE SHALL BE AT LEAST 6" WIDER THAN THE BOTTOM PRE-CAST BARREL SECTION AND WIDE ENOUGH TO PREVENT FLOTATION AS DESIGNED BY THE ENGINEER.
8. PRE-CAST PIPE PENETRATIONS SHALL BE INSTALLED WITH A-LOK RUBBER BOOT CONNECTORS OR APPROVED EQUAL.
9. FOR PIPE PENETRATIONS IN CAST-IN-PLACE BASE, AN APPROVED RUBBER SEAL ON PIPE BARREL SHALL BE USED. SEE SPECIFICATIONS FOR APPROVED MFR AND INSTALLATION REQUIREMENTS.

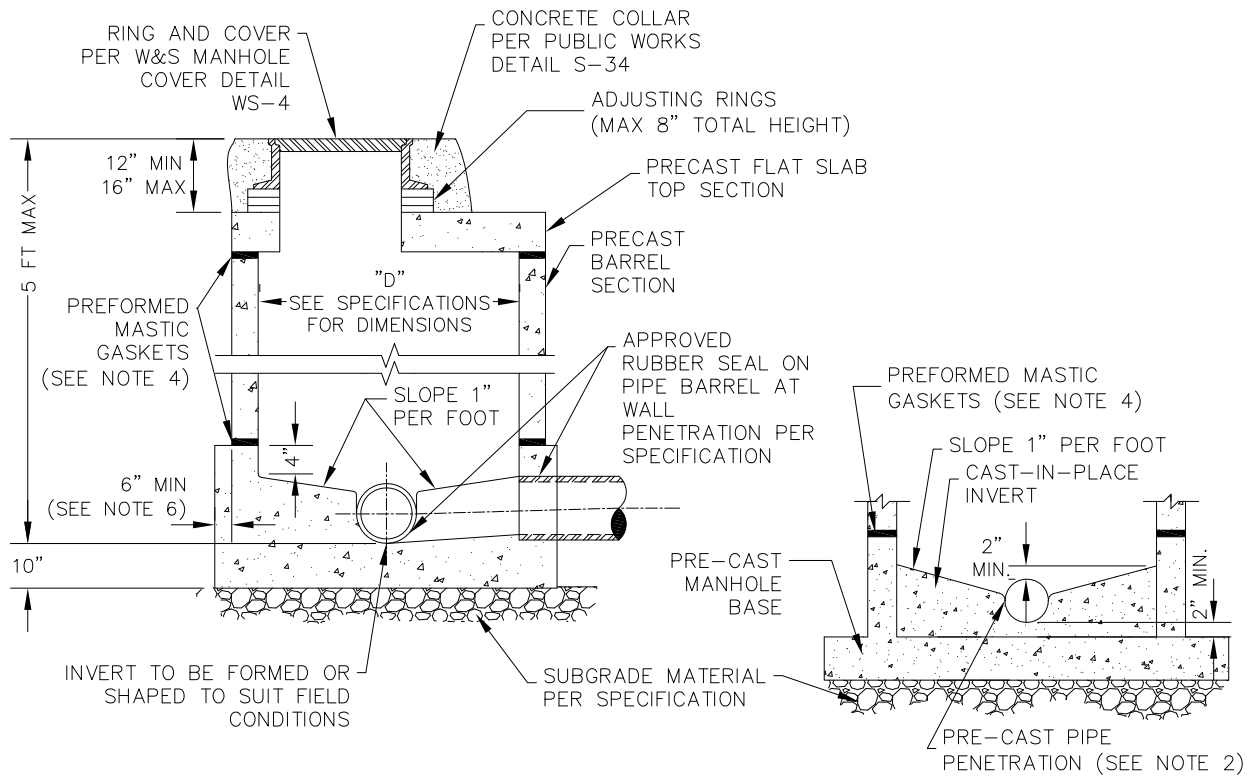


## INSIDE DROP SANITARY SEWER MANHOLE DETAIL SS-2

DATE: OCTOBER 2021

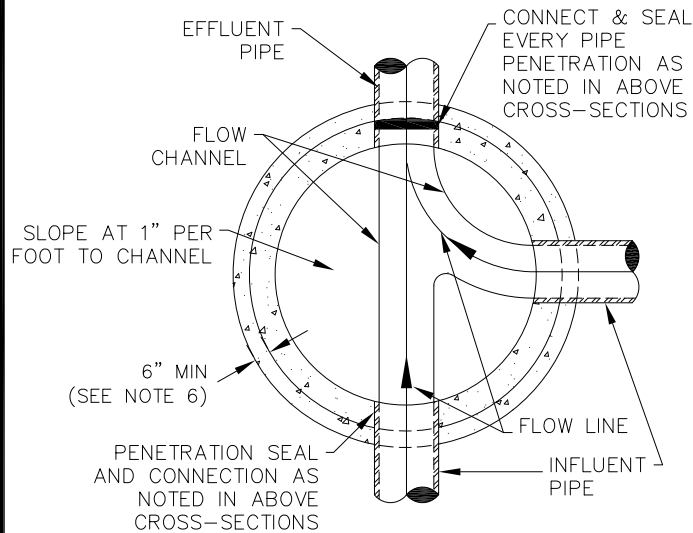
SCALE: N.T.S.





CAST-IN-PLACE BASE

ALTERNATIVE PRE-CAST BASE



NOTES:

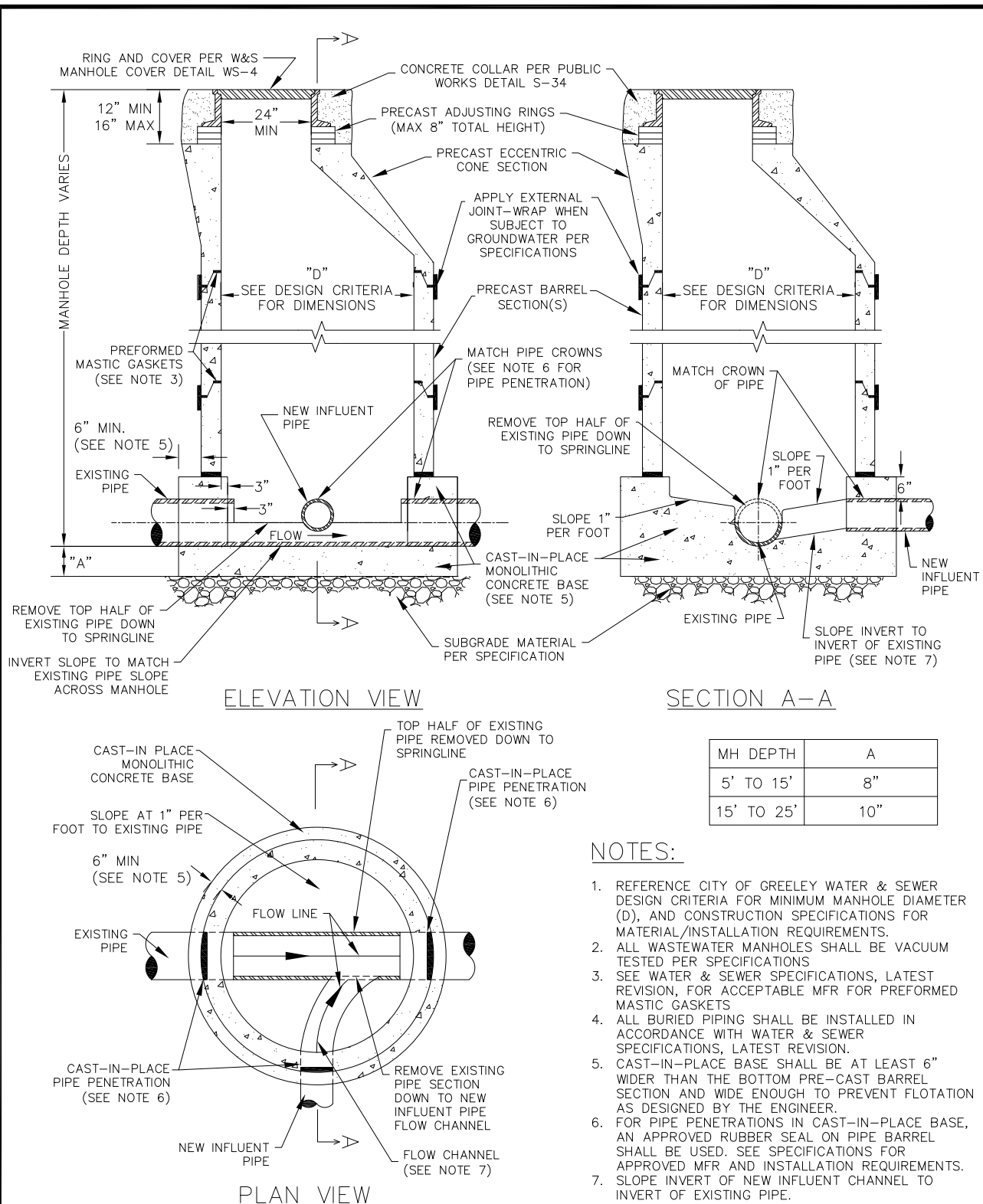
1. REFERENCE CITY OF GREELEY WATER & SEWER DESIGN CRITERIA FOR MINIMUM MANHOLE DIAMETER (D), AND CONSTRUCTION SPECIFICATIONS FOR MATERIAL/INSTALLATION REQUIREMENTS.
2. PRE-CAST PIPE PENETRATIONS SHALL BE INSTALLED WITH AN A-LOK RUBBER BOOT CONNECTOR OR APPROVED EQUAL.
3. ALL WASTEWATER MANHOLES SHALL BE VACUUM TESTED PER SPECIFICATIONS
4. SEE SPECS FOR ACCEPTABLE MFR FOR PREFORMED MASTIC GASKETS
5. ALL BURIED PIPING SHALL BE INSTALLED IN ACCORDANCE WITH WATER & SEWER SPECIFICATIONS, LATEST REVISION.
6. BASE SHALL BE AT LEAST 6\"



SHALLOW SANITARY SEWER MANHOLE  
DETAIL SS-3

DATE: OCTOBER 2021

SCALE: N.T.S.

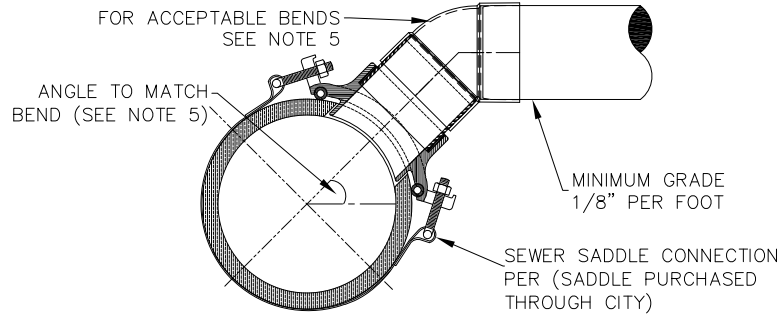


# MANHOLE OVER EXISTING SANITARY SEWER LINE

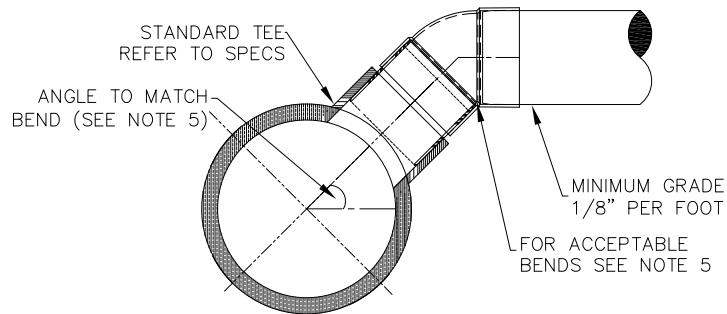
DETAIL SS-4

DATE: OCTOBER 2021

SCALE: N.T.S.



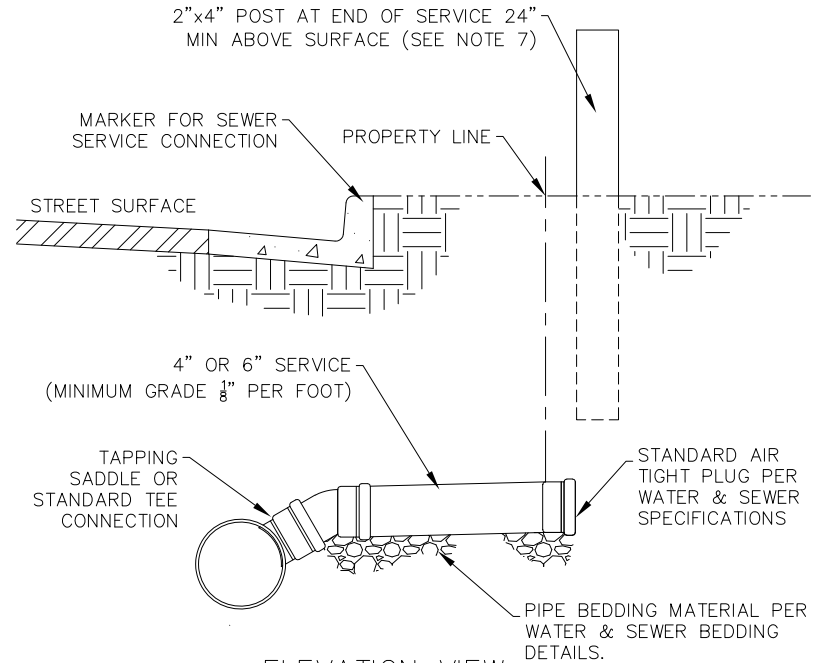
STANDARD SADDLE CONNECTION



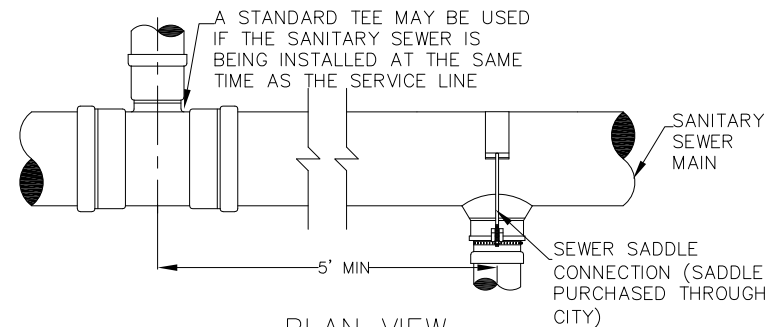
STANDARD TEE CONNECTION

NOTES:

1. IN NO CASE SHALL THE SERVICE LINE PROTRUDE INTO THE MAIN.
2. SERVICES ARE 4" OR 6" IN DIAMETER AND SHALL HAVE A MINIMUM SLOPE OF 1.0% (1/8" PER FOOT) AND A MAXIMUM SLOPE OF 8.0%.
3. SERVICES LARGER THAN 6" DIAMETER SHALL BE CONNECTED TO A MANHOLE.
4. SERVICES SHALL EXTEND TO THE PROPERTY LINE UNLESS OTHERWISE SHOWN ON CITY ACCEPTED CONSTRUCTION DRAWINGS.
5. ACCEPTABLE BENDS FOR SERVICE CONNECT ARE 45°. REFER TO SPECIFICATIONS FOR MINIMUM HEIGHT BETWEEN SERVICE CONNECTION AND SPRINGLINE OF MAIN.
6. INSTALL TRACER WIRE ACCORDING TO CITY OF GREELEY WATER & SEWER SPECIFICATIONS AND W&S UTILITY LOCATING ("UL") DETAILS, LATEST REVISION OF EACH.
7. 2 X 4 POST SHALL BE EXTERIOR GRADE, PRESSURE TREATED, LUMBER



ELEVATION VIEW



PLAN VIEW

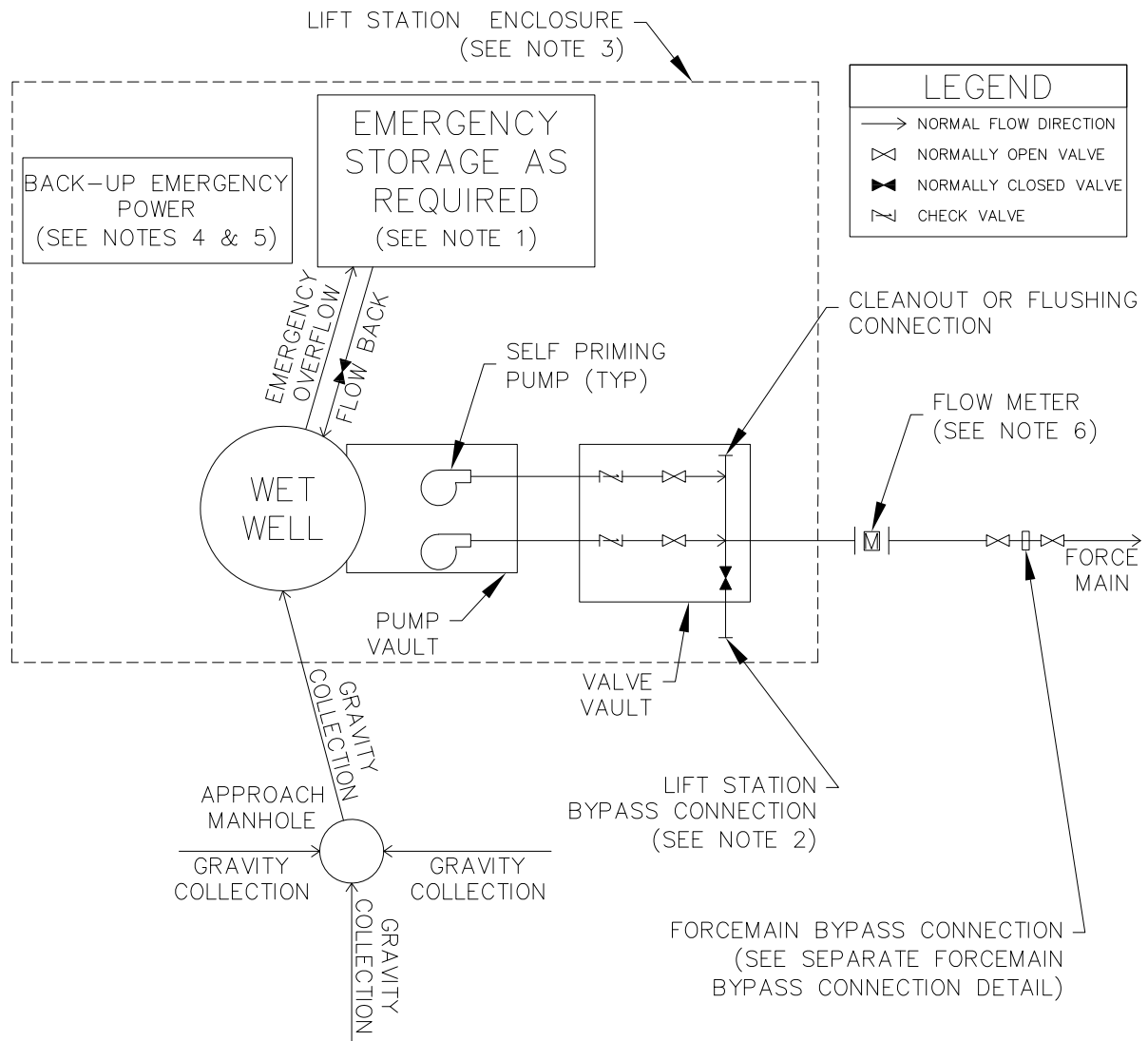


## SANITARY SEWER SERVICE CONNECTION

DETAIL SS-5

DATE: OCTOBER 2021

SCALE: N.T.S.



## NOTES:

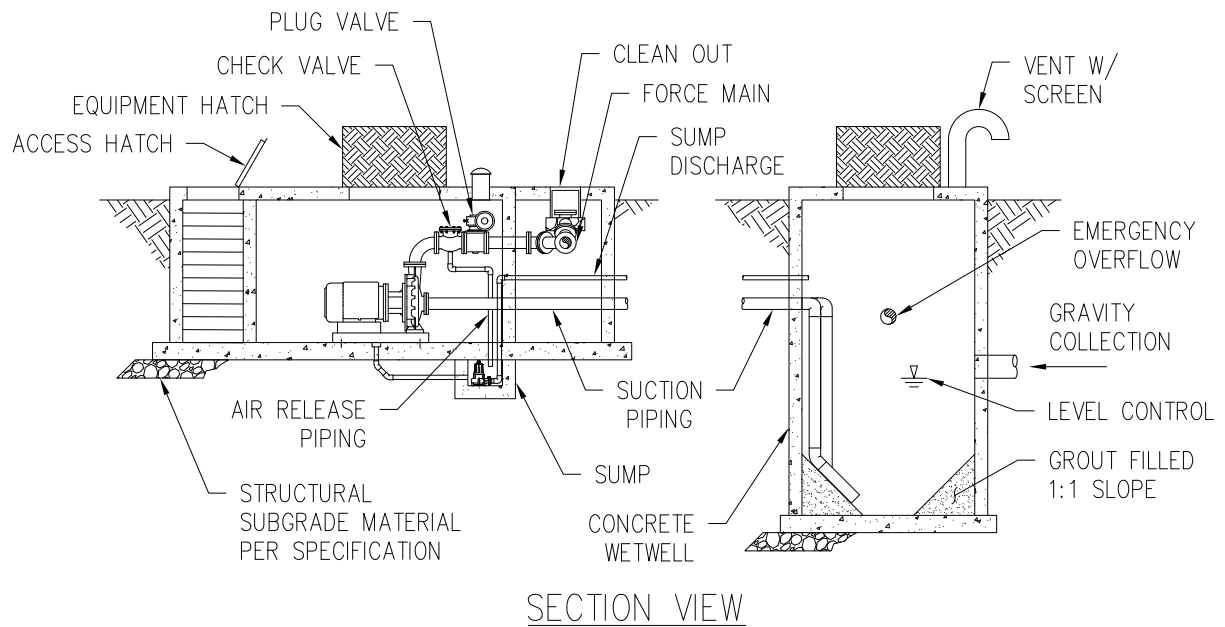
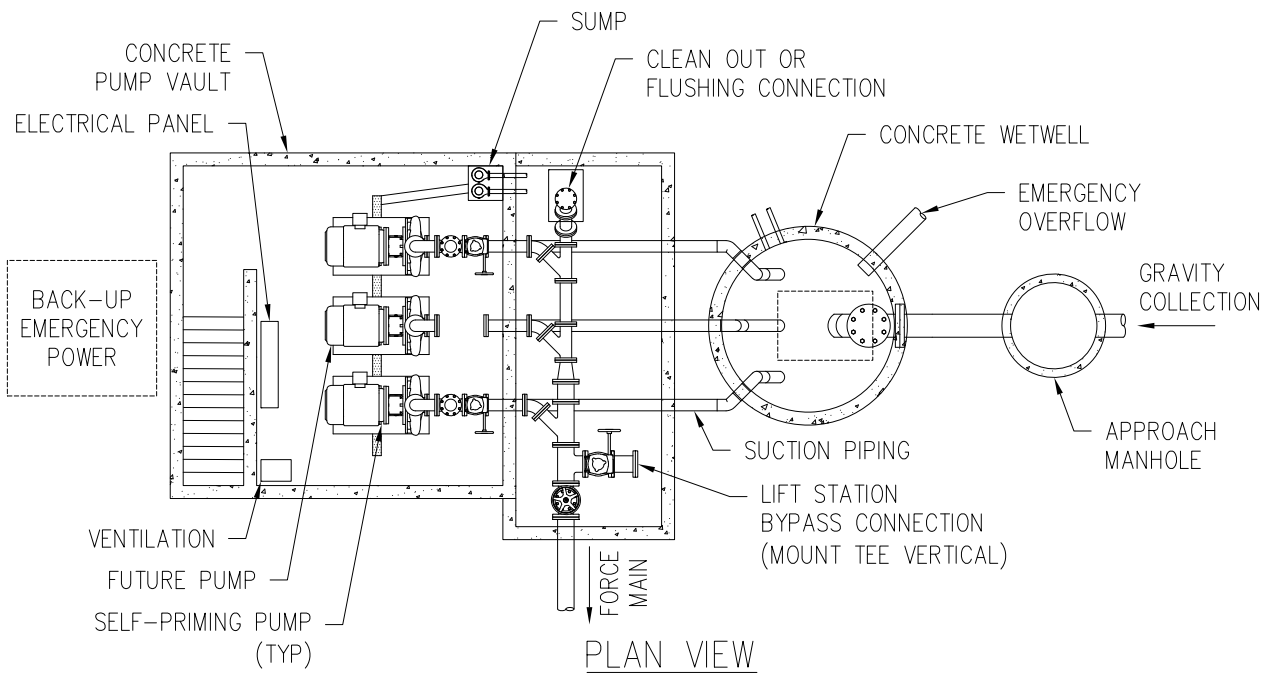
1. EMERGENCY STORAGE VOLUME WILL BE BASED ON PEAK HOURLY FLOW AND RESPONSE TIME. STORAGE VOLUME IS SUBJECT TO REVIEW BY THE CITY.
2. LIFT STATION BYPASS CONNECTION IS REQUIRED FOR ALL LIFT STATIONS
3. FINAL ORIENTATION AND ARRANGEMENT OF LIFT STATION AND FORCEMAIN SUBJECT TO FINAL APPROVAL BY CITY.
4. BACK-UP EMERGENCY POWER SYSTEM SHALL BE INCLUDED WITH PUMP MANUFACTURER.
5. SKID-MOUNTED NATURAL GAS DRIVEN ENGINES INTEGRAL WITH SKID-MOUNTED LIFT STATION PUMP SYSTEM PREFERRED FOR BACK-UP EMERGENCY POWER SYSTEMS.
6. FLOW METER SHALL BE INSIDE DEDICATED METER VAULT PER WATER METER VAULT DETAILS, LATEST REVISION, OR LIFT STATION ENCLOSURE.
7. REFER TO WATER & SEWER SPECIFICATIONS, LATEST REVISION, FOR ACCEPTABLE PRODUCT AND EQUIPMENT MODELS AND MANUFACTURERS.



## (TYP) LIFT STATION FLOW SCHEMATIC DETAIL SS-6

DATE: OCTOBER 2021

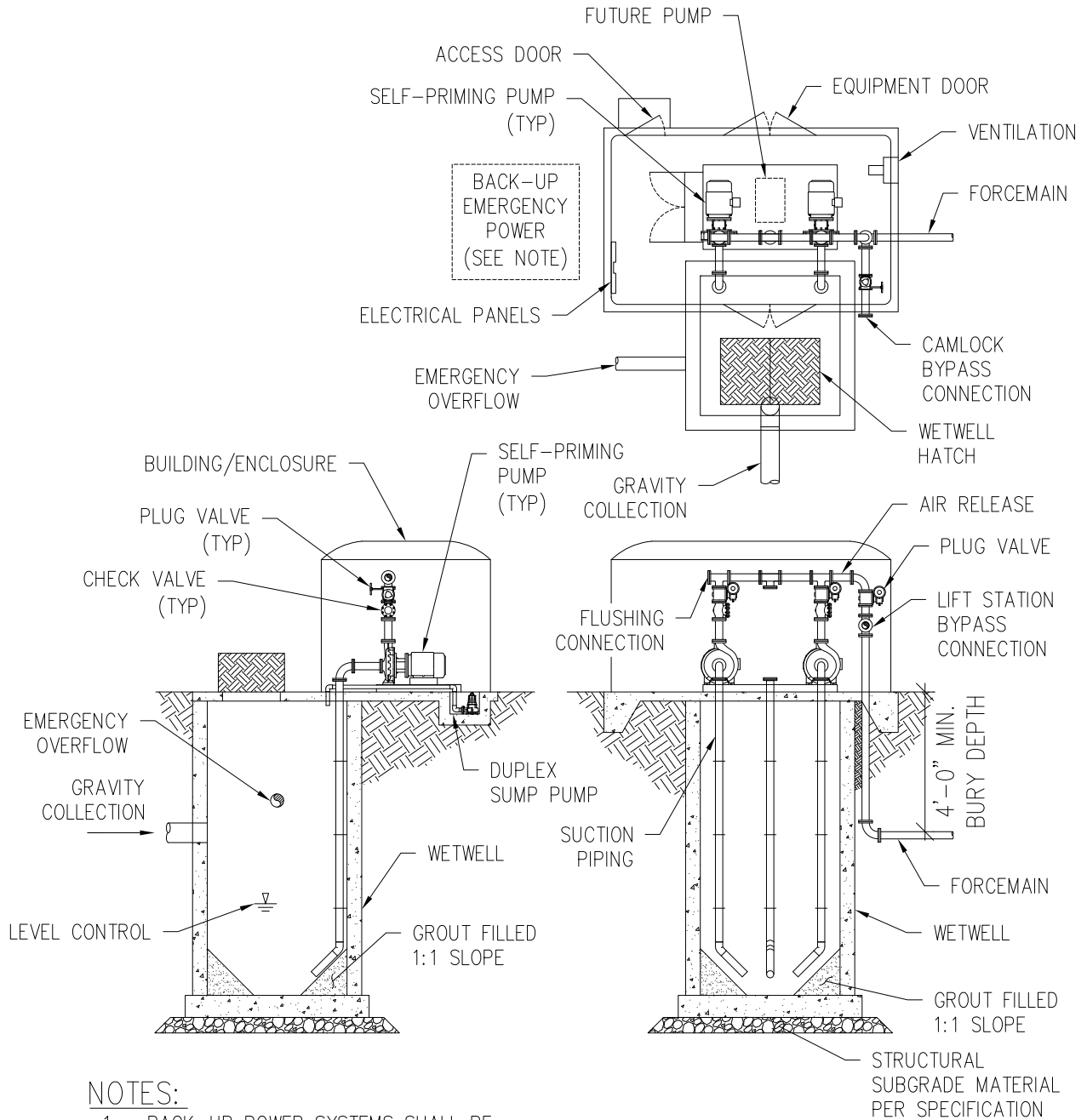
SCALE: N.T.S.



(TYP) BELOW GRADE LIFT STATION  
DETAIL SS-7

DATE: OCTOBER 2021

SCALE: N.T.S.



**NOTES:**

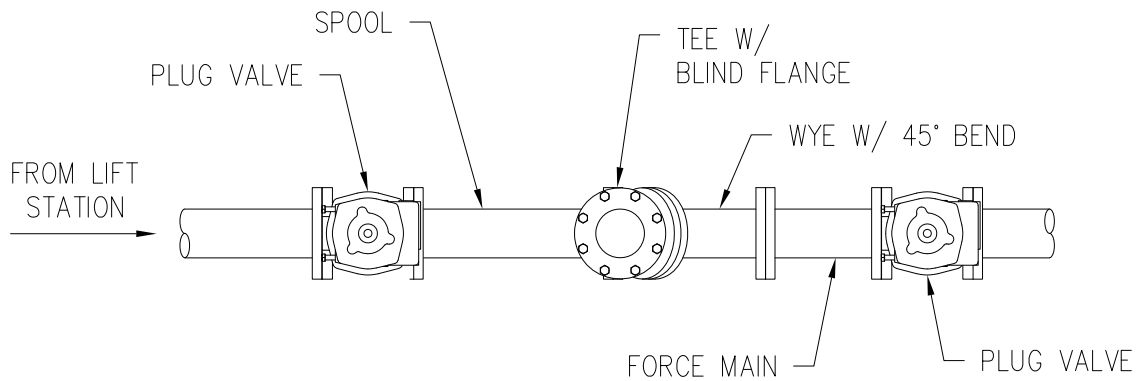
1. BACK-UP POWER SYSTEMS SHALL BE PROVIDED BY PUMP MANUFACTURER.



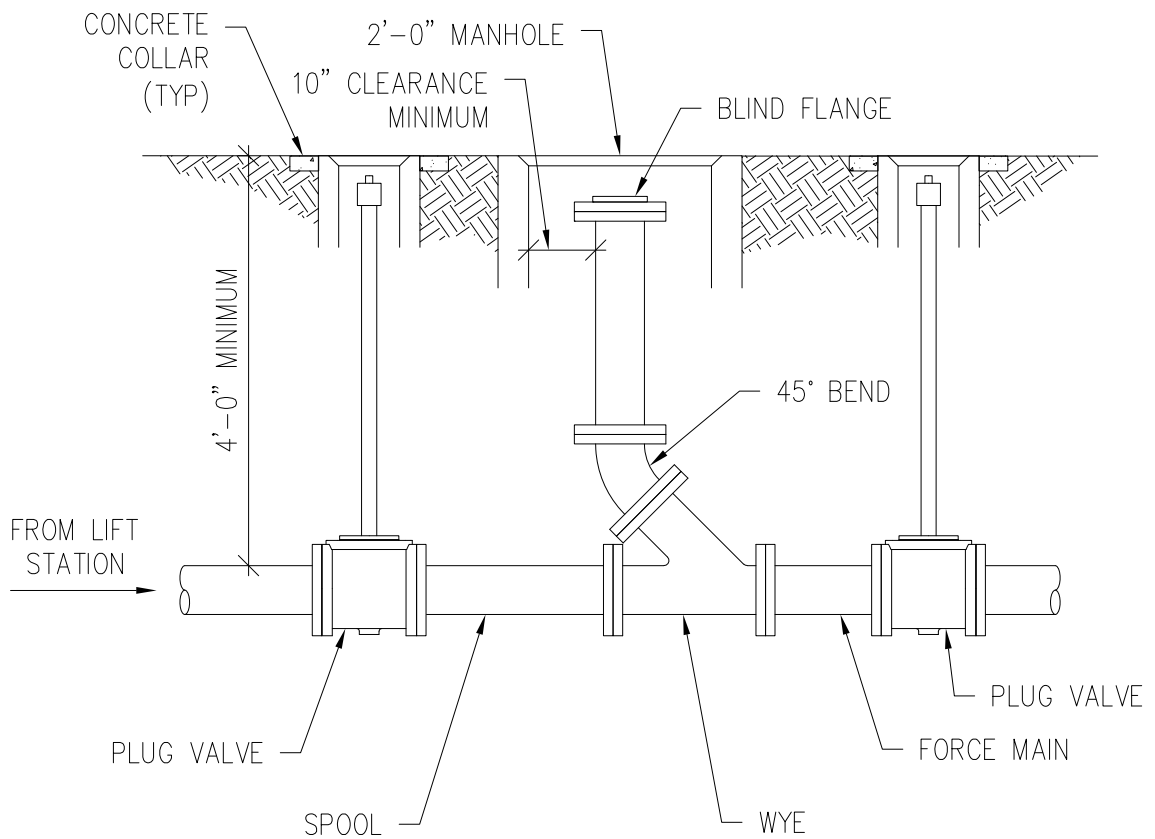
(TYP) ABOVE GRADE LIFT STATION  
DETAIL SS-8

DATE: OCTOBER 2021

SCALE: N.T.S.



PLAN VIEW



SECTION VIEW



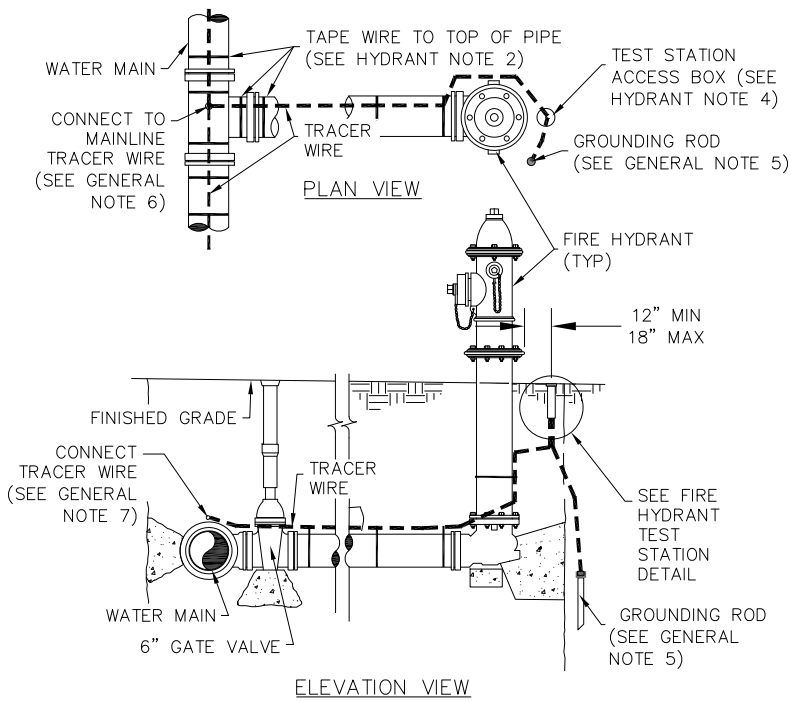
(TYP) FORCEMAIN BYPASS &  
CLEANOUT CONNECTION DETAIL

DETAIL SS-9

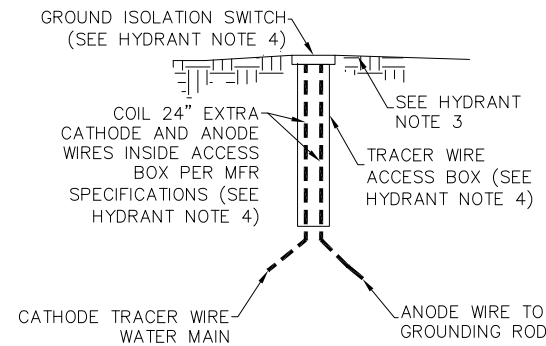
DATE: OCTOBER 2021

SCALE: N.T.S.

### FIRE HYDRANT TRACER WIRE



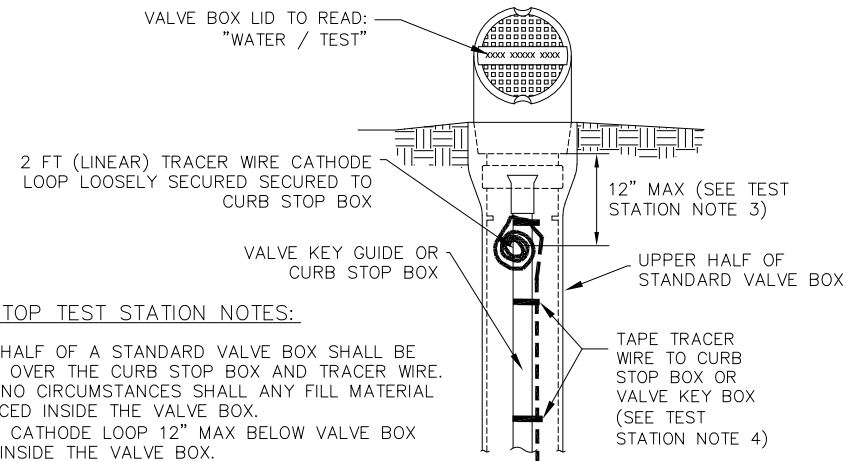
### FIRE HYDRANT & STANDARD MFR TEST STATION DETAIL



### HYDRANT & STANDARD MFR TEST STATION NOTES:

1. REFER TO RELATED DETAIL FIRE HYDRANT DETAIL, LATEST REVISION, FOR FIRE HYDRANT INSTALLATION STANDARD DRAWING.
2. REFER TO GENERAL NOTES FOR ADDITIONAL TRACER WIRE REQUIREMENTS.
3. GRADE SURROUNDING TRACER WIRE ACCESS BOX SHALL SLOPE AWAY FROM LID AT 2% MINIMUM GRADE.
4. FIRE HYDRANT TEST STATION ACCESS BOX SHALL BE COPPERHEAD SNAKEPIT ACCESS POINT WITH TWO-TERMINAL SWITCHABLE LID OR APPROVED EQUAL.

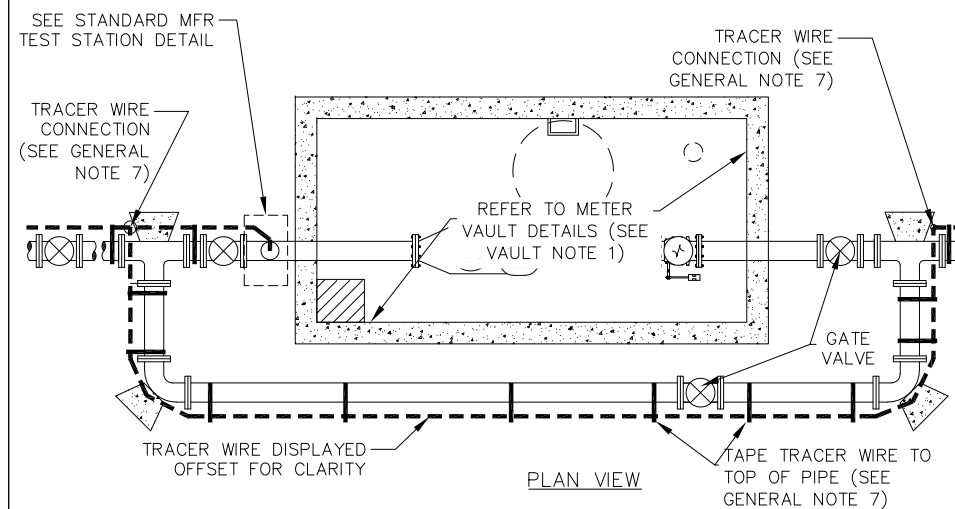
### CURB STOP TEST STATION DETAIL



### CURB STOP TEST STATION NOTES:

1. UPPER HALF OF A STANDARD VALVE BOX SHALL BE PLACED OVER THE CURB STOP BOX AND TRACER WIRE.
2. UNDER NO CIRCUMSTANCES SHALL ANY FILL MATERIAL BE PLACED INSIDE THE VALVE BOX.
3. SECURE CATHODE LOOP 12" MAX BELOW VALVE BOX COVER INSIDE THE VALVE BOX.
4. FOLLOW SAME TAPING INTERVAL FOR TRACER WIRE ALONG CURB STOP AS TRACER WIRE IS TAPED ALONG PIPE.

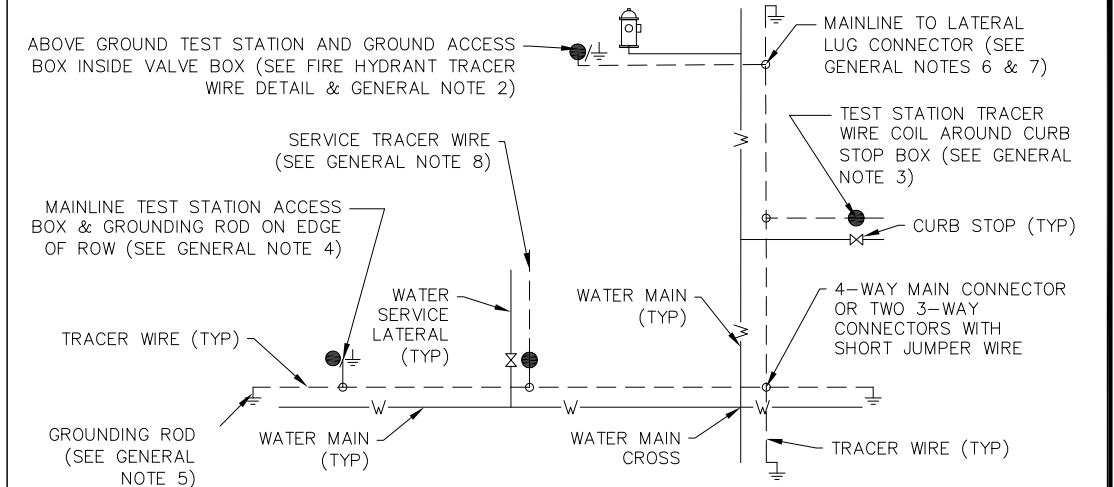
### TRACER WIRE AROUND VAULTS



### VAULT TRACER WIRE NOTES:

1. REFER TO RELATED DETAILS W-10, W-11, AND W-15 FOR METER VAULT DETAILS AND REQUIREMENTS.
2. REFER TO GENERAL NOTES FOR ADDITIONAL TRACER WIRE REQUIREMENTS.

### SAMPLE PLAN OF WATER MAIN TRACER WIRE



### LEGEND

— WATER MAIN	⊕ DRIVE-IN MAGNESIUM GROUNDING ROD (TYP)	● TRACER WIRE ACCESS BOX (LOOSE COIL AROUND CURB STOP FOR ABOVE GROUND ACCESS)
- - - - TRACER WIRE	⊗ CURB STOP (TYP)	●/⊕ TRACER WIRE ACCESS BOX (ABOVE GROUND ACCESS BOX / GROUNDING ROD)
— WATER SERVICE	⊕ FIRE HYDRANT (TYP)	

### GENERAL NOTES:

1. TRACER WIRE DEPICTED OFFSET FROM PIPE FOR CLARITY. TRACER WIRE SHALL BE INSTALLED ON TOP OF PIPE, IN ACCORDANCE WITH THE WATER & SEWER UTILITY LOCATING DETAIL UL-6, AND WATER & SEWER CONSTRUCTION SPECIFICATIONS, LATEST REVISION OF EACH.
2. TRACER WIRE ACCESS IN THE FORM OF A TEST STATION ACCESS BOX FROM A CITY APPROVED MFR MUST BE PROVIDED AND GROUNDED AT EVERY FIRE HYDRANT. REFER TO WATER & SEWER SPECIFICATIONS, LATEST REVISION, FOR PRODUCT AND MANUFACTURER RECOMMENDATIONS AND REQUIREMENTS.
3. TRACER WIRE ACCESS IN THE FORM OF A CATHODE WIRE LOOPED AROUND THE CURB STOP BOX SHALL BE PLACED INSIDE OF A STANDARD VALVE BOX AT EVERY SERVICE LATERAL. REFER TO W&S SERVICE LATERAL UTILITY LOCATING DETAILS UL-3 AND UL-4, LATEST REVISION OF EACH, FOR ADDITIONAL INSTALLATION REQUIREMENTS.
4. FOR LONG RUNS IN EXCESS OF 1,000 FEET WITHOUT SERVICE LATERALS OR HYDRANTS – TRACER WIRE ACCESS MUST BE PROVIDED IN THE FORM OF EITHER AN APPROVED MFR GRADE LEVEL WIRE ACCESS BOX OR A STANDARD VALVE BOX WITH CATHODE WIRE LOOP. EITHER FORM OF ACCESS SHALL BE LOCATED ABOVE THE PIPE OR AT THE EDGE OF RIGHT-OF-WAY AND OUT OF THE ROAD-WAY. TRACER WIRE ACCESS BOX SHALL ALSO BE DELINEATED USING A MINIMUM 48" POLYETHYLENE MARKER POST, COLOR CODED PER APWA STANDARD FOR THE SPECIFIC UTILITY BEING MARKED.
5. TRACER WIRE MUST BE GROUNDED AT EVERY MAINLINE DEAD END/STUB, AND ALONG CONTINUOUS RUNS AT A MAXIMUM OF 1,000 FT INTERVALS WITH A 1.5 LB DRIVE-IN MAGNESIUM GROUNDING ROD PER GROUNDING ROD MFR REQUIREMENTS. PLACEMENT OF GROUNDING ROD SHALL BE INSTALLED IN SUCH A WAY THAT ALLOWS FOR PROPER WIRE LOCATING WITHOUT A LOSS OR DETERIORATION OF LOW FREQUENCY SIGNAL (512 Hz) FOR DISTANCES IN EXCESS OF 1,000 FT. EVERY FIRE HYDRANT TEST STATION SHALL BE GROUNDED PER MFR RECOMMENDATIONS.
6. TRACER WIRE SYSTEMS MUST BE INSTALLED AS A SINGLE CONTINUOUS WIRE, EXCEPT WHERE USING APPROVED CONNECTORS. NO LOOPING OR COILING OF WIRE IS ALLOWED.
7. REFER TO WATER & SEWER SERVICE LATERAL TRACER WIRE DETAIL AND GENERAL TRACER WIRE NOTES ON DETAIL UL-6, LATEST REVISION OF EACH, FOR ADDITIONAL TRACER WIRE INSTALLATION, TAPING, CONNECTION, SPLICING, AND GROUNDING REQUIREMENTS.
8. SERVICE LATERAL TRACER WIRE SHALL EXTEND PAST CURB STOP TEST STATION AND TERMINATE AT STRUCTURE PER SERVICE LATERAL UTILITY LOCATING DETAIL.



## WATER MAIN TRACER WIRE AND UTILITY LOCATING

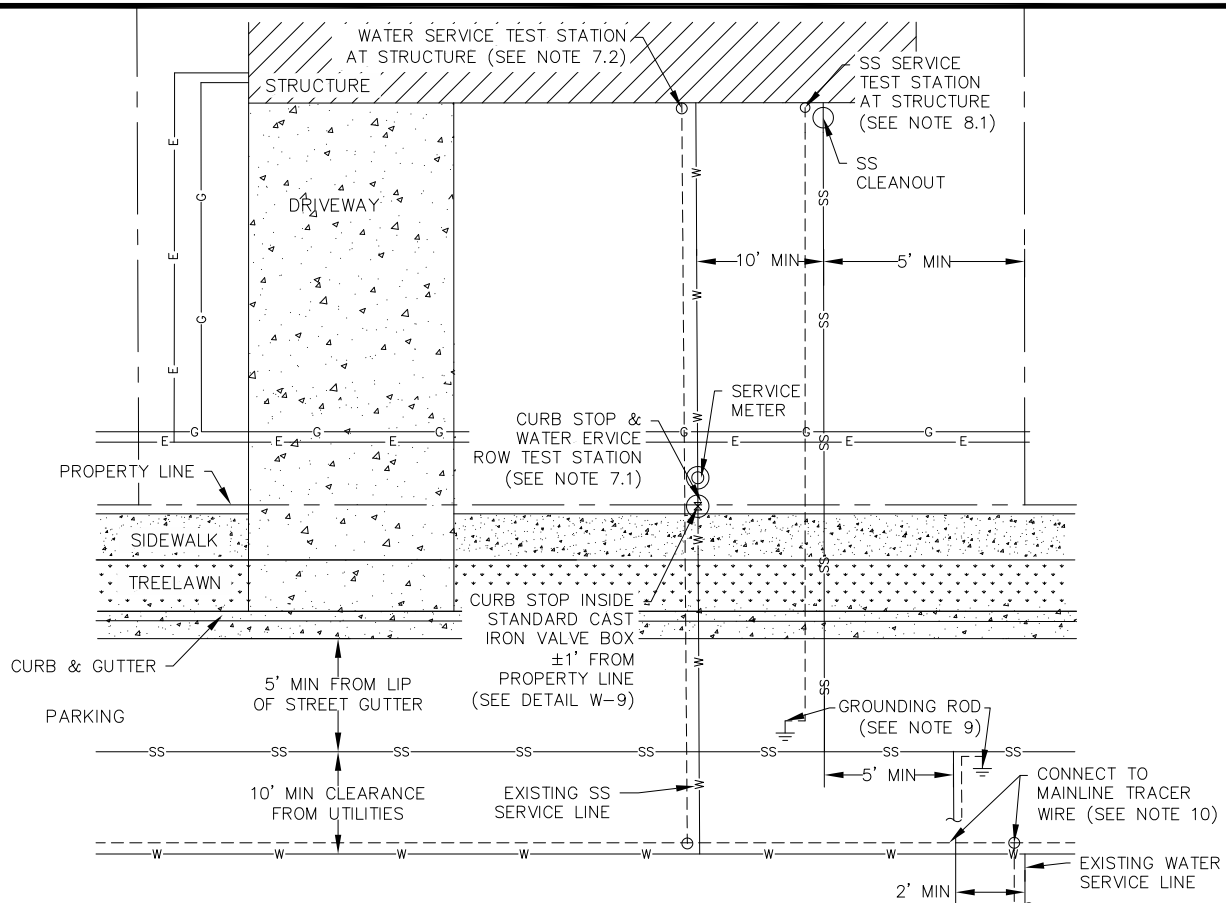
DETAIL NO. UL-1

DATE: OCTOBER 2021

SCALE: N.T.S.







#### NOTES:

1. ALL BURIED PIPE, VALVES, AND APPURTENANCES SHALL BE INSTALLED ACCORDING TO THE CITY OF GREELEY WATER & SEWER DETAILS AND SPECIFICATIONS LATEST REVISION.
2. TRACER WIRE IS REQUIRED FOR ALL SERVICE PIPES, ALL WATER MAINS, AND ALL NON-POTABLE IRRIGATION MAINS.
3. TRACER WIRE IS ONLY DEPICTED AWAY FROM PIPE IN ABOVE DRAWING FOR CLARITY.
4. REFER TO GENERAL NOTES ON WATER & SEWER DETAIL UL-6, LATEST REVISION, FOR ADDITIONAL TRACER WIRE INSTALLATION, TAPING, CONNECTION, SPICING, AND GROUNDING REQUIREMENTS.
5. FOR FUTURE CONNECTION SERVICE STUBS, DEVELOPER SHALL PROVIDE A MINIMUM OF 2 FEET OF WIRE WRAPPED AND TAPED TO MARKER POST AT PROPERTY LINE (PROPERTY BUILDER SHALL SPlice TO THIS TRACER WIRE COIL AT LATER DATE).

#### LEGEND

- w— WATER MAIN/ SERVICE
- - - - - TRACER WIRE MAIN/ SERVICE
- ss- SAN. SEWER MAIN/ SERVICE
- - - - - PROPERTY LINE
- — — — — EDGE OF CONCRETE/ PAVEMENT
- g- GAS SERVICE
- e- ELECTRIC SERVICE
- ⊥ DRIVE-IN MAGNESIUM GROUNDING ROD (TYP)

6. REFER TO WATER & SEWER CONSTRUCTION SPECIFICATIONS, LATEST REVISION, FOR APPROVED TRACER WIRE, GROUNDING ROD, TEST STATION, AND MISC. PRODUCT MFR.
7. WATER SERVICE TEST STATIONS AND TRACER ACCESS:
  - 7.1. ROW TEST STATION (AT CURB STOP): TAPE TRACER WIRE TO CURB STOP BOX AND RUN TO SURFACE. SECURE A TWO FOOT (LINEAR) COIL OF TRACER WIRE AT THE TOP OF THE CURB STOP BOX, AND PLACE THE UPPER HALF OF A STANDARD VALVE BOX AROUND THE CURB STOP AND TEST STATION.
  - 7.2. PROPERTY OWNER TEST STATION AT STRUCTURE: TERMINATE TRACER WIRE AT STRUCTURE WITH AN APPROVED TEST STATION ACCESS BOX FROM AN APPROVED MFR, MOUNTED TO STRUCTURE.
  - 7.3. SEE W&S DETAIL UL-4, LATEST REVISION, FOR ADDITIONAL DETAILS.
8. SANITARY SEWER SERVICE TEST STATIONS AND TRACER ACCESS:
  - 8.1. PROPERTY OWNER TEST STATION AT STRUCTURE: TERMINATE TRACER WIRE AT STRUCTURE WITH AN APPROVED TEST STATION ACCESS BOX FROM AN APPROVED MFR, MOUNTED TO THE STRUCTURE.
  - 8.2. SEE W&S DETAIL UL-5, LATEST REVISION, FOR ADDITIONAL DETAILS.
9. ALL SANITARY SEWER SERVICE LATERAL TRACER WIRES SHALL TERMINATE WITHIN 2FT OF THE SS MAIN WITH AN APPROVED 1.5 LB DRIVE-IN MAGNESIUM GROUNDING ROD.
10. ALL WATER SERVICE LATERAL TRACER WIRES SHALL BE CONNECTED TO MAINLINE TRACER WITHOUT CUTTING / SPICING THE MAINLINE TRACER WIRE, ACCORDING TO WATER & SEWER DETAIL UL-6, LATEST REVISION.

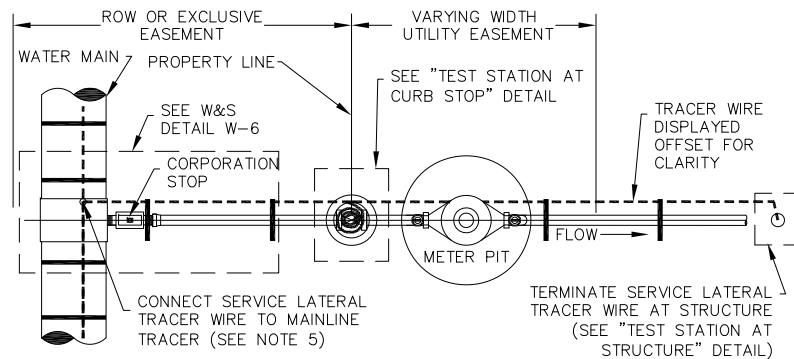


## (TYP) SERVICE LATERAL UTILITY LOCATING PLAN

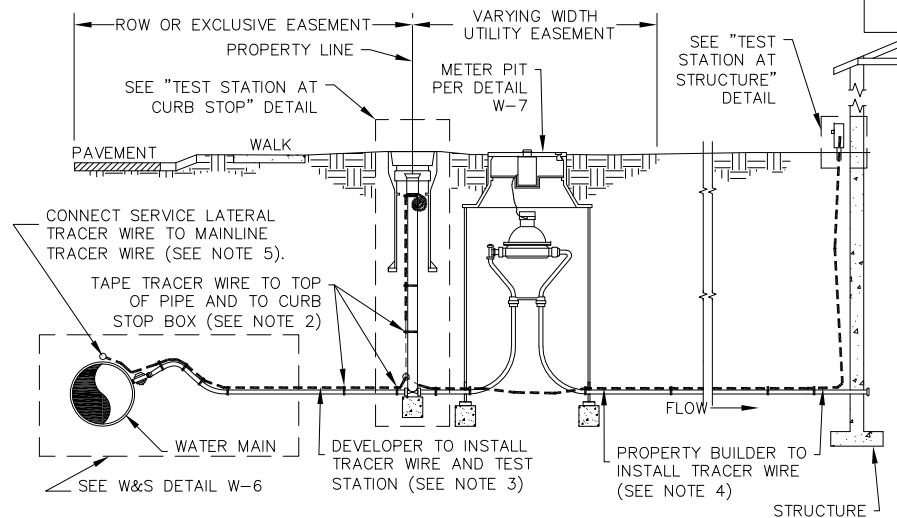
DETAIL UL-3

DATE: OCTOBER 2021

SCALE: N.T.S.

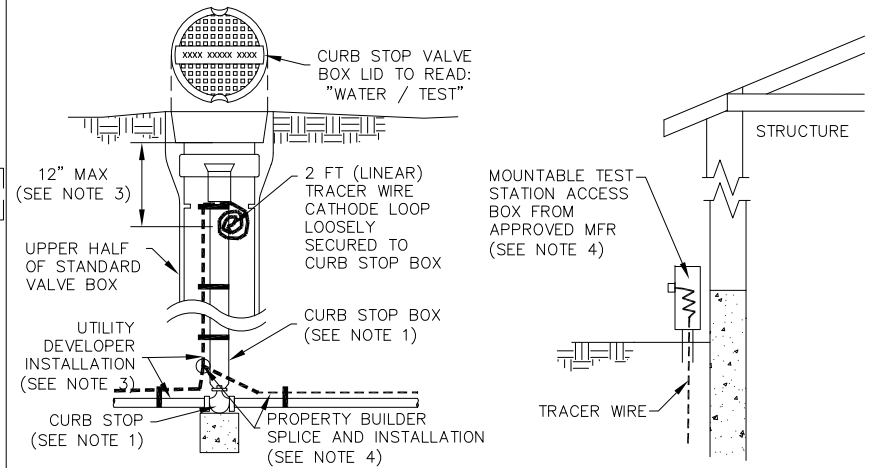


TRACER WIRE INSTALLATION PLAN VIEW



ELEVATION VIEW

WATER SERVICE TEST STATION DETAIL



TEST STATION AT CURB STOP

TEST STATION AT STRUCTURE

### NOTES:

1. REFER TO RELATED WATER & SEWER DETAILS W-6 THROUGH W-11, LATEST REVISION OF EACH, FOR WATER SERVICE LATERAL AND METER INSTALLATION DETAILS.
2. REFER TO RELATED SERVICE LATERAL TRACER WIRE DETAIL UL-3, AND GENERAL TRACER WIRE NOTES ON UL-6, LATEST REVISION OF EACH, FOR ADDITIONAL TRACER WIRE TAPING, SPLICING, CONNECTING, AND GROUNDING DETAILS.
3. UTILITY DEVELOPER TO INSTALL TRACER WIRE ON MAIN AND UP TO TEST STATION AT CURB STOP ON THE EDGE OF ROW. PROVIDE 2 FT (LINEAR) OF EXCESS TRACER WIRE, SECURED AT THE TOP OF THE CURB STOP BOX, AND PLACE THE UPPER HALF OF A STANDARD VALVE BOX AROUND THE CURB STOP AND TEST STATION. FOR NEW DEVELOPMENT, UTILITY DEVELOPER SHALL PROVIDE A MINIMUM 2 FT COIL AT MARKER POST IF PRIOR TO CURB STOP INSTALLATION.
4. PROPERTY BUILDER TO SPlice SERVICE TRACER WIRE TO TEST STATION TRACER WIRE AND INSTALL UP TO STRUCTURE, TERMINATING DIRECTLY ABOVE THE SERVICE LATERAL AT THE STRUCTURE WITH AN APPROVED ACCESS BOX FROM AN APPROVED MFR AND INSTALLED IN ACCORDANCE WITH MFR SPECIFICATIONS. REFER TO WATER & SEWER SPECIFICATIONS, LATEST REVISION, FOR APPROVED MFR.
5. ALL MAINLINE TRACER WIRE CONNECTIONS SHALL BE INSTALLED PER LATEST REVISION OF WATER & SEWER SPECIFICATIONS. MAINLINE TRACER SHALL NOT BE CUT OR SPLICED IN ANY WAY (SEE NOTE 3).



## (TYP) WATER SERVICE UTILITY LOCATING DETAIL SECTION & TEST STATION

DETAIL UL-4

DATE: OCTOBER 2021

SCALE: N.T.S.



1. REFER TO RELATED DETAIL SS-5, LATEST REVISION, FOR SANITARY SEWER SERVICE LATERAL STANDARD DRAWING.
2. REFER TO RELATED SERVICE LATERAL TRACER WIRE DETAIL UL-3, AND GENERAL TRACER WIRE NOTES ON UL-6, LATEST REVISION OF EACH, FOR ADDITIONAL TRACER WIRE TAPING, SPLICING, CONNECTING, GROUNDING, AND MISC. INSTALLATION DETAILS.
3. UTILITY DEVELOPER TO INSTALL TRACER WIRE FROM SS MAIN TO THE TEST STATION BOX ON THE EDGE OF ROW. TEST STATION FOR NEW DEVELOPMENT SHALL BE A COIL OF 2 FT (LINEAR) TRACER WIRE, SECURED TO THE SERVICE STUB MARKER POST.
4. PROPERTY BUILDER TO SPLICE SANITARY SEWER SERVICE TRACER WIRE PROPERTY LINE AND INSTALL UP TO STRUCTURE, TERMINATING AT THE SS SERVICE CLEANOUT WITH AN APPROVED MFR TEST STATION ACCESS BOX FROM AN APPROVED MFR. TEST STATION ACCESS BOX SHALL BE MOUNTED TO THE STRUCTURE WITHIN 18" OF THE SS SERVICE CLEANOUT AND INSTALLED ACCORDING TO THE TEST STATION MFR SPECIFICATIONS. REFER TO WATER & SEWER SPECIFICATIONS, LATEST REVISION, FOR APPROVED MFR.



DETAIL UL-5

DATE: OCTOBER 2021

SCALE: N.T.S.

### TRACER WIRE NOTES

1. LOCATING MUST MEET REQUIREMENTS OF SENATE BILL 18-167 OR ANY UPDATE.
2. TRACER WIRE SHALL BE LOCATED ON TOP OF PIPE, TAPED EVERY 3 TO 4 FEET MAX AND EACH SIDE OF EVERY JOINT, FITTING, AND VALVE.
3. TRACER WIRE IS REQUIRED FOR ALL WATER SERVICE LATERALS, NON-POTABLE IRRIGATION SERVICE LATERALS, ALL SANITARY SEWER LATERALS, ALL WATER MAINS, AND ALL NON-POTABLE IRRIGATION MAINS.
4. TWO UNDERGROUND WIRE SPLICES ARE ALLOWED PER SERVICE, SHALL HAVE LOCKABLE CONNECTIONS SPECIFICALLY DESIGNED FOR DIRECT BURIAL, AND DIELECTRIC SILICONE GEL FILLED OR APPROVED EQUAL.
5. REFER TO WATER & SEWER SPECIFICATIONS, LATEST REVISION, FOR TRACER WIRE GAUGE, MATERIAL, AND COATING REQUIREMENTS.
6. TRACER WIRE SYSTEMS MUST BE INSTALLED AS A SINGLE CONTINUOUS WIRE, EXCEPT WHERE USING APPROVED CONNECTORS. NO LOOPING OR COILING OF WIRE AROUND THE PIPE IS ALLOWED.
7. ALL WATER SERVICE LATERAL TRACER WIRES SHALL BE CONNECTED TO MAINLINE TRACER USING AN APPROVED MAINLINE TO LATERAL LUG CONNECTOR WITHOUT CUTTING / SPLICING THE MAINLINE TRACER WIRE.
8. ALL MAINLINE TRACER WIRE BRANCHES SHALL BE MADE WITH AN APPROVED MAINLINE TO MAINLINE LUG CONNECTOR WITHOUT CUTTING / SPLICING EITHER MAINLINE TRACER WIRE.
9. REFER TO WATER & SEWER CONSTRUCTION SPECIFICATIONS, LATEST REVISION, FOR APPROVED TRACER WIRE MFR AND ADDITIONAL INSTALLATION REQUIREMENTS.

### TEST STATIONS

1. TRACER WIRE SHALL BE ACCESSIBLE AT LEAST ONCE EVERY 1,000 FT MAX.
2. TEST STATION SHALL NOT BE FURTHER THAN 1,000 FT FROM AN APPROVED "FAR-END" GROUNDING ROD. THIS GROUNDING ROD MUST MEET WATER & SEWER CONSTRUCTION SPECIFICATIONS AND DESIGN CRITERIA STATED IN THE GROUNDING NOTES.
3. TEST STATION MAY EITHER BE IN THE FORM OF A CATHODE WIRE LOOP ACCESSIBLE FROM FINAL GRADE SURFACE OR AN APPROVED TEST STATION ACCESS BOX FROM AN APPROVED MFR. EITHER TEST STATION FORM SHALL BE WITHIN THE FAR-END GROUNDING INTERVAL REQUIREMENT, AND MEET WATER & SEWER TRACER WIRE CONSTRUCTION SPECIFICATIONS AND DETAILS, LATEST REVISION OF EACH.
4. GROUND SURROUNDING TEST STATION ACCESS BOXES SHALL SLOPE AWAY FROM LID AT 2% MINIMUM GRADE.

### GROUNDING NOTES

1. ALL SANITARY SEWER SERVICE LATERAL TRACER WIRES SHALL TERMINATE WITHIN 2 FT OF THE SS MAIN WITH AN APPROVED DRIVE-IN MAGNESIUM GROUNDING ROD. SINGLE GROUNDING ROD MAY BE UTILIZED FOR UP TO 3 SEWER SERVICES MAX.
2. MAINLINE TRACER WIRE MUST BE GROUNDED AT EVERY DEAD END/STUB, AND ALONG CONTINUOUS RUNS AT A MAXIMUM OF 2,000 FT INTERVALS WITH A 1.5 LB DRIVE-IN MAGNESIUM GROUNDING ROD PER MFR REQUIREMENTS. PLACEMENT OF GROUNDING ROD SHALL BE INSTALLED IN SUCH A WAY THAT ALLOWS FOR PROPER WIRE LOCATING WITHOUT A LOSS OR DETERIORATION OF LOW FREQUENCY SIGNAL (512 HZ) FOR DISTANCES IN EXCESS OF 1,000 FT.
3. IF GROUNDING ROD IS TOO CLOSE TO A TEST STATION THAT IT INTERFERES WITH PROPER LOCATING, THE GROUNDING ROD MUST BE SWITCH-ABLE IN ORDER TO TEMPORARILY DEACTIVATE THE INTERFERING GROUND SIGNAL IN THE VICINITY. SUCH A TEST STATION SHALL BE IN THE FORM OF A TEST STATION ACCESS BOX FROM A CITY APPROVED MFR.
4. REFER TO WATER & SEWER CONSTRUCTION SPECIFICATIONS, LATEST REVISION, FOR APPROVED GROUNDING ROD MFR AND ADDITIONAL REQUIREMENTS.

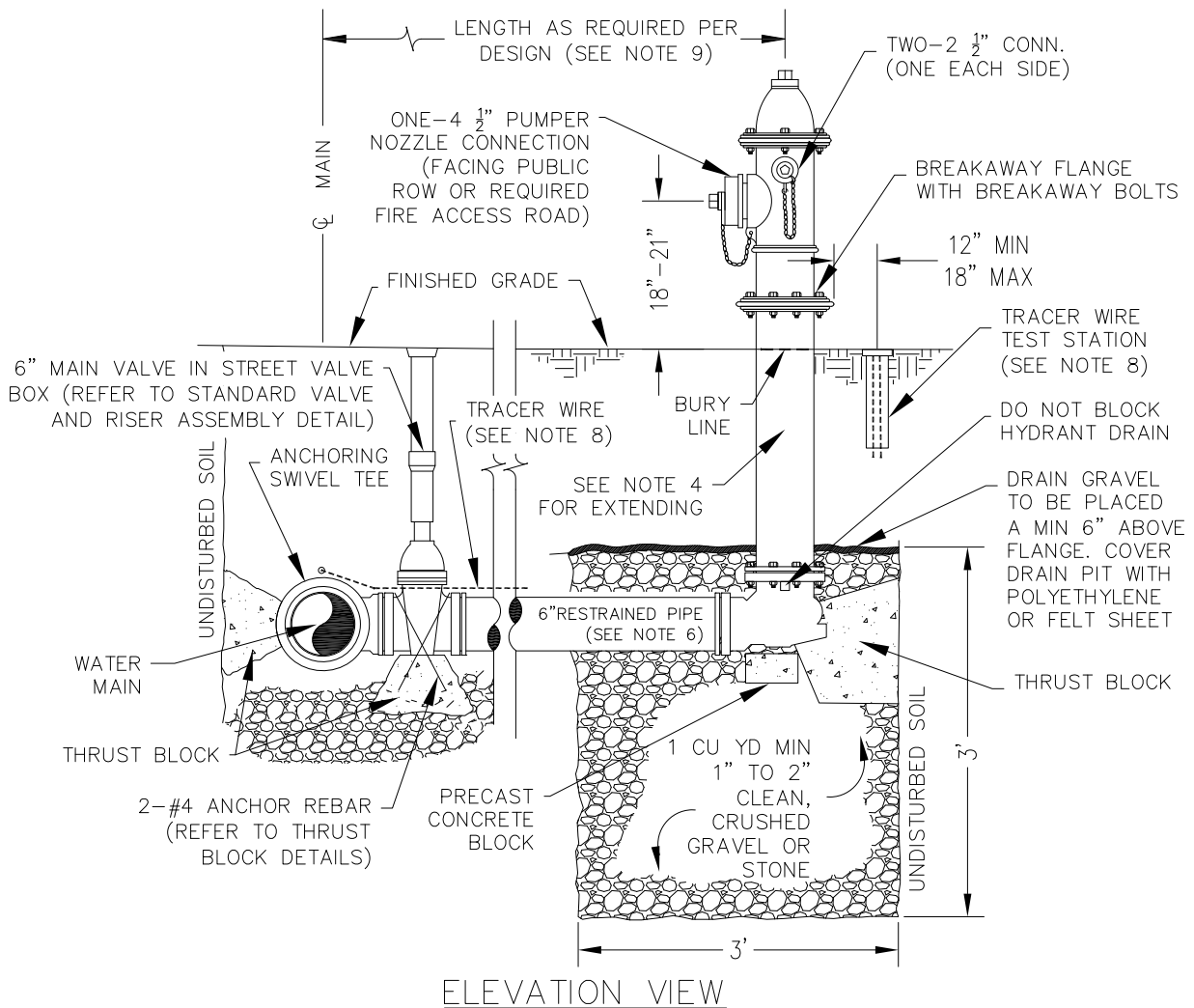


## TRACER WIRE GENERAL NOTES

DETAIL UL-6

DATE: OCTOBER 2021

SCALE: N.T.S.



### NOTES:

1. MINIMUM DEPTH OF BURY 5'-6' FROM FINISHED GRADE TO TOP OF PIPE.
2. PROVIDE POLYETHYLENE BOND BREAKER BETWEEN ALL PIPE/FITTINGS AND POURED CONCRETE.
3. FIRE HYDRANTS MUST BE PURCHASED FROM W&S OPERATIONS WITH A MINIMUM 48 HOUR NOTICE. CALL TO ORDER 970-350-9320.
4. ONLY A SINGLE FIRE HYDRANT EXTENSION IS PERMITTED. FIRE HYDRANT EXTENSION MAY BE UP TO 36" (MAX) PER WATER & SEWER SPECIFICATIONS.
5. ALL BURIED VALVES, FITTINGS, AND APPURTENANCES SHALL BE RESTRAINED AND INSTALLED PER W&S SPECIFICATIONS, LATEST REVISION.
6. EITHER ZINC-COATED D.I.P. OR PVC IS ACCEPTABLE FOR HYDRANT LATERAL PIPE MATERIAL.
7. BEDDING AND BACKFILL SHALL BE PLACED PER W&S SPECIFICATIONS
8. INSTALL TEST STATION AND TRACER WIRE ACCORDING TO WATER & SEWER SPECIFICATIONS AND W&S UTILITY LOCATING ("UL") STANDARD DETAILS, LATEST REVISION OF EACH.
9. HYDRANT DISTANCE FROM MAIN SHALL BE SUCH THAT THE MINIMUM FIRE FLOW PRESSURE MEETS WATER & SEWER DESIGN CRITERIA, LATEST REVISION. FOR AN INITIAL PRESSURE OF 40 PSI, A MINIMUM OF 20 PSI AVAILABLE DURING HYDRANT FLOW OF 1500 GPM, AND THE REQUIRED 6 INCH HYDRANT LATERAL, THE MAXIMUM DISTANCE A HYDRANT MAY BE FROM THE MAIN SHALL NOT EXCEED 150 FT UNLESS FURTHER HYDRAULIC ANALYSIS IS PERFORMED UNDER THE DIRECTION OF THE CITY OF GREELEY WATER & SEWER DEPT.

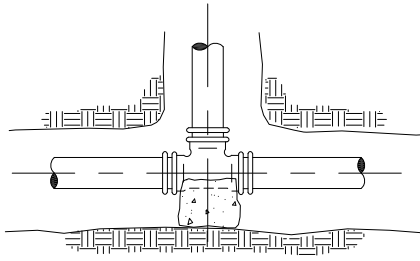


## FIRE HYDRANT ASSEMBLY

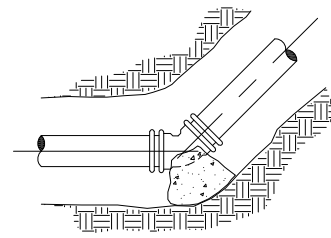
DETAIL NO. W-1

DATE: OCTOBER 2021

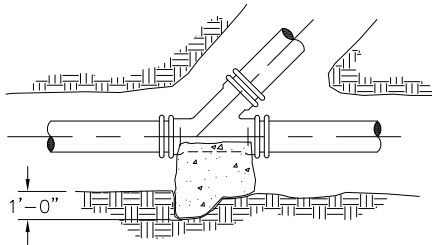
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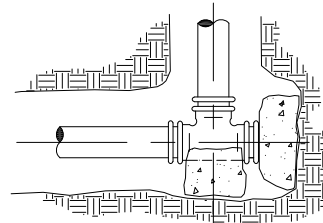
TEE



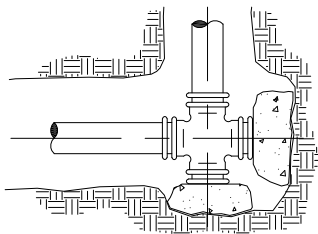
BEND—HORIZONTAL OR  
BOTTOM OF VERTICAL



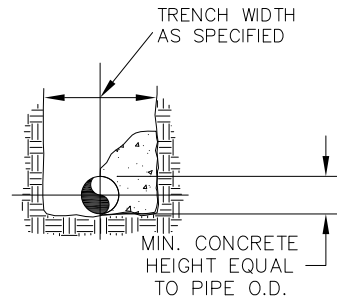
WYE



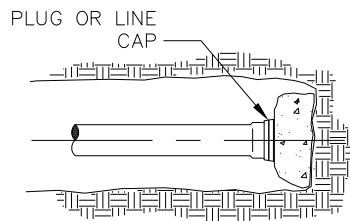
TEE W/DEAD END ON  
RUN



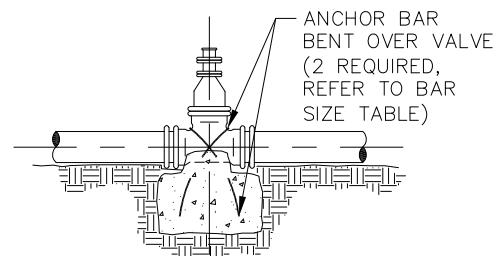
CROSS WITH DEAD END  
BRANCHES



SECTION (TYPICAL)



DEAD END



VALVE  
(GATE OR BUTTERFLY)

NOTES:

1. SEE TABLE ON SHEET 3 OF THRUST BLOCK DETAILS FOR MINIMUM AREA OF CONCRETE TO BEAR ON UNDISTURBED EARTH.
2. POLYETHYLENE BOND BREAKER SHALL BE INSTALLED BETWEEN ALL FITTINGS AND CONCRETE.

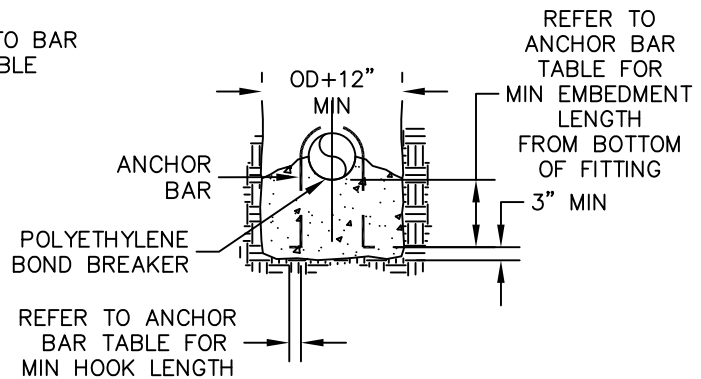
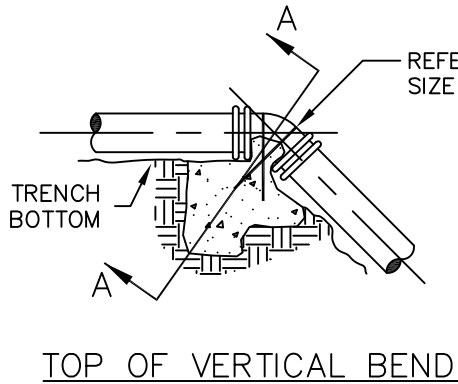


THRUST BLOCKS  
SHEET 1 OF 3

DETAIL NO. W-2

DATE: OCTOBER 2021

SCALE: N.T.S.



SECTION A-A

VOL. CONCRETE FOR 150 PSI  
TEST PRESSURE (CU FT)

PIPE SIZE	BENDS		
	45°	22 ½°	11 ¼°
6"	27.1	13.8	6.9
8"	48.1	24.5	12.3
12"	108.2	55.2	27.7
16"	192.4	98.1	49.3
20"	SPECIAL DESIGN REQUIRED		
24"			

FOR TEST PRESSURE GREATER THAN 150 PSI, ADJUST  
CONCRETE VOLUMES BY MULTIPLYING TABLE VALUES  
BY CORRECTION FACTOR "F"

$$F = \frac{\text{TEST PRESSURE}}{150}$$

ANCHOR BAR INFORMATION  
FOR 150 PSI TEST PRESSURE

PIPE SIZE	REBAR SIZE	MIN EMBEDMENT LENGTH	MIN HOOK LENGTH
6"	NO. 3	8"	5"
8"	NO. 4	11"	6"
10"	NO. 5	13"	8"
12"	NO. 6	16"	9"
16"	SPECIAL DESIGN REQUIRED		
20"			
24"			

NOTES:

1. SEE TABLE ON SHEET 3 OF  
THRUST BLOCK DETAILS FOR  
MINIMUM AREA OF CONCRETE TO  
BEAR ON UNDISTURBED EARTH.
2. POLYETHYLENE BOND BREAKER  
SHALL BE INSTALLED BETWEEN ALL  
FITTINGS AND CONCRETE.



THRUST BLOCKS  
SHEET 2 OF 3

DETAIL NO. W-3

DATE: OCTOBER 2021

SCALE: N.T.S.



THRUST BLOCK BEARING AREAS (SQ-FT) FOR INTERNAL STATIC  
PRESSURE OF 150 PSI AND SOIL BEARING CAPACITY OF 1000 PSF

DIAM (IN)	90° BEND	45° BEND	22½° BEND	11¼° BEND	DEAD ENDS, VALVES & TEES, PLUGGED CROSS BRANCHES
4	3.3	1.8	0.9	0.5	2.4
6	7.5	4.1	2.1	1.0	5.3
8	13.3	7.2	3.7	1.8	9.4
12	30.0	16.2	8.3	4.2	21.2
16	53.3	28.9	14.7	7.4	37.7
20	83.3	45.1	23.0	11.5	58.9
24	120.0	64.9	33.1	16.6	84.8

NOTES:

1. POLYETHYLENE BOND BREAKER SHALL BE INSTALLED BETWEEN ALL FITTINGS AND CONCRETE.
2. ALL THRUST BLOCKING SHALL BE CAST-IN-PLACE CONCRETE WITH A MINIMUM YIELD 28 DAY STRENGTH OF 2000 P.S.I.
3. THRUST BLOCKING SHALL BE CAST AGAINST UNDISTURBED SOIL. FORMS SHALL BE USED AS REQUIRED TO OBTAIN ADEQUATE BEARING AREA AND TO CONFINE THE CONCRETE. THRUST BLOCKING SHALL BEAR ON THE FITTING OR END CAP ONLY AND WILL NOT BE ALLOWED TO SPILL OVER THE JOINT OR AGAINST THE PIPE.
4. THE CITY MAY REQUIRE LARGER THRUST BLOCKS THAN SPECIFIED IF SOILS ARE DETERMINED TO PROVIDE LESS THAN 1000 PSF BEARING CAPACITY.
5. IN THE ABSENCE OF SOIL BEARING CAPACITY INFORMATION USE 1000 PSF.
6. BEARING AREAS FOR ANY PRESSURE AND SOIL BEARING CAPACITY MAY BE OBTAINED BY MULTIPLYING THE TABULATED BEARING AREAS BY A CORRECTION FACTOR "F":

$$F = \frac{(\text{ACTUAL SPECIFIED TEST PRESSURE IN PSI}) / (150 \text{ PSI})}{(\text{ACTUAL SOIL BEARING CAPACITY IN PSF}) / (1000 \text{ PSF})}$$

7. EXAMPLE: CALCULATE THE BEARING AREA FOR 8"-90° BEND WITH A STATIC INTERNAL PRESSURE OF 120 PSI AND SOIL BEARING CAPACITY OF 3000 PSF.

FROM TABLE BEARING AREA = 13.3 SF

$$F = \frac{(120 \text{ PSI}) / (150 \text{ PSI})}{(3000 \text{ PSF}) / (1000 \text{ PSF})} = 0.27$$

REQUIRED BEARING AREA ON UNDISTURBED SOIL = (0.27)(13.3 SF) = 3.5 SF

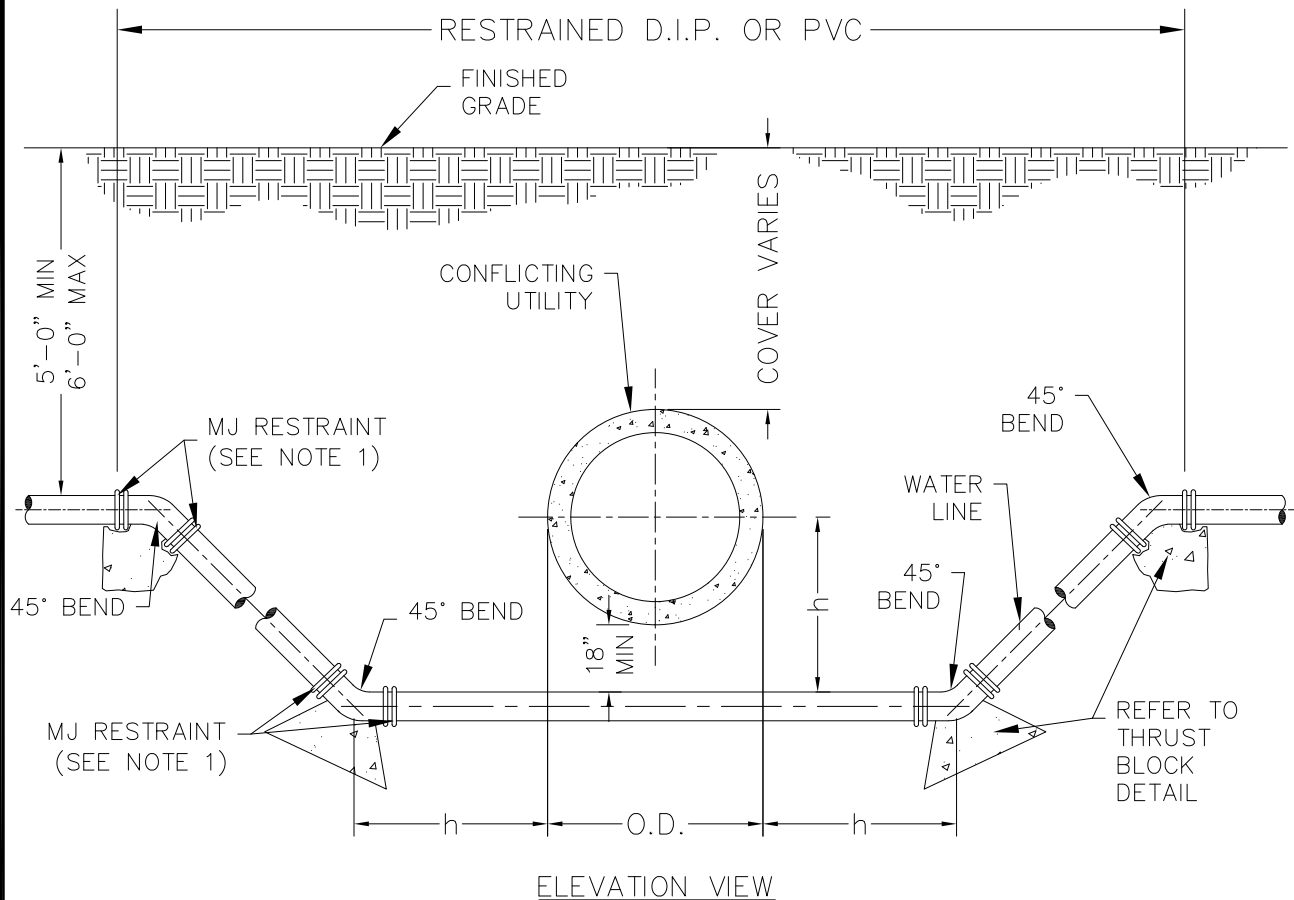


THRUST BLOCKS  
SHEET 3 OF 3

DETAIL NO. W-4

DATE: OCTOBER 2021

SCALE: N.T.S.



### NOTES:

1. ALL FOUR VERTICAL 45-BENDS SHALL BE RESTRAINED BY MECHANICAL JOINT RESTRAINTS AND THRUST BLOCKS PER THE LATEST REVISION OF W&S THRUST BLOCK DETAILS. ALL BURIED PIPE, FITTINGS, AND APPURTENANCES SHALL BE RESTRAINED AND INSTALLED PER W&S SPECIFICATIONS, LATEST REVISION.
2. ALL D.I.P. SHALL BE REQUIRED TO BE ZINC-COATED AND POLYWRAPPED ACCORDING TO THE WATER & SEWER SPECIFICATIONS, LATEST REVISION.
3. INSTALL TRACER WIRE ACCORDING TO WATER & SEWER SPECIFICATIONS AND STANDARD UTILITY LOCATING ("UL") DETAILS, LATEST REVISION OF EACH.
4. MINIMUM CLEARANCE FROM CONFLICTING UTILITY SHALL BE NO LESS THAN 18 INCHES AT THE NEAREST DIMENSION OR 5 FEET FROM THE CONFLICTING UTILITY CENTERLINE ("h" DIMENSION).
5. INSULATION BOARD ABOVE THE WATERLINE IS REQUIRED IF THE WATER LINE CROSSES WITHIN 4 FEET OF STORMWATER CROSSINGS OR OTHER OPEN-AIR CONDUITS. IN SUCH CASES, INSULATION BOARD SHALL EXTEND 5 FT HORIZONTALLY ON EITHER SIDE OF THE CROSSING CONDUIT. PLACEMENT SHALL BE IN ACCORDANCE WITH THE SEPARATE TRENCH CROSS SECTION DETAIL AND WATER & SEWER SPECIFICATIONS, LATEST REVISION OF EACH.

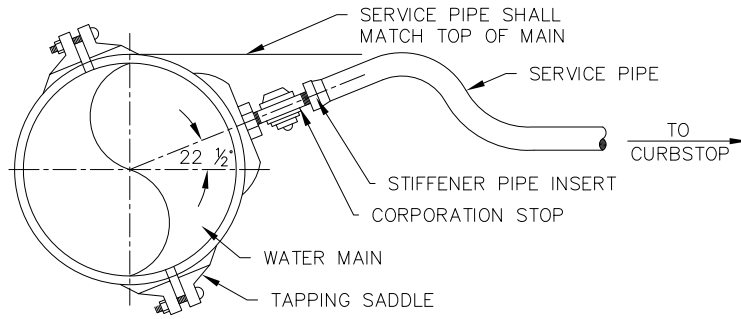


## WATER LINE LOWERING DETAIL W-5

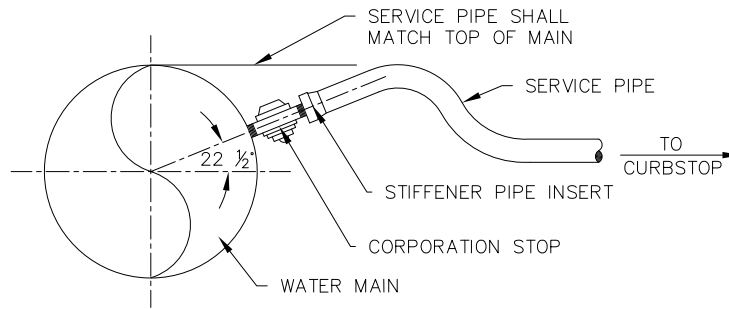
DATE: OCTOBER 2021

SCALE: N.T.S.

TAPPING  
SADDLE:



DIRECT TAP:



ELEVATION VIEW

TYPE OF PIPE AND SIZE OF TAP												
PIPE SIZE	CAST IRON					DUCTILE IRON					PVC C-900	
	3/4"	1"	1 1/2"	2"	3"&4"	3/4"	1"	1 1/2"	2"	3"&4"	< 2"	> 2"
4"	DT	S	NO	NO	TSV	S	S	NO	NO	TSV	S	TSV
6"	DT	DT	S	S	TSV	DT	S	S	S	TSV	S	TSV
8"	DT	DT	S	S	TSV	DT	DT	S	S	TSV	S	TSV
12"	DT	DT	S	S	TSV	DT	DT	S	S	TSV	S	TSV
16"	DT	DT	S	S	TSV	DT	DT	S	S	TSV	N/A	N/A

- "S" – TAPPING SADDLE REQUIRED, ALL SADDLES SHALL HAVE AWWA TAPER THREADS.  
 "DT" – DIRECT TAP ALLOWED.  
 "NO" – NO TAP PERMITTED WITH OR WITHOUT A SADDLE, A TEE CONNECTION MAY BE PERMITTED IF SPECIFICALLY AUTHORIZED BY THE WATER DEPARTMENT.  
 "TSV" – TAPPING SLEEVE AND VALVE REQUIRED.  
 "N/A" – NOT APPLICABLE.

NOTES:

1. REFERENCE CITY OF GREELEY, WATER AND SEWER CONSTRUCTION SPECIFICATIONS, LATEST REVISION, FOR TAPPING SADDLE SPECIFICATIONS.
2. EXISTING STEEL MAINS, TWELVE INCHES (12") IN DIAMETER OR LESS, SHALL BE TAPPED USING A CITY ACCEPTED TAPPING SADDLE.
3. ALL BURIED PIPE, FITTINGS, VALVES, AND APPURTENANCES SHALL BE RESTRAINED AND INSTALLED PER CITY OF GREELEY WATER & SEWER SPECIFICATIONS, LATEST REVISION.
4. INSTALL TRACER WIRE ACCORDING TO CITY OF GREELEY WATER & SEWER SPECIFICATIONS AND W&S UTILITY LOCATING ("UL") STANDARD DETAILS, LATEST REVISION OF EACH.
5. REFER TO CITY OF GREELEY WATER AND SEWER SPECIFICATIONS, LATEST REVISION, FOR PRODUCT AND MFR SPECIFICATIONS.
6. THIS DETAIL ALSO APPLIES TO NON-POTABLE IRRIGATION SERVICE CONNECTIONS TO NON-POTABLE IRRIGATION MAINS.
7. SERVICE TAPS ON WATER MAINS LARGER THAN 16" MAY BE CONSIDERED UNDER CERTAIN CIRCUMSTANCES WITH SPECIAL DESIGN ON A CASE-BY-CASE SCENARIO.



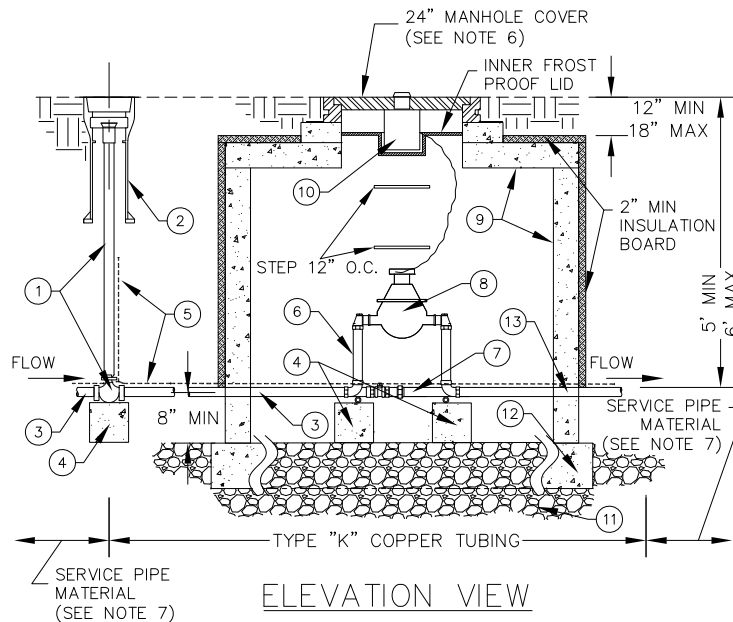
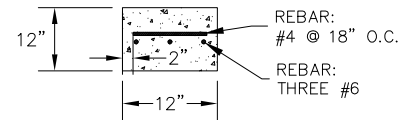
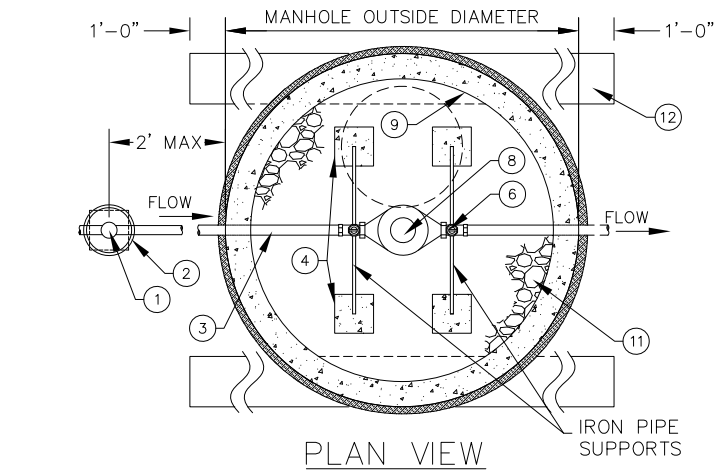
# WATER SERVICE CONNECTION

DETAIL NO. W-6

DATE: OCTOBER 2021

SCALE: N.T.S.





#### NOTES:

1. METER MUST BE PURCHASED FROM THE WATER & SEWER DEPARTMENT. NO EXCEPTIONS.
2. FOR PRODUCT AND MANUFACTURER SPECIFICATIONS, REFER TO CURRENT VERSION OF CITY OF GREELEY WATER & SEWER CONSTRUCTION SPECIFICATIONS.
3. REFER TO WATER & SEWER DETAIL W-15, LATEST REVISION, FOR ADDITIONAL METER INSTALLATION AND VAULT REQUIREMENTS.
4. ALL VAULTS SHALL MEET CITY OF GREELEY WATER & SEWER CONSTRUCTION SPECIFICATIONS, LATEST REVISION.
5. NO CONCRETE FLOOR SHALL BE POURED IN METER VAULT.
6. 24" MANHOLE COVER SHALL BE A BOLT DOWN LID MARKED "WATER" AND INCLUDE AN INNER FROST PROOF LID. REFER TO CITY OF GREELEY WATER & SEWER SPECIFICATIONS, LATEST REVISION, FOR SPECIFIC MANHOLE COVER MFR AND PRODUCT INFORMATION.
7. REFER TO CITY OF GREELEY WATER & SEWER DETAIL W-9 AND CONSTRUCTION SPECIFICATIONS, LATEST REVISION OF EACH, FOR CURB STOP, BOX, AND SERVICE PIPE REQUIREMENTS.
8. ALL BURIED PIPE, FITTINGS, VALVES, AND APPURTENANCES SHALL BE INSTALLED AND RESTRAINED IN ACCORDANCE WITH WATER & SEWER DEPARTMENT SPECIFICATIONS, LATEST REVISION.
9. INSTALL TRACER WIRE ACCORDING TO CITY OF GREELEY WATER & SEWER SPECIFICATIONS AND STANDARD DETAILS, LATEST REVISION.

#### LEGEND

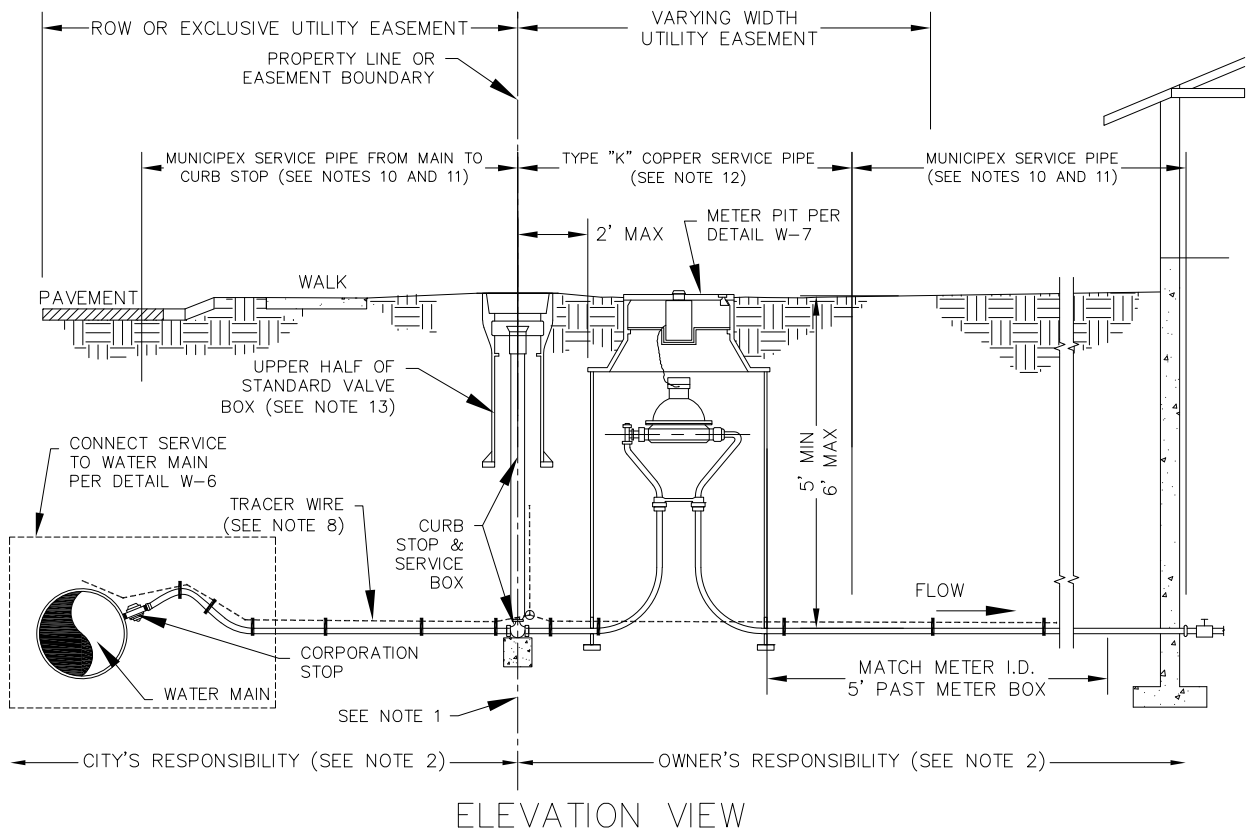
1	CURB STOP VALVE AND SERVICE BOX
2	UPPER HALF OF STANDARD VALVE BOX (INSTALLED PER SPECIFICATIONS)
3	1½" OR 2" SERVICE PIPE (MATCH SERVICE PIPE I.D.)
4	BRICK SUPPORT (PLACED ON UNDISTURBED SOIL OR 1½" STABILIZATION ROCK)
5	TRACER WIRE (SEE NOTE 9)
6	COPPER METER SETTER (MFR PER SPECIFICATIONS)
7	METER SETTER BYPASS
8	METER UNIT (ORDER FROM CITY OF GREELEY METER SHOP)
9	48" DIAMETER CONCRETE MANHOLE (SEE NOTE 4 FOR PRE-CAST)
10	RT UNIT
11	6" MIN OF SUBGRADE MATERIAL UNDER GRADE BEAM AND INSIDE VAULT PER SPECIFICATION
12	CONCRETE MANHOLE BASE BEAM (SEE BASE BEAM DETAIL)
13	APPROVED RUBBER SEAL ON PIPE BARREL AT WALL PENETRATION PER SPECIFICATION



## OUTSIDE SETTING FOR 1½" & 2" METER DETAIL W-8

DATE: OCTOBER 2021

SCALE: N.T.S.



## NOTES

1. PLACEMENT OF CURB STOP SERVICE BOX MAY VARY FROM A MAXIMUM OF  $\pm 1$  FOOT OF THE PROPERTY LINE. PLACEMENT OF CURB STOP BOX OUTSIDE THE PROPERTY LINE IS PREFERRED. ANY VARIANCE OF LOCATION OF CURB STOP MUST BE APPROVED PRIOR TO CONSTRUCTION.
2. WATER DEPARTMENT'S RESPONSIBILITY SHALL BE THE WATER MAIN, THE METER INSIDE THE METER PIT, THE CORPORATION STOP, AND SERVICE PIPING FROM THE WATER MAIN UP TO THE TUBE NUT ON THE STREET SIDE OF THE CURB STOP. OWNER'S RESPONSIBILITY SHALL INCLUDE THE METER PIT, AND EVERYTHING FROM THE STRUCTURE UP TO AND INCLUDING THE CURB STOP AND BOX, EXCEPT FOR THE METER ITSELF.
3. SHOULD ANY SITUATION ARISE OTHER THAN SHOWN CONCERNING THE DEPTH OR OBSTRUCTION OF SERVICE LINE OR THE PLACEMENT OF THE METER PIT OR STOP BOX, CALL (970) 350-9317 AND ASK FOR METER SERVICES DIVISION.
4. REFER TO WATER AND SEWER STANDARD DRAWINGS AND CONSTRUCTION SPECIFICATIONS FOR METER INSTALLATION REQUIREMENTS.
5. POTABLE WATER SERVICE METER PITS/ VAULTS SHALL BE LOCATED IN A LANDSCAPED AREA WITHIN 2 FEET OF THE CURB STOP ON OWNER'S PROPERTY. SEE DESIGN CRITERIA, LATEST REVISION, FOR METER PIT LOCATION.
6. CURB STOP IS TO BE MINNEAPOLIS PATTERN OR APPROVED EQUAL.
7. CURB STOP MUST BE INSTALLED WITH EITHER PLASTIC OR STAINLESS STEEL PIPE INSERTS TO ENSURE PROPER COMPRESSION FITTING ON MUNICIPEX PIPE.
8. INSTALL TRACER WIRE ACCORDING TO CITY OF GREELEY WATER & SEWER SPECIFICATIONS AND STANDARD DETAILS, LATEST REVISION.
9. ALL BURIED PIPE, FITTINGS, VALVES, AND APPURTENANCES SHALL BE INSTALLED AND RESTRAINED IN ACCORDANCE WITH WATER & SEWER SPECIFICATIONS, LATEST REVISION.
10. SERVICE PIPE INSTALLED FROM THE MAIN TO CURB STOP AND FROM 2 FT PAST THE METER PIT ON THE OWNER SIDE UP TO BUILDING SHALL BE MUNICIPEX OR APPROVED EQUAL ACCORDING TO BUILDING CODE. REFER TO WATER & SEWER CONSTRUCTION SPECIFICATIONS FOR APPROVED SERVICE PIPE PRODUCT AND MFR REQUIREMENTS.
11. SERVICE PIPE SHALL BE SIZED ACCORDING TO SERVICE TAP INSIDE DIAMETER AND MUST COMPLY WITH AWWA C904. SEE W&S DESIGN CRITERIA, LATEST REVISION.
12. TYPE "K" COPPER SHALL BE PLACED FROM THE CURB STOP, THROUGH THE METER PIT, AND UP TO 2 FEET PAST THE METER PIT ON CUSTOMER SIDE.
13. UPPER HALF OF STANDARD VALVE BOX SHALL BE PLACED OVER CURB STOP AND TRACER WIRE TEST STATION LOOP ACCORDING TO WATER AND SEWER SPECIFICATIONS, LATEST REVISION.



## POTABLE WATER SERVICE LINE, STOP BOX, & METER INSTALLATION

DETAIL W-9

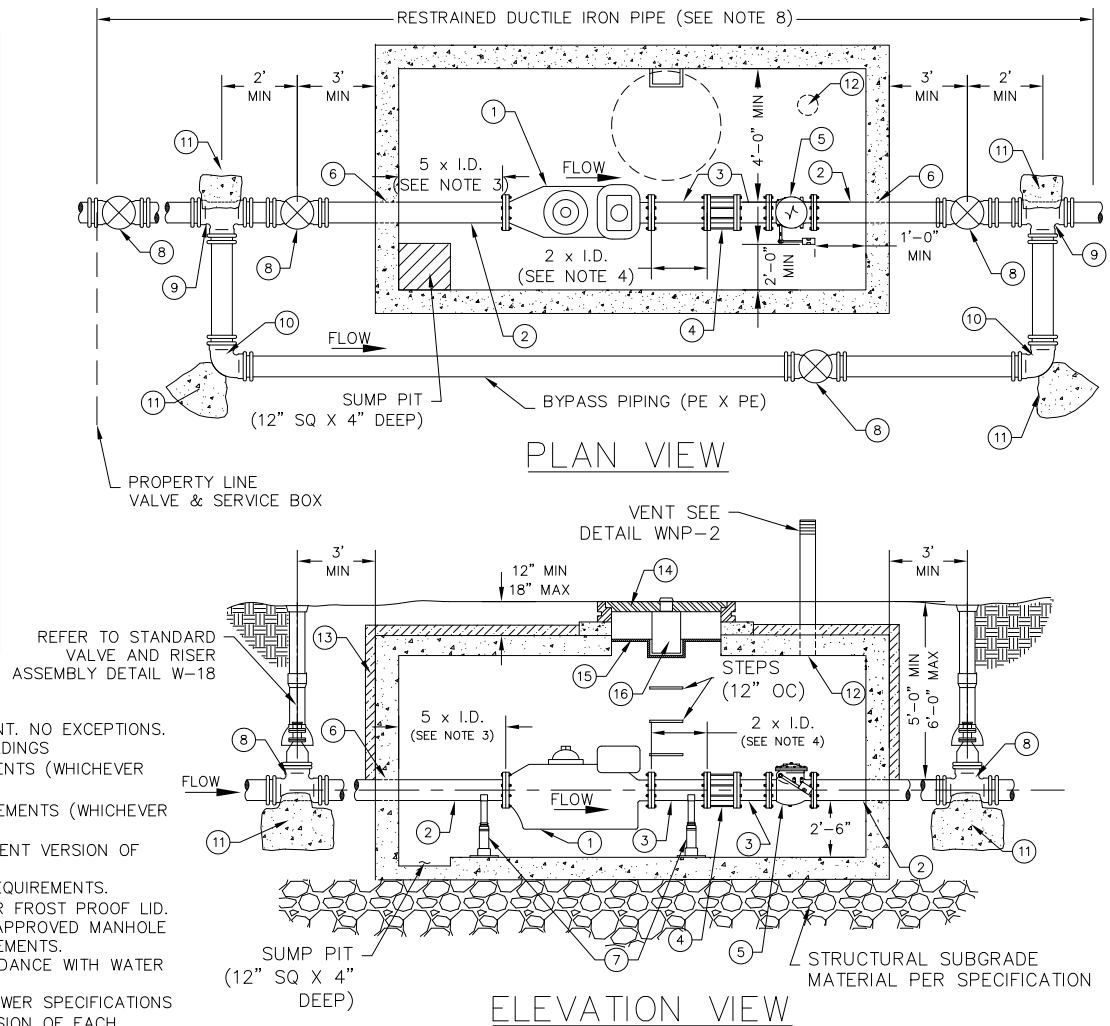
DATE: OCTOBER 2021

SCALE: N.T.S.

LEGEND	
1	METER (SEE NOTE 1)
2	FLG X PE SPOOL PIECE WITH WALL RING IN CENTER OF VAULT WALL
3	FLG x FLG SPOOL PIECE (SEE NOTES 3 & 4)
4	MECHANICAL COUPLER
5	SWING CHECK VALVE
6	APPROVED RUBBER SEAL ON PIPE BARREL AT WALL PENETRATION PER SPECIFICATION
7	ADJUSTABLE S.S. PIPE SUPPORT
8	GATE VALVE (MJ X MJ)
9	TEE (MJ X MJ)
10	ELBOW (MJ X MJ)
11	THRUST BLOCK
12	6" HOLE FOR VENT
13	2" MIN INSULATION BOARD
14	36" MANHOLE COVER (SEE NOTE 7)
15	INNER FROST PROOF LID
16	RT UNIT

#### NOTES:

1. METER MUST BE PURCHASED FROM THE WATER & SEWER DEPARTMENT. NO EXCEPTIONS.
2. VAULT AND MANHOLE COVER TO BE RATED FOR HS-20 TRAFFIC LOADINGS
3. UPSTREAM PIPE SPOOL LENGTH 5X PIPE I.D. OR PER MFR REQUIREMENTS (WHICHEVER YIELDS THE LONGER PIPE LENGTH).
4. DOWNSTREAM PIPE SPOOL LENGTH 2X PIPE I.D. OR PER MFR REQUIREMENTS (WHICHEVER YIELDS THE LONGER PIPE LENGTH).
5. FOR PRODUCT AND MANUFACTURER SPECIFICATIONS, REFER TO CURRENT VERSION OF CITY OF GREELEY WATER & SEWER CONSTRUCTION SPECIFICATIONS.
6. SEE DETAIL W-15 FOR ADDITIONAL METER & VAULT INSTALLATION REQUIREMENTS.
7. 36" VAULT COVER SHALL BE BOLT DOWN LID AND INCLUDE AN INNER FROST PROOF LID. REFER TO WATER & SEWER SPECIFICATIONS, LATEST REVISION, FOR APPROVED MANHOLE COVER MATERIALS, MANUFACTURERS, MARKINGS, AND OTHER REQUIREMENTS.
8. ALL BURIED PIPING SHALL BE INSTALLED AND RESTRAINED IN ACCORDANCE WITH WATER & SEWER DEPARTMENT SPECIFICATIONS.
9. INSTALL TRACER WIRE ACCORDING TO CITY OF GREELEY WATER & SEWER SPECIFICATIONS AND W&S UTILITY LOCATING ("UL") STANDARD DETAILS, LATEST REVISION OF EACH.



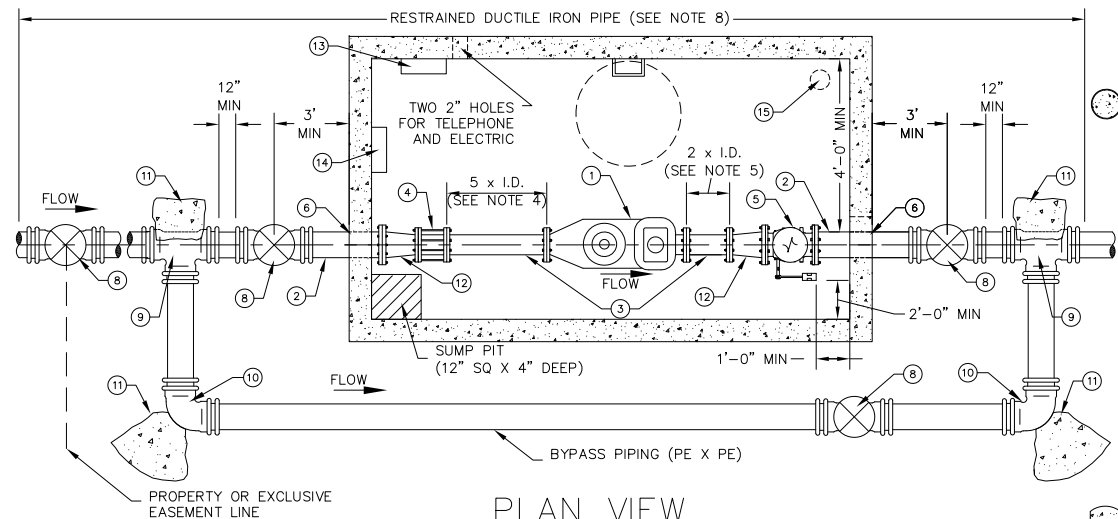
## TYPICAL SETTING FOR 3" AND 4" COMPOUND OR TURBINE SERVICE METER & VAULT

DETAIL W-10

DATE: OCTOBER 2021

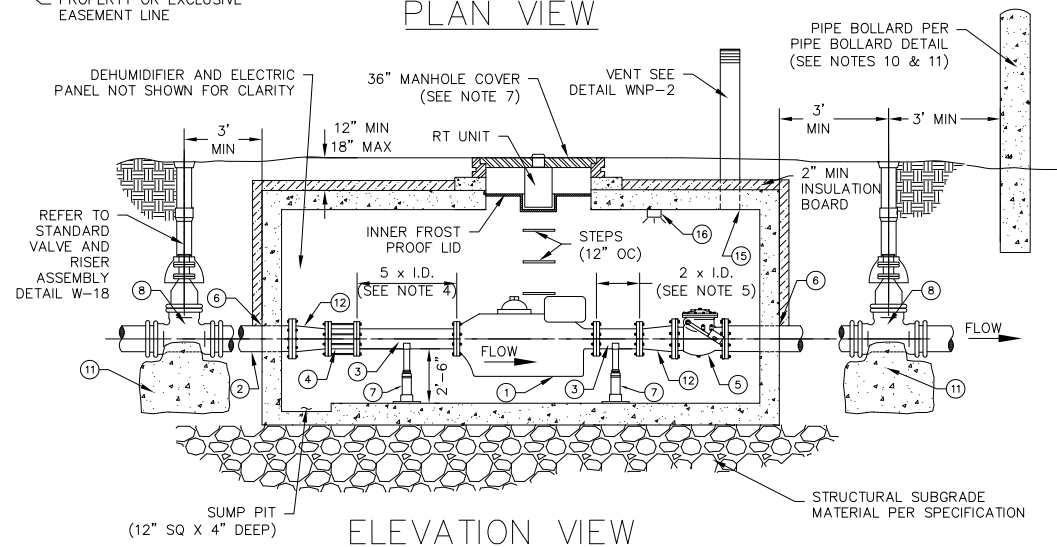
SCALE: N.T.S.

LEGEND	
1	MAG METER
2	FLG X PE SPOOL PIECE
3	FLG X FLG SPOOL PIECE
4	RESTRAINED MECHANICAL COUPLER
5	SWING CHECK VALVE
6	APPROVED RUBBER SEAL ON PIPE BARREL AT WALL PENETRATION PER SPECIFICATION
7	ADJUSTABLE S.S. PIPE SUPPORT
8	(MJ x MJ) GATE VALVE
9	MJ TEE
10	MJ ELBOW
11	THRUST BLOCK
12	CONCENTRIC REDUCER (AS REQUIRED)
13	ELECTRICAL PANEL
14	DEHUMIDIFIER
15	6" HOLE FOR VENT
16	LED LIGHT



#### NOTES:

- METER MUST BE PURCHASED FROM THE WATER & SEWER DEPARTMENT. NO EXCEPTIONS.
- SEE DETAIL W-15 FOR ADDITIONAL METER & VAULT INSTALLATION REQUIREMENTS.
- VAULT & MANHOLE COVER SHALL BE RATED FOR HS-20 TRAFFIC LOADINGS.
- UPSTREAM PIPE SPOOL LENGTH 5X PIPE I.D. OR PER MFR REQUIREMENTS (WHICHEVER YIELDS THE LONGER PIPE LENGTH).
- DOWNSTREAM PIPE SPOOL LENGTH 2X PIPE I.D. OR PER MFR REQUIREMENTS (WHICHEVER YIELDS THE LONGER PIPE LENGTH).
- FOR PRODUCT AND MANUFACTURER SPECIFICATIONS, REFER TO CURRENT VERSION OF CITY OF GREELEY WATER & SEWER CONSTRUCTION SPECIFICATIONS.
- 36" VAULT COVER SHALL BE A BOLT DOWN LID AND INCLUDE AN INNER FROST PROOF LID. REFER TO WATER & SEWER SPECIFICATIONS, LATEST REVISION, FOR APPROVED MANHOLE COVER MATERIALS, MANUFACTURERS, MARKINGS, AND OTHER REQUIREMENTS.
- ALL BURIED PIPING SHALL BE INSTALLED AND RESTRAINED IN ACCORDANCE WITH WATER & SEWER DEPARTMENT SPECIFICATIONS.
- INSTALL TRACER WIRE ACCORDING TO CITY OF GREELEY WATER & SEWER SPECIFICATIONS AND W&S UTILITY LOCATING ("UL") STANDARD DETAILS, LATEST REVISION OF EACH.
- PIPE BOLLARD MAY BE OMITTED AT THE CITY OF GREELEY WATER & SEWER DEPARTMENT'S DISCRETION.
- IF PIPE BOLLARD IS REQUIRED, BOLLARD SHALL BE INSTALLED IN ACCORDANCE WITH THE WATER & SEWER STANDARD DETAILS AND CONSTRUCTION SPECIFICATIONS, LATEST REVISION OF EACH.



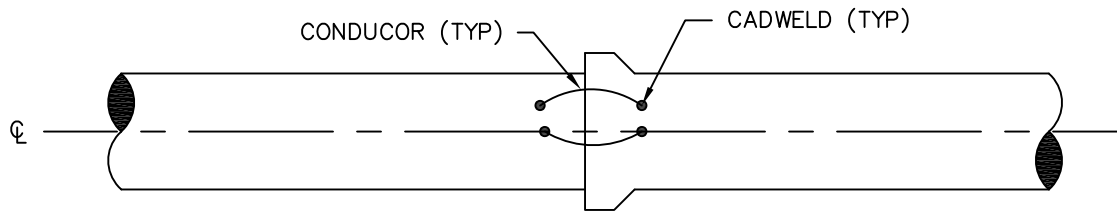
## TYPICAL SETTING FOR 6" AND LARGER ELECTROMAGNETIC (MAG) METER & VAULT

DETAIL W-11

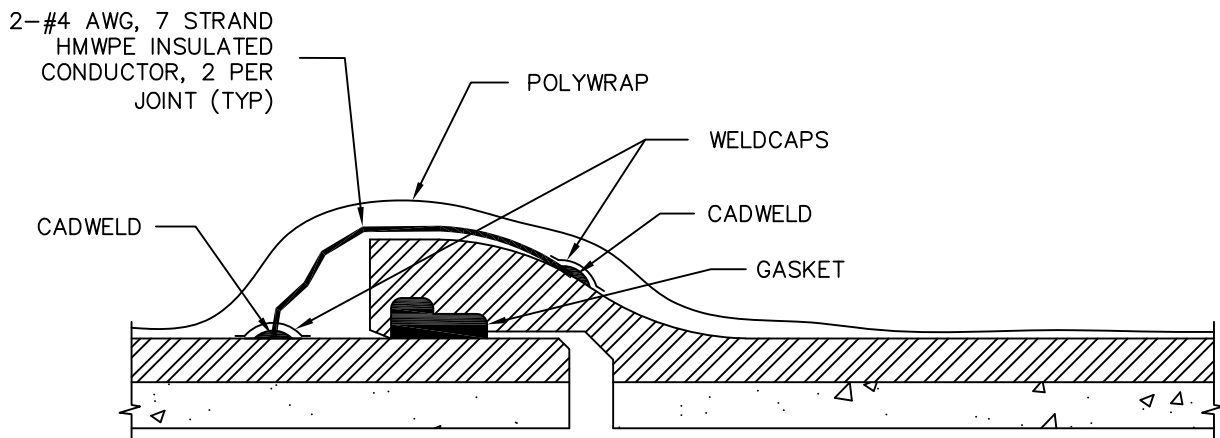
DATE: OCTOBER 2021

SCALE: N.T.S.





ELEVATION VIEW



CUTAWAY ELEVATION VIEW

NOTES:

1. CONDUCTOR WIRE SHALL BE RATED FOR DIRECT BURIAL, AND HAVE BOTH ENDS CAD WELDED TO THE PIPE OR BONDING STRAP BOLTED TO PIPE. WIRE SHALL HAVE A MINIMUM OF 2" SLACK.
2. JOINT BONDING SHALL ALSO APPLY TO RESTRAINED AND MECHANICAL JOINT PIPE AND FITTINGS.
3. CONSTRUCT CADWELD CONNECTIONS PER WATER & SEWER CONSTRUCTION SPECIFICATIONS AND DETAILS, LATEST REVISION.
4. ACCEPTABLE ALTERNATIVE TO ANODE CATHODIC PROTECTION IS ZINC COATED D.I.P.



DUCTILE IRON PIPE JOINT BONDING

DETAIL NO. W-12

DATE: OCTOBER 2021

SCALE: N.T.S.

GENERAL NOTES:

1. POLYETHYLENE (PE) WRAP MAY BE OMITTED WHEN ZINC COATED D.I.P. IS USED.
2. PE WRAP IS REQUIRED FOR ALL STANDARD (NON-ZINC) DUCTILE IRON PIPE, FITTINGS, AND APPURTENANCES.
3. PE WRAP SHALL BE INSTALLED IN ACCORDANCE WITH THE WATER & SEWER SPECIFICATIONS AND STANDARD DETAILS BELOW, LATEST REVISION OF EACH.
4. REPAIR ANY CUTS, TEARS, PUNCTURES, OR DAMAGE WITH ADHESIVE TAPE. TO PREVENT DAMAGE TO THE PE WRAP DURING BACKFILL, ALLOW ADEQUATE SLACK IN THE TUBE AT THE JOINT. AVOID DAMAGING THE TUBE WHEN USING TAMPING DEVICES.

PIPE-SHAPED APPURTENANCES:

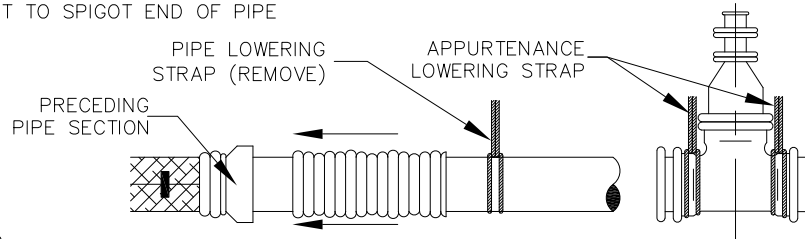
COVER BENDS, REDUCERS, OFFSETS, AND OTHER PIPE-SHAPED APPURTENANCES WITH PE IN SAME MANNER AS PIPE ON W&S DETAIL W-13B, LATEST REVISION.

ODD-SHAPED APPURTENANCES:

WHEN IT IS NOT PRACTICAL TO WRAP VALVES, FITTINGS, AND OTHER ODD-SHAPED PIECES IN TUBE, WRAP WITH FLAT SHEET OR SPLIT LENGTH OF PE TUBE IN THE FOLLOWING STEPS:

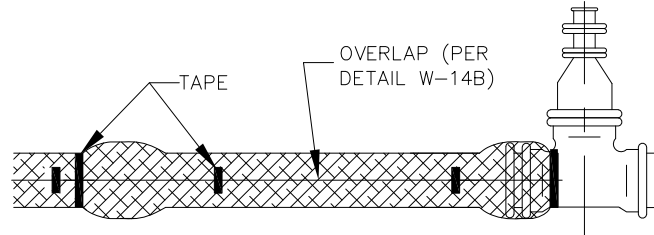
STEP 1

BEFORE CONNECTING THE APPURTENANCE TO THE SPIGOT END OF PIPE, INSTALL THE ADJACENT PIPE AND PE TUBE ACCORDING TO WATER & SEWER DETAIL W-13B, LATEST REVISION. BUNCH THE TUBE IN AN ACCORDIAN-FASHION TO EXPOSE THE SPIGOT END OF THE PIPE. THEN LOWER THE APPURTENANCE INTO THE TRENCH AND CONNECT TO SPIGOT END OF PIPE



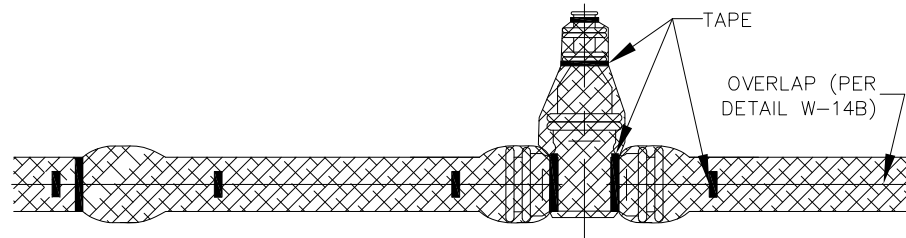
STEP 2

PULL THE PRECEDING AND ADJACENT PE TUBE OVER THE PIPE JOINTS ACCORDING TO STEPS 2 THROUGH 4 IN W-14B.



STEP 3

REPEAT STEP 2 WITH A NEW PIPE ON THE OTHER SIDE OF THE APPURTENANCE. THEN WRAP FLAT PE SHEET OR SPLIT LENGTH OF PE TUBE AROUND APPURTENANCE BY PASSING THE SHEET UNDER THE APPURTENANCE AND BRINGING IT UP AROUND BODY. MAKE SEAMS BY BRINGING EDGES TOGETHER, FOLDING OVER TWICE, AND TAPING DOWN. TAPE PE SECURELY IN PLACE AT VALVE STEM AND OTHER PENETRATIONS.



STEP 4

REPAIR ANY CUTS, TEARS, PUNCTURES, OR DAMAGE WITH ADHESIVE TAPE. TO PREVENT DAMAGE TO THE POLYETHYLENE WRAP DURING BACKFILL, ALLOW ADEQUATE SLACK IN THE TUBE AT THE JOINT. AVOID DAMAGING THE TUBE WHEN USING TAMPING DEVICES.



POLYETHYLENE WRAP INSTALLATION ON  
STANDARD DUCTILE IRON FITTINGS & GENERAL  
NOTES

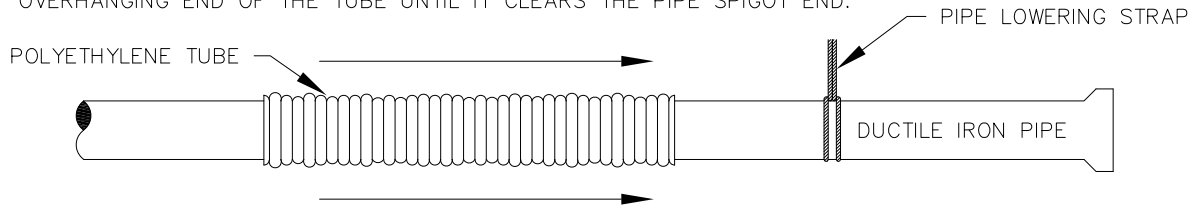
DETAIL NO. W-13A

DATE: OCTOBER 2021

SCALE: N.T.S.

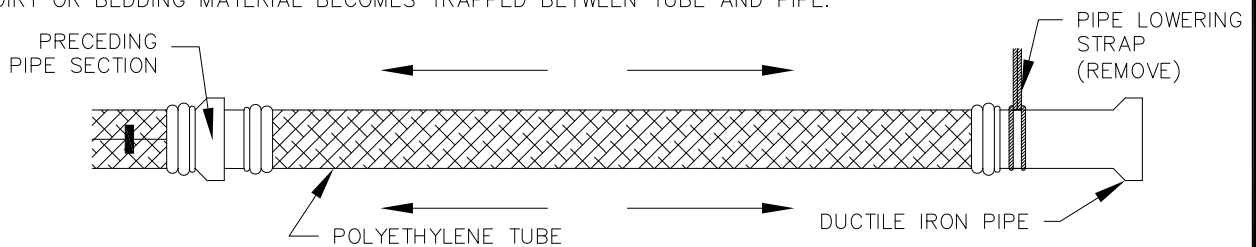
#### STEP 1

CUT A SECTION OF POLYETHYLENE (PE) TUBE APPROXIMATELY 2' LONGER THAN THE PIPE SECTION. REMOVE ALL DEBRIS FROM THE PIPE SURFACE. SLIP THE TUBE AROUND THE END OF THE PIPE, STARTING AT THE SPIGOT END. BUNCH THE TUBE ACCORDION-FASHION ON THE END OF THE PIPE. PULL BACK THE OVERHANGING END OF THE TUBE UNTIL IT CLEARS THE PIPE SPIGOT END.



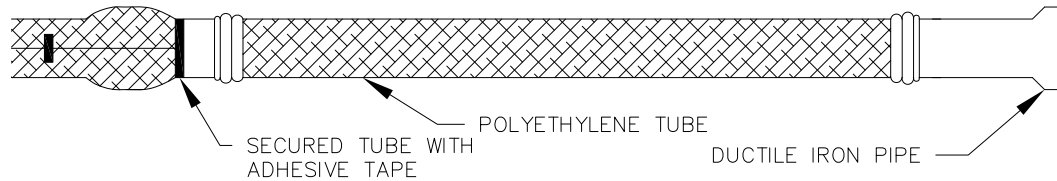
#### STEP 2

LOWER THE PIPE INTO THE TRENCH AND MAKE UP THE PIPE JOINT WITH THE PRECEDING SECTION OF PIPE. SPREAD THE TUBE OVER THE ENTIRE PIPE BARREL AND REMOVE THE PIPE LOWERING STRAP. MAKE SURE NO DIRT OR BEDDING MATERIAL BECOMES TRAPPED BETWEEN TUBE AND PIPE.



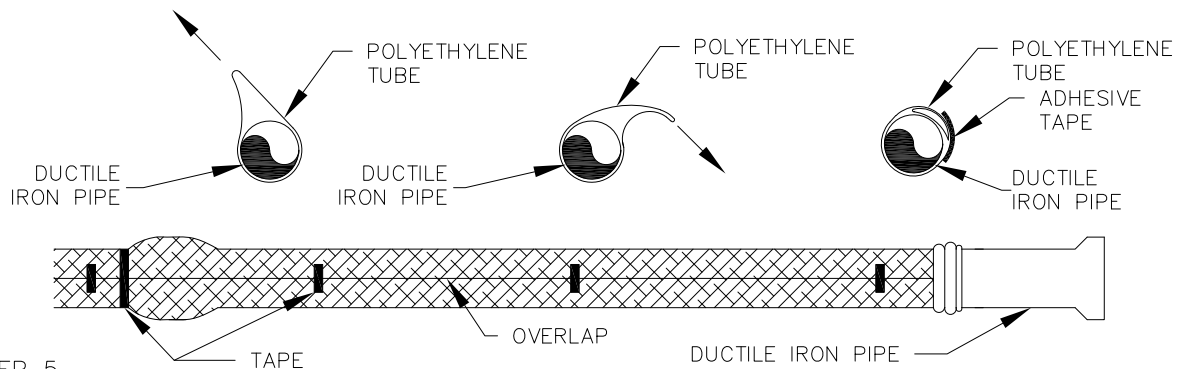
#### STEP 3

OVERLAP THE JOINT WITH THE TUBE FROM THE PRECEDING LENGTH OF PIPE AND SECURE IT INTO PLACE WITH THREE CIRCUMFERENTIAL TURNS OF 2" ADHESIVE TAPE.



#### STEP 4

OVERLAP THE SECURED TUBE END WITH THE TUBE END OF THE NEW PIPE SECTION AND SECURE THE NEW TUBE END IN PLACE WITH THE TAPING PROCEDURE IN STEP 3. TAKE UP THE SLACK IN THE TUBE ALONG THE BARREL OF THE PIPE TO MAKE A SNUG, BUT NOT TIGHT, FIT BY FOLDING THE EXCESS TUBE BACK OVER THE TOP OF THE PIPE. SECURE THE TUBE AT 3' TO 5' INTERVALS ALONG THE PIPE BARREL WITH ADHESIVE TAPE.



#### STEP 5

REPAIR ANY RIPS, TEARS, OR OTHER DAMAGE WITH ADHESIVE TAPE. CAREFULLY BACKFILL PIPE. TO PREVENT DAMAGE TO THE TUBE DURING BACKFILL, ALLOW ADEQUATE SLACK IN THE TUBE AT THE JOINT. AVOID DAMAGING THE TUBE WHEN USING TAMPING DEVICES.

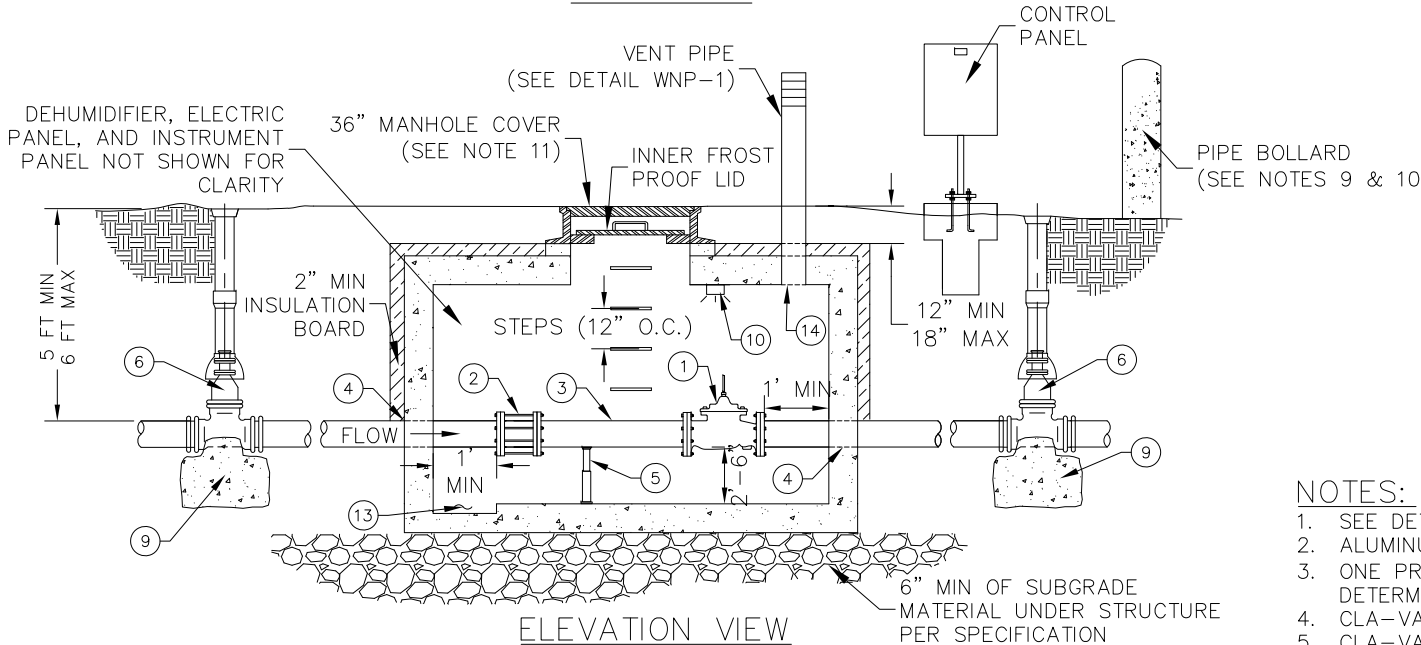
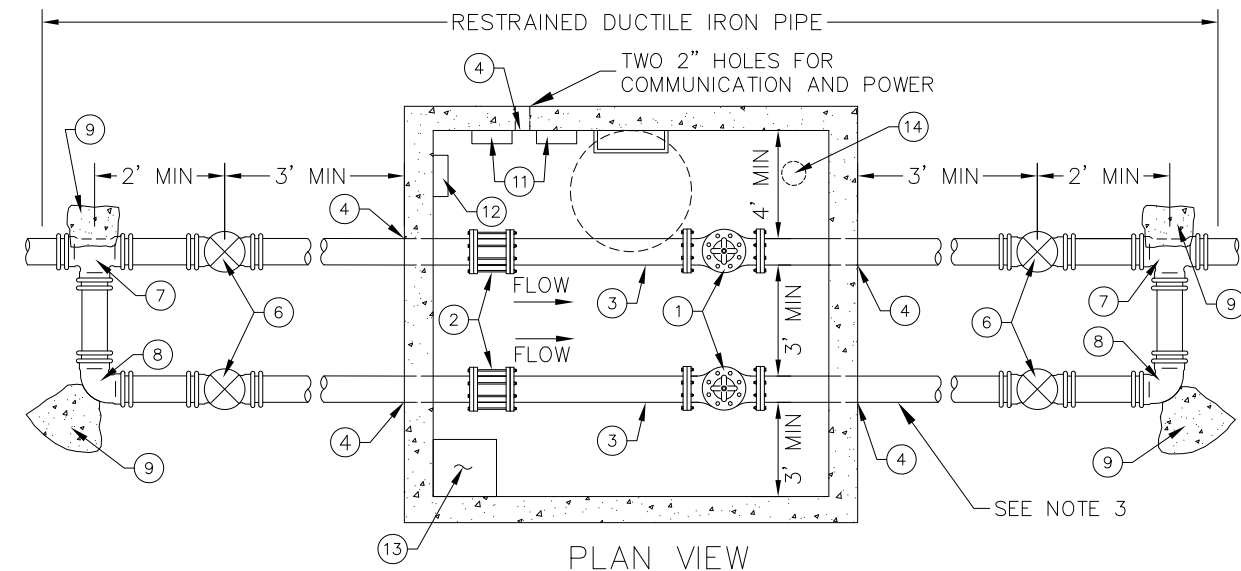


## POLYETHYLENE WRAP INSTALLATION ON STANDARD DUCTILE IRON PIPE

DETAIL NO. W-13B

DATE: OCTOBER 2021

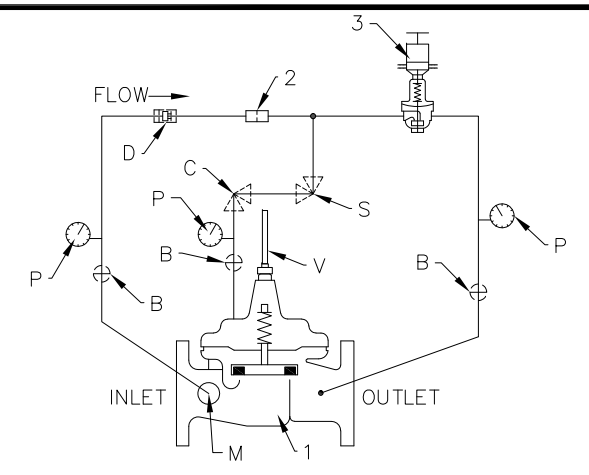
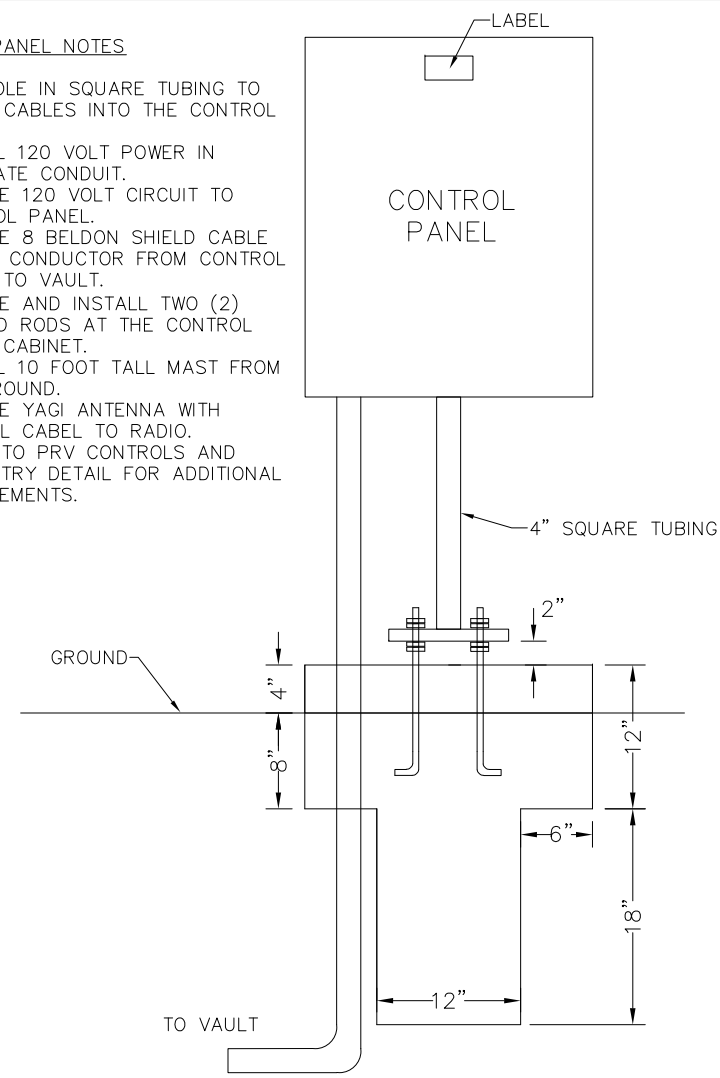
SCALE: N.T.S.



LEGEND	
1	CLA-VAL 390-01 PRV (MATCH PIPE SIZE)
2	RESTRAINED MECHANICAL COUPLER
3	SPOOL PIPE
4	APPROVED RUBBER SEAL PER SPECIFICATION
5	ADJUSTABLE STAINLESS STEEL PIPE STAND
6	GATE VALVE (MJ X MJ) AND RISER PER DETAIL W-18
7	TEE (MJ X MJ)
8	ELBOW (MJ X MJ)
9	THRUST BLOCK
10	LED LIGHT (NO MFR PREFERENCE)
11	ELECTRICAL JUNCTION BOXES (SEE CONTROLS DETAIL, W-14B)
12	DEHUMIDIFIER (NO MFR PREFERENCE)
13	SUMP PIT (12\"/>

**CONTROL PANEL NOTES**

1. CUT HOLE IN SQUARE TUBING TO ROUTE CABLES INTO THE CONTROL PANEL.
2. INSTALL 120 VOLT POWER IN SEPARATE CONDUIT.
3. PROVIDE 120 VOLT CIRCUIT TO CONTROL PANEL.
4. PROVIDE 8 BELDON SHIELD CABLE WITH 2 CONDUCTOR FROM CONTROL PANEL TO VAULT.
5. PROVIDE AND INSTALL TWO (2) GROUND RODS AT THE CONTROL PANEL CABINET.
6. INSTALL 10 FOOT TALL MAST FROM THE GROUND.
7. PROVIDE YAGI ANTENNA WITH COAXIAL CABLE TO RADIO.
8. REFER TO PRV CONTROLS AND TELEMETRY DETAIL FOR ADDITIONAL REQUIREMENTS.



**PRV COMPONENTS SCHEMATIC**

PRESSURE REDUCING VALVE COMPONENTS	
ITEM	DESCRIPTION
1	CLA-VAL MODEL 390-01 PRV (100-01 HYTROL MAIN VALVE, SEE NOTE 5)
2	X58C RESTRICTION FITTING
3	CRD ELECTRONIC PRESSURE REDUCING CONTROL (4-20 mA COMMAND SIGNAL)
B	CK2 ISOLATION VALVE
C	CV FLOW CONTROL (CLOSING)
D	CHECK VALVES ISOLATION VALVE
M	X144 E-FLOWMETER (SEE NOTE 4)
P	X141 PRESSURE GAUGE
S	CV FLOW CONTROL (OPENING)
V	X101 VALVE POSITION INDICATOR

**NOTES:**

1. SEE DETAIL W-15 FOR ADDITIONAL VAULT INSTALLATION REQUIREMENTS.
2. ALUMINUM VAULT AND MANHOLE COVER TO BE RATED FOR HS-20 TRAFFIC LOADINGS.
3. ONE PRV PER VAULT AND NO BYPASS SHOULD BE SUFFICIENT UNLESS DEEMED OTHERWISE. NUMBER OF PRV'S ARE TO BE DETERMINED BY THE CITY OF GREELEY WATER & SEWER DEPARTMENT.
4. CLA-VAL X144D E-FLOW METER OR APPROVED EQUAL.
5. CLA-VAL 100-01 HYTROL MAIN VALVE SHALL BE CONTROLLED BY ELECTRIC ACTUATOR WITH 4-20 MA CONTROL AND FEEDBACK.
6. ALL BURIED PIPE, VALVES, FITTINGS, AND APPURTENANCES SHALL BE INSTALLED IN ACCORDANCE WITH WATER & SEWER SPECIFICATIONS, LATEST REVISION.
7. ALL VAULT PIPE, VALVES, FITTINGS, AND APPURTENANCES LARGER THAN 3" SHALL BE FLANGED.
8. INSTALL TRACER WIRE ACCORDING TO CITY OF GREELEY WATER & SEWER SPECIFICATIONS AND STANDARD DETAILS, LATEST REVISION.
9. PIPE BOLLARD MAY BE OMITTED AT THE CITY OF GREELEY WATER & SEWER DEPARTMENT'S DISCRETION.
10. IF PIPE BOLLARD IS REQUIRED, BOLLARD SHALL BE INSTALLED IN ACCORDANCE WITH THE WATER & SEWER STANDARD DETAILS AND CONSTRUCTION SPECIFICATIONS, LATEST REVISION OF EACH.
11. 36" MANHOLE COVER SHALL BE A BOLT DOWN LID MARKED "WATER" AND INCLUDE AN INNER FROST PROOF LID. REFER TO CITY OF GREELEY WATER & SEWER SPECIFICATIONS, LATEST REVISION, FOR SPECIFIC MANHOLE COVER MFR AND PRODUCT INFORMATION.



**TYPICAL PRESSURE REDUCING VALVE AND VAULT**

DETAIL W-14A

DATE: OCTOBER 2021

SCALE: N.T.S.

NOTES:

1. INSTALL 12x12x6 JUNCTION BOX FOR SIGNAL WIRING. INSTALL TERMINAL BLOCKS FOR SPLICING.
2. INSTALL 12x12x6 JUNCTION BOX FOR 120 VOLT (20 AMP) CIRCUITS:

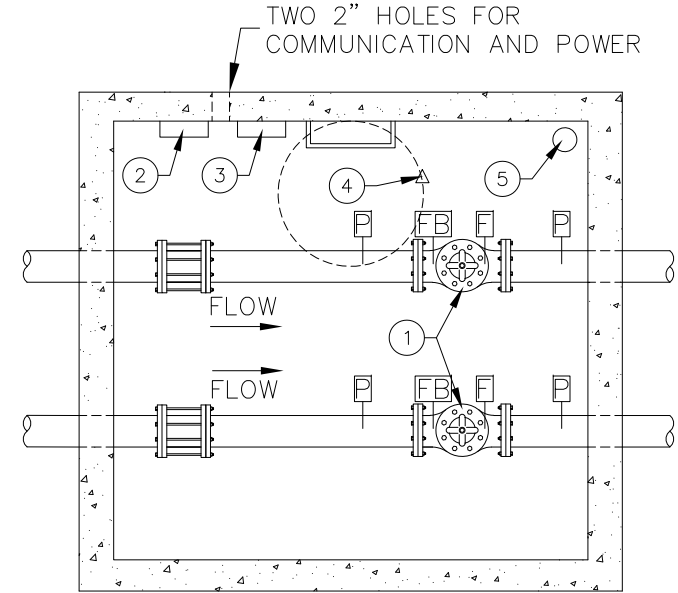
2.1. GENERAL OUTLETS

2.2. DEHUMIDIFIER

2.3. SUMP PUMP

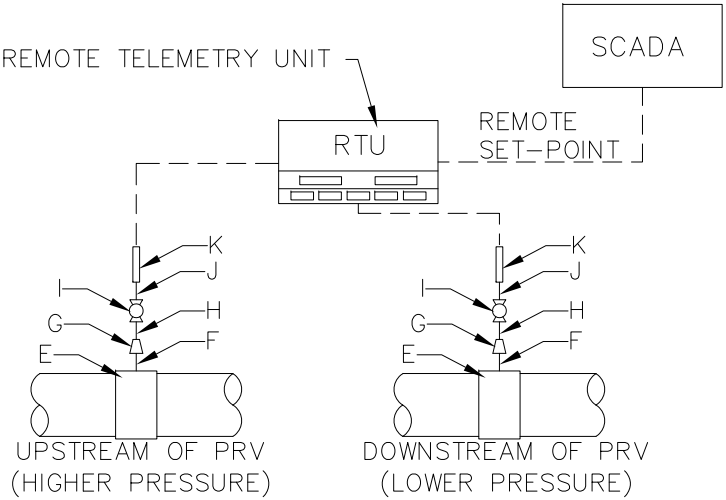
2.4. VAULT LIGHTING

2.5. CONTROL PANEL
3. INSTALL WIRING FOR TWO (2) PRESSURE SENSORS. REFER TO PRESSURE TRANSDUCER INSTALLATION DETAIL FOR MORE INFORMATION.
4. INSTALL WIRING FOR PRV MAIN VALVE
5. INSTALL WIRING FOR FLOW METER.
6. ALL RIGID CONDUIT IN VAULT MUST BE PVC SCHEDULE 80 OR APPROVED EQUAL.
7. PROVIDE AND INSTALL WIRING FOR 4-20MA FOR CONTROL.
8. INSTALL WIRING FOR 4-20MA FEEDBACK (FB) ON MAIN VALVE.
9. PROGRAM PRV OPEN AND CLOSE TO BE AUTOMATIC OR MANUALLY ADJUSTED FROM SCADA. FEEDBACK TO BE DISPLAYED ON SCADA.
10. INSTALL FLOOD ALARM AND WIRE BACK TO CONTROL PANEL.
11. INSTALL INTRUSION ALARM ON MANHOLE COVER.
12. PROVIDE AND INSTALL ALLEN BRADLEY PLC FOR CONTROLS. USE FIBER OR XETAWAVE RADIO TO COMMUNICATE BACK TO SCADA.
13. UNIK 5000F GE PRESSURE TRANSDUCER (MODEL#: PTX5032-TA-A2-CA-H0-PF) OR APPROVED EQUAL.



PLAN VIEW

LEGEND	
1	MAIN VALVE (SEE PRV VALVE & VAULT DETAIL, W-14A)
2	SIGNAL WIRING JUNCTION BOX (SEE NOTE 1)
3	120V JUNCTION BOX (SEE NOTE 2)
4	INTRUSION ALARM (SEE NOTE 11)
5	FLOOD ALARM (SEE NOTE 10)
F	X144 E-FLOWMETER (SEE PRV & VAULT DETAIL)
FB	FEEDBACK & SIGNAL
P	PRESSURE TRANSDUCER



PRESSURE TRANSDUCER INSTALLATION

PRESSURE TRANSDUCER COMPONENTS	
ITEM	DESCRIPTION
E	3/4" BRONZE SADDLE
F	3/4" X 2" NIPPLE
G	3/4" X 1/4" BRASS REDUCER
H	1/4" X 2" NIPPLE
I	1/4" BALL VALVE
J	1/4" X 2" NIPPLE
K	UNIK 5000 PRESSURE TRANSDUCER (SEE NOTE 13)

PLC INPUT AND OUTPUTS		
FUNCTION	INPUT/OUTPUT	PIN
	DI - 0	0
	DI - 1	1
	DO - 0	2
	DO - 1	3
	AI - 0	4
	AI - 1	5
	AI - 2	6
	AI - 3	7
		8
		9
		10
		11
		12
		13
		14
		15
		16
		17

- INT. ALARM
- FLOOD ALARM
- PRV OPEN
- PRV CLOSED
- INLET PRESSURE
- OUTLET PRESSURE
- FLOW METER
- PRV FEEDBACK



TYPICAL PRESSURE REDUCING VALVE CONTROLS AND TELEMETRY

DETAIL W-14B

DATE: OCTOBER 2021

SCALE: N.T.S.

TYPICAL VAULT NOTES:

- 1. ALL METER, VALVE, AND VAULT COMPONENTS AND PRODUCT SPECIFICATIONS SHALL BE IN ACCORDANCE WITH APPROVED CONSTRUCTION DRAWINGS ALONG WITH W & S DEPARTMENT SPECIFICATIONS, LATEST REVISION.
- 2. PIPING CONFIGURATION IS GENERAL AND INDICATES MINIMUM REQUIREMENTS. CONTRACTOR TO PROVIDE ADDITIONAL PIPING, COUPLINGS, REDUCERS, AND ACCESSORIES AS NECESSARY FOR A COMPLETE SYSTEM. VAULT MODIFICATIONS MAY BE REQUIRED FOR A COMPLETE SYSTEM.
- 3. METER OR PRV COMPONENTS, INSTRUMENTATION, AND ELECTRICAL SHALL BE INSTALLED PER MANUFACTURER’S RECOMMENDATIONS.
- 4. CONTRACTOR TO SUBMIT VAULT MANUFACTURER’S SHOP DRAWINGS TO ENGINEERING DEVELOPMENT REVIEW FOR ACCEPTANCE A MINIMUM OF 2 WEEKS PRIOR TO ORDER AND INSTALLATION.
- 5. APPROPRIATE LENGTH OF STRAIGHT PIPE SEGMENTS UPSTREAM AND DOWNSTREAM OF METER OR VALVE SHALL BE PROVIDED PER THE METER/VALVE MANUFACTURER’S RECOMMENDATION.
- 6. FOR INSTALLATIONS LARGER THAN 2”, ALL PIPING AND APPURTENANCES WITHIN THE VAULT SHALL BE FLANGED DIP. ALL OTHER EXTERIOR PIPING AND APPURTENANCES, BETWEEN AND INCLUDING THE EXTERIOR TEES AND VALVES, SHALL BE MECHANICAL RESTRAINED JOINT DIP.
- 7. ALL VAULT JOINTS SHALL BE WATER TIGHT.
- 8. ALL EQUIPMENT AND PIPING SHALL BE ADEQUATELY SUPPORTED AND ATTACHED TO THE VAULT WALL USING STAINLESS STEEL FASTENERS AND BOLTS OR APPROVED EQUIVALENT.
- 9. VAULT COVERS SHALL BE APPROVED MANHOLE COVERS, MARKED “WATER” OR “IRRIGATION” AS REQUIRED, AND INCLUDE AN INNER FROST PROOF LID. REFER TO WATER & SEWER SPECIFICATIONS, LATEST REVISION, FOR APPROVED VAULT COVER MATERIALS AND MANUFACTURERS.
- 10. FOR VAULTS PERMITTED IN ROAD RIGHT-OF-WAY, VAULT AND RING/COVER SHALL BE RATED FOR HS-20 TRAFFIC LOADING.
- 11. VAULT LADDER SHALL HAVE OSHA-APPROVED EXTENSION POST INSTALLED IF VAULT FLOOR IS GREATER THAN 5 FEET BELOW VAULT COVER.
- 12. VAULT EXTERIOR SHALL BE COVERED WITH 2” THICK INSULATION BOARD. VAULTS CONTAINING LINES DRAINED PRIOR TO FREEZING TEMPERATURES ARE EXEMPT FROM THIS REQUIREMENT.
- 13. IF SURFACE IS NOT TO FINAL GRADE AT TIME OF METER INSTALLATION OR GRADE CHANGES AFTER INSTALLATION, OWNER MUST ADJUST PIT OF VAULT MANHOLE COVER TO MEET SPECIFICATIONS.
- 14. SLOPE FINAL GROUND SURFACE AWAY FROM PIT VAULT COVER AT A 2% MINIMUM GRADE.
- 15. SUBGRADE AND SOIL SURROUNDING VAULT SHALL BE BACKFILLED AND COMPACTED IN ACCORDANCE WITH WATER & SEWER SPECIFICATIONS, LATEST REVISION.
- 16. MANHOLE BASEBEAMS ARE REQUIRED FOR ALL MANHOLE VAULT INSTALLATIONS.
- 17. ALL PIPING TO BE PRESSURE TESTED PER W & S SPECIFICATIONS, LATEST REVISION.
- 18. ALL THREADED CONNECTIONS SHALL HAVE TEFLON TAPE OR APPROVED EQUIVALENT TO ENSURE NO LEAKING OCCURS.
- 19. COPPER SHALL NOT SHOW ANY VISIBLE SIGNS OF CRIMPING.

VAULT ELECTRICAL SPECIFICATIONS:

- 1. PROVIDE 100 AMP 240/120 VOLT METER LOAD CENTER COMBINATION WITH A MINIMUM 12 SPACES, LOCATED WITHIN 25’ OF VAULT.
- 2. PROVIDE 1 ¼” CONDUIT, SCHEDULE 80, FROM LOAD CENTER TO JUNCTION OR PULL BOX IN VAULT.
- 3. JUNCTION OR PULL BOX SHALL HAVE 12”X12X8” MINIMUM PANEL LOCATED INSIDE VAULT FOR EXTRA CIRCUIT CONDUIT CONNECTIONS.
- 4. PROVIDE FIVE 20-AMP BREAKERS FOR LOAD CENTER.
- 5. PROVIDE OUTLET FOR SUMP PUMP AND DEHUMIDIFIER, 20-AMP 120 VOLT CIRCUIT.
- 6. PROVIDE LED LIGHTING CIRCUIT: TWO 10-WATT LED LIGHTS WITH OUTDOOR SWITCH LOCATED IN VAULT ON 20-AMP 120 VOLT CIRCUIT.
- 7. PROVIDE ONE 20-AMP GFI OUTLET FOR SERVICE WORK LOCATED INSIDE VAULT.
- 8. ALL CONDUIT BOXES, FITTINGS, AND HANGERS SHALL BE PVC, FIBERGLASS, OR STAINLESS STEEL AND SUITABLE FOR OUTDOOR USE.
- 9. PROVIDE DISCONNECT LOCATED BEFORE METER COMBINATION AS REQUIRED PER ELECTRIC UTILITY IF APPLICABLE.
- 10. PROVIDE 2” SCHEDULE 80 PVC CONDUITS FROM POLE TO TRANSFORMER TO LOAD CENTER.
- 11. PROVIDE 240 VOLT SURGE PROTECTION FOR LOAD CENTER.
- 12. MUST MEET ALL CITY OF GREELEY AND STATE ELECTRICAL CODE REQUIREMENTS.

DEHUMIDIFIER SPECIFICATIONS:

- 1. DEHUMIDIFIER SHALL BE A LOW TEMP 38 DEGREES OR LOWER AND BE INSTALLED TO MANUFACTURER SPECIFICATIONS.
- 2. DEHUMIDIFIER SHALL BE INSTALLED A MINIMUM 2’ FROM THE VAULT FLOOR.
- 3. A MINIMUM ½” HOSE SHALL BE INSTALLED FROM DEHUMIDIFIER TO THE SUMP PIT.

METER INSTALLATION NOTES:

- 1. METER SETTING MUST BE INSPECTED BEFORE BACKFILLING. FOR INSPECTION CALL (970) 350-9317.
- 2. NO SPRINKLER SYSTEM CONNECTION SHALL BE MADE IN THE VAULT. SPRINKLER PIT SHALL BE MINIMUM 5’ DOWNSTREAM FROM THE FINAL VAULT APPURTENANCE (BYPASS TEE).
- 3. NO MAJOR LANDSCAPING OR STRUCTURES SHALL BE LOCATED WITHIN 10’ OF METER VAULT.
- 4. PRESSURE REDUCING AND BACKFLOW DEVICES SHALL BE INSTALLED INSIDE THE BUILDING SERVED. INSTALL PER CITY OF GREELEY ADOPTED BUILDING CODE.
- 5. REFER TO W & S SPECIFICATIONS, LATEST REVISION, FOR PRODUCT SPECIFICATIONS.
- 6. LOCATION OF METER VAULT SHALL NOT BE MORE THAN 2 FEET DOWNSTREAM OF CURBSTOP UNLESS OTHERWISE PLACED BY METER SERVICES.

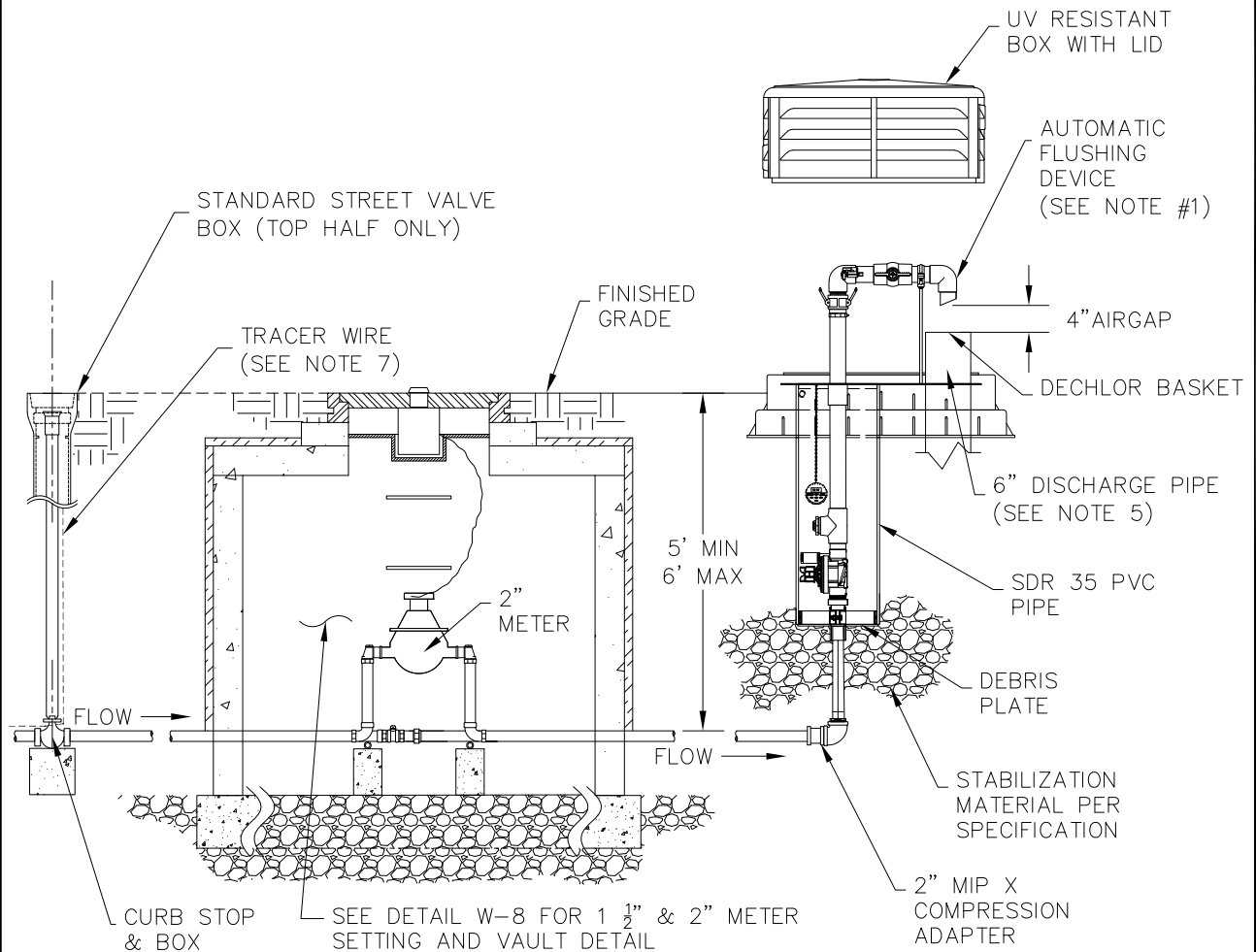


TYPICAL VAULT NOTES

DETAIL W-15

DATE: OCTOBER 2021

SCALE: N.T.S.



## NOTES:

1. FLUSHING DEVICE SHALL BE KUPFERLE #9800 FLUSHING STATION OR APPROVED EQUAL.
2. FLUSHING DEVICE SHALL BE INSTALLED PER MFR REQUIREMENTS.
3. REFER TO WATER & SEWER DETAIL W-8, LATEST REVISION, FOR METER INSTALLATION AND LOCATION REQUIREMENTS.
4. FLUSH LINES FREE OF DEBRIS BEFORE INSTALLATION
5. CITY MAY REQUIRE INSTALLATION OF STORMWATER LINE UP TO DISCHARGE POINT.
6. ALL BURIED PIPING SHALL BE INSTALLED AND RESTRAINED IN ACCORDANCE WITH WATER & SEWER SPECIFICATIONS, LATEST REVISION.
7. INSTALL TRACER WIRE ACCORDING TO WATER & SEWER SPECIFICATIONS AND STANDARD DETAILS, LATEST REVISION.
8. ALL PIPING SHALL BE 2 INCHES.



## AUTOMATIC FLUSHING STATION WITH METER DETAIL W-16

DATE: OCTOBER 2021

SCALE: N.T.S.

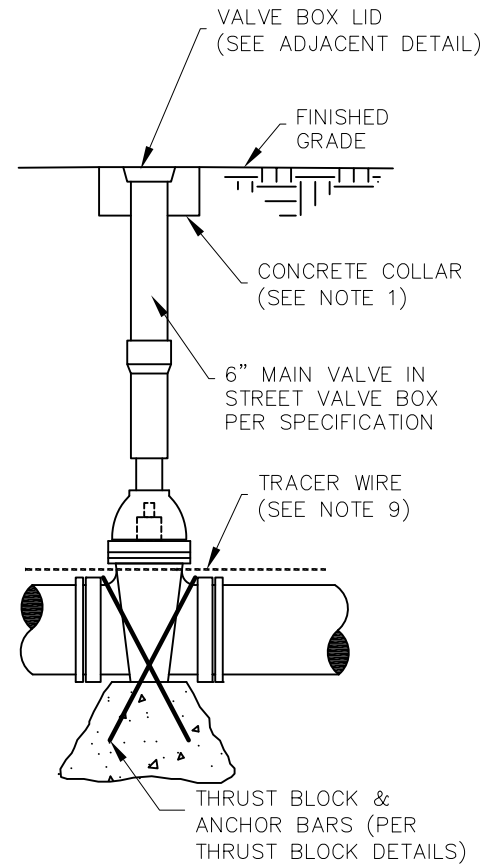
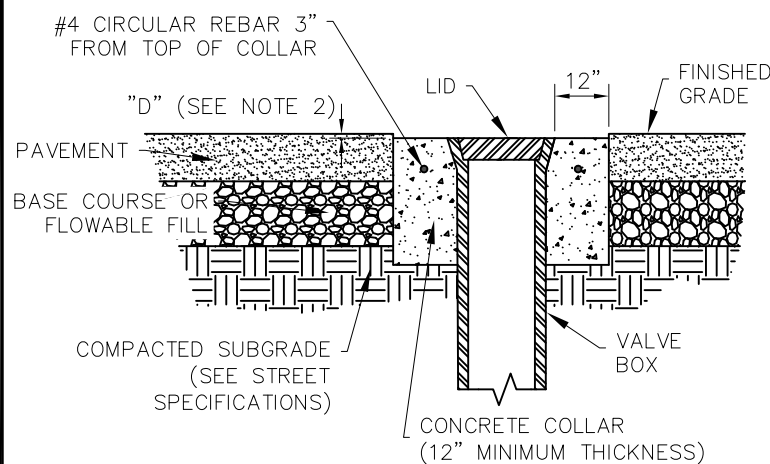
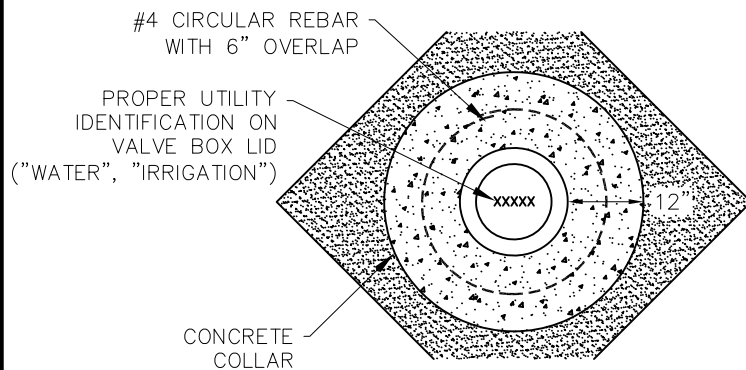
1. MINIMUM DEPTH OF BURY 5' – 6' FROM FINISHED GRADE TO TOP OF PIPE.
2. PROVIDE POLYETHYLENE BOND BREAKER BETWEEN ALL PIPE FITTINGS AND POURED CONCRETE.
3. ALL PIPE CONNECTIONS OUTSIDE OF BUILDING FOOTPRINT SHALL BE RESTRAINED ACCORDING TO CITY OF GREELEY WATER & SEWER SPECIFICATIONS, LATEST REVISION.
4. ALL PIPE CONNECTIONS INSIDE BUILDING FOOTPRINT SHALL BE RESTRAINED & INSTALLED ACCORDING TO CITY OF GREELEY ADOPTED BUILDING CODE, LATEST REVISION.



DETAIL W-17

SCALE: N.T.S.





## NOTES:

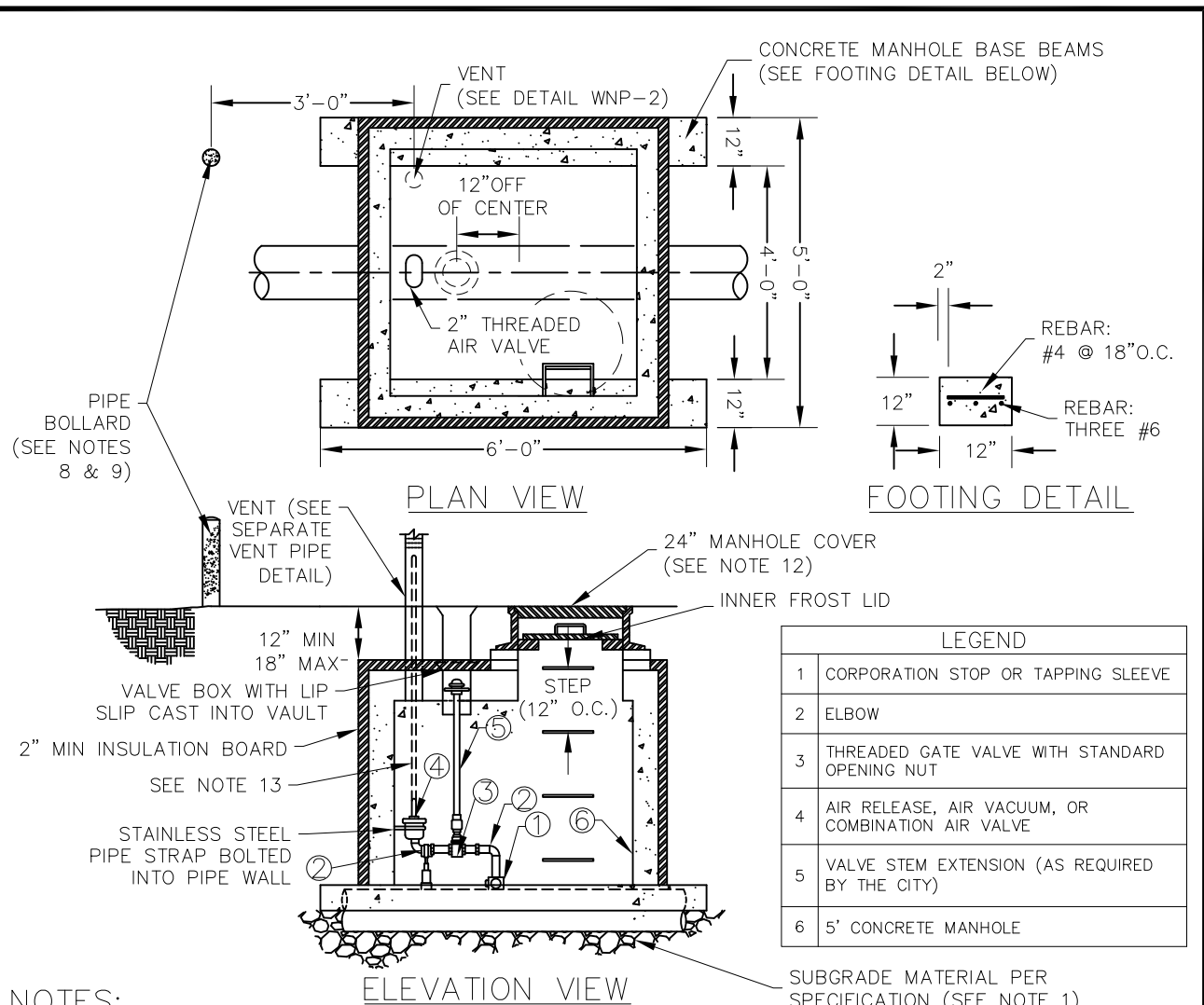
1. VALVE BOX SHALL BE PLACED IN A CONCRETE COLLAR AT THE SURFACE FOR STABILIZATION. REFER TO STREETS STANDARD DETAILS, LATEST REVISION, FOR VALVE BOXES LOCATED IN PUBLIC STREETS AND ROADWAYS.
2. "D" = 1/4" FOR HOT MIX ASPHALT PAVEMENT OVERLAYS, SURFACE TREATMENTS, PAVEMENT RECONSTRUCTION, NEW CONSTRUCTION, AND CONCRETE STREETS.
3. VALVE BOX SHALL BE CENTERED & PLUMB OVER THE OPERATING NUT.
4. OPERATING NUT ON BURIED VALVES SHALL BE BETWEEN 4' & 6' BELOW FINISHED GRADE. EXTENSION REQUIRED IF DEEPER THAN 6' TO BRING THE OPERATING NUT TO THE SPECIFIED RANGE.
5. PROVIDE POLYETHYLENE BOND BREAKER BETWEEN ALL PIPE/FITTINGS AND POURED CONCRETE.
6. ALL BURIED VALVES, FITTINGS, AND APPURTENANCES SHALL BE RESTRAINED AND INSTALLED PER W&S SPECIFICATIONS, LATEST REVISION.
7. ALL BURIED VALVES TO BE INSTALLED ACCORDING TO W&S THRUST BLOCK DETAILS AND SPECIFICATIONS, LATEST REVISION OF EACH.
8. BEDDING AND BACKFILL AROUND VALVE SHALL BE PLACED PER W&S SPECIFICATIONS, LATEST REVISION.
9. INSTALL TEST STATION AND TRACER WIRE ACCORDING TO WATER & SEWER SPECIFICATIONS AND W&S UTILITY LOCATING ("UL") STANDARD DETAILS, LATEST REVISION OF EACH.
10. UNLESS OTHERWISE SPECIFIED, THIS DETAIL ALSO APPLIES TO BOTH POTABLE WATER AND NON-POTABLE IRRIGATION STANDARD VALVES.



## STANDARD VALVE AND RISER ASSEMBLY DETAIL NO. W-18

DATE: OCTOBER 2021

SCALE: N.T.S.



#### NOTES:

1. PLACE 6 INCHES OF SUBGRADE MATERIAL IN THE BOTTOM OF THE MANHOLE TO THE CROWN OF PIPE ONLY. REFER TO WATER & SEWER SPECIFICATIONS, LATEST REVISION, FOR MATERIAL GRADATION.
2. VALVE TYPE AND SIZE SHALL BE SPECIFIED BY THE DESIGN ENGINEER AND APPROVED BY THE CITY.
3. INSTALL AIR RELEASE, AIR/VACUUM, AND COMBINATION AIR VALVES IN ACCORDANCE WITH MFR SPECIFICATIONS.
4. ALL SUPPORT MATERIALS SHALL BE GIVEN 2 COATS OF RUST INHIBITIVE PAINT.
5. TOP FOOTER TO BE 6" HIGHER THAN TOP OF PIPE.
6. VAULT AND MANHOLE COVER TO BE RATED FOR HS-20 TRAFFIC LOADINGS.
7. SEE WATER & SEWER CONSTRUCTION SPECIFICATIONS AND DETAIL W-15, LATEST REVISION, FOR ADDITIONAL RELEVANT VAULT INSTALLATION REQUIREMENTS.
8. PIPE BOLLARD MAY BE OMITTED AT THE CITY OF GREELEY WATER & SEWER DEPARTMENT'S DISCRETION.
9. IF PIPE BOLLARD IS REQUIRED, BOLLARD SHALL BE INSTALLED IN ACCORDANCE WITH THE WATER & SEWER STANDARD DETAILS AND CONSTRUCTION SPECIFICATIONS, LATEST REVISION OF EACH.
10. INSTALL TRACER WIRE ALONG MAIN ACCORDING TO WATER & SEWER SPECIFICATIONS AND W&S UTILITY LOCATING ("UL") STANDARD DETAILS, LATEST REVISION OF EACH.
11. PIPE SHALL BE INSTALLED ACCORDING TO WATER & SEWER SPECIFICATIONS, LATEST REVISION.
12. 24" MANHOLE COVER SHALL BE A BOLT DOWN LID MARKED WITH THE APPROPRIATE UTILITY. REFER TO CITY OF GREELEY WATER & SEWER SPECIFICATIONS, LATEST REVISION, FOR SPECIFIC MANHOLE COVER MFR AND PRODUCT INFORMATION.
13. FOR AIR VACUUM VALVE VAULTS IN REGIONS OF FREQUENT INUNDATION, AIR VALVE INTAKE SHALL BE WATER TIGHT AND PIPED TO THE SURFACE INSIDE THE VENT PIPE WITH 3 INCH SCHEDULE 80 PVC.



## AIR RELEASE/VACUUM, & COMBINATION AIR VALVE & VAULT

DETAIL WNP-1

DATE: OCTOBER 2021

SCALE: N.T.S.



NOTES:

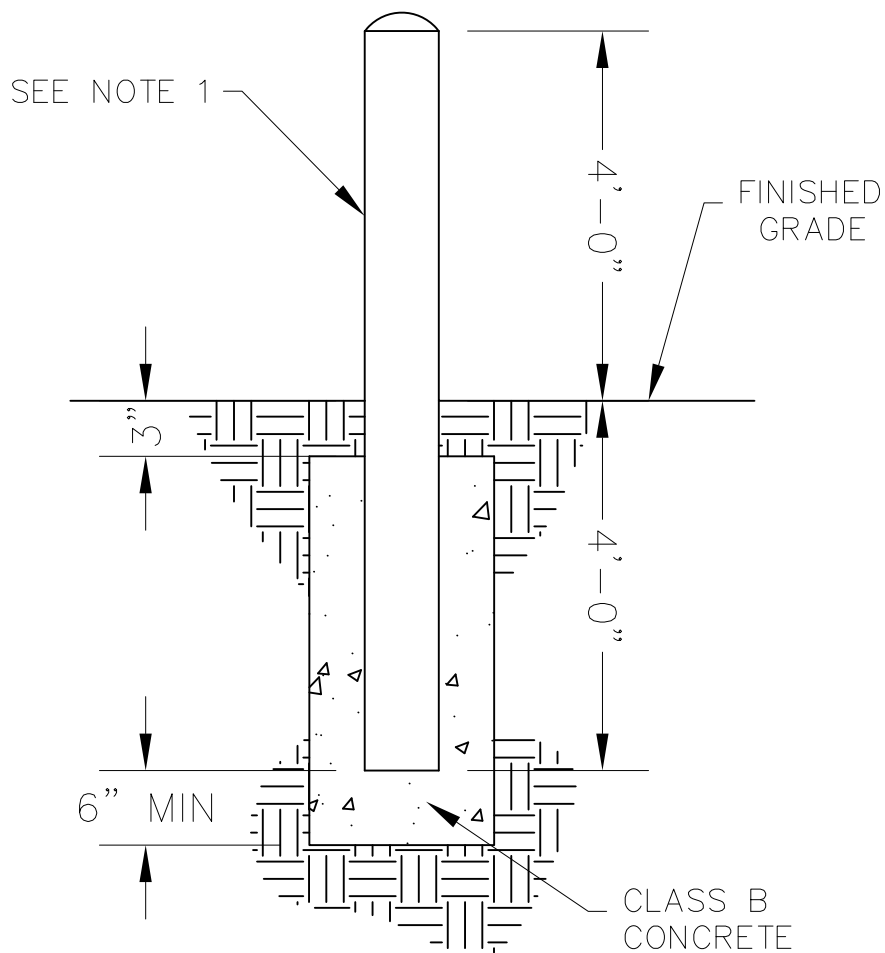
1. REFER TO CONCRETE STANDARD SPECIFICATIONS
2. VENT PIPE SHALL BE MANUFACTURED BY CUSTOM METAL MFG OR APPROVED EQUAL.
3. VENT PIPES SHALL BE PRIMED AND COATED ACCORDING TO THE APWA UNIFORM COLOR CODE FOR FOR THE CORRESPONDING UTILITY:
  - 3.A. POTABLE WATER: SHERWIN-WILLIAMS SAFETY BLUE NO. SW4086 OR APPROVED EQUAL
  - 3.B. NON-POTABLE IRRIGATION: SHERWIN-WILLIAMS SAFETY PURPLE NO. SW 4080 OR APPROVED EQUAL.
4. 4" DIAMETER AIR VENT TO BE PVC SCHEDULE 40 WITH GLUED JOINTS BELOW GRADE.
5. WHEN SITE CONDITIONS PREVENT INSTALLING VENT IN ROOF OF VAULT AND PER WATER & SEWER DEPARTMENT'S DIRECTION, 4" SCH 40 PVC MAY PENETRATE VAULT WALL AND RUN HORIZONTAL BEFORE BENDING VERTICAL AT AN ACCEPTABLE LOCATION FOR THE ROUND VENT SCREEN.
6. PER WATER & SEWER DEPARTMENT'S DIRECTION, A 6" MINIMUM CONCRETE-FILLED BOLLARD MAY BE REQUIRED 3 FT FROM VENT PIPE (REFER TO SEPARATE PIPE BOLLARD DETAIL, LATEST REVISION, FOR ADDITIONAL REQUIREMENTS).



VAULT & AIR/VAC VENT PIPE  
DETAIL WNP-2

DATE: OCTOBER 2021

SCALE: N.T.S.



## NOTES

1. PROVIDE A 6" MIN SCHEDULE 40 STL. PIPE BOLLARD FILLED WITH CONCRETE WITH ROUNDED TOP, PAINT SAFETY YELLOW.
2. BOLLARD SHALL BE PLACED AT MINIMUM 3'-0" FROM VALVE BOXES, VAULTS, AND CONCRETE STRUCTURES.
3. THE CITY OF GREELEY RESERVES THE RIGHT TO DETERMINE WHERE AND WHEN A PIPE BOLLARD MAY BE REQUIRED OR OMITTED.

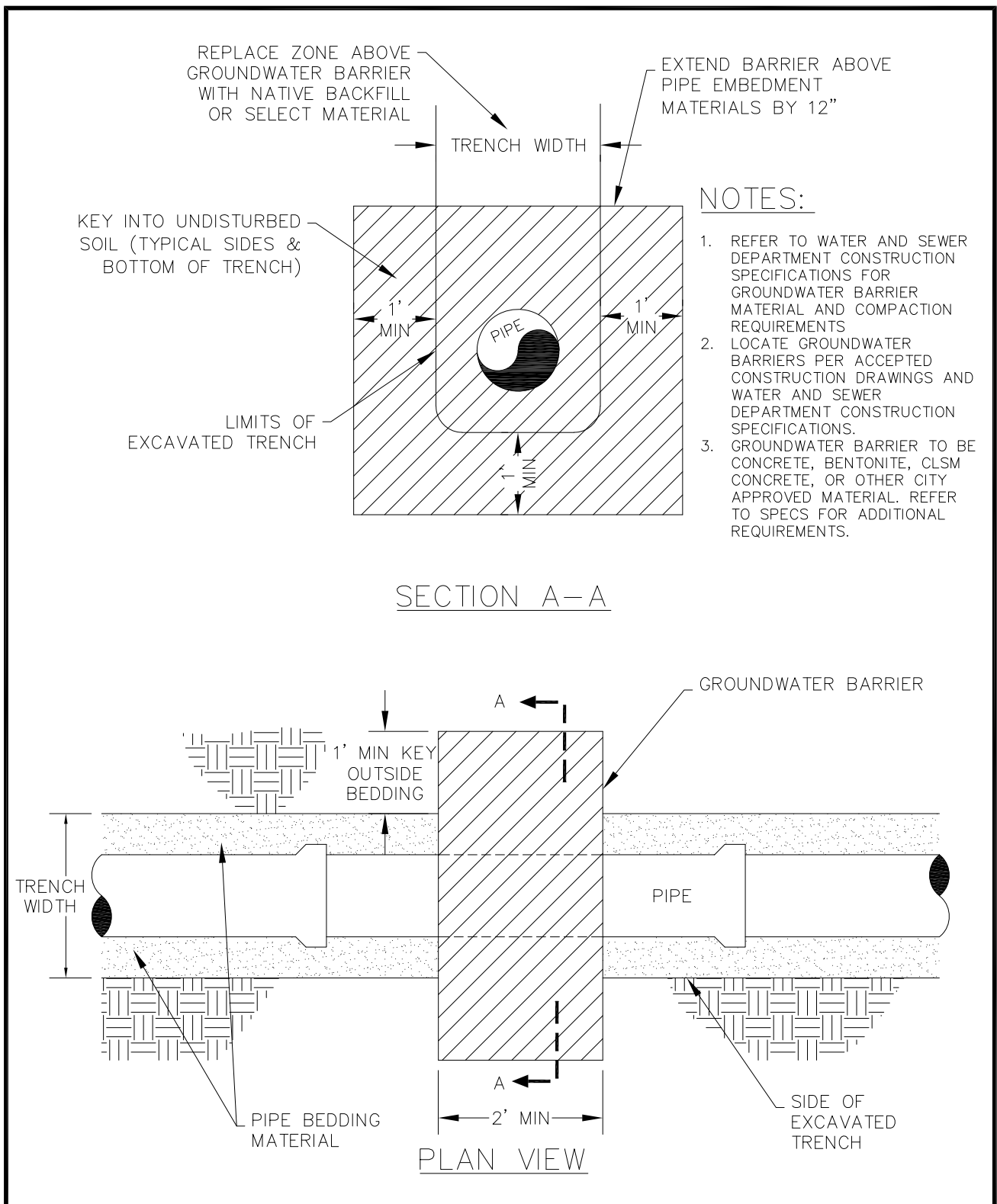


(TYP) CONCRETE PIPE BOLLARD

DETAIL WNP-3

DATE: OCTOBER 2021

SCALE: N.T.S.



### NOTES:

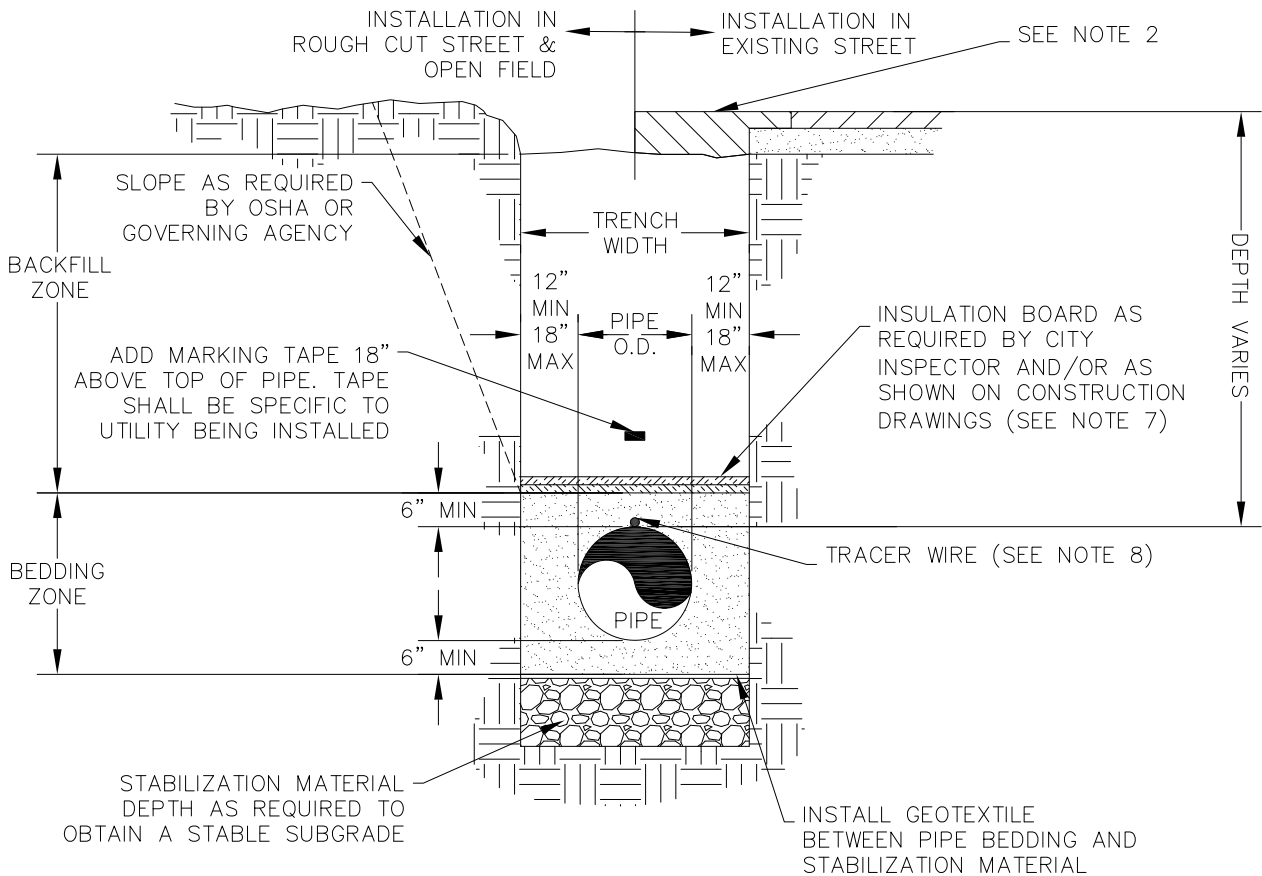
1. REFER TO WATER AND SEWER DEPARTMENT CONSTRUCTION SPECIFICATIONS FOR GROUNDWATER BARRIER MATERIAL AND COMPACTION REQUIREMENTS
2. LOCATE GROUNDWATER BARRIERS PER ACCEPTED CONSTRUCTION DRAWINGS AND WATER AND SEWER DEPARTMENT CONSTRUCTION SPECIFICATIONS.
3. GROUNDWATER BARRIER TO BE CONCRETE, BENTONITE, CLSM CONCRETE, OR OTHER CITY APPROVED MATERIAL. REFER TO SPECS FOR ADDITIONAL REQUIREMENTS.



## GROUNDWATER BARRIER DETAIL WS-1

DATE: OCTOBER 2021

SCALE: N.T.S.



## NOTES:

1. REFER TO WATER AND SEWER DEPARTMENT CONSTRUCTION SPECIFICATIONS FOR STABILIZATION, GEOTEXTILE, BEDDING, BACKFILL MATERIAL, COMPACTION, AND MARKING TAPE REQUIREMENTS. FOR ANY CONFLICT BETWEEN WATER AND SEWER AND PUBLIC WORKS BACKFILL MATERIAL SPECIFICATIONS AND COMPACTION REQUIREMENTS, THE MORE STRINGENT SPECIFICATION SHALL APPLY.
2. REFER TO STREETS DETAIL S-31 "EXISTING STREET PAVEMENT PATCH DETAIL FOR ASPHALT & CONCRETE", CURRENT VERSION, FOR STREET CUT REQUIREMENTS.
3. AN OVER EXCAVATED TRENCH SHALL BE BACKFILLED AND COMPACTED WITH STABILIZATION OR BEDDING MATERIALS (AS PER SPECIFICATIONS) UNDER THE DIRECTION OF THE CITY.
4. PIPELINE SHALL BE INSTALLED IN A PROPOSED FILL AREA PRIOR TO AREA BEING COMPLETELY FILLED TO PROPOSED FINAL GRADES AND COMPACTED PER THE CITY OF GREELEY SPECIFICATIONS.
5. BACKFILLING AND COMPACTION OPERATIONS REQUIREMENTS SHALL BE IN ACCORDANCE WITH THE WATER & SEWER CONSTRUCTION SPECIFICATIONS AND DESIGN CRITERIA. REFER TO WATER AND SEWER EXCAVATION AND FILL SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
6. TRENCHES SHALL BE SHORED, BRACED, OR SHEETED PER OSHA REQUIREMENT AND AS NECESSARY FOR THE SAFETY AND PROTECTION OF PERSONNEL AND OTHER UTILITIES.
7. INSULATION BOARD SHALL BE 2" THICK MINIMUM, CONSISTING OF TWO BOARDS (1" MINIMUM PER BOARD) WITH OFFSET JOINTS PLACED ACROSS FULL TRENCH WIDTH. REFER TO LATEST REVISION OF WATER & SEWER SPECIFICATIONS.
8. INSTALL TRACER WIRE ACCORDING TO W&S CONSTRUCTION SPECIFICATIONS AND W&S UTILITY LOCATING ("UL") DETAILS, LATEST REVISION OF EACH.

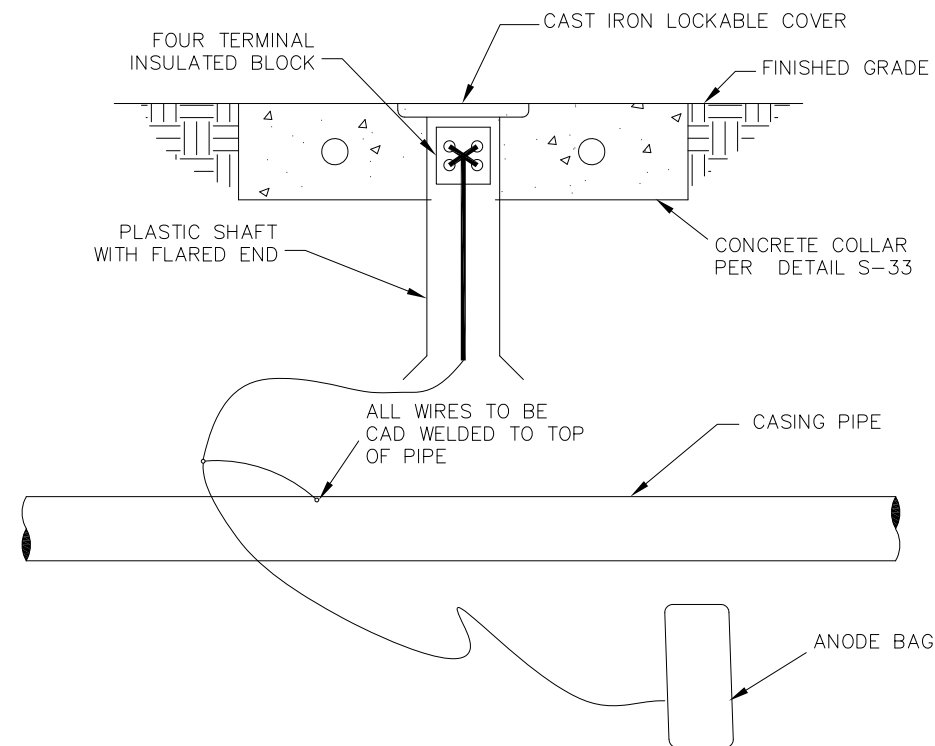


## TRENCH CROSS SECTION

DETAIL WS-2

DATE: OCTOBER 2021

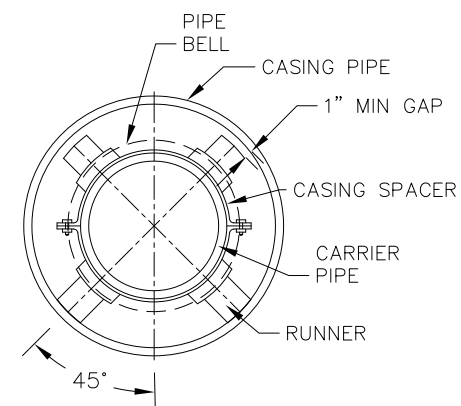
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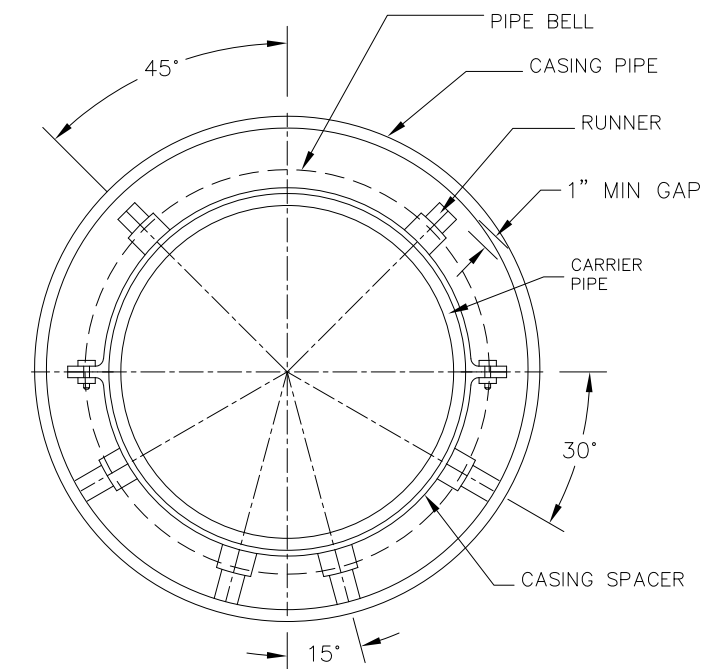
CATHODIC TEST STATION DETAIL

CATHODIC PROTECTION NOTES:

1. INSTALL THE ANODES VERTICALLY OR HORIZONTALLY IN SOIL WITH TOP OF ANODES BELOW THE SPRINGLINE OF THE PIPE. ANODES MUST BE PLACED IN NATIVE SOIL, NOT SELECT BACKFILL SUCH AS SAND, BEDDING, OR CRUSHED ROCK.
2. INSTALL A 17 LB HIGH POTENTIAL MAGNESIUM ANODE BAG ON EACH END OF STEEL CASING PIPES WITH A CATHODIC TEST STATION.
3. STATION TEST WIRES TO BE THHN/THWH.
4. INSTALL A MINIMUM OF 2 FT SLACK AT EACH END OF WIRES.
5. BE CAUTIOUS DURING BACKFILLING. DO NOT DAMAGE OR STRESS WIRES OR CONNECTIONS.



FOR CARRIER PIPES 4"–12"

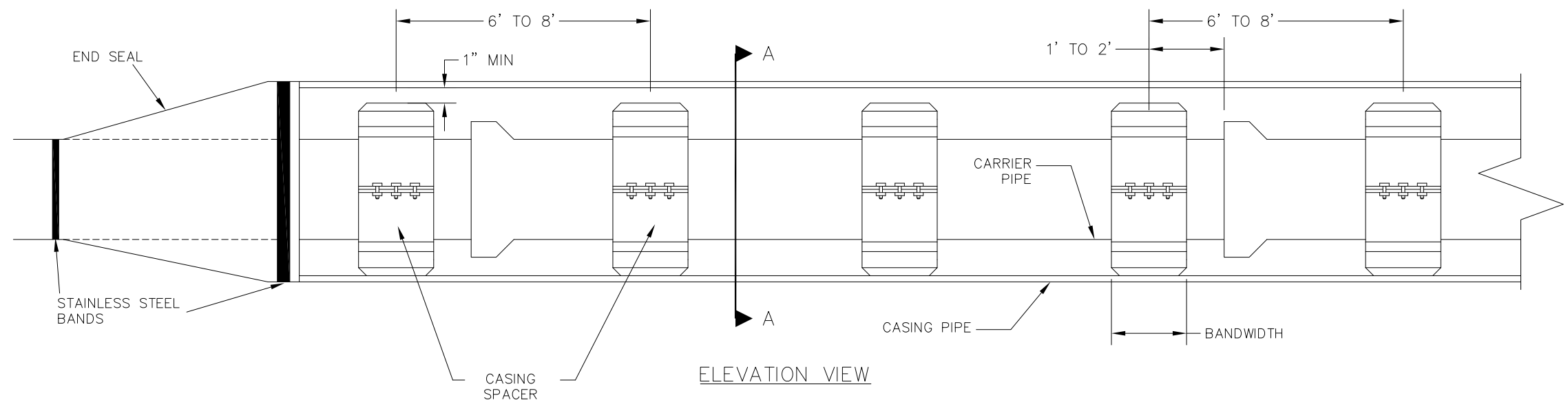


FOR CARRIER PIPES 15" & 16"

SECTION A–A

NOTES:

1. CASING PIPE, CASING SPACERS, AND END SEALS TO BE INSTALLED PER WATER AND SEWER DEPARTMENT CONSTRUCTION SPECIFICATIONS.
2. RECOMMENDED CASING SPACER POSITIONING – PLACE ONE CASING SPACER 1–2 FT ON EITHER SIDE OF THE BELL JOINT AND ONE EVERY 6–8 FT APART THERE AFTER FOR A TOTAL OF 3 CASING SPACERS PER PIPE LENGTH UNLESS OTHERWISE SPECIFIED BY THE MANUFACTURER OR CITY.
3. FOR 12" DIAMETER AND SMALLER CARRIER PIPES USE 8" CASING SPACER BANDWIDTH.
4. FOR CARRIER PIPES LARGER THAN 12' DIAMETER USE 12" CASING SPACER BANDWIDTH.
5. CASING SPACERS TO BE IN THE "CENTER RESTRAINED" POSITION.
6. REFER TO WATER & SEWER SPECIFICATIONS, LATEST REVISION, FOR PIPE CASING SIZES AND MATERIALS.
7. ALL BORINGS & ENCASEMENTS WILL REQUIRE END SEALS AS SHOWN.



ELEVATION VIEW



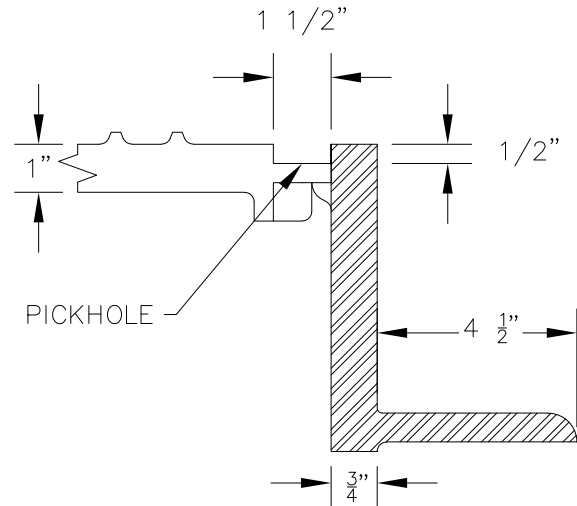
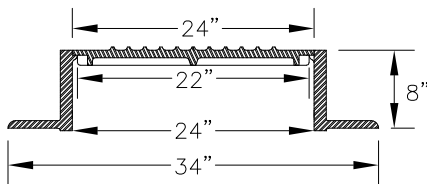
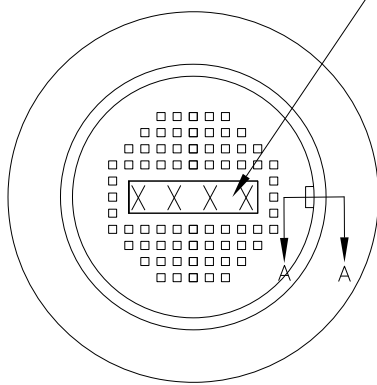
BORINGS AND ENCASEMENTS

DETAIL NO. WS–3

DATE: OCTOBER 2021

SCALE: N.T.S.

PROPER UTILITY IDENTIFICATION  
ON MANHOLE COVER (WATER,  
SEWER, & IRRIGATION)



SECTION A-A PICK OPENING

## NOTES:

- A. ALL RINGS SHALL BE A MAXIMUM EIGHT-INCH (8") IN HEIGHT
- B. STANDARD IRON RING AND COVERS SHALL BE HS-20 LOADING CAPABLE GRAY IRON CONFORMING TO ASTM A48 CLASS 305B, WITH A BLACK BITUMINOUS FINISH.
  1. THE "PROPER UTILITY" DESIGNATION SHALL BE CAST IN THE COVER (WATER, SEWER, NON-POTABLE).
  2. HORIZONTAL BEARING SURFACES OF ALL RINGS AND COVERS SHALL BE MACHINED TO ELIMINATE ANY ROCKING ACTION OR NON-UNIFORM BEARING.
  3. PICK-HOLE SHALL BE ONE AND ONE-HALF INCH (1 1/2") WIDE BY ONE-HALF INCH (1/2") DEEP.
- C. COVERS SHALL BE NON-PERFORATED CHECKER PATTERN WITH MAXIMUM 3/16" "RAISED PATTERN IN NON-PEDESTRIAN TRAFFIC AREAS AND NON-PERFORATED, NON-SKID PATTERN COMPLYING WITH AMERICAN WITH DISABILITIES ACT (ADA) REQUIREMENTS IN PEDESTRIAN TRAFFIC AREAS.
  1. THE "PROPER UTILITY" DESIGNATION SHALL BE CAST IN THE COVER (WATER, SEWER, NON-POTABLE).
  2. RING AND COVER SHALL BE HS-20 TRAFFIC RATED AND SHALL NOT ROCK UNDER TRAFFIC.
- D. MANHOLE COVERS LOCATED WITHIN DESIGNATED 100-YEAR FLOODPLAINS AND AREAS SUBJECT TO FREQUENT WATER INUNDATION SHALL BE THE NON PERFORATED, BOLT DOWN, & GASKETED COVER.
  1. RING AND COVERS SHALL BE HS-20 LOAD CAPABLE, GRAY IRON CONFORMING TO ASTM A48 CLASS 30, WITH BLACK COAT FINISH.
  2. THE "PROPER UTILITY" DESIGNATION SHALL BE CAST IN THE COVER (WATER, WASTEWATER, NON-POTABLE).
- E. REFER TO WATER & SEWER SPECIFICATIONS, LATEST REVISION FOR ALL ACCEPTABLE RING AND COVER MANUFACTURERS & MODELS.

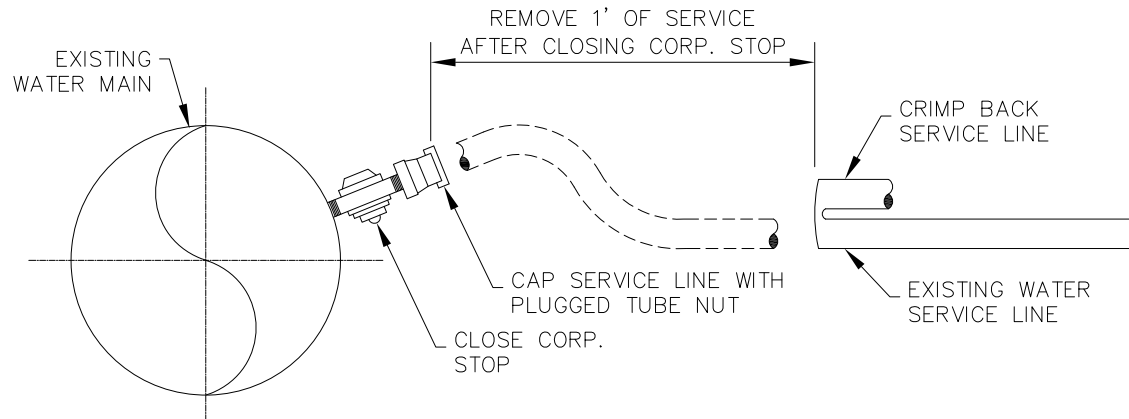


## TYPICAL MANHOLE COVER DETAIL DETAIL WS-4

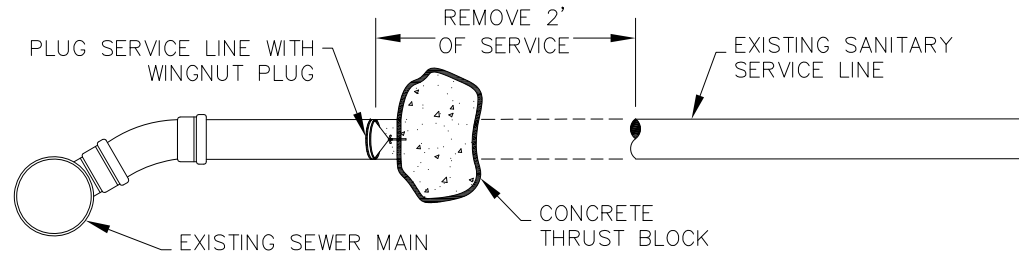
DATE: OCTOBER 2021

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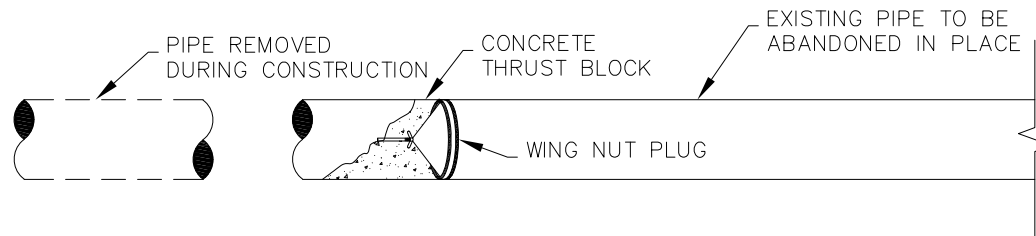




EXISTING WATER SERVICE ABANDONMENT DETAIL



EXISTING SANITARY SEWER SERVICE ABANDONMENT DETAIL



MAIN (WATER OR SEWER) ABANDONMENT DETAIL

## NOTES:

### WATER SERVICE ABANDONMENT

1. EXISTING WATER SERVICES THAT ARE TO BE ABANDONED SHALL BE ABANDONED AT THE MAIN.
2. SERVICE SHALL HAVE THE CORPORATION STOP CLOSED.
3. PLUGGED TUBE NUT SHALL BE INSTALLED NEAREST TO THE CORPORATION STOP.
4. THE END FURTHEST FROM THE CORPORATION STOP SHALL BE CRIMPED BACK.
5. REMOVE CURB STOP AT PROPERTY LINE.

### SANITARY SEWER SERVICE ABANDONMENT

1. EXISTING SANITARY SERVICE LINES TO BE ABANDONED SHALL BE ABANDONED AT THE PROPERTY LINE.
2. CONTRACTOR TO INSTALL CONCRETE THRUST BLOCK BEHIND THE WINGNUT PLUG.

### WATER AND SANITARY SEWER ABANDONMENT

1. EXISTING SANITARY SEWER MAINS AND SERVICES ABANDONED IN MANHOLES SHALL HAVE A WING NUT PLUG PLACED 2' OUTSIDE OF MANHOLE & HAVE A CONCRETE THRUST BLOCK PLACED FROM INSIDE THE MANHOLE TO THE WING NUT PLUG.



## EXISTING WATER & SANITARY SEWER SERVICE & MAIN ABANDONMENT DETAILS

DETAIL WS-5

DATE: OCTOBER 2021

SCALE: N.T.S.

**DESIGN CRITERIA  
AND  
CONSTRUCTION SPECIFICATIONS**

**VOLUME III**

**POTABLE WATER DISTRIBUTION,  
SANITARY SEWER COLLECTION,  
NON-POTABLE IRRIGATION SYSTEMS,  
AND LANDSCAPE & IRRIGATION**



**April 2022**

**DEPARTMENT OF WATER & SEWER**

**CITY OF GREELEY, COLORADO**



## FORWARD

The City of Greeley *Design Criteria and Construction Specifications, Volume III, Potable Water Distribution, Sanitary Sewer Collection, Non-Potable Irrigation Systems, and Landscape Irrigation* documents are intended to provide guidance for the design, review, and construction of those public utility improvements pertaining to water in or under the public right-of-way or dedicated easements.

This document represents an attempt to assist those in the design, review, and construction industry to provide quality and long-lasting public utility improvements and facilities. The document also provides for consistency in the areas of design, review, and construction.

This document is not intended to replace or restrict the function of the design engineer or the innovativeness and expertise of developers and contractors. Users of this document are encouraged to submit their ideas and methods of improving this document.

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Sean Chambers  
Water and Sewer Director

Effective: April 1, 2022

# **CITY OF GREELEY, COLORADO**

## **DEPARTMENT OF WATER & SEWER**

### **DESIGN CRITERIA**

### **AND**

### **CONSTRUCTION SPECIFICATIONS**

### **VOLUME III**

### **POTABLE WATER DISTRIBUTION, SANITARY SEWER COLLECTION, NON-POTABLE IRRIGATION SYSTEMS, AND LANDSCAPE & IRRIGATION**

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**POTABLE WATER DISTRIBUTION, SANITARY SEWER COLLECTION,  
AND NON-POTABLE IRRIGATION SYSTEMS DESIGN CRITERIA**

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## SECTION 1

### GENERAL REQUIREMENTS

#### 1.01 SCOPE

The purpose of the City of Greeley *Design Criteria and Construction Specifications, Volume III, Potable Water Distribution, Sanitary Sewer Collection, and Non-Potable Irrigation Systems and Landscape and Irrigation*, hereafter referred to as the “Criteria”, is to present the minimum design and technical criteria for the analysis and design of potable water distribution, sanitary sewer collection, and non-potable irrigation systems for which City of Greeley acceptance is required. The Criteria may be amended as new technology is developed or a need for revision is demonstrated and proven through experience and use. The Design Engineer shall be responsible for compliance with these Criteria as well as other applicable design and construction standards in the preparation of engineering reports, construction drawings, and specifications for City review and acceptance.

#### 1.02 DEFINITIONS AND ABBREVIATIONS

Wherever the following words, phrases, and abbreviations appear in these specifications they shall have the following meaning:

- A. ac – acre
- B. ac-ft – acre-feet
- C. ANSI – American National Standards Institute
- D. APPROVED PLAN – The latest revised Construction Drawing(s) accepted by the City of Greeley.
- E. APWA – American Public Works Association
- F. AS-CONSTRUCTED DRAWINGS – Drawings reflecting actual conditions and information for the project after construction is completed.
- G. ASME – American Society of Mechanical Engineers
- H. ASTM – American Society for Testing Materials
- I. AWWA – American Water Works Association
- J. CDOT – Colorado Department of Transportation
- K. CDPHE – Colorado Department of Public Health and Environment
- L. cfs – cubic feet per second
- M. CITY – City of Greeley
- N. CONSTRUCTION DRAWINGS – Engineered working drawings including plan, profile, and detail sheets of proposed development and utility improvements accepted by the City.

- O. CONTRACTOR – The individual, firm, partnership, corporation, or combination thereof, private, municipal, or public including joint ventures, which, as an independent contractor, has entered into a contract with the Developer/Owner.
- P. CRITERIA – City of Greeley *Design Criteria and Construction Specifications, Volume III, Potable Water Distribution, Sanitary Sewer Collection, and Non-Potable Irrigation Systems.*
- Q. DESIGN ENGINEER – The partnership, corporation, or individual who is registered as a Professional Engineer, according to Colorado statutes, who is hired by the Developer/Owner to conduct engineering design services and may be empowered by the Developer/Owner to act as his agent for the project.
- R. DEVELOPER – The owner, corporation, association, partnership, agency, or individual who or which shall participate in development, has entered into a development agreement with the City and has entered into an agreement with the Design Engineer and Contractor to perform the development work.
- S. DEVELOPMENT – Any construction or activity which changes the basic characteristic or use of land on which construction or activity occurs, including but not limited to, any non-natural change to improved or unimproved real estate, substantial improvements to buildings or other structures, installation of utilities, mining, dredging, filling, grading, paving, extraction, or drilling operations.
- T. DEVELOPMENT CODE – A section of the City Municipal Code prepared by the City of Greeley Community Development Department which sets forth requirements and standards for land development, land use, and the *Subdivision Regulations*.
- U. DIP – Ductile-iron pipe.
- V. EASEMENT – A right granted by the property owner permitting a designated part or interest of the property to be used by others for specific use or purpose.
- W. EPA – Environmental Protection Agency
- X. ft<sup>2</sup> – square feet
- Y. ft/s – feet per second
- Z. GEOTECHNICAL ENGINEER – A partnership, corporation, or individual who is registered as a Professional Engineer, according to Colorado statutes, proficient in the area of soil mechanics, and who is hired by the Developer/Owner to conduct subsurface soils investigations and evaluations, ground water assessments, and other related engineering services.
- AA. gpcd – gallons per capita per day
- BB. gpd – gallons per day
- CC. gpm – gallons per minute
- DD. HP - horsepower

- EE. INSPECTOR – Representative of the City of Greeley designated to conduct construction/field observation.
- FF. LAND SURVEYOR – A registered Professional Land Surveyor, according to State of Colorado statutes, who is hired by the Developer/Owner to determine the boundaries and elevations of land and/or a structures and other related surveying services.
- GG. LIVING UNIT - one or more connected rooms, constituting a separate, independent housekeeping establishment for owner occupancy, or rental or lease as a single unit on a monthly basis or longer, physically separated from any other room or dwelling units which may be in the same structure and served by no more than one gas meter and one electric meter.
- HH. MAY – A permissive condition. Where the word “may” is used, no requirement for design or application is intended.
- II. NEC – National Electric Code
- JJ. NFRWQPA – North Front Range Water Quality Planning Association (regional 208 agency)
- KK. NON-POTABLE – Water that is not treated to approved drinking water standards and is not suitable or intended for human consumption, but is produced and delivered for irrigation use.
- LL. OSHA – Occupational Safety and Health Administration
- MM. OWNER – Any person having title or right of ownership in the surface estate of real property or leasehold interest within.
- NN. PGI – PVC Geomembrane Institute
- OO. PLANNING COMMISSION – Appointed members to advise the City Council on land use planning and development and to make decisions on land use matters.
- PP. PLANS – See CONSTRUCTION DRAWINGS.
- QQ. PLC – Programmable Logic Controller
- RR. PROFESSIONAL ENGINEER – An engineer registered with the State of Colorado according to State of Colorado statutes.
- SS. PROFESSIONAL LAND SURVEYOR – A land surveyor registered with the State of Colorado according to State of Colorado statutes.
- TT. psi – pounds per square inch
- UU. PVC – Polyvinyl chloride
- VV. SDC – City of Greeley *Design Criteria and Construction Specifications, Volume I, Streets.*
- WW. SDDC – City of Greeley *Design Criteria and Construction Specifications, Volume II, Storm Drainage.*

- XX. SDR – Standard Dimension Ratio (pipe outside diameter over minimum pipe wall thickness).
- YY. SHALL – A mandatory condition. Where certain requirements in the design or application are described with the “shall” stipulation, it is mandatory that these requirements be met.
- ZZ. SHOULD – An advisory condition. Where the word “should” is used, it is considered to be advisable usage, but not mandatory. Deviations may be allowed when reasons are given which show that the intent of the standard is met.
- AAA. SPECIFICATIONS – The construction specifications portion of the City of Greeley *Design Criteria and Construction Specifications, Volume III, Potable Water Distribution, Sanitary Sewer Collection, and Non-Potable Irrigation Systems*.
- BBB. STRUCTURE - Anything constructed or erected on or in the ground, the use of which requires a more or less permanent location on or in the ground, and, including, but not limited to, walls, retaining walls, fences, parking lots, parking slabs and oil and gas production facilities.
- CCC. STANDARDS – The design criteria portion of the City of Greeley *Design Criteria and Construction Specifications, Volume III, Potable Water Distribution, Sanitary Sewer Collection, and Non-Potable Irrigation Systems*.
- DDD. SUBCONTRACTOR – Any person, firm or corporation, other than the employees of the Contractor, who enters into contract with the Contractor, to furnish labor, materials, or labor and materials.
- EEE. SUBDIVISION REGULATIONS – A section of the Development Code prepared by the City of Greeley Community Development Department, which contains requirements for various land use, land development, and subdivision processes.
- FFF. UNCC – Utility Notification Center of Colorado.
- GGG. UNDERDRAINS – Private line or system that controls or managing any subsurface water on individual foundation lot or lots. No private underdrain systems shall be allow in Water & Sewer easements.
- HHH. UTILITY – City of Greeley Water and Sewer Department.
- III. UTILITIES – Shall mean all utilities, wet and dry, on site prior to the time of any design and development and all utilities proposed with design. Wet utilities shall include, but are not limited to potable water lines, sanitary sewer lines, non-potable irrigation lines, transmission gas lines, storm water lines, ditches and other runoff conveyance elements. Dry utilities shall include, but are not limited to electric lines, telephone lines, gas service lines, fiber optic lines, and cable television lines.
- JJJ. VFD – Variable Frequency Drive
- KKK. WATER AND SEWER DIRECTOR – Shall mean the Director of the City of Greeley Water and Sewer Department or their designated representative.

### 1.03 MINIMUM STANDARDS

- A. The City of Greeley’s Community Development Department has *Subdivision Regulations* and Development Code documents that can help define the various processes required for projects within the City.
- B. The City’s review and acceptance will only be to determine if the plans and specifications conform to the City’s requirements. The City’s review and acceptance will not relieve the Developer, Design Engineer and Contractor from responsibility for any variation from the City requirements or adequate design standards. The City’s review and acceptance shall not constitute any assumption of responsibility or liability for the design or construction. It is the intent and purpose of these standards and specifications to obtain high quality construction throughout, with the completed work complying with the City standards and specifications.
- C. All vertical and horizontal control shall be based on the currently adopted City of Greeley vertical and horizontal monumentation. Proposed reference monumentation shall be approved by the City prior to survey. A list of approved monuments may be obtained from the City.

### 1.04 RELATIONSHIP TO OTHER STANDARDS

- A. Whenever a provision of these Criteria and any other provision in any law, ordinance, resolution, rule, policy, or regulation of any kind contain any restrictions covering any subject matter within these Criteria, the most restrictive standard shall apply.
- B. The provisions of these Criteria and standards are minimum requirements that do not preclude the use of more restrictive standards by the Design Engineer or City.
- C. Adherence to these Criteria does not remove the Developer’s responsibility to investigate and obtain any other regulatory permits or approvals, from either local, regional, state, or federal agencies, that may be required for a particular project.

### 1.05 REVIEW AND ACCEPTANCE

- A. All potable water, sanitary sewer, and non-potable irrigation construction plans and specifications submitted to the City for review preliminary and final, comment, and acceptance shall be prepared by, or under the direct supervision of a Professional Engineer. Said Professional Engineer shall be responsible for the design, preparation of the construction drawings and reports, determining material specifications, and reviewing the field survey for accuracy.
- B. The construction plan review process for all development as outlined in the *Development Code* shall be followed.
  - 1. The preliminary plan set shall be reviewed by the City for general compliance with these Criteria and the City shall provide comments to the Developer or their agents regarding corrections, additions, and omissions.

2. All submittals to the City shall be done in accordance with the city Development Code.
3. It is the responsibility of the Design Engineer to confirm that submittals are in conformance with these current standards. Any preliminary or final submittal not meeting these criteria may be rejected without review.
4. After final corrections are made and the plans are accepted, the plans set shall be signed by the Water and Sewer Director or designated representative. The signing of the plans will constitute acceptance. The acceptance is qualified in that: ***The plans are reviewed and accepted for concept only and the plan acceptance does not imply responsibility by the Water and Sewer Department or the City of Greeley for accuracy and correctness. The plans acceptance does not imply that quantities of items indicated on the plans are the final quantities required. The plans acceptance shall not be construed for any reason as acceptance of financial responsibility by the Water and Sewer Department or City of Greeley for additional items not shown that may be required during the planning or engineering phase and the construction phase.***
- C. If the Design Engineer responsible for the plans disagrees with any requested changes to the submitted plans that may be required by the City for acceptance, such disagreement shall be brought to the attention of the City, and if required by the City, in writing.
- D. The Seal of the Design Engineer on plans so corrected and accepted for construction will signify that the Professional Engineer has reviewed, approved, and authorized said corrected plans for construction.
- E. No construction shall be undertaken without a City accepted and signed set of Construction Drawings and a recorded plat or required potable water, sanitary sewer, and/or non-potable irrigation exclusive easements.

## SECTION 2

### SUBMITTAL REQUIREMENTS

#### 2.01 GENERAL

Requirements discussed in this section are the minimum for potable water distribution, sanitary sewer collection, and non-potable irrigation systems and are not meant to be all-inclusive. Other requirements may be needed for a complete design. The Design Engineer shall consider the maintenance and operational aspects of the potable water distribution, sanitary sewer collection, and non-potable irrigation systems' infrastructure, as well as, constructability in their design.

- A. All construction drawings shall be legible and submitted on PDF 22" x 34" sheets. Additional sizes may be accepted with prior approval.
- B. A legend describing all line types, symbols, and abbreviations shall be shown either on the cover sheet or each individual sheet.
- C. Each sheet in the Construction Drawings shall be marked "PRELIMINARY, NOT FOR CONSTRUCTION" with the date of submittal. This statement shall be removed on the final City accepted Construction Drawings.
- D. City accepted and signed construction plans are required prior to the City's issuance of construction permits.

#### 2.02 PRELIMINARY CONSTRUCTION PLAN REQUIREMENTS

For Preliminary subdivisions, plans shall be submitted to the City for review and acceptance prior to the preparation of final Construction Drawings. Acceptance of the preliminary submittal shall constitute only a conceptual acceptance and shall not be construed as acceptance of specific design details. The preliminary plans set shall include the following:

- A. Cover Sheet
  - 1. Project name and location.
  - 2. City case or project number assigned by City Planning Department shall be included.
  - 3. A vicinity map specifying the project's geographical location with north arrow and adequate graphic scale and detail to be clear and uncluttered.
  - 4. Sheet index.
  - 5. Name of Owner and Developer.
  - 6. Name of the Design Engineer responsible for the design and preparation of the Construction Drawings and the Land Surveyor responsible for the project survey information.
  - 7. City recognized project benchmarks and two (2) horizontal control points to serve as the basis of the project horizontal control.

8. General Project notes from the *A2 – Final Construction Plans Checklist* in the appendix as applicable.

**B. Utility Sheet**

1. An acceptance signature block, located in the lower right hand corner of the Utility Plan drawing
2. Any additional information deemed necessary by the Design Engineer or City.
3. A general overview of the entire project including, but not limited to, streets (complete with names), alleys, lot and block numbers, all proposed and existing utilities on and within 100 feet of the project site, all existing and proposed easement, rights-of-way on and adjacent to the project site, and storm water facilities.
4. The entire project shall be shown on one (1) sheet unless the project is too large to show sufficient detail. City acceptance must be granted to show the project on more than one sheet and a key map to aid in drawing orientation and locating the sheet construction in relation to the overall project will be required on each sheet.
5. Proposed project phasing for utilities and structures.
6. Proposed point(s) of connection for potable water, sanitary sewer, or non-potable irrigation mains to the existing system(s). All existing potable and non-potable water lines shall be labeled with the pipe diameter, type of material, and year of installation (available from the City). All existing sanitary sewer lines shall show existing manholes, complete with rim and invert elevations, and pipe diameter.
7. Geotechnical bore locations shall be shown in plan view within the utility plans.
8. Any other information deemed necessary by the Design Engineer or City.

**2.03 FINAL CONSTRUCTION PLAN REQUIREMENTS**

Final Construction Plans shall contain the same information as indicated in the Preliminary Construction Plan Requirements section 2.02 of these Criteria with the following additional requirements:

- A. After one (1) year from the original acceptance date, the City may require resubmittal of the plans for review and acceptance due to revised or updated City design criteria or construction specifications.
- B. City accepted easements or a City accepted final plat must be executed before final Construction Plan acceptance.
- C. One set of 22" x 34" plans shall be submitted to the City for acceptance signatures when all known issues have been addressed to the satisfaction of the City. Additional sizes may be accepted with prior approval. Once the plans receive City signatures, the Developer or their agents shall make copies of the signed plans and provide them to the City.
- D. An electronic version, in a format acceptable to the City, of the final Construction Drawings



shall be provided to the City at the time of plan signatures.

- E. Potable water, sanitary sewer, and non-potable irrigation main designs shall be provided on separate plan and profile sheets specific to potable water, sanitary sewer, and non-potable irrigation.
- F. The Utility Plan shall contain a signature line for all Ditch Companies, or end user(s) if the ditch is not controlled by a Ditch Company, that have their facilities impacted or modified by the project.
- G. All utility verifications shall be in compliance with Colorado Revised Statute 9-1.5 as updated.
- H. “Call Utility Notification Center of Colorado (UNCC) at 1-800-922-1987 or dial 811 for utility locates 72 hours prior to any excavation work” shall be put on all drawing sheets.
- I. Conduit Plan
  - 1. The conduit plan serves to show all proposed utility conduits crossing public rights-of-way and easements. ***The conduit plan may be a separate sheet from the utility plan as requested by the City.***
  - 2. Provide a general overview of the project including but not limited to street names, street rights-of-way, all proposed and existing utilities, all proposed and existing easements, and lot and block numbers.
  - 3. Show all utility conduits crossing the public rights-of-way and easements and indicate the utility conduit diameter, number of conduits, depth of installation, and name of utility using the conduit.
  - 4. Add the following note to the conduit plan: “All utility conduit crossings of potable water, sanitary sewer and non-potable irrigation lines shall be encased in High Density Polyethylene (HDPE) or C900-16 PVC Pipe, with minimum Standard Dimension Ratio (SDR) 11 across the entire easement or right-of-way width. The encasement joint shall be butt fused. Flexible joints are not allowed.”
- J. Construction Plan View
  - 1. A key map shall be required on each sheet to aid in drawing orientation and locating the sheet construction in relation to the overall project.
  - 2. Provide a north arrow and horizontal graphic scale.
  - 3. A design horizontal scale of not less than 1" = 50'.
  - 4. Provide existing and proposed roads and alleys complete with names.
  - 5. Label proposed lot and block numbers.
  - 6. Provide existing wet and dry utilities including potable and non-potable water line pipe material, diameter and year of installation, and sanitary sewer manhole inverts and pipe diameter.

7. Clear distance between utilities shall be outside wall to outside wall.
  8. Show and label proposed and existing easements, rights-of-way, and property lines.
  9. List the name of adjacent developments or lots and their property owners.
  10. Indicate the proposed method of connection to existing potable water distribution, sanitary sewer collection, and non-potable irrigation systems.
  11. Show all proposed and existing potable water, sanitary sewer, and non-potable irrigation services. Indicate the station of service locations on the potable water, sanitary sewer, and non-potable irrigation mains or include a tabular list of stations.
  12. Provide linear stationing along the potable water, sanitary sewer, and non-potable irrigation mains.
  13. Provide match lines indicating references to adjacent sheet(s) of design.
  14. Where the minimum cover over sanitary sewer mains provides less than 10 feet of elevation difference between the top of foundation grade and the top of the sewer main, a note shall indicate the lot is served by a “shallow sewer” and appropriate elevation information shall be provided. Shallow sewer is defined in *Section 4* of these Criteria.
- K. Pothole information of all water or sewer mainlines and impacted services. At critical locations and as determined by City, with date including month and year, elevation, depth and datum.
- L. Construction Profile View
1. Provide the design vertical scale of not less than 1" = 10'.
  2. Show all existing and proposed utility crossings in compliance with Colorado Revised Statute 9-1.5 as updated.. Existing utility crossing locations and elevations shall be obtained from the current project design field survey. Existing utilities shall be potholed as required to perform complete and accurate design prior to construction plan acceptance. Field obtained elevations shall be provided on the Construction Drawings complete with when the field information was gathered, the exact location where it was collected, the Firm that performed the potholing and surveying, and the date the survey was conducted.
    - a. Clear distance between utilities shall be outside wall to outside wall.
  3. Where the potable water and sanitary sewer mains are within two feet vertically of each other, all water and sewer services that cross a main shall be shown.
  4. Provide the diameter, type of pipe material, pipe class, length of pipe between all fittings and manholes for proposed and existing potable water lines, sanitary sewer lines, or non-potable irrigation lines.
  5. Provide stationing for all potable and not-potable mainline appurtenances including but not limited to top of pipe elevations on proposed fittings, valves, and points of vertical

deflection.

6. Provide pipe slope, manhole inverts in and inverts out (main and service line), and rim elevations and manhole stationing for proposed sanitary sewer lines.
7. Provide match lines indicating references to adjacent sheet(s) of design.
8. Any other information deemed necessary by the Design Engineer or City.

M. Standard Drawing (Detail) Sheets

1. Include all project applicable City of Greeley Standard Drawings as part of the construction plans set. Water and Sewer Department Standard Drawings are provided in these Criteria. Refer to the Department of Public Works' *SDC* and *SDDC*, latest revision, for other project related details.
2. All City of Greeley Standard Drawings shall contain the City logo in the bottom left corner. If any standard City detail is modified, the City logo shall be removed from the detail and placed on a separate sheet before standard details. All modified detail shall be stamped by design engineer.
3. Where Standard Drawings are not applicable to the work, provide project specific construction details. These shall include construction details of critical connections, atypical crossings, special fittings and appurtenances, and any other details deemed necessary by the Design Engineer or City.

N. Requirements for Changes to Final Accepted Plans

1. Should circumstances warrant changes from the City accepted Construction Plans, acceptance of the changes shall be obtained from the City prior to construction.
2. All modified drawings shall be on 22" x 34" sheets. Depending on the extent of the changes, the City will decide if revised plans are required.

O. Wastewater Pumping Station (Lift Station) Final Construction Plans

1. Lift station final construction plan requirements are specific to the design requirements of the lift station in addition to state and regional guidelines. Refer to *Section 4* for lift station requirements.

P. Geotechnical bore logs and groundwater data shall be shown in the Construction Plans.

**2.04 FINAL PLAT AND REPLAT REQUIREMENTS**

- A. Final plats shall adhere to the requirements set forth in the City of Greeley Community Development Department *Subdivision Regulations* and the Department of Public Works' *SDC*, latest revision. The following requirements shall also apply:

1. Clearly show, label, and dimension newly dedicated and existing potable water, sanitary sewer, and non-potable irrigation easements.
  2. Clearly denote the allocation of any new or existing water dedication credits between the parcels included on the plat.
  3. Where minimum cover over sanitary sewer provides less than 10 feet of elevation difference between the finished top of foundation elevation and the invert of the sewer main, the plat shall indicate that the lot is served by a “shallow sewer”. Shallow sewer is defined in *Section 4* of these Criteria.
  4. Where a compound service is allowed for multiple buildings on a single lot the plat shall indicate that if the lot is ever subdivided the service and main configuration must be brought into alignment with the current City of Greeley Design Criteria.
  5. All platted lots shall be adjacent to a public potable water distribution and sanitary sewer collection main. No potable water or sanitary sewer services shall cross lot lines.
- B. An exception may be made for “zero lot line” and row house developments as defined in the Development Code.
- C. For all replats where lot lines or street locations change, all existing potable water, sanitary sewer, and non-potable irrigation mains, services, fire hydrants, fire sprinkler lines, etc. shall be relocated to their appropriate location or abandoned. Potable water distribution, sanitary sewer collection, and non-potable irrigation system designs in this replatted area must conform to the current City of Greeley Design Criteria.

## **2.05 LANDSCAPE PLANS REQUIREMENTS**

- A. No plant material with mature growth greater than three (3) feet in height shall be planted within potable water, sanitary sewer, or non-potable irrigation easements.
- B. No shrubs shall be planted within five (5) feet or trees within ten (10) feet of potable and non-potable water meters, fire hydrants, sanitary sewer manholes, or potable water, sanitary sewer, and non-potable irrigation mains and services.
- C. Clearly show and label all proposed and existing potable water and non-potable irrigation meter pits/vaults, mains and services, sanitary sewer mains and services, fire hydrants, and easements on the landscape plans.
- D. Show and label all proposed water taps that will be used for landscape irrigation.
- E. Provide a table summarizing irrigation water use by area per Section **20-254** of municipal code
- F. Add sections 2.05-A and 2.05-B of these Criteria as notes on the landscape plans.

## **2.06 EASEMENTS**

- A. When it is not feasible for potable water, sanitary sewer, or non-potable irrigation main installation to be in a dedicated street right-of-way, the installation shall be made within a

dedicated easement. The conditions for allowance of such an exception shall be determined for each individual case. The minimum easement width acceptable to the City is as follows:

1. For a dedicated potable water, sanitary sewer, or non-potable irrigation main easement containing just one (1) main, the width shall be twenty (20) feet or twice the depth to the invert of the pipe, whichever is greater. This easement shall be for the exclusive use by City of Greeley potable water, sanitary sewer, or non-potable irrigation mains. The easement name, which shall be “EXCLUSIVE WATER LINE EASEMENT”, “EXCLUSIVE SANITARY SEWER EASEMENT” or “EXCLUSIVE NON-POTABLE IRRIGATION EASEMENT”, and the easement width shall be labeled on the Construction Drawings and plat.
  2. For any combination with two utilities, potable water, sanitary sewer or non-potable irrigation main easements, the total width shall be thirty (30) feet or twice the maximum depth to the invert of each utility, whichever is greater. This easement shall be for the exclusive use by the City of Greeley. The easement name and the easement width shall be labeled on the Construction Drawings and plat.
  3. For any combination with three utilities, potable water, sanitary sewer or non-potable irrigation main easements, the total width shall be forty (40) feet or twice the maximum depth to the invert of each utility, whichever is greater. This easement shall be for the exclusive use by the City of Greeley. The easement name and the easement width shall be labeled on the Construction Drawings and plat.
- B. The mains within the easement shall be located a minimum ten (10) feet from the edge of the easement or equal to the depth to the pipe invert, whichever is greater.
- C. There shall be no detention ponds, berms greater than three (3) feet, permanent structures, fences, trees, shrubs with mature height greater than three (3) feet, or other obstructions that will impede the ability of the City to adequately maintain and service the main(s) located within the easement.
- D. Easements not dedicated with a plat, shall be dedicated by separate document and recorded prior to City acceptance of the Construction Drawings. Easement dedication by separate document shall include:
1. Easement Dedication Form. An easement dedication form shall be completed by the Developer. Standard easement dedication forms are available in the appendix. The completed easement dedication form must be signed by the property Owner and notarized.
  2. Exhibit Map. An exhibit map (8 ½” x 11”) with sufficient description information to establish the legal boundary of the easement shall be provided. The exhibit map shall show and label all existing easements, property lines, and public rights-of-way. The City may request additional information, not listed here, for the exhibit at the city's discretion.
  3. A Written Legal Description of the dedicated easement boundary.
  4. Funds for Recording. The Developer shall provide cash or a check made out to the **City of Greeley** for the easement recording fees. The City shall provide the recording fee

sum once all easement documents are finalized. *The City does not provide the funds for recording easement documents.*

5. Once the easement dedication documents are accepted by the City and the recording fees have been provided in the appropriate amount, the City shall have the easement documents recorded with Weld County.

## **2.07 HYDRAULIC REPORT – POTABLE WATER & SANITARY SEWER**

A hydraulic analysis for the potable water distribution and sanitary sewer collection systems for a given project shall be submitted by the Design Engineer, as a report, to the City for review and acceptance. The report shall be accepted by the City prior to final Construction Drawing acceptance. The hydraulic analysis report will be reviewed by the City, along with the Construction Drawings, in the same review and acceptance process as outlined in *Section 1* of these Criteria. Projects that move forward to final design without a City accepted potable water distribution and sanitary sewer collection system hydraulic analysis report are subject to possible design changes, including but not limited to, pipe re-alignment, upsizing, extensions, and additional stubouts.

The objective of the hydraulic analysis report is to assist the Design Engineer with designing a project's potable water distribution and sanitary sewer collection systems to adequately serve peak demands while adhering to the design requirements set forth in these Criteria. For the potable water distribution system, the hydraulic analysis report serves as a tool for demonstrating the necessary number of connection points to the existing system for adequate water line looping, system reliability and required pipe sizing. For the sanitary sewer collection system, the hydraulic analysis report evaluates peak flow quantities, flow type, pipe capacity, and flow velocity and establishes appropriate pipe sizing.

Non-potable irrigation system hydraulic and design reports are also required for projects utilizing non-potable water for irrigation purposes; however, since non-potable irrigation systems are unique, the non-potable hydraulic and design report requirements have been provided in section 2.08 of these Criteria.

The written hydraulic report shall include the following information:

- A. Title Page
  1. Report title.
  2. Project name and location.
  3. The name, address, and phone number of the Owner, Developer and Design Engineer that prepared the report.
  4. Report preparation date.
- B. Engineer Certification Sheet
  1. The report shall be prepared by or under the supervision of a Professional Engineer, licensed to practice in the State of Colorado, possessing adequate experience in the design of potable water distribution and sanitary sewer collection systems. The report shall contain a certification sheet with the following statement to be signed and sealed

by the Design Engineer:

“I understand the City’s acceptance does not relieve the Design Engineer’s responsibility for errors, omissions, or design deficiencies for which the City is held harmless.

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Registered Professional Engineer

(Affix Seal)

C. Table of Contents

D. Project Description and Location

1. Clearly state the location of the project. Provide a site vicinity map specifying the project’s geographical location and the project area in acres. The project acreage shall be the same as on the project plat.
2. Clearly state the land use zoning, estimated number of residential lots or living units, commercial square footages, and the irrigated acreages.
3. Indicate if the project will be phased. Elaborate on the anticipated timing for each project phase and the phase’s associated building and infrastructure construction.
4. For multifamily, commercial, or industrial developments, indicate if potable or non-potable water will be used for landscape irrigation.
5. Identify the locations of all potable water, sanitary sewer, and non-potable irrigation connection points to the existing systems.
6. Provide the pipe diameter, pipe material, and year of installation for the existing potable water, non-potable water, and sanitary sewer lines.

E. References and Appendices

1. Provide a page referencing all design criteria, resources, and modeling software used in preparing the hydraulic report.
2. Provide appendices as necessary to include modeling result printouts, copies of demand assumption data, and fire flow test results.
3. Hydrant flow tests results may be available from Greeley Fire Department (970-350-9511). Obtained fire flow test pressures will be evaluated for use by the City on a case by case basis.

F. Potable Water System Report Requirements and Assumptions

1. Provide all used equations, demand assumptions, and essential design requirements, parameters, and constraints.
2. Indicate the software package(s) and version used for the water system modeling.

3. Indicate in which City of Greeley potable water pressure zone the project is located.
4. Provide calculations for estimated population, design flows and velocities, irrigated acreage, irrigation application rates, peaking factors, and any other necessary design calculations.
5. Provide hydrant fire flow and fire sprinkler system flow requirements.

G. Potable Water System Analysis and Modeling

1. Modeling Scenarios

- a. Static. The static scenario shall establish the available water pressure for the site with no demands on the system and serves to check that pressure requirements are maintained.
- b. Peak hour demand plus fire flow. This scenario shall include peak hour domestic water use<sup>1</sup> demands plus fire flow<sup>2</sup>.
- c. Peak hour demand plus fire flow with one (1) water connection closed. While using the determined potable water demands for the peak hour plus fire flow scenario, each connection to the existing potable water system shall be closed, in turn, and modeled. Fire flow shall be placed at a hydrant nearest to the closed connection. This scenario represents a worst-case water demand condition and shall only serve to demonstrate how the potable water distribution system within the development functions during this condition. It is acceptable to have the potable water system velocity requirements violated in this scenario only. The system must maintain a minimum pressure of 20 psi with fire flow.
- d. Phasing. Water modeling shall be required for the incomplete potable water system as indicated per the planned phasing on the Construction Drawings, in order to demonstrate that peak hour demand plus fire flow can be met for the interim phased condition.

The hydraulic report shall verify that a proposed potable water system can provide the required water demands for a given development, at an acceptable pressure, and meet the overall potable water system design requirements set forth in these Criteria. At the City's discretion all ultimate connections to existing water mains may be required regardless of development phasing. Upsizing water mains within a development as a means to increase water system capacity in lieu of making a connection to another water source, is not permitted.

If the hydraulic water model demonstrates that a larger main is required to serve the phased condition than would be needed for the full build out condition, the Developer is required to install the larger pipe at their expense and is not eligible for

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<sup>1</sup> Domestic water use shall refer to all household and corresponding lot irrigation for single family and applicable multifamily residential potable water use. It shall also refer to all potable water use, including potable irrigation, for commercial and industrial uses.

<sup>2</sup> Fire flow shall be inclusive of fire hydrant and fire sprinkler flow. Residential, commercial, or industrial developments requiring fire sprinkler systems shall have fire sprinkler demands, in addition to hydrant fire flows, placed in the hydraulic water model at appropriate node locations.



pipe oversizing reimbursement from the City when the larger pipe is no longer needed.

- e. Additional scenarios. At the City's discretion, the City may require additional scenarios, adjustments to the fire flow placement, reservoir elevations, and existing system connections, revisions to the pipe and node schematic layout, and other model modifications as necessary to verify that the proposed potable water system will meet the design requirements and potable water demands of the development and the City as a whole.
- f. At the City's discretion, the hydraulic analysis may be required to extend beyond the limits of the project boundary.
- g. Demands for undeveloped parcels shall be calculated based on the higher of the current or anticipated land use or zoning of the property.
- h. Model must be compatible and capable of being integrated with City's hydraulic model developed with InfoWater. Model must be provided to Water and Sewer upon request.

## 2. Modeling Procedure

- a. Connections to the existing potable water distribution system are typically denoted as reservoirs with the same hydraulic grade elevation. The City shall provide inflow pressure.
- b. Place estimated domestic water, fire sprinkler, and irrigation tap demands at appropriate node locations within the model as they relate within the project.
- c. Locate fire flow demands at hydrant locations according to the modeling scenarios in section 2.07-G of these Criteria. The maximum allowable fire flow provided from any one (1) hydrant shall be 1,500 gpm. If the required fire flow is in excess of 1,500 gpm, the next closest hydrant shall be used until the required fire flow is met.
- d. Depending on the location of the development, existing potable water system performance and reliability in the area, number of available potable water connections, and surrounding land uses, some of the project's proposed potable water connections may require modeling as a demand point or no connection instead of a water source. The City shall provide additional outflow demands for a development on a case by case basis.

## H. Potable Water System Report Results

- 1. Provide a schematic layout of the potable water distribution system showing and labeling the reservoir connections, pipe network, and demand nodes as presented and analyzed for each water model scenario.
- 2. Provide a Reservoir Report for the static condition. The Reservoir Report shall include the following information:
  - a. Reservoir Identification Label

- b. Elevation (ft) per City of Greeley datum
- 3. Provide Pipe Reports for all modeled scenarios. Pipe Reports shall include the following information.
  - a. Modeled Scenario Title
  - b. Pipe Identification Label
  - c. Pipe Length (ft)
  - d. Pipe Diameter (in)
  - e. Pipe Material
  - f. Hazen-Williams Coefficient
  - g. Pipe Control Status (open or closed)
  - h. Pipe Velocity (ft/s)
  - i. Upstream Calculated Pressure (psi)
  - j. Headloss (ft)
- 4. Provide Junction/Node Demand Reports for all modeled scenarios. Junction/Node Demand Reports shall include the following information:
  - a. Modeled Scenario Title
  - b. Node Identification Label
  - c. Node Elevation (ft) per City of Greeley datum
  - d. Node Demand (gpm)
  - e. Calculated Hydraulic Grade (ft)
  - f. Pressure (psi)
- I. Potable Water System Design Conclusions
  - 1. Discuss hydraulic analysis results for all modeled scenarios.
  - 2. Confirm that the pipe velocity and pressure requirements during the peak hour demand plus fire flow operating condition are met per *Section 3* of these Criteria.
  - 3. Confirm that the pressure requirements during the peak hour demands plus fire flow operating conditions, with one water connection closed, are met per *Section 3* of these Criteria.
  - 4. Discuss any potable water line oversizing required by the City over and above what is

necessary for the development's potable water needs.

5. For phased developments, discuss phased construction of the potable water distribution system and confirm that potable water pipes are sized and looped appropriately to meet the peak hour, plus fire flow demand velocity and pressure requirements during the interim condition.

J. Sanitary Sewer System Design Requirements and Assumptions

1. Provide all used equations, demand assumptions, and essential design requirements, parameters, and constraints.
2. If a model is required, it must be compatible with the City's InfoSWMM model. Model must be provided to Water and Sewer upon request.
3. Provide calculations for estimated population, design flows, peaking factor(s), hydraulic design, infiltration, flow type, and any other necessary design calculations.

K. Sanitary Sewer Systems Analysis and Modeling

1. If the development is phased, the sanitary sewer system shall be analyzed for full build out. This evaluation shall include the development's sanitary sewer flows and anticipated offsite sanitary sewer flows impacting the sanitary sewer system within the development.
2. Evaluate the development's sanitary sewer sizing for capacity to convey offsite flows.
3. Undeveloped areas shall have sanitary sewer flows calculated based on the higher of the current or anticipated land use or zoning of the property.
4. The City may require additional analysis in order to further verify that the proposed sanitary sewer system will meet the design requirements and needs of the development and the City. The City will evaluate sanitary sewer system hydraulic evaluations on a case by case basis.

L. Sanitary Sewer System Report Results

1. Provide a schematic layout of the sanitary sewer collection system showing and labeling all manholes, design points used for analysis, pipe slopes, and pipe sections.
2. Provide written calculations or printouts of software analysis results for each pipe evaluation including the following information:
  - a. Pipe Diameter (in)
  - b. Material
  - c. Date of installation
  - d. Pipe Slope (%)

- e. Sub and Super Critical Calculations, when a model is required
  - f. Manning's n Value
  - g. Pipe Discharge-(gpm)
  - h. Pipe Flow Velocity (ft/s)
  - i. Pipe Flow Depth (in)
  - j. d/D (depth of flow/diameter of pipe)
  - k. Maximum Capacity at d/D of 50% and/or 80% – (gpm) dependent on date of installation
- M. Sanitary Sewer System Conclusions
- 1. Discuss analysis results for all pipe evaluations.
  - 2. Confirm that acceptable pipe velocities and flow depth criteria are met.
  - 3. If design constraints arise and pipe velocity, flow depth, minimum allowable slope per pipe diameter, or any other Criteria requirements cannot be maintained, the Design Engineer shall provide the City written explanation as to why the Criteria is violated, why the non-standard sewer system design should be accepted, and request a variance to the Criteria. Water & Sewer Department acceptance is required for the variance.
  - 4. Discuss any sanitary sewer main oversizing required by the City over and above what is necessary for the development needs.
  - 5. Indicate if the development is served by “shallow sewer.” Shallow sewer is defined in *Section 4* of these Criteria.
  - 6. Discuss potential impacts that future upstream developments may have on the sanitary sewer capacity through the proposed development. Explain the capacity issues within the development and the proposed solutions for resolving them.
- N. Supplemental Engineering Calculations
- 1. These calculations shall include but are not limited to pipe restrained lengths, external pipe load analysis, traffic loadings, casing pipe wall thickness, and air and vacuum release valve sizing.
  - 2. Any calculations deemed necessary by the Design Engineer or City.
- O. Wastewater Pumping Stations (Lift Station) Design Report
- 1. Refer to *Section 4* of these Criteria and CDPHE for lift station design and approval guidelines and lift station design report requirements.

## 2.08 DESIGN REPORT – NON-POTABLE IRRIGATION SYSTEM

The objective of the non-potable irrigation system design report is to assist the Design Engineer with designing a non-potable irrigation system and storage facility to adequately serve peak season irrigation demands while adhering to the design requirements set forth in these Criteria. Refer to section 2.07 of these Criteria regarding report review and acceptance.

The non-potable irrigation system design report shall include, but is not limited to, the following information:

- A. Title Page, Engineer Certification Sheet, and Table of Contents requirements, refer to section 2.07 of these Criteria.
- B. Project Description and Location
  - 1. Clearly state the location of the project. Provide a site map identifying the project area and location of the non-potable storage facility (pond), pump station, discharges/fill lines, and overflow works.
  - 2. Indicate if the non-potable system will be phased. Elaborate on the anticipated timing of the project phasing and how it will affect the overall design and construction of the non-potable irrigation system.
  - 3. If connecting to an existing non-potable irrigation system, identify locations of pipe connections. Provide the pipe diameter, pipe material, and year of installation of the existing main.
- C. References and Appendices
  - 1. Provide a page referencing all design criteria, resources, and modeling software used in preparing the design report.
  - 2. Provide appendices as necessary to include supplementary information.
- D. Non-potable Irrigation System Report Requirements and Assumptions
  - 1. Provide all used equations, assumptions, design methodologies, essential requirements, parameters, and constraints.
  - 2. Indicate any software package(s) and version used for the non-potable pipe system modeling. The model should be compatible with Innovyze InfoWater for incorporation into the City's model.
  - 3. Provide calculations for determining irrigated acreage, required storage volume, pond design including high and low operating elevations, watering requirements, application rates, and design flow.
  - 4. Provide the number and type of pumps, motor horsepower, system head curves, head computations, discharge pressure, and any other pertinent information for the pump system design.
- E. Discussion Items
  - 1. Discuss specific design features of the non-potable irrigation system and their

requirements, including but not limited to, non-potable/potable water sources and means of delivery into the system, the lining and aeration system, pond shoreline treatment, overflow works, and pond design.

2. General design requirements for the pump station, including but not limited to, power and electrical requirements, control and monitoring systems, and building requirements.

F. Non-Potable Irrigation System Analysis and Modeling

1. The non-potable irrigation system shall be modeled for the static scenario and the design irrigation demands scenario. Refer to section 2.07 of these Criteria for modeling procedures and report results requirement.

G. Non-potable Irrigation System Design Conclusions

1. Discuss hydraulic analysis results for all modeled scenarios.
2. Confirm that the pipe velocity and pressure requirements during irrigation demand are met per *Section 5* of these Criteria.

H. The City may require electronic copies of the hydraulic models be submitted.

## 2.09 GEOTECHNICAL SOILS REPORT

- A. A geotechnical soils evaluation, prepared by or under the supervision of a Geotechnical Engineer, licensed in the State of Colorado, shall be submitted to the City for review and shall be accepted by the City prior to final Construction Drawing acceptance. The geotechnical soils report shall describe the classifications and characteristics of the soils encountered on the project and include recommended methods of backfilling and compaction. Refer to the Department of Public Works' *SDC*, latest revision, for soils testing and geotechnical soils report requirements.
- B. The Geotechnical Engineer shall evaluate groundwater conditions for the site and provide recommendations for sanitary sewer main groundwater barriers.

## 2.10 VERIFICATION SURVEY DRAWING REQUIREMENTS

- A. Prior to paving, the Design Engineer shall provide the City with a survey of the installed potable water, sanitary sewer, and non-potable irrigation systems. The purpose of this survey is to verify that the mains and appurtenances were installed per design and within allowable construction tolerances. Once the City has accepted the verification survey, the City shall give the Contractor written notice to proceed with paving construction. ***Verification Survey plans are not As-Constructed Record drawings.*** See section 2.11 of these Criteria for As-Constructed Record Drawing requirements.
- B. The Verification Survey drawing(s) shall be prepared for easy modification and transition to final As-Constructed Record drawings.
- C. The Verification Survey drawings shall be modified from the original construction plan and profile sheets showing the design information as well as the surveyed information. The original design information shall be shown as "lined through" if as constructed conditions differs from approved construction plans. The surveyed information shall be located in the

same area as the design information and shall be either “clouded” or made with a heavier line weight than the design information for clear differentiation.

- D. Verifications Survey drawings shall be prepared by a Professional Engineer. Surveyed elevations for the Verification Survey shall be obtained by a Colorado Registered Land Surveyor. The Surveyor shall obtain horizontal locations, surveyed elevations and information for the following: To the same precision and datum as design drawings.
1. Potable and non-potable – Horizontal locations of valves, fire hydrants, blow-offs, air/vacuum release valves, and top of pipe elevations at all valves.
  2. Sanitary sewer – Horizontal locations of manholes, diameter of manholes, sizes of installed pipe, invert elevations of all mainline pipes and services entering and exiting a manhole, distances between manholes, pipe slopes based on the surveyed invert elevations, and proposed manhole rim elevations.
  3. Utilities – Provide horizontal and vertical location of all existing and proposed utility crossings.
  4. For potable and non-potable water lines, provide the proposed final ground elevations at all valve boxes. ***Surveyed top of valve nut and valve nut key extension elevations. This information must be used to calculate top of pipe elevation based on the height of the installed valve bonnet, which varies due to pipe diameter and valve manufacturer.***
  5. Any other surveyed information as required by the City.
- A. Construction tolerances shall be:
1. Water System - Horizontal locations:  $\pm 0.30$  feet and Elevations:  $\pm 0.30$  feet
  2. Sanitary System - Horizontal locations:  $\pm 0.30$  feet and Elevations:  $\pm 0.08$  feet
- B. Survey measurement accuracy shall be:
1. Horizontal locations:  $\pm 0.10$  feet
  2. Elevations:  $\pm 0.01$  feet
- C. A completed A5 – *Verification Survey Checklist and Certification* form found in the appendix, shall accompany the submitted Verification Survey plans.

## **2.11 AS-CONSTRUCTED RECORD DRAWING REQUIREMENTS**

- A. The Contractor and Design Engineer shall be responsible for recording As-Constructed information on a set of Record Drawings kept at the construction site. A representative of the Developer shall monitor construction to assure that changes in construction (as approved in writing) and other pertinent details, such as horizontal location of fittings and manholes, valves, top of pipe elevations, manhole inverts, service tap locations, pipe sizes, depths, etc. are kept current on the As-Constructed Record Drawings.
- B. Where the construction is phased with a more than 30-day lapse between phases, As-Constructed Record Drawings shall be submitted to the City after each completed phase. The

Construction Drawings for all future phases shall also reflect the “As-Constructed” conditions of the previous phases.

- C. At a minimum, the As-Constructed Record Drawings set shall include the following sheets from the original accepted Construction Drawings:
1. Cover Sheet
  2. Utility Plan
  3. All potable water, sanitary sewer, and non-potable irrigation plan and profile sheets.
  4. All construction details and City of Greeley Standard Drawings that were used in the construction of the potable water distribution, sanitary sewer collection, and non-potable irrigation.
  5. Landscape plans.
- D. The As-Constructed Record Drawings shall show the original design information as well as the As-Constructed information. The original design information shall be shown as “lined through”. The As-Constructed information shall be located in the same areas as the design information and shall be either “clouded” and/or made with a heavier line weight as the design information for clear differentiation. The month and year of the construction shall also be noted.
- E. A Colorado Registered Land Surveyor shall certify the As-Constructed horizontal locations and surveyed elevations of all items listed in section 2.10 of these Criteria in addition to:
1. Final sanitary sewer manhole rim elevations and Inverts.
  2. Final top of water valve box elevations, top of pipe.
  3. Construction tolerances shall be evaluated based on original design and City design criteria.
  4. Measurement tolerances shall be:
    - i. Horizontal locations:  $\pm 0.10$  feet
    - ii. Elevations:  $\pm 0.01$  feet
- F. The project responsible Design Engineer and Land Surveyor shall observe construction, as required, in order to certify the conditions and information recorded on the As-Constructed Record drawings is true and correct.
- G. The General Contractor for the project shall sign each drawing sheet of the As-Constructed Record plans set with the following statement:
- I, \_\_\_\_\_, hereby state that this project was constructed to City of Greeley accepted Construction Drawings and standards, as designed by the project Design Engineer, and as field staked by the project Land Surveyor. All deviations to the approved Construction Drawings, standards, design, or survey were so noted on field drawings and these were



provided to the project Design Engineer for acceptance and inclusion in the As-Constructed Record Drawings.

\_\_\_\_\_  
Construction Company

\_\_\_\_\_  
Address

\_\_\_\_\_  
Authorized Representative

\_\_\_\_\_  
Title

\_\_\_\_\_  
Date

- H. A Professional Land Surveyor shall perform or directly supervise all field survey data collection to verify the As-Constructed conditions and shall stamp and seal each drawing sheet in the As-Constructed Record Drawing set with the following statement:

I, \_\_\_\_\_, hereby state that this project was field staked for construction per City of Greeley accepted Construction Drawings and standards and in accordance with the project design. I certify that the field survey information obtained for the As-Constructed Drawings was obtained in accordance with City current standards and is accurately represented on these As-Constructed Record Drawings.

\_\_\_\_\_  
Registered Professional Land Surveyor

(Affix Seal)

- I. A Professional Engineer shall review all the As-Constructed information for compliance with the original approved design and standards and shall stamp and seal each drawing sheet in the As-Constructed Record plan set with the following statement:

I, \_\_\_\_\_, hereby state that I have reviewed the As-Constructed information provided by the project Contractor and project Land Surveyor. I certify that according to the information provided the As-Constructed Record Drawings are in compliance with the City of Greeley accepted Construction Drawings and standards and will function as designed.

\_\_\_\_\_  
Registered Professional Engineer

(Affix Seal)

- J. As-Constructed Record signed and sealed drawings shall be submitted to and accepted by the City prior to issuance of Substantial Completion, in the form of one electronic PDF version and one file package containing GIS spatial data compatible with ESRI ArcGIS. The two (2) year warranty period for the installed potable water, sanitary sewer, and non-potable irrigation systems will begin **after** the Certificate of Substantial Completion has been issued by the City. The request for the Substantial Completion Certificate may be initiated by the City or requested by the Developer, but in all cases is the sole responsibility of the Developer.
- K. The City will compare the certified As-Constructed Record Drawing information with the approved Construction Drawings, previously submitted Verification Survey, and information the City may be aware of during the construction process. Any corrections, additions, or

omissions to the As-Constructed Record Drawings shall be provided to the Design Engineer who prepared the As-Constructed Drawings for changes.

- L. The Certificate of Substantial Completion, will NOT be granted until the As-Constructed Drawings for the potable water, sanitary sewer, and non-potable irrigation systems are accepted by the City. (Ordinance 44, 2002)
- M. The Certificate of Final Acceptance occurs at the end of the two year warranty period and final walk through of the project.

## **2.12 REIMBURSEMENT FOR PUBLIC INFRASTRUCTURE DESIGN AND INSTALLATION COSTS**

- A. The City may require the Developer to install a potable water, sanitary sewer or lift station, non-potable irrigation main or non-potable pond and pump station larger than is needed to adequately serve development.
- B. For the installation of mains the City will reimburse the Developer for the materials costs above that required for the development. The difference in materials costs shall only include the difference in pipe materials, manhole materials, valve materials, and fitting materials. Additional materials costs, if any, shall be agreed upon in writing, prior to commencement of construction.
- C. For sanitary sewer collection main oversizing, the City may reimburse the Developer for additional costs due to sanitary sewer main installation excavation depth or width beyond that required for the development.
- D. If the City requested oversizing results in significant change to horizontal or vertical alignment, additional reimbursement may be agreed to prior to construction.
- E. For the installation of sanitary sewer lift stations and non-potable ponds and pump stations the City will reimburse the Developer for the materials costs above those required by the development on a pro rata basis using the portion of the lift or pump station capacity that is not required for the development. The scope of the reimbursement and the reimbursement ratio shall be agreed upon in writing prior to the commencement of construction.
- F. For non-potable pond oversizing, the City may reimburse the Developer for extra depth costs due to additional excavation above that required size for the development.
- G. The Developer shall submit a materials list with unit prices, quantities, and, if appropriate, a cost comparison between the two pipe sizes under consideration. Reimbursement will only be paid after the As-Constructed Record Drawings have been accepted by the City. Copies of material invoices for materials delivered to the development site and used in construction shall be provided along with the Developer's request for reimbursement.
- H. If the Developer is required to design and construct off site potable water, sanitary sewer, or non-potable irrigation mains in order to serve the development, the Developer may be eligible for design and construction cost reimbursements from other developments that connect to that main. Conversely, if the Developer connects to potable water, sanitary sewer, or non-potable irrigation mains constructed by another Developer or the City, the Developer may be required to participate in the design and construction costs of those lines. Refer to the *City*

*of Greeley Charter and Code, Title 14: Public Services, sections 14.08.360, 14.08.370, 14.08.380, 14.12.080, 14.12.090 and 14.12.100, for additional reimbursement requirements.*

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## SECTION 3

### POTABLE WATER DISTRIBUTION SYSTEM DESIGN CRITERIA

#### 3.01 GENERAL

The purpose of this section is to provide information for the design and layout of a potable water distribution system. Potable water distribution system design shall be in accordance with the City of Greeley *Water Master Plan*, latest revision, and these Criteria.

This section is not intended to be inclusive of all situations and the Design Engineer may be required to use additional engineering judgment to meet the overall design intent for constructability and long-term operations and maintenance. **This Design Criteria typically applies to potable water mains sixteen-inches (16”) in diameter and smaller.** The City of Greeley Water and Sewer Director reserves the right to make final determinations of the system design based on the best interest of the City’s system. Refer to standard detail drawings for additional design information.

#### 3.02 DEFINITIONS

##### A. Potable Water Distribution Mains

1. A potable water distribution main is a water pipe that primarily serves as a delivery conduit to transport potable water from transmission mains directly to individual water services.
2. Potable water distribution mains within the City are eight-inches (8”), twelve-inches (12”), and sixteen-inches (16”) in diameter.

##### B. Potable Water Transmission Mains

1. A potable water transmission main is a water pipe that primarily serves as a delivery conduit to transport potable water directly to the distribution mains.
2. Potable water transmission mains are larger than sixteen-inches (16”) in diameter.

##### C. Potable Water Services

1. Potable water services include all piping, fittings, and appurtenances used to convey potable water from the distribution main to the customer.

#### 3.03 DESIGN FLOW

- A. The potable water distribution system shall be designed to transport peak hour plus fire flow demands in accordance with these Criteria.
- B. All water demands used in the design of potable water distribution systems are subject to approval by the City.

C. Design Flow

1. The water demand criteria presented in the following table are minimum criteria and the City reserves the right to modify the Criteria, at any time, for the design of specific projects. Potable water demand criteria for uses not provided in the table shall be determined during system design.

**TABLE 3-1: Potable Water Design Flow**

<b>Residential</b>			
Zoning based on <i>City of Greeley Charter and Code, Chapter 24.401, Zoning</i>			
Use	Units Per	Occupancy	Peak Hour Demand
R-E	3	3.1 persons	1.9 gpm/unit
R-L	5	3.1 persons	1.9 gpm/unit
R-M	10	2.7 persons	1.7 gpm/unit
R-H	20	1.7 persons	1.1 gpm/unit
R-MH	15	1.7 persons	1.1 gpm/unit
*Use these unit per acre values unless specific unit counts are known			
<b>Commercial</b>			
Where uses are known, use the specific demand values. Commercial demands based on 1000 ft <sup>2</sup> of building area unless noted otherwise. Otherwise use the appropriate zoning demand values.			
Use	Average Day Demand without Irrigation		
C-L	1500 gpd per acre		
C-H	3000 gpd per acre		
I-L & I-M	1500 gpd per acre		
I-H	3000 gpd per acre		
Use	Average Day Demand		
Restaurant	500 gpd		
Retail/Office	200 gpd		
Grocery	430 gpd		
Laundry, Dry Cleaning	1000 gpd		
Auto Dealer, Repair/Service	115 gpd		
Car Wash with Water	1500 gpd		
Hospital	380 gpd		
Hotel/Motel	350 gpd		
Retirement & Nursing	350 gpd		
School	12 gpd/student without showers 36 gpd/student with showers		
Religious Building	300 gpd		

Warehouse (Non-	25 gpd
Irrigation	25 gpm per acre

2. Irrigation is included in the residential water demand, but not included in the commercial water demand. Irrigation demands for commercial uses shall be determined using the provided irrigation demand criteria and the commercial development's estimated irrigated acreage.
3. For residential demands without irrigation flows, a base flow of 60 gallons per capita per day shall be used.
4. Treat Mixed-Use High Intensity Zoning as 50% R-H and 50% C-H and Mixed-Use Low Intensity Zoning as 50% R-H and 50% C-L unless a more detailed breakdown is known.
5. Due to the extreme variation in water consumption amongst the different types of industry, industrial water demands shall be determined during system design when the industrial use is known.

D. Fire Flows

1. Contact City of Greeley Fire/Rescue Department (970-350-9510) for the latest adopted fire code and to confirm project fire flow requirements.
2. For design purposes, the maximum allowable fire flow provided from any one (1) hydrant is 1,500 gpm. Fire flow may be obtained from more than one (1) fire hydrant providing the additional hydrants are accessible to any possible fire location and meet the spacing requirements and distances from structures as specified in section 3.19 of these Criteria and by the City of Greeley Fire Department.

### 3.04 PRESSURE REQUIREMENTS

Potable water distribution systems must be designed to provide minimum and maximum system pressures as discussed in the following sections. Water system pressure information for the City's existing system shall be verified by the City.

- A. The potable water distribution system in all areas shall be designed for a maximum pressure of 125 psi and a minimum pressure of 40 psi at peak hour demands without fire flow.
- B. Twenty (20) psi residual pressure is required at any one (1) hydrant with peak hour demand plus fire flow with one (1) water connection closed.
- C. Pressure zones shall conform to existing City of Greeley pressure zones as provided in the *Water Master Plan*, latest revision. Specific information on the pressure zones or to confirm which pressure zone a development or site is actually located may only be obtained from the City.
- D. Pressure regulating valves (PRV) will be required between pressure zones. The final PRV location shall be determined by the City.

**TABLE 3-2: Pressure Zone High Water Levels**

Zone 1: 4830' (HWL- High Water Level)
Zone 2: 4940' (HWL)
Zone 3: 5040' (HWL)
Zone 4: 5200' (HWL)

**3.05 HYDRAULIC DESIGN**

**A. Friction Coefficient**

1. Potable distribution mains shall be designed using a Hazen-Williams friction coefficient "C" equal to 120.

**B. Velocity**

1. All pipes shall be sized for a maximum water velocity of no greater than five (5) feet per second (fps) at peak hour demand and seven (7) fps at peak hour demand plus fire flow.

**C. Head Loss**

1. Head loss in pipes twelve-inches (12") in diameter or less, at peak hour demand plus fire flow, shall not exceed ten (10) feet of head loss per 1,000 linear feet of pipe (10 ft/1,000 ft).
2. For sixteen-inch (16") diameter pipes, head loss at peak hour demand plus fire flow shall not exceed three (3) feet of head loss per 1,000 feet of pipe (3 ft/1,000 ft).

**3.06 POTABLE WATER MAIN SIZE**

- A. Unless specifically indicated in the *Water Master Plan*, sixteen-inch (16") mains are required every mile and twelve-inch (12") mains are required every half-mile. Other distribution mains shall have a minimum diameter of eight-inches (8").
- B. Hydrant leads connecting to the potable distribution system shall be six-inches (6") in diameter. Other pipe diameters for hydrant leads are prohibited.

**3.07 DEPTH OF BURY**

- A. The minimum depth of cover shall be five (5) feet and the maximum depth of cover should generally not exceed six (6) feet. Design preference is to minimize lowering which can be challenging to locate and maintain.
- B. When design or constructability constraints are present, deeper or shallower water main installation may be permitted only with acceptance from the City. Additional design and installation considerations may be required by the City depending on the situation. Design

considerations should minimize additional fittings and elevation changes where feasible.

### **3.08 CONNECTIONS TO THE EXISTING POTABLE WATER SYSTEM**

- A. Main connections to the existing potable water distribution system may be made by wet tap or cut in tee. The City shall make all twelve-inch (12") diameter or smaller wet taps on the existing system. It is the Contractor's responsibility to provide all approved tapping materials (tapping sleeves, tapping valves, insulator kit, etc.) when the City is drilling the wet tap.
- B. All wet taps greater than twelve-inch (12") diameter and all cut-in tees shall be made by the Contractor under the direct supervision of the City.
- C. For direct wet taps on existing transmission mains or sixteen-inch (16") and larger distribution mains, manufacturer's shop drawings and specifications for the proposed tapping sleeve shall be submitted to the City for review and acceptance prior to installation of the tapping sleeve by the Contractor.
- D. Direct taps on existing transmission mains or sixteen-inch (16") and larger distribution mains shall require the installation of an insulator kit between the tapping sleeve and tapping valve.
- E. Construction documents shall include a note for all wet taps: "Contractor to reference specifications for approved tapping materials and installation wet taps 16" and larger shall contact Distribution for direct supervision of installation by the City."

### **3.09 LOCATION AND LOOPING OF POTABLE WATER MAINS**

- A. Potable water mains shall be located in the center of a dedicated street right-of-way, where feasible, or within a dedicated exclusive easement of appropriate width. If narrow street sections do not allow the water line to be located in the center of the street right-of-way while maintaining clearances from other utilities and the lip of street gutter, the City may allow the potable water main to be located five (5) feet offset from centerline of the street right-of-way. City approval is required for all other proposed potable water main locations.
- B. The centerline of potable water mains shall not be placed closer than five (5) feet to the lip of street gutter without prior acceptance by the City. Preferred location is to maximize distance from lip of gutter
- C. Potable water mains serving a cul-de-sac shall be extended to within ten (10) feet of the lip of street gutter at the end of the cul-de-sac and shall have a hydrant assembly placed on the end of the line.
- D. A potable water main serving one (1) lot shall extend all the way across the frontage for that lot.
- E. Permanent dead-ends longer than 300 feet are prohibited. City preference is no dead-end lines.
- F. Temporary dead-ends shall have fire hydrant or a flushing station with an acceptable discharge point at the end of the line.



- G. For temporary phasing, an adequate number of connections to the existing potable water distribution system shall be provided such that no more than fifteen (15) single family units, or the equivalent flow, can be constructed.
  - 1. Potable water mains shall extend to the extremities of the property or the subdivision served. Extensions shall be in appropriate locations to provide adequate water connections and to maintain looping requirements for adjacent, future developments and to facilitate the completion of the grid described in section 3.06 of these Criteria.
  - 2. Water mains shall be extended offsite when required to tie into the existing distribution system for additional water source connections. Appropriately sized easements shall be provided.
- H. In all instances, the City shall determine the potable water system looping, connections, and valving in order to maintain overall water system performance. Ultimately, the required source connections to the existing potable water system shall be solely determined by the Water & Sewer Department.

### **3.10 POTABLE WATER SYSTEM PHASED INSTALLATION AND STUBOUTS**

- A. Potable water distribution system phasing, if proposed by the Developer, shall be clearly identified on the overall utility plan. Water plan and profile sheets shall clearly show and label the phasing transitions in the potable water line design.
- B. The proposed potable water system phasing shall maintain looping integrity within the system as described in section 3.09 of these Criteria.
- C. The phased potable water system design shall meet the phased water demands for the development and adhere to all potable water system and hydraulic design requirements provided in these Criteria.
- D. Locate line valves and temporary fire hydrant and flushing station at the end of each phase or stub out, as described in section 3.09 of this criteria. The stubout shall be shown on the potable water plan and profile sheets.
- E. Phased water line or stubout construction shall be extended a minimum ten (10) feet beyond phased street paving to avoid asphalt removal during excavation for future connections.
- F. Phased potable water mains or stubouts intended for future connections shall be valved such that only one (1) valve needs to be closed when the main is extended and no customers are without water service when the line is extended. The valve must be appropriately restrained so it will not “blow off” when the water line is exposed and all thrust blocking is removed for the extension. See section 3.14 of these Criteria regarding pipe restraint.
- G. The maximum length of a stubout shall be fifty (50) feet unless otherwise approved by the City.
- H. Potable water main stubouts not utilized shall be abandoned. Refer to appendix section A9 – *Policies Impacting Design and Construction* for abandonment procedures.

### 3.11 PIPE MATERIAL

- A. Potable water pipes less than or equal to sixteen-inches (16") in diameter shall be AWWA C151 cement-lined ductile iron pipe or AWWA C900-16 polyvinyl chloride (PVC) pressure pipe.
1. HDPE pipe and fused PVC may be used with City approval for specifically identified purposes, location and uses such as horizontally bored crossings.
- B. The Design Engineer shall specify the pipe material and class, as required for specific project conditions. The pipe material and class shall be called out on the Construction Drawings.
- C. All ductile iron pipe shall be protected against soil corrosion based on the corrosion level determined from pH and Resistivity levels in accordance with the following table. If the corrosion level is found to be Medium or lower, the pipe shall be wrapped with 8-mils of V-Bio Enhanced Polyethylene Encasement in accordance with AWWA C105. If the Corrosion level is Medium-High or High, then additional Zinc coating of the pipe shall be required.

**TABLE 3-3: Corrosive Soil Function of pH and Resistivity**

pH	Resistivity (Ohms-cm)	Corrosion
<3.5	Any	High
3.5-4	<4,500	High
	>4,500	Medium-High
4.5-5.5	<4,500	High
	4,500-5,000	Medium-High
	>5,000	Medium
5.5-6.0	<1,000	High
	1,000-5,000	Medium-High
	5,000-10,000	Medium
	>10,000	Medium-Low
6.0-9.0	<1,000	High
	1,000-3,000	Medium-High
	3,000-10,000	Medium
	10,000-20,000	Medium-Low
	>20,000	Low

### 3.12 VALVES

- A. All valves shall be located in dedicated street right-of-way or within a dedicated exclusive easement of appropriate width. City approval is required for all other proposed valve locations.

#### B. Gate Valves

1. Gate valves are assigned in the potable water distribution system so that no single accident, break, or repair necessitates shutting down a length of pipe greater than 500 feet in all directions or no more than fifty (50) single family units, or the equivalent single family flow for non-residential developments, are out of service at any one time.
2. At street intersections, gate valves shall be located at the extension of property lines, wherever possible.
3. Gate valves shall be located a minimum five (5) feet away from the edge of concrete cross pans or cutters and away from intersection. This requirement has precedence over section 3.12-B. of these Criteria.
4. Fire hydrant and fire sprinkler line gate valves shall be placed at the main. These gate valves shall be mechanical joint valves and fasten to a mechanical joint anchor tee (swivel tee) on the main.
5. All potable water line valves shall have a concrete collar around the valve box in accordance with *SDC Standard Drawings*.
6. City may require additional valves to allow for maintenance and control, and minimizing service outages. Final valve locations shall be solely determined by the City.
7. Valves shall be provided at both ends of water pipelines where the potential of inaccessibility for repairs may exist, this may include; rivers, ponds, ditches, railroads and highways. Where looping is required, valves shall be located at easement lines or ROW to maintain potable service.

#### C. Combination Air Valves

1. Sixteen inch (16") diameter mains shall have combination air valves installed at high points along the main and shall be properly sized by the Design Engineer in accordance with the manufacturer's recommendation. The City shall have final determination on valve size, placement, and type of valve to install.

#### D. Pressure Regulating Valves

1. Pressure regulating valves (PRVs) control pressures between potable water distribution system and shall be placed at pressure zone boundary. The final installation location shall be determined by City.
2. The standard PRV size is eight-inches (8") for all 8" mains unless otherwise approved by the City. Duplex 8" PRVs will be required for all mains larger than 8".

#### E. Blowoffs

1. Any required Blowoff location shall utilize a city approved fire hydrant.

### 3.13 PIPE ALIGNMENT

- A. Potable water mains may have a change in alignment or grade to avoid obstructions, within the limits of the pipe joints. If joint deflections is not feasible or permitted by the City, an appropriate bend fitting shall be used.
- B. Allowable Joint Offset for PVC Pipe

**TABLE 3-4: Maximum PVC Pipe Joint Deflection (or per manufacturers limits)**

Pipe Diameter (in)	Maximum Joint Deflection (°)
8"	2.5° – 1°
12"	1.5° – 1°

- C. PVC pipe can be joined with High Deflection (HD) Couplings which allow five degrees (5°) of pipe joint deflection per coupling. HD couplings can be used in the place of small bends or where it is undesirable or impossible to joint deflect the pipe.
- D. Allowable Joint Deflection for DIP Pipe

**TABLE 3-5: Maximum DIP Pipe Joint Deflection**

Pipe Diameter (in)	Maximum Joint Deflection (°)
6"	4.0°
8"	4.0°
12"	4.0°
16"	2.5°

### 3.14 THRUST BLOCKING AND PIPE RESTRAINT

- A. Thrust Blocks
  - 1. Concrete thrust blocks shall be constructed at all mainline bends and tees.
  - 2. The thrust block details, as shown in the City of Greeley Standard Drawings, are to be used as minimums only. The Design Engineer shall determine the required size of thrust blocks to use.
- B. Pipe Restraint
  - 1. If for any reason (i.e. temporary dead end line), concrete thrust blocks cannot be used, restrained push-on or mechanical joint restraints shall be required.
  - 2. The Design Engineer shall determine the length of required pipe restraint, for the pipe material being used, PVC or DIP, in accordance with AWWA M41 *Ductile-Iron Pipe and Fittings* or AWWA M23 *PVC Pipe – Design and Installation*, latest revision.
    - a. Restraint calculations shall be submitted to the City for review and acceptance.
    - b. Restrained length(s) shall be provided on the Construction Drawings.

- C. In some instances (i.e. fire hydrants, large diameter fire lines, water line lowering's, etc.) thrust blocks may be required in addition to pipe restraint. The City shall make such determinations on a case by case basis.

### 3.15 POTABLE WATER MAIN AND SERVICE ENCASEMENTS FOR WET UTILITIES

Wet utilities should be defined as any pipe line that could contaminate the potable water system.

- A. No general statement can be made to cover all encasement conditions, therefore only typical encasement situations are addressed in this section. Encasement requirements shall ultimately be determined by the City on a case by case basis.
- B. Refer to construction specification *Section 02445, Casing Pipe – Borings and Encasements* for encasement pipe material, diameter, and wall thickness (if applicable), casing spacers, and standard detail end seals, and installation requirements. No encasements shall be constructed from poured concrete.
- C. The use of “line” or “lines” in this section shall refer to both mains and services.
  - 1. Where sanitary sewer lines cross beneath potable water lines with less than eighteen-inches (18”) clearance or any sanitary sewer lines cross above potable water lines, or the ten (10) feet horizontal clearance between potable water lines and sanitary sewer lines cannot be maintained, pipe encasement shall be designed and constructed so as to protect the potable water line.
  - 2. Where non-potable Distribution lines cross above or below potable water lines with less than eighteen-inches (18”) clearance, pipe to be center on potable water Main or Fused and shall be designed and constructed so as to protect the potable water line.
  - 3. Pipe encasement shall be placed on the sanitary sewer line or non-potable irrigation line except in situations where the sanitary sewer or non-potable irrigation line is existing. Where the sanitary sewer or non-potable irrigation line is already constructed, the pipe encasement shall be placed on the potable water line. Priority shall be given to encase service lines before main lines.
  - 4. The encasement pipe shall extend a minimum ten (10) feet on either side of the crossing measured from the outside diameter of the crossed pipe. Longer casing pipes may be required depending on the encasement situation.
  - 5. For any atypical encasement sizing situations, the Design Engineer shall size the encasement pipe such that the inside clearance is at least one-inch (1”) greater than the maximum outside diameter of the casing spacer runners.
  - 6. Where storm water lines cross above potable water mains, storm water pipe joints shall utilize rubber gaskets and exterior joint wrap a minimum ten (10) feet on either side of the crossed potable water main, measured from the outside diameter of the pipe.
- D. Potable water main crossings under any open irrigation ditch shall have a minimum five (5) feet of cover and shall be encased.
- E. Bored utility crossings shall have a minimum twenty-four inches (24”) of vertical clearance

from the outside diameter of the utility casing to the outside diameter of the potable water line if the bored utility crosses above the potable water line and a minimum thirty-six inches (36") of vertical clearance from the outside diameter of the utility casing to the outside diameter of the potable water line if the bored utility crosses below the water line.

- F. If there are horizontal or vertical clearance conflicts between the potable water line and gravity utilities, the City may require that the potable water main be lowered, raised, or realigned in order to maintain the required clearances.

### **3.16 POTABLE WATER MAIN BORINGS & ENCASEMENTS REQUIRED BY OTHER AGENCIES**

- A. Installation of potable water mains through City of Greeley or another agency's right-of-way, easement, or other, may require a bored casing pipe to facilitate main installation. The type of bored casing material and its properties will be specified by the agency granting permission to cross. Such crossings shall be subject to approval by the City to avoid conflicts in requirements or standards between the City and the agency granting permission to cross.
1. A letter, permit, or approved crossing application from the agency granting permission to cross, must be provided to the City prior to the boring.
  2. The City shall not accept any bored crossings imposed with an annual user or crossing fee from the agency granting permission to cross. All bored crossing fees, if applicable, shall be paid by the Developer prior to the boring.
- B. The minimum requirements for bored casings within the City shall be in accordance with construction specification *Section 02445, Casing Pipe – Borings and Encasements. & standard drawings*
1. The required bore length of casing pipe shall be determined by the Design Engineer and must be accepted by the City.
  2. All bored casing shall have a minimum of twenty-four inches (24") of vertical clearance from the outside diameter of the casing pipe to the outside diameter of the utility line if the bored casing crosses above the utility and a minimum thirty-six inches (36") of vertical clearance from the outside diameter of the casing pipe to the outside diameter of the utility line if the bored casing crosses below the utility, unless more stringent requirements by other utility.

### **3.17 POTABLE WATER SERVICES AND FIRE SPRINKLER LINES**

- A. General
1. Potable water service lines shall not be installed in trenches with other wet or dry conduits/utilities. A service line shall be separated from other conduits a minimum ten (10) feet horizontally and eighteen-inches (18") vertically. The only exception will be a fire sprinkler line. In this instance, the horizontal separation may be a minimum of five (5) feet, from outside diameter of the pipe and final determination. This shall be evaluated by the City on a case by case basis.

2. Potable water services and fire sprinkler lines for a given lot must be tapped on the potable water main within the confines of the extended property lines. Certain lots and cul-de-sacs may have the potable water service line or fire sprinkler line located anywhere along the lot frontage but shall be a minimum five (5) feet inside the property line being served
3. No potable water service taps shall be made on fire sprinkler lines.
4. Potable water services and fire sprinkler lines not intended to be utilized shall be abandoned. Refer to appendix section A9 – *Policies Impacting Design and Construction* for abandonment procedures.

B. Water Services

1. Refer to construction specification *Section 02514, Water Service Lines, Meters, and Appurtenances*, for service pipe materials and installation requirement.
2. A separate potable water service line and meter must serve each building with individual owners.
3. No potable water service lines shall cross property lines, including irrigation systems, unless otherwise approved by the City for irrigating multiple outlots. Irrigation systems from a single potable water service shall only be allowed for use on that single property. Refer to appendix section A7 – *Compound Tap Exemption Policy for Irrigation of Multiple Outlots*.
4. No compound potable water taps are allowed. Refer to *City of Greeley Charter and Code, Title 14: Public Services, Section 14.04.200*.
5. Pressure boosters are prohibited without adequate backflow protection.
6. Potable water services shall be located a minimum five (5) feet inside the property being served.
7. Under no condition is a potable water service to be located under driveways, trees, or other permanent structures.
8. Potable water service taps shall be separated by at least two (2) feet, measured along the potable water main length, including when taps are on opposite sides of the potable water main. Potable water service taps shall also be a minimum two (2) feet from all joints, fittings, or valves.
9. The corporation stop, curbstop, meter, that portion of the service line between the corporation stop and the meter, and five (5) feet past the meter shall all be the same internal diameter.
10. Potable water service curb stops shall be located  $\pm$  one (1) foot from the property line or easement boundary and preferred inside the row. Potable water service meter pits/vaults shall be located as close as possible beyond the curb stop. See City of Greeley Standard Drawings for additional service and meter installation requirements.

11. Potable water service meter pits/vaults shall normally be located after the curbstop in a landscaped area or streetscape. Meter pits/vaults shall not be installed in any street, parking area, driveway, or sidewalk unless otherwise approved by the City. If a meter pit/vault is permitted by the Water & Sewer Department to be located in any traffic area, the pit/vault shall be designed to withstand HS-20 traffic loadings. Curbstops with tracer wire test stations shall be in a valve box.
12. There shall be no major landscaping (trees, boulders, or shrubs with mature growth greater than three (3) feet), buildings, or other permanent structures within ten (10) feet of the meter pit/vault.
13. The maximum allowable number of living units on a single tap may be determined using a fixture analysis per the process outlined in the most recent edition of AWWA Manual of Water Supply Practices M22 – Sizing Water Service Lines and Meters. If no analysis is provided, the maximum values are shown below:

**TABLE 3-6: Living Units Allowed Per Tap Size**

Tap Size (inch)	Maximum Allowable Living Units	Tap Size (inch)	Maximum Allowable Living Units
3/4"	2	4"	90
1"	4	6"	170
1 1/2"	10	8"	300
2"	25	10"	500
3"	45	12"	825

14. Commercial and industrial developments may provide potable water service stubouts, if the end user is known.

**C. Fire Sprinkler Lines**

1. Fire sprinkler lines two-inch (2") or smaller shall be type "K" copper. Fire sprinkler lines larger than two-inch (2") shall be restrained DIP. Restrained DIP fire sprinkler lines require concrete thrust blocking at the main and a gate valve at the main. Fire sprinkler lines are not metered.
2. Fire sprinkler lines must be connected to the potable water distribution system. Connections to non-potable irrigation system are prohibited.

### **3.18 POTABLE WATER MAINS AND SERVICES IN RELATION TO DRY UTILITIES**

Dry utilities shall be defined as any utility pipe line that could not contaminate the potable water system.

- A. Potable water services and distribution mains shall have a minimum ten (10) feet horizontal and eighteen-inches (18") vertical separation from all utilities measured from outside diameter.
- B. Dry utility crossings shall be encased in high density polyethylene pipe (HDPE), Standard Dimension Ratio (SDR) 11 or approved equal from edge to edge of the easement or right-of-way, or ten (10) feet on either side of the potable water main, whichever is greater. Final



determination shall be accepted only by the City

- C. Right angle utility crossings are only permitted above and below the potable water main with adequate clearance. Non-right angle crossings shall be approved by the City. Parallel installation of other utilities in exclusive water easements is not permitted.
- D. For a potable water line crossing situation not specifically mentioned in this section, the crossing requirements provided in these Criteria shall be applied to that particular situation to the best extent possible.

### **3.19 FIRE PROTECTION AND HYDRANT SPACING**

- A. All fire protection, fire flow, and hydrant requirements are subject to approval by the Greeley Fire Department.
- B. Hydrant Spacing
  - 1. Residential structures shall be no further than 300 feet, fire access distance<sup>1</sup>, from a fire hydrant.
  - 2. In R-L zoned areas, fire hydrant spacing shall be no further than 600 feet measured along the street curb line.
  - 3. In R-M and R-H zoned areas, fire hydrants shall be spaced equal to or less than 500 feet apart, measured along the street curb line. Structures shall be 250 feet or closer, fire access distance, from a fire hydrant.
- C. In commercial and industrial areas, structures shall be 250 feet or closer, fire access distance, from a fire hydrant.
- D. Where potable water mains are extended along streets where hydrants are not needed for the protection of structures, hydrants shall be provided at spacing not to exceed 1,000 feet.
- E. Hydrants shall be located at intersections whenever possible. Hydrants located mid-block shall be aligned with the extension of a property line.
- F. Fire hydrants shall be placed at the end of cul-de-sacs over 300 feet in length measured from the centerline of the intersecting street to the end of the cul-de-sac. For cul-de-sacs less than 300 feet in length, install fire hydrants at the entrance of the cul-de-sac.
- G. Fire hydrants shall be installed in accordance with construction specification *Section 02516, Water Utility Distribution Fire Hydrants* and City of Greeley Standard Drawings.
- H. A three (3) foot radius in all directions around the hydrant shall be clear of obstructions.
  - 1. Where hydrants are vulnerable to vehicular damage, crash posts shall be provided outside of the three (3) foot radius clearance in all directions from the hydrant and a minimum of one foot from edge of sidewalk.

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<sup>1</sup> Fire access distance is the distance a fire pumper must travel to lay a standard hose line from a hydrant to the primary access point of a structure. The hose lay distance is not measured over unimproved areas that may be impassable due to weather conditions, obstructions, etc.

2. When hydrants are located less than 4 feet from a vehicular travel path, or not protected by curb and gutter then crash posts shall be provided. Crash posts shall be concrete filled pipes that are four-inches (4") in diameter and a minimum of four (4) feet in height above the finished ground surface with two (2) feet of post below the finished ground surface.
- I. All hydrants must be within dedicated exclusive easements or public rights-of-way. Refer to *Section 2* of these Criteria for easement requirements.

### **3.20 CROSS CONNECTION AND BACKFLOW PREVENTION**

- A. Potable water service lines on any property or inside any building shall have NO physical connection with any pipes, pumps, hydrants, tanks or non-potable irrigation systems that could draw or discharge any unsafe or contaminated water (including steam condensation or cooling water) into the potable water distribution system.
- B. For additional information on cross connection or backflow prevention requirements, refer to appendix section A6 – *Cross Connection and Backflow Prevention Policy*.

## SECTION 4

### SANITARY SEWER COLLECTION SYSTEM DESIGN CRITERIA

#### 4.01 GENERAL

- A. The purpose of this section is to provide information for the design and layout of a sanitary sewer collection system. Sanitary sewer collection system design shall be in accordance with the City of Greeley Sanitary Sewer Master Plan, latest revision, and these Criteria.
- B. This section is not intended to be inclusive of all situations and the Design Engineer may be required to use additional engineering judgment to meet the overall design intent for constructability and long-term operations and maintenance. **This Design Criteria typically applies to sanitary sewer mains fifteen inches (21") in diameter and smaller.** The City of Greeley Water and Sewer Director reserves the right to make final determinations of the system design based on the best interest of the City's system. Refer to standard detail drawings for additional design information.

#### 4.02 DEFINITIONS

- A. Sanitary Sewer Collection Mains
  - 1. A sanitary sewer collection main is a sanitary sewer pipe that gathers wastewater flows directly from individual sanitary sewer services or private sewer mains and transports.
- B. Sanitary Sewer Interceptor Lines
  - 1. Sanitary sewer interceptors within the City are fifteen inches (15"), eighteen inches (18"), or twenty one inches (21") in diameter.
- C. Sanitary Sewer Trunk Lines
  - 1. A sanitary sewer trunk line is a sanitary sewer pipe that collects sewage flows from the collection mains and interceptors and carries those flows to the wastewater treatment facility.
  - 2. Sanitary sewer trunk lines are larger than twenty one inches (21") in diameter.
  - 3. All sanitary sewer trunk lines require additional approval through the Colorado Department of Public Health and Environment (CDPHE), and all permitting shall be completed by Developer and Design Engineer.
- D. Sanitary Sewer Services
  - 1. Sanitary sewer services include all piping, fittings, and appurtenances used to convey sanitary sewage from the plumbing system of a structure to a sanitary sewer collection main.
  - 2. Sanitary sewer services are typically four inches (4") or six inches (6") in diameter.

#### 4.03 DESIGN FLOW

- A. The sanitary sewer collection system shall be designed to carry peak wastewater flows plus infiltration/inflow in accordance with these Criteria.
- Depending on a development's location, consideration of upstream and offsite flow contributions may be required by the City to ensure proper sizing of the sanitary sewer collection mains within the development. This will be determined by the City on a case by case basis.
  - Depending on the existing capacity of the downstream sanitary sewer collection system, the City may require verification that the downstream sewer system can convey the development's peak flows. If the downstream capacity is inadequate, the Developer may be required to make appropriate downstream sewer system upgrades. This will be determined by the City on a case by case basis.
  - Any infill or redevelopment project that is an intensification of use shall require the Developer to verify that the downstream sewer system can convey the development's peak flows. If the downstream capacity is inadequate, the Developer may be required to make appropriate downstream sewer system upgrades.
- B. Design Flow
- The wastewater flows presented in the following table are minimum criteria and the City reserves the right to modify the Criteria, at any time, for the design of specific projects. Wastewater flows for uses not provided in the table shall be determined during system design.

**TABLE 4-1: Sanitary Sewer Design Flow**

Residential			
<i>Zoning based on City of Greeley Charter and Code, Chapter 24.401, Zoning District Development Standards</i>			
Use	Units Per Acre	Occupancy	Average Day Wastewater Flows*
R-E	3	3.1 persons	0.22 gpm/unit
R-L	5	3.1 persons	0.22 gpm/unit
R-M	10	2.7 persons	0.19 gpm/unit
R-H	20	1.7 persons	0.12 gpm/unit
Commercial			
Use	Average Day Wastewater Flows*		
C-L (not specified)	1,500 gpd/acre (minimum)		
C-H (not specified)	3,000 gpd/acre (minimum)		
Retail/Offices	200 gpd/1,000 SF		
Hotels/Motels	350 gpd/1,000 SF		
Restaurants	500 gpd/1,000 SF		
Bars and Lounges	300 gpd/1,000 SF		

Neighborhood Stores	200 gpd/1,000 SF
Department Stores	200 gpd/1,000 SF
Laundry and Dry Cleaning	1,000 gpd/1,000 SF
Banks	300 gpd/1,000 SF
Nursing Homes	350 gpd/1,000 SF
Warehouses	25 gpd/1,000 SF
Car Washes	1,500 gpd/1,000 SF
Auto Dealer/Repair/Service	115 gpd/1,000 SF
Grocery Store	430 gpd/1,000 SF
Religious Buildings	300 gpd/1,000 SF
Factories	800 gpd/1,000 SF
Hospitals	380 gpd/1,000 SF
Schools (without showers)	12 gpd/student
Schools (with showers)	36 gpd/student
<b>Industrial</b>	
Use	Average Day Wastewater Flows*
I-L (not specified)	1,500 gpd/acre
I-M (not specified)	1,500 gpd/acre
I-H (not specified)	3,000 gpd/acre
*1cfs = 448.33 gpm Average day wastewater flow per capita = 60 gpcd	

- All flows used in the design of sanitary sewer collection systems are subject to approval by the City.

#### C. Peaking Factor

- A domestic peaking factor shall be obtained from ASCE Peak Flow Curve G<sup>1</sup>:

$$P_f = \frac{18 + \sqrt{P}}{4 + \sqrt{P}}$$

Where P = Population in thousands (example: P = 2 for population of 2,000)

<sup>1</sup> American Society of Civil Engineers (ASCE). 1982. *Gravity Sanitary Sewer Design and Construction. Manuals and Reports on Engineering Practice – No. 60*. Reston, VA: American Society of Civil Engineers.

$$Pf = \frac{18 + \sqrt{\frac{F}{60000}}}{4 + \sqrt{\frac{F}{60000}}}$$

Where F = Flow in gallons per day (based on 60 gpcd in Table 4-1)

#### 4.04 INFILTRATION AND INFLOW (I/I)

- A. Infiltration and inflow (I/I) is extraneous water flow that enters the sanitary sewer collection system.
  - 1. Infiltration is water entering the sanitary sewer collection system from the ground through service connections, defective pipes, pipe joints, and manhole connections.
  - 2. Inflow is unintentional water entering the sanitary sewer collection system from roof drains, underdrains, surface stormwater runoff, and natural drainage.
- B. 100 gallons per day per inch-diameter per mile of pipe shall be added to the peak design wastewater flow as the allowance for I/I.
- C. I/I flows are not subject to a peaking factor.

#### 4.05 HYDRAULIC DESIGN

- A. The required pipe size shall be computed by Manning's Equation below:

$$Q = \frac{1.49}{n} AR^{2/3} \sqrt{S}$$

Where:

Q = Flow (cfs)

n = Manning's Coefficient of 0.013

A = Area of Flow (ft<sup>2</sup>)

R = Hydraulic Radius (A/P)

Where: P = Wetted Perimeter

S = Slope of pipe (ft/ft)

- B. All sanitary sewer collection mains shall be designed to a maximum depth of flow, depending on age.
  - 1. Half full (d/D=0.5) for all construction prior to 2021 due to historical tap locations on the mark.
  - 2. 4/5 full (d/D=0.8) for all new development.

Where:

d = Depth of Flow

D = Diameter of Pipe

- C. Minimum design velocity at peak flow shall not be less than two (2) ft/s or greater than seven (7) ft/s. Where 2 ft/s is not feasible, the minimum slope shall be 1% slope for 8" pipe.
  - 1. Sewer shall be designed for velocities less than seven (7) ft/s whenever possible and for subcritical flows whenever possible.
  - 2. When conditions require velocity to be greater than seven (7) feet per second, special provisions shall be made to avoid scour and protect against displacement caused by erosion or impact.
- D. When lines are 12" and larger, Developer shall analyze flows for hydraulic jumps and special provisions shall be made to avoid H<sub>2</sub>S and protect against its effects.

#### 4.06 SANITARY SEWER MAIN SIZE AND SLOPE

- A. The following table shows the minimum allowable slopes per sanitary sewer main diameter. These minimum slopes may be used provided that the hydraulic design requirements in 4.05 of these Criteria are met.

**TABLE 4-2: Minimum Sanitary Sewer Main Slopes (ASCE)**

Pipe Diameter (in)	Minimum Slope (%)
8"	0.40%
10"	0.28%
12"	0.22%
15"	0.15%
18"	0.12%
21"	0.10%

- B. The maximum slope for any sanitary sewer collection main shall be 5%
- C. The City requires sanitary sewers to maintain a consistent slope throughout the sewer alignment in order to maintain capacity.
- D. All proposed sanitary sewers shall maintain the same inner diameter (ID) pipe size to match the existing City collection system; no downsizing shall be allowed.
- E. The City may require the Developer to install a sanitary sewer collection main larger than is needed to adequately service the development. Refer to *Section 2* of these Criteria for oversizing reimbursement.

#### 4.07 **DEPTH OF BURY**

- A. Sanitary sewer collection mains shall have four (4) feet minimum depth of cover from the top of pipe to finished ground surface.
- B. Where grading, existing field conditions, or service constraints demonstrate that a sanitary sewer main must have less than four (4) feet of cover or when sewer main installation is deeper than twenty (20) feet at the invert, refer to section 4.10.
- C. Where the elevation difference between the top of foundation and the top of the sanitary sewer collection main is less than ten (10) feet, the Construction Drawings and the plat shall indicate the lot is served by a “shallow sewer” and appropriate elevation information shall be given.

#### 4.08 **LOCATION OF SANITARY SEWER COLLECTION MAINS**

- A. All sanitary sewer collection mains shall be located in dedicated street right-of-ways. Any other sanitary sewer collection mains shall be in a dedicated exclusive easement of appropriate width (refer to section 2.06). City approval is required for all proposed locations.
- B. The centerline of sanitary sewer collection mains shall not be placed closer than five (5) feet to the lip of the street gutter without prior acceptance by the City.
- C. Sanitary sewer collection mains shall extend to the upstream extremities of the property or subdivision being served. Main extensions shall be in appropriate locations to provide adequate sanitary sewer system connections for adjacent, future developments.
  - 1. A sanitary sewer collection main serving one (1) lot shall extend all the way across the frontage for that lot.
  - 2. The City may grant exceptions to sanitary sewer collection main extensions if development of an adjacent property is located in a different sewer basin, or if the property can currently connect to the sanitary sewer system. This will be determined by the City on a case by case basis.
  - 3. Sanitary sewer mains shall be extended offsite when required to tie into the existing collection system.
- D. Sanitary sewer collection mains shall be straight between manholes, both in alignment and slope.

#### 4.09 **SANITARY SEWER COLLECTION SYSTEM PHASED INSTALLATION AND STUBOUTS**



- A. Sanitary sewer collection system phasing, if proposed by the Developer, shall be clearly identified on the master utility plan. Sewer plan and profile sheets shall clearly show and label the phasing transitions in the sanitary sewer main design.
- B. The phased sanitary sewer collection system shall be designed for full build out of the development being served including any additional offsite flows that must be passed through the development. Stub-out shall be designed for future development flows.
- C. Phased sanitary sewer main or stub-out construction shall be extended a minimum ten (10) feet beyond phased street paving to avoid asphalt removal during excavation for future connections.
- D. A stub-out for future connection shall be provided for an adjoining phase or adjacent future developments.
- E. The stub-out design and installation shall maintain both vertical and horizontal alignment in accordance with these Criteria. The stub-out shall be shown on the sanitary sewer plan and profile sheets with the length and end of pipe invert labeled.
- F. The end of the stub-out shall be sealed with a removable water tight plug until the time of future connection.
- G. The maximum length of a stub-out shall be forty (40) feet unless otherwise approved by the City. If the maximum stub-out length must be exceeded, the sewer main installation shall end at a terminal manhole or be extended to the next upstream manhole.
- H. Sanitary sewer main stub-outs not utilized shall be abandoned. Refer to appendix section A9 – *Policies Impacting Design and Construction* for abandonment procedures.

#### 4.10 PIPE MATERIAL

- A. Sanitary sewer collection mains shall be polyvinyl chloride (PVC) SDR 35 pipe suitable for sanitary sewer flows.
- B. Alternative pipe materials shall only be used in the following situations:
  - 1. Where sanitary sewer collection mains are installed less than four (4) feet from the finished ground elevation to the top of pipe, approval by Water & Sewer Department is required.
    - a. The pipe material shall be PVC SDR 26 with flow fill from bottom of trench to one (1) foot above top of pipe, and the full trench width, and manhole to manhole.
  - 2. Where sanitary sewer collection mains are installed deeper than twenty (20) feet at the invert, polyvinyl chloride (PVC) SDR 26 shall be used.
    - a. For alternative pipe material installation situations, external load (earth and live load) analysis is required to verify the minimum alternative pipe material is suitable for the specific project conditions. If the alternative pipe material is unsuitable, the Design Engineer shall specify an acceptable pipe material. External pipe load calculations shall be submitted to the City for review and acceptance.

- b. The length of alternative pipe material to install shall be called out on the Construction Drawings.
- C. Changes between pipe materials are not permitted along a continuous sewer main. The alternative pipe material shall be installed from manhole to manhole.

#### 4.11 MANHOLE LOCATION AND SIZE

##### A. General

1. Manholes shall be installed at every change in direction, slope, or connection with other sanitary sewer collections mains.
2. There shall be no more than three (3) lines designed to discharge into any one manhole. This includes both main and service lines.
3. The Design Engineer shall determine if conditions require an interior coating to protect the manhole from corrosion. Water & Sewer Department reserves the right to require additional locations where interior coatings may be required. Locations that require interior manhole coatings may include, but are not limited to:
  - a. Locations where hydraulic jump may occur and the next upstream/downstream manhole
  - b. Every drop manhole and the next adjacent upstream/downstream manhole.
  - c. Any manhole where invert slope exceeds 5% or velocities exceed 5 ft/s.
4. Buoyancy calculations shall be provided for manholes and pipes where groundwater may be encountered and/or has been identified in the geotechnical report. The manhole shall be sealed from the outside with an approved seal wrap, where groundwater or other water sources are present.

##### B. Manhole Location

1. All manholes shall be located in dedicated street right-of-way or within a dedicated exclusive easement of appropriate width (refer to section 2.06). City approval is required for all other proposed manhole locations.
2. The center of manholes shall not be placed closer than eight (8) feet to the lip of the street gutter without prior acceptance by the City.
3. The edge of the manhole cover shall be located a minimum five (5) feet from the edge of cross pans, wherever feasible.
4. Manholes located outside of the street section shall be located in areas not subject to flooding, stormwater conveyance, ponding or detention.
  - a. If locating manholes in stormwater conveyance areas cannot be avoided, a solid, water tight, bolt down manhole cover with an integral O-ring type gasket, shall be used.

- b. Manholes located within the 100-year flood plain shall have a solid, watertight, bolt down manhole cover. The manhole ring shall be bolted to the manhole cone, and all manhole joints and grade rings shall be sealed from the outside with an approved seal wrap, where ground water or other water sources are present.
5. Manholes outside of road rights-of-way shall be provided with direct access by means of an all-weather road. All-weather road requirements are as follows:
  - a. All-weather roads shall be designed to support City maintenance vehicles up to thirty-five (35) tons with a minimum turning radius of sixty (60) feet.
  - b. At a minimum, all-weather roads shall be ten (10) feet wide with eight (8) inches of compacted aggregate base course. Subgrade preparation, compaction, and aggregate base course shall be in accordance with *SDC* construction specifications.
  - c. If the all-weather road terminates at the manhole it provides access to, and is longer than fifty (50) feet, an appropriately sized turn around shall be provided.
  - d. The Design Engineer shall verify that these minimum requirements for the all-weather road are suitable for the specific project conditions.
  - e. The all-weather road shall be located in a dedicated sanitary sewer easement.

C. Manhole Size and Spacing

1. The following table displays the diameter of standard manholes and the maximum manhole spacing for each sanitary sewer pipe diameter:

**TABLE 4-3: Standard Manhole Diameter and Spacing**

Sewer Pipe Diameter (in)	Manhole Diameter (ft)	Manhole Spacing (ft)
8"	4 ft	450 ft
10"	4 ft	450 ft
12"	4 ft	550 ft
15"	5 ft	550 ft
18"	5 ft	550 ft
21"	5 ft	550 ft

2. The following table displays the diameter of inside drop manholes. Use standard manhole spacing from Table 4-3 for inside drop manhole spacing. Inside drop manhole shall only be allowed for utility conflicts and pipe sizes up to eight inches (8"). City approval is required for all other proposed inside drops.

**TABLE 4-4: Inside Drop Manhole Diameter**

Inside Drop Pipe Diameter (in)	Manhole Diameter (ft)
4" or 6"	4 ft
8"	5 ft

#### 4.12 MANHOLE INVERTS

- A. The minimum elevation drop across a manhole shall be one-tenth of a foot (0.1 ft) except where cast-in-place manholes are to be installed over existing sanitary sewer mains. In such cases, the existing sanitary sewer pipe grade determines the elevation drop across the manhole, by constructing the cast-in-place manhole over the existing, straight sewer main and removing the upper half of the pipe.
- B. Where a smaller sanitary sewer main joins a larger one, the smaller sanitary sewer main crown elevation shall match the crown elevation of the larger sanitary sewer main. This includes sanitary sewer service lines.
- C. Where the invert elevation difference between the invert in and invert out is twenty four inches (24") or more and eight inches (8") or smaller pipe size, an inside drop apparatus shall be constructed. Refer to City of Greeley Standard Drawings for drop manhole construction.
- D. Sanitary sewer mains and services entering a manhole with less than twenty four inches (24") but greater than six inches (6") of elevation difference between the invert in and invert out shall be avoided. If unavoidable, the invert shall have a sloping bench to prevent solids deposition.

#### 4.13 GROUNDWATER BARRIERS

- A. Groundwater barriers shall be installed across the sanitary sewer collection main, ten (10) feet upstream of every manhole, in areas where sanitary sewer collection mains are below groundwater.
- B. Refer to the Standard Drawings and construction specification *Section 02315, Excavation and Fill* for additional information and installation requirements for groundwater barriers.

#### 4.14 SANITARY SEWER MAIN AND SERVICE ENCASEMENTS

- A. Refer to 3.15 of these Criteria and construction specification Section 02445, Casing Pipe – Borings and Encasements for typical sanitary sewer main and service encasement requirements.

#### 4.15 SANITARY SEWER MAIN BORINGS

- A. Refer to 3.16 of these Criteria and construction specification Section 02445, Casing Pipe – Borings and Encasements for sanitary sewer main boring requirements.

#### 4.16 SANITARY SEWER SERVICES

A. General

1. Sanitary sewer service lines shall not be installed in trenches with dry conduits/utilities. A service line shall be separated from other conduits a minimum of five (5) feet horizontally and eighteen inches (18") vertically.
2. Sanitary sewer service lines shall not be installed in trenches with wet conduits/utilities. A service line shall be separated from other conduits a minimum of ten (10) feet horizontally and eighteen inches (18") vertically.
3. Sanitary sewer services for a given lot must be tapped on the sanitary sewer collection main within the confines of the extended property lines. The sanitary sewer service line shall be located a minimum five (5) feet inside the property being served.
4. Sanitary sewer services not utilized shall be abandoned. Refer to appendix section A9 – *Policies Impacting Design and Construction* for abandonment procedures.

B. Sewer Services

1. Sanitary sewer services shall be polyvinyl chloride (PVC) SDR 35 pipe
  - a. Sanitary sewer services are four inches (4") or six inches (6") in diameter and shall have a minimum slope of 1% (1/8" per foot).
  - b. The maximum allowable slope for a sanitary sewer service is 8%.
  - c. If a sanitary sewer service line is required to be greater than six inches (6") in diameter, its design and connection to the existing sanitary sewer system shall be considered as a collection main. Even though the sanitary sewer service is larger than six inches (6") in diameter, it is still considered private and maintained by the property owner.
2. A separate sanitary sewer service line must serve each structure.
3. No sanitary sewer service lines shall cross property lines.
4. Compound sanitary sewer services should be avoided where feasible.
5. Sanitary sewer services shall be located a minimum ten (10) feet downstream of the potable water service, wherever feasible.
6. The sanitary sewer service line shall be electronically locatable and have tracer wire installed per *Section 02534, Sanitary Sewer Service Lines* and Standard Detail Drawings.
7. Sanitary sewer service connections to the sanitary sewer collection main shall be made with a tee or tapping saddle and shall be separated by at least five (5) feet along the

sewer main length, including when connections are on opposite sides of the sanitary sewer collection main.

8. Sanitary sewer service wyes are not allowed on the sanitary sewer collection main except in cul-de-sacs where a manhole or tee connection is not feasible.
9. Sanitary sewer service clean-outs are not permitted in the public right-of-way or exclusive sanitary sewer easement.
10. Sanitary sewer service connections to 18" or 21" collection system interceptors or trunk lines are not permitted unless approved by the Water & Sewer Department.

#### **4.17 SANITARY SEWER MAINS AND SERVICES IN RELATION TO OTHER UTILITIES**

- A. Refer to 3.18 of these Criteria and construction specification Section 02510, Water Utility Distribution Piping for sanitary sewer main and service separation in relation to other utilities requirements.

#### **4.18 SANITARY SEWER LIFT STATIONS AND FORCE MAINS**

- A. All lift stations with capacities at 2,000 gallons per day (gpd) or greater are subject to Colorado Department of Health and Environment (CDPHE) Regulation 22.
- B. Cost Responsibilities
  1. Design and Construction
    - a. The Developer shall be solely responsible for all costs associated with the design and construction of the lift station and force mains. This includes the cost of any easements, land acquisition, documents associated with permitting approval through CDPHE and North Front Range Water Quality Association (NFRWQPA), and any other cost associated with the project.
  2. Reimbursement
    - a. Where additional service area outside of the proposed development is anticipated, the City of Greeley will require the lift station and associated improvements to provide additional capacity than what is necessary for the initial development. Refer to Section 2.12 of this criteria for additional clarification.
  3. Operations and Maintenance
    - a. Public Facilities: Public lift stations are defined as any lift station serving more than one user and accepted by the Public utility. Operations and maintenance activities shall be the responsibility of the City for all public lift stations only upon completion and acceptance of the proposed improvements. The Developer shall provide an operations and maintenance manuals and procedures for all equipment and processes associated with the lift station. The Developer shall coordinate with the City during

the planning and design phases on equipment operations and maintenance requirements.

- b. Private Facilities: Private lift stations are defined as any lift station serving only one user. Operations and maintenance responsibilities for private lift stations are the sole responsibility of the owner or private entity.

## C. Planning and Permitting

### 1. General

- a. Gravity based solutions are preferred to lift stations as it provides the most reliable and lowest cost service for our customers. The use of a lift station and force main shall be evaluated on a case by case basis. If there is an appropriate gravity solution then the developer shall design and construct the proposed improvements meeting the City of Greeley Criteria. Any lift station or force main shall first be approved by the City following proper justification by the Developer. Where a lift station is determined to be required it shall be designed to allow for an eventual connection into a gravity system.
- b. The lift station and force main design shall adhere to state and regional approval processes and the Developer shall keep informed and notify the City of major milestones during the design and approval processes. The Developer shall adhere to the submittal requirements previously stated in Section 2 of these Criteria.

### 2. Procedures

- a. The Developer shall employ the services of an engineer licensed in Colorado that has successfully designed and permitted at least two lift stations of similar size as proposed, within the State of Colorado. The Developer and the engineer shall adhere to the following procedures through the planning and design phases:
  - i. Coordinate a conceptual project meeting with the City to provide justification for the project and initial design considerations including site location, force main alignments, land acquisition requirements, preliminary design criteria, project schedule, and permitting requirements.
  - ii. Upon initial conceptual acceptance for consideration of the need for a lift station, provide written project justification for the project and design considerations including site location, force main alignments, land acquisition requirements, preliminary design criteria, project schedule, and permitting requirements
  - iii. Attend follow up meeting following completion of the review of conceptual documents
  - iv. It is the expectation that the developer keep the City informed of the project's progress from design through construction approval. This includes notifying the City of the major project milestones associated NFRWQPA and CDPHE review and approval process and allowing for City review of major reports and documents. Major milestones include but are not limited to:
    - Site Application submittal to NFRWQPA

- Signed and approved Site Application submitted to CDPHE
  - Basis of Design Report (BDR) submittal to CDPHE
  - Design approval from CDPHE
  - Funding requests
  - Public meetings/outreach
- v. Upon the City's review and acceptance of the conceptual design, the applicant may proceed with the Lift Station Site Application process in accordance with CDPHE Regulation 22.
    - The Site Application shall be submitted to NFRWQPA following review and acceptance by the City
    - Following NFRWQPA and local agencies approval of the Site Application, the applicant shall submit the Site Application and required counterparts in accordance with Regulation 22 to CDPHE for review and approval
  - vi. The Lift Station BDR shall be reviewed by the City prior to submitting the BDR to CDPHE for review and approval. The BDR shall include at least a 60 percent design package and shall only be submitted to CDPHE upon City approval of 60 percent design package
  - vii. Prepare and deliver final design plans and technical specifications for the City's review and approval.
  - viii. Applicant shall coordinate with the City through the construction bidding process as necessary.
  - ix. Applicant shall coordinate construction inspections with City Inspectors.
  - x. Applicant shall submit all construction submittals for review including shop drawings and data and operation and maintenance manuals
  - xi. Applicant shall coordinate with the City for start-up testing and required training
  - xii. Applicant shall submit final record drawings to the City in AutoCAD and pdf format
3. Colorado Department of Public Health and Environment (CDPHE)
    - a. The design and construction of all lift stations and force mains shall adhere to CDPHE's most recent version of Regulation 22 – Site Location and Design Approval for Domestic Wastewater Treatment Works (The City reserves the right to review all procedures and reports required under Regulation 22 and request revision if necessary. Where CDPHE's Regulation 22 and the City's Criteria differ, the more restrictive of the conditions shall apply.
  4. North Front Range Water Quality Planning Association (NFRWQPA)
    - a. The planning and Site Application process of the proposed lift station and force main shall be in accordance with NFRWQPA wastewater utility plan guidance. The applicant will be required to provide updates to the City's Wastewater Utility Plan



(WUP) for the proposed lift station and force main as part of the Site Application process.

- b. The process for obtaining lift station approval from the Water Quality Control Division (WQCD) begins with the NFRWQPA ([www.nfrwqpa.org](http://www.nfrwqpa.org)). CHPHE *Regulation 22*, latest revision, requires that prior to WQCD final design review and approval, the lift station Site Application must be submitted to the NFRWQPA. Refer to the NFRWQPA website and *Regulation 22* for guidelines and requirements on the lift station site location and design approval process.

5. City of Greeley

- a. The Developer shall coordinate with the following City's departments to ensure all procedures and policies are adhered to.
  - i. Water and Sewer Department
  - ii. Community Development
    - ii-a. Engineering Development Review
    - ii-b. Planning Department
    - ii-c. Building Inspections
  - iii. Other Departments as Required

6. Lift Station Design Criteria

- a. Applicable Codes, Environmental Compliance, and Health and Safety
  - i. Applicable Codes: For work done in the City, work shall be performed in accordance to the codes established by the City's building department.
  - ii. Environmental Compliance: Environmental assessments and/or environmental reviews may be required as a preliminary investigation to determine if a particular parcel of real property is subject to recognized environmental constraints such as, and not limited to the following: floodplain areas, wetlands, endangered species, and hazardous conditions. Should environmental constraints as identified above, it is the Developer's responsibility to incorporate mitigation measures to comply with environmental requirements in accordance with applicable and current rules and regulations.
  - iii. Health and Safety: Public lift stations are required to conform to all City and OSHA health and safety requirements. City operation staff safety shall also be considered during the design and construction of the lift station including, but not limited to:
    - Readily accessible equipment placement for maintenance activities
    - Classified areas in accordance with the National Fire Protection Association (NFPA) 820 Regulations
    - Lifting assistance for heavy equipment

- Nonslip floor finishes
- Handrails
- First-aid and safety equipment
- Fall protection
- Limitation of confined spaces – it is desired by the City to limit confined space entries where possible

b. Determination of Wastewater Flows

- i. Existing wastewater flows shall be calculated using the calculation methods stated in Section 4.03, 4.04, and 4.05. Should the project area not fit the previously stated design flow estimation methods, applicable and industry-standard calculation methods shall be utilized. Methods include real-time flow monitoring or calculations based on land-use. Methods and calculations shall be included in relevant planning documents and subject to City's review.
- ii. Proposed and future wastewater flow projections shall be estimated for the build-out conditions of the service area. Estimation methods shall be based on projected land-use. The planning period and projected land-use within the service area shall be coordinated with the City during the planning phases.
- iii. Organic and other applicable wastewater constituent loadings shall be considered and evaluated based on existing and projected land-use. It is the Developer's responsibility to calculate based on most current available information, flows and constituent loadings for accessing available sewer and wastewater treatment capacities.

c. Impacts on Downstream Lift Stations or Sewer Capacities

- i. Ultimate peak hour design flows shall be used to determine the impact to downstream collection system infrastructure including treatment facilities, lift stations, and sewers. Existing infrastructure needs to be able to accommodate peak flows and loadings from new lift stations and force mains. The capacity of existing infrastructure to accommodate flows from new lift stations shall be justified to the City as part of the planning and design documents.

d. Lift Station Capacity

- i. Lift station capacity shall be designed to accommodate existing and future projected peak flows for the entire service area.
- ii. Hydraulic calculations and system/pump curves require consideration and shall be submitted for review during the planning phases to the City of Greeley and as part of the CDPHE's approval process.
- iii. Receiving sewers shall be evaluated to ensure adequate capacity to accommodate the ultimate lift station flow.

e. Emergency Storage

- i. The lift station shall be designed for at least 60 minutes of emergency storage at peak hour flow conditions or as required by CDPHE. Emergency storage can utilize volume within the wet well above the high level alarm and upstream collection system piping provided that it is demonstrated that back-up will not occur into any existing or potential future service connections or taps. No future taps shall be constructed within the section of influent sewer or sewers to the lift station designated to provide emergency storage. If a piping connection is required to accommodate emergency storage provisions, the invert of the pipe connecting the wet well to emergency storage shall be above the high level alarm. Additional emergency storage may be required at the discretion of the City based on site location, emergency response time, and potential environmental concerns.
- ii. Emergency storage can be accomplished using an additional pre-cast concrete manhole or storage vault like structure. The emergency storage structures shall provide adequate access and floor slope for cleaning and shall be designed with pre-cast concrete, cast-in-place concrete or fiberglass reinforced plastic. If constructed of concrete, adequate protection (i.e. polymer concrete or concrete admixtures) shall be provided to mitigate corrosion caused by hydrogen sulfide. If used, the emergency storage vault shall be designed to provide flow to and from the wet well to the vault and with adequate access for pumping via vacuum truck or other appropriate method.
- iii. If emergency storage can be accomplished through gravity flow from the lift station to another existing collection system, the City may consider that as an option to meet emergency storage requirements. It shall be demonstrated that the gravity overflow, existing collection system, and downstream facilities be adequately sized to accept increased flow. Additionally, should the collection system be operated by another entity, a legal agreement stating the entity can and shall receive emergency flows shall be coordinated and presented to the City during the design review process.

7. Force Main Design Criteria

a. Materials and Sizing

- i. Force main material shall be AWWA C900-16 with minimum wall thickness of at least DR-25. DR-18 or DR-14 shall be required if pressure or surface loading at any location in the system exceeds the DR-25 pressure rating.
- ii. Force mains shall be minimum 4-inch diameter. Force mains shall be sized appropriately for a minimum fluid velocity of 2 feet per second and maximum velocity of 7.5 feet per second. Sizing shall also conform to CDPHE design requirements, whichever is most limiting. Parallel force mains are strongly preferred by the City for maintenance procedures, emergency conditions, and capacity optimization between existing and build-out flows. If parallel force mains are not considered feasible for a specific installation, it shall be demonstrated that the force main diameter is optimal for existing and build-out flow velocities.

- iii. If force main diameter is such that the wastewater velocity is less than 2 feet per second at initial operating conditions, the design shall include VFDs on the pumps to allow the motors for the pump or pumps to increase frequency to increase the wastewater velocity in the force main to be a minimum of 3 feet per second for a minimum flushing time of 5 minutes. Reference the Electrical and Controls section of this criteria.
- b. Access / Cleaning Stations
  - i. Force main clean-out access shall be provided every 500-feet in situations where the force main is 950-feet or longer. Clean-outs shall provide adequate access to allow for pipeline condition observations via video camera.
- c. Protection, Bedding and Compaction
  - i. Pipe bedding and backfill of force mains shall conform to the specifications in Section 02315 of these standards.
- d. Force Main Alignments and Separation
  - i. The minimum buried depth of the force main shall be 60-inches from top of pipe.
  - ii. Wastewater force mains shall adhere to CDPHE and City standards for separation between potable water lines and other utilities. Wastewater force mains shall travel below existing potable water lines meeting the minimum requirements as outlined in Section 4.18. Should minimum separation requirements not be possible, refer to encasement requirements in Section 4.15 of the Criteria.
  - iii. Should the wastewater force main alignment be such that it cannot accommodate these separation requirements vertically or horizontally, provisions shall be provided to safeguard the existing utilities in accordance with the City design criteria and construction standards.
- e. Special Permitting Requirements
  - i. In situations where the force main alignment crosses areas that include wetlands, floodplains, irrigation ditches, railroads, and waterways. The Developer shall be responsible for all permitting during the design phase to ensure that local and state requirements are adhered to. The Developer shall document all required permits with the City prior to proceeding with construction. In all cases, the Developer shall evaluate alternative force main alignments to minimize impact to sensitive areas described herein.
  - ii. Easements required for the force main alignment shall adhere to Section 2.06 of these criteria. All easements required for the force main shall be approved by the City and granted to the City prior to City of Greeley approval of construction documents.

## 8. Land Acquisition and Easements

- a. All land area requests for the lift station sites shall be submitted and approved by the City prior to starting the land acquisition process. Lift Stations shall be located on property deeded to the City. The minimum size for the lift station site shall allow for adequate equipment access, maintenance activities, and ancillary equipment (i.e. generator, odor control, emergency storage, etc.). In no cases shall the lift station site be less than 2,500 square feet in size. Applicant shall provide preliminary lift station site drawings showing major lift station components, security, buildings, and access for the City to review and determine required site size.
- b. Force main alignments exiting the lift station site up to the point of gravity connection shall be contained within an exclusive sewer easements and shall be dedicated to the City per Section 2.06 of this criteria.

## D. Lift Station Site

### 1. Location and Topography

- a. The lift station and site location shall be designed and constructed to limit disturbance to the surrounding properties both aesthetically and during construction activities. The site shall allow adequate access to the site from existing public right of way. The lift station site shall be designed to provide adequate drainage away from the lift station and building and conform to City standards for drainage and storm water management plans. Developer shall perform a geotechnical evaluation of the site to determine soil conditions and hydrology as well as recommendations for lift station construction. Lift station sites shall be located outside of the FEMA 100-year floodplain with the finished floor elevation of the lift station a minimum of 2-feet above the floodplain. All lift station site locations are subject to review and approval by the City and CDPHE Regulation 22.

### 2. Lift Station Building / Enclosure

- a. The lift station shall be enclosed in a weather proof structure. The lift station enclosure and lift station pumping components as a minimum shall be accessible without permitting for confined space access. As a minimum the lift station enclosure shall be ventilated and heated and conform to the City's planning and building department requirements and applicable structural and building codes. The size of the building or enclosure shall allow for adequate clearance to maintain pumping equipment, piping, valves, electrical gear and controls. The minimum spacing between pumps shall be 30 inches, spacing around pumps of 36 inches, and electrical panel clearance shall be no less than 48 inches or as required by the National Electrical Code. Building or enclosure entry ways, hatches and overhead door shall allow for convenient access and equipment removal for maintenance and replacement. All lift station enclosures or buildings must be approved by the City

and applicable architectural committees that are associated with the subdivision or local association.

3. Aesthetics

- a. The lift station shall be subject to the City's Development Review process and applicable development standards. The lift station architecture and aesthetics shall be designed to match the surrounding structures. Landscaping shall be considered on the perimeter outside of the fence and planned to match the surrounding environment. Appropriate screening and other methods shall be utilized to minimize noise and visual impacts.

4. Access

- a. All wastewater lift stations shall be sited to allow access by all-weather surface roads capable of accommodating maintenance trucks from public right of way to the lift station site. The access shall at a minimum support HS-20 loading with a minimum width of 15 feet. The access points and site shall be designed to allow WB-50 trucks to maneuver within the site and exit the site without backing into public right of way. The site layout shall allow for access to the wet well and vacuum/jetter truck to clean out accumulated material in the wet well. All hard or concrete surfaces shall be designed for the expected vehicle and equipment loads.

5. Security Fencing

- a. The lift station site shall contain perimeter security fencing minimum 6' in height. The fencing is subject to the City of Greeley Municipal Code and shall be reviewed and approved by the City.
- b. The lift station site access gate shall have a minimum size full width opening of 18-feet and of lockable type.

6. Lighting

- a. Lighting shall be provided at the lift station site to allow for necessary activities during night and times of low visibility. The lighting system shall be designed to provide illumination best suited for the station layout with may include suspended, wall, or ceiling mounted fixtures and shall be suitable for routine maintenance activities and inspections. Site lighting equipped with photocells shall not be

allowed. Refer to Chapter 18 of Greeley Municipal Code for more information, as applicable.

7. Potable Water

- a. The site shall have access to potable water. Potable water connection, service size, backflow device and meter shall be coordinated with the City. At a minimum, there shall be frost proof yard hydrant located in the vicinity of the wet well.

E. Lift Station Components

1. Pumping System

- a. Each Lift Station shall have a minimum of 2 pumps. The pumps shall be designed to accommodate existing flows and future flows from fully developed contributing area. Firm capacity of the pump system shall be designed (or phased) to pump ultimate peak flow at maximum computed total dynamic head. Pump operation shall be automatic but fitted with the capability to run the system in manual control.
- b. Lift Stations shall be designed as a duplex system as a minimum. Duplex system for ultimate flow of the service area, shall be designed so that each pump is sized for peak hourly flow. The applicant shall provide a spare pump of the same capacity. Lift stations serving service areas that are phased over several years shall be designed initially as a duplex system as a minimum with room to add additional pumps for meeting the ultimate flow demands of the service area. Lift stations that are designed with more than two pumps shall be capable of pumping peak hourly flows with the largest pump out of service. The applicant shall provide a spare pump matching the size of the largest pump in service.
- c. In all cases pumping systems shall be designed to accommodate existing and build-out flows with adequate redundancy as defined by CDPHE Regulation 22 and in these criteria. If future build-out conditions require pumps (greater than 2) that are not needed for near term flow conditions, the lift station shall be designed to add additional pumps, piping, valves, electrical and control without the need for a major system shutdown and / or bypass pumping.
- d. Pumping system shall be designed to allow for adequate access between other pumps, piping, and ancillary equipment for maintenance activities including, but not limited to, routine maintenance and inspection and pump removal.
- e. Required Pumping System Type: Above Ground Mounted Self-priming Suction

The pumping system is self-priming suction pumps placed on grade with minimal piping to suction from the wet well. The only accepted manufacturer for the pumping system is Gorman Rupp. Pumping systems shall be site-specific designs or pre-packaged systems meeting site requirements. All designs are contingent upon review and approval by the City.

f. Alternate Pumping System

If the Developer with approval from the City, determines above ground mounted self-priming suction pumps are insufficient for the application, the Developer can seek a variance to utilize either wet well / dry well or submersible pump configurations. The Developer must adequately prove that the alternative pump configuration is the optimal choice for the application and include evaluations between both dry-pit and submersible configurations.

- i. Submersible Pumps: Where above ground mounted self-priming suction pumps are insufficient, City of Greeley will only consider submersible pumps where the ultimate build out peak hour flow rate is less than 100 gallons per minute. Where submersible pumps are approved by City of Greeley, the pumps must be removable without entering the wet well by providing rail and crane system. Control Panels and associated equipment shall be located within an enclosure of adequate size. The Developer shall provide two spare pumps to the City of Greeley.
- ii. Wet Well/Dry Well: Where above ground skid mounted self-priming suction pumps are insufficient and flow rate is greater than 100 gallons per minute during peak hour flow at full build out, the lift station shall be configured to provide separate wet wells and dry wells. Common walls between wet wells and dry wells shall be water and gas tight. Suitable and safe means of access shall be provided to the dry well for operations staff, maintenance, and removal of all equipment from the dry well. Access shall include separate equipment and access hatches. Access to the dry well shall be provided through stairs. Ladder access is not allowed. Where dry wells are considered, the lift station shall be designed to ensure that surface runoff cannot enter the lift station. Where groundwater may exist above the dry well, adequate measures shall be provided to prevent infiltration of groundwater into the dry well and wet well.

g. Pumping System Components

- i. Each pump shall have a dedicated check valve, plug valve, and air-relief valve on the discharge side of the pump. Pressure gauges shall be provided on both the suction and discharge (prior to the check valve) side of the pump. Pressure gauges shall be provided with a pulsation snubber constructed of 316 stainless steel and an isolation valve. It is preferred that these pump system components are supplied by the pump manufacturer if supplied as a skid-type system to ensure compatibility, performance and single point of supply.

h. Hydraulics

- i. Pumps shall be designed to accommodate existing and future flows. Pump design calculations shall be included in the design reports and subject to City review. Hydraulic calculations shall include pipe friction losses using appropriate friction coefficients and minor friction losses. Net positive suction head available ( $NPSH_A$ ) and net positive suction head required ( $NPSH_R$ ) shall be considered to ensure pump cavitation will not occur. Control descriptions for the pumps shall consider water levels required to maintain adequate  $NPSH_A$  and  $NPSH_R$ .



## 2. Station Piping

### a. Material and sizing

- i. Station piping shall be ductile iron and sized to accommodate the necessary flow ranges. Flanged header pipe shall be ductile iron complying with ANSI/AWWA A21.51/C115 and Class 53 thickness. Flanges shall be ductile iron class 125, or as required by pumping application and pressures, and comply with ANSI B16.1. Generally, the liquid velocity in the station piping shall be no less than 3 feet per second and no greater than 7 feet per second.

### b. Expansion Joints/Victaulic Coupling

- i. Station piping shall include expansion joints, flanged coupling adaptors and/or grooved couplings to allow for dismantling of station piping for maintenance and parts replacement.

## 3. Valves

### a. Plug Valves

- i. Isolation valves shall be eccentric non-lubricated plug valves. Each pump discharge shall have a dedicated isolation valve so that each pump can be isolated from the common discharge header. Plug valves shall be of cast iron body, ASTM A126 Class B. Valve plugs shall be cast iron ASTM A126 Class B covered with a Buna-N Rubber compound. The seats are to be a corrosion resistant alloy either 316 stainless steel or nickel. Valve body shall be semi steel with flanged end connections drilled to 125 pound, or higher as required by application pressures, standard. Valve shall be operated with a single lever actuator providing lift, turn, and reseal action. The lever shall be equipped with a locking device to hold the plug in the desired position. Valves shall be able to pass a spherical solids not less than 3 inches diameter. Accepted manufacturers include DeZurik, Valvmatic, Milliken.

### b. Check Valves (4" or more in diameter)

- i. Check valves shall be swing check valves capable of passing a 3-inch spherical solid. Check valves shall meet the latest AWWA C508 standard and be of the resilient hinge check valve type. All internal hardware shall be stainless steel. Valve shall be equipped with flanged ends and be fitted with an external lever and spring. Valves shall be equipped with removable cover plate to permit entry or for complete removal of internal components without removing the valve from the line. Valve shall be rated at 175 PSI water working pressure, 350 PSI hydrostatic test pressure. For high pumping head applications (150 feet or greater), the Developer shall submit a type of check valve that will minimize hydraulic surges or slam to the system. Each pump discharge shall have a dedicated check valve. Accepted manufacturers include Valmatic, DeZurik, Victaulic, Golden Anderson.

- c. Combination Air and Vacuum Valves
  - i. Sewage rated combination air and vacuum valves shall be placed at the discharge of pumps as close to the check valve as possible and at any local high points in the station piping. Accepted manufacturers include Valvmatic and Golden Anderson.
- 4. Bypass Pumping Assembly
  - a. Lift Station Out of Service
    - i. A bypass pumping configuration shall be designed to bypass the lift station should it ever need to be taken offline. The bypass pumping configuration shall include provisions to bypass the entire lift station as well as lift station components including the wet well and pumping equipment and station piping. Bypass connections shall also be included on the common discharge header to the lift station pumps (station piping) as well as the force main (site piping) along with isolation valves. All bypass connections shall be at a minimum 6" camlock.
  - b. Approach Manhole
    - i. An approach manhole shall be constructed upstream of the wet well within the lift station site boundaries. The approach manhole shall serve as a common connection for the gravity sewer or sewers feeding the pump station and shall connect to the wet well by a single gravity pipe.
  - c. Wet well
    - i. Lift Station wet wells shall be Polymer Concrete or concrete with Xypex Bio-San C500 admixture to prevent corrosion on the interior surfaces caused by concentrated levels of H<sub>2</sub>S and other corrosive properties of raw wastewater.
    - ii. All wet well penetrations shall be link sealed and grouted to inhibit any leakage from the wet well or groundwater infiltration.
  - d. Coatings and Paintings
    - i. All exposed carbon steel surfaces, piping and equipment shall have field-applied protective painting or coating except where material (i.e. PVC, stainless steel, hot-dipped galvanized or aluminum) or factory coating warrants exception. All paint and coatings systems shall be approved by the City and shall adhere to City standards for color coding.
- 5. Electrical and Controls
  - a. Electrical Equipment
    - i. All electrical equipment shall be in accordance with the latest standards of NEC and, where applicable, meets all requirements for hazardous locations in accordance with NFPA 820. Developer shall coordinate with City Building Department on applicable codes.

- ii. Developer shall coordinate with the City for electrical utility providing electrical service. Station shall be provided with a separate utility transformer and meter/main with ground fault protection. Primary power to the station shall be 480 volt, 60 Hz, 3-phase service per utility provider standards. Developer is required to pay permitting, design and costs for primary power to the lift station site. Secondary power service shall be designed by a certified electrical engineer licensed in the State of Colorado. As a minimum, the station shall include service disconnect panel, automatic transfer switch (ATS), motor control center (MCC) or electrical distribution panel. The service disconnect panel shall be mounted on the exterior face of the lift station building common wall to the indoor electrical switch gear.
  - iii. The ATS shall be provided to switch from normal utility power to standby emergency power upon power outage and switch back to normal power once the power outage is restored. The ATS shall have indicating lights for normal power, emergency power, and a digital panel indicating volts and amps. The ATS shall be mounted inside the lift station building integral to the MCC. The ATS manufacturer shall be compatible and approved by the accepted lift station pump manufacturer, Gorman Rupp. The City's standard for standby emergency power is natural gas-powered engine generators manufactured and provided with the lift station pumps manufacturer, Gorman Rupp. If the lift station pumps are provided by a manufacturer other than Gorman Rupp, the Developer shall provide the ATS and standby emergency power generator specifications and manufacturer for City review and approval.
  - iv. Electrical switchgear (480 volt) shall be mounted in a NEMA 1 MCC with removable buckets within a NEMA 3R wrapper. A step-down transformer shall be included to provide power service to a separate light or power panel rated for 120 / 240 volt service. The light or power panel is required to provide service for interior and exterior lighting, receptacles, ventilation and controls. Switchgear shall be manufactured by Cutler-Hammer, Allen Bradley, Square "D", or approved equal by the City.
  - v. Transient voltage suppression rated at 80 KA minimum shall be provided at the main electrical service panel and shall be installed in accordance with the latest requirements of NEC Article 285
- b. VFDs and Soft Start and Stop
- i. All motor sizes greater than 20 HP shall be equipped with a reduced voltage solid state start and stop or also known as soft start and stop. The use of variable frequency drives (VFD) for the lift station pumps shall be evaluated on a case by case basis. The Developer will be required to demonstrate the advantages for installing VFDs for the ranges of pumped flows. The soft start / stop device and / or VFD shall be mounted adjacent to the MCC. Accepted manufacturers for the soft start / stop and VFD equipment shall be Allen-Bradley or Mitsubishi.

c. Level Controls

- i. The primary level control system used for the lift station to turn pumps on and off and sequence lead and lag operations shall consist of the radar level measurement type. The primary level control system shall have a minimum of five differential level set points including low liquid level, start / stop lead pump, start / stop lag pump, start / stop standby pump (if required), and high water level. The level control shall be equipped with a transmitter device and user interface screen for user set points and display of liquid level in the wet well. Contacts shall be provided for selected alarm outputs for integrating into the SCADA and telemetry system. Accepted manufactures for level control shall be Endress Hauser or a manufacturer approved by the City.
- ii. In addition to the primary level control system, the lift station shall be equipped with a secondary level control system for back-up. The secondary level control shall consist of electro-mechanical float switches for low water cut-off, pump on / off, and high water alarm. Accepted manufacturers for float switches shall be Siemens Water Technologies Model 9G-EF or approved equal

d. Lift Station Control Systems

- i. Controls shall provide automatic reset of alarm conditions for normal power fail, high water level, standby pump run, and a common alarm contact. However, alarm conditions shall activate an alarm light that is mounted at the roof line of the lift station building or enclosure. The alarm light shall require a manual reset. Each pump shall be provided with alarm lights and pump shutdown for pump motor high temperature, pump moisture detection, and pump overload fail conditions. Any pump alarm conditions shall require manual reset. All lift station alarm outputs shall be transmitted via telemetry system to on-call City operation staff and master SCADA control center.
- ii. Elapsed time meters shall be supplied for each pump and shall consist of the six digit non-reset type. The elapsed time meters shall be connected to the each pump motor starter to indicate total running time for each pump in “hours” and “tenths of hours”. An integral pilot light shall be wired in parallel to indicate that the motor is energized and running.
- iii. The lift station PLC shall be an Allen Bradley CompactLogix 5069-L320ER. Alternate PLC manufacturer’s must demonstrate compatibility with the City’s control logics platform. The PLC shall be equipped with a CPU with 1 MB of user memory, two Ethernet / IP communication ports and 1 USB port for firmware download and programming. The PLC control panel shall be sized to adequately contain all PLC and communication equipment and rated for NEMA 3R enclosure. The face of the control panel shall include a minimum size 10-inch color operator interface terminal (OIT) for data entry and display. The OIT shall be Red Lion Graphite. Each PLC shall have a minimum of a 2-hour uninterrupted power supply (UPS). Each control panel shall contain adequate surge protective devices.

e. Flow Meters

- i. Flow meters shall be of the electro-magnetic type and installed on the common discharge header downstream of the last pump discharge connection. The flow meter shall be fitted with grounding rings as required and 125 pound / 150 pound flanged connections. Flow meter shall include a wall mounted transmitter along with 4-20mA DC output. Flow meter shall be integrated and programmed with the supplied PLC for local and remote display for flow and totalizer. The flow meter shall be manufactured by Rosemont Model 8750W or accepted substitution.

f. Back-up Power Supply

- i. Back-up power shall be supplied at the lift station to power the pumps and ancillary equipment in the event of a power outage. The back-up power system shall be natural gas powered. The Gorman Rupp standby engine system is preferred and the Developer shall determine if that system is suitable for the application. Other back-up power systems will be considered if application is not suitable for the Gorman Rupp system. If not provided by Gorman Rupp, alternate back-up power system will be evaluated and approved by the City on a case-by-case basis. The City's preference for alternate back-up power systems is Cummins for both the generator and ATS.

g. Telemetry and SCADA

- i. The Remote Telemetry Unit (RTU) shall communicate by way of Modbus serial or Ethernet, or Allen Bradley Ethernet or serial. If there is no ability to communicate with the Control Panel, analog and digital Inputs may be utilized. Required Inputs: A: Wetwell Level, B: Flow, C: Flow totalization, D: Pump motor status, E: Soft Start status "Faulted", F: Power Fail, G: Pump Amperage, H: VFD Status, I: VFD speed, J: Station common alarm, K: Generator Running, L: Generator Switch in Normal or Emergency, M: Generator common alarm, N: Pump runtime, O: Pump starts, P: Control Panel Temperature, Q: Selector Switches Status

h. H2S Monitoring Systems in Wet well or discharge manhole

- i. The City may require that the Developer design and install H2S monitoring in the manhole the force main discharge into. Factors that may require H2S monitoring in the manhole include pump flow, force main length and location of the discharge manhole.

6. Mechanical

a. Ventilation

- i. Adequate ventilation shall be designed in buildings and vaults as required and adhere to all applicable State, NFPA, and OSHA requirements. Ventilating system shall consist of natural gas make-up air units sized to provide minimum of 6 air changes per hour and shall automatically begin operation upon user selected indoor temperature settings for both summer and winter modes.

Supplemental cooling and heating will be required if building temperatures exceed 85 degrees Fahrenheit (F) or fall below 55 degrees F. Ventilation shall be accomplished by the introduction of fresh air in the station and be filtered to remove debris and minimize particles. Ventilation fans shall automatically come on upon entry of the lift station enclosure or building or activated by the light switch adjacent to the entry door. Heating

- ii. In addition to the make-up air ventilation system supplemental heat shall be required using natural gas unit heaters to maintain a minimum temperature of 55 degrees F. Unit heaters shall be automatically controlled thermostatically. Heating systems shall be designed based on an outside ambient temperature of negative 20 degrees F.

b. Air Conditioning

- i. Air conditioning shall be provided if ventilation system cannot ensure inside air temperature of below 85 degrees F within a reasonable time period of ventilating. Cooling systems shall be designed based on an outside ambient temperature of 105 degrees F.

c. Drains

- i. Lift station enclosures or buildings shall contain no floor drains that connect to the wet well. The enclosure at the level the pumps are located shall include a trench drain which slopes to a sump pit equipped with a duplex submersible sump pump system controlled with weighted float level switches. The sump pump system shall discharge to the top of the wet well with an air gap. The pump system shall be sized based on expected drain flows such as air release valves, seal water, maintenance, etc. Each sump pump discharge shall contain a check valve and isolation valve along with a pump removal system. The sump pump system shall be connected to the back-up or emergency power system.
- ii. The lift station site shall be equipped with a perimeter drain if recommended from the geotechnical study.

7. Odor Control and H<sub>2</sub>S Generation

- a. The lift station shall be evaluated for the odor mitigation system and final determination of implementing odor control measures will be reviewed and determined by the City. Supporting data, calculations, or assumptions for hydrogen sulfide generation based on estimated wastewater characteristics and industry standards shall be included in the evaluation. In the absence of supporting data and / or calculations, the Developer shall utilize the latest edition of “Metcalf and Eddy Wastewater Engineering Treatment and Resource Recovery” for medium strength sulfide concentrations in wastewater. Other factors to consider in the evaluation include but are not limited to:
  - Proximity to and use of neighboring properties
  - Wastewater composition (BOD<sub>5</sub>, COD, TSS, Sulfides, TKN, Ammonia-N)
  - Wind direction and downwind properties
  - Operation and maintenance requirements of odor control system

- b. If odor control is determined necessary, the type of system shall be selected based on the site-specific needs of the lift station. All ancillary equipment and necessary provisions shall be incorporated into the design of the lift station to provide a functional system. Odor control systems may include but are not limited to the following mitigation technologies:
    - Carbon absorption systems
    - Biological scrubber or filter
    - Chemical scrubber
  - c. If odor control is not required, provisions for future addition of odor control facilities (i.e. installation of ventilation ducts and penetration into the wet well for future connections) shall be provided.
8. Force Main Components
- a. Connection to Existing Gravity Sewer and Discharge Manhole
    - i. Force mains shall connect to a gravity wastewater system at a manhole or a structure designed to receive pumped wastewater. At a minimum the discharge manhole and the next two downstream manholes shall be polymer concrete or concrete with Xypex Bio-San C500 admixture. The force main discharge shall be designed to minimize turbulence and scour within the connecting structure. The City will determine on a case by case whether odor control is required at the receiving structure.
  - b. Valves
    - i. It is desired by the City to design the force main to limit required valves along the force main alignment. High points and low points shall be minimized along the pipe alignment.
  - c. Air and Vacuum Relief Valves
    - i. Air relief valves shall be provided on ultimate and local high points throughout the force main alignments. All air relief valves shall be located in an access manhole or vault appropriately sized for the application and maintenance staff access.
  - d. Non-return Valves
    - i. If required, isolation valves shall be swing check type. All non-return valves shall be located in an access manhole or vault appropriately sized for the application. Accepted manufacturers include DeZurik, Valvmatic, Milliken
  - e. Isolation Valves
    - i. If required, isolation valves shall be plug valve type. All direct buried plug valves shall normally remain open (with exception of bypass connection and isolation valves) and be installed with a valve box and lid. Accepted manufacturers include DeZurik, Valvmatic, Milliken

- f. Corrosion Protection
    - i. A cathodic protection system shall be designed for any buried carbon steel or ductile iron piping and structures in the system.
- 9. Testing and Start-up
  - a. Lift Stations
    - i. The Developer shall develop a plan to test and demonstrate successful and flawless performance of all equipment and components of the lift station in manual and automatic mode. The start-up and testing plan shall be submitted to the City for review prior to commencing the start-up. A factory representative for the pumps and controls shall be on site for the start-up operations.
  - b. Force Mains
    - i. Force mains shall undergo hydrostatic pressure testing for at least two hours at two times the working pressure. Test results shall be documented and demonstrate holding pressure within the criteria and specifications described in the City's Design Criteria and Construction Specifications (see Section 01713 Water Distribution System Testing for requirements).
- 10. Operation and Maintenance Procedures and Warranties
  - a. Operations and Maintenance
    - i. The Developer shall supply the Water and Sewer Department with two (2) complete sets of operation and maintenance instructions, shop drawings, and pump curves. An electronic set on a thumb drive shall also be submitted. Developer and/or manufacturer shall provide one half day training on operations of the lift station for City Staff
    - ii. Operation and maintenance instructions shall be specific to the equipment installed. All non-relevant reference material shall be removed or clearly crossed out using heavy red line.
    - iii. All emergency power generation equipment shall have operation and maintenance instructions.
  - b. Warranties
    - i. A two (2) year warranty shall be provided for the lift station system including performance, materials, and installation.
    - ii. Any warranties associated with the lift station shall be transferred to the City after final acceptance and construction is complete.



## SECTION 5

### NON-POTABLE IRRIGATION SYSTEM DESIGN CRITERIA

#### 5.01 GENERAL

The City of Greeley (City) uses non-potable (untreated) water to irrigate both public and private property throughout the City. The City has a network of irrigation ditches for supplying source water for irrigation purposes. The typical irrigation system arrangement is a “hub-and-spoke” layout where irrigation water is diverted from an irrigation ditch to an irrigation water storage pond and then pumped to the distribution system to provide sufficient pressure and capacity to serve many customers. Another arrangement specifically for a small irrigation system is a direct connection between the ditch and pump station excluding the storage pond. The goal of the City is to expand the non-potable water system and reduce the use of potable water for irrigation purposes and improve irrigation practices, which is key to the City’s long-term water conservation plan.

The purpose of this section is to provide information for the design and layout of a non-potable irrigation system. Non-potable irrigation system design shall be in accordance with the City of Greeley *Non-Potable Water Master Plan*, latest revision, and these Criteria.

This section is not intended to be inclusive of all situations and the Design Engineer may be required to use additional engineering judgment to meet the overall design intent for constructability and long-term operations and maintenance.

The Design Engineer shall meet with Engineering Development Review (EDR) and Water and Sewer (W&S) Departments to discuss how new developments fit into the City’s overall Master Plan to provide non-potable irrigation service at acceptable pressures in both new and existing areas. The City has the right to oversize the irrigation system to serve customers outside the development’s improvements limits. The City will reimburse the developer for oversizing based on Section 2.12 of these Criteria.

The Design Engineer shall also meet with the ditch company from where the raw water is being diverted. The City will assist in coordinating the meeting and have a City representative present. The purpose of this meeting is to discuss the diversion requirements such as check structures, head gates, and flow measurement, and determine if there is sufficient capacity within the ditch to serve the new Non-potable Irrigation System.

The non-potable irrigation storage pond and pump station facility shall be located on property deeded to the City. The raw water supply line and its appurtenances between the water source (i.e. ditch) and the storage pond shall be within a utility easement dedicated to the City.

The Design Engineer shall provide supporting calculations, design methodologies, and references documentation used to establish the design parameters. All information shall be included in the Non-Potable Irrigation System Design Report. Refer to Section 2.08 of these Criteria for Non-Potable Irrigation System Design Report requirements and formatting.

The Non-Potable Irrigation System Design Report shall be stamped and certified by a Professional Engineer registered in the state of Colorado. The design report shall verify that the proposed non-potable irrigation system can provide the required irrigation demands for the service area, at an acceptable pressure, and meet the overall non-potable irrigation system design

requirements set forth in these Criteria.

The City of Greeley Water and Sewer Director reserves the right to make final determinations of the system design based on the best interest of the City's system.

## **5.02 DEFINITIONS**

- A. Non-potable Irrigation System – The non-potable irrigation system consists of (1) ditch headgate and appurtenances to divert flows, (2) raw water supply line and appurtenances between the water source and storage pond, (3) storage pond, (4) pump station facility, and (5) distribution mains and appurtenances.
- B. Non-potable Irrigation Main - A pressurized pipeline that conveys non-potable water to individual non-potable irrigation services.
- C. Non-potable Irrigation Services – Non-potable irrigation services include all piping, fittings, and appurtenances used to convey non-potable water from the irrigation main to the consumer.
- D. Air Gap – A method of backflow prevention defined as the unobstructed, physical distance of two (2) feet minimum of free atmosphere between the discharge point of a potable water supply line and the highest level of the irrigation storage pond or the FEMA 100-year floodplain, whichever is greater.
- E. Reduced Pressure Zone (RPZ) Backflow Preventer – A device that can be connected to a potable water system to supply water to a non-potable water system and protect the potable water system from backflow contamination. The device consists of two check valves with a pressure vacuum breaker in the middle. This device can be used in lieu of an Air Gap.
- F. Shoulder month/season – The periods in early spring and late fall where non-potable customers require some irrigation water, but the agricultural ditches are not operational, occasionally resulting in the non-potable water system being supplied by potable water.
- G. Shoulder tap – A connection from the potable water distribution system to the non-potable water system to provide water for irrigation purposes during the early spring and late fall shoulder months.

## **5.03 DESIGN FLOW**

- A. The non-potable irrigation system shall be designed to transport peak season irrigation demands in accordance with these Criteria.
- B. All irrigation demands used in the design of non-potable irrigation systems are subject to approval by the City.
- C. Pump Station Design Capacity
  - 1. The non-potable irrigation demand criteria presented below are the minimum criteria and the City reserves the right to modify the criteria, at any time, for the design of specific projects. The non-potable irrigation application rate includes provisions for evapotranspiration and operational efficiency losses in the non-potable irrigation

system.

- a. Weekly Irrigation Application Rates:
    - i. Bluegrass turf, arborvitae, willows = 1.9 inches/week
    - ii. Tall Fescue, columbine, potentilla purple coneflower = 1.4 inches/week
    - iii. Buffalograss turf, sedums, succulents, iris, penstemon = 0.9 inches/week
    - iv. Native grasses, yarrow, rabbitbrush = 0.1 inches/week
  - b. Daily Watering Window = 8 hours
  - c. Irrigation Days/Week = 6 days (with half the system being watered on any given day) This is based on a “three-days-per-week” watering schedule meaning that customers may irrigate only three days per week on their assigned days.
2. Sizing the design capacity of a pump station shall be based on the following equation:

$$\sum Q_{i,ii,iii,iv} = \frac{a}{b} \times \frac{c}{d} \times \frac{e}{f \times g}$$

**Where:**

Q = Pump Station Design Capacity (gpm)

a = Irrigation Application Rate (inches/week)

b = Number of Irrigation Days per Week (days/week)

c = Total Irrigable Area (acres)

d = 12 inches/foot (conversion factor)

e = 325,829 gallons/acre-foot (conversion factor)

f = Daily Watering Window (hours/day)

g = 60 minutes/hour (conversion factor)

## 5.04 HYDRAULIC DESIGN

### A. Raw Water Supply Pipe

1. The design flow shall be based on the time it takes to replace two (2) full days’ worth of storage over a 24 hour period.
2. Pipe size shall be computed by Manning’s Equation up to a maximum 80% full and friction coefficient of 0.013, but shall not be less than 12-inches in diameter.

### B. Pump Station Intake Pipe

1. The design flow shall be based on the Pump Station Design Capacity.
2. Pipe diameter shall be based on a maximum velocity of 1.0 feet per second (fps) when the pipe is flowing full, but shall not be less than 24-inches in diameter.
3. The intake pipe shall be equipped with a passive intake screen. Refer to 5.21 of these Criteria for additional information.

C. Distribution System

1. Distribution System Pressure

- a. The non-potable irrigation distribution system in all areas shall be designed for a maximum pressure of 125 psi and a working pressure range of 70 - 100 psi at high points and the furthest service point of application.

2. Friction Coefficient

- a. Non-potable irrigation lines shall be designed using a Hazen-Williams friction coefficient "C" equal to 120.

3. Velocity

- a. All pipes shall be sized for maximum water velocity of no greater than five (5) feet per second (fps) at peak flow.

4. The minimum size of non-potable irrigation mains shall be eight-inches (8") in diameter.

**5.05 DEPTH OF BURY**

- A. The minimum depth of cover shall be four (4) feet and the maximum depth of cover shall be six (6) feet for non-potable irrigation mains.
- B. When design or constructability constraints are present, deeper or shallower main installation may be permitted only with acceptance from the City. Additional design and installation considerations may be required by the City depending on the situation.

**5.06 CONNECTIONS TO THE EXISTING NON-POTABLE IRRIGATION SYSTEM**

- A. Connections to the existing non-potable irrigation system shall be in accordance with the *Construction Specifications, Section 02510, Water Utility Distribution Piping*.

**5.07 LOCATION AND LOOPING OF NON-POTABLE IRRIGATION MAINS**

- A. All non-potable irrigation mains shall be located in dedicated street right-of-way or within a dedicated exclusive easement of appropriate width. City approval is required for all other proposed non-potable irrigation main locations.
- B. The centerline of non-potable irrigation mains shall not be placed closer than three (3) feet to the inner edge of concrete gutter without prior acceptance by the City.

- C. A non-potable irrigation main serving one (1) lot shall extend all the way across the frontage for that lot.
- D. Non-potable irrigation mains shall extend to the extremities of the property or the subdivision served. Extensions shall be in appropriate locations to provide adequate connections.
- E. The City shall determine on a case by case basis if non-potable irrigation system looping is required for a development.

#### **5.08 NON-POTABLE IRRIGATION SYSTEM PHASED INSTALLATION AND STUBOUTS**

- A. Non-potable irrigation system phased installation and stubouts shall be in accordance with Section 3.10 of these Criteria.
- B. Locate temporary blowoff assemblies at the end of each phase or stubout.

#### **5.09 PIPE MATERIAL**

- A. PVC: AWWA C900-16 DR 18 (235 PSI) polyvinyl chloride (PVC) pressure pipe, purple color for direct buried applications only. Refer to construction specification *Section 02513, for Polyvinyl Chloride Pressure Pipe* for additional information.
- B. DIP:
  - 1. ANSI/AWWA C151/A21.51 ductile iron pipe with mechanical joints for direct buried applications only. Refer to Section 3.11 C. of these Criteria for corrosion protection requirements.
  - 2. ANSI/AWWA C115/A21.88 flanged ductile iron pipe with flat faced flanges for exposed applications only.
  - 3. Refer to construction specification *Section 02512, for Ductile Iron Pipe* for pipe additional information.
- C. Steel: AWWA C200 steel pipe for both direct bury and exposed applications. Design Engineer shall determine required thickness for each application. The Design Engineer shall submit proposed interior and exterior coatings for City review and approval.

#### **5.10 VALVES**

- A. All valves shall be located in dedicated street right-of-way or within a dedicated exclusive easement of appropriate width. City approval is required for all other proposed valve locations.
- B. Gate Valves
  - 1. Gate valves shall be installed in accordance with Section 3.12 of these Criteria and *W&S Standard Drawings*, latest revision.
  - 2. All non-potable water line valves located in paved areas shall have a concrete collar around the valve box in accordance with *W&S Standard Drawings*, latest revision.

3. Refer to construction specification *Section 02515, Water Utility Distribution Valves* for gate valve requirements.

C. Air/Vacuum Valves

1. Air/Vacuum Valves shall be installed at all high points along the non-potable irrigation main and shall be properly sized by the Design Engineer in accordance with the manufacturer's recommendation. The City shall have final determination on valve size and placement. NOTE: It is the City's preference that the number of high points within the pipeline be minimized.
2. Refer to construction specification *Section 02515, Water Utility Distribution Valves* for Air/Vacuum valve requirements.
3. Reference *W&S Standard Drawings* for installation requirements.

D. Non-potable Blowoffs

1. Non-potable blowoffs shall be installed at the end of all non-potable irrigation mains. The City may also require that non-potable blowoffs be located at low points within the system.
2. Reference *W&S Standard Drawings* for installation requirements.

**5.11 PIPE ALIGNMENT**

- A. The curved pipe alignment design requirements for non-potable irrigation mains shall be in accordance with Section 3.13 of these Criteria.

**5.12 THRUST BLOCKING AND PIPE RESTRAINT**

- A. Thrust blocking and pipe restraint requirements for non-potable irrigation mains shall be in accordance with Section 3.14 of these Criteria.

**5.13 NON-POTABLE IRRIGATION MAIN AND SERVICE ENCASEMENTS**

- A. Refer to Section 3.15 of these Criteria and construction specification Section 02445, Casing Pipe – Borings and Encasements for typical non-potable irrigation main and service encasement requirements.

**5.14 NON-POTABLE IRRIGATION MAIN BORINGS**

- A. Refer to section 3.16 of these Criteria and construction specification Section 02445, Casing Pipe – Borings and Encasements for non-potable irrigation main boring requirements.

**5.15 NON-POTABLE IRRIGATION SERVICES**

- A. General
  1. Non-potable irrigation service lines shall not be installed in trenches with other conduits/utilities.

2. There shall be no physical connections between the non-potable irrigation system and the potable water system unless an approved backflow device is used to prevent non-potable water from entering the potable water system (i.e. RPZ device).
3. Non-potable irrigation services not utilized shall be abandoned. Refer to appendix section A9 – *Policies Impacting Design and Construction* for abandonment procedures.

B. Irrigation Services

1. Non-potable irrigation services 3/4” to 2” in diameter shall be Municipex®, Uponor AquaPEX®.
2. The non-potable irrigation service for a given lot must be tapped on the non-potable irrigation main within the confines of the extended property lines unless excepted by the City for the irrigation of multiple outlots under single ownership. Refer to appendix section A7 – *Compound Tap Exemption Policy for Irrigation of Multiple Outlots*. Otherwise, irrigation systems from a single non-potable irrigation service shall only be allowed for use on that single property. Refer to *City of Greeley Charter and Code, Title 14: Public Services*, Section 14.04.200 for compound tap restrictions.
3. Non-potable irrigation services shall not be located under driveways, trees, or other permanent structure.
4. Non-potable irrigation services shall be located a minimum five (5) feet inside the property being served.
5. Non-potable irrigation service taps shall be separated by at least two (2) feet, measured along the non-potable irrigation main length, including when taps are on opposite sides of the non-potable irrigation main. Non-potable irrigation service taps shall also be a minimum two (2) feet from all joints, fittings, or valves.
6. The corporation stop, curbstop, meter, the service line between the corporation stop and the meter, and five (5) feet past the meter shall all have the same equivalent inside pipe diameter.
7. Non-potable irrigation shutoff valves (curb stops and gate valves) shall be placed within one (1) foot of the property line or easement boundary (inside or outside).
8. Non-potable irrigation meter vaults pits/vaults shall normally be located after the curbstop in a landscaped area or streetscape. Meter pits/vaults shall not be installed in any street, parking area, driveway, or sidewalk unless otherwise approved by the City. If a meter pit/vault is permitted by the Water & Sewer Department to be located in any traffic area, the pit/vault shall be designed to withstand HS-20 traffic loadings. Curbstops with tracer wire test stations shall be in a valve box.. See *W&S Standard Drawings* for additional service and meter installation requirements.
9. There shall be no major landscaping (i.e. boulders, and trees, or shrubs with mature growth greater than three (3) feet), and buildings, or other permanent structures within ten (10) feet of the meter vault.

10. Pressure boosters are allowed if required. Booster pumps must be prefabricated units with variable speed controls. Provide submittal cut sheets for City approval prior to ordering booster pump.

#### **5.16 NON-POTABLE IRRIGATION MAINS AND SERVICES IN RELATION TO OTHER UTILITIES**

- A. Non-potable irrigation mains and services shall have a minimum eighteen-inch (18") vertical separation and minimum five (5) feet horizontal separation or twice the depth of the invert of the pipe, whichever is greater from all utilities measured from outside diameter.
- B. Where non-potable irrigation lines cross above or below potable water lines with less than eighteen-inch (18") clearance, pipe encasement shall be designed and constructed so as to protect the potable water line. Note: It is the City's preference to have non-potable waterlines located below potable water lines.
- C. Non-potable irrigation main crossings under any open irrigation ditch shall have a minimum five (5) feet of cover and shall be encased.
- D. Dry utility crossings shall be encased in high density polyethylene (HDPE) pipe, Standard Dimension Ratio (SDR) 11 from edge to edge of the easement or right-of-way, or ten (10) feet on either side of the non-potable irrigation main, whichever is greater. Perpendicular utility crossings are permitted above and below the non-potable irrigation main. Parallel installation of other utilities in exclusive non-potable irrigation easements is not permitted.
- E. Bored utility crossings shall have a minimum twenty-four inches (24") of vertical clearance from the outside diameter of the utility casing to the outside diameter of the non-potable irrigation line if the bored utility crosses above or below the non-potable irrigation line.
- F. If there are horizontal or vertical clearance conflicts between the non-potable irrigation line and a utility, the City may require that the non-potable irrigation main be lowered, raised, or realigned in order to maintain the required clearances.
- G. For a non-potable irrigation line crossing situation not specifically mentioned in this section, the crossing requirements provided in these Criteria shall be applied to that particular situation to the best extent possible.

#### **5.17 UNDERGROUND MARKING AND IDENTIFICATION**

- A. Underground un-detectable marking tape shall be installed 18-inches above non-potable irrigation mains.
- B. Reference construction specification Section 02315, Excavation and Fill for Marking Tape Requirements.

#### **5.18 NON-POTABLE IRRIGATION WATER STORAGE FACILITIES (PONDS)**

- A. General
  1. All water to be stored in the non-potable irrigation pond and the pond location shall be



approved by the Water and Sewer Department prior to proceeding with facility design.

2. Combining non-potable irrigation storage with storm water detention requires approval by both the Water and Sewer Department and Public Works Department Storm Water Division. A written explanation shall be submitted describing the circumstance as to why a combined pond is needed.
3. The Design Engineer shall determine the high and low operating levels, required design storage volume, and the invert elevation of the pump station intake pipe.
4. The Design Engineer shall design a gravity flow raw water supply pipe from the water source (i.e. ditch) to the irrigation storage pond.
5. There shall be no major landscaping (trees, shrubs) with mature height greater than three (3) feet planted within ten (10) feet of the liner anchor trench.

**B. Storage Volume Design**

1. Non-potable irrigation ponds shall be sized to accommodate a minimum four (4) days of supply based on the Pump Station Design Capacity. The four day supply volume shall not include the dead storage.
2. Dead storage shall be based on the water level that limits the wet well inflow below 75% of the Pump Station Design Capacity. For example, if the Pump Station Design Capacity is 1,000 gpm, the dead storage begins when the inflow is less than 750 gpm.
3. A minimum freeboard of 6-inches shall be provided for storage ponds not combined with storm water and 12-inches for combined storage ponds.
4. Minimum usable storage volume of an irrigation storage pond shall be based on the following equation:

$$V = \frac{Q \times a \times b \times c}{d}$$

**Where:**

V = Total Useable Storage Volume (acre-feet)

Q = Pump Station Design Capacity (gpm)

a = Daily Watering Window = 8 hours/day

b = 60 minutes/hour (Conversion Factor)

c = Days of Storage (days) = 4 minimum

d = 325,829 gallons/acre-foot (Conversion Factor)

5. The minimum depth of the pond shall be 8-feet from the full pond surface level to the bottom.

6. Pond side slopes shall include a 4:1 safety bench for 12-feet horizontally and 3:1 slope thereafter to achieve maximum depth of pond. If steeper side slopes are required to meet storage volume requirements due to site constraints, then fencing must be installed around the pond for safety purposes. Fencing materials must match architectural components of development or HOA fencing requirements.
7. The non-potable irrigation pond shall be designed with either an overflow spillway if topography allows or an overflow structure hydraulically connected to storm sewer.
  - a. Spillway or overflow structure shall be designed to convey a minimum of 150% of the pond fill rate based on 5.04 A. 1. of these Design Criteria..
  - b. The Design Engineer shall provide necessary design information and construction details on the Construction Drawing for the irrigation pond overflow/spillway.
8. If the non-potable irrigation pond is intended to also function as a stormwater detention facility, with approval from the City, the Design Engineer shall include the additional detention storage volume over and above that required for irrigation operations. Refer to the *SDDC*, for stormwater detention pond design requirements. In addition, the irrigation source water flow shall be measured and recorded. Refer to 5.22 of these Criteria for additional information.

C. Non-Potable Irrigation Pond Liner

1. All non-potable irrigation ponds shall be designed with an approved liner system. Field conditions, constructability, storage volume fluctuations, costs, warranty, and operation and maintenance shall be considered in the selection and design of the pond liner system.
2. Approved pond liner materials include: 45 MIL EPDM, 36 MIL RPP, 30 MIL RPE. A layer of 8 oz. geotextile must be included on top and bottom of pond liner material for protection purposes.
3. The Design Engineer may specify a pond liner alternative depending on the project conditions. The alternative pond liner system is subject to approval by the City.
4. Lining installation in areas where groundwater pressure can occur shall be avoided. The bottom of the liner shall be above the water table to prevent the liner from floating.
5. Additional Pond Liner Information:
  - a. Site structures such as piping, concrete, and drains shall be completed prior to lining installation.
  - b. The design and construction requirements for special liner installations such as anchor trenches, pipe protrusions through the liner, liner vents, batten attachments to concrete structures, seaming methods/testing, subgrade preparation, and cover treatment over the liner shall be in accordance with the manufacturer's specifications and the design shall ensure that the liner warranty is not invalidated. Coordination with and approval by the liner manufacturer is required. The proposed special liner installation details are subject to approval by the City.

- c. Construction details for special liner installation items shall be provided by the Design Engineer to be included on the Construction Drawings.

D. Shoreline Protection Treatment

1. Non-potable irrigation ponds shall be designed with a perimeter shoreline protection treatment to protect against wave action erosion. Due to the numerous shoreline protection treatments available (i.e. riprap, boulders, perimeter concrete walls, geotextile products, riparian plantings) the Design Engineer shall propose a suitable shoreline protection treatment depending on the project conditions. The proposed shoreline protection treatment for erosion protection is subject to approval by the City.
2. The Design Engineer shall make special considerations regarding the selection, design, and installation of shoreline protection treatment to ensure that the liner warranty is not invalidated. Coordination with and approval by the liner manufacturer is required.
3. Areas subject to scouring water velocities, such as at the raw water supply culvert discharge conveyance into the pond or beneath the pond fill line/service, shall be adequately protected against erosion and wash out (i.e. concrete splash pad, grouted riprap, large boulders, or appropriately sized riprap).
4. Appropriate construction details for shoreline protection treatment and erosion protection shall be provided by the Design Engineer to be included on the Construction Drawings.

**5.19 AERATION SYSTEMS**

- A. The Criteria provided here offer generic guidelines for the design of non-potable storage pond aeration systems. Each aeration system is unique and requires special design, therefore, it is the Design Engineer's responsibility to design a fully operational system for the given conditions and provide necessary construction details and specifications to accompany the design.
- B. Refer to construction specification *Section 11230, Aeration System* for additional non-potable pond aeration system requirements.
- C. Aeration System Design
  1. Coordinate the aeration system design and construction with the non-potable irrigation pump station design. House and incorporate aeration system components within the irrigation pump station building.
  2. Aeration system design components shall include, but are not be limited to, air compressors, aftercoolers, condensate separators, electrical controls, valves, pipe manifolds, flow meters, gauges, aeration pods/diffusers, housing requirements, installation and operational instructions, and recommended maintenance.
  3. The Construction Drawings for the aeration system shall show a typical layout, elevation and plan views, and critical dimension for the aeration system design and construction. The aeration system manufacturer is responsible for the layout and design of the aeration system supplied and any special coordination issues that affect

the critical dimensions, layout or orientation of the aeration system.

4. Aeration system shall be sized to provide four (4) pond volume turnovers per day based on the following equation:

$$X = \frac{V \times b}{c}$$

**Where:**

X = Number of Fine Bubble Diffusers

V = Pond Volume (millions of gallons)

b = 4 (Turnovers/day)

c = Effective Turnover Rate = d x e / f

**Where:**

d = Diffuser Depth (feet)

e = Diffuser Turnover Rate = 3.5 mgd

f = Diffuser Effective Depth = 15 ft

5. Fine Bubble Diffusers shall be spaced to provide even coverage.

## **5.20 NON-POTABLE IRRIGATION PUMP STATION**

### **A. General**

1. Pump station sites shall be located outside of the FEMA 100-year floodplain with the finished floor elevation of the pump station a minimum of 2-feet above the floodplain. All pump station site locations are subject to review and approval by the City.
2. The non-potable irrigation pump station location shall allow adequate access to the site from new or existing public right of way. The site shall be designed to provide adequate drainage away from the pump station building and pond, and conform to City standards for drainage and storm water management plans.
3. The building shall be sited to allow access by all-weather surface roads capable of accommodating maintenance trucks from public right of way to the pump station site. The access shall at a minimum support HS-20 loading with a minimum width of 15 feet. The access points and site shall be designed to allow WB-50 trucks to maneuver within the site and exit the site without backing into public right of way. The site layout shall allow for access to the wet well and vacuum/jetter truck to clean out accumulated

material in the wet well. All paved surfaces shall be designed for the expected vehicle and equipment loads.

4. Developer shall have a geotechnical evaluation completed of the site to determine soil conditions and hydrology as well as recommendations for storage pond, pump station foundation and wet well construction. Refer to Section 2.09 of these Criteria for Geotechnical Soils Report for additional information.
5. The Criteria provided here offer guidelines for the design of non-potable irrigation pumping systems. Each pumping system is unique and requires special design, therefore, it is the Design Engineer's responsibility to design a fully operational system for the given conditions and provide necessary construction details and specifications to accompany the design.
6. Refer to construction specification *Section 15140, Irrigation Pump Station* for additional non-potable irrigation pump system requirements.

#### B. Pump System Design

1. The pump system shall be designed with a reinforced concrete one common wet well and multiple, variable frequency drive (VFD), vertical turbine pumps to provide irrigation flows at varying demands and constant discharge pressure. Pump redundancy is not required.
2. The bottom of the wet well shall be a minimum 4-feet below the invert of the intake pipe.
3. The wet well shall be designed to prevent vortices and cavitation which can adversely affect pump performance.
4. Pump efficiency shall be a minimum eighty percent (80%) at the specified operating point.
5. The pump system design shall include a skid assembly to support all pump components during shipping and to serve as the installed mounting base. The base shall be of sufficient size and strength to resist twisting and bending from hydraulic forces and support the full weight of all components (i.e. pumps, motors, filters, piping, valves, etc.).
6. The pump system shall include a pressure maintenance pump for sustaining the pressure in the non-potable irrigation system during non-irrigated times and shall operate no more than every 15-minutes to maximize pump life. If the pressure maintenance pump operates more frequently then allow larger pressure differential (in pump controls) to reduce operating cycles to recover lost water pressure.
7. Pump system design components shall include, but not be limited to, motors, filters, valves, gauges, mounting and support structures, power and electrical equipment, control systems, operator interface devices, alarms, data acquisition and telemetry, and monitoring devices, .
8. Pump discharge piping and filter waste pipe shall be supported 6 to 18-inches off the

building floor and exit through the wall before pipe burial.

9. Filter to waste pipe shall discharge into the storage pond away from the Pump Station Intake Pipe inlet.
10. The Construction Drawings for the irrigation pumping system shall show a typical layout, elevation and plan views, and critical dimensions or clearances for the pump system, building, wet well, electrical, etc.
11. The pump system manufacturer is responsible for the layout and design of the pump system supplied and any special coordination issues that affect the critical dimensions, layout or orientation of the pump system.
12. The pump system design is subject to approval by the City.

#### **5.21 PUMP STATION INTAKE PIPE AND INTAKE SCREEN**

- A. Intake pipe shall be AWWA C905 DR32.5 (125 PSI) polyvinyl chloride (PVC) pressure pipe, color purple or green or ASTM F679 PVC gravity sewer pipe.
- B. The exposed section of the intake pipe shall have intermediate concrete pipe cradles with a stainless steel strap to secure the pipe to the cradle. The maximum length of unsupported pipe shall be 9-feet.
- C. Intake Screen
  1. Intake pipe shall be equipped with a square shaped passive intake screen constructed of 16 gauge, flattened 304 stainless steel, with 3/8 x 7/8 inch openings. The frame shall be constructed of stainless steel.
  2. The intake screen shall be sized such that the velocity through the screen does not exceed 0.25 feet per second (ft/s).
  3. The bottom of the screen shall be a minimum 16-inches above the bottom of the pond. The intake screen shall be supported by and mounted on top of a reinforced concrete block.

#### **5.22 RAW WATER SUPPLY SYSTEM**

- A. Raw water supply pipes shall have a minimum eighteen-inch (18") vertical separation and minimum five (5) feet horizontal separation or twice the depth of the invert of the pipe, whichever is greater from all utilities measured from outside diameter.
  1. Pipe Material: PVC, DIP, or RCP. Refer to City of Greeley *Stormwater Design Standards*, Section 6, subsection 9.3.7 for additional culvert information.
- B. Flow shall be controlled by a hand wheel operated slide gate (headgate) mounted to a reinforced concrete headwall. The headwall shall be equipped with a steel trash rack anchored to the concrete headwall with stainless steel hardware.
  1. Head Gate Manufactures/Models: Refer to Construction Specification *Section 11285, Slide Gates*.
  2. Refer to City of Greeley *Stormwater Design Standards*, Section 9, subsection 9.3.7 for additional trash rack requirements.

3. The headgate configuration shall be approved by both the City and the associated ditch company.

C. Flow Measurement

1. A parshall flume shall be used to measure flow in close proximity to the headgate. The parshall flume stilling well shall be equipped with an instrument shelf for mounting of the stage discharge recorder. Construction of the parshall flume shall be dictated by the ditch company.
2. A stage discharge recorder shall be mounted within the stilling well of the parshall flume to compute and log discharge flow and totals. The stage discharge recorder data shall be transmitted to the City's SCADA system via the Pump Station's Remote Telemetry Unit (RTU). Refer to Section 5.2 of these Design Criteria for additional SCADA information.
  - a. Manufacturer and Model: Sutron Corporation, model SDR-0001-4 or approved equal with 12 VDC/24AH battery and solar power system for recharging battery.

D. Check Structures

1. A check structure may be required where there is not sufficient depth within the irrigation ditch to provide sufficient head to achieve the raw water supply design flow. If the Design Engineer determines that a check structure is needed, a HEC-RAS model shall be created to compute water surface profiles. The check structure shall not prevent deliveries of water to downstream users.
2. The check structure shall be constructed of reinforced concrete with removable boards.

**5.23 PUMP BUILDING**

- A. The pump building shall be a precast concrete building sufficiently sized to house all the equipment including but not limited to pump skid, electric and controls cabinets, telemetry cabinet, and aeration system.
- B. There shall be a minimum 5-feet spacing between the building walls and pump skid.
- C. There shall be sufficient space between the pump skid filter(s) and building walls to allow removal of the filter screen for servicing and replacement.
- D. The minimum wall height shall be 8-feet 6-inches with equipment doors sufficiently sized to be remove and replace electrical and controls panels.
- E. The pump building shall be equipped with floor drains connected to the wet well.
- F. Refer to construction specification *Section 15140, Irrigation Pumps for additional requirements.*

**5.24 SHOULDER MONTH WATER SUPPLY**

- A. All non-potable irrigation systems require a backup potable water tap (shoulder tap) for providing irrigation water when it is in demand but non-potable water is unavailable

(“shoulder months”).

- B. Shoulder month water supplies must be approved by the City.
- C. Shoulder month water shall be discharged into the non-potable irrigation system’s water storage facility (pond). A candy cane configured discharge pipe with a minimum two (2) foot air gap shall be provided between the shoulder tap discharge and the maximum operating or overflow elevation of the pond water surface, whichever is greater.
- D. The shoulder tap shall be four (4) inches in diameter and metered. Only City personnel may operate the shoulder tap.

#### 5.25 SCADA

- A. A Remote Telemetry Unit (RTU) shall be provided to communicate with the City’s SCADA system. The RTU shall communicate with the City’s SCADA via City fiber optic if within 1,500-feet of the pump station. If fiber optic is not available, the RTU shall communicate via XetaWave radios.
- B. The RTU shall communicate with the pump system and instrumentation by way of Modbus serial or Ethernet, or Allen Bradley Ethernet or serial. If there is no ability to communicate with the Control Panel, analog and digital inputs may be utilized.
- C. Refer to construction specification *Section 15140, Irrigation Pumps for additional requirements.*

#### 5.26 SIGNAGE

- A. Irrigated Areas
  - 1. Signage must be posted at sites where non-potable water is utilized for irrigation. Coordinate signage locations with the City of Greeley during design process. An example of an approved sign is provided below.



#### 5.27 WATER DEDICATION REQUIREMENTS FOR NON-POTABLE IRRIGATION



- A. A total water dedication of three (3) ac-ft per acre for irrigated landscape will be required for new developments.
- B. Contact the Water and Sewer Department and refer to *City of Greeley Charter and Code, Title 14: Public Service* regarding water dedication requirements.

#### **5.28 WATER SUPPLY WELLS**

- A. Under certain circumstances the City may, at its election and in its sole discretion, accept use of a well(s) to meet non-potable needs. In that case, ownership of the well(s) would need to be transferred to the City and the well(s) permit changed to non-exempt irrigation well permit. Depending on the development layout and capacity of the well(s), the well could be used directly for irrigation without filling a storage pond first. The Design Engineer would need to evaluate each system individually and obtain City approval. Sufficient information regarding the well(s) such as condition and sustainable yield will be required to assist in the evaluation.

## SECTION 6

### LANDSCAPE AND IRRIGATION DESIGN CRITERIA

#### 6.01 GENERAL

The City of Greeley Landscape and Irrigation Criteria and Standards, hereafter referred to as the “Criteria”, is intended to provide information for the design, review, installation and maintenance of landscape and irrigation systems within the City of Greeley to promote the efficient use of water and the reduction of water waste through best management practices. Both landscape and irrigation systems should be designed for non-potable water type water.

It is the purpose and intent of this Criteria to support the City of Greeley Comprehensive Plan, the Greeley Water Master Plan, and the Landscape Policy Plan for Water Efficiency to:

##### Promote water conservation

- Reduce or eliminate outdoor water waste
- Reduce peak summer water usage
- Reduce water demand of new construction and development
- Reduce overall per capita demand
- Guide smart development by incorporating land use and water planning principals
- Guide smart development through practices, problem solving, technology and innovation
- Utilize onsite stormwater runoff to supplement landscape irrigation through rain water harvesting

##### Support attractive and sustainable landscapes

- Use of low-water adaptive plants like native landscapes and xeriscape
- Stormwater and rain garden utilization
- Improve aesthetic and maintain property values
- Support an urban canopy by strategically placed trees to reduce heat islands and energy use.

These Criteria shall be regarded as the minimum requirements and performance standards for the design, installation and maintenance of landscape and irrigation systems.

Whenever a provision of these Criteria and any other provision of the City of Greeley Municipal Code or any provisions in any law, ordinance, resolution, rules or regulations of any kind, contains any requirements covering any of the same subject matter, the requirements that are more restrictive or impose higher standards shall govern. In the event that there is a discrepancy in the interpretation of these Criteria, the Water and Sewer Director or designee thereof, shall make the final determination of the intent of these Criteria.

Supplemental information including but not limited to forms, checklists, notes, etc. are available on the City of Greeley’s website ([www.greeleygov.com/wc](http://www.greeleygov.com/wc)) and shall be referenced or submitted in accordance with the requirements set forth in these Criteria. It is the responsibility of the owner, designer, installer or maintenance contractor to obtain the latest version of any submitted document, as the City will periodically update these items.

- Landscape and Irrigation Criteria Checklists
- Irrigation Performance Audit Guidelines
- Sprinkler Performance Audit Form
- Temporary Irrigation Criteria
- Water Budget Chart and Example
- WaterWise Best Management Practices
- Water Efficient Planting Guide
- Example of median and right-of-way designs
- Hydrozone Guide

## 6.02 DEFINITIONS

- A. **APPLICATION RATE:** The depth of water applied to a given area and during a specific time, usually expressed in inches per hour or inches per week.
- B. **CHECK VALVE OR ANTI-DRAIN VALVE:** A valve located under or incorporated within a sprinkler head or other location within the system to prevent the system from draining on the lowest head(s) when the system is off.
- C. **CYCLE AND SOAK:** Method of irrigation where water is applied in multiple, short cycles. This allows the water to be applied more slowly, allowed to soak into the soil and prevent run-off, promoting deeper roots and healthier plants.
- D. **DISTRIBUTION UNIFORMITY:** The measure of the uniformity of the irrigation water over a defined area.
- E. **DROUGHT:** Periods or seasons with below average precipitation.
- F. **EMITTERS:** A component of an irrigation system that disperses water to the landscape (i.e. sprinklers, bubblers, micro-sprays, etc).
- G. **ESTABLISHED LANDSCAPE:** The point at which plants in the landscape have developed roots into the soil beyond the root ball, which promotes long-term health and growth.
- H. **ESTABLISHMENT PERIOD:** The first year after installing the plant in the landscape or the first two years if irrigation will be terminated after establishment. Typically, most plants are established after one or two years of growth. Native habitat mitigation areas and trees may need three to five years for establishment.
- I. **HARDSCAPES:** A non-living landscape feature that is made of any durable material (pervious and non-pervious) such as building, pavement, walkways and parking areas-including those of crushed stone, patios, and decks.
- J. **HYDROZONE:** An area within a landscape where the plant materials require a similar amount of water. For the purpose of this document, hydrozones are divided into four (4) categories:
  - *Very-Low hydrozone:* Plant materials that require less than one gallon per square foot of area per growing season of supplemental water once established. The plant materials

within this zone are typically drought-tolerant natives. This hydrozone is designated by the letter “V” on landscape plans.

- *Low Hydrozone:* Plant materials that require between one (1) and nine (9) gallons per square foot of area per growing season of supplemental water. This hydrozone shall be designated by the letter “L”.
- *Moderate Hydrozone:* Plant materials that require between ten (10) and 14 gallons per square foot of area per growing season of supplemental water. This hydrozone shall be designated by the letter “M”.
- *High Hydrozone:* Plant materials that require more than 14 gallons per square foot of area per growing season of supplemental water. The plant material within this zone are intended for high-pedestrian traffic areas such as sport fields or community gathering spaces. This hydrozone shall be designated by the letter “H”.

- K. **IRRIGATION EFFICIENCY:** The measurement of the amount of water beneficially used divided by the amount of water applied. Irrigation efficiency is derived from measurements and estimates of irrigation system characteristics and management practices. Greater irrigation efficiency can be expected from well designed and maintained systems.
- L. **LOW FLOW IRRIGATION OR DRIP IRRIGATION:** The application of irrigation water at low pressure through a system of tubing or lateral lines and emitters such as point source emitters, dripper lines, micro-sprays and bubblers. Low flow irrigation systems apply small volumes of water slowly at or near the root zone of plants.
- M. **MAINTENANCE OR MAINTENANCE OF LANDSCAPING:** Shall mean but not be limited to regular watering, mowing, pruning, fertilizing, clearing of debris and weeds, the removal and replacement of dead plants and the repair and replacement of an irrigation system. Any activity undertaken to prevent the deterioration, impairment, or need for repair of an area, structure, rights-of-way, or land use.
- N. **MASTER SHUT-OFF VALVE:** An automatic valve installed at the irrigation supply point which controls water flow into the irrigation system. When this valve is closed water will not be supplied to the irrigation system.
- O. **MULCH:** Organic material such as leaves, bark, straw, compost or inorganic mineral materials such as rocks, gravel, decomposed granite or pebbles smaller than a half-inch in diameter left loose and applied to the soil surface for the beneficial purposes of reducing evaporation, suppressing weeds, moderating soil temperature, and preventing soil erosion.
- P. **NON-ESSENTIAL AREAS:** A high hydrozone with traditional turf that receives little, if any, use (i.e. the only person who walk on those areas is the person maintaining the turf).
- Q. **RIGHT-OF-WAY LANDSCAPING** Shall mean landscaping located within the public or private right-of-way adjacent to a privately owned lot, outlot, or tract, including parkways.
- R. **SEASONAL WATERING SCHEDULE:** The programmed schedule set in the Smart Irrigation Controller. The schedule is based on the summation of the water that has been

lost to evaporation and that has been used by the plant materials. The amount of water required to meet the needs of the plant materials change with the weather (seasons).

- S. **SMART IRRIGATION CONTROLLER:** An automatic timing device with nonvolatile memory used to remotely control valves that operate an irrigation system that is contractor grade quality. Smart irrigation controllers are able to self-adjust and reschedule irrigation events based on integrated instrumentation that measures evapotranspiration (weather-based) or soil moisture or flow or a combination. The Smart Irrigation Controller must be selected from the WaterSense labeled irrigation controller list ([www.epa.gov/watersense/watersense-labeled-controllers](http://www.epa.gov/watersense/watersense-labeled-controllers)). Retail grade controllers are not acceptable.
- T. **SOIL AMENDMENT:** An organic and inorganic material that is added to native soil to improve texture, moisture holding capacity, nutrient capacity, and water and air infiltration.
- U. **SUSTAINABLE LANDSCAPES:** Landscapes that feature climate-appropriate landscape design and efficient technologies and are maintained through efficient irrigation practices to support community water objectives.
- V. **TRADITIONAL TURF:** High hydrozones grasses defined as Bluegrass (*Poa pratensis*), genus *Poa* and turf type tall fescue (*Festuca arundinacea*) and cultivars thereof having dense tufts blades and creeping rhizomes.
- W. **TURF PREFERRED:** Very-low to low hydrozones grasses such as Buffalo Grass (*Buchloe dactyloides*), Blue Grama (*Bouteloua gracilis*) or other native seed and seed blends
- X. **WATER BUDGET:** The water that is applied annually from an irrigation system to an established landscape area. It is based upon the area's reference evapotranspiration and is adjusted for plant factors and irrigation efficiency, two major influences upon the amount of water that needs to be applied to the landscape.
- Y. **XERIC LANDSCAPING OR XERISCAPE OR WATERWISE:** Shall mean the use hydrozones that are very-low to low-water use in place of plants that typically require more water to survive and include, but are not limited to, plants having a low or very low water requirement.
- Z. **ZONE:** Typically, an area served by a single irrigation control valve, sometimes referred to as a "station". Zones are comprised of plant materials and soil types with similar water requirements.

### 6.03 APPLICABILITY

- A. These Criteria shall apply to all landscape and irrigation system design, and installation and maintenance performed as a requirement of Chapter 8 – Landscape Standards of the Greeley Development Code and any other code, policy or criteria adopted by the City of Greeley. Areas that fall under these Criteria include but are not limited to:
- Civic and Open spaces
  - Common areas for all customer classes (outlots, pocket parks, usable detention, private/on-lot required/usable areas)

- Right-of-ways
  - Municipal buildings
  - Multi-family residential
  - Non-residential (institutional, commercial, and industrial)
- B. Applicability for these Criteria shall follow major development as defined in Chapter 8, Section 24-801 b. – Landscape Standards of the Greeley Development Code.
- C. These Criteria shall govern over privately enforced guidelines or requirements related to landscaping and irrigation (i.e. business association, homeowners association design guidelines, regulations and requirements, etc.).
- D. Exemptions or where these criteria do not apply to:
- Single-family and two-family lots
  - Ecological restoration projects not requiring a permanent irrigation system.
  - Exemptions listed in Chapter 8, Section 24-801 b.3.- Landscape standards

#### **1.04 ENFORCEMENT**

- A. The City of Greeley shall be provided the opportunity to review all landscape and irrigation plans, site and soil analyses, design and installation for compliance with these Criteria. The Criteria are enforced by the City or authorized representative.
- B. All landscape improvements, indigenous plant material, and irrigation system components shall meet performance standards and supporting criteria. The City shall review all submittals for general compliance with these Criteria. An approval by the City does not relieve the owner, designer, installer or maintenance contractor from the responsibility of ensuring the design, plans, specifications, construction, maintenance, and record drawings are in compliance with these Criteria.
- C. In the event of Level 3 or 4 drought declared by the Water and Sewer Board, extreme water use plantings temporary irrigation may occur at the discretion of the Water and Sewer Director or designee thereof. For drought declarations visit <https://greeleygov.com/services/ws/home>.

#### **6.05 SOIL EVALUATION**

- A. Soil testing is required for those landscape areas exceeding 20,000 square feet in size. Exceptions for soil evaluations are for landscapes that are one-hundred percent (100%) native and or hydrozone very-low, as defined in Section 6.02 of these Criteria, as long as enough native onsite soil can support that proposed landscape. Soil evaluations will be used to identify potential soil issues and provide recommendations to improve the landscape health and survival rate.
1. A professional soil scientist at a certified soils laboratory shall conduct a soil analysis.

2. Soil sample(s) shall be taken after over lot grading is completed and prior to landscaping. Ideally, soil sample results should be incorporated into the landscape design.
3. Soil sample(s) collection shall be no less than one sample per 5,000 square feet, unless justified from a soil scientist, and must represent a uniform area. Differences in soil texture, color, slope, degree of erosion, drainage, past management practices, and types of plant materials proposed for each area should be taken into account when collecting samples. The professional soil scientist shall determine the sample sites, depth, and frequency.
4. The soil analysis shall determine the organic and inorganic composition of native/indigenous soils in the landscaped areas and shall be analyzed for:
  - pH
  - Soil texture class
  - Electrical Conductivity
  - Organic matter
  - Content of nitrogen, phosphorus, potassium, zinc, iron, manganese, copper and lime
5. Soil analysis shall include specific landscape recommendations based on the soil results for the type of plan material to be grown in each landscape area. The type and volume of soil amendment shall be determined by the soil scientist and be consistent with the indigenous soil and the needs of the plant materials in each areas of the landscape.

#### **6.06 HANDLING OF TOPSOIL**

- A. Stripping and stockpiling of native topsoil onsite shall be required during construction. This topsoil shall be incorporated as the final layer of soil for landscaping unless soil contamination has been determined. Soil contamination determinations shall be at the discretion of the Public Works Director or his or her designee.
- B. The onsite replacement of topsoil and the addition of soil amendments are critical to successful establishment and ongoing health of plant material and efficient use of water through the life of the project.

#### **6.07 SOIL AMENDMENTS**

- A. Soil amendments (organic or inorganic) shall adhere to the Greeley Municipal Code, Section 24-804(e)(3) – Landscape Standards Installation and Maintenance for all properties unless a soil evaluation is required (See 6.05).
- B. If a soil evaluation is required, the type and volume of soil amendment shall be determined by the soil scientist and the needs of the plant materials in each area of landscape.

- C. For all areas less than 20,000 square feet, a minimum of four (4) cubic yards of compost per 1,000 square feet of area shall be used for hydrozones moderate and high.
- D. If applicable, per Greeley Municipal Code Chapter 8, Section 24-801(b) and 24-804(e)(3) – Landscape Standards, soil amendment verification documentation and receipts shall be submitted to the Water and Sewer Department, Water Conservation Program prior to installation of plant material, and shall include review of adherence to all criteria and performance standards. Written documentation reflecting approved volume and type of soil amendment is required upon inspection.

## **6.08 MULCH**

- A. Mulch (organic or inorganic) shall be used in areas used to cover bare ground, reduce evaporation, suppress weeds, moderate soil temperatures and prevent soil erosion to promote landscape establishment.
  - 1. Organic Mulch
    - a. Organic mulch material includes bark and wood chips. No construction debris such as pallets shall be used.
    - b. Shall be applied at one (1) cubic yard per eight (8) square feet at a depth of four (4) inches, and as appropriate to each species.
    - c. Shall be applied to soil surface, not against the plant stem, or high against the base of tree trunks to minimize disease.
  - 2. Inorganic Mulch
    - a. Inorganic mulch includes rock, gravel and pebbles (pea gravel) smaller than a half-inch in diameter for water conservation and weed suppression. Any materials greater than a half-inch is not considered mulch.
    - b. Rock mulch shall have a minimum depth of two inches (2”).

## **6.09 WEED BARRIER**

- A. Black plastic (polyethylene) and woven weed barrier fabrics (polypropylene) are not allowed unless they are used for playgrounds or large-scale vegetable/edible plant production.

## **6.10 SUSTAINABLE LANDSCAPE DESIGN**

- A. Hydrozones
  - 1. For the purposes of this document, hydrozones are broken into the following four categories:



**Table 6-1: Hydrozone Category**

<b>Hydrozone Category</b>	<b>Water Needs</b>	<b>Landscape Examples</b>
High	>14 gallons/S.F./season	Bluegrass turf, arborvitae, willows
Moderate	10-14 gallons/S.F./season	Tall Fescue, columbine, potentilla purple coneflower
Low	1-9 gallons/S.F./season	Buffalograss turf, sedums, succulents, iris, penstemon
Very-Low	<1 gallons/S.F./season once established	Native grasses, yarrow, rabbitbrush

**B. Landscape water budget and plant material**

1. An annual water budget, available on the City's website ([greeleygov.com/services/ws/conservation/](http://greeleygov.com/services/ws/conservation/)) shall be submitted for the landscape and irrigation plans. A water budget chart will show the total annual water used, which shall not exceed an average of 15 gallons/square foot for the landscape for all hydrozones.
2. Plants are to be hydrozoned with plants of similar hydrozone (i.e. low with low). Plants of very low hydrozones are not to be planted in moderate to high hydrozones.
3. High hydrozones shall be limited to appropriate high-use areas with high visibility and functional needs. No more than 25% of the design shall be high hydrozones. Where commercial and industrial uses include residential or recreational components, such as, but not limited to, assisted living, schools and daycares, picnic grounds, pocket park, outlots, the Water and Sewer Director or his or her designee may approve a greater percentage of high hydrozones. The applicant must demonstrate that the additional high hydrozones (traditional turf grass) areas are being used in high-traffic areas, such as, but not limited to, athletic fields, children's play areas, parks and courtyards.
4. Turf preferred grass species are not limited in the design.
5. Non-essential area detention and retention ponds shall be placed with very-low hydrozone plants only, such as preferred turf grass species.
6. Plant material shall be selected from a list of native and other plants determined to be appropriate for and well adapted to the soil and local environmental conditions and solar exposure requirements. The material plant lists can be found under the Water and Sewer Department, Water Conservation website [www.greeleygov.com/wc](http://www.greeleygov.com/wc) , and City of Greeley's Forestry Department [greeleygov.com/forestry](http://greeleygov.com/forestry). Upon request to the Water and Sewer Director or his or her designee, additional plants may be added to the list that are appropriate for the above criteria.
7. Plant materials shall provide an enriched quality of life by providing year round color, texture and diversity in plant material using the WaterWise Best Management Practices

found under Water and Sewer Department, Water Conservation website  
[www.greeleygov.com/wc](http://www.greeleygov.com/wc)

8. Plant material that is banned for use by the City of Greeley, Weld County and/or the State of Colorado shall not be used. This applies to all builders, installers, and owners. See the Colorado Department of Agriculture website for detailed list of restrictions <https://ag.colorado.gov/conservation/noxious-weeds>.
9. Greeley Municipal Code, Chapter 8 – Landscape Standards shall be adhered to.
10. Turf preferred grass mixes shall be approved by one of the following: a Certified Professional Agronomist (CPAg), a Certified Horticulturist, a Colorado State University Certified Master Gardener, a Local Seed Company, or a combination of the above.
11. The following landscape practices are highly recommended:
  - a. Methods outlined in the WaterWise Landscaping Best Practices ([www.greeleygov.com/wc](http://www.greeleygov.com/wc)).
  - b. Protection and preservation of native species and natural vegetation.
  - c. Plant selection based on disease and pest resistance.
  - d. Implementing stormwater best management practices into the landscape and grading areas to minimize runoff and to increase on-site retention and infiltration.
  - e. Rain gardens, water quality ponds, bioswales and other landscape feature and practices that increase rainwater capture and create opportunities for infiltration while adhering to the water right of less than 72 hours of water retention and Storm Drainage Design Criteria and Construction Specification manual.

## **6.11 LANDSCAPE PLANS**

Landscape Plan requirements shall be used to aid the applicant, designer, installer and maintenance contractor in the analysis, design, installation, and maintenance of landscapes. These requirements presented herein are the minimum necessary for landscape plan submittals and shall be considered in conjunction with the requirements set forth by the City's Community Development Department and Greeley Municipal Code, Chapter 8 – Landscape Standards.

A general landscape plan shall be included with the Site Development Plan submittal and a more detailed landscape and irrigation plan shall be submitted with the Construction Document submittal. All forms, checklists and plant list can be found online at the City's website ([www.greeleygov.com/wc](http://www.greeleygov.com/wc))

All landscape plans shall adhere to Water and Sewer Department's Section 2.05 of the Design Criteria and Construction Specification-Potable Water Distribution, Sanitary Sewer Collection, and Non-Potable Irrigation System, Volume III. (<https://greeleygov.com/services/pw/design-criteria-and-construction-specifications>)

A. The landscape plans analyses shall include:

1. A site analysis of all existing features that may influence landscape design such as prevailing winds, exposures, topography, hardscapes, and existing features like utilities, fences, structures etc. Site analyses shall adhere to local zoning and codes related to utility easements, site distance requirements, and buffer zones.
2. Use site analysis to identify the landscape function and activities. This includes the overall theme of the site and neighborhood, onsite traffic patterns and activity and service area needs.

B. Landscape design plans shall include:

1. Scaled of one (1) inch = twenty (20) feet and no greater than one (1) inch = forty (40) feet drawings.
2. Searchable pdf format.
3. A title block with name of project, sheet name, company identification including address, phone number, name of person preparing the plan and date. Name, address and contact phone number for property owner.
4. Hatch keys, north arrow and scale.
5. One (1) foot grading and contour lines. Note all slopes equal to or greater than 3:1 are to be identified on the landscape sheets.
6. Property lines, existing and future easements and rights-of-way.
7. Delineation of all applicable hydrozones with square footage using the four defined categories in Section 6.10 using letter marking found in Section 6.01 of these Criteria.
8. Include irrigation methods according to the hydrozones. See Section 6.12-Irrigation System Design Requirement of these Criteria.
9. Water budget charts for each irrigation tap that shows the total annual water use, which shall not exceed fifteen (15) gallons per square foot over the site.
10. Identify and locate:
  - a. High-traffic areas with functional needs
  - b. Soil amendments, types and quantities
  - c. Type of mulch and applicator depth
  - d. Type and surface area of water features
  - e. Hardscapes (pervious and impervious)
  - f. Structures (buildings, fences, retaining walls, gazebos/patios, pavement, decks, sidewalks, parking structures, and other visual features).
  - g. All plant materials drawn at mature size for trees, shrubs, living groundcovers, grasses, vines, annual and perennial flowers, and vegetable gardens.

- h. Any special features
- 11. Any needed variances to established new sod or lawn  
([greeleygov.com/services/ws/conservation/new-lawn-variances](http://greeleygov.com/services/ws/conservation/new-lawn-variances))
- 12. Final landscape design plans shall be stamped by a Colorado registered landscape architect.

## 6.12 Irrigation System Design Requirements

Per section Chapter 8, Section 24-804(h)-of the Greeley Municipal Code, an irrigation system design shall be submitted in conjunction with a landscape plan. The irrigation system design shall incorporate the required items set forth below:

### A. Irrigation Methods and Layout

- 1. Provisions shall be made for permanent, automatic irrigation of all plant material, with the following exceptions:
  - a. Hydrozones very-low water use plantings that do not require any supplemental irrigation beyond establishment.
  - b. Trees and other plants placed within the landscape area along residential local street parkways for single-family detached dwellings.
- 2. The irrigation method shall be selected to correlate the hydrozones shown on the landscape plan. The following criteria shall be followed during the design of the irrigation system:
  - a. Drip irrigation or bubblers shall be used for sparsely-planted trees and shrubs which are greater than three (3) feet.
  - b. Rotors, spray heads with multi-jet rotary nozzles shall be used for turf grass. Spray heads are not allowed unless retrofitted with rotary nozzles.
  - c. Only subsurface drip irrigation shall be used to irrigate strips less than 11 feet wide within street right-of-ways. Above ground irrigation is strictly prohibited.
  - d. Inline emitter driplines are encouraged especially for higher density of planting.
  - e. Each hydrozone shall irrigate a landscape with similar site, soil conditions and plant material with similar water needs. To the extent reasonably feasible, areas with significantly different solar exposures shall be zoned separately.
  - f. Traditional turf and non-turf areas shall be irrigated on separate hydrozones.
  - g. On steep grades, an irrigation method with a lower application rate shall be used in order to minimize runoff and, to the extent feasible, these areas shall be zoned separately. Traditional and preferred turf shall not be allowed on slopes greater than 25 percent where the toe is adjacent or within ten (10) feet to an impermeable hardscape.
  - h. Drip, micro-sprays, retrofitted spray heads with rotary nozzles and rotors shall not be combined on the same zone.

## B. Equipment

1. Valves
  - a. A backflow prevention assembly shall be installed in accordance with Greeley Municipal Code, Chapter 14.08.070-Cross-connection control. All backflow assemblies shall be equipped with adequately sized winterization ports downstream of the backflow assembly.
  - b. In order to reduce water leaks from the irrigation system, a master shut-off valve shall be installed downstream of the backflow device to shut off water to the system automatically when not operating. Flow sensors, integrated with the Smart Irrigation Controller are required for single or combined point of connection flows of 200 gpm or greater.
2. Submeters for irrigation systems are encouraged to enable the owner and landscape maintenance contractor to monitor water use. The installation and maintenance of the submeter shall be borne by the owner of the property and not by the City. All such submeters shall be installed in accordance with the specifications established by the City.
3. Smart Irrigation Controllers shall:
  - a. Be climate-based or soil moisture-based technology selected from the WaterSense labeled irrigation controllers list. (<https://www.epa.gov/watersense/watersense-labeled-controllers>.)
  - b. Be installed and programmed according to the manufacturer's specifications.
  - c. Post at each smart irrigation controller a data input chart including the precipitation rate from the audit and water budget.
  - d. Each Smart Irrigation Controller shall be programed to:
    - i. A standard seasonal watering schedule within thirty (30) days of the installation of new landscaping.
    - ii. To ensure traditional turf is not irrigated between January 1<sup>st</sup> and April 15<sup>th</sup> without an approved variance from the Water and Sewer Department.
    - iii. Use a cycle and soak irrigation method with no irrigation allowed between the times of 10:00 a.m. to 6:00 p.m.
4. Sprinklers and nozzles shall meet the following requirements:
  - a. The type of sprinkler and associated nozzles shall be selected to correlate with the size and geometry of the zone being irrigated.
  - b. Sprinklers shall be spaced no closer than seventy-five (75) percent of the maximum radius of throw for the given sprinkler and nozzle. Maximum spacing shall be head-to-head coverage.
  - c. Coverage arcs and radius of throw for turf areas shall be selected and adjusted to water only turf areas and minimize overspray onto vegetated areas, hard surfaces, buildings, fences, or other non-landscaped surfaces.
  - d. Sprinklers, bubblers or emitters on a zone shall be of the same manufacturer.
  - e. Sprayheads in turf areas shall have a minimum six (6) inch pop-up riser height. A four (4) inch pop-up riser height is permitted when the irrigation head is in line with a curb along a parking space.

- f. Spray nozzles are not allowed.
  - g. Nozzles for rotors shall be selected to achieve an approximate uniform precipitation rate throughout the zone.
  - h. All sprayheads and rotors shall be equipped with check valves and pressure regulating stems in accordance with Colorado's House Bill 19-1231.
  - i. Pressure-compensating emitters shall be used for drip irrigation. For sloped areas, check valve(s) shall be installed and the drip line shall be parallel to the slope.
  - j. Remote control valves shall have flow control.
  - k. Properties with single or combined point of connection flows of 200 gpm or greater, shall have a control system capable of providing real-time flow monitoring and the ability to shut down the system in the event of a high flow condition.
  - l. Emitters shall be set back from foundations a minimum of five (5) feet or as recommended by the project soils engineer's investigation and analysis.
  - m. Sprayheads in turf areas shall be matched precipitation nozzles. Variable Arc Nozzles (VANS) are not acceptable for 90, 180, and 360 degree applications. High-Efficiency Variable Arch Nozzles (HE-VANS) are allowed in odd shaped areas where 90, 180 and 360 degrees nozzles are not applicable.
5. Sleeving
- a. Separate sleeves shall be installed beneath paved areas to route each run of irrigation pipe or wiring bundle. The diameter of sleeve shall be twice that of the pipe or wiring bundle.
  - b. The sleeve material beneath sidewalks, drives and streets shall be PVC Class 200 pipe with solvent welded joints.
  - c. All sleeving located under concrete, pavement or other hard surfacing shall be notched on both sides to mark the sleeve location.

#### C. Water Pressure

- 1. The irrigation system designer shall verify the existing available water pressure.
- 2. The irrigation system shall be designed such that the point-of-connection design pressure, minus the possible system pressure losses, is greater than or equal to the design sprinkler operating pressure.
- 3. All rotary sprinklers and multi-stream rotary nozzles pop-up spray sprinkler bodies shall operate at the manufacturer's specific optimum performance pressure range.
- 4. All pop-up spray sprinkler bodies equipped with a sprayheads shall operate at no less than twenty (20) psi and no more than thirty (30) psi.
- 5. If the operating pressure exceeds the manufacturer's specified maximum operating pressure for any sprinkler body, pressure shall be regulated at the zone valve or sprinkler heads.
- 6. Pressure boosters are allowed if required. Booster pumps must be prefabricated units with variable speed controls.

## 6.13 IRRIGATION DESIGN PLAN

The purpose of a preliminary irrigation design plans is to provide a general design and annual water allotment for landscapes. The final irrigation design plans build upon the preliminary design with additional details. In accordance with Greeley Municipal Code, Chapter 8, Section 24-804(h) – Landscape Standards, the irrigation plan shall be designed in conjunction with a landscape plan in a manner to maximize irrigation efficiencies:

### A. Preliminary Irrigation Design Plans shall include:

1. A title block with name of project, sheet name, company identification including address, phone number, name of person preparing the plan and date. Name, address and contact phone number for property owner.
2. A reference to the specific landscape plan, with its date and the designer's name and contact information.
3. Hatch keys, north arrow and scale.
4. Show grading and contours. Note all slopes equal to 3:1 are to be identified on the landscape sheets.
5. Property lines, existing and future easements and rights-of-way.
6. The location/point of irrigation tap connection with the water system. This must match the information on the Utility Plans.
7. Accurately and clearly identify all applicable hydrozones with square footage using the defined four categories in Section 6.10 and using letter marking found in Section 6.2 of these Criteria.
8. Include irrigation methods according to the hydrozones. See Section 6.12-Irrigation System Design Requirements of these Criteria.
9. Show the layout of the irrigation main lines proposed.
10. A water budget chart that shows the total annual water use, which shall not exceed fifteen (15) gallons per square foot over the site.

### B. Irrigation Design Plans Submittal Requirements

1. Drawings shall be scaled of one (1) inch = twenty (20) feet and no greater than one (1) inch = forty (40) feet.
2. Drawings shall be submitted in a searchable pdf format.

- C. Final Irrigation Design Plans shall include:
1. Same information required for the Preliminary Irrigation Design Plan submittal and;
  2. A Smart Irrigation Controller data input chart. Irrigation schedules for landscape establishment period and established planting shall include irrigation frequency, cycles per day, and minutes per cycle. A note stating that the schedule is a guide only and actual field conditions may require more or less watering time as plants mature.
  3. A pressure calculation worksheet that shall demonstrate the point-of-connection design pressure, minus the possible system pressure losses, is greater than or equal to the design sprinkler operating pressures.
  4. Identify and locate:
    - a. Each irrigation zone shall be based on hydrozones and shall indicate:
      - i. Sprinkler type
      - ii. General description
      - iii. Pressure
      - iv. Flow in gallons per minutes
      - v. Radius of influence
      - vi. Zone square footage
    - b. Location of:
      - i. Main and lateral lines and material types
      - ii. Master valves
      - iii. Manual valves
      - iv. Flow sense
      - v. Irrigation sleeves (if applicable)
      - vi. Smart Irrigation Controller and accessories (weather-base, soil moisture etc.)
      - vii. Backflow prevention assembly
      - viii. Water meter and/or irrigation meter (if applicable).
      - ix. Heads, sprinklers, nozzles types
      - x. General terrain slope to ensure proper drainage
      - xi. Additional irrigation accessories
    - c. Irrigation zones
      - i. Sprinkler type
      - ii. Description
      - iii. Pressure
      - iv. Flow in gallons per minute
      - v. radius
  5. The following General Notes:
    - a. Contractor installing the system including name, address, and phone number
    - b. Any irrigation certifications
    - c. All field adjustments or redesign to show “as-built” drawings after installation is complete
  6. The owner of the property shall be provided:
    - a. “As-built” irrigation drawings.



- b. Water budget chart
- c. Smart Irrigation Controller data input chart
- d. Two (2) operating keys for each type of manually operated valves
- e. Two (2) of each servicing wrench or tool needed for complete access, adjustment and repair of sprinklers.

#### **6.14 Irrigation System Installation**

Irrigation system installation shall be consistent with approved plans and meet the City's Criteria prior to issuance of Certification of Occupancy or other City approvals. Release of bonding or surety (if applicable) shall be withheld until approval is given.

Materials, installation and execution for parks shall follow City of Greeley Design Criteria and Construction Specifications, Section 02810 Irrigation Specifications.

Otherwise the following shall occur for irrigation system installation:

##### **A. Quality Assurance:**

1. Irrigation system installation shall be consistent with approved system design and applicable water type (potable versus non-potable systems). It is recommend for the irrigation system to be designed and construction for non-potable water systems.
2. Work and materials shall be in accordance with the latest edition of the National Electric Code, the Uniform Plumbing Code as published by the Western Plumbing Officials Association, and applicable laws and regulations of the governing authorities.
3. When contract documents call for material or construction of better quality or larger size than required by the above-mentioned rules and regulations, provide the quality and size required by the contract documents.
4. A Field Supervisor shall review and sign-off on the installation. Field Supervisor shall have at least five years (5-years) experience in two wire installation.

##### **B. Excavation, trenching and backfilling**

1. Excavate to permit the pipes to be laid at the intended elevations and to permit work space for installing connections and fittings.
2. Trenching and/or pipe pulling shall meet the minimum burial depths (distance from top of pipe or control wire to finish grade):
  - a. 24-inches over mainline pipe and over electrical conduit
  - b. 28-inches over control wire
  - c. 18-inches over lateral pipe to sprinklers

3. Trenches may be curved to change direction or to avoid obstructions within the limits of the curvature of the pipe. Minimum radius of curvature and offset shall be based on manufactures recommendations. No deflection will be allowed at a pipe joint.
4. Backfill shall occur only after lines have been reviewed and tested. Backfill materials shall be free to sharp objects, rubbish, trash and other objects that may damage the pipe.

C. Installation

1. Contact the City of Greeley at [conserve@greeleygov.com](mailto:conserve@greeleygov.com) when irrigation construction begins.
2. Installation shall be consistent with approved system design.
3. Tree and shrub locations as shown on the landscape plants take precedence over irrigation equipment locations. Conflicts between irrigation system, planting material and architectural features shall be avoided.
4. Assembling pipe and fittings shall be in a manner recommended by the manufacturer and in accordance with accepted industry practices.
5. A minimum of two (2) appropriately sized control wires and one (1) common wire from controller located to each dead-end of mainline for use as spares in case of control wire failure. Cap end of wires with water-proof wire connector. Wire terminations must be located in a valve box. In addition, coil three (3) feet of wire in the valve box.
6. Sprinkler assemblies shall be installed as per the specifications and at the locations of the irrigation plans. All sprinkler assemblies shall be installed for best performance. The City reserves the right to conduct follow-up audits as deemed necessary at the expense of the customer to ensure irrigation system efficiencies.

D. Testing

1. All irrigation zones shall be free of leaks, defects or deficiencies in the irrigation system. It is unlawful for any owner or user of water to fail to comply to the prevision of Greeley Municipal Code, Section 10.08.100 and to waste water through neglect or by reason of faulty or imperfect plumbing or fixtures per Greeley Municipal Code, Section 14.08.090.

## 6.15 IRRIGATION PERFORMANCE AUDIT

Per Greeley Municipal Code, Section 24-801(b)(5) and 24-804(h)(5) a letter of substantial completion of the landscape plan and an irrigation performance audit must be completed prior to issuance of Certification of Occupancy or other City approvals. Release of bonding or surety (if

applicable) shall be withheld until approval is given. Details of the Irrigation System Installation, Performance Audit and Landscape and Irrigation System Maintenance

A. Exemptions

1. Systems with only subsurface irrigation are exempt from the audit.

B. Certification

1. The contractor in charge of the irrigation system installation must contract to have an irrigation performance audit completed by either a:
  - a. Certified Landscape Irrigation Auditor (CLIA) and/or the Irrigation Association (a non-profit industry organization dedicated to promoting efficient irrigation)
  - b. Qualified Water Efficient Landscaper (QWEL) who is certified by EPA WaterSense
2. A sprinkler audit must be performed either by the City of Greeley's Water Conservation Program personnel, a CLIA or QWEL independent of the installation contractor. A list of CLIA can be found at [www.irrigation.org/IA](http://www.irrigation.org/IA) and a list of QWEL can be found at <https://www.qwel.net/>.
3. The cost of hiring the CLIA/QWEL contractor shall be the responsibility of the contractor in charge of the installation.

C. Performance Audit Guidelines

1. Irrigation audits must be performed according to the City's *Sprinkler Performance Audit Form and Guidelines* and using the *Performance Audit and Catch Can Data forms* (<https://greeleygov.com/services/ws/conservation>).
2. Operating pressure tests will be conducted at the furthest sprinkler on each zone. All pop-up spray sprinkler bodies equipped with a sprayheads shall operate at no less than twenty (20) psi and no more than thirty (30) psi. All rotary sprinklers and multi-stream rotary nozzles on pop-up spray bodies shall operate at the manufacturer's specific optimum performance pressure range.
3. The minimum acceptable distribution uniformities shall be sixty (60) percent for sprayhead zones and seventy (70) percent for rotor zones.
4. Results below minimum acceptable distribution uniformity will require adjustments and/or repairs made to the irrigation system. These corrections will be noted on the irrigation as-builts and the test area re-audited until acceptable results are produced.
4. The auditor may elect to perform tests on one-third to one-half of the zones to get an average value that could be applied to all zones that are identical (have the same sprinkler head, nozzle, spacing and operating pressure).
5. A signed copy of the Irrigation Performance Audit shall be submitted to and approved by the Water and Sewer Department, Water Conservation Program Manager before issuance of a Certificate of Occupancy or other City approvals.

## 6.16 LANDSCAPE MAINTENANCE

Per section 24-804(e) installation and maintenance of the landscape areas of the Greeley municipal code, the developer, owners' association, property owner and/or tenant, as required by Chapter 8, shall be responsible for maintaining in a healthy condition all on-lot and right-of-way landscaping, buffering, perimeter treatment and screening improvements. The landscape and irrigation maintenance shall incorporate the required items set forth below:

- A. The Owners' Association, property owner and/or tenant shall be jointly and severally responsible for the regular maintenance of all landscaping elements and irrigation system in good condition. All landscaping shall be maintained free from disease, pests, weeds and litter.
- B. Regular maintenance shall be consistent with the needs of the plant material and may include pruning, mowing, fertilization, mulching and weeding, and plant materials replacement.
- C. Turf Preferred shall follow the City of Greeley's Natural Areas & Trails Department No-Mow policy (<https://greeleygov.com/docs/default-source/public-works/no-mow-policy.pdf>). The policy requires the following targeted mowing:
  - 1. 6' maximum width, 6-12" high on each side of a concrete or soft-surface trail up to 3 times per growing season, May 15th through September 15th.
  - 2. 15' maximum width, 6-8" high, along the property line, if feasible and accessible, where a designated natural area abuts residential/commercial property up to 3 times per growing season, May 15th through September 15th.

#### **6.17 IRRIGATION SYSTEM MAINTENANCE**

- A. Regular maintenance of the irrigation system includes backflow prevention assembly testing, leak repair, replacement of damaged system components, head adjustments, filter and strainer cleaning/replacement and application rate adjustments.
- B. A completed, passing backflow prevention assembly test, consistent with the parameters outlined in the City's Cross-Connection Control Standards Section 14.08.070 is required for irrigation system start-up. Proper assembly operations shall also be verified through passing backflow prevention assembly test when the assembly is taken out of service for maintenance or repair.
- C. All irrigation system elements shall be repaired and replaced periodically to maintain an efficient and well operating system.
- D. Subject to Chapter 14.08-Water Rates and Regulation, failure to maintain any plumbing or fixtures of any premises are so defective as to waste any water is unlawful and shall be subject to penalties and/or water shutoff.

# Water & Sewer Agenda Summary

Date: April 20, 2022

Key Staff Contact: Dena Egenhoff

**Title:** Review Water Conservation Program Performance

**Summary:** Greeley's Water Conservation program was selected for a WaterNow Alliance's Project Accelerator program in 2020. The WaterNow Accelerator program is a vehicle to jumpstart sustainable water projects by providing professional hands-on support and technical assistance. Greeley's project focused on optimizing its existing conservation program through performance analysis and an equity-focused analysis of metrics such as socioeconomic status of participants, age and geographic distribution, and the value of each program to the City's residents.

Though key findings within this project allows the Water Conservation team to:

- Execute data-based program decisions driven by innovation and technology.
- Ensure a return on investment
- Fulfilling future customer needs and changing values.

**Recommended Action:** Informational item only

**Attachments:**

Greeley Water Board Report: Enhancing Water Efficiency Portfolio through Performance Analysis



# Enhancing Greeley's Water Conservation Portfolio through Performance Analysis

WaterNow Alliance & Western Resource Advocates  
April 2022



# AGENDA



1. Project Background



2. Survey Results



3. Trends in Participation



4. Water Savings



5. Questions / Discussion

# INTRODUCTIONS



**Amy Weinfurter**  
Director of Strategic Projects  
WaterNow Alliance



**Lindsay Rogers**  
Water Policy Analyst  
Western Resource Advocates



**John Berggren**  
Water Policy Analyst  
Western Resource Advocates



# WaterNow Alliance



WaterNow Alliance is a forum and network of local water leaders advancing sustainable, affordable, equitable and climate resilient water strategies



PROTECTING THE WEST'S LAND, AIR, AND WATER

## Western Resource Advocates

- We are a conservation organization with more than 30 years experience in the Intermountain West
- We use law, science, and economics to craft innovative solutions to the most pressing environmental challenges
- We work to conserve western lands, advance clean energy, ensure healthy rivers, and protect air quality throughout the region

**OUR MISSION:** Western Resource Advocates is dedicated to protecting the West's land, air, and water to ensure that vibrant communities exist in balance with nature.



# Project Accelerator

A WaterNow Alliance Initiative

Twice-a-year call for cities, towns, special districts and other public entities seeking additional bandwidth to develop affordable, sustainable, equitable, and climate-resilient water solutions

- 250 hours of program and technical assistance
- City/Agency identified project, driven by your priorities



# KEY PROJECT ELEMENTS



1. Understanding Program Background and Priorities



2. Review Water Conservation Program Portfolio and Data



3. Customer Survey on Water Conservation Programs



4. Quantitative Analysis of Water Conservation Programs

# SURVEY BACKGROUND

- Focused on 4 categories of programming:
  - Education programs
  - Water audits
  - Incentives/rebates
  - Online water efficiency tools
- Included optional demographic questions
- 45 questions (~10-15 minute completion time)
- Advertised through a bill stuffer, emails, social media, WaterSmart portal & water conservation webpage
- Raffle prizes for local restaurants
- 720 completed responses



## *Your opinions on Greeley's water conservation efforts matter!*

The City of Greeley is conducting an evaluation of its water conservation programs to determine which programs are most effective in helping the city meet its conservation goals.

Your feedback on these programs, regardless if you have participated or not, will help ensure that we can continue to improve our conservation programs and help you *save water and money*.

For participating in this 5-15 minute survey, you will be entered to win a \$100 gift card to a local restaurant and other prizes!

Type the URL below into a web browser or use the QR code with your smartphone camera to access the survey.

<http://bit.ly/GreeleyWater>

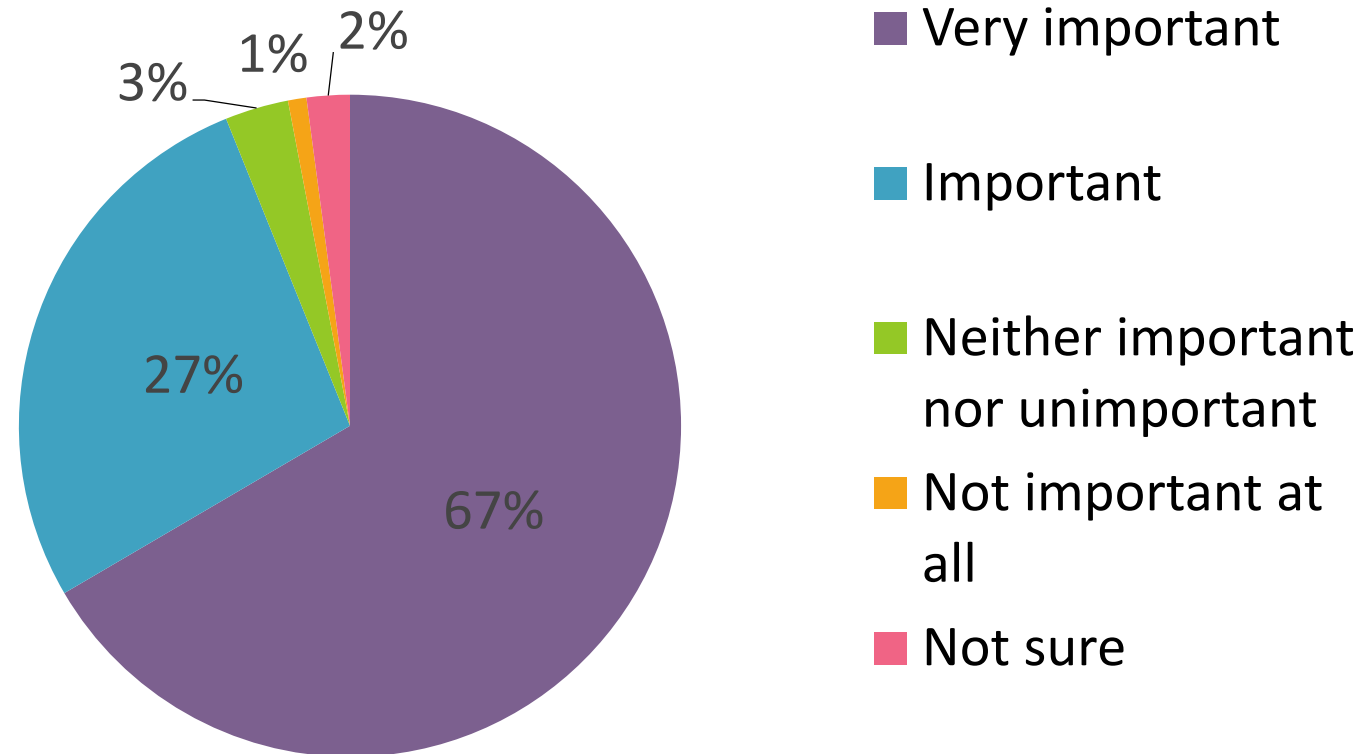


*Thank you!*



# IMPORTANCE OF WATER CONSERVATION PROGRAMS

How important do you feel the City of Greeley's water conservation programs are?



# WATER CONSERVATION MOTIVATION

*What would motivate you to participate in Greeley's Water Conservation Program?*

## Top Responses:

1. To save money on my water bill (85%)
2. To protect our limited water resources (65%)
3. To reduce my personal water use (47%)
4. To pay for a fixture/appliance (43%)
5. To support community values (38%)

# CONSERVATION PROGRAM AWARENESS

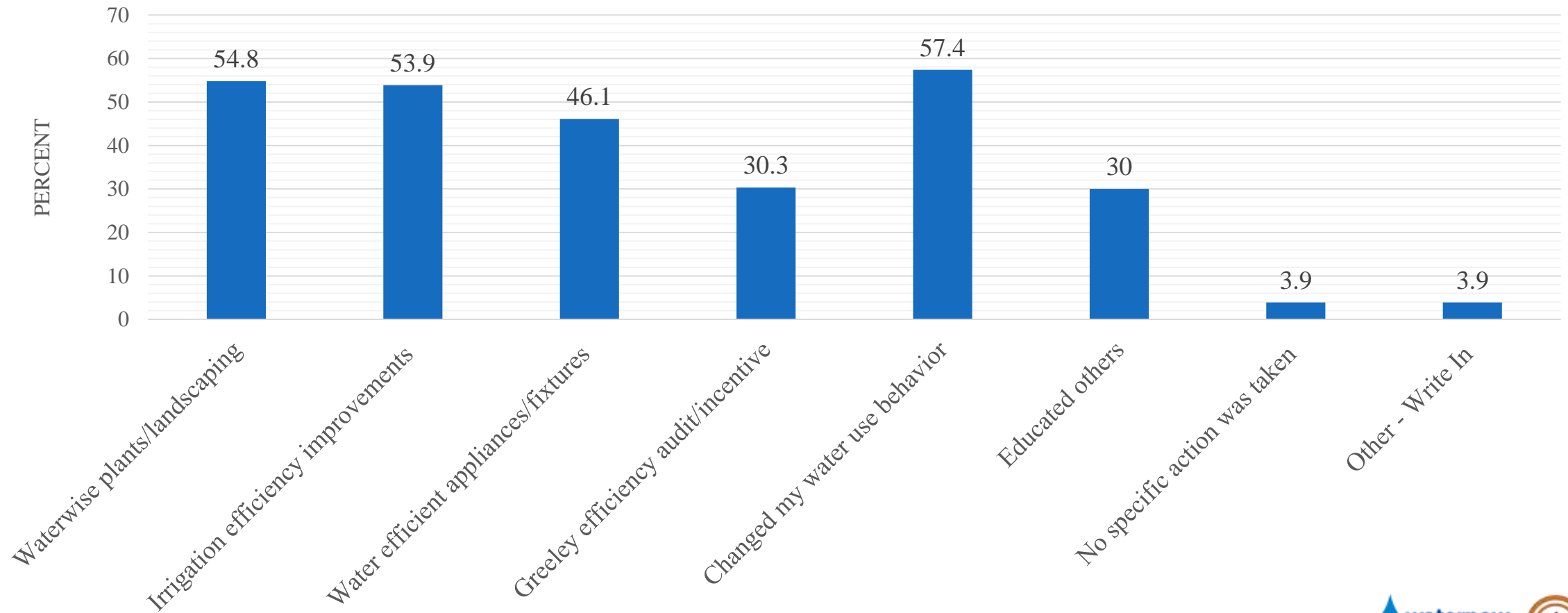
*Percentage of respondents aware of the 4 primary categories of conservation programming:*

- Water Efficiency Incentive Programs (80%)
- Educational Programs (76%)
- Water Audits (70%)
- Online Water Efficiency Tools (55%)



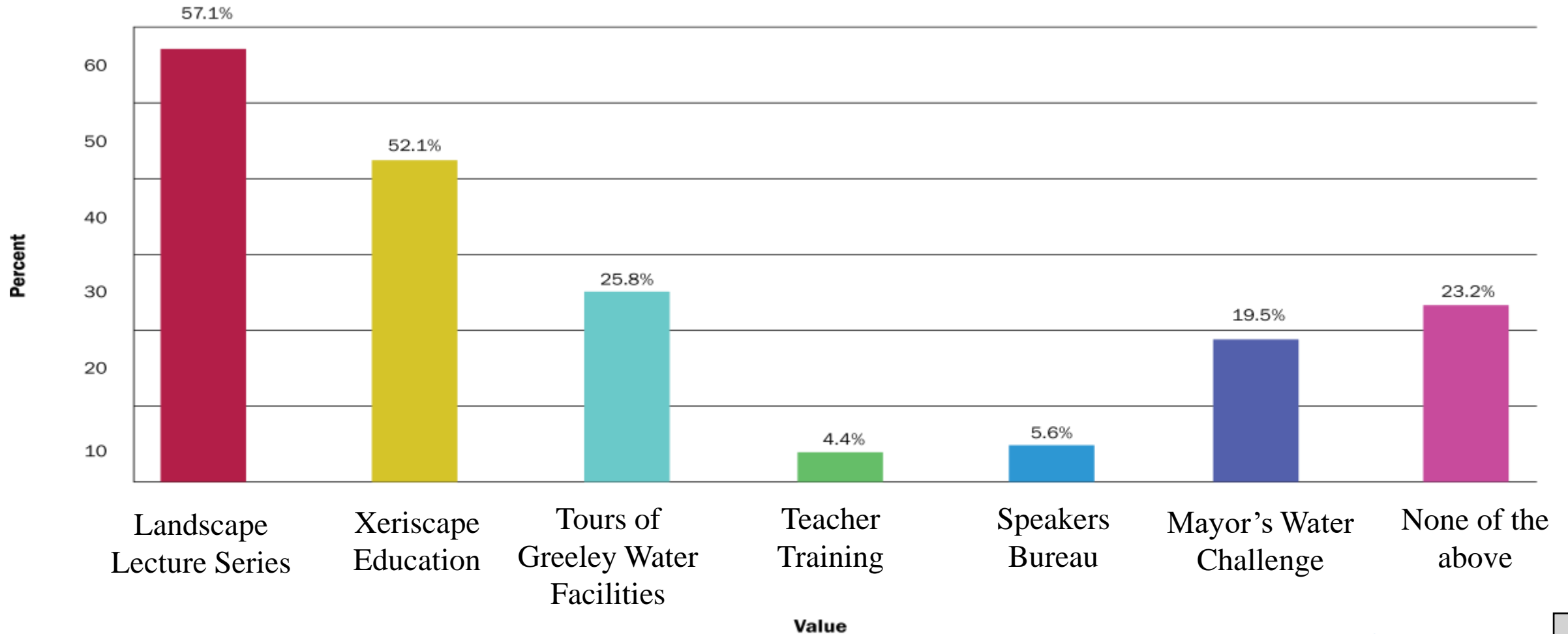
# EDUCATIONAL PROGRAMS: WATER SAVING ACTIONS

*What type of action, if any, was taken as a result of participating in an educational program?*



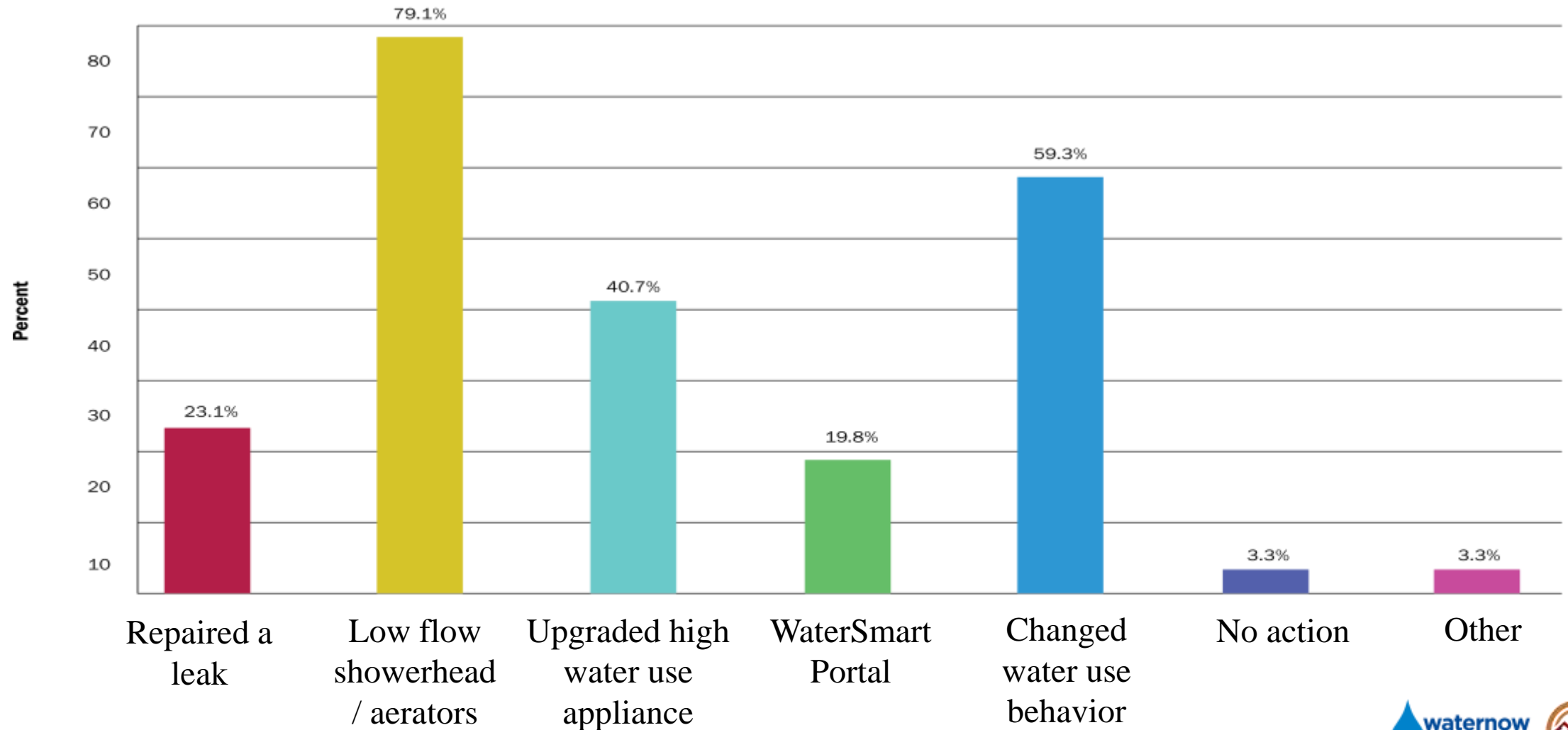
# EDUCATIONAL PROGRAMS: FUTURE PARTICIPATION

*Which educational programs, if any, are you most interested in participating in within the next 3 years?*



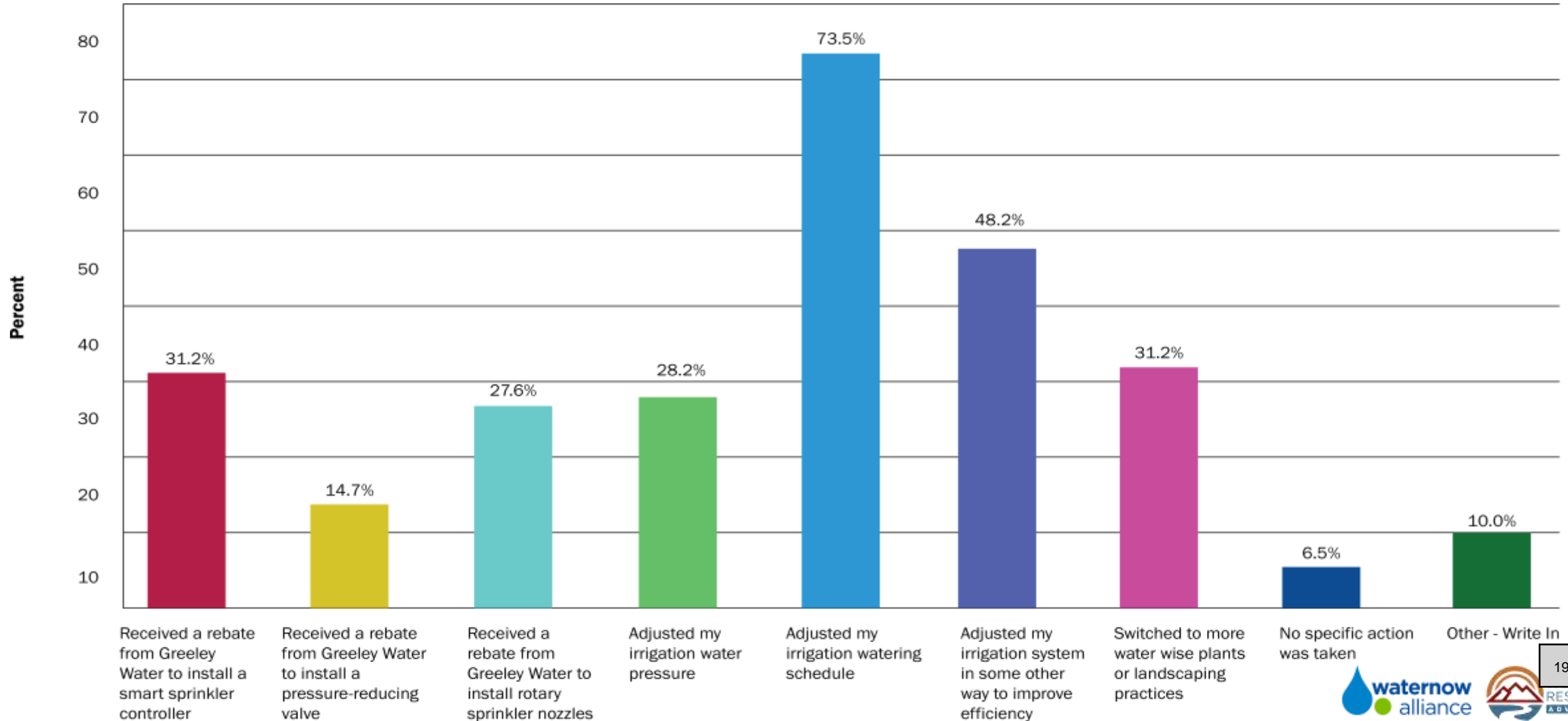
# WATER AUDITS: INDOOR WATER SAVING ACTIONS

*What action, if any, did you take a result of your participation in an indoor water audit?*



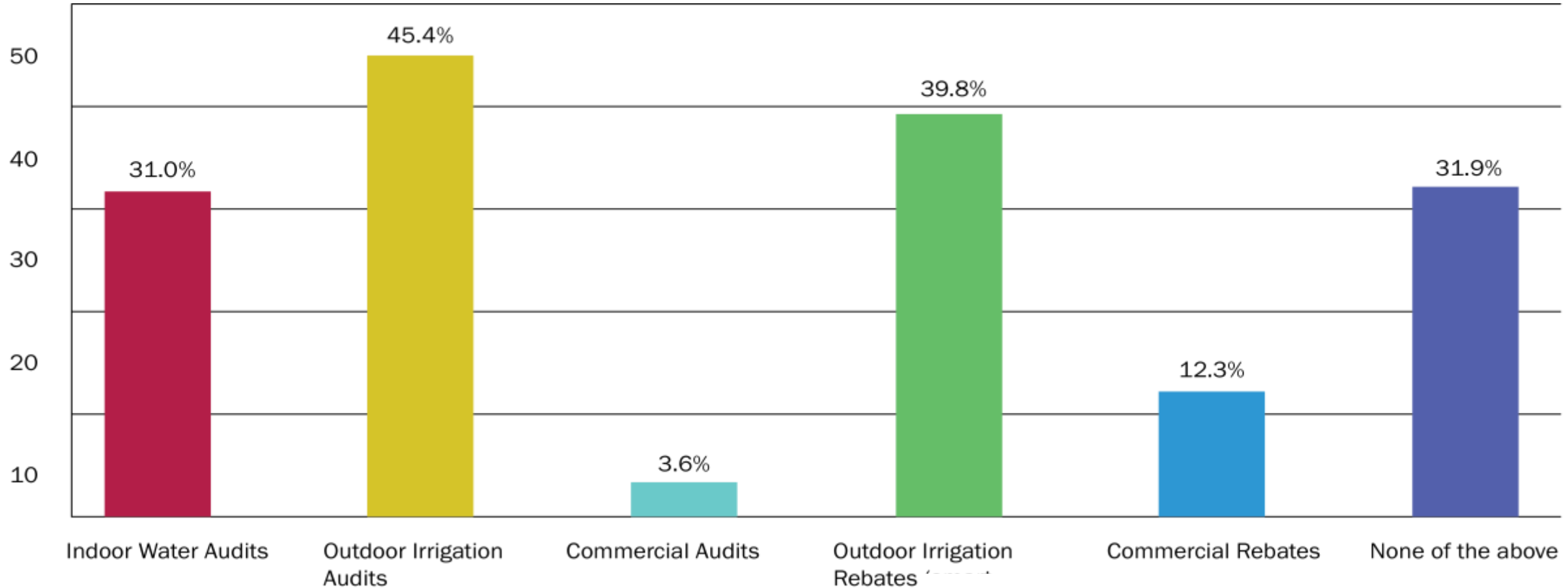
# WATER AUDITS: OUTDOOR WATER SAVING ACTIONS

*What action, if any, did you take a result of your participation in an indoor water audit?*



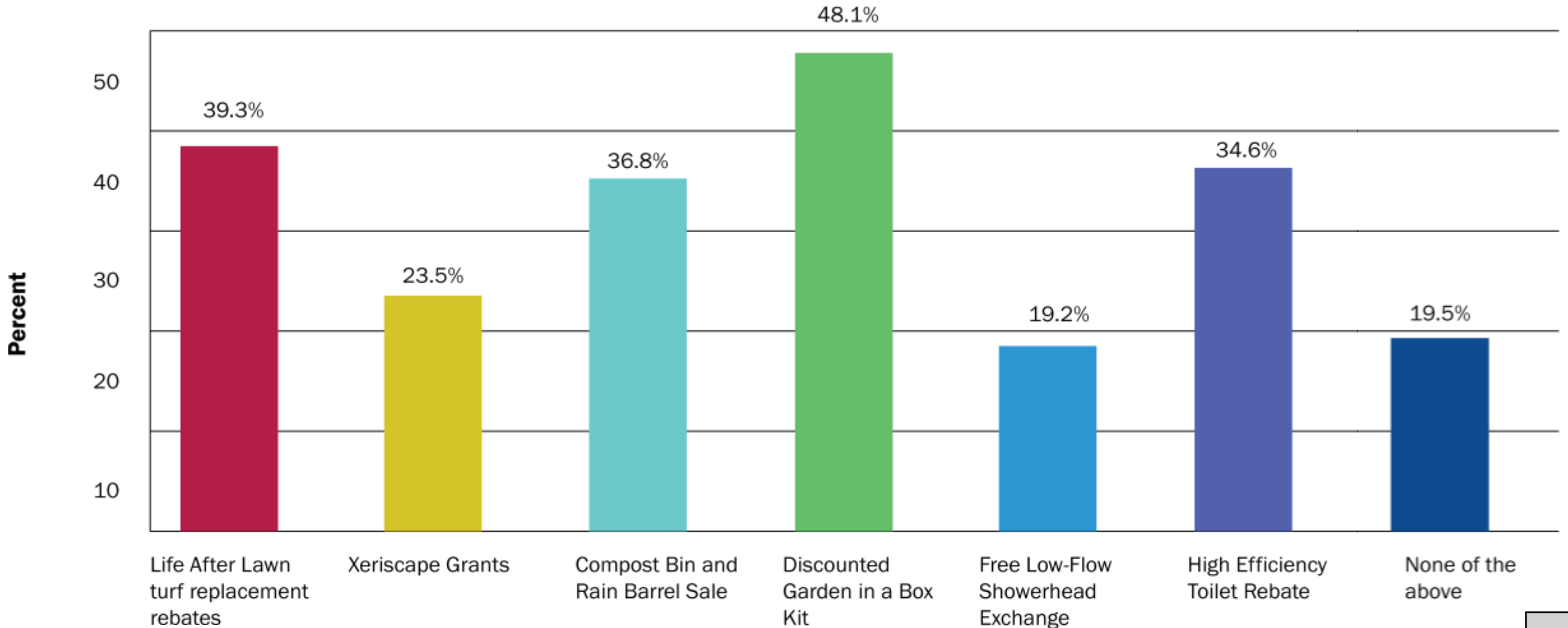
# WATER AUDITS: FUTURE PARTICIPATION

*Which water audit programs, if any, are you most interested in participating in within the next 3 years?*



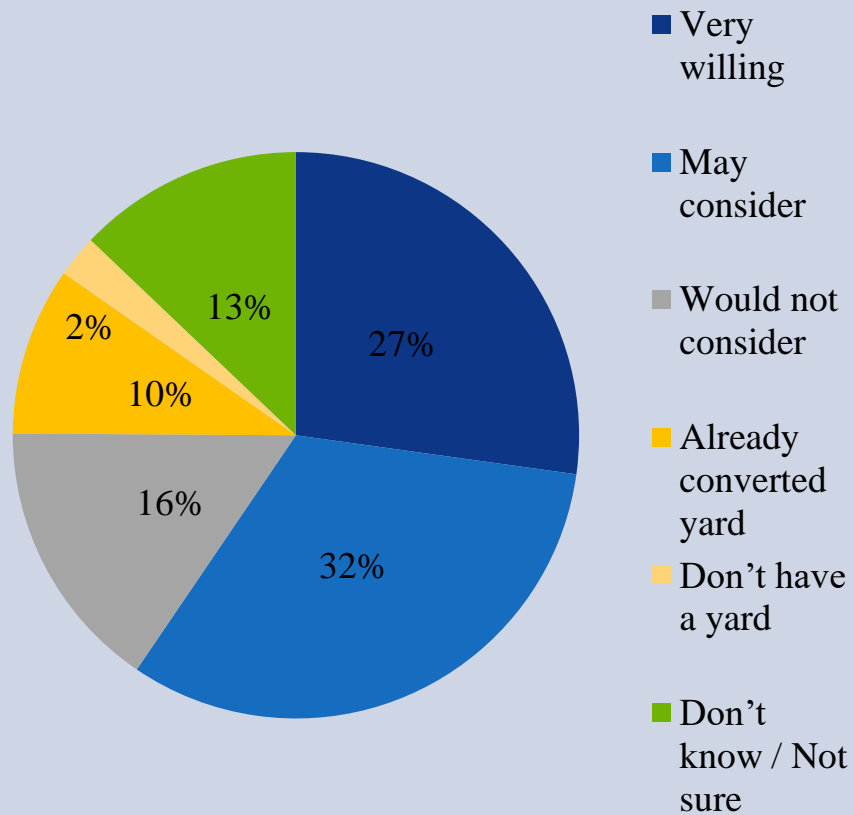
# WATER EFFICIENCY INCENTIVES: FUTURE PARTICIPATION

*Which water efficiency incentive programs, if any, are you most interested in participating in within the next 3 years?*

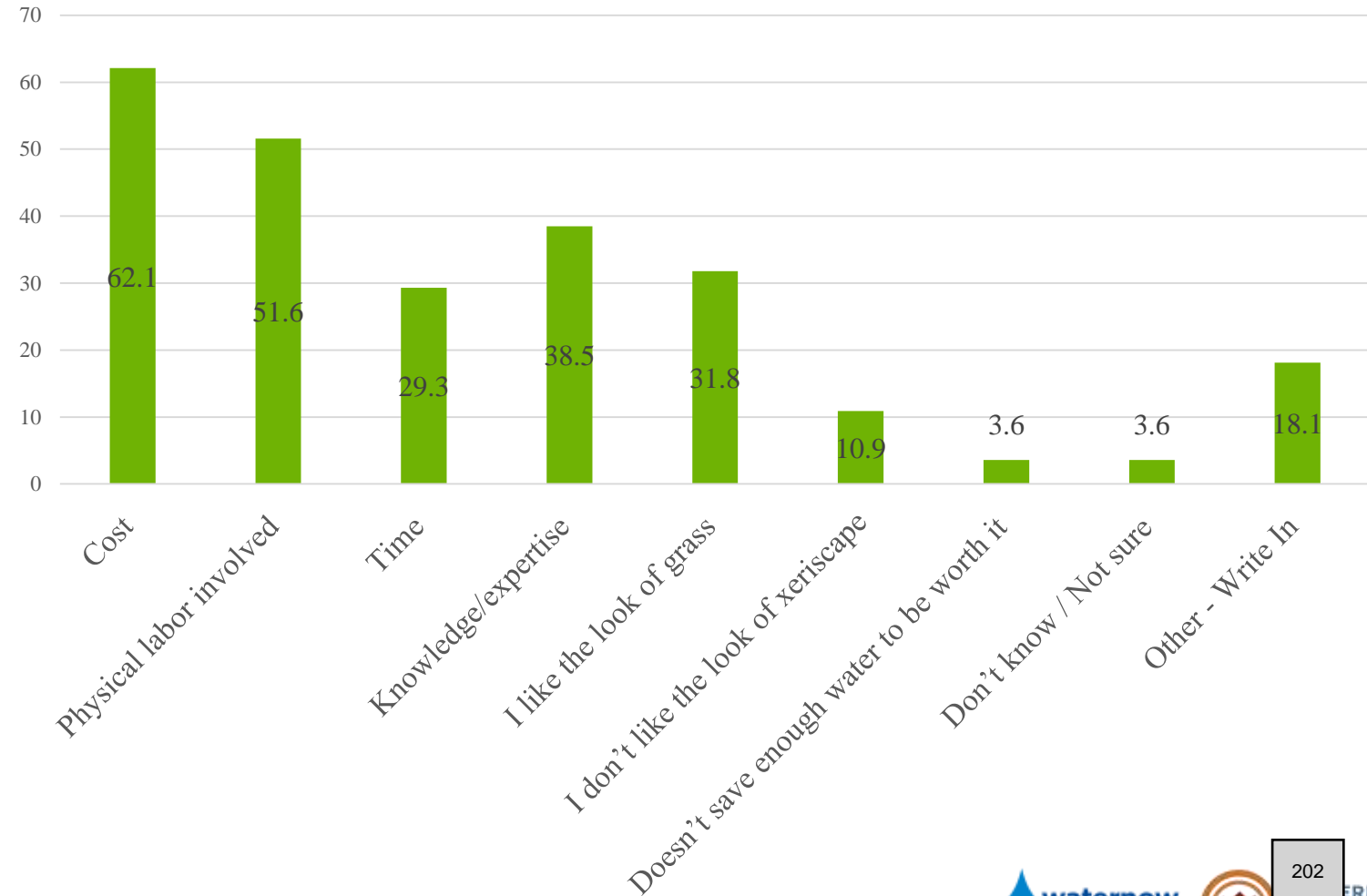


# LIFE AFTER LAWN RESULTS

*Willingness to remove grass from front yard*

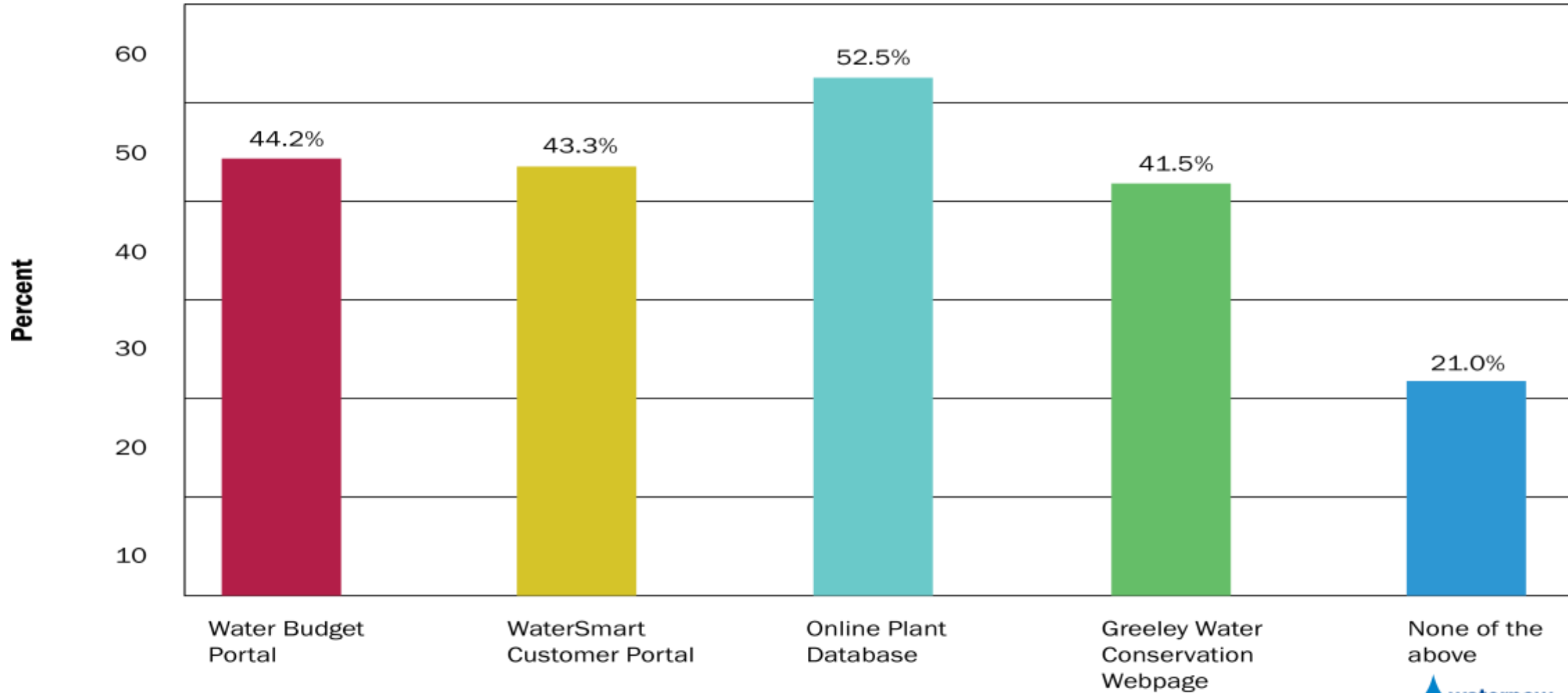


*Primary barriers to turf replacement*



# ONLINE EFFICIENCY TOOLS: FUTURE UTILIZATION

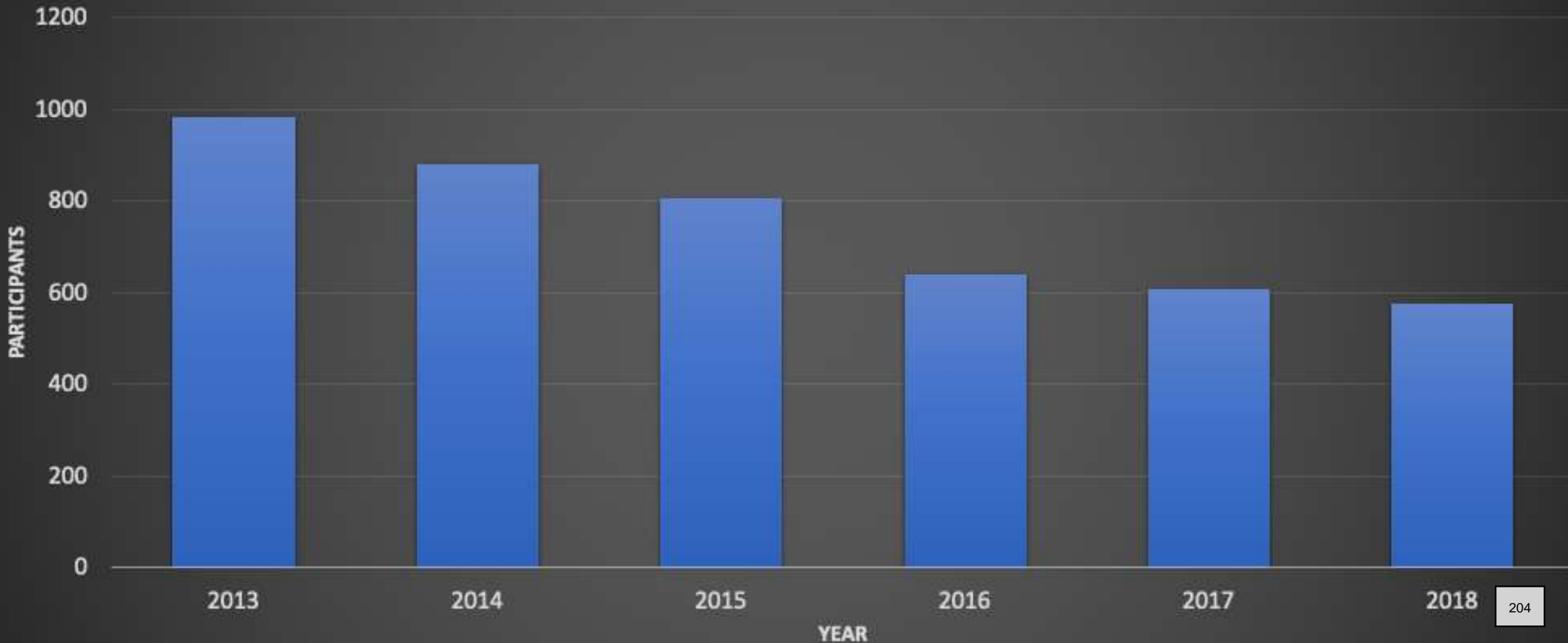
*Which online efficiency tools, if any, are you most interested in using within the next 3 years?*



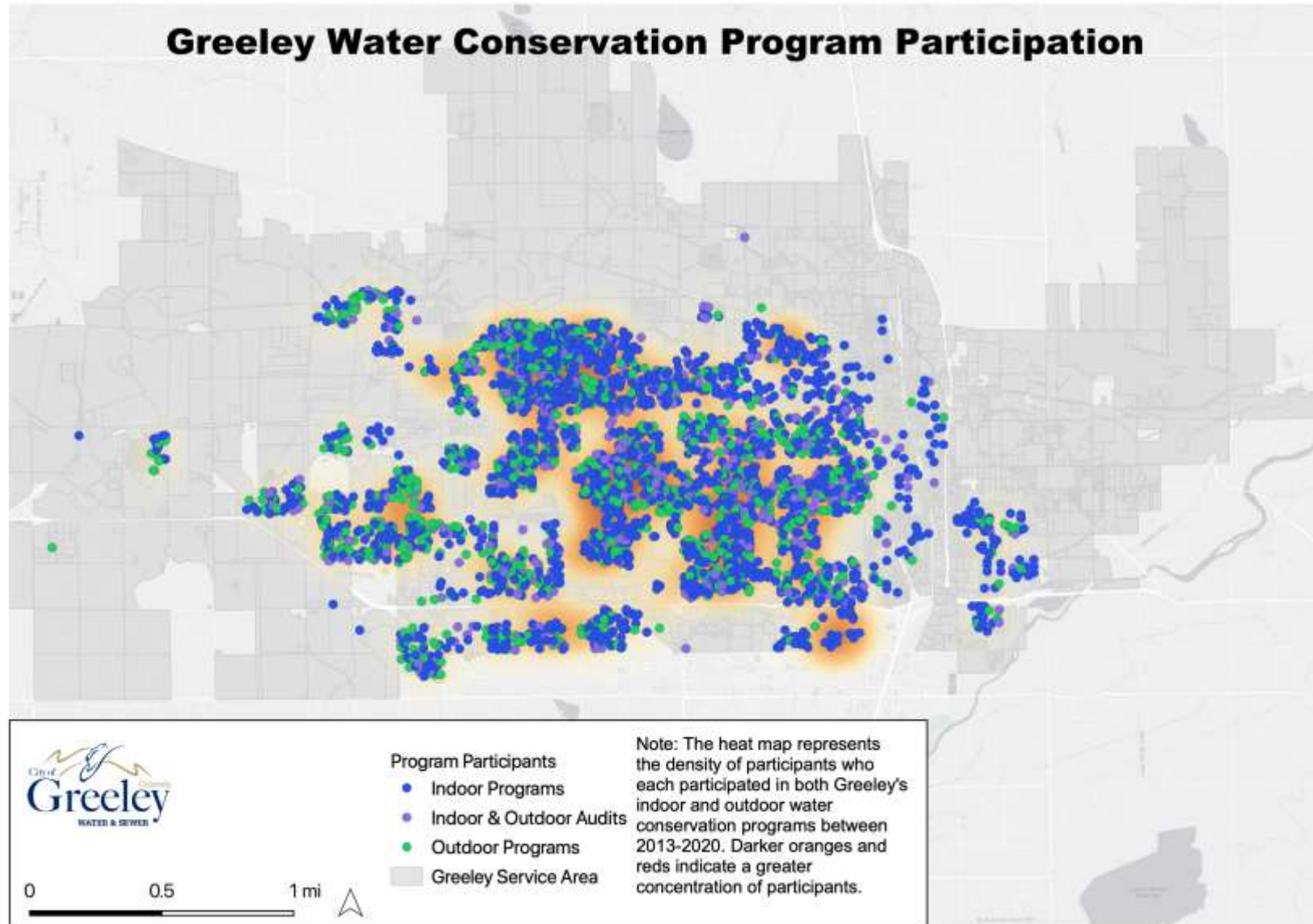


# PROGRAM COSTS & PARTICIPATION

**Participation in Greeley's Water Conservation Programs, 2013-2018**



# PARTICIPANT DISTRIBUTION



# PARTICIPATION DISTRIBUTION

Water conservation program participation is generally **lower** in neighborhoods with **higher** percentages of these demographics:



Renter-Occupied Housing



Median Household Income



% Population Speaking Spanish

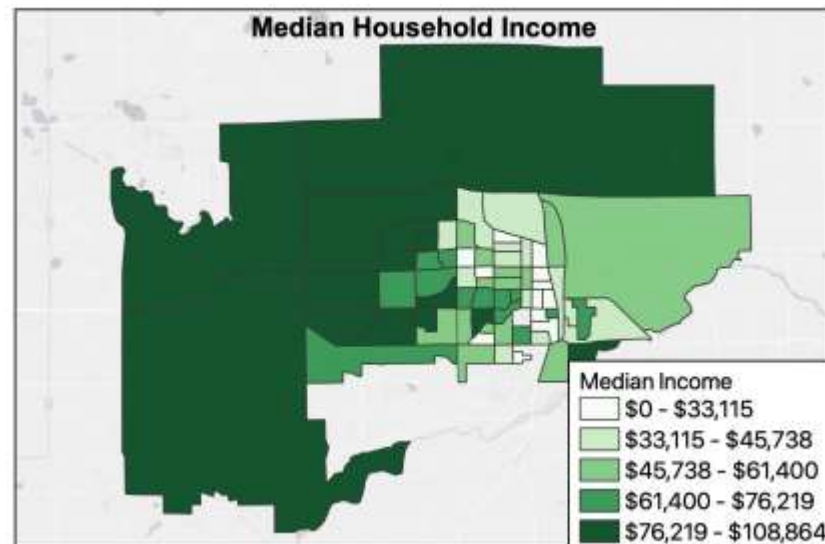
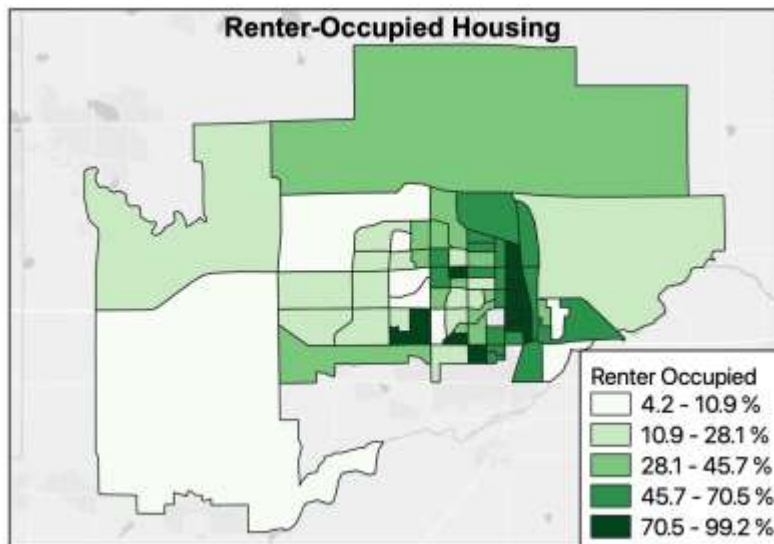
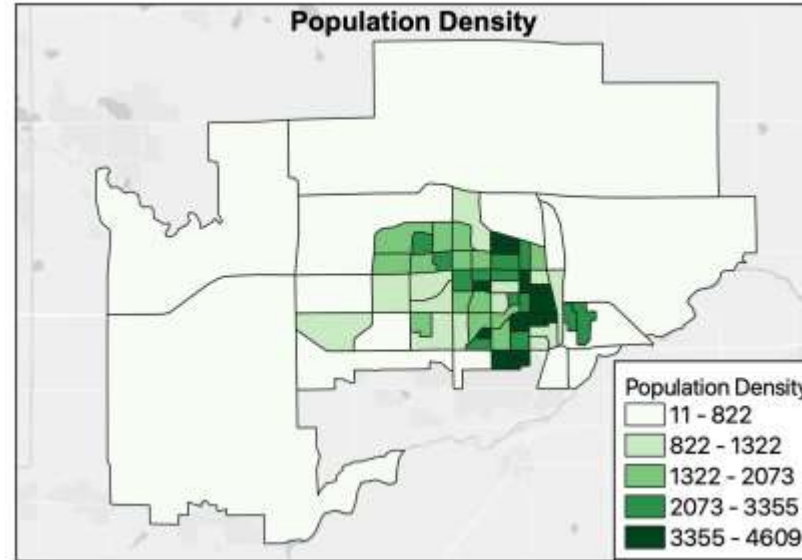
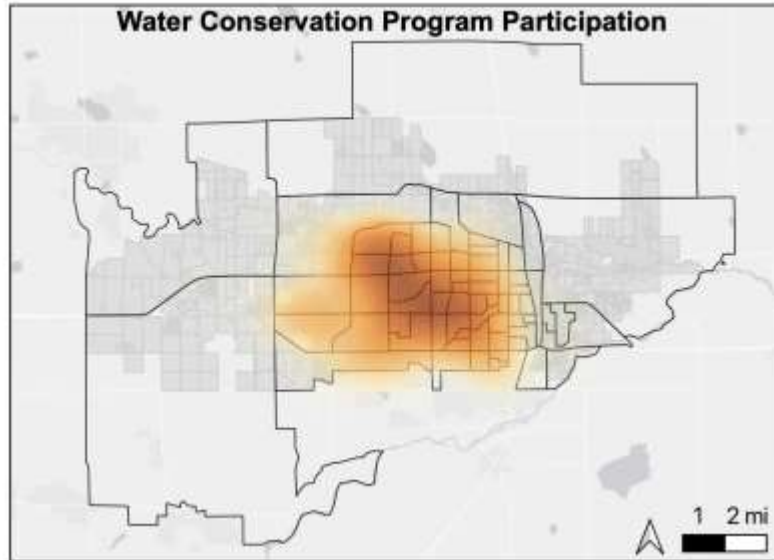


% Population Speaking an AAPI Language



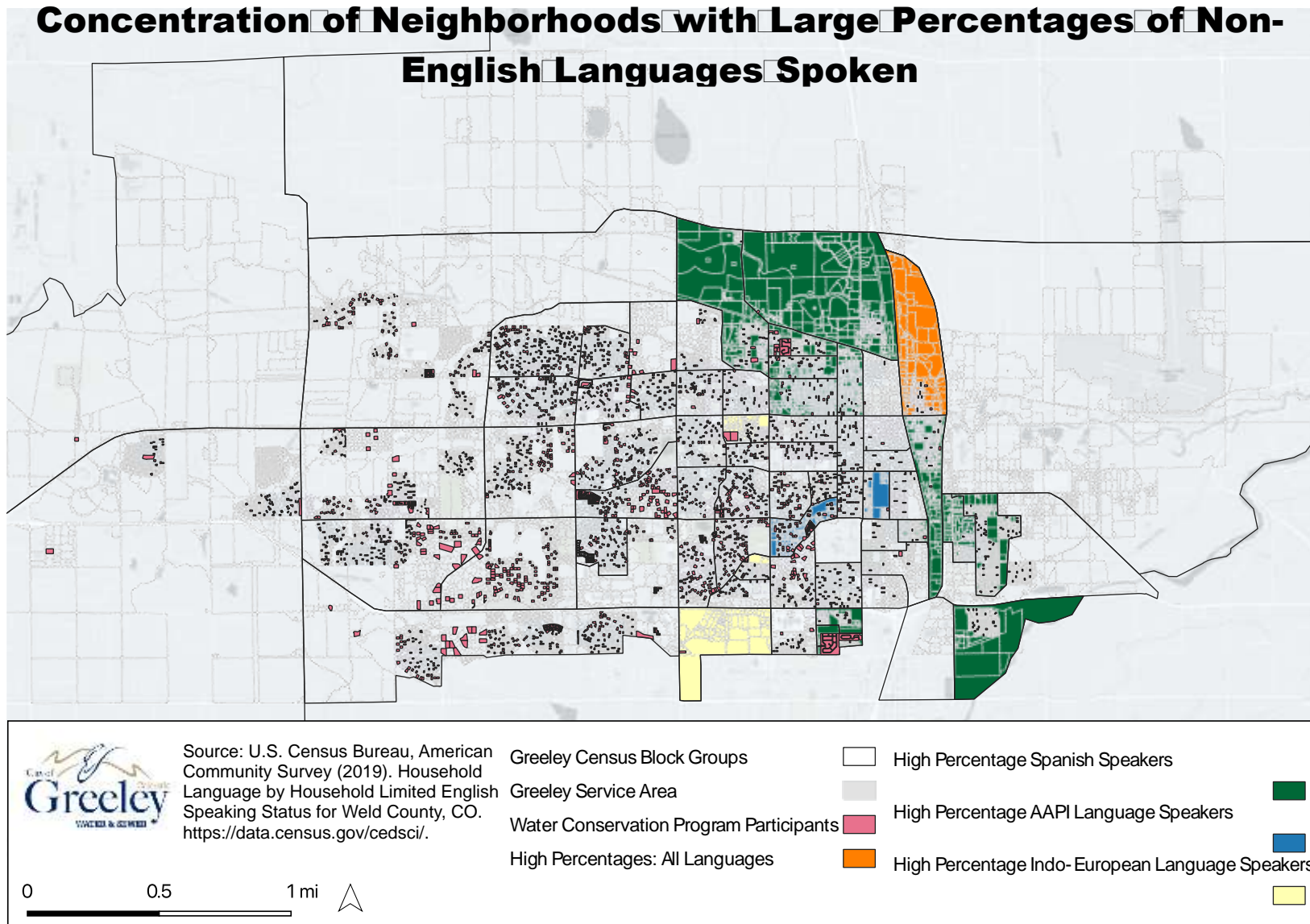
% Population Speaking an Indo-European Language

# PARTICIPANT DISTRIBUTION





# PARTICIPANT DISTRIBUTION



# CHANGES IN WATER USE: METHODOLOGY

- **Annual water use change** = Average water use for the two years prior to participating in program – average water use for the two years after participating
- **Indoor water use** = (Total use in Jan., Feb., March, Nov., Dec.) + (WQA\*7)
  - WQA (Winter Quarterly Average) = Average use in Jan., Feb., March, Nov., Dec.
- **Outdoor water use** = Apr. – Oct. water use greater than WQA
  - Outdoor water use is normalized for weather using the annual Irrigation Water Requirement (IWR)

# CHANGES IN WATER USE

Over the six-year study period (2013-2018), the analyzed water conservation programs have:

- Engaged nearly **5,000 participants**
- Achieved water savings ranging from **2.9 - 19.5 AF per program per year**
- Cost approximately **\$181-\$625/AF/year/program**

The programs' average cost per acre foot savings is **\$1,350**

# CHANGES IN WATER USE: INCENTIVES

Conservation Program*	Number of Accounts	Annual Water Savings (AF)	Annual ROI (\$/AF/Year)	Estimated Annual Savings Per Account (Gallons/Year)
Front Loading Washer Rebate	994	17.1	\$181	33,714
Toilet Rebates	756	14.7	\$625	6,271
Smart Controller Rebate	132	4.3	\$403	10,682
PRV Rebate	149	3.2	\$188	7,093
Rotary Nozzles	147	3.2	\$190	7,013

\*\*\*Only accounts with sufficient water use data were included in these calculations, and only programs with at least 50 participants with sufficient water use data are presented in this table.

\*\*\*\*Average annual cost reflects the total cost divided by the number of years a program was active between 2013-2018.



# CHANGES IN WATER USE: AUDITS

<b>Conservation Program*</b>	<b>Number of Accounts</b>	<b>Annual Water Savings (AF)</b>	<b>Annual ROI (\$/AF/Year)</b>	<b>Estimated Annual Savings Per Account (Gallons/Year)</b>
<b>Residential Audits (Indoor + Outdoor)</b>	1,294	19.5	\$341	4,903
<b>Commercial Audits (Indoor + Outdoor)</b>	182	2.9	\$285	5,118

\*\*\*Only accounts with sufficient water use data were included in these calculations, and only programs with at least 50 participants with sufficient water use data are presented in this table.

\*\*\*\*Average annual cost reflects the total cost divided by the number of years a program was active between 2013-2018.

# RECOMMENDATIONS

## *Program Prioritization*

- Residential Audit as a “gateway” program
  - Many participants participate in other programs & report taking water saving action
  - Outdoor irrigation audit is particularly popular
- Strong interest in outdoor water efficiency rebates and incentives
  - Opportunity to aim for larger overall savings from outdoor rebate programs (which have had large water savings/account, but lower levels of overall participation)
- Educational programs are popular and result in water savings actions
  - Particularly Landscape Lecture Series, Xeriscape Education, and Tours of Greeley Water facilities

# RECOMMENDATIONS

## *Communications & Outreach*

- Further encourage participation across different programs
  - ~30% of participants participated in more than one program
- Program preferences among respondents of Hispanic, Latino, or Spanish origin could inform targeted neighborhood outreach and/or prioritization of translated materials
  - Ex. High Efficiency Toilet rebate
- Use popular contact methods – email updates and monthly newsletter – to increase awareness of programs, particularly online efficiency tools

# Water Conservation Past, Present and Future

Dena Egenhoff  
Water Conservation Manager

# Audits

User Groups:

- Residential
- Commercial, Industrial & Institutional

Types

- Indoor
- Outdoor



# Rebates

- Toilets
- Outdoor irrigation components
- Commercial Rebates
- Professional Landscape Certification

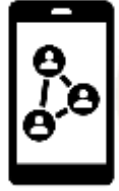
## Incentives ★★★

- Life After Lawn
- Grants

## Seasonal Offerings

- Garden in a Box
- Showerhead Exchanges

## Online tools



- WaterSmart
- Water Budget Portal
- Online Plant Database
- Website



# Education Programs



- Landscape Lecture Series
- Speakers Bureau
- Teacher Training
- Tours
- Xeriscape Education



# Programs removed

- Front Loading Washers (residential)
- Compost bins
- Rain Barrels
- Direct install smart irrigation clocks



# Future



- Data based water conservation decisions driven by innovation and technology.
- Ensure a return on investment.
- Fulfilling future customer needs and changing values.



# THANK YOU



Amy Weinfurter  
aw@waternow.org

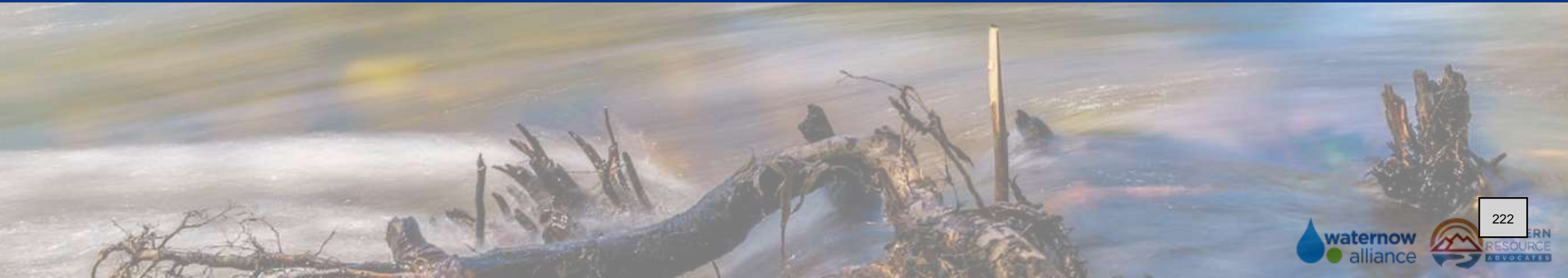


Lindsay Rogers  
lindsay.rogers@westernresources.org





# Questions





**Subject:** Greeley Water Board Report: Enhancing Water Efficiency Portfolio through Performance Analysis

**Date:** April 11, 2022

**Project:** Enhancing Water Efficiency Portfolio through Performance Analysis (Project Accelerator)

**To:** City of Greeley Water and Sewer Board

**From:** Lindsay Rogers and John Berggren, Western Resource Advocates; Amy Weinfurter, WaterNow Alliance

## Background

Greeley's leadership in water conservation began in 1907, with the City's first watering restrictions, and the City now has one of the most robust water conservation programs in the State of Colorado.<sup>1</sup> Given Greeley's location in a semi-arid environment, which receives an average of less than 13 inches of rainfall per year, these water conservation programs form an important strategy to ensure a reliable and sufficient water supply for city residents, now and into the future.<sup>2</sup>

In 2020, Greeley Water applied and was selected for WaterNow Alliance's (WaterNow) Project Accelerator program. The WaterNow Project Accelerator program is a vehicle to jumpstart sustainable water projects by providing professional hands-on support and technical assistance. Greeley's project focused on the capacity and expertise in optimizing its existing conservation programs through performance analysis and an equity-focused analysis of metrics such as socioeconomic status of participants, age and geographic distribution, and the value of each program to the City's residents. The resulting analysis, summarized in this board report and explored in much more detail in the Final Report, includes (1) key findings from a customer survey, (2) analysis on spatial trends in program participation, and (3) water use change and financial analysis for past program participants. These findings are intended to help guide the City's forthcoming Water Efficiency Plan update and inform its annual water conservation program budget and priorities.

## Section 1 - Survey Findings

In early 2021, Greeley Water – with support from WaterNow Alliance (WaterNow) and Western Resource Advocates (WRA) – administered a survey to gain a better understanding of customer sentiments towards Greeley's Water Conservation Programs and interest in the four primary types of programs: Educational Programs, Water Audits, Water Efficiency Incentives, and Online Efficiency Tools. Questions included – but were not limited to – past participation, value derived from programs, actions taken to advance conservation, and interest in future participation. The questionnaire also included optional demographic questions derived from the 2020 U.S. Census. The online survey garnered 720 completed responses.

Across the board, the survey results indicate a high level of awareness, interest in, participation in, and value derived from Greeley's current portfolio of Water Conservation Programs. Data on the utilization

<sup>1</sup> City of Greeley, Colorado. (2016). Greeley Water Conservation Report 2016.

<sup>2</sup> City of Greeley, Colorado. (2020). Conservation. <https://greeleygov.com/services/ws/conservation/about/city-of-greeley-water-conservation-rebate-program#:~:text=In%20fact%2C%20Greeley%20offers%20one,must%20be%20used%20very%20wisely.>

of Greeley's Educational Programs and Online Efficiency Tools is particularly useful as these programs were not captured in the water use change analysis summarized in Section 3. Survey results should be considered in unison with the spatial trends in participation and water use change analysis sections described below.

From the survey, the key takeaways are highlighted below:

- **Importance of Conservation Programming:** Overwhelmingly, survey respondents found Greeley's Water Conservation program to be important, with 94% reporting that the programs are important or very important.
- **Motivation for Conserving Water:** Motivation in future water conservation programs varies slightly by demographics but is primarily based on saving money on water bills, protecting Greeley's limited water resources, reducing personal use, paying for a fixture or appliance, and supporting community values.
- **Ease of conserving water indoor versus outdoors:** More respondents (39%) felt that it would be easier to reduce the amount of water they now use for outdoor landscaping and gardening, compared to 31% that reported they could reduce both indoor and outdoor water use easily. 22% reported it would be easier to conserve water indoors.
- **Educational Programs:** The Landscape Lecture Series and Xeriscape Education were consistently the most common programs for respondents to have participated in the past and the programs that were rated as most helpful (indicated by rating programs a 4 (helpful) or 5 (very helpful) on a scale of 1-5). The most common programs for respondents to be interested in participating in within the next 3 years continue to be the Landscape Lecture Series and Xeriscape Education. Interestingly, there was a strong increase in interest for future participation in Tours of Greeley Water Facility tours, compared to those that had participated in the past (26% compared to 6%). Respondents in the lowest income bracket were slightly more interested in these tours than other income brackets (36% compared to 26%). The Annual Mayor's Water Challenge scored the lowest of the Educational Programs on interest in future participation and on how helpful the program was for past participants. However, respondents of Hispanic, Latino or Spanish origin expressed greater interest in the Mayor's Water Challenge than those of non-Hispanic, Latino, or Spanish origin (28% compared to 20%). The results suggest that Greeley Water should prioritize – and perhaps even expand – its Landscape Lecture Series and Xeriscape Education offerings and continue offering its other Educational Programs.
- **Water Audits:** The Residential Outdoor Irrigation Audit was consistently the most common program for respondents to have participated in within the past 5 years, the program that was rated as most helpful, and the most common program for respondents to be interested in participating in within the next 3 years (45%). Outdoor Irrigation Rebates, available to those that have participated in a Residential Outdoor Irrigation Audit, were also widely of interest to respondents for future participation (40%). Respondents of Hispanic, Latino or Spanish origin, expressed slightly more interest in outdoor irrigation rebates than those of non-Hispanic, Latino or Spanish origin (50% and 40%, respectively). Residential indoor audits were reported as slightly less popular for future participation, though 31% of respondents were still interested in participating in the future. Notably, since the survey, as Greeley has installed advanced metering infrastructure (AMI) that can easily detect leaks, demand for indoor irrigation audits has

increased.<sup>3</sup> Across the board, the vast majority (95%) of past water audit participants reported that they had taken some kind of water saving action as a result of the audit (e.g., receiving and installing a low flow showerhead and/or faucet aerator or adjusting their irrigation watering schedule). Based on these findings, Greeley Water should continue to prioritize its Residential Audit program, particularly the Outdoor Irrigation Audit and associated Irrigation Rebates.

- Water Efficiency Incentives:** While the Free Low Flow Showerhead Exchange was the most common program for respondents to have participated in within the last five years, discounted Garden in a Box Kits (48%) and Life After Lawn turf replacement rebates (39%) rose to the top as the most popular incentive opportunities for future participation. The Free Low Flow Showerheads were reported as the least popular for future participation (19%). The vast majority of past participants (84%) found all programs to be very valuable, however the High Efficiency Toilet Rebate ranked the highest (94%), followed by the Garden in a Box program (92%). Respondents in the lowest income bracket expressed the most interest in Life After Lawn (32%) and High Efficiency Toilet Rebates (32%). Those of Hispanic, Latino or Spanish origin, expressed slightly more interest in efficiency incentives overall than those of non-Hispanic, Latino or Spanish origin, particularly the High Efficiency Toilet Rebate (52%) and the Life After Lawn program (46%). The results suggest that the Life After Lawn program, the Garden in a Box program, and the High Efficiency Toilet Rebate program (due in part to its interest among the lowest income bracket and respondents of Hispanic, Latino or Spanish origin) should be prioritized by Greeley Water moving forward. While the Low Flow Showerhead Exchange Program is less popular, it is also one of the more accessible programs to all Greeley residents, including renters. Greeley Water should continue to offer Showerhead Exchanges, but only when coupled with other water conservation programming, such as Xeriscape Education.
- Online Water Efficiency Tools:** Of the four main categories of programming, respondents were least aware of the Online Water Efficiency Tools compared to other programming categories, suggesting a potential benefit of increased outreach and communication efforts around these specific tools. The Online Plant Database scored consistently high for respondents that had used the tool in the past (20%), were interested in using it in the future (53%), and found the tool to be helpful or very helpful (92%). Compared to other income brackets, respondents in the lowest income bracket were most interested in Greeley's Water Conservation webpage (57%). Respondents of Hispanic, Latino or Spanish origin were more interested than those of non-Hispanic, Latino and Spanish origin in the Water Budget Portal (59% compared to 43%) and the WaterSmart customer portal (56% compared to 43%). Should limited capacity and resources exist for tool updates, the results suggest it may be most beneficial to prioritize the Online Plant Database.
- Preferred contact method:** Greeley Water can most effectively reach their customers through email updates and the monthly newsletter, bill inserts, and the Greeley's Water website.

## Section 2 - Spatial Trends in Participation

To complement the information gathered on Greeley's Water Conservation Programs directly from participants through the survey, this project also analyzed geographic trends in participation among

<sup>3</sup> For instance, in January – March of 2022, demand for indoor water audits averaged 20-30 per month. City of Greeley, Colorado. Water Budget: Metering. <https://greeleygov.com/services/ws/water-budget/metering>.

participants. As Figure 1 illustrates, participation in Greeley's water conservation programs is densest in the center of the City, and sparser in the outer sections of Greeley's service area, in the southwest quadrant of the city's center, and in the northeast quadrant of the city's center.

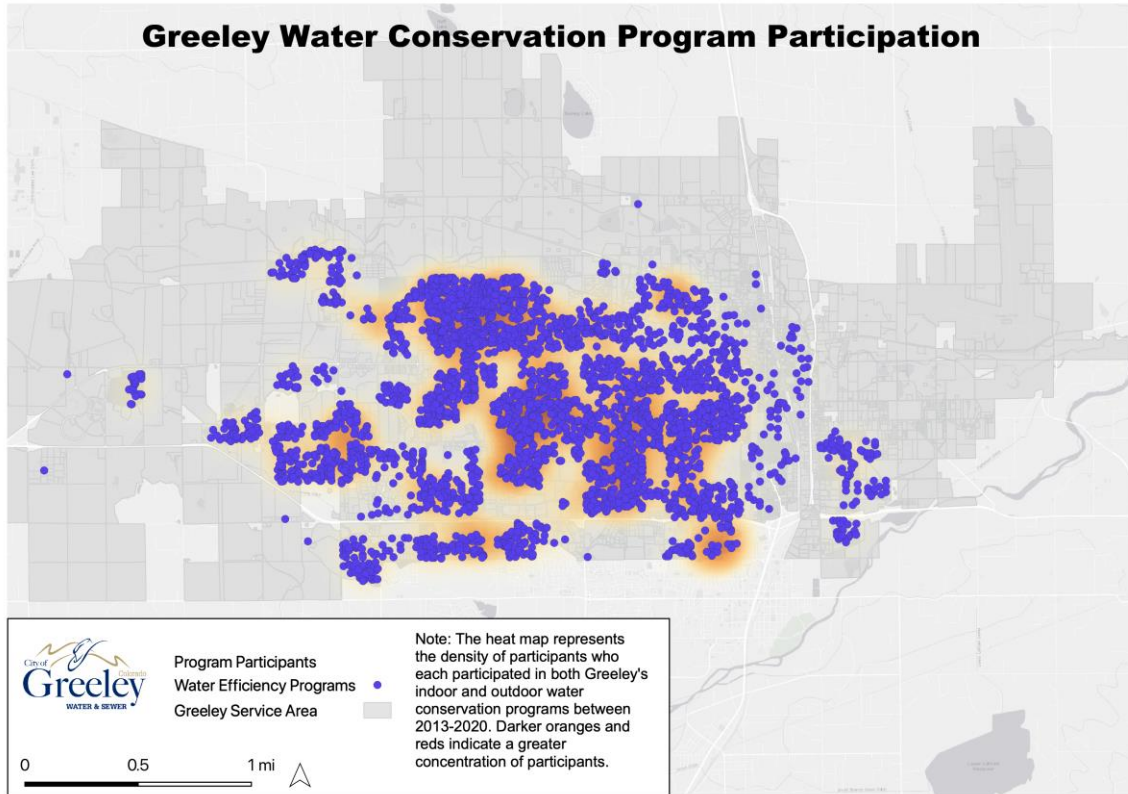


Figure 1. Greeley Water Conservation Program participation from 2013-2020.

The Project Team compared participation with different demographic characteristics, using the 2019 U.S. Census Bureau's American Community Survey (ACS) data.<sup>4</sup> Detailed descriptions of this data and the resulting maps are available in the Final Report. While participation spans most parts of the City, lower participation in Greeley's Water Conservation Programs often coincides with areas that have higher percentages of renter-occupied housing; lower household income; and higher percentages of residents speaking Spanish, Asian American or Pacific Islander (AAPI) languages, or Indo-European languages.<sup>5</sup> These trends are especially clear within the northeast and southwest areas of the City's center. Around the perimeter of Greeley's service area, participation is also sparser, in part reflecting a lower population density in these areas of the City. These perimeter areas also differ somewhat in their demographics, as they represent areas with greater median household income; lower percentages of residents speaking Spanish, an AAPI language, or Indo-European language; and lower percentages of renter-occupied housing.

<sup>4</sup> The American Community Service (ACS) data reflects information gathered annually by the U.S. Census Bureau. The Bureau poses questions to randomly sampled addresses each year, and then uses this information to calculate community demographic information. This ACS data complements the Decennial Census the Bureau conducts every 10 years, which seeks responses from every resident. For information, see: <https://www.census.gov/programs-surveys/acs/about.html>.

<sup>5</sup> A more detailed explanation of how the Census defines language categories is available at: <https://www.census.gov/topics/population/language-use/about.html>.

These trends suggest that increasing participation within the city's center might require strategies such as language translation (e.g., through partnerships with local community groups or non-profits) and a particular emphasis on programs that renters are eligible to participate in. In-person events may be especially helpful, providing the opportunity for in-person translation and avoiding the need for Internet access, which may be lower in areas with lower median incomes. Engaging the outer perimeter of the city, in contrast, might be most effectively done through other forms of outreach, such as direct mail, bill inserts, or email outreach, that target participants spread across a wider area, and include programs aimed at both renters and homeowners. In addition to these immediate trends, this data might inform specific strategies for different locations (e.g., by identifying the most common non-English languages spoken, or the number of past participants who might be able to share their participation and generate word of mouth, etc.)

### Section 3 - Participation in and Changes in Water Use

In addition to analyzing geographic trends in participation, this project analyzed the water use change and cost of saved water resulting from participation in Greeley's Water Conservation Programs over six years, from 2013-2018,<sup>6</sup> to shed light on the return on investment in these programs. This analysis also tracks how customer participation in each program has changed over time.

To conduct the analysis of water use change among participants in Greeley's Water Conservation Programs, we calculated the annual change in water use resulting from participation in a program, and then applied that annual savings to the years a participant was active in that program. A more detailed description of the methodology is available in the Final Report.

While each program shown in Table 1 generated water savings during the six years spanning 2013-2018, the amount of savings varies across different programs. Three programs resulted in especially large savings during the 2013-2018 time period: the Residential Audit (Indoor & Outdoor), followed closely by the Front Loading Washing Rebate<sup>7</sup> and the Toilet Rebates. The programs with the largest water savings reflect high levels of participation in these programs, in addition to the water savings generated by these interventions. The Smart Controller Rebate, PRV Rebate, and Rotary Nozzles Rebates have relatively lower levels of total participation and total savings, but a high level of water savings for each individual participating account. If there is additional demand, expanding these programs could help scale their overall impact on water conservation.

<sup>6</sup> Given the unusual factors – the COVID pandemic and resulting stay-at-home orders – affecting 2020 water use, 2020 water use is not included in these calculations, and the water use change for participation in programs during 2018 is analyzed using only 2019 water use data.

<sup>7</sup> Note: the Front Loading Washing Rebate was discontinued in 2018 due to market trends over time that resulted in front loading washing being the standard for new purchases.



Conservation Program	Number of Accounts	6 Year Water Program Savings (AF)	Annual Water Savings (AF)	Annual ROI (\$/AF/Year)	Estimated Annual Savings Per Account (Gallons/Year)
<b>Residential Audits (Indoor + Outdoor)</b>	1294	116.8	19.5	\$341	4,903
<b>Front Loading Washer Rebate</b>	994	102.8	17.1	\$181	33,714
<b>Toilet Rebates</b>	756	87.3	14.7	\$625	6,271
<b>Smart Controller Rebate</b>	132	26.0	4.3	\$403	10,682
<b>PRV Rebate</b>	149	19.5	3.2	\$188	7,093
<b>Rotary Nozzles</b>	147	19.0	3.2	\$190	7,013
<b>Commercial Audits (Indoor + Outdoor)</b>	182	17.2	2.9	\$285	5,118

\*For Residential and Commercial Audits, participants could select either or both the indoor and outdoor audits.

\*\* The Toilet Rebate program encompasses the 0.8 GPF Toilet, Dual Flush Toilets, Low Flow Toilet, and Ultra Low Flow Toilet programs. See Appendix G for more details about these programs.

\*\*\*Only accounts with sufficient water use data were included in these calculations, and only programs with at least 50 participants with sufficient water use data are presented in this table, according to the methodology of the report (see the Final Report for additional details).

\*\*\*\*Average annual cost reflects the total cost divided by the number of years a program was active between 2013-2018.

*Table 1. Estimated water savings achieved by selected water conservation programs from 2013-2018.*

In terms of the return on investment (ROI) – or the cost invested for each acre-foot (AF) of water a program saves – the Front Loading Washer is cheapest, at \$181 per AF, followed closely by the PRV Rebate (\$188/AF), and the Rotary Nozzles Rebate (\$190/AF). Commercial Audits (\$285/AF) and Residential Audits (\$341/AF), along with the Smart Controller Rebate (\$403/AF) make up the middle of the pack. The Toilet Rebates (\$625/AF) are the most expensive program.

We do not recommend simply adding up the total water saved from all programs, as some double counting – e.g., customers who participated in multiple programs – is likely. However, this approach does give a rough estimate of the approximate savings across the selected programs, which is roughly 65 acre-feet per year, or 389 acre-feet over the six years spanning 2013-2018. It is also important to recognize that the number of participants included in this analysis is lower than the total number of program participants in Greeley's Water Conservation Programs. This reflects the fact that many participants did not have sufficient water use data<sup>8</sup> to be included in the calculations. Also, a number of conservation programs had less than 50 accounts with sufficient data to be analyzed, and were thus

<sup>8</sup> Defined as water use for two years prior to and following participation in a water conservation program; see the Final Report for additional details about the methodology.

excluded from the final calculations; their inclusion would increase the total AF of water saved through conservation programs.

Nevertheless, dividing the total cost of the included programs by the water savings realized by their participants yields a cost per acre foot of \$1,350 per AF, far below the current cost for Colorado Big-Thompson Project water shares (estimated to be \$62,500 per share as of July 2020, according to the *Loveland Reporter-Herald*).<sup>9</sup> While the savings from water conservation do not continue into perpetuity, many have fairly long expected lifetimes of savings, ranging from 5 years (for audit programs) to 25 years (for toilet rebates). A more detailed description of the estimated duration of each program's water savings is available in the Final Report.

## Recommendations

Across the board, Greeley's Water Conservation Programs have saved both water and money, and have been highly valued by program participants. During the six years spanning 2013-2018, they engaged nearly 5,000 participants, and achieved water savings ranging from 2.9 to 19.5 AF per year per program. These programs' average cost per acre foot savings is far below the current cost of water from the Colorado Big-Thompson Project. While the data analysis suggests that these programs are effective, it also provides insight into specific programs to expand or condense and how to most effectively conduct outreach to Greeley's target audiences.

### Program Prioritization

- **Residential Audits:** The Residential Audits (Indoor and Outdoor) saved an estimated 19.5 AF per year, which is encouraging because the customer survey results suggest continued interest in further participation in this program, particularly the Outdoor Irrigation Audit. The quantitative analysis also shows that participation in the Residential Audit often overlaps with participation in other indoor and outdoor water conservation programs, suggesting that this program is an effective "gateway" to utilizing other water conservation tools and resources. Survey results support this finding in that 95% of Residential Audit participants reported taking some kind of water saving action as a result of their audit. Separate from this analysis, Greeley Water is experiencing a recent increase in demand for indoor audits due to AMI leak detection services.
- **Outdoor Efficiency Incentives:** The survey showed particularly large interest in outdoor water efficiency rebates and incentives. There may be an opportunity to expand participation in programs like the Smart Controller Rebate, PRV Rebate, and Rotary Nozzles Rebate. These programs have high water savings per account but have seen lower levels of overall participation, compared to other programs. The outdoor Life After Lawn and Garden in a Box programs – though not captured by the water use change analysis – were the most popular incentive opportunities for future participation according to the survey results.
- **Educational Programs & Online Efficiency Tools:** Per the survey results, Greeley's array of educational programs and online tools were, for the most part, well utilized by Greeley residents and of interest to respondents for future participation. Many past participants reported taking

<sup>9</sup> Amundson, Ken. (17 June 2020). "NoCo Real Estate Summit: Water drives home prices, but can be controlled." *Loveland Reporter-Herald*. <https://www.reporterherald.com/2020/06/17/noco-real-estate-summit-water-drives-home-prices-but-can-be-controlled/>.

specific water savings actions as a result of participation in an educational program. While data on staff resources and cost for educational programs and online efficiency tools was not included in the scope for this project, one can assume that most of these programs and tools are less expensive and time intensive than residential audits and outdoor efficiency incentive programs.

### Communications and Outreach

- In addition to the potential benefits of targeting outreach to specific neighborhoods and communities within the City, there may be opportunities to continue to harness synergies across conservation programs. Approximately 30% of residents were part of multiple conservation programs, suggesting there may be ways to further encourage participants to take advantage of other relevant programs. Strategies may include continuing to encourage participants to complete an audit as an entry point to other programs, as well as reaching out to past participants to suggest additional or complementary programs.
- Survey results suggest some differences in program preferences among Hispanic and Latino respondents. For example, respondents of Hispanic, Latino or Spanish origin expressed more interest in the High Efficiency Toilet rebate. These insights could help target outreach around specific programs in neighborhoods with larger percentages of Hispanic and Latino residents, as identified in the spatial analysis, or help prioritize the translation of specific program materials.
- Popular outreach methods, such as email updates and the monthly newsletters, offer ways to further promote and increase awareness of the conservation programs, specifically Greeley's online efficiency tools with which respondents were generally less familiar.
- Motivation to participate in future water conservation programs is primarily based on saving money on water bills, protecting Greeley's limited water resources, reducing personal use, paying for a fixture or appliance, and supporting community values. Community engagement messaging may focus on these key points for better marketing strategies.

### Considerations for Future Water Conservation Program Analysis

It is recommended that Greeley Water complete a Water Conservation Customer Survey every 5-7 years to stay informed on customers' values and interests and to analyze trends and changes in respondent answers over time. Updating the quantitative analysis on an annual basis could also enable Greeley Water to follow trends in participation in real time and shed light on the impact of different outreach and communication strategies.

### Conclusion

It is important to keep in mind that Greeley's substantial gains in water conservation – reducing water usage by 20% even as the City's population has grown – are not entirely captured by the water savings associated with the conservation programs analyzed for this project. Water demand in Greeley is also influenced by state and local water use policies and regulations, rates, and market trends. For instance, integrated water and land use planning approaches, such as conservation-oriented system development charges, plumbing codes, zoning standards, and landscaping ordinances, have likely resulted in significant water savings. Additionally, Greeley's water budget-based rate structure provides residential customers with a price signal to incentivize conservation. Finally, market trends and state regulations have led to the standardization of more water efficient appliances, fixtures, and equipment available for

purchase. Additionally, the introduction of AMI presents additional incentives and tools to enhance water conservation behavior and program participation. While comparing the value of policies and regulations with the impact of water conservation programs is beyond the scope of this project, it is important to recognize their importance to Greeley's water supply resiliency goals.

The City of Greeley should be very proud of its efforts to build a popular, impactful, and highly valued Water Conservation Program. This performance analysis – including the customer survey, spatial analysis on participation, and change in water use analysis – is intended to provide the City with new data and information to prioritize its Water Conservation Program spending and to inform its forthcoming Water Efficiency Plan update. Greeley may also elect to use the tools and methodologies established through this project in upcoming years to assess program performance over time.

# Water & Sewer Agenda Summary

Date: April 20, 2022

Key Staff Contact: Mary Gearheart, P.E.

**Title:** 2022 State Legislative Update

**Summary:** The 73<sup>rd</sup> Colorado General Assembly convened on Jan. 12<sup>th</sup> and is scheduled to adjourn on May 11<sup>th</sup> 2022. Greeley has remained active on water legislation through the Colorado Water Congress State Affairs Committee, communication with our legislators and in coordination with peer organizations and their lobbyists on important matters.

**Recommended Action:**

None

**Attachments:**

Bill #	Bill Title	Status
<a href="#">HB22-1007</a>	Concerning wildfire mitigation assistance for landowners.	To Appropriations committee
<a href="#">HB22-1012</a>	Concerning healthy forests, and, in connection therewith, creating the wildfire mitigation and recovery grant program.	To Appropriations committee
<a href="#">HB22-1092</a>	Concerning the issuance of loans by irrigation districts to landowners for certain purposes.	Laid over in the House
<a href="#">HB22-1104</a>	Concerning public recreational trails in electric transmission corridors of the state, and, in connection therewith, encouraging transmission providers to enter into written agreements for the construction and maintenance of powerline trails and requiring transmission providers to provide informational resources and notify local governments regarding the potential for powerline trails when planning for the expansion or construction of transmission corridors.	Laid over in the House
<a href="#">HB22-1132</a>	Concerning the provision of wildfire mitigation services, and, in connection therewith, regulating controlled burns on private property.	To Appropriations committee

<a href="#"><u>HB22-1148</u></a>	Concerning the establishment of a pilot program to implement a remote camera wildfire alert system, and, in connection therewith, making an appropriation.	To Appropriations committee
<a href="#"><u>HB22-1151</u></a>	Concerning measures to incentivize water-wise landscapes, and, in connection therewith, creating a state program to finance the voluntary replacement of irrigated turf.	To Appropriations committee
<a href="#"><u>HB22-1316</u></a>	Concerning the funding of Colorado water conservation board projects, and, in connection therewith, making an appropriation.	Passed 3 <sup>rd</sup> reading in the House
<a href="#"><u>HB22-1322</u></a>	Concerning the regulation of water quality in the state.	To Appropriations committee
<a href="#"><u>HB22-1323</u></a>	Concerning updates to the Colorado state forest service seedling tree nursery.	To Appropriations committee
<a href="#"><u>HB22-1345</u></a>	Concerning measures to increase protections from perfluoroalkyl and polyfluoroalkyl chemicals.	To House environment and Ag committee
<a href="#"><u>HB22-1358</u></a>	Concerning measures to eliminate the presence of lead in the drinking water of certain facilities where children are present.	To Appropriations committee
<a href="#"><u>SB22-007</u></a>	Concerning outreach to the public relating to wildfire risk mitigation practices, and, in connection therewith, making an appropriation.	To Appropriations committee
<a href="#"><u>SB22-028</u></a>	Concerning the creation of the groundwater compact compliance and sustainability fund.	To House environment and Ag committee
<a href="#"><u>SB22-029</u></a>	Concerning water speculation in the state.	To Senate Ag committee
<a href="#"><u>SB22-030</u></a>	Concerning the expansion of the water resources review committee to the water resources and agriculture review committee.	Waiting for Governor's signature

<a href="#"><u>SB22-114</u></a>	Concerning fire suppression ponds, and, in connection therewith, making an appropriations.	To Appropriations committee
<a href="#"><u>SB22-126</u></a>	Concerning a requirement that the Colorado water conservation board prioritize water storage in the South Platte river basin in choosing projects to finance with money from the Colorado water conservation board construction fund.	Postponed Indefinitely
<a href="#"><u>SB22-131</u></a>	Concerning measures to improve pollinator habitats for the protection of the environment.	Postponed Indefinitely
<a href="#"><u>SB22-158</u></a>	Concerning support for species conservation trust fund projects, and, in connection therewith, making an appropriation.	To Appropriations committee
<a href="#"><u>SJR22-002</u></a>	Concerning approval of water project revolving fund eligibility lists administered by the Colorado water resources and power development authority.	Waiting for Governor's signature



# Water & Sewer Agenda Summary

Date: April 20, 2022

Key Staff Contact: Kelen Dowdy, [kelen.dowdy@greeleygov.com](mailto:kelen.dowdy@greeleygov.com) (970)350-9845

**Title:** Integrated Water Resources Plan update: Planning scenario development

## **Summary:**

The current Greeley Water Supply Master Plan is more than 17 years old. Since the creation of the last master plan in 2003, Greeley's strategies to continue to provide a robust, resilient water supply have evolved and the water market has transformed. Likewise, widely accepted strategies used to plan for water development have progressed. Consequently, the Water Resources team has been developing a new water master plan, through a process termed Integrated Water Resource Planning (IWRP). The IWRP process will evaluate Greeley's long-term water supply sustainability, develop a road map to buildout and identify near-term CIP components. As part of the process, the IWRP evaluate a suit of future conditions to plan for called "planning scenarios". These scenarios define key components of future conditions such as the state of Greeley's water supply system, demands, climates and other system risks. Staff will be providing a briefing on the initial selected planning scenarios as well as an update on project status.

**Recommended Action:** Information only

## **Attachments:**



# Integrated Water Resource Plan

## Water and Sewer Board Update

*April 20, 2022*



# Shift in Planning Methodology



## Past Approach:

Predicating a single future demand and firm yield

- Single expected future condition
- Last Water Master Plan completed 2003, did not consider Terry Ranch

## Current Approach:

Incorporates risk and uncertainty

- Multiple future conditions

# What is an Integrated Water Resource Plan?



- Planning-level study focused on Greeley's water resources system
- Evaluates long-term water supply sustainability
- Develops road map to Buildout
- Identifies near-term Capital Improvement Plan components



# IWRP Objectives

Create a long-term adaptive planning document that:

- Develops a suite of planning scenarios that explore future risks and uncertainties
- Investigates Greeley's ability to meet Level of Service Goals in an uncertain future
- Identifies an actionable water resources strategy
- Evaluates the timing and integration of Terry Ranch
- Produces a water resources CIP



# IWRP Vision Statement

*“An actionable and adaptive master plan for Greeley’s water resources that uses modern, defensible methods to develop a roadmap ensuring a reliable water supply for our community through an uncertain future.”*



# IWRP Process

**1**

## Define Goals and Objectives

- What questions should the IWRP answer?

**2**

## Lay IWRP Groundwork

- What risks should be evaluated?
- How should performance be measured?
- What tool should be used?

**3**

## Define Planning Scenarios

- What future conditions does the IWRP need to evaluate?

**4**

## Analyze Future Water Supply System

- What does Greeley need to do to ensure sustainable water supply?

# IWRP Process

**1**

## Define Goals and Objectives

- What questions should the IWRP answer?

**2**

## Lay IWRP Groundwork

- What risks should be evaluated?
- How should performance be measured?
- What tool should be used?

**3**

## Define Planning Scenarios

- What future conditions does the IWRP need to evaluate?

*Focus of today's presentation*

**4**

## Analyze Future Water Supply System

- What does Greeley need to do to ensure sustainable water supply?

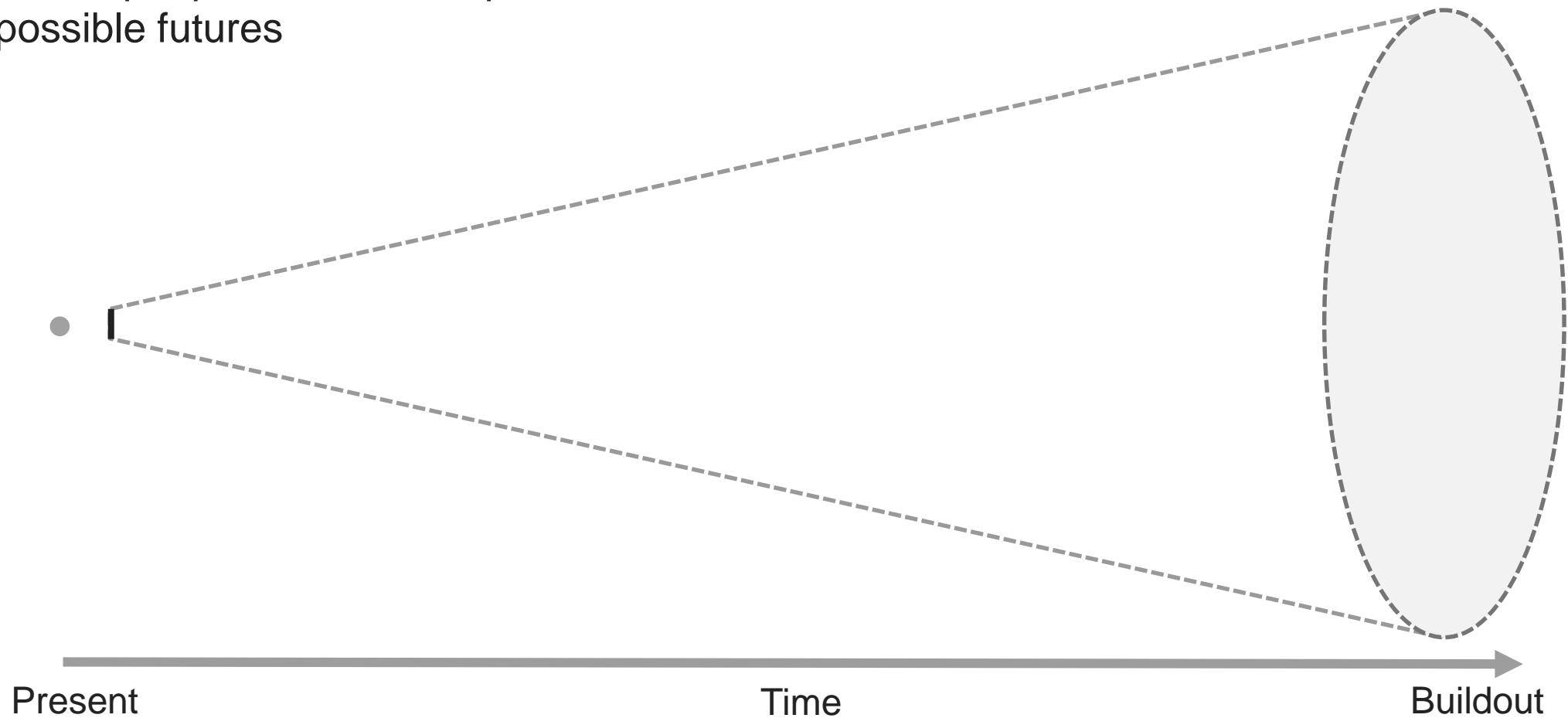




# PLANNING SCENARIO BACKGROUND

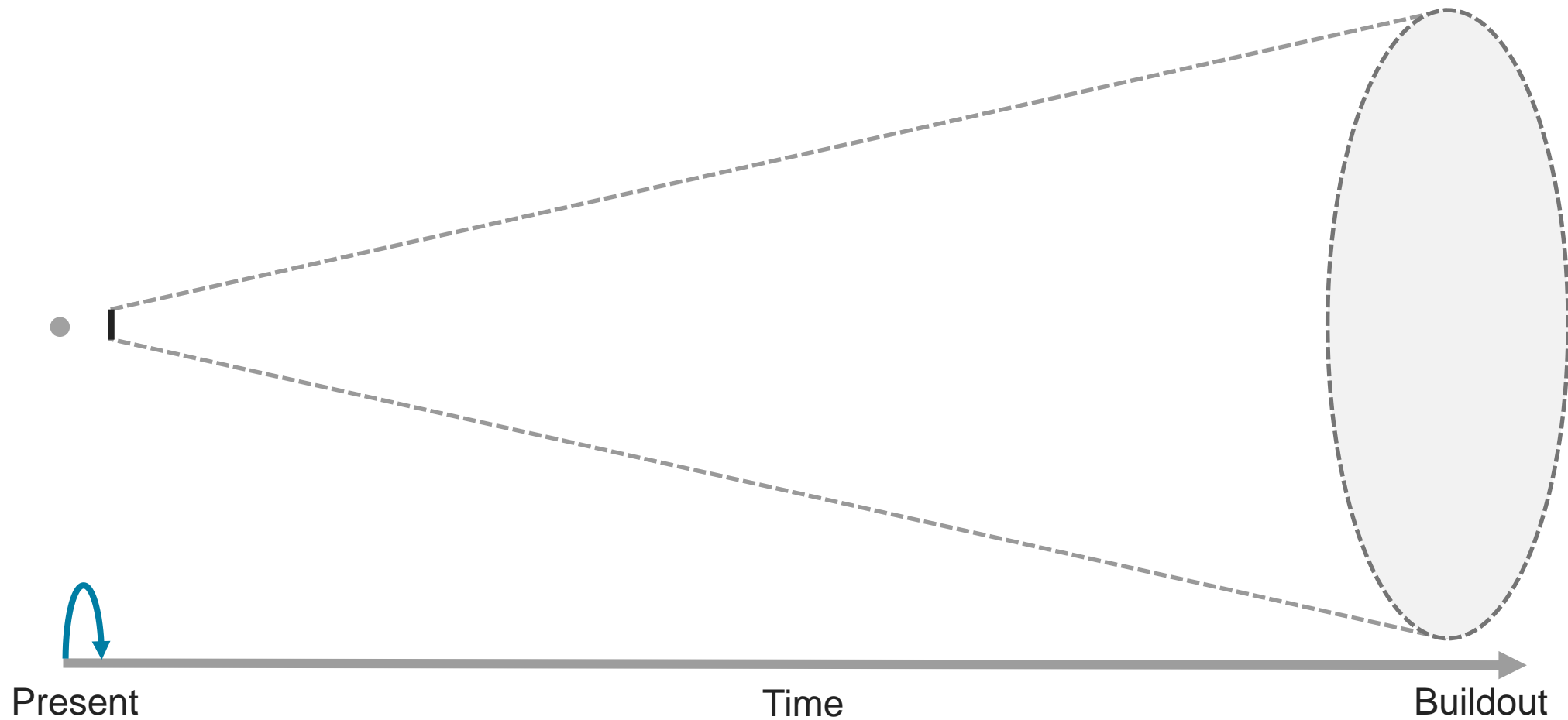
**This cone represents all potential futures  
of Greeley's water supply system**

Develop a plan that encompasses these  
possible futures



## Looking to Next Year...

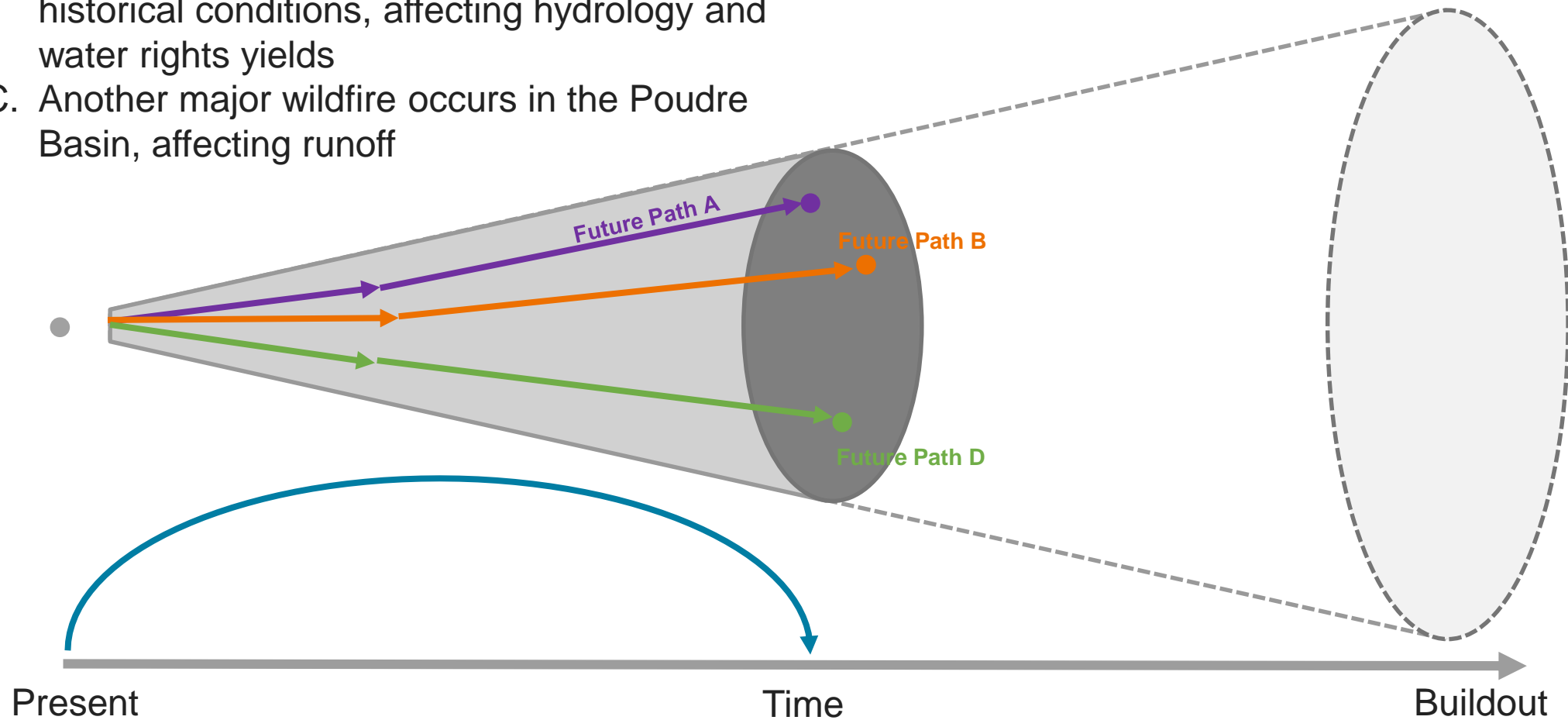
- New water demands are known
- Unknown if it will be a drought year



## Looking Out to 2050...

- A. Terry Ranch encourages multiple industries to build facilities in Greeley
- B. The climate has changed significantly from historical conditions, affecting hydrology and water rights yields
- C. Another major wildfire occurs in the Poudre Basin, affecting runoff

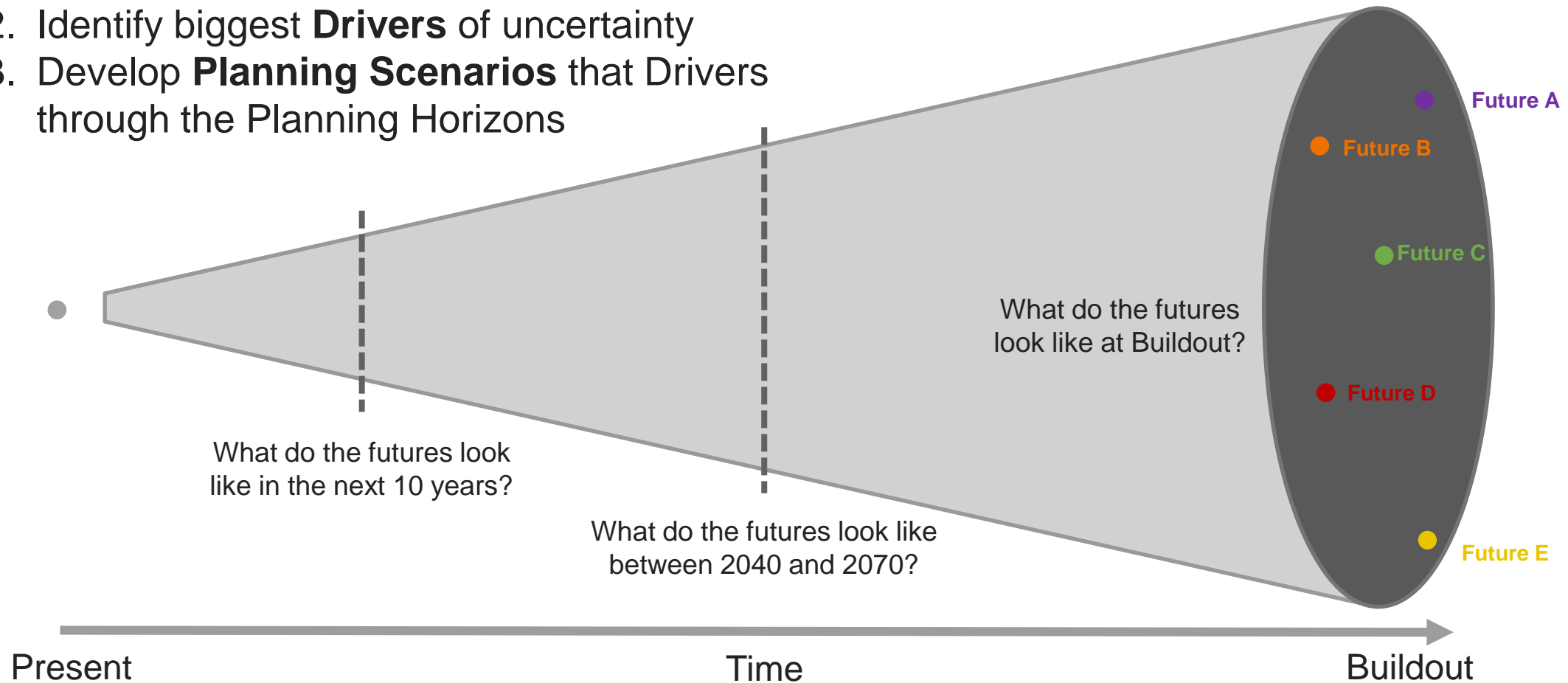
### Potential Futures of Greeley's Water Supply System



## Incorporating future uncertainty in the IWRP...

Cannot quantify system performance under all possible future conditions. Instead:

1. Define key **Planning Horizons** to plan for
2. Identify biggest **Drivers** of uncertainty
3. Develop **Planning Scenarios** that Drivers through the Planning Horizons





# PLANNING SCENARIOS

# Planning Horizons

- IWRP will define planning horizons, which are either:
  - Specific point in time (2030)
  - Specific set of future conditions (Buildout)



# Planning Horizons

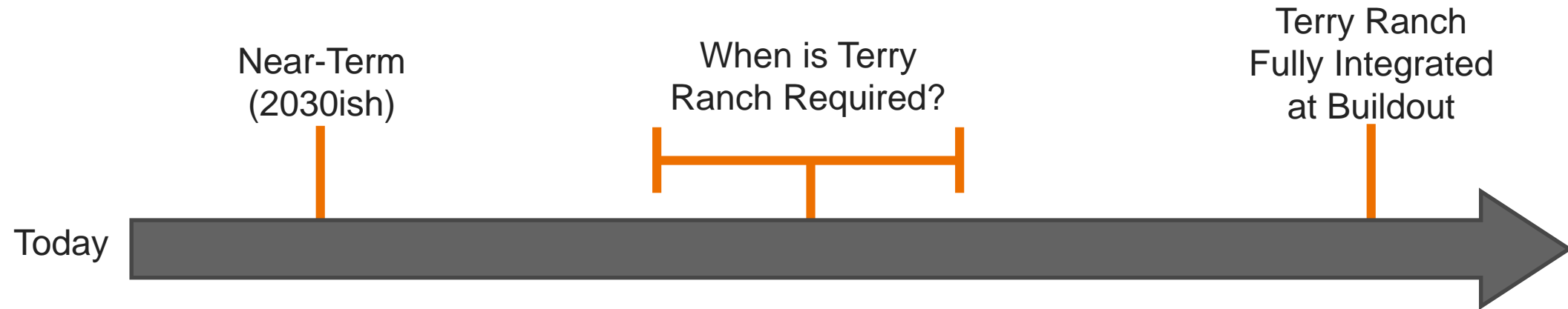




# Planning Horizons



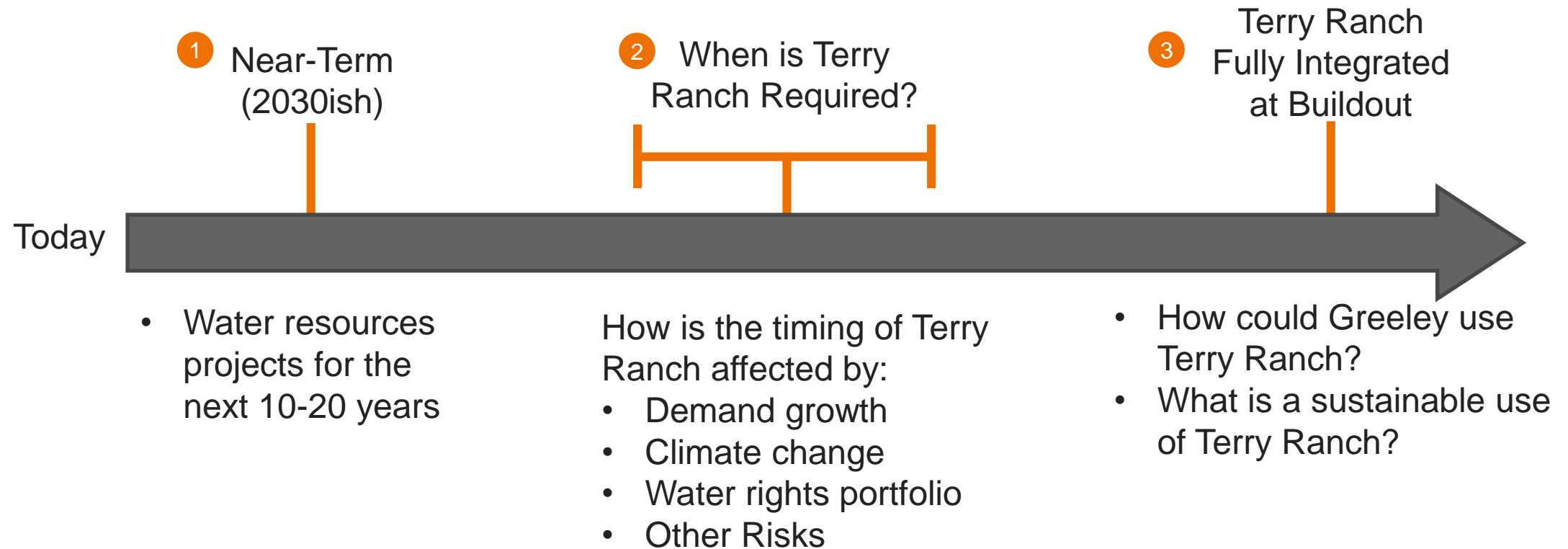
# Planning Horizons



How is the timing of Terry Ranch affected by:

- Demand growth
- Climate change
- Water rights portfolio
- Other Risks

# Planning Horizons



# Planning Scenario Drivers

**Water Rights Competition and  
Administration**

**Water Demands**

**Future Climate Conditions**

**System Risks**

# Planning Scenario Drivers

## Water Rights Competition and Administration

- Yields could be reduced due to competition and changes in administration/regulation

## Water Demands

## Future Climate Conditions

## System Risks

# Planning Scenario Drivers

## Water Rights Competition and Administration

- Yields could be reduced due to competition and changes in administration/regulation

## Water Demands

## Future Climate Conditions

- Variety of long-term changes in average temperature and precipitation possible

## System Risks

# Planning Scenario Drivers

## Water Rights Competition and Administration

- Yields could be reduced due to competition and changes in administration/regulation

## Water Demands

- Growth rate and per capita water use uncertain

## Future Climate Conditions

- Variety of long-term changes in average temperature and precipitation possible

## System Risks

# Planning Scenario Drivers

## Water Rights Competition and Administration

- Yields could be reduced due to competition and changes in administration/regulation

## Water Demands

- Growth rate and per capita water use uncertain

## Future Climate Conditions

- Variety of long-term changes in average temperature and precipitation possible

## System Risks

- Colorado River Basin yields could be impacted several ways
- Other water providers could see water supply failures



# Initial Planning Scenarios

Planning Scenario	Description
<b>High Bookend</b>	A hot and dry future in which Greeley grows at a rate faster than expected. Greeley's water right yields are reduced overall and are impacted by Colorado River Basin issues, wildfires, and regional water issues.
<b>Median</b>	A warmer future in which Greeley grows as expected, water supply yields are reduced and source water threats like Colorado River Basin issues and wildfires occur.
<b>Low Bookend</b>	A warmer and wetter future in which Greeley grows at a rate slower than expected. However, issues within the Colorado River Basin impact Greeley's yields.
<b>No Climate Change</b>	Greeley grows as expected with climate reflective of historical conditions. Source water threats like Colorado River Basin issues and wildfires occur.
<b>Mix and Match</b>	A hot and wet future in which Greeley grows as expected. Greeley's water right yields are reduced overall and are impacted by Colorado River Basin issues, wildfires, and regional water issues

# Initial Planning Scenarios

Planning Scenario Name	Water Supply System	Climate	Demands	Risks
High Bookend	Reduced Yields	Hot and Dry	Increased growth rate, Low decrease in per capita water use	CO Basin Reductions Increased Wildfires Increased Evaporation Regional water issues
Median	Reduced Yields	Warm	Planned growth rate, Planned per capita water use	CO Basin Reductions Increased Wildfires Increased Evaporation
Low Bookend	Expected Yields	Warm and Wet	Reduced growth rate, High decrease in per capita water use	CO Basin Reductions
No Climate Change	Expected Yields	No Change	Planned growth rate, Low decrease in per capita water use	CO Basin Reductions
Mix and Match	Reduced Yields	Hot and Wet	Planned Growth rate, High decrease in per capita water use	CO Basin Reductions Increased Wildfires Regional water issues

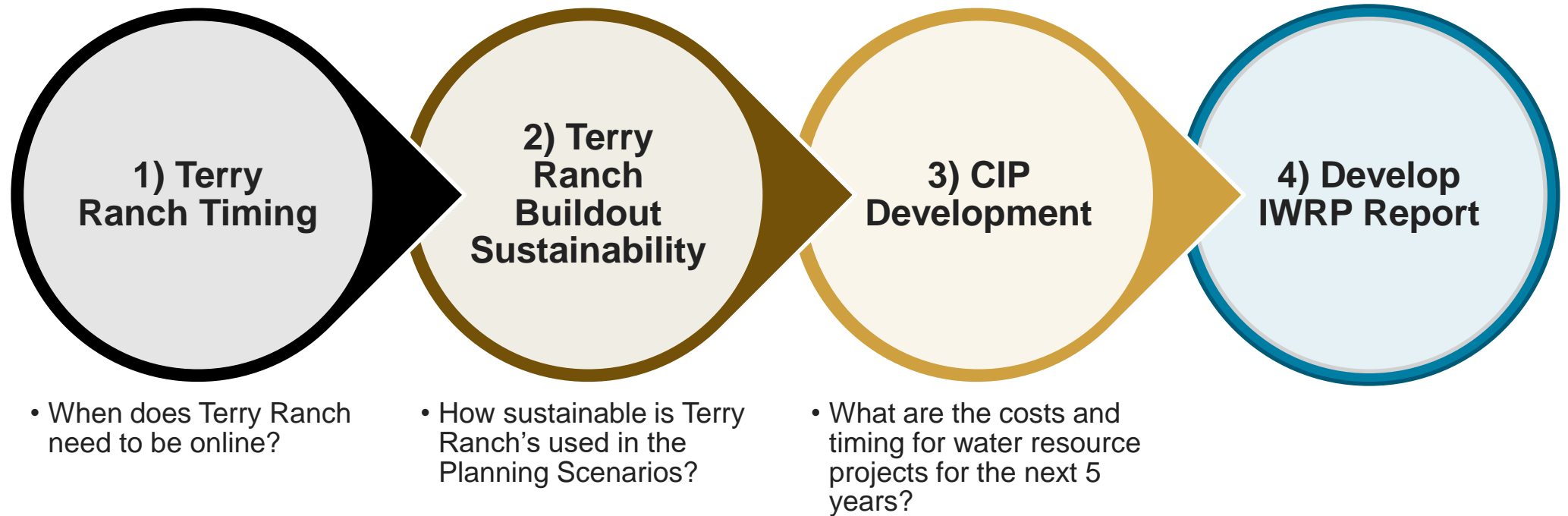


# QUESTIONS

*Email: [Kelen.Dowdy@GreeleyGov.com](mailto:Kelen.Dowdy@GreeleyGov.com)*



# IWRP Analysis Progression



# Initial Planning Scenarios

Planning Scenario Name	Water Supply System	Climate	Demands	Risks
<b>High Bookend</b>	Reduced Yields	Hot and Dry	Increased growth rate, Low decrease in per capita water use	CO Basin Reductions Increased Wildfires Increased Evaporation Regional water issues
<b>Median</b>	Reduced Yields	Warm	Planned growth rate, Planned per capita water use	CO Basin Reductions Increased Wildfires Increased Evaporation
<b>Low Bookend</b>	Expected Yields	Warm and Wet	Reduced growth rate, High decrease in per capita water use	CO Basin Reductions
<b>No Climate Change</b>	Expected Yields	No Change	Planned growth rate, Low decrease in per capita water use	CO Basin Reductions
<b>Mix and Match</b>	Reduced Yields	Hot and Wet	Planned Growth rate, High decrease in per capita water use	CO Basin Reductions Increased Wildfires Regional water issues

# Planning Scenarios: Near-Term Planning Horizon

Planning Scenario Name	Water Supply System	Climate	Demands	Risks
<b>High Bookend</b>	Reduced Yields -10%	Hot and Dry +2T, -5%P	Increased growth rate, Decreased water use <i>WMP High</i>	CO Basin Reductions Increased Wildfires Increased Evaporation Regional water issues
<b>Median</b>	Reduced Yields -10%	Warm +2T	Planned growth rate, Planned water use <i>WMP Moderate</i>	CO Basin Reductions Increased Wildfires Increased Evaporation
<b>Low Bookend</b>	Expected Yields <i>No Change</i>	Warm and Wet +2T, +7%P	Reduced growth rate, Decreased water use <i>WMP Low</i>	CO Basin Reductions
<b>No Climate Change</b>	Expected Yields <i>No Change</i>	No Change	Planned growth rate, Decreased water use <i>WMP Moderate</i>	CO Basin Reductions
<b>Mix and Match</b>	Reduced Yields -10%	Hot and Wet +2T, +7%P	Planned Growth rate, Decreased water use <i>WMP Moderate</i>	CO Basin Reductions Increased Wildfires Regional water issues

# Planning Scenarios: Long-Term Planning Horizon

Planning Scenario Name	Water Supply System	Climate	Demands	Risks
<b>High Bookend</b>	Reduced Yields -25%	Hot and Dry +8T, -5%P	Increased growth rate, Decreased water use <i>TBD</i>	CO Basin Reductions Increased Wildfires Increased Evaporation Regional water issues
<b>Median</b>	Reduced Yields -25%	Warm +5T	Planned growth rate, Planned water use <i>TBD</i>	CO Basin Reductions Increased Wildfires Increased Evaporation
<b>Low Bookend</b>	Expected Yields <i>No Change</i>	Warm and Wet +5T, +7%P	Reduced growth rate, Decreased water use <i>TBD</i>	CO Basin Reductions
<b>No Climate Change</b>	Expected Yields <i>No Change</i>	No Change	Planned growth rate, Decreased water use <i>TBD</i>	CO Basin Reductions
<b>Mix and Match</b>	Reduced Yields -25%	Hot and Wet +8T, +7%P	Planned Growth rate, Decreased water use <i>TBD</i>	CO Basin Reductions Increased Wildfires Regional water issues



# Water & Sewer Agenda Summary

Date: April 20, 2022

Key Staff Contact: Jen (Petrzelka) Dial

**Title:** WATER SUPPLY UPDATE AND ADEQUACY DETERMINATION

**Summary:**

Staff reports to the Water and Sewer Board (“Board”) in April, July, and November of each year on Greeley’s water supply status. In April, the Board makes a declaration concerning the adequacy of the Water Year. Based on projected storage, staff recommends that the Board declare an “Adequate Water Year,” with normal watering restrictions and authorize staff to rent out available excess water supply, so long as the target storage volume of 21,300 acre-feet is maintained.

**Recommended Action:** FINDING OF ADEQUATE WATER YEAR AS OF APRIL 2022

**Attachments:**

Memo: ‘Water Supply Update and Adequacy Determination’

# Water Supply Update

## April 20, 2022

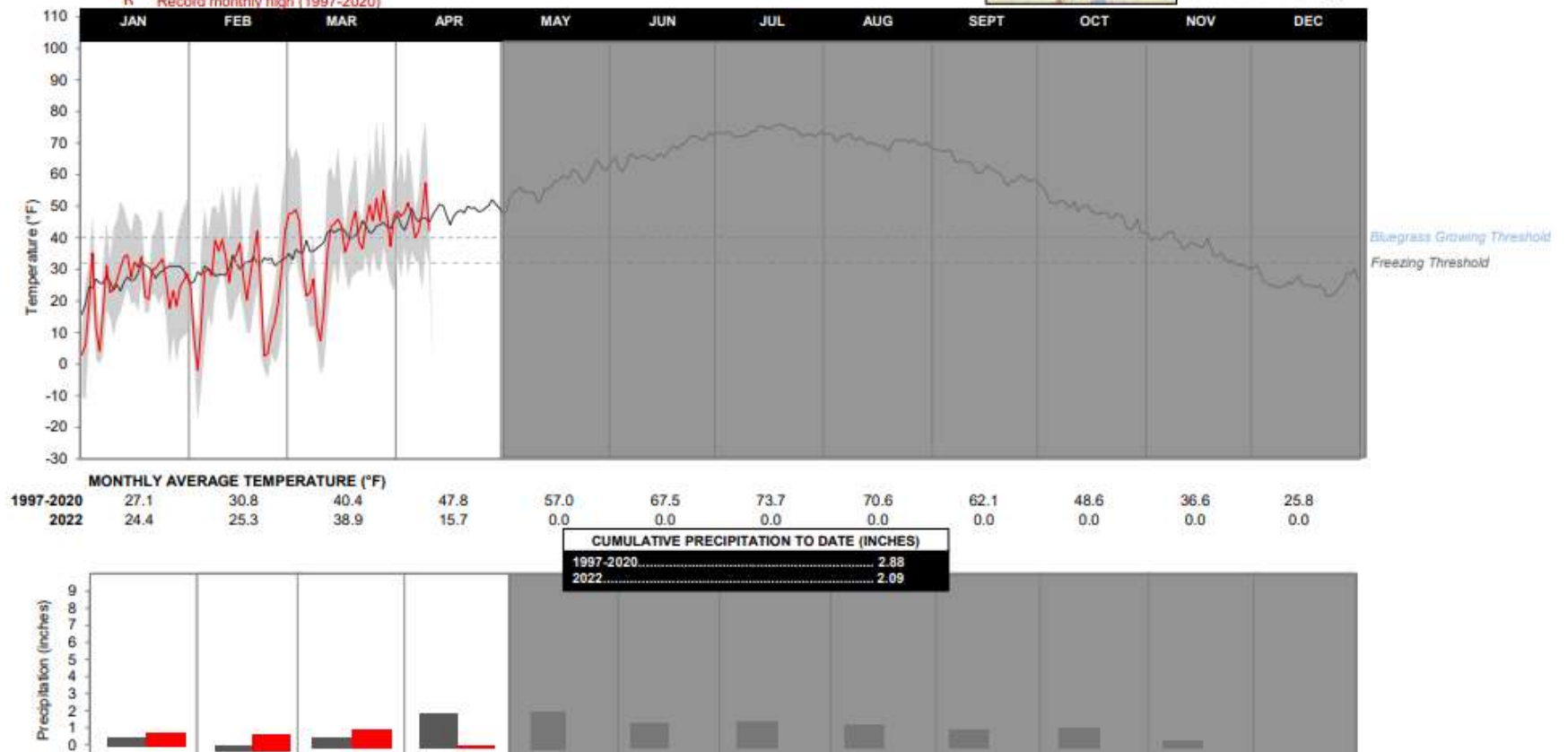
Water & Sewer Board

# City of Greeley: Temperature (°F) and Precipitation 1997-2022

- 1997-2020 Average Temperature
- 2022 Average Daily Temperature
- 2022 Daily Temperature Range
- R Record monthly high (1997-2020)



Greeley West station (224)  
Source: northernwater.org

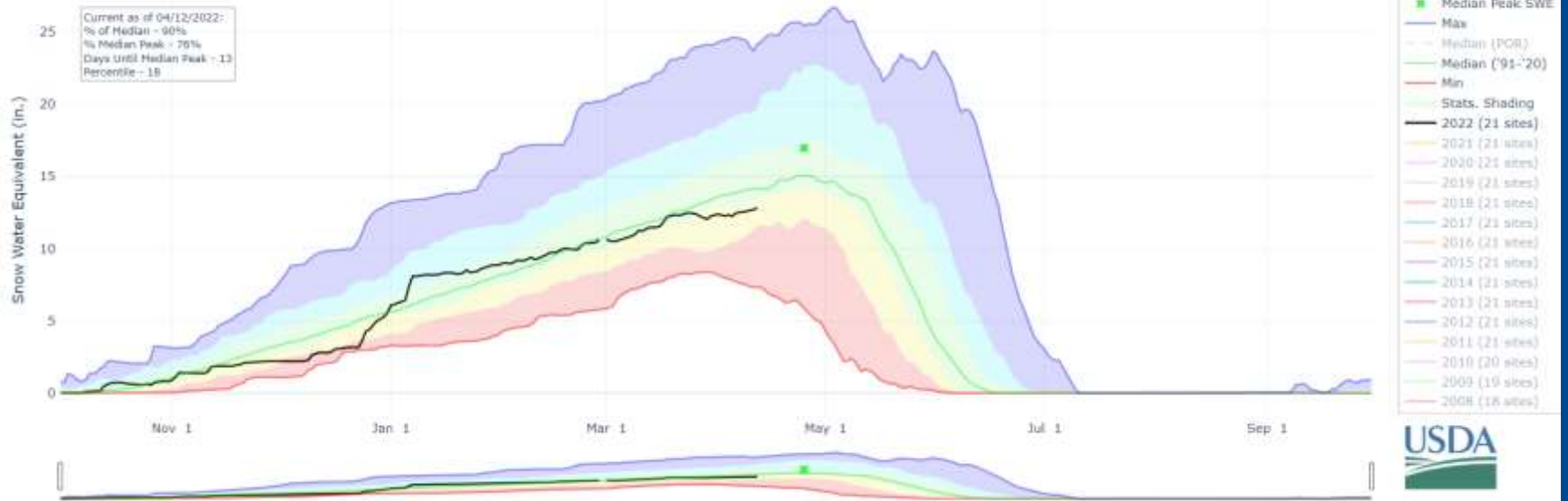


# SNOW WATER EQUIVALENT IN SOUTH PLATTE

Reset Range

Link to data: CSV / JSON

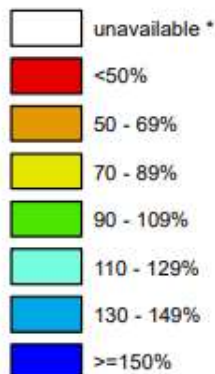
Station List



# Colorado SNOTEL Current Snow Water Equivalent (SWE) % of Normal

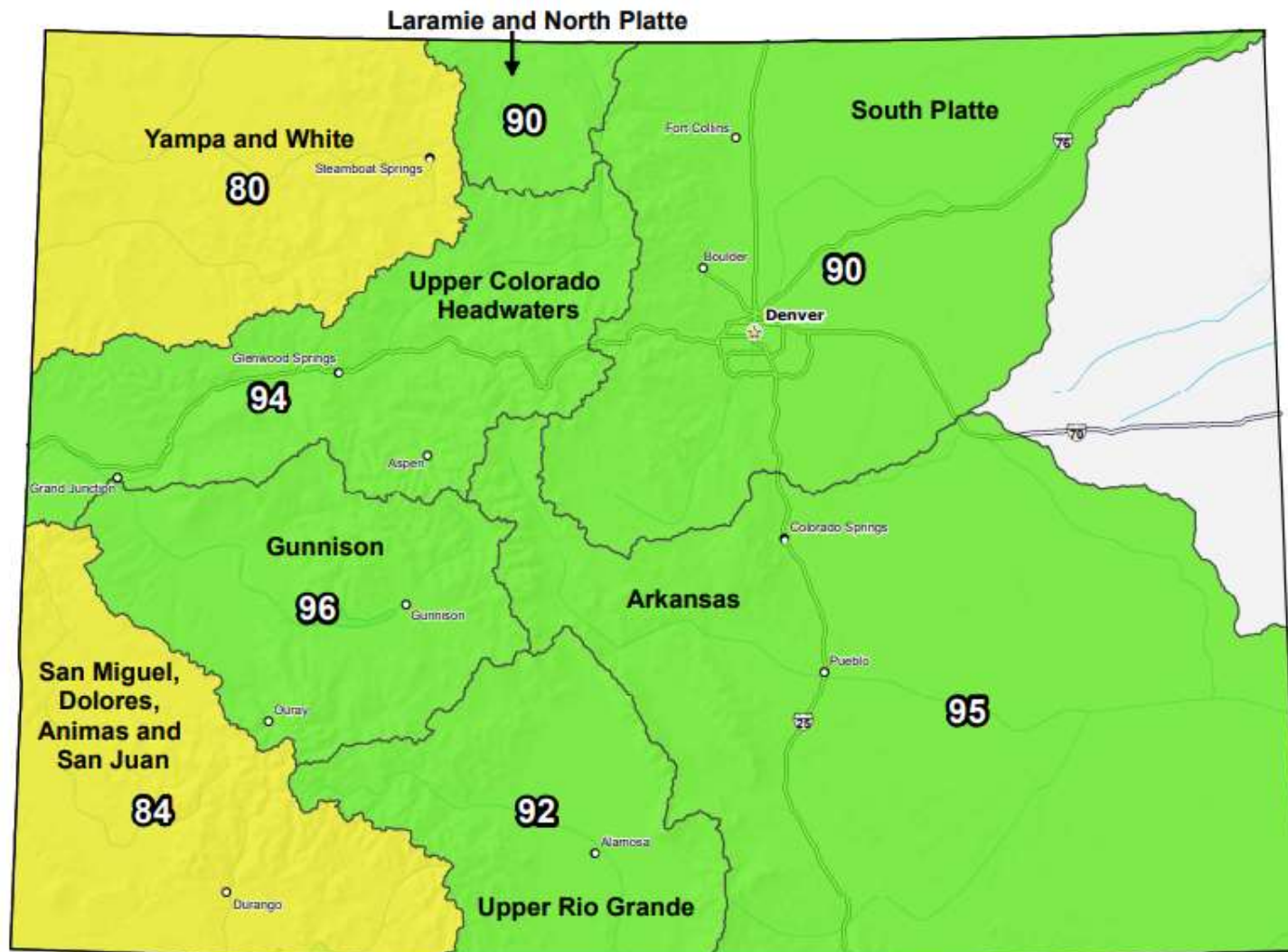
Apr 12, 2022

Current Snow Water  
Equivalent (SWE)  
Basin-wide Percent  
of 1991-2020 Median



\* Data unavailable at time  
of posting or measurement  
is not representative at this  
time of year

**Provisional Data  
Subject to Revision**



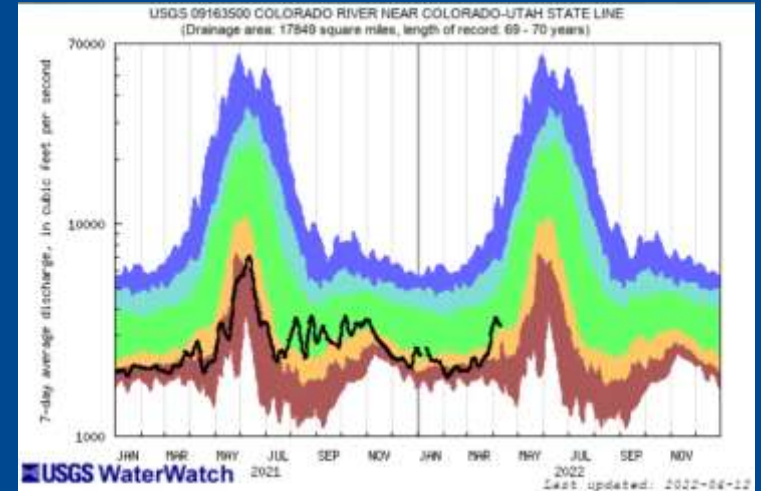
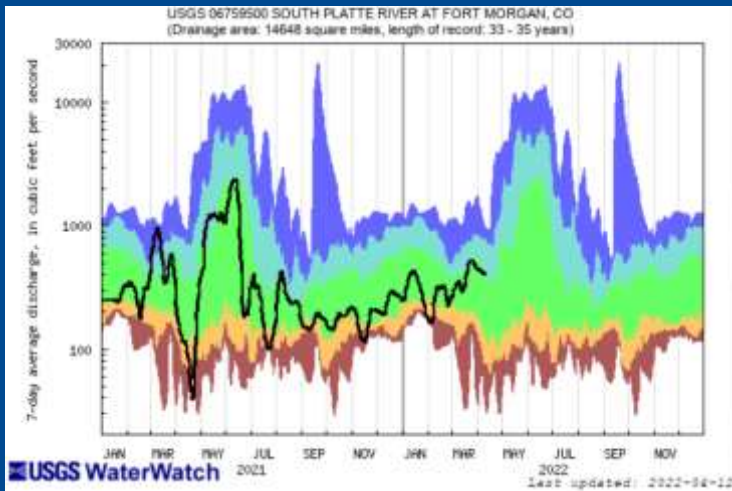
The snow water equivalent percent of normal represents the current snow water equivalent found at selected SNOTEL sites in or near the basin compared to the average value for those sites on this day. Data based on the first reading of the day (typically 00:00).



Prepared by:  
USDA/NRCS National Water and Climate Center  
Portland, Oregon  
<https://www.nrcs.usda.gov/wps/portal/wcc/home/>



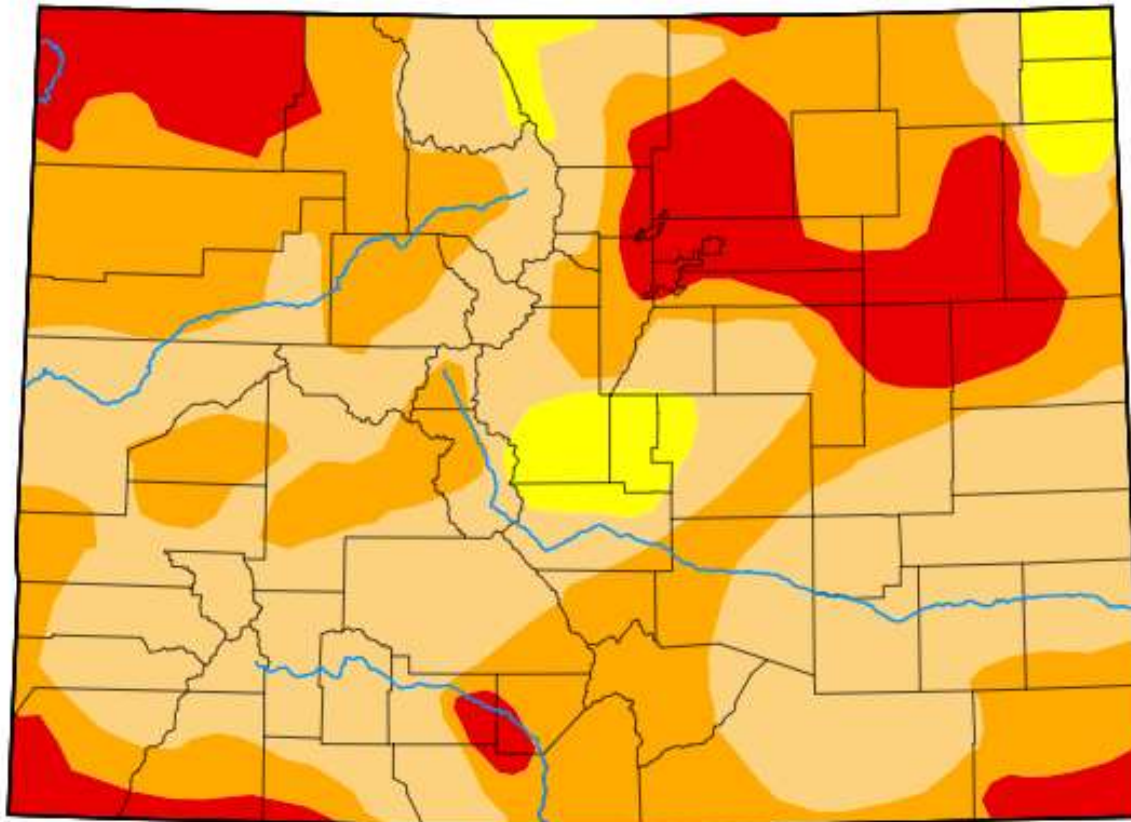
# Stream Flows & Forecasts



## Apr-Jul Maximum, Minimum and Most Probable Streamflow Forecasts (1000 af)

Watershed	Forecast Minimum	Most Probable	Forecast Maximum	Apr-Jul Avg <sup>(3)</sup>	Most Prob % Avg
Blue River	159	224	288	283	79%
Upper Colorado River	156	196	246	226	87%
Willow Creek	33	48	63	50	96%
Fraser River	67	96	125	118	81%
Poudre River	130	213	296	230	93%
Big Thompson River	49	84	119	91	92%
St. Vrain River	53	87	121	90	97%
Boulder Creek	36	51	67	54	94%
South Platte Tributaries	--	435	--	465	94%

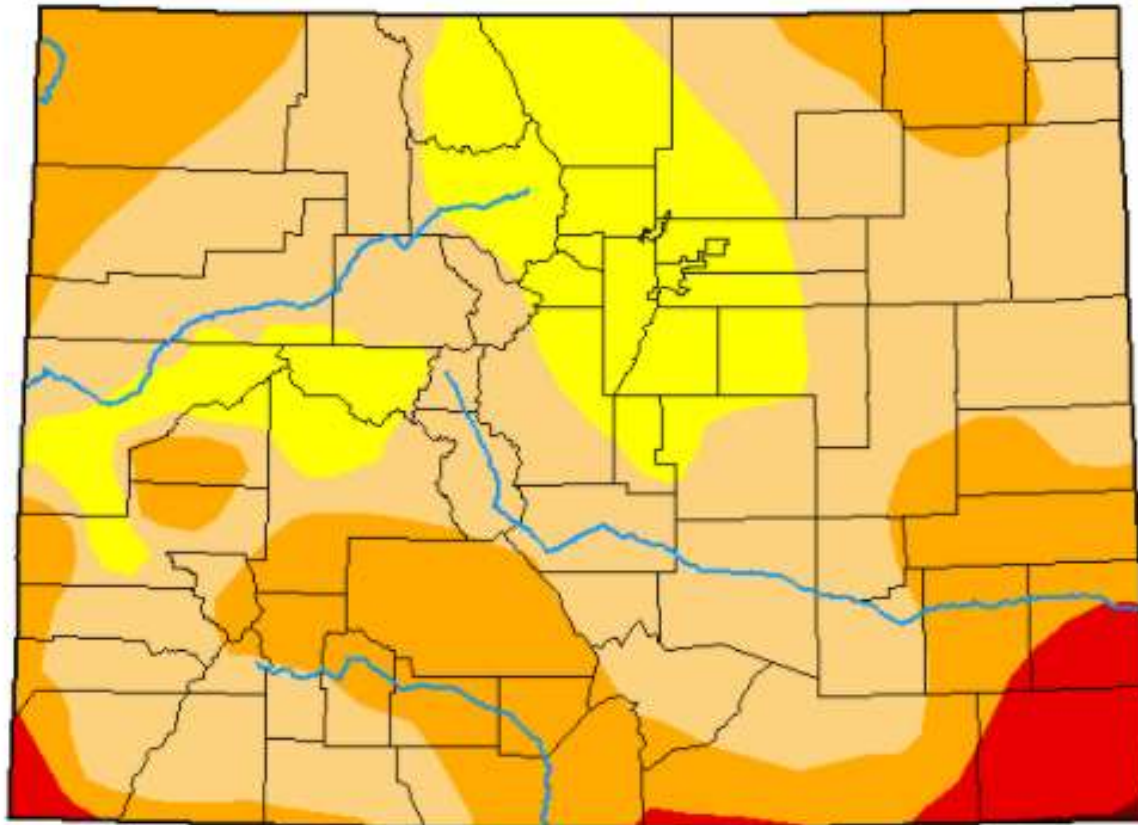
# Drought Conditions November 2021



## Intensity:

- None
- D0 (Abnormally Dry)
- D1 (Moderate Drought)
- D2 (Severe Drought)
- D3 (Extreme Drought)
- D4 (Exceptional Drought)

# Drought Conditions April 2022



## Intensity:

- None
- D0 (Abnormally Dry)
- D1 (Moderate Drought)
- D2 (Severe Drought)
- D3 (Extreme Drought)
- D4 (Exceptional Drought)



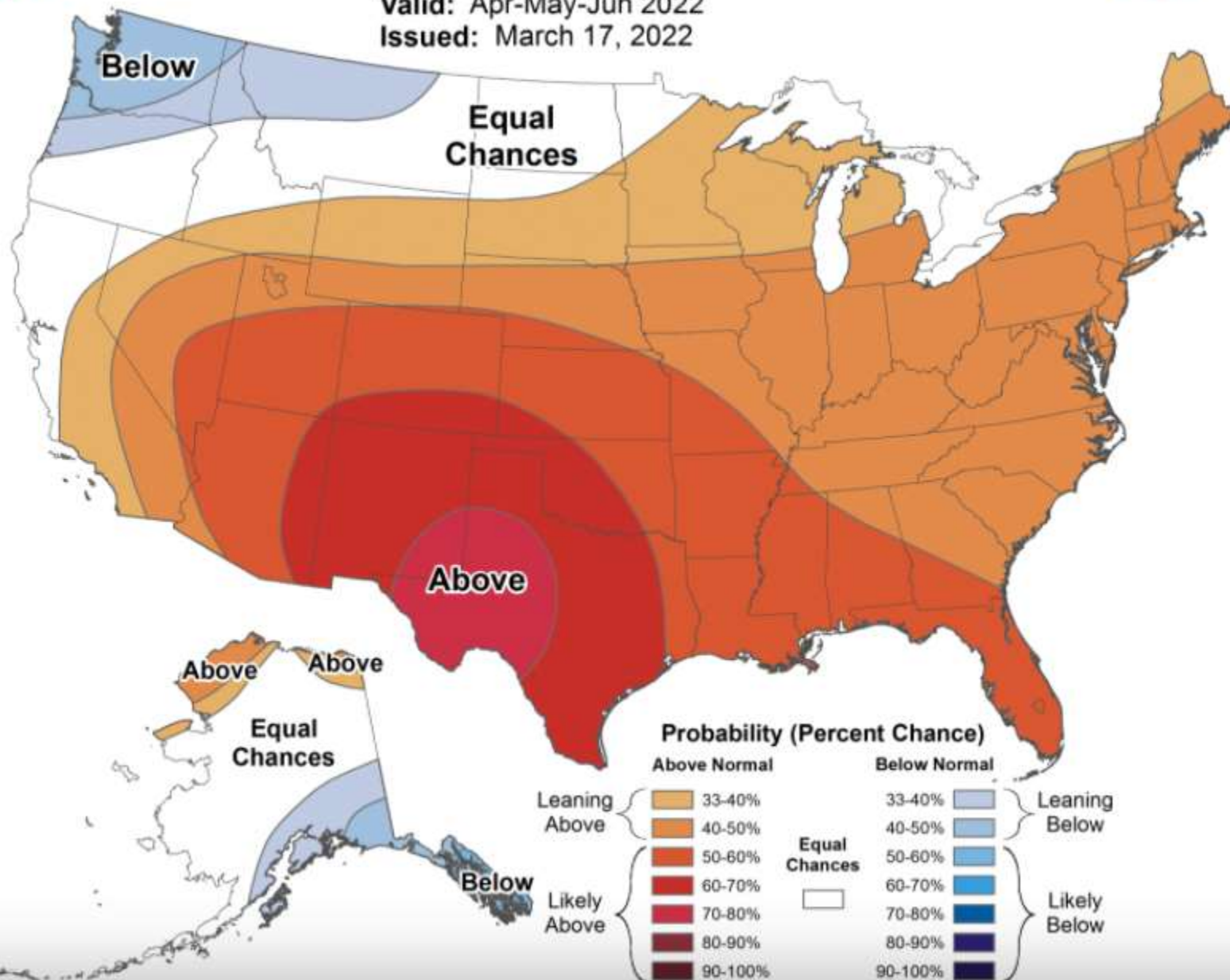


# Seasonal Temperature Outlook



Valid: Apr-May-Jun 2022

Issued: March 17, 2022



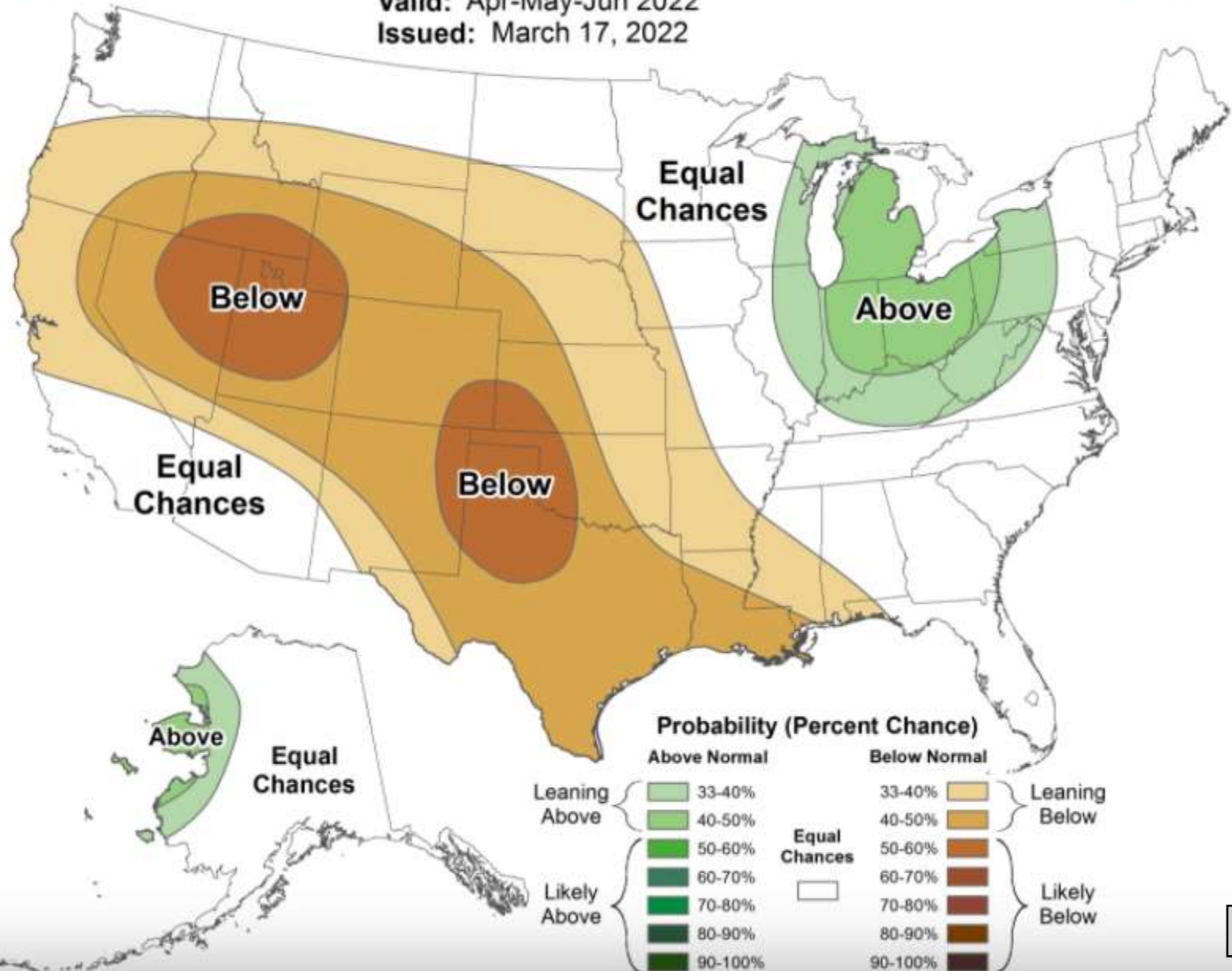


# Seasonal Precipitation Outlook



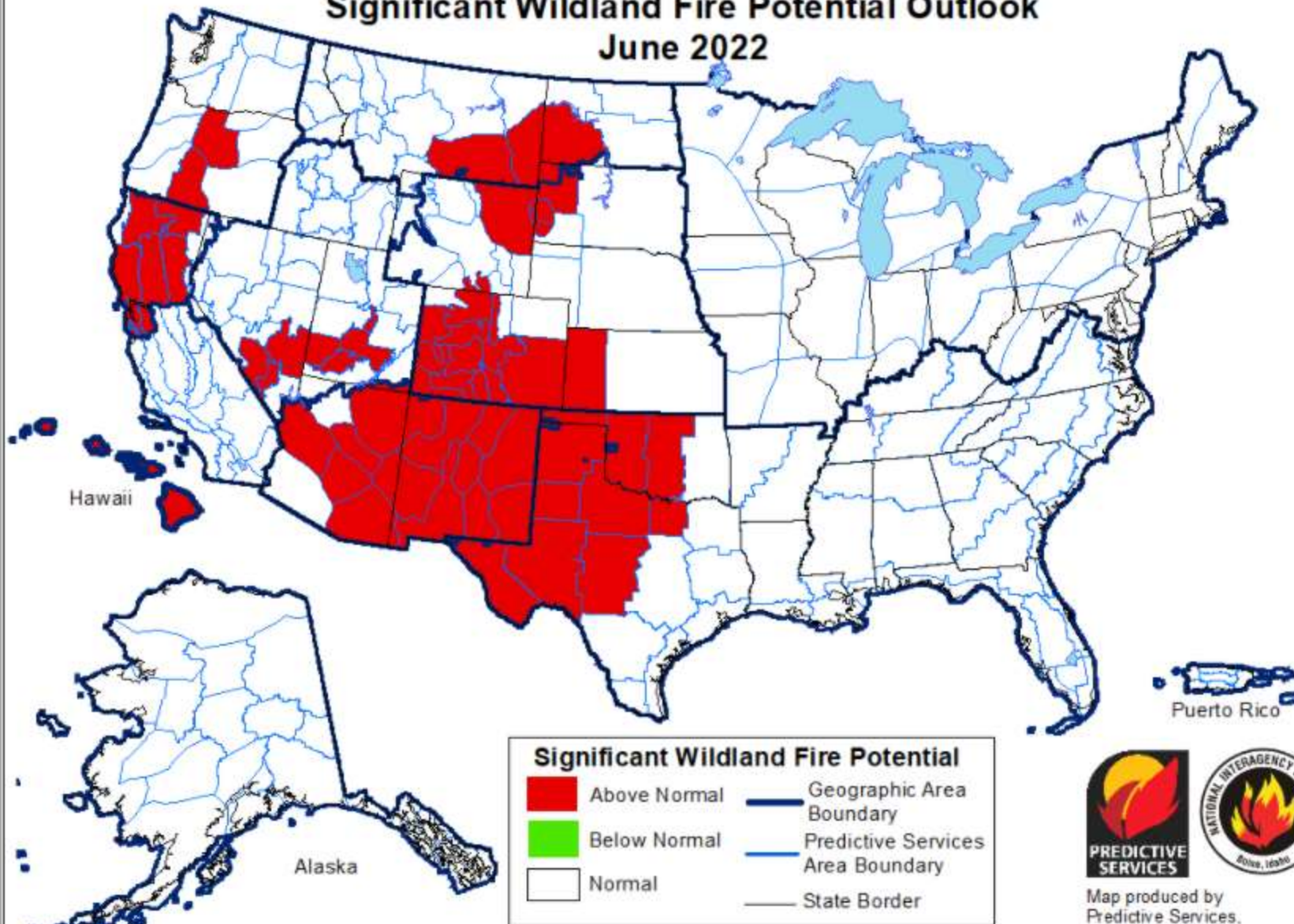
Valid: Apr-May-Jun 2022

Issued: March 17, 2022





# Significant Wildland Fire Potential Outlook June 2022



Above normal significant wildland fire potential indicates a greater than usual likelihood that significant wildland fires will occur. Significant wildland fires should be expected at typical times and intervals during normal significant wildland fire potential conditions. Significant wildland fires are still possible but less likely than usual during forecasted below normal periods.



Map produced by  
Predictive Services,  
National Interagency Fire Center  
Boise, Idaho  
Issued April 1, 2022  
Next issuance May 1, 2022

# 2022 Fire Mitigation Plans

- Complete 6 point mitigation projects from 2021 with Emergency Watershed Protection funding
- Received \$6 million from USFS for ~3,000 acres of aerial mulching and point mitigation planning
- \$2.7 million from the CO Water Conservation Board for mulching and point mitigation



# Target Storage Assumptions

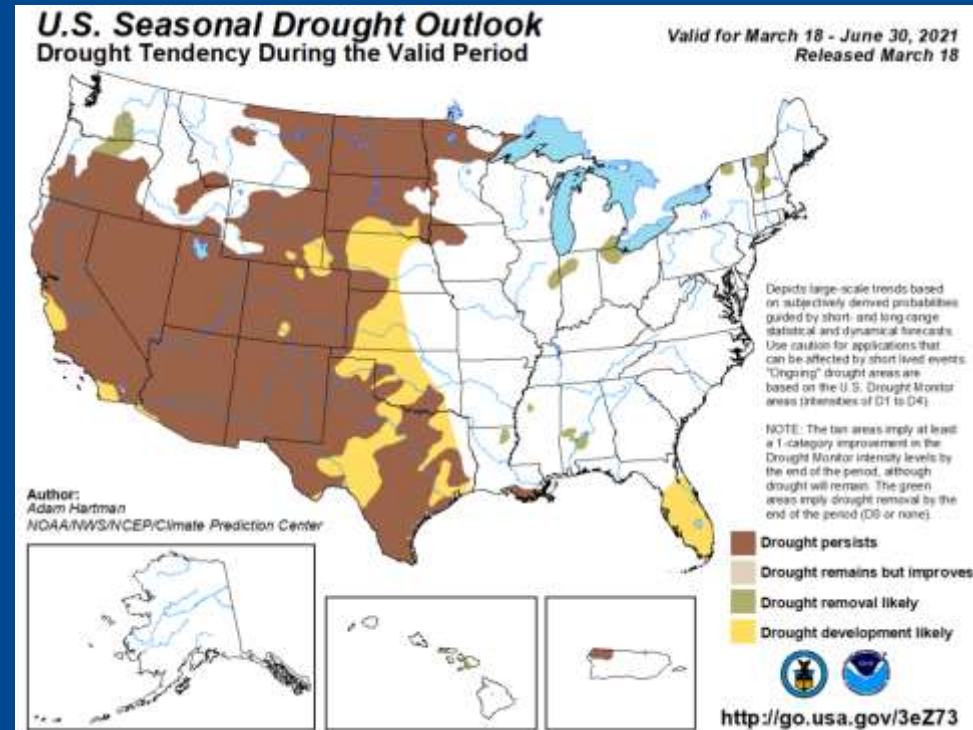
- 70% quota from Northern (issued Apr 13)
- GLIC dividends for dry-year
- 2012 water demands
- No pumping of Windy Gap water (collateralize C-BT)
- 2,000 acre-feet of directs unable to be treated due to water quality issues from Cameron Peak fire impacts

# 21,300 AF Target Storage

April 1, 2022 Storage (acre-feet)	
CBT	19,664
Windy Gap	756
GLIC	18,520
Tunnel	518
<b>Total</b>	<b>39,458</b>
Demands (April 1, 2022-March 31, 2023) (acre-feet)	
CBT	12,272
Windy Gap	3,883
GLIC	10,435
Tunnel	1,141
<b>Total</b>	<b>27,730</b>
Yields through April 2023 (acre-feet)	
CBT (Nov. 2022-April 1, 2022)	11,402
Windy Gap	3,450
GLIC	8,767
Tunnel	647
<b>Total</b>	<b>24,266</b>
April 2023 Storage by Source	
CBT	18,794
Windy Gap	324
GLIC	12,852
Tunnel	23
<b>April 2023 Storage</b>	<b>31,994</b>
<b>Target Storage Volume</b>	<b>21,300</b>

# Recommendations

- Declare “Adequate Water Year”
- Maintain target storage volume at 21,300 AF
- Continue long-term rentals
- Rent excess supply





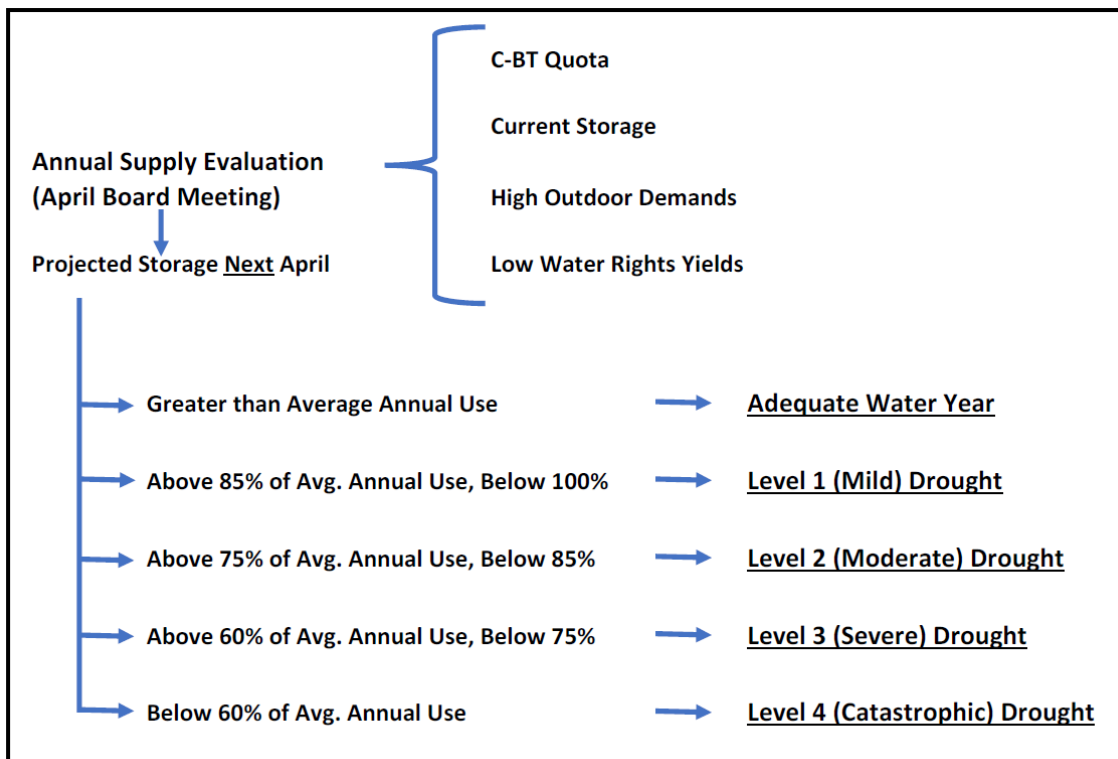


# MEMORANDUM

TO: Sean Chambers, Water and Sewer Director  
FROM: Jen Petrzeka, Water Resources Operations Manager  
DATE: April 20, 2022  
RE: April 2022 Water Supply Update and Adequacy Determination

## ISSUE

In accordance with the Drought Emergency Plan, staff will report the water supply status to the Greeley Water and Sewer Board ("Board") in April, July and November of each year. Previous modeling analysis has shown that the amount of water needed in storage to supply the citizens of Greeley for 12 months is approximately 21,300 acre-feet. When this target storage level is met, the Board can declare an "adequate water year" with normal watering restrictions. The following graphic illustrates the process for determining the projected target storage volume for April 2023.



## BACKGROUND

The beginning of water year 2022 experienced below average snowpack levels until early January when we saw a series of storms that brought the snowpack to slightly above average.

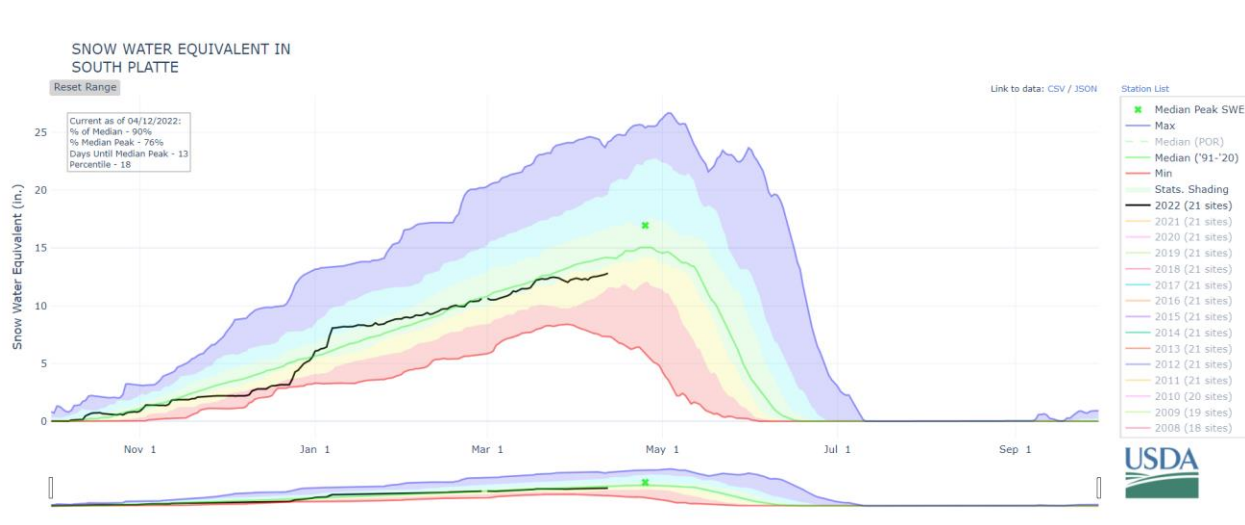
## SERVING OUR COMMUNITY • IT'S A TRADITION

We promise to preserve and improve the quality of life for Greeley through timely, courteous and cost effective service.



Precipitation events kept our snowpack at around average until early to mid April when warmer weather caused a decent amount of melt. As of April 12, the South Platte River basin is at 90% of average and the Colorado River basin is at 94% of average. Water supply conditions are slightly below normal as indicated by a Colorado SWSI<sup>1</sup> value of -0.67 for the South Platte basin, however reservoir storage in the South Platte basin is at 111% of average. Streamflows are expected to be slightly below average for the Cache la Poudre, Big Thompson and Colorado River basins at 93%, 92%, and 87% of average, respectively ('Northern Water Streamflow Forecasts').

In November 2021, much of Colorado was in a moderate to severe drought with a part of northeast Colorado in extreme drought. Conditions have improved slightly with most of the state in abnormally dry to moderate drought. The 3 month temperature and precipitation forecasts show above average temperatures and below average precipitation indicating moderate drought conditions will likely continue.



The Greeley System Storage Analysis table for Water Year 2022 shows the April 2023 storage levels will be approximately 31,994 acre-feet (table on following page). This is after collateralizing 4,100 acre-feet of C-BT for Windy Gap operations in the Northern system and a xx% CBT quota that which was declared at Northern's April Board meeting to satisfy demand for 2022. The WY2022 projections for the Greeley Loveland Irrigation system are based on dry year yields.

Wildfire potential is projected to be high and we expect impacts to continue from the Cameron Peak burn scar. Therefore, we also have reserved 2,000 acre-feet of CBT to replace Poudre directs in anticipation that water quality from the fire will prevent treatment of directs approximately 50% of the irrigation season. Similar to 2021, we are also finalizing an agreement with a local ditch company to trade our directs for C-BT they have stored in Horsetooth Reservoir when we cannot treat river water.

<sup>1</sup> The Surface Water Supply Index (SWSI) was developed by the Colorado Division of Water Resources and the U.S.D.A Natural Resources Conservation Service (NRCS). This is an indicator of mountain-based water supply conditions for the major river basins in Colorado. It is based on streamflow, reservoir storage, and precipitation. The SWSI scale goes from -4 (severe drought) to +4 (abundant supply) with 0 being near normal supply.

<b>April 1, 2022 Storage (acre-feet)</b>	
CBT	19,664
Windy Gap	756
GLIC	18,520
Tunnel	518
<b>Total</b>	<b>39,458</b>
<b>Demands (April 1, 2022-March 31, 2023) (acre-feet)</b>	
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<b>April 2023 Storage</b>	<b>31,994</b>
<b>Target Storage Volume</b>	<b>21,300</b>

## SERVING OUR COMMUNITY • IT'S A TRADITION

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**RECOMMENDATION**

The projection for the April 1, 2023 storage volume exceeds the target storage volume. Staff recommends the Board declare an adequate water year and that supplies be made available for immediate rental to agriculture while assuring target storage does not fall below 21,300 acre-feet.

# Water & Sewer Agenda Summary

Date: April 20, 2022

Key Staff Contact: Jen (Petrzelka) Dial

**Title:** *Ratify Participating Agreement with the U.S Forest Service for Cameron Peak Fire Mitigation Work*

## **Summary:**

The 2020 Cameron Peak Fire burned over 200,000 acres in the watersheds of the Cache la Poudre and Big Thompson River basins where Greeley obtains more than 50% of its water supplies. The major wildfire is the state's largest on record and severely burned areas include both public and private properties. This fire significantly affected hundreds of thousands of acres of watersheds that are of critical importance for the domestic, agricultural, and municipal water supplies for over one million people and tens of thousands of acres of productive irrigated agriculture. The damage to these watersheds continues to pose immediate and future threats to public infrastructure serving communities across Larimer and Weld Counties, including but not limited to water supply diversions and storage infrastructure. The purpose of this agreement is to document the cooperation between the parties to implement watershed recovery and restoration in and adjacent to lands affected by the Cameron Peak Fire and includes an initial reimbursement of \$6,000,000 to Greeley for this mitigation work. This agreement is being recommended for approval to City Council on April 19, 2022. This is coming before the Board for ratification.

## **Recommended Action:**

Ratification of Participating Agreement with the U.S. Forest Service for Cameron Peak Fire Mitigation Work

## **Attachments:**

Participating Agreement with the U.S. Forest Service for Cameron Peak Fire Mitigation Work

Financial Plan

Scope of Work

2022 Work Plan

# Participating Agreement with U.S. Forest Service for Post-fire Recovery Work on the Cameron Peak Fire



# Background

- The Poudre River Watershed experienced a large % of medium to high burn severity from the Cameron Peak Fire
- Aerial Mulching has been implemented on ~6,000 acres for mitigation purposes
- An additional ~8,000 acres of mulching need has been identified



# Background

- The Forest Service received funding they would like to provide to Greeley for mulching and other post-fire mitigation work
- Initial commitment is \$6,000,000
- Greeley is not funding this work-it is a pass through agreement
- No cost match is required





# Terms of Agreement

- Forest Service and Greeley will cooperate on the mutual goal of watershed protection and restoration
- Forest Service will reimburse Greeley for agreed upon mitigation work as identified in the Financial and Operating Plans
- Agreement will terminate May 1<sup>st</sup> 2027





# Questions?



## THE CITY OF GREELEY, COLORADO

### RESOLUTION \_\_, 2022

#### **A RESOLUTION AUTHORIZING ENTRY INTO AN INTERGOVERNMENTAL AGREEMENT WITH THE UNITED STATES FOREST SERVICE FOR WATERSHED RECOVERY AND RESTORATION GRANT FUNDING**

WHEREAS, the City of Greeley ("Greeley") is authorized by Section 3-5 of the Greeley City Charter and Section 2-461 of the Greeley Municipal Code to enter into contracts with other governmental entities for the performance of cooperative or joint activities; and

WHEREAS, Greeley has been coordinating wildfire mitigation and watershed rehabilitation activities in the Cache la Poudre and Big Thompson watersheds in response to the Cameron Peak Fire, which ignited in August of 2020, burned for over 100 days, and eventually became the largest recorded wildfire in Colorado history; and

WHEREAS, the United States Forest Service recently made available to Greeley federal emergency supplemental grant funds that may be used to continue its facilitation of such recovery and restoration work in the Cache la Poudre and Big Thompson watersheds; and

WHEREAS, the Participating Agreement between The City of Greeley and The USDA, Forest Service, Arapaho and Roosevelt National Forests and Pawnee National Grassland, attached hereto and incorporated herein as Exhibit A, sets forth the terms and conditions by which Greeley may utilize these grant funds to continue its facilitation of such recovery and restoration work in the Cache la Poudre and Big Thompson watersheds; and

WHEREAS, the mitigation work facilitated pursuant to this intergovernmental agreement constitutes one aspect of a larger regional and national policy objective, that is, to mitigate and rehabilitate the impacts of the Cameron Peak Fire, and Greeley's role in facilitating the mitigation work is for the benefit of all water users and other parties with an interest in the Cache la Poudre and Big Thompson watersheds; and

WHEREAS, all grant funding received, passed through, or otherwise managed by Greeley pursuant to this intergovernmental agreement is for the purposes of the greater policy objective and the common benefit of the parties described, and will not result in a revenue subsidy or production of a capital asset for the Water Enterprise of the City of Greeley; and

WHEREAS, it is in the best interest of the citizens of The City of Greeley for Greeley to enter into the Participating Agreement between The City of Greeley and The USDA, Forest Service, Arapaho and Roosevelt National Forests and Pawnee National Grassland.

#### **NOW THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF GREELEY, COLORADO:**

Section 1. The City of Greeley, Colorado is hereby authorized to enter into the Participating Agreement between The City of Greeley and The USDA, Forest Service, Arapaho and Roosevelt National Forests and Pawnee National Grassland, in the form attached hereto and incorporated herein as Exhibit A.

Section 2. City staff and legal counsel are hereby authorized to make minor revisions to the Participating Agreement between The City of Greeley and The USDA, Forest Service, Arapaho and Roosevelt National Forests and Pawnee National Grassland, provided that the material substance of the agreement remains unchanged.

Section 3. This resolution shall take effect immediately upon its passage.

**PASSED AND ADOPTED, SIGNED AND APPROVED THIS \_\_\_\_\_ DAY OF \_\_\_\_\_ 2022.**

**ATTEST:**

**THE CITY OF GREELEY, COLORADO**

\_\_\_\_\_  
**City Clerk**

\_\_\_\_\_  
**Mayor**

**Instructions:** Use this form in conjunction with Forest Service Handbook (FSH) 1509.11, Ch. 70, Financial Planning Requirements, for participating, challenge cost-share, joint venture, and cost-reimbursable agreements. This form may be used for other types of Forest Service Manual 1580 agreements, when useful. Choose one of the two (2) financial plan versions and complete. Use Version 1 (Financial Plan - Cash to Coop) when you will have Cash to the Cooperator. Use Version 2 (Financial Plan - Cash to FS) when you have cash to the Forest Service. Users do not have to use or print versions/sheets that are not applicable to their agreement.

The purpose of this form is to capture the total estimated value of the proposed agreement. Once the agreement is approved, in writing, by the parties, then this financial plan becomes the financial estimates for the agreement. This financial plan must display the parties' expected contributions to the agreement. These contributions should be broken down by party contribution type (e.g., non-cash, in-kind, cash to cooperator), see below for definitions, and cost elements (e.g., salaries, supplies, travel). Cost element values should be the result of documented cost analysis on this form. Each financial plan version provides samples of cost analysis calculations, see associated Excel comment balloons. Additional instructions are located on version 1 and 2 cost analysis tabs.

#### Definitions for the Matrix Column Headings:

(a) **Forest Service Noncash Contribution:** Forest Service noncash contributions may consist of employee salaries, overhead (indirect), travel provided, and/or equipment and supplies purchased and provided to the Cooperator for use in the project. These costs are an expense to the Forest Service, but do not include funding for reimbursement of Cooperator expenses.

(b) **Forest Service Volunteer Labor (In-Kind) Contribution:** This is the value of volunteer labor donated for completion of the project by the Forest Service for which the Forest Service has incurred no expense. Forest Service volunteer agreements (either sponsored or individual) should be used to document the donated services. The value of volunteer labor should be commensurate with local labor rates for similar work.

(c) **Forest Service Cash to the Cooperator:** This is the maximum amount of funding that will be reimbursed or advanced to the Cooperator. This is an expense to the Forest Service.

(d) **Cooperator Noncash Contribution:** These are expenses the Cooperator incurs that are contributed to the project in lieu of cash, but for which costs are incurred, such as employee salaries, overhead (indirect costs), travel, equipment, supplies, and so forth. These do not include in-kind contributions from third parties, such as donations from other entities or volunteer labor.

(e) **Cooperator, In-Kind Contribution:** In-kind contribution provided to the Cooperator from a third party organization(s) for use in the project for which the Cooperator has incurred no expense. Value assessed for volunteer labor and donated materials, equipment and supplies should be valued based on FSH 1509.11, Ch. 70. These values are not reimbursable and can only be used to satisfy the Cooperator's matching requirement. Display these contributions by Cost Element Expenditures.

(f) **Cooperator Cash to the Forest Service:** These are Cooperator cash contributions actually transferred to the Forest Service for use in completing the project. This is an expense to the Cooperator and does not include in-kind contributions made to the Cooperator from other organizations. Display by Cost Element where these funds will be expended. Be sure to cite a collection authority in the Agreement if this column is used.

Include cash the Cooperator is transferring to the Forest Service for the project, that has been received as a grant(s) from a non-Federal entity(ies).

(g) **Cooperator, Other Federal Contribution:** Contribution provided to the Cooperator from Federal agency(ies) for use in the project. Display these contributions by Cost Element Expenditures.

(h) **Total Project Value:** The sum of all the values provided toward the project. This figure reflects the true estimated cost of the project.

#### Definitions for Cost Allowability

(a) **Allowable Cost:** A cost, as recorded on the Agreements Financial Plan (Long, Medium, and Short) forms, associated with an agreement, which meets the criteria for authorized expenditures specific in a cost principle methodology. Generally, it meets the cost principle methodology, and is a cost the parties to an agreement intend to charge, and must be: Reasonable for the performance of the award; Necessary and reasonable for proper and efficient performance and administration of the agreement; Consistently treated as either a direct or indirect cost; Generally, determined in accordance with generally accepted accounting principles (GAAP);

Net of all applicable credits (that is, less any future rebates from the purchase of goods or services); Separate from a cost or from a cost-sharing/matching requirement of another Federal award or agreement, unless otherwise permitted by Federal law or regulation; Adequately documented, Authorized or not prohibited by Federal, State, or local laws and regulations; Compliant with limits or exclusions on types or amounts of costs, as set forth in relevant Federal laws, agreement terms and conditions, or other governing regulations (examples of such costs include: entertainment, alcohol, and taxes); and, Consistent with the agency's and cooperator's internal policies, regulations, and procedures that apply to both Federal

(b) **Allocable Cost:** A cost, as recorded on the Agreements Financial Plan (Long, Medium, and Short) forms, associated with an agreement, which in accordance with the relative benefit received by either party for the award, is treated consistently with other costs incurred for the same purpose and in like circumstances, and if it: Is incurred specifically for the award; Benefits both the award and other ancillary work, and the cost may be distributed in reasonable proportion to the benefits received (an example of this type of cost is a piece of equipment that is used for multiple projects); or Necessary to the overall operation of the organization, although a direct relationship to any particular cost objective may not be shown.

(c) **Reasonable Cost:** A cost, as recorded on the Agreements Financial Plan (Long, Medium, and Short) forms, associated with an agreement, that, in its nature and amount, does not exceed an amount that a prudent person, under the circumstances prevailing at the time the decision was made, would incur. Other factors to consider are: Whether the cost is of a type generally recognized as ordinary and necessary for the entity's operation or agreement performance; The restraints or requirements imposed by factors such as generally accepted, sound, business practices; arms-length bargaining; Federal and State laws and regulations; and the terms and conditions of the agreement; Market prices or industry standard costs for similar goods and services (that is, is the cooperator offering goods or services for an amount that exceeds what is readily available in the marketplace); Whether individuals concerned acted with prudence under the circumstances, considering their responsibilities to the entity; its members, employees, and clients; the public; and the government; and Significant deviations from established practices of the governmental entity that might unjustifiably increase costs charged to the agreement.

#### Burden Statement

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0596-0217. The time required to complete this information collection is estimated to average 45 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or part of an individual's income is derived from any public assistance. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotope, etc.) should contact USDA's TARGET Center at 202-720-2600 (voice and TDD). To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, 1400 Independence Avenue, SW, Washington, DC 20250-9410 or call toll free (866) 632-9992 (voice). TDD users can contact USDA through local relay or the Federal relay at (800) 877-8339 (TDD) or (866) 377-8642 (relay voice). USDA is an equal opportunity provider and employer.

Attachment USFS Agreement No.:   
Cooperator Agreement No.: Mod No. 

**This Financial Plan may not be used to collect funds AND disburse funds on the same agreement. Separate agreements must be used in this situation.**

### Agreements Financial Plan (Medium Form)

#### 1. Financial Plan Matrix:

Note: All columns may not be used. Use depends on source and type of contribution(s).

COST ELEMENTS (Direct Costs)	FOREST SERVICE CONTRIBUTIONS			COOPERATOR CONTRIBUTIONS			(g) TOTAL
	(a) Noncash	(b) Volunteer Labor (In-Kind)	(c) Cash to Cooperator	(d) Noncash	(e) In-Kind	(f) Other Federal	
Salaries/Labor	\$18,750.00	\$0.00	\$0.00	\$6,320.00	\$0.00	\$0.00	\$25,070.00
Travel	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Equipment	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Supplies/Materials	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Printing	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Other	\$0.00	\$0.00	\$6,000,000.00	\$200,000.00	\$0.00	\$30,000.00	\$6,230,000.00
Other	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Subtotal	\$18,750.00	\$0.00	\$6,000,000.00	\$206,320.00	\$0.00	\$30,000.00	\$6,255,070.00
Cooperator Indirect Costs			\$0.00	\$0.00			\$0.00
FS Overhead Assessment	\$0.00						\$0.00
Gross Total	\$18,750.00	\$0.00	\$6,000,000.00	\$206,320.00	\$0.00	\$30,000.00	\$6,255,070.00

Matching Costs Determination	
Total Forest Service Share = (a+b+c)/(g) = (h)	(h) 96.22%
Other Federal Contribution = (f)/(g) = (i)	(i) 0.48%
Total Federal Share = (h+i) = (j)	(j) 96.70%
Total Cooperator Share (d+e)/(g) = (k)	(k) 3.30%
Total (j+k) = (l)	(l) 100.00%



## WORKSHEET FOR

### FS Non-Cash Contribution Cost Analysis Column

Use this worksheet to perform the cost analysis that supports the lump sum figures provided in the matrix. NOTE: This worksheet auto populates the relevant and applicable matrix cells.

Cost element sections may be deleted or lines may be hidden, if not applicable. Line items may be added or deleted as needed. The Standard Calculation sections provide a standardized formula for determining a line item's cost, e.g. cost/day x # of days=total, where the total is calculated automatically. The Non-Standard Calculation sections provide a write-in area for line items that require a calculation formula that is other than the standardized formulas, e.g. instead of salaries being calculated by cost/day x # of days, costs may be calculated simply by a contracted value that is not dependent on days worked, such as 1 employee x \$1,200/contract= \$1,200. Be sure to review your calculations when entering in a Non-Standard Calculation, and provide a brief explanation of units used to make calculation, e.g. '1 month contract,' on a line below the figures.

#### Salaries/Labor

##### Standard Calculation

Job Description	Cost/Day	# of Days	Total
Fire Recovery Coordinator	\$450.00	25.00	\$11,250.00
Hydrologist	\$350.00	10.00	\$3,500.00
Forester	\$400.00	10.00	\$4,000.00
			\$0.00
			\$0.00

##### Non-Standard Calculation

**Total Salaries/Labor**

**\$18,750.00**

#### Travel

##### Standard Calculation

Travel Expense	Employees	Cost/Trip	# of Trips	Total
				\$0.00
				\$0.00
				\$0.00
				\$0.00
				\$0.00

##### Non-Standard Calculation

**Total Travel**

**\$0.00**

#### Equipment

##### Standard Calculation

Piece of Equipment	# of Units	Cost/Day	# of Days	Total
				\$0.00
				\$0.00
				\$0.00
				\$0.00

##### Non-Standard Calculation

Total Equipment		\$0.00
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<b>Supplies/Materials</b>	
<b>Standard Calculation</b>	
Supplies/Materials	# of Items Cost/Item Total
	\$0.00
	\$0.00
	\$0.00
	\$0.00

<b>Non-Standard Calculation</b>
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Total Supplies/Materials	\$0.00
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<b>Printing</b>	
<b>Standard Calculation</b>	
Paper Material	# of Units Cost/Unit Total
	\$0.00

<b>Non-Standard Calculation</b>
---------------------------------

Total Printing	\$0.00
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<b>Other Expenses</b>	
<b>Standard Calculation</b>	
Item	# of Units Cost/Unit Total
	\$0.00
	\$0.00
	\$0.00
	\$0.00

<b>Non-Standard Calculation</b>
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Total Other	\$0.00
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<b>Subtotal Direct Costs</b>	<b>\$18,750.00</b>
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Forest Service Overhead Costs				
Current Overhead Rate	Subtotal Direct Costs			Total
		\$18,750.00		\$0.00
Total FS Overhead Costs				\$0.00

<b>TOTAL COST</b>	<b>\$18,750.00</b>
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## WORKSHEET FOR

### Volunteer Labor (In-Kind) Cost Analysis Column

Use this worksheet to perform the cost analysis that supports the lump sum figures provided in the matrix. NOTE: This worksheet auto populates the relevant and applicable matrix cells.

Cost element sections may be deleted or lines may be hidden, if not applicable. Line items may be added or deleted as needed. The Standard Calculation sections provide a standardized formula for determining a line item's cost, e.g. cost/day x # of days=total, where the total is calculated automatically. The Non-Standard Calculation sections provide a write-in area for line items that require a calculation formula that is other than the standardized formulas, e.g. instead of salaries being calculated by cost/day x # of days, costs may be calculated simply by a contracted value that is not dependent on days worked, such as 1 employee x \$1,200/contract= \$1,200. Be sure to review your calculations when entering in a Non-Standard Calculation, and provide a brief explanation of units used to make calculation, e.g. '1 month contract,' on a line below the figures.

#### Salaries/Labor

##### Standard Calculation

Job Description		Cost/Day	# of Days		Total
					\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00

##### Non-Standard Calculation

#### Total Salaries/Labor

**\$0.00**

#### Travel

##### Standard Calculation

Travel Expense	Employees	Cost/Trip	# of Trips		Total
					\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00

##### Non-Standard Calculation

#### Total Travel

**\$0.00**

#### Equipment

##### Standard Calculation

Piece of Equipment	# of Units	Cost/Day	# of Days		Total
					\$0.00
					\$0.00
					\$0.00
					\$0.00

##### Non-Standard Calculation

Total Equipment		\$0.00
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Supplies/Materials				
Standard Calculation				
Supplies/Materials		# of Items	Cost/Item	Total
				\$0.00
				\$0.00
				\$0.00
				\$0.00

Non-Standard Calculation				
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Total Supplies/Materials		\$0.00
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Printing				
Standard Calculation				
Paper Material		# of Units	Cost/Unit	Total
				\$0.00

Non-Standard Calculation				
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Total Printing		\$0.00
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Other Expenses				
Standard Calculation				
Item		# of Units	Cost/Unit	Total
				\$0.00
				\$0.00
				\$0.00
				\$0.00

Non-Standard Calculation				
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Total Other		\$0.00
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Subtotal Direct Costs	\$0.00
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TOTAL COST	\$0.00
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## WORKSHEET FOR

### FS Cash to the Cooperator Cost Analysis Column

Use this worksheet to perform the cost analysis that supports the lump sum figures provided in the matrix. NOTE: This worksheet auto populates the relevant and applicable matrix cells.

Cost element sections may be deleted or lines may be hidden, if not applicable. Line items may be added or deleted as needed. The Standard Calculation sections provide a standardized formula for determining a line item's cost, e.g. cost/day x # of days=total, where the total is calculated automatically. The Non-Standard Calculation sections provide a write-in area for line items that require a calculation formula that is other than the standardized formulas, e.g. instead of salaries being calculated by cost/day x # of days, costs may be calculated simply by a contracted value that is not dependent on days worked, such as 1 employee x \$1,200/contract= \$1,200. Be sure to review your calculations when entering in a Non-Standard Calculation, and provide a brief explanation of units used to make calculation, e.g. '1 month contract,' on a line below the figures.

Salaries/Labor				
Standard Calculation				
Job Description		Cost/Day	# of Days	Total
				\$0.00
				\$0.00
				\$0.00
				\$0.00
				\$0.00
Non-Standard Calculation				
<b>Total Salaries/Labor</b>				<b>\$0.00</b>

Travel				
Standard Calculation				
Travel Expense	Employees	Cost/Trip	# of Trips	Total
				\$0.00
				\$0.00
				\$0.00
				\$0.00
				\$0.00
Non-Standard Calculation				
<b>Total Travel</b>				<b>\$0.00</b>

Equipment				
Standard Calculation				
Piece of Equipment	# of Units	Cost/Day	# of Days	Total

					\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00
<b>Non-Standard Calculation</b>					

<b>Total Equipment</b>					<b>\$0.00</b>
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<b>Supplies/Materials</b>					
<b>Standard Calculation</b>					
Supplies/Materials		# of Items	Cost/Item	Total	
					\$0.00
					\$0.00
					\$0.00
					\$0.00
<b>Non-Standard Calculation</b>					

<b>Total Supplies/Materials</b>					<b>\$0.00</b>
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<b>Printing</b>					
<b>Standard Calculation</b>					
Paper Material		# of Units	Cost/Unit	Total	
					\$0.00
<b>Non-Standard Calculation</b>					
					\$0.00
<b>Total Printing</b>					<b>\$0.00</b>

<b>Other Expenses</b>					
<b>Standard Calculation</b>					
Item		# of Units	Cost/Unit	Total	
Helicopter Mulching - estimated per-acre cost		2939.00	\$2,000.00	\$5,878,000.00	
Point mitigation planning- Contract geomorphology, hydrology and design consultant to attend planning and coordination meetings, as well as work on design guidelines for different proposed structures				\$50,000.00	
Mulching planning-prioritization, mapping, reporting, inspection and verification of mulch polygons				\$72,000.00	
<b>Non-Standard Calculation</b>					

<b>Total Other</b>					<b>\$6,000,000.00</b>
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<b>Subtotal Direct Costs</b>				<b>\$6,000,000.00</b>	
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<b>Cooperator Indirect Costs</b>					
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Current Overhead Rate	Subtotal Direct Costs		Total
	\$6,000,000.00		\$0.00
Total Coop. Indirect Costs			\$0.00

TOTAL COST	\$6,000,000.00
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## WORKSHEET FOR

### Cooperator Non-Cash Contribution Cost Analysis Column

Use this worksheet to perform the cost analysis that supports the lump sum figures provided in the matrix. NOTE: This worksheet auto populates the relevant and applicable matrix cells.

Cost element sections may be deleted or lines may be hidden, if not applicable. Line items may be added or deleted as needed. The Standard Calculation sections provide a standardized formula for determining a line item's cost, e.g. cost/day x # of days=total, where the total is calculated automatically. The Non-Standard Calculation sections provide a write-in area for line items that require a calculation formula that is other than the standardized formulas, e.g. instead of salaries being calculated by cost/day x # of days, costs may be calculated simply by a contracted value that is not dependent on days worked, such as 1 employee x \$1,200/contract= \$1,200. Be sure to review your calculations when entering in a Non-Standard Calculation, and provide a brief explanation of units used to make calculation, e.g. '1 month contract,' on a line below the figures.

Salaries/Labor					
Standard Calculation					
Job Description		Cost/Hr	# of hours		Total
Water Resources Operations Manager		\$60.00	32.00		\$1,920.00
Water Source Supply Manager		\$50.00	60.00		\$3,000.00
Deputy Director of Water Resources		\$70.00	20.00		\$1,400.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00

#### Non-Standard Calculation

<b>Total Salaries/Labor</b>		<b>\$6,320.00</b>
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Travel					
Standard Calculation					
Travel Expense	Employees	Cost/Trip	# of Trips		Total
					\$0.00
					\$0.00
					\$0.00

\$0.00

\$0.00

**Non-Standard Calculation**

**Total Travel** **\$0.00**

**Equipment**

**Standard Calculation**

Piece of Equipment	# of Units	Cost/Day	# of Days		Total
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\$0.00

\$0.00

\$0.00

\$0.00

\$0.00

**Non-Standard Calculation**

**Total Equipment** **\$0.00**

**Supplies/Materials**

**Standard Calculation**

Supplies/Materials		# of Items	Cost/Item	Total
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\$0.00

\$0.00

\$0.00

\$0.00

**Non-Standard Calculation**

**Total Supplies/Materials** **\$0.00**

**Printing**

**Standard Calculation**

Paper Material		# of Units	Cost/Unit		Total
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\$0.00

**Non-Standard Calculation**

		\$0.00
<b>Total Printing</b>		<b>\$0.00</b>

<b>Other Expenses</b>					
<b>Standard Calculation</b>					
Item		# of Units	Cost/Unit		Total
CWCB Grant pvt mulching		100.00	\$2,000.00		\$200,000.00
					\$0.00
					\$0.00
					\$0.00

<b>Non-Standard Calculation</b>					
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<b>Total Other</b>		<b>\$200,000.00</b>
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<b>Subtotal Direct Costs</b>	<b>\$206,320.00</b>
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<b>Cooperator Indirect Costs</b>					
Current Overhead Rate	Subtotal Direct Costs			Total	
	\$206,320.00				\$0.00
<b>Total Coop. Indirect Costs</b>					<b>\$0.00</b>

<b>TOTAL COST</b>	<b>\$206,320.00</b>
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## WORKSHEET FOR

### Cooperator In-Kind Cost Analysis Column

Use this worksheet to perform the cost analysis that supports the lump sum figures provided in the matrix.

NOTE: This worksheet auto populates the relevant and applicable matrix cells.

Cost element sections may be deleted or lines may be hidden, if not applicable. Line items may be added or deleted as needed. The Standard Calculation sections provide a standardized formula for determining a line item's cost, e.g. cost/day x # of days=total, where the total is calculated automatically. The Non-Standard Calculation sections provide a write-in area for line items that require a calculation formula that is other than the standardized formulas, e.g. instead of salaries being calculated by cost/day x # of days, costs may be calculated simply by a contracted value that is not dependent on days worked, such as 1 employee x \$1,200/contract= \$1,200. Be sure to review your calculations when entering in a Non-Standard Calculation, and provide a brief explanation of units used to make calculation, e.g. '1 month contract,' on a line below the figures.

#### Salaries/Labor

##### Standard Calculation

Job Description		Cost/Day	# of Days		Total
					\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00

##### Non-Standard Calculation

Total Salaries/Labor		\$0.00
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#### Travel

##### Standard Calculation

Travel Expense	Employees	Cost/Trip	# of Trips		Total
					\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00

##### Non-Standard Calculation

Total Travel		\$0.00
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#### Equipment

##### Standard Calculation

Piece of Equipment	# of Units	Cost/Day	# of Days		Total
					\$0.00
					\$0.00
					\$0.00
					\$0.00

##### Non-Standard Calculation

Total Equipment		\$0.00
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<b>Supplies/Materials</b>				
<b>Standard Calculation</b>				
Supplies/Materials		# of Items	Cost/Item	Total
				\$0.00
				\$0.00
				\$0.00
				\$0.00

<b>Non-Standard Calculation</b>				
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Total Supplies/Materials		\$0.00
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<b>Printing</b>				
<b>Standard Calculation</b>				
Paper Material		# of Units	Cost/Unit	Total
				\$0.00

<b>Non-Standard Calculation</b>				
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Total Printing		\$0.00
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<b>Other Expenses</b>				
<b>Standard Calculation</b>				
Item		# of Units	Cost/Unit	Total
				\$0.00
				\$0.00
				\$0.00
				\$0.00

<b>Non-Standard Calculation</b>				
---------------------------------	--	--	--	--

Total Other		\$0.00
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<b>Subtotal Direct Costs</b>	<b>\$0.00</b>
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<b>TOTAL COST</b>	<b>\$0.00</b>
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## WORKSHEET FOR

### Cash to FS Cost Analysis Column

Use this worksheet to perform the cost analysis that supports the lump sum figures provided in the matrix. NOTE: This worksheet auto populates the relevant and applicable matrix cells.

Cost element sections may be deleted or lines may be hidden, if not applicable. Line items may be added or deleted as needed. The Standard Calculation sections provide a standardized formula for determining a line item's cost, e.g. cost/day x # of days=total, where the total is calculated automatically. The Non-Standard Calculation sections provide a write-in area for line items that require a calculation formula that is other than the standardized formulas, e.g. instead of salaries being calculated by cost/day x # of days, costs may be calculated simply by a contracted value that is not dependent on days worked, such as 1 employee x \$1,200/contract=\$1,200. Be sure to review your calculations when entering in a Non-Standard Calculation, and provide a brief explanation of units used to make calculation, e.g. '1 month contract,' on a line below the figures.

Salaries/Labor					
Standard Calculation					
Job Description		Cost/Day	# of Days		Total
					\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00

Non-Standard Calculation
--------------------------

<b>Total Salaries/Labor</b>	<b>\$0.00</b>
-----------------------------	---------------

Travel					
Standard Calculation					
Travel Expense	Employee	Cost/Trip	# of Trips		Total
					\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00

Non-Standard Calculation
--------------------------

<b>Total Travel</b>	<b>\$0.00</b>
---------------------	---------------

Equipment					
Standard Calculation					
Piece of Equipment	# of Units	Cost/Day	# of Days		Total
					\$0.00
					\$0.00
					\$0.00
					\$0.00

<b>Non-Standard Calculation</b>
---------------------------------

<b>Total Equipment</b>		<b>\$0.00</b>
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<b>Supplies/Materials</b>				
<b>Standard Calculation</b>				
Supplies/Materials		# of Items	Cost/Item	Total
				\$0.00
				\$0.00
				\$0.00
				\$0.00

<b>Non-Standard Calculation</b>
---------------------------------

<b>Total Supplies/Materials</b>		<b>\$0.00</b>
---------------------------------	--	---------------

<b>Printing</b>					
<b>Standard Calculation</b>					
Paper Material		# of Units	Cost/Unit		Total
					\$0.00

<b>Non-Standard Calculation</b>
---------------------------------

<b>Total Printing</b>		<b>\$0.00</b>
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<b>Other Expenses</b>					
<b>Standard Calculation</b>					
Item		# of Units	Cost/Unit		Total
					\$0.00
					\$0.00
					\$0.00
					\$0.00

<b>Non-Standard Calculation</b>
---------------------------------

<b>Total Other</b>		<b>\$0.00</b>
--------------------	--	---------------

<b>Subtotal Direct Costs</b>	<b>\$0.00</b>
------------------------------	---------------

<b>Forest Service Overhead Costs</b>				
Current Overhead Rate	Subtotal Direct Costs			Total
				\$0.00
<b>Total FS Overhead Costs</b>				<b>\$0.00</b>

<b>TOTAL COST</b>	<b>\$0.00</b>
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## WORKSHEET FOR

### Other Federal Cost Analysis Column

Use this worksheet to perform the cost analysis that supports the lump sum figures provided in the matrix. NOTE: This worksheet auto populates the relevant and applicable matrix cells.

Cost element sections may be deleted or lines may be hidden, if not applicable. Line items may be added or deleted as needed. The Standard Calculation sections provide a standardized formula for determining a line item's cost, e.g. cost/day x # of days=total, where the total is calculated automatically. The Non-Standard Calculation sections provide a write-in area for line items that require a calculation formula that is other than the standardized formulas, e.g. instead of salaries being calculated by cost/day x # of days, costs may be calculated simply by a contracted value that is not dependent on days worked, such as 1 employee x \$1,200/contract= \$1,200. Be sure to review your calculations when entering in a Non-Standard Calculation, and provide a brief explanation of units used to make calculation, e.g. '1 month contract,' on a line below the figures.

Salaries/Labor					
Standard Calculation					
Job Description		Cost/Day	# of Days		Total
					\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00
Non-Standard Calculation					

<b>Total Salaries/Labor</b>		<b>\$0.00</b>
-----------------------------	--	---------------

Travel					
Standard Calculation					
Travel Expense	Employees	Cost/Trip	# of Trips		Total
					\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00
Non-Standard Calculation					

<b>Total Travel</b>		<b>\$0.00</b>
---------------------	--	---------------

Equipment					
Standard Calculation					
Piece of Equipment	# of Units	Cost/Day	# of Days		Total
					\$0.00
					\$0.00
					\$0.00
					\$0.00
Non-Standard Calculation					

Total Equipment		\$0.00
-----------------	--	--------

<b>Supplies/Materials</b>		
<b>Standard Calculation</b>		
Supplies/Materials	# of Items	Cost/Item
		Total
		\$0.00
		\$0.00
		\$0.00
		\$0.00

<b>Non-Standard Calculation</b>
---------------------------------

Total Supplies/Materials		\$0.00
--------------------------	--	--------

<b>Printing</b>		
<b>Standard Calculation</b>		
Paper Material	# of Units	Cost/Unit
		Total
		\$0.00

<b>Non-Standard Calculation</b>
---------------------------------

Total Printing		\$0.00
----------------	--	--------

<b>Other Expenses</b>		
<b>Standard Calculation</b>		
Item	# of Units	Cost/Unit
		Total
EWP Funding for Contractor Planning		\$30,000.00
		\$0.00
		\$0.00
		\$0.00

<b>Non-Standard Calculation</b>
---------------------------------

Total Other		\$30,000.00
-------------	--	-------------

<b>Subtotal Direct Costs</b>	<b>\$30,000.00</b>
------------------------------	--------------------

<b>Forest Service Overhead Costs</b>		
Current Overhead Rate	Subtotal Direct Costs	Total
	\$30,000.00	\$0.00
Total FS Overhead Costs		\$0.00

<b>TOTAL COST</b>	<b>\$30,000.00</b>
-------------------	--------------------

Attachment: USFS Agreement No.: Mod. No. Cooperator Agreement No.: 

**This Financial Plan may not be used to collect funds AND disburse funds on the same agreement. Separate agreements must be used in this situation.**

### Agreements Financial Plan (Medium Form) with Program Income

**1. Financial Plan Matrix:**

Note: All columns may not be used. Use depends on source and type of contribution(s).

COST ELEMENTS (Direct Costs)	FOREST SERVICE CONTRIBUTIONS		COOPERATOR CONTRIBUTIONS				(g) GROSS TOTAL BY LINE
	(a) Noncash	(b) Volunteer Labor (In-Kind)	(c) Noncash	(d) In-Kind	(e) Cash to FS	(f) Other Federal	
Salaries/Labor	\$18,750.00	\$0.00	\$6,320.00	\$0.00	\$0.00	\$0.00	\$25,070.00
Travel	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Equipment	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Supplies/Materials	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Printing	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Other	\$0.00	\$0.00	\$200,000.00	\$0.00	\$0.00	\$30,000.00	\$230,000.00
Other	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
<b>Subtotal</b>	<b>\$18,750.00</b>	<b>\$0.00</b>	<b>\$206,320.00</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$30,000.00</b>	<b>\$255,070.00</b>
Cooperator Indirect Costs			\$0.00				\$0.00
FS Overhead Assessment	\$0.00				\$0.00		\$0.00
<b>Gross Total</b>	<b>\$18,750.00</b>	<b>\$0.00</b>	<b>\$206,320.00</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$30,000.00</b>	<b>\$255,070.00</b>

Matching Costs Determination	
Total Forest Service Share =	(h)
(a+b)/(g) = (h)	0.07350923
Other Federal Contribution =	(i)
(f)/(g) = (i)	11.76%
Total Federal Share =	(j)
(h+i) = (j)	19.11%
Total Cooperator Share	(k)
[(c+d+e) = (k)	80.89%
Total	(l)
(j+k) = (l)	100.00%



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# CAMERON PEAK FIRE

## WATERSHED RESTORATION PROJECT

### STATEMENT OF WORK

---

#### ARAPAHO AND ROOSEVELT NATIONAL FORESTS AND PAWNEE NATIONAL GRASSLAND & GREELEY WATER

#### OVERVIEW

This document provides a description of the preliminary work to be accomplished through the partnership with the Forest Service and Greeley related to the watershed restoration in the Powder River Watershed.

#### TASK 1: DATA ANALYSIS, DATA COLLECTION, ANALYSIS AND PLANNING: \$122,000

Contract expert consultant(s) to complete the following tasks:

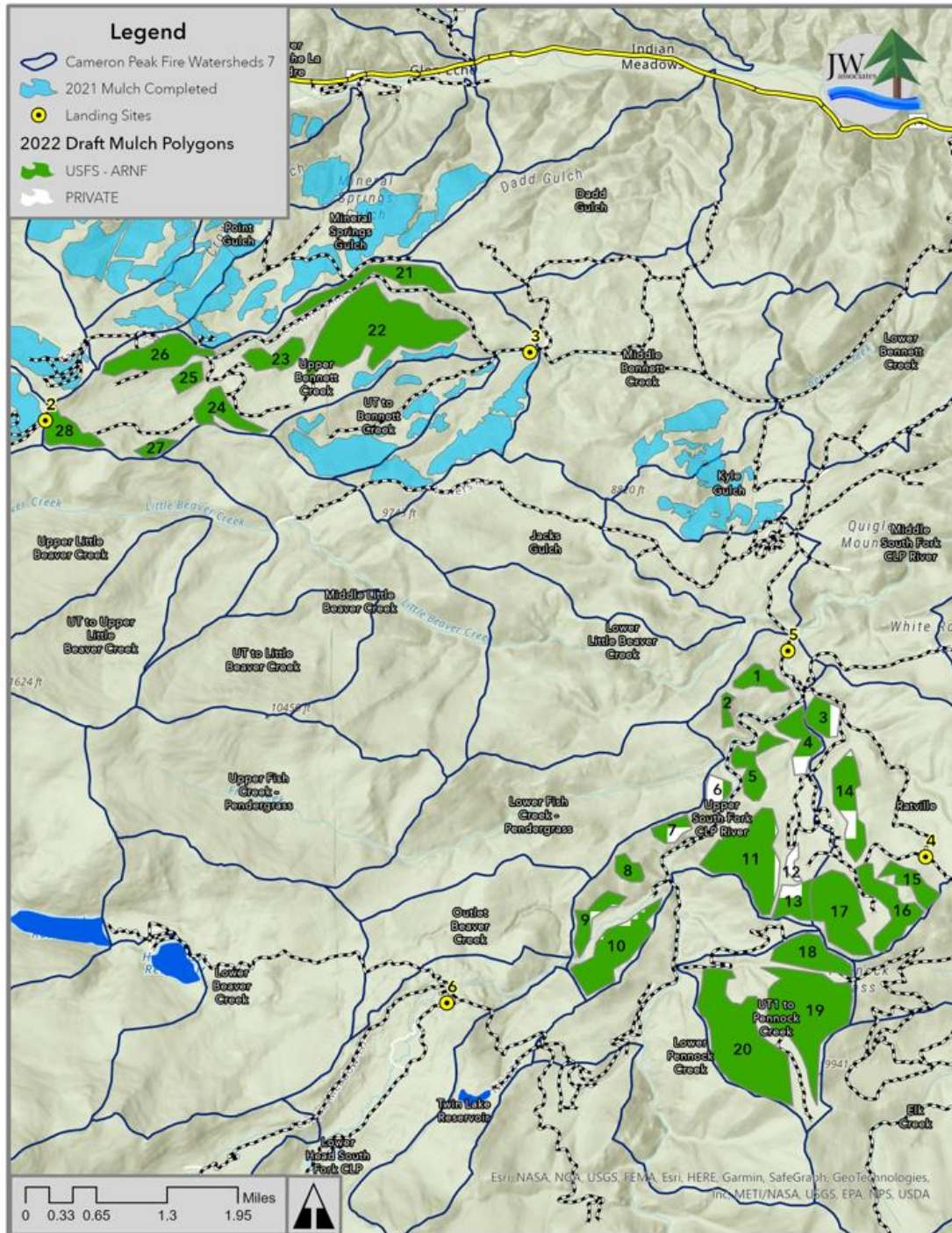
- 1) Analyze existing data, including but not limited to Soil Burn Severity Mapping, US Geologic Survey Debris Flow Study, Colorado Forest Restoration Institute Sediment Loading Study, Colorado Water Conservation Board Hydrologic Analysis, Composite Hazard Ranking, Disaster Survey Report, other USFS data sets, water quality, and precipitation data analysis. Identify data gaps. Conduct supplemental data collection to fill the gaps.
- 2) Identify watersheds (HUC 14) and stream reaches that are currently or likely to become unstable in post-fire hydrology and contribute sediment transport that would degrade water quality and/or damage infrastructure in Greeley's water supply system (also known as 'zones of concern').
- 3) Field verify mulch polygons that were identified as high priority and adjust prioritization based on findings. Inspect polygons after mulch has been distributed.
- 4) Coordinate and cooperatively plan projects that will prevent or mitigate instream and hillslope erosion and sediment transport that would degrade water quality and/or damage infrastructure in Greeley's water supply system to create the most effective and beneficial approach for all parties involved. Collaborate to develop common goals for point mitigation projects, as well as develop clear guidelines for the different mitigation features that are being proposed for future point mitigation projects and complete design of these features. Identify several point mitigation projects to evaluate for approval and start preliminary design for this season.





## TASK 2: AERIAL MULCHING OF: APPROXIMATELY 2,939 ACRES = \$5,878,000

Of the 18,000 acres identified in need of soil stabilization, approximately 2,900 acres have been identified as the highest priority and are illustrated on the attached map on units 1-28:





## IMPLEMENTATION CRITERIA FOR AERIAL MULCHING

### Wood Shreds/Wood Strands for Mulching

**Description:** Wood shreds serve to disperse rain drop energy and hold burned soil in place on moderate slopes. Wood shreds are created by mechanically grinding logs and limbs, using equipment such as a horizontal grinder and a chipper. See Figures 1 and 2 at end of this document.

**Discussion:** Research has shown wood shreds to be moderately effective in reducing hillslope erosion in the post-fire environment when applied as prescribed below (Robichaud 2013, 2010). Wood shred mulch also tends to increase soil moisture (Jonas et al. 2019). Aerial mulching is logistically demanding and expensive. See Figure 3.

#### Guidelines/Protocols:

- Wood shred mulch shall only be applied to slopes in the range of 20 to 60 percent.
- Wood shred mulch shall only be applied to areas that experienced moderate to high soil burn severity based on the most recently published fire soil burn severity map. Areas of lesser burn severity will recover quickly naturally.
- Wood shred mulch shall be applied to a depth of 1-3 inches. Deeper layers of material will hinder natural revegetation, and lighter layers are ineffective at holding soil.
- The most effective wood shreds are ground to create an average piece size of 4 inches.
- Aerial treatments are feasible on polygons greater than ten acres. Hand application may occur on smaller parcels.
- Aerial treatments must be coordinated directly with the Forest Service and will require safety documentation. The Permittee must submit a project map with times and locations of planned flights to Fort Collins Dispatch (FTC), and provide aircraft identification (make, model, color, tail number). Provide a ground contact for dispatch if airspace deconfliction is needed.
- The Permittee must call FTC at 970-295-6800 prior to flight and close out with FTC and the end of flight operations that day.
- The helicopter flight path from staging area to aerial application area must not cross a road open to the public. Landing areas must be approved by the Forest Service.
- Avoid visible raptor nests while dropping mulch loads.
- Avoid aerial application of mulch directly into or immediately adjacent to perennial or intermittent streams
- Staging areas shall be no larger than ten acres and must undergo soil rehabilitation when operations are completed. Allowable staging areas for use in wood shred creation shall be determined on a case-by case basis.
- Staging areas and mastication units shall be at least 150 feet from perennial streams, wetlands or fens.
- Burned trees may be used for the creation of wood shreds **if the product does not leave NFS lands**. Stands of dead trees to be used in the creation of mulch shall be designated solely by the Forest Service.



- Skid trail locations shall be identified by FS personnel to ensure no more than 15 percent detrimental soil disturbance in the activity unit. Dedicated skid trails will be no less than 100 feet apart.
- Skid trails shall be rehabilitated by placing woody debris on the trail.

## ACTIONS NOT ALLOWED

### Application of agricultural products and seed is not permitted authorized

Agricultural straw is not allowed to be applied as mulch, wattles, or bales for checkdams due to the likelihood of introducing invasive and/or non-native species. Further, straw mulch has a much lower efficacy rate than wood shred mulch and is easily displaced by wind (Robichaud 2021).

## REFERENCES

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## FIGURES



Figure 1. Mulch created by wood shredder



Figure 2. Wood shreds mulch



Figure 3. Mulch being applied by helicopter.



Forest Service  
U.S. DEPARTMENT OF AGRICULTURE



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# 2022 Cameron Peak Fire Recovery Work Plan – Aerial Mulching & Point Mitigation



Submitted in Partnership with:



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# Introduction

This work plan relies heavily on geospatial data to convey mitigation needs resulting from the Cameron Peak Fire. An online map with relevant layers has been generated to support this report. It can be accessed and viewed using the following link: [2022 Cameron Peak Fire Work Plan Map Series](#)

## Cameron Peak Fire

During the summer and fall of 2020, the Cameron Peak Fire burned approximately 210,000 acres of alpine forest in the Poudre River and Big Thompson watersheds (Figure 1). Exigent recovery for community needs, such as utilities, debris removal, and initial stabilization and protection, have dominated the recovery efforts during 2021 and have largely been addressed. This report focuses on a more distributed approach which leverages small improvements used in upper watershed at a variety of sites.

Wildfires affect almost all runoff processes within a watershed including infiltration, evapotranspiration, and landscape roughness, generally resulting in more rapid runoff and larger runoff volumes. This increase in runoff volumes and velocities substantially increases sediment yields (USDA, 2016). Typically, a fire-affected watershed requires 10 years to recover hydrologically from the wildfire. Because these effects are most pronounced in the first few years of watershed recovery, emergency mitigation efforts are essential to protect life, property, and valuable resources from debris flows and debris floods (Robichaud et. al., 2010).

The bulk of the Cameron Peak Fire burned on National Forest System lands (83%). Private property is typically located along the Poudre River at the outlet of burnt tributary watersheds. Because initial Federal funding efforts for mitigation were limited to private property, the implementation was focused on the downstream portions of watersheds, typically well downstream of where debris flows and floods initiate. For example, the Black Hollow debris flow, which occurred on 7/20/21, was initiated by hillslope erosion within National Forest System lands in the upper watersheds rather than slope failures (CGS, 2021). Eroded material cascaded downstream until reaching the Poudre River, killing four people and damaging adjacent infrastructure, including private property, private homes, and Colorado State Highway 14. No traditional point mitigation on downstream private property can protect these assets once the debris flow is initiated in the upper watershed.

The 2022 Work Plan utilizes two different mitigation approaches, area treatments and point mitigation, to maximize mitigation potential and watershed resiliency to high-intensity storm events. Area treatments within this report and effort will be focused on aerial wood mulch applications. Areas of high burn severity and moderate slopes provide the largest mitigation potential for aerial mulching and are the focus of this effort. Point mitigation is designed to be implemented at discrete locations along a stream or within a watershed. It is most effective when implemented in a distributed approach across small tributaries higher in contributing watersheds. The ability to implement mitigation on National Forest System lands will allow for these types of approaches to be implemented more consistently and in combination. Pairing these two mitigation strategies is likely to lead to additive benefits and improved outcomes.

## Post-Fire Stream & Water Quality Impacts

The primary objective of post-fire recovery is to reduce flood risk to life, property, and other valuable assets at risk (VAR) during the 10-year period following the Cameron Peak Fire. VARs include emergency access roads, private structures, and corresponding private utilities or infrastructure. While protection against watershed disturbances on private property can reduce the risk and impacts, area treatment and distributed point mitigation features in the upper tributary channels, mostly on National Forest System lands, will have a larger impact. This is particularly true when mitigating against debris flows initiated by hillslope erosion. These events generally occur within 2-3 years post-fire and can initiate during as little as a 2-year recurrence interval storm event (Parise & Cannon, 2011). Because these types

of debris flows initiate across an entire watershed, the approach outlined in this Work Plan is the most applicable mitigation tactic. Roadway infrastructure is the most vulnerable and proximal infrastructure being addressed with this Work Plan and mitigation effort. However, mitigation activities will support all downstream users and VARs as described later in this report.

The main secondary objective is to mitigate water quality impacts resulting from the increased sediment influx from fire-affected basins tributary to the Poudre River and Big Thompson River. Several communities, including City of Fort Collins, City of Greeley, and City of Loveland, rely on the Poudre and Big Thompson Rivers for municipal water supply. Increased sediment inputs will likely result in additional intake shutoffs, increased treatment costs, and degraded water quality for communities across northern Colorado, as seen during 2021. During 2021, all water providers were unable to treat water from post-fire watersheds for prolonged periods due to degraded water quality. In addition, increases in sediment yield can harm local fish habitat and species (Short et al., 2015). Proposed point mitigation and aerial mulch would increase sediment and debris deposition and storage within the tributaries systems to reduce these impacts to downstream systems.



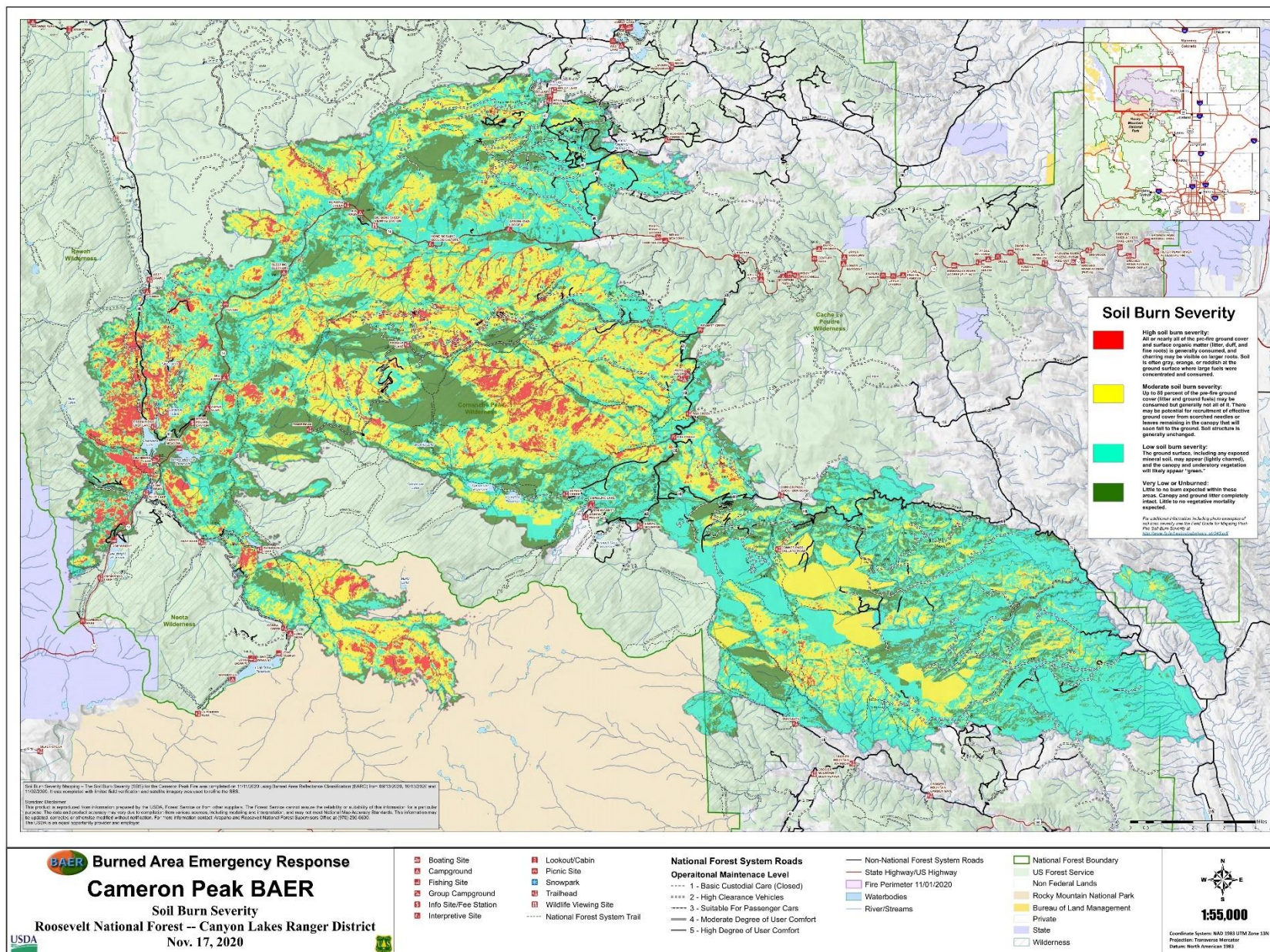


Figure 1: Cameron Peak Fire BEAR Soil Burn Severity (SBS) Map. The USFS has updated portions of the SBS mapping since the initial release. We will use the updated mapping in addition to recent aerial imagery and field verification efforts to prioritize watersheds for treatment.



The three main localized drivers of increased sediment yield to streams and large river systems post-fire are:

**Hillslope Erosion to Streams** – The removal of protective vegetation due to forest fires results in the destabilization of soils and soil structures (USDA, 2016). Hillslopes are stabilized and protected by a combination of forest canopies, intercepting rain drop impacts, root structures, holding soil particles in place, and forest litter, dampening sheet flow velocities. Destabilized soils are more vulnerable to increase runoff volumes caused by reduced evapotranspiration, raindrop interception, and infiltration. This increased vulnerability and runoff volume combine to create massive rilling on burnt hillslopes which mobilizes sand, silt, and ash into adjacent river systems to be transported downstream. An example of hillslope erosion is shown in **Figure 2**.



**Figure 2: Hillslope rilling and erosion has caused local deposition in riparian environment in the Black Hollow watershed.**

As mentioned previously, upland (hillslope) erosion is a common trigger for debris flows and in-channel erosion in post-fire watersheds immediately after a burn event (Parise & Cannon, 2011). Hillslope erosion of disturbed sediments creates a positive feedback loop that can build immensely powerful and destructive debris flows. During a rainfall event, fine-grained sediment is entrained in overland sheet flow. This sediment increases the density of the runoff, increasing its ability to entrain larger sediment and bulking the flows. In steep mountain watersheds, hillslope sheet flow consolidates in channels, initiating in-channel erosion and entrainment of debris. These processes continue until a debris flow threshold is crossed, at which the debris flow will continue downstream until a reduction in slope causes most of the material to fall out of suspension (Parise & Cannon, 2011). At this point, the debris flow will likely transition to a mudflow and traditional flood event that can still damage and negatively impact communities far downstream.

**Stream Incision and Headcutting** – As discussed previously, wildfires result in more discharge and peak flows in stream systems. Increases in flow is more pronounced in smaller systems where high-severity burn can dominate contributing areas. In addition, runoff generating events are more common after a fire causing channel heads, topographic inflection points that mark the transition from hillslope to channel flow, to migrate upstream through incision and downcutting. Downcutting can degrade and destroy valuable riparian and wetland habitat. Headcuts occur when hydraulic forces overcome surface resistance which is



**Figure 3: An example of headcutting and resulting incision in a post-fire watershed.**

influenced by sediment size and vegetation stabilization (Wohl, 2014). Since vegetation resistance is lost during a wildfire, headcuts are more likely to trigger and less likely to stabilize in a post-fire watershed. Headcuts result in significant sediment pulses transported downstream and may impact vulnerable habitat and infrastructure. An example of headcutting in a fire affected watershed can be seen in **Figure 3**.

**Roadway Drainage** – The increase in runoff associated with post-fire hydrology is likely to overwhelm existing road drainage infrastructure leading to instability and increased sedimentation to creeks and riparian environments. This indirect impact is even more pronounced on National Forest System lands where lower standard roads on steeper slopes can contribute erosion into drainages. This funding will also focus on improving roads that are desired and planned for access into non-wilderness areas and stabilizing legacy roads that can increase sedimentation. An example of a washed-out road is depicted in **Figure 4**.



**Figure 4: Road damage resulting from increased runoff generated in a post-fire watershed during a 2021 summer storm event.**

**Impacts to Downstream Communities** - These localized processes initiate significant flood events with debris and sediment that increases the destructive potential of these flows and degrades water quality for all downstream users and communities. City of Greeley could not use a total of 980 acre-feet of diverted degraded water from the Poudre River over a total of 40 days during 2021. City of Greeley Water Resources estimates \$134 million dollars in additional costs associated with post-fire water quality impacts over the 10-year recovery if no mitigation is implemented in burned watersheds. Other impacted municipalities include City of Fort Collins, City of Loveland, Town of Windsor, and City of Laramie. Post-fire water quality degradation will likely lead to high maintenance costs, interrupted operations, lost revenue, higher treatment costs, and uncertainty in water resource supplies and needs.

While the most dramatic impacts to infrastructure occur directly downstream of small high burn tributary channels during high-intensity rain events, large-scale flood events are also influenced by post-burn hydrologic adjustments. In 2013, regional flooding along the Front Range was worsened along the Poudre River due to the recent High Park Fire (2012) and its impacts to the watershed. Large rain events in post-fire watersheds lead to increased peak flows which can overwhelm populations centers along the Front Range, leading to costly. Mitigation aimed at dampening the impacts and enhancing recovery are invaluable to the long-term management of burned forest and Front Range communities.

## Cameron Peak Fire Mitigation Strategy

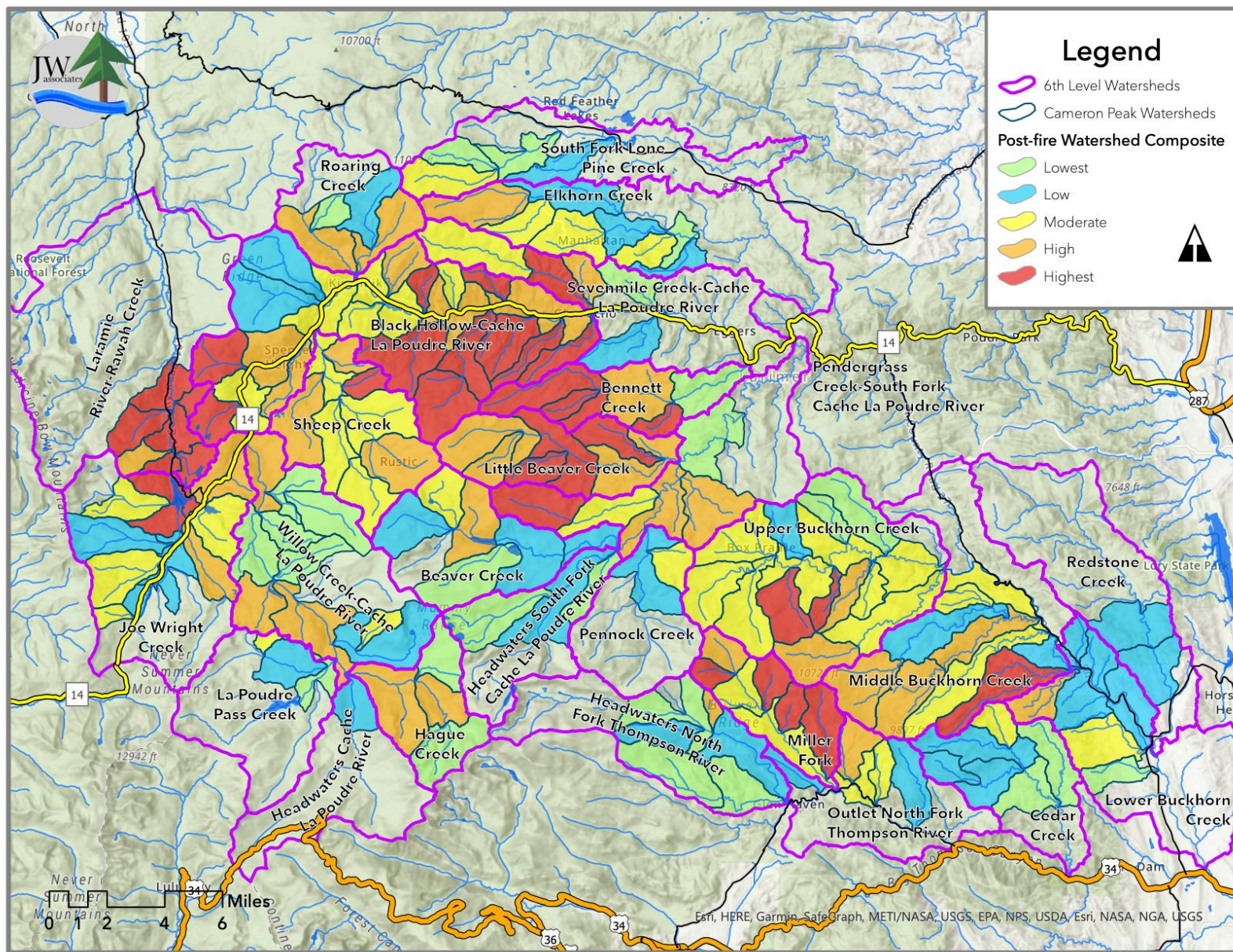
### Watershed Prioritization

Small watersheds (Seventh-level or HUC14) were delineated by JW Associates with the goal of identifying and prioritizing hazards that would be targets of post-fire mitigation actions. These watersheds were analyzed and ranked based upon the following hazard components;

1. Soil Burn Severity (SBS)
2. Hillslope Erosion
3. Debris Flow
4. Road Composite

The Post-fire Composite Hazard Ranking combines the first four components by combining their rankings for each small watershed and then re-categorizing the results. The Post-fire Composite Hazard Ranking is being used as a basis for prioritizing and targeting small watersheds for post-fire treatments. The results of this calculation were ranked from 1 (lowest Post-fire Composite Hazard) to 5 (highest Post-fire Composite Hazard) to create the Post-fire Composite Hazard Ranking. Based upon this analysis, there are 34 small watersheds that received a Post-fire Composite Hazard Rank of Highest (**Figure 5**).







## Area Treatments - Post-Fire Mulch Mitigation

Mulching is one of the most effective post-fire treatments (Robichaud et al. 2010 and Robichaud et al. 2013) and is primarily effective at reducing hillslope erosion. It has been shown to reduce rainfall splash and surface runoff, increase soil moisture and, consequently, improve revegetation. Wood mulch has been increasingly used in as a post-fire treatment in Colorado, including after the High Park Fire (2012). Unlike agricultural straw mulch, which can bring invasive weeds and can be moved off site by wind during dry weather, wood mulch can be made from trees burned in the fire, thereby minimizing the risk of introducing any noxious plants or foreign materials. It is also less prone to being blown off-site during windy periods. Wood mulch applied in burned areas following the High Park Fire survived the 2013 Flood, where 12 inches of rain fell in two days. Wood mulch also helps promote plant and tree recovery and can enhance soil protection for several years post-fire (Jonas et al. 2019).

Mulching, shown in **Figure 6**, also reduces rapid overland flow on moderate and high burn severity soils, thereby reducing post-fire peak flows from rainfall events. Mulch used in combination with other treatments in channels or further downstream, the strategy laid out in this Work Plan, can increase the effectiveness of the combined treatments. In general, mulch is recommended to be used when there is a large percentage of a watershed that contains moderate and/or high burn severity and there is a value at risk downstream.

Initial estimates of the amount and locations for mulch treatments were completed for the Cameron Peak Fire burned area. These treatments are directed at minimizing the post-fire effects on downstream VARs and water suppliers downstream of the burned watersheds. The estimates were made using the following criteria;



**Figure 6: Wood Mulch Application in High Park Burned Watershed**

1. Slopes between 20-60 percent were identified in the burned area.
2. Areas identified as moderate and high soil burn severity were delineated within those slopes.
3. Polygons were created from contiguous areas from steps 1 and 2 above to identify the potential mulching areas.

Polygons were accumulated within watersheds (HUC14) that were identified as high and highest post-fire hazard.

## Post-Fire Point Mitigation

As mentioned previously, point mitigation is intended to be placed at a discrete location in a stream or watershed. The location is determined by upstream burn and watershed characteristics as well as equipment access. Typically, point mitigation is proposed at locations in which the contributing watershed has been identified during prioritization efforts and the impacts are expected to threaten VARs and degrade stream habitat and water quality. Additionally, point mitigation should be employed in areas that are at risk of encroachment from downstream stream instability that will migrate upstream and degrade stream habitat, threaten VARs, or degrade water quality with mass erosion.

The prioritization between individual sites included in this Work Plan will need to be completed once site evaluations are conducted and the scope of the total funding is in place. Because the limiting factor to



work is likely to be access, this will play a large role in the final selection of mitigation sites. Other factors to be included in the next phase of prioritization will be downstream VARs, upstream valuable habitat, stream vulnerability, and stream degradation.

While this Work Plan highlights areas with potentially appropriate access and need, it is important to understand that the mitigation proposed in this report will be altered to fit each site specifically based on the geomorphic controls, upstream fire-impact, available on-site material, stakeholder inputs, and access. The concepts and mitigation techniques described below have been applied to a wide range of post-fire environments and are designed to provide decadal stability during large thunderstorm events in post-fire watersheds. The intention is to use on-site and native materials when possible and to create subtle and hidden features that function during storm events while enhancing the natural recovery.

These concepts will likely go through several phases of adjustment to satisfy the needs of the US Forest Service and private property owners impacted. Adjustments will be made based on site visits with the project team to meet the design intent and limit the impact to alpine, riparian, and forest habitat. While the planning and prioritization of these projects will take place in 2022, it is also likely that construction efforts may extend in to 2023. However, because the impact of wildfire is most pronounced in the first few years of recovery, the goal will be to complete high priority areas as soon as possible.

### Point Mitigation Concepts & Features

The conceptual design for each of the features described below can be found in **Appendix A** of the submittal package. Again, these designs are likely to alter with stakeholder input and site evaluations, but the processes, goals, and intentions will remain the same.

**Armored Drainage Crossing** – This feature is designed to convert an existing culvert crossing to an armored ford that will also act as stabilization features for the stream system. The lack of a culvert adds resiliency to the system while offering opportunities for upstream sediment storage. A large upstream and downstream apron of rock allows for flows to overtop the feature without causing total failure to the embankment. These structures rely on imported riprap and smaller rock to limit the disturbance and impacts. Fish passage will need to be examined at each site to limit impacts to aquatic species.

**Large Wood Material (LWM) Stabilization** - This feature is ideal for stream stabilization in smaller tributaries or ephemeral streams. Burnt wood material that remains structurally sound will be sourced on-site during clearing. This wood is pinned together and buried several feet into the channel to slightly above existing grade to facilitate deposition. The LWM will be ballasted with boulder material sourced on-site. An example of those installed in 2021 in series is shown in **Figure 7**.



**Figure 7: LWM Stabilization installation constructed in the Fall of 2021 in the CLP watershed.**

**Rock Stabilization** – These features are intended to stabilize larger, wider tributary creeks affected by post-burn impacts such as headcutting and incision. Typically, native rock is harvested during the excavation and construction of adjacent features, including LWM stabilization or Armor Drainage Crossings. The larger boulders, if available, are to be used for the apex rocks which are subjected to the bulk of the hydraulic forces, while 9- to 24-inch material is used in the wings and splash rock of the structure. The wings of the structure slope down towards the center, consolidating flows and mitigating channel widening. A complete rock stabilization structure can be seen in **Figure 8**.



**Figure 8: Rock Stabilization downstream of a fire-impact watershed. Installed during 2021 mitigation efforts.**

**Log Jams** – Jams will be installed far upstream of most project areas to create depositional opportunities while intercepting debris. These jams will be stabilized with large rock, buried into the banks, or anchored to other standing and stable trees. They are intended to provide a key log that will initiate and enhance wood recruitment at the location of installation. These features require time to fully develop but should provide long-term habitat and channel heterogeneity. **Figure 9** shows a Log Jam installation enhanced with a temporary wattle.

**Riparian Revegetation** – Recovery of riparian areas is vital to the recovery of water quality. Revegetation will increase sediment accumulation and storage in fluvial systems and will accelerate watershed recovery while improving water quality (Pollock et al., 2014). Primarily, this will be accomplished through native willow harvesting and staking. In wetland areas, willow wattles or willow fences will also be installed to reverse the effects to downcutting and incision.





**Figure 9: A log jam installed and enhanced with a wattle during Fall 2021 mitigation.**

**Road Drainage Improvements** – As mentioned previously, poorly maintained roadways can increase sedimentation inputs and erosion concerns in tributary streams. Removing abandoned roads and improving desired roads can limit their impact on water quality. Armored drainage crossings and roadside swales are a part of this work. However, the main concept to be deployed in this effort are water bars. This feature consolidates on road sheet flow and conveys it across the road down slope to an armored location to reduce riling and erosion.

**Hillslope Wattles** – Laying approved biodegradable wattles parallel to contours is an effective way to generate several cubic feet of deposition space on vulnerable hillslopes. This concept will be used in small areas where aerial mulching is impractical. It was deployed during the Fall of 2020 in the areas surrounding Chamber Lake with success (**Figure 10**).





Figure 10: Hillslope wattles creating significant deposition and storage on vulnerable hillslopes just upstream of Chambers Lake.

Mitigation Technique	Hillslope Erosion	Stream Incision	Road & Crossing Damage
Armored Drainage Crossing		X	X
LWM Stabilization		X	X
Rock Stabilization		X	X
Log Jams		X	X
Riparian Revegetation	X	X	X
Hillslope Wattles	X		X
Road Drainage Improvements	X	X	X

Table 1: A table showing the benefits of each mitigation strategy compared with the hazards in post-fire watersheds.

## 2021 Funding & Mitigation Projects

The mitigation strategy described previously was deployed during the initial mitigation efforts and activities that took place immediately after the Cameron Peak Fire. Initial funding for post-fire recovery was provided from an assortment of governments including local municipalities, Colorado Water Conservation Board (CWCB), and the Natural Resources Conservation Service (NRCS). This mitigation effort focused on aerial mulching and point-based mitigation to reduce and protect against the post-fire impact to water users and private properties within or downstream of the burn area. The goals of the aerial mulching and point migration funded and completed was to reduce hillslope erosion, enhance sediment deposition, and protect VARs from flood and debris damage. Approximate total funding for the aerial mulching is \$14.5 million and was completed in 2021. The total funding for the point mitigation effort

is roughly \$3 million to be completed in Spring 2022. Each watershed of focus during the 2021 Mitigation is outlined in the Online Map Series ([2022 Cameron Peak Fire Work Plan Map Series](#)).

## 2021 Aerial Mulching

A number of targeted watersheds were partly or fully treated with aerial wood mulch in 2021. A total of 5,805 acres in 10 priority watersheds were mulched in 2021 (**Table 2**). These treatments addressed some of the top priorities for watershed protection, but substantial watershed protection needs remain unaddressed. The Poudre River Watershed was the focus on 2021 Post-Fire Mitigation because the bulk of the burn was in this watershed, and there are more water supply users impacted within the Poudre River. However, the Big Thompson also had work completed as described below:

**Table 2: Priority Watersheds Treated with Wood Mulch in 2021**

Watershed	Acres
Peterson Lake	219
Barnes Meadow Reservoir	226
Crown Point Gulch	426
Mineral Gulch	460
Sheep Creek	699
Bennett Creek	848
Black Hollow	1,371
Roaring Creek	802
Miller Fork – Big Thompson	406
Black Creek – Big Thompson	348
<b>Total</b>	<b>5,805</b>

## 2021 Point Mitigation

### Cache La Poudre River Watershed

The 2021 point mitigation efforts were successful in repairing flood damage that occurred during the 2021 monsoon season. However, these projects have yet to be tested during large flow events. The projects have successfully enhanced deposition of baseflow sedimentation and rely on mitigation techniques that have proven successful in past EWP efforts including the 2018 Spring Creek Fire Recovery and the 2013 Front-Range Flood Recovery. Additional revegetation work is planned for all the project during the Spring of 2022 to further enhance the resilience of the structures and overall recovery of the riparian areas.

The point mitigation sites complete or funded during the 2021 mitigation effort are listed below with a brief description of the work. For more information, please request and refer to the Design Report and Deliverables package prepared for the NRCS at each site and subwatershed.



- **Dry Creek (Complete 2021)** – Structure protection (**Figure 11**) and stream stabilization features were installed on private property just north of CO14 at Dry Creek. Features include log jams, flood diversion barriers, channel grading, willow staking, and woody vegetation clearing.



**Figure 11: Structure & Road Overtopping Protection at Dry Creek. The area will be stabilized with native vegetation Fall 2021.**

**Black Hollow (In Progress 2021 & 2022)** – On July 20, 2021, a debris flow occurred in this watershed because of a high-intensity rain event. The resulting deposition and damage is shown in **Figure 12**. More than half of the 13 structures were destroyed and four people were killed during this event. Large-scale stabilization and protection efforts will be implemented in late Fall of 2021 and early Spring 2022. Efforts focus on mitigating the impact of the July 2021 event and facilitating conveyance of flood flows and sediment to the Poudre River. Features included in this stabilization effort are rock stabilization, LWM stabilization, grading, and riparian revegetation. Additionally, the lower portion of the Black Hollow channel realigned during the July 2021 event and cause adverse impacts to a structure upstream of the confluence with the Poudre River. Grading and diversion barriers were used to protect this structure.



**Figure 12: Black Hollow Fan following the 7/20/21 debris flow caused by a summer thunderstorm on fire affected watershed.**



- **UT3 (Complete 2021)** - Structure protection, stream stabilization, roadway access protection, and diversion features were installed on private property just south of CO14 near the Fish Hatchery. Features include LWM stabilization, flood diversion barriers, diversion channels, armored crossing, willow staking, and woody vegetation clearing.
- **Sheep Creek (Norman Fry Road) (Complete 2021)** - Structure protection, stream stabilization, roadway access protection, and diversion features were installed on private property just south of CO14 near Poudre Fire House #2. Features include LWM stabilization, flood diversion barriers, diversion channels, armored crossings (**Figure 13**), willow staking, road drainage improvements, and woody vegetation clearing.



**Figure 13: An Armored Drainage Crossing completed at Sheep Creek.**

- **MM87 (Complete 2021)** – A small drainage just west of Black Hollow and north of CO14 has had several mudflows this year that has blocked CO14 and threatened private property. Structure protection, stream stabilization, diversion channels, and diversion features were installed on private property. Features include rock stabilization, flood diversion barriers, and diversion channels.
- **Crown Point Gulch (Construction 2022)** - Structure protection, stream stabilization, roadway access protection, and diversion features will be installed on private property just south of CO14 and west of Rustic. Features include LWM stabilization, flood diversion barriers, diversion channels, armored drainage crossing, willow staking, road drainage improvements, and woody vegetation clearing.
- **Roaring Creek (Construction 2022)** - This large drainage is home to a community of private property adjacent to its confluence with the Poudre River. Structure protection, stream stabilization, diversion channels, and diversion features are to be installed on private property. Features will include rock stabilization, flood diversion barriers, bank stabilization, and diversion channels.
- **Boston Peak Creek (Construction 2022)** – On August 1, 2021, a debris flow occurred in this watershed because of a high-intensity rain event. No structures were destroyed. However, a

large amount of material was deposited on private property and adjacent to structures. Structure protection, stream stabilization, diversion channels, and diversion features are to be installed on private property. Features implemented will include LWM stabilization, flood diversion barriers, diversion channels, road drainage improvements, and riparian revegetation.

- **Little Beaver (Construction 2022)** – A historic structure owned by City of Greeley will be protected at this site just west of Pingree Park Road. Features include flood diversion barriers and diversion channels. Additionally, wetland rehabilitation was completed in 2021 with the Coalition for the Poudre River Watershed (CPRW) to valuable wetland habitat along Jacks Gulch, a tributary to Little Beaver.
- **Fish Creek (Construction 2022)** - A large drainage with two structures in need of protection, this watershed was severely burned. Structure protection, stream stabilization, and crossing improvements will be implemented on the site. Features include LWM stabilization, flood diversion barriers, and riparian revegetation. Additionally, hand-crew mitigation was completed with CPRW along ephemeral channels in 2021.
- **Peterson Lake Road (Construction 2022)** – Crossing improvements including a trash rack and road armoring are to be constructed in the Spring of 2022 to maintain access to Peterson Lake.
- **Mainstem Poudre (Construction 2022)** – During the spring of 2022, outreach and modeling will be used to determine additional structure protection that is required to protect from potential post-fire flooding on the Poudre River. Flood diversion barriers will be primarily used to achieve the required protection. This effort will include specific areas such as Spencer Heights, Poudre Park, and other larger community in the Poudre River Canyon.

### Big Thompson Watershed

The Big Thompson portions of the Cameron Peak Fire are smaller, but more densely populated with county roads. Point mitigation efforts in 2021 have focused on county road improvements, specifically in Black Creek and Miller Fork. The Retreat is a community of private homeowners that resides on Black Creek and Miller Fork which are tributaries to the North Fork Big Thompson River. Both watersheds were severely burned from the Cameron Peak Wildfire and have since seen a lot of damage resulting from post-fire increases in runoff and sediment loads. During the first year of recovery efforts, Larimer County and the Big Thompson Watershed Coalition have funded work to achieve the following goals:

- Restore access to residents along Black Creek
- Culvert upsizing and road repairs along Buckhorn Creek and Buckhorn Rd.
- Replace three major culvert crossings with larger culverts for increased capacity and adding overtopping protection to prevent future failure
- Remove minor culvert crossings along Black Creek and replace them with armored drainage crossings
- Installing debris racks at strategic locations to help protect against debris jams inside the remaining culverts.
- Installing flood barrier bags and diversion berms to help protect properties from future events
- Installing sediment catchment areas

The constructed projects have primarily focused on repairing damaged roads, culverts, and crossing along county roads and private roads maintained by the Larimer County.

Aerial mulching has also been completed in portions of the watershed to mitigate runoff and improve water quality. The combination aerial mulching on hillslopes and point mitigation in the channel will allow for a more complete recovery effort. These two mitigation approaches will likely function with additive benefits enhancing the overall function and recovery. More mulching is proposed as a large part of the



mitigation efforts for 2022 and can be reviewed in *Cameron Peak Fire 2022 Mulch Treatment Areas & Priorities*.

## Need, Quantities, and Costs By Subwatershed

Initial estimates of the amount and locations for mulch treatments were completed for the Cameron Peak Fire burned area by JW Associates in 2021. These values and prioritizations will be updated along with the updates to the Soil Burn Severity (SBS) data which are occurring now in collaboration with the U.S. Forest Service. The same criteria listed earlier was used to generate the proposed 2022 aerial mulching. These treatments are directed at minimizing the post-fire effects on downstream VARs and water suppliers downstream of the burned watersheds.

For the 2022 Point Mitigation Work Plan, areas within the Cameron Peak Fire were analyzed and conceptual designs were drafted based on experience in the area and desktop analysis. Support data sets included topographic information, soil burn severity, existing road data, and hydrology information developed by Colorado Water Conservation Board (CWCB) for the Cameron Peak Fire. The two largest hurdles for point mitigation practicality at any given site are the existing access to the location and the severity of the burn in the contributing watershed.

These areas will all need initial site investigations before a determination can be made on the exact point mitigation strategy, cost, and priority. Based on experiences in other Colorado Front Range fire mitigation, the need is likely more extensive in these areas than determinable from desktop analysis. Additionally, more sites will likely be added during investigations as needs are better characterized and prioritized in the field.

For this proposal, the areas of interest have been broken into four main regions within the Cache La Poudre and Big Thompson Watershed. These can be viewed using the [2022 Cameron Peak Fire Work Plan Map Series](#). These areas are each made up of several tributary watersheds that have experienced varying burn severities but are likely to need further rehabilitation and stabilization during the post-wildfire hydrologic recovery period.

## Implementation Quantities & Costs

The supporting Online Map ([2022 Cameron Peak Fire Work Plan Map Series](#)) shows the exact locations of the area treatment polygons and point mitigation features, including log jams, LWM stabilization, rock stabilization, and armored drainage crossings. It also highlights areas for riparian revegetation and hillslope wattle installation. Road improvements were estimated using the total mileage of existing Forest Service Roads assuming approximately a water bar installation every ¼ mile (\$14,000/mi). While these are not broken down by specifically and likely won't until detail conversation with the Forest Service, estimates by region are shown in **Table 12**.

Costs used in the 2022 Work Plan were sourced from unit pricing approved during the construction phase of the 2021 Western Cameron Peak Fire EWP – City of Greeley project and the 2021 Aerial Mulching effort. Willow staking was assumed to be one stake approximately every 4 SY throughout the specified areas. Hillslope wattles were assumed to be installed at a rate of 1210 LF/acre and installations should be focused on lower portion of burnt hillslopes. Road Drainage Improvements were assumed to be \$14,000 per mile of Forest Service Roads based on available GIS data. A large focus of the planning will be working with stakeholders to determine the exact condition of roadways as well as the desire to provide long-term maintenance on existing roads. The aerial mulching costs, \$2,500/acre, were determined based on 2021 wood mulching operation and implementation costs.

**Tables 3 through 10** provide both the quantities and costs of mulching and point mitigation in each region by subwatershed. The subwatersheds are color coded according to the prioritization rank and consistent with the Online Map Series and are:

- Lowest – Green
- Low – Blue
- Moderate – Yellow
- High – Orange
- Highest – Red

## Northern CLP

The northern portion of the Cache La Poudre Watershed experienced large swaths of low and moderate burn areas with pockets of high severity burn. The major tributaries systems are Sevenmile Creek, Manhattan Creek, Washout Gulch, Swamp Creek, and Elkhorn Creek. Several subwatershed within each of these areas have been identified for mitigation. Proposed mulching locations and areas with a combination of point mitigation and aerial mulching are shown in **Table 3**. Point Mitigation features and proposed quantities by watershed are shown in **Table 4**.

### Regional Values At Risk:

- **Roadways:** CO-14; CR-69; CR-68C; NF-225; NF-517.
- **Private Property:** Shambhala Mountain Center; Manhattan Community (13 structures); Elkhorn Creek Property Owners (11 structures).
- **Drinking Supplies:** City of Fort Collins, City of Greeley, Tri-Districts (North Weld, Eastern Larimer County, Fort Collins – Loveland Water District), Northern Water, Irrigation Companies, and Private Users.

**Table 3: Northern CLP Region proposed aerial mulching acres in non-wilderness & wilderness areas by subwatershed, including percent burn area treatment, cost, and combination with Point Mitigation.**

Northern CLP Region Watersheds	Total Mulch Non-Wilderness (acres)	Total Mulch Wilderness (acres)	Moderate & High Soil Burn Severity (acres)	Burned Area Treated (%)	Estimated Cost (\$)	Point Mitigation in Combination?
Boston Peak Creek	567	0	1,012	56%	\$1,417,500	Yes (2021)
Lower Upper BH - CLP	585	0	1,180	50%	\$1,462,500	No
Dry Creek	235	0	481	49%	\$587,500	Yes (2021)
Upper Sevenmile Creek	314	0	1,647	19%	\$785,000	Yes
UT2 to BH - CLP	159	0	486	33%	\$397,500	No
<b>Totals</b>	<b>1,860</b>	<b>0</b>	<b>4,806</b>	<b>39%</b>	<b>\$4,577,500</b>	

**Table 4: Proposed Point Mitigation Features in subwatersheds within the Northern Region of the CLP including cost and quantity. The unit prices reflect 2021 data.**

Northern CLP Region Watersheds	Armored Crossing (EA)	LWM Stabilization (EA)	Rock Stabilization (EA)	Log Jams (EA)	Willow Staking (AC)	Hillslope Wattles (AC)	Total Cost by Subwatershed (No Road Improvements)
<b>2021 Unit Prices</b>	<b>\$30,000</b>	<b>\$3,112</b>	<b>\$6,000</b>	<b>\$1,200</b>	<b>\$10,285</b>	<b>\$5,445</b>	
Headwaters Elkhorn Creek	1 (\$30,000)	2 (\$6,224)	3 (\$18,000)	5 (\$6,000)	0 (\$0)	0 (\$0)	<b>\$60,224</b>
Lower Manhattan Creek	0 (\$0)	0 (\$0)	3 (\$18,000)	1 (\$1,200)	4 (\$41,140)	0 (\$0)	<b>\$60,340</b>
Lower Sevenmile Creek	5 (\$150,000)	6 (\$18,672)	5 (\$30,000)	4 (\$4,800)	4 (\$41,140)	0 (\$0)	<b>\$244,612</b>
Swamp Creek	0 (\$0)	0 (\$0)	0 (\$0)	0 (\$0)	6 (\$61,710)	0 (\$0)	<b>\$61,710</b>
Upper Elkhorn Creek	0 (\$0)	3 (\$9,336)	3 (\$18,000)	1 (\$1,200)	0 (\$0)	5 (\$27,225)	<b>\$55,761</b>
Upper Sevenmile Creek	1 (\$30,000)	1 (\$3,112)	4 (\$24,000)	3 (\$3,600)	0 (\$0)	0 (\$0)	<b>\$60,712</b>
UT5 to Elkhorn Creek	2 (\$60,000)	0 (\$0)	3 (\$18,000)	1 (\$1,200)	0 (\$0)	0 (\$0)	<b>\$79,200</b>
Washout Gulch	0 (\$0)	0 (\$0)	0 (\$0)	2 (\$2,400)	0 (\$0)	0 (\$0)	<b>\$2,400</b>
<b>Totals &amp; Feature Construction Costs</b>	<b>9 (\$270,000)</b>	<b>12 (\$37,344)</b>	<b>21 (\$126,000)</b>	<b>17 (\$20,400)</b>	<b>14 (\$141,550)</b>	<b>5 (\$27,225)</b>	

## Western CLP

The Cameron Peak Fire was initiated in the western portion of the Cache La Poudre Watershed. While this area of access in this region is smaller in size, it experienced large swaths of high severity burn primarily in the area surrounding Chambers Lake, including Sawmill Creek and Joe Wright Creek, the Laramie River Headwaters, Trapp Creek, and Peterson Lake.

Mulching is proposed along the Mainstem of the Poudre River, Joe Wright Creek, Tunnel Creek, Tributaries to Sheep Creek, and Twin Lakes (**Table 5**). No areas are conducive to the combination of point mitigation and aerial mulching due to the steep terrain, limited access points, and expansive wilderness areas. Several of the tributaries in the Laramie River Valley have been prioritized for point mitigation and rehabilitation using the access along Skyline Ditch and County Road 103 (**Table 6**).

### Regional Values At Risk:

- **Roadways:** CO-14; Long Draw Rd.; NF-159.; CR-103;
- **Water Resource Infrastructure:** Skyline Ditch; Chambers Lake; Peterson Lake; Rawah and Lower Supply Ditch; Laramie-Poudre Tunnel
- **Drinking Supplies:** City of Fort Collins, City of Greeley, City of Laramie, Tri-Districts (North Weld, Eastern Larimer County, Fort Collins – Loveland Water District), Northern Water, Irrigation Companies, and Private Users.

**Table 5: Western CLP Region proposed aerial mulching acres in non-wilderness & wilderness areas by subwatershed, including percent burn area treatment, cost, and combination with Point Mitigation.**

Western CLP Region Watersheds	Total Mulch Non-Wilderness (acres)	Total Mulch Wilderness (acres)	Moderate & High Soil Burn Severity (acres)	Burned Area Treated (%)	Estimated Cost (\$)	Point Mitigation in Combination?
Upper Upper BH - CLP	678	0	1,012	56%	\$1,695,000	No
Twin Lakes	396	0	1,180	50%	\$990,000	No
Tunnel Creek	501	0	481	49%	\$1,252,500	No
Lower Joe Wright Creek	803	0	1,647	19%	\$2,007,500	No
Headwaters BH - CLP	622	0	486	33%	\$1,555,000	No
UT2 to Sheep Creek	0	847	1,175	47%	\$2,117,500	No
<b>Totals</b>	<b>3,000</b>	<b>847</b>	<b>5,980</b>	<b>42%</b>	<b>\$7,500,000</b> <b>\$2,117,500</b>	

**Table 6: Proposed Point Mitigation Features by subwatersheds within the Northern Region of the CLP including cost and quantity. The unit prices reflect 2021 data.**

Western CLP Region Watersheds	Armored Crossing (EA)	LWM Stabilization (EA)	Rock Stabilization (EA)	Log Jams (EA)	Willow Staking (AC)	Hillslope Wattles (AC)	Total Cost by Subwatershed (No Road Improvements)
<b>2021 Unit Prices</b>	<b>\$30,000</b>	<b>\$3,112</b>	<b>\$6,000</b>	<b>\$1,200</b>	<b>\$10,285</b>	<b>\$5,445</b>	
Laramie Lake	0 (\$0)	3 (\$9,336)	0 (\$0)	1 (\$1,200)	0 (\$0)	0 (\$0)	\$10,536
Lower Laramie River-Rawah Creek	0 (\$0)	0 (\$0)	2 (\$12,000)	6 (\$7,200)	0 (\$0)	0 (\$0)	\$19,200
Lower Trap Creek	1 (\$30,000)	0 (\$0)	0 (\$0)	0 (\$0)	3 (\$30,638)	0 (\$0)	\$60,638
Middle Joe Wright Creek	0 (\$0)	0 (\$0)	0 (\$0)	0 (\$0)	0 (\$0)	20 (\$108,900)	\$108,900
Middle Laramie River-Rawah Creek	0 (\$0)	12 (\$37,344)	0 (\$0)	5 (\$6,000)	0 (\$0)	0 (\$0)	\$43,344
Peterson Lake	0 (\$0)	0 (\$0)	0 (\$0)	2 (\$2,400)	1 (\$10,285)	32 (\$174,240)	\$186,925
Sawmill Creek	0 (\$0)	0 (\$0)	0 (\$0)	2 (\$2,400)	0 (\$0)	0 (\$0)	\$2,400
Two and One Half Creek	1 (\$30,000)	2 (\$6,224)	2 (\$12,000)	1 (\$1,200)	0 (\$0)	0 (\$0)	\$49,424
Upper Laramie River-Rawah Creek	0 (\$0)	0 (\$0)	2 (\$12,000)	2 (\$2,400)	34 (\$347,916)	0 (\$0)	\$362,316
UT1 to Laramie River-Rawah Creek	0 (\$0)	2 (\$6,224)	0 (\$0)	1 (\$1,200)	0 (\$0)	0 (\$0)	\$7,424
<b>Totals &amp; Feature Construction Costs</b>	<b>2 (\$60,000)</b>	<b>19 (\$59,128)</b>	<b>6 (\$36,000)</b>	<b>20 (\$24,000)</b>	<b>37 (\$391,143)</b>	<b>52 (\$283,140)</b>	

## Southern CLP

This is the largest area of proposed mitigation within this request for funding. Tributary watersheds within US Forest Service lands include Fish Creek, Jacks Gulch, Little Beaver, Upper Sheep Creek, Bennet Creek, Dadd Gulch, and Black Hollow Creek. There are some private land areas on the eastern portion of this region including Ratville and Monument Gulch. Mulching is proposed within the Jacks Gulch, Black Hollow, Sheep Creek, Little Beaver, and Ratville (**Table 7**). Point mitigation by subwatershed is shown in **Table 8**.

Regional Values At Risk:

- **Roadways:** CO-14; Crown Point Rd.; Pingree Park Rd.; NF-259; NF-263; NF-259; NF-268; NF-139A; NF-142; NF-135; NF-350.
- **Private Property:** Ratville Community (1 structure); Monument Gulch Community (4 structures); Black Hollow Community (4 structures); Mineral Gulch Community (7 structures).
- **Drinking Supplies:** City of Fort Collins, City of Greeley, Tri-Districts (North Weld, Eastern Larimer County, Fort Collins – Loveland Water District), Northern Water, Irrigation Companies, and Private Users.

Table 7: Southern CLP Region proposed aerial mulching acres in non-wilderness & wilderness areas by subwatershed, including percent burn area treatment, cost, and combination with Point Mitigation. The green totals are indicating mulching in Wilderness areas.

Southern CLP Region Watersheds	Total Mulch Non-Wilderness (acres)	Total Mulch Wilderness (acres)	Moderate & High Soil Burn Severity (acres)	Burned Area Treated (%)	Estimated Cost (\$) Non-Wilderness & Wilderness	Point Mitigation in Combination?
Lower East Fork Sheep Creek	273	0	1,484	18%	\$682,500	Yes
Upper East Fork Sheep Creek	541	72	1,606	38%	\$1,352,500 \$180,000	Yes
Upper West Fork Sheep Creek	164	0	880	19%	\$410,000	Yes
UT3 to Sheep Creek	109	26	642	21%	\$272,500 \$65,000	No
UT1 to Headwaters CLP	162	1,217	2,915	47%	\$405,000 \$3,042,500	Yes
Upper South Fork CLP River	643	28	1,562	43%	\$1,607,500 \$70,000	Yes
Ratville	454	0	1,006	45%	\$1,135,000	Yes
Upper Bennett Creek	356	61	2,165	31% 51%	\$890,000 \$152,500	Yes
Middle Little Beaver Creek	161	1,194	2,233	63% 51%	\$402,500 \$2,985,000	No
Lower Little Beaver Creek	72	547	2,180	57%	\$180,000 \$1,367,500	Yes (2021)
Lower Fish Creek - Pendergrass	103	490	1,335	38%	\$257,500 \$1,225,000	No
Jacks Gulch	0	299	1,302	19%	\$747,500	Yes
Comanche Reservoir	0	462	1,504	21%	\$1,155,000	Yes (2021)
UT to Upper Little Beaver Creek	0	398	780	47%	\$995,000	No
UT to Little Beaver Creek	0	683	1,080	43%	\$1,707,500	No
Upper Little Beaver	0	988	1,948	45%	\$2,470,000	No
Upper Fish Creek - Pendergrass	0	1,140	1,987	19%	\$2,850,000	No
Lower Black Hollow	771	81	1,632	61%	\$1,927,500 \$202,500	Yes (2021)
Totals	3,809	7,686	28,241	40%	\$9,617,500 \$19,215,000	

**Table 8: Proposed Point Mitigation features by subwatersheds within the Southern Region of the CLP including cost and quantity. The unit prices reflect 2021 data.**

Southern CLP Region Watersheds	Armored Crossing (EA)	LWM Stabilization (EA)	Rock Stabilization (EA)	Log Jams (EA)	Willow Staking (AC)	Hillslope Wattles (AC)	Total Cost by Subwatershed (No Road Improvements)
<b>2021 Unit Prices</b>	<b>\$30,000</b>	<b>\$3,112</b>	<b>\$6,000</b>	<b>\$1,200</b>	<b>\$10,285</b>	<b>\$5,445</b>	
Dadd Gulch	0 (\$0)	2 (\$6,224)	1 (\$6,000)	0 (\$0)	0 (\$0)	0 (\$0)	<b>\$12,224</b>
Jacks Gulch	0 (\$0)	0 (\$0)	0 (\$0)	6 (\$7,200)	1 (\$10,285)	0 (\$0)	<b>\$17,485</b>
Kyle Gulch	0 (\$0)	0 (\$0)	1 (\$6,000)	4 (\$4,800)	0 (\$0)	0 (\$0)	<b>\$10,800</b>
Lower Bennett Creek	0 (\$0)	0 (\$0)	1 (\$6,000)	5 (\$6,000)	11 (\$113,135)	0 (\$0)	<b>\$125,135</b>
Lower East Fork Sheep Creek	1 (\$30,000)	2 (\$6,224)	0 (\$0)	1 (\$1,200)	0 (\$0)	40 (\$217,800)	<b>\$255,224</b>
Middle Bennett Creek	3 (\$90,000)	16 (\$49,792)	13 (\$78,000)	10 (\$12,000)	1 (\$10,285)	23 (\$125,235)	<b>\$365,312</b>
Mineral Springs Gulch	1 (\$30,000)	2 (\$6,224)	0 (\$0)	0 (\$0)	0 (\$0)	0 (\$0)	<b>\$36,224</b>
Ratville	6 (\$180,000)	5 (\$15,560)	12 (\$72,000)	5 (\$6,000)	0 (\$0)	0 (\$0)	<b>\$273,560</b>
Upper Bennett Creek	2 (\$60,000)	5 (\$15,560)	15 (\$90,000)	11 (\$13,200)	3 (\$30,855)	6 (\$32,670)	<b>\$242,285</b>
Upper Black Hollow Creek	6 (\$180,000)	10 (\$31,120)	2 (\$12,000)	3 (\$3,600)	0 (\$0)	0 (\$0)	<b>\$226,720</b>
Upper East Fork Sheep Creek	2 (\$60,000)	2 (\$6,224)	2 (\$12,000)	2 (\$2,400)	17 (\$174,845)	0 (\$0)	<b>\$255,469</b>
Upper South Fork CLP River	0 (\$0)	0 (\$0)	0 (\$0)	5 (\$6,000)	0 (\$0)	0 (\$0)	<b>\$6,000</b>
Upper West Fork Sheep Creek	1 (\$30,000)	1 (\$3,112)	2 (\$12,000)	0 (\$0)	3 (\$30,855)	8 (\$43,560)	<b>\$119,527</b>
UT1 to Bennett Creek	0 (\$0)	7 (\$21,784)	8 (\$48,000)	4 (\$4,800)	0 (\$0)	0 (\$0)	<b>\$74,584</b>
UT1 to Headwaters CLP	1 (\$30,000)	1 (\$3,112)	1 (\$6,000)	1 (\$1,200)	0 (\$0)	0 (\$0)	<b>\$40,312</b>
<b>Totals &amp; Feature Construction Costs</b>	<b>23 (\$690,000)</b>	<b>53 (\$164,936)</b>	<b>58 (\$348,000)</b>	<b>57 (\$68,400)</b>	<b>36 (\$373,742)</b>	<b>77 (\$419,264)</b>	

## Big Thompson

The Big Thompson was not divided additionally due to the size of the burn area and relatively limited number of fire-affected tributary watersheds. The most heavily impacted areas during the 2021 monsoon season were the private properties adjacent to Miller Fork and Black Creek. Because these areas received some funding during 2021 efforts, additional proposed sites are more limited. However, there are opportunities for mitigation implementation is Big Bear Gulch, Cascade Gulch, Fish Creek (Big T), and Sheep Creek (Big T). Additionally, teams have noticed that the burn severity in the Big Thompson may be higher than catalogued in the Soil Burn Severity map due to snow cover and difficult conditions during the analysis. This will be evaluated during site visits and may result in greater need than currently anticipated.

Mulching is proposed in many different highly impacted subwatersheds (**Table 9**). Point mitigation is proposed where access allows and is intended to mitigate downstream issues (**Table 10**).

### Regional Values At Risk:

- **Roadways:** Crystal Mountain Rd.; Stringtown Gulch Rd.; Big Bear Rd.; Buckhorn Rd.; Deer Path St.; Windsong Rd.; Granite Rd.; Foogy Park Rd.; Ballard Rd.; Pack Trail; Streamside Dr.; Fishermans Ln.; Miller Fork Rd.; NF-345A
- **Private Property:** Miller Fork Community (>10 structures); Drake Community (>10 structures); Buckhorn Community (>50 structures); Big Bear Community (6 structures);

Stringtown Gulch Community (4 structures); Owl Hollow Community (2 structures); Crystal Mountain Community (4 structures).

- **Drinking Supplies:** City of Fort Collins, City of Greeley, City of Loveland, Tri-Districts (North Weld, Eastern Larimer County, Fort Collins – Loveland Water District), Northern Water, Irrigation Companies, and Private Users.

**Table 9: Big Thompson Region proposed aerial mulching acres in non-wilderness & wilderness areas by subwatershed, including percent burn area treatment, cost, and combination with Point Mitigation.**

Big Thompson Region Watersheds	Total Mulch Non-Wilderness (acres)	Total Mulch Wilderness (acres)	Moderate & High Soil Burn Severity (acres)	Burned Area Treated (%)	Estimated Cost (\$)	Point Mitigation in Combination?
Middle Miller Fork	270	0	1,218	22%	\$675,000	Yes (2021)
Upper Miller Fork	521	0	1,044	50%	\$1,302,500	Yes (2021)
UT1 to Miller Fork	252	0	840	30%	\$630,000	No
UT2 to Miller Fork	48	0	1,041	5%	\$120,000	No
UT3 to Miller Fork	258	0	553	47%	\$645,000	Yes
Elk Creek	1,286	0	2,096	61%	\$3,215,000	No
Headwaters Buckhorn Creek	1,507	0	2,274	66%	\$3,767,500	No
Cascade Creek	1,291	0	1,818	71%	\$3,227,500	Yes
UT2 to Upper Buckhorn Creek	326	0	555	59%	\$815,000	No
UT4 to Upper Buckhorn Creek	391	0	852	46%	\$977,500	Yes
Upper Sheep Creek	1,097	0	2,030	54%	\$2,742,500	Yes
Upper Fish Creek - Buckhorn	531	0	1,723	31%	\$1,327,500	Yes
Lower Fish Creek - Buckhorn	638	0	1,252	51%	\$1,595,000	No
Stringtown Gulch	939	0	2,146	44%	\$2,347,500	Yes
Big Bear Gulch	1,111	0	2,346	47%	\$2,777,500	Yes
<b>Totals</b>	<b>10,466</b>	<b>0</b>	<b>21,788</b>	<b>46%</b>	<b>\$26,165,000</b>	

**Table 10: Proposed Point Mitigation Features by subwatersheds within the Northern Region of the CLP including cost and quantity. The unit prices reflect 2021 data.**

Big Thompson Region Watersheds	Armored Crossing (EA)	LWM Stabilization (EA)	Rock Stabilization (EA)	Log Jams (EA)	Willow Staking (AC)	Hillslope Wattles (AC)	Total Cost by Subwatershed (No Road Improvements)
<b>2021 Unit Prices</b>	<b>\$30,000</b>	<b>\$3,112</b>	<b>\$6,000</b>	<b>\$1,200</b>	<b>\$10,285</b>	<b>\$5,445</b>	
Big Bear Gulch	1 (\$30,000)	6 (\$18,672)	6 (\$36,000)	11 (\$13,200)	0 (\$0)	0 (\$0)	<b>\$97,872</b>
Cascade Creek	1 (\$30,000)	2 (\$6,224)	2 (\$12,000)	2 (\$2,400)	0 (\$0)	0 (\$0)	<b>\$50,624</b>
Galuchie Gulch	1 (\$30,000)	0 (\$0)	2 (\$12,000)	1 (\$1,200)	0 (\$0)	0 (\$0)	<b>\$43,200</b>
Lower Miller Fork	0 (\$0)	2 (\$6,224)	1 (\$6,000)	2 (\$2,400)	0 (\$0)	0 (\$0)	<b>\$14,624</b>
Lower North Fork Fish Creek	1 (\$30,000)	2 (\$6,224)	5 (\$30,000)	4 (\$4,800)	0 (\$0)	0 (\$0)	<b>\$71,024</b>
Spruce Gulch - Cedar Creek	0 (\$0)	2 (\$6,224)	2 (\$12,000)	1 (\$1,200)	0 (\$0)	0 (\$0)	<b>\$19,424</b>
Stringtown Gulch	2 (\$60,000)	4 (\$12,448)	3 (\$18,000)	2 (\$2,400)	0 (\$0)	0 (\$0)	<b>\$92,848</b>
Upper Fish Creek	3 (\$90,000)	8 (\$24,896)	5 (\$30,000)	8 (\$9,600)	0 (\$0)	0 (\$0)	<b>\$154,496</b>
Upper North Fork Fish Creek	1 (\$30,000)	0 (\$0)	0 (\$0)	0 (\$0)	8 (\$83,525)	0 (\$0)	<b>\$93,525</b>
Upper Sheep Creek	1 (\$30,000)	2 (\$6,224)	2 (\$12,000)	2 (\$2,400)	0 (\$0)	0 (\$0)	<b>\$50,624</b>
UT to North Fork Fish Creek	0 (\$0)	4 (\$12,448)	1 (\$6,000)	0 (\$0)	2 (\$20,328)	0 (\$0)	<b>\$38,776</b>
UT1 to Miller Fork	0 (\$0)	1 (\$3,112)	2 (\$12,000)	2 (\$2,400)	0 (\$0)	0 (\$0)	<b>\$17,512</b>
UT4 to Upper Buckhorn Creek	1 (\$30,000)	2 (\$6,224)	2 (\$12,000)	2 (\$2,400)	0 (\$0)	0 (\$0)	<b>\$50,624</b>
<b>Totals &amp; Feature Construction Costs</b>	<b>12 (\$360,000)</b>	<b>35 (\$108,920)</b>	<b>33 (\$198,000)</b>	<b>37 (\$44,400)</b>	<b>10 (\$83,853)</b>	<b>0 (\$0)</b>	

### Summary by Subwatershed

**Table 11** shows the summary of mulching and point mitigation costs by subwatershed priority. These will likely fluctuate slightly as the Soil Burn Severity (SBS) updates are analyzed.

**Table 11: Summary of costs by subwatershed priorities. This does not include funding for road improvements which is included in Table 13**

Priority Watershed Type	Total Mulch (acres)	Total Mulching Costs	Total Point Mitigation Costs (No Road Improvements)	Total Subwatershed Costs
Highest Priority Subwatersheds	11,684	\$29,210,000	\$1,543,850	<b>\$30,753,850</b>
High Priority Subwatersheds	8,802	\$22,005,000	\$1,564,821	<b>\$23,569,821</b>
Moderate Priority Subwatersheds	5,968	\$14,920,000	\$725,021	<b>\$15,645,021</b>
Low Priority Subwatersheds	567	\$1,417,500	\$373,273	<b>\$1,790,773</b>
Lowest Priority Subwatersheds	0	\$0	\$125,135	<b>\$125,135</b>



## Summary Cost Estimates by Region

**Table 12** and **13** present the summarized costs totals for each of the regions and treatment types. The total needs for aerial mulching in the Cache La Poudre Watershed is \$21,695,000 in non-wilderness areas and \$21,332,500 in wilderness areas. The combined total is for the Cache La Poudre is \$43,027,500. The total need for the Big Thompson Watershed is \$26,165,000. The total need for point mitigation in the Cache La Poudre Watershed is \$6,791,675 while the need for the Big Thompson is \$2,604,383. Additional related projects and needs for recovery that do not fit directly into watershed treatments are listed below.

**Table 12: A costs summary of proposed aerial mulching by region. The total aerial mulching costs for the Cache La Poudre is \$21,695,000 in non-wilderness areas and \$21,332,500 in wilderness areas. The total mulching need for the Cameron Peak Fire is \$69,192,500.**

Regions within the Cache La Poudre and Big Thompson Watersheds	Total Mulch Non-Wilderness (acres)	Total Mulch Wilderness (acres)	Moderate & High Soil Burn Severity (acres)	Burned Area Treated (%)	Estimated Cost in Non-Wilderness Areas (\$)	Estimated Cost in Wilderness Areas (\$)
Northern CLP	1,860	0	4,806	39%	\$4,577,500	\$0
Western CLP	3,000	847	5,980	42%	\$7,500,000	\$2,117,500
Southern CLP	3,809	7,686	28,241	40%	\$9,617,500	\$19,215,000
Big Thompson	10,466	0	21,788	46%	\$26,165,000	\$0
<b>Totals</b>	<b>19,106</b>	<b>8,533</b>	<b>56,695</b>	<b>34%</b>	<b>\$47,860,000</b>	<b>\$21,332,500</b>

**Table 13: A costs summary of proposed point mitigation construction and design by feature and region. Total Construction Costs by Region are: Northern CLP- \$1,649,724, Southern CLP- \$3,596,862, Western CLP- \$1,692,105, Big Thompson- \$2,604,383.**

	Armored Crossing	LWM Stabilization	Rock Stabilization	Log Jams	Willow Staking	Road Drainage Improvements	Hillslope Wattles
<b>2021 Unit Prices</b>	<b>\$30,000</b>	<b>\$3,112</b>	<b>\$6,000</b>	<b>\$1,200</b>	<b>\$10,285</b>	<b>\$14,000</b>	<b>\$5,445</b>
Northern CLP Region	\$270,000	\$37,344	\$126,000	\$20,400	\$141,550	\$599,500	\$27,225
Southern CLP Region	\$690,000	\$164,936	\$348,000	\$68,400	\$373,742	\$600,000	\$419,264
Western CLP Region	\$60,000	\$59,128	\$36,000	\$24,000	\$391,143	\$400,000	\$283,140
Big Thompson Region	\$360,000	\$108,920	\$198,000	\$44,400	\$83,853	\$1,134,000	\$0
<b>Total Cameron Peak Fire Construction Costs by Feature</b>	<b>\$1,380,000</b>	<b>\$370,328</b>	<b>\$708,000</b>	<b>\$157,200</b>	<b>\$990,287</b>	<b>\$2,733,500</b>	<b>\$729,629</b>
Contractor Mobilization (10%)	\$138,000	\$37,033	\$70,800	\$15,720	\$99,029	\$273,350	\$72,963
Engineering Design (10%)	\$138,000	\$37,033	\$70,800	\$15,720	\$99,029	\$273,350	\$72,963
Permitting (5%)	\$69,000	\$18,516	\$35,400	\$7,860	\$49,515	\$136,675	\$36,482
Construction Oversight (10%)	\$138,000	\$37,033	\$70,800	\$15,720	\$99,029	\$273,350	\$72,963
<b>Total Costs By Feature</b>	<b>\$1,863,000</b>	<b>\$499,943</b>	<b>\$955,800</b>	<b>\$212,220</b>	<b>\$1,336,888</b>	<b>\$3,690,225</b>	<b>\$985,000</b>
<b>Total Cameron Peak Fire Point Mitigation Costs</b>						<b>\$9,543,076</b>	

## Other Funding Needs

While the general principles of mitigating post-fire impacts are generally well known, there is a large amount of information still missing due to the remoteness of the areas these large wildfires typical impact. Data collection to assess the impact of the fire and large flood events is extremely important in

understand and mitigating the overall strain on infrastructure. Three data needs with rough costs are detailed below.

**Updated Topographic/Imagery Data in Support of Design** – Following disasters like fire or flood, it is important to have accurate topographic data to plan and design recovery efforts and improvements. The Black Hollow flood event on July 20, 2021 completely transformed the watershed, lower fan, and Poudre River. It was vital that funding was available and budgeted to collect data soon after this event. However, it is more effective and equally important to have accurate topography for area prior to large landscape alterations. The Geospatial Group at Ayres has compiled a proposal for a large-scale data collection effort for the entire Cache La Poudre Watershed and Larimer County. This data will be invaluable to design, future mitigation, forest management, development, and economic growth in the area of interest. The full proposal is in **Appendix B**.

*Cost Estimates of Collection: \$566,000-\$700,000 (Price varies based on deliverables)*

**Tree Planting Support & Materials** – Post-fire forest vegetation recovery is key to reducing the short and long-term impacts of the Cameron Peak Fire on water quality. Tree planting is a long-term restoration action that can have multiple benefits in re-establishing forest on areas that would not return to forest for a long time. Areas targeted for tree planting would be identified high hazard watersheds and locations that are far enough from live trees that they would not re-seed for decades or longer. The basic criteria for tree planting include;

1. Moderate to high soil burn severity
2. North to northeast aspects
3. More than 200 meters from live trees (seed sources)
4. Relatively gentle slopes (< 20%)

The scale of tree planting needed far exceeds the capability of growing seedlings and planting them. The costs of planting seedlings includes; collecting seeds, growing seedlings (1-2 years depending on species), transport of seedlings to the site, seedling storage pre-planting, layout of units, crews to plant, and monitoring. The expected budget for these activities is \$6/seedling. That cost would cover the listed actions.

The targeted areas would be on National Forest lands, because there are current efforts underway to plant trees on private lands. It is assumed that seedlings would be planted at about 150 per acre. **Table 9** displays the expected amounts of tree planting and costs.

Year	Planting Area (acres)	Seedlings per acre	Cost per Seedling	Planting cost per year
2022	500	150	\$6	\$450,000
2023	1,000	150	\$6	\$900,000
<b>Totals</b>	<b>1,500</b>			<b>\$1,350,000</b>

**LiDAR & Bathymetry of Existing Reservoir Infrastructure** – Several reservoirs in the burn area are vulnerable to sedimentation impact from post-fire watersheds. While this plan assesses mitigation of those impacts, repeat topographic data collection is likely the best tool to quantify the impacts to these basins of the hydrologic recovery of the burn area.

Several of these reservoirs are emptied on a yearly basis, allowing for the use of aerial LiDAR collection on an at least biyearly schedule to provide information on the magnitude of the impact, areas of specific concern, and potential mitigation options. These LiDAR reservoirs include Peterson Lake, Comanche Reservoir, and Hourglass Reservoir.

Additionally, two reservoirs in the burn area, Chambers Lake and Barnes Meadow Reservoir, require the collection of bathymetry data to provide a clear picture of sedimentation and potential storage loss. This data should be collected at least three times during the 10-year recovery.

*Cost Estimates of Collection over 10-yr Recovery: \$400,000*

**Cache La Poudre River Floodplain Mapping Update** – The floodplain mapping and modeling along the Cache La Poudre River Canyon from just west of Laporte to the headwaters remains a Zone A with no detailed modeling or analysis. In many areas of the canyon, this model is inaccurate and does not adequately convey riverine flooding risk to property owners. This is especially true following the Cameron Peak Fire and resulting debris flows at Black Hollow and other areas that have altered the topography or realigned the river. Updating the Poudre River Floodplain Mapping should be prioritized to help planning and communication to the effected property owners.

*Cost Estimates of Floodplain Mapping and Modeling Update: \$1.5 million*

## Conclusion

The Cameron Peak Fire led to degradation of the Poudre River and Big Thompson watersheds; post-fire flooding may exacerbate these issues for the next decade. While various efforts during 2021 served to protect private property and access within the Poudre River and Big Thompson watersheds, more needs exist on National Forest System lands to provide additional protection to VARs and water quality improvements. Four regions have been identified for mitigation for 2022 within the Poudre and Big Thompson watersheds. Nearly \$9.4 million is estimated to design and construct the point mitigation features discussed in this report to reduce hillslope erosion, stream incision, and headcutting, and improve roadway drainage on National Forest System lands. Many of these feature types have already been installed in the efforts in 2021 and proven successful during post-fire storm events. The total mulching need for the Cameron Peak Fire is \$69,192,500; however, areas will be prioritized for mulch treatment so that the most impacted areas with VARs are treated first and in combination with point mitigation efforts. The specific implementation locations and conditions can be viewed using the [2022 Cameron Peak Fire Work Plan Map Series](#). These improvements will ultimately protect VARs and improve water quality for municipal, recreational, and ecological purposes. There is also the need to continue collecting data and monitoring valuable water resource infrastructure that will likely continue to degrade through each year of watershed recovery. The data collection needs are estimated to cost between roughly \$600,000 and \$1.2 million, but would provide research, management, and recovery benefits for an increasingly post-fire burdened US Forest Service.

## References

- United States Department of Agriculture. Hydrology Technical Note No. 4. Title 210: Hydrologic Analyses of Post-Wildfire Conditions. August, 2016.
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- Jonas, J. L., E. Berryman, B. Wolk, P. Morgan, and P. R. Robichaud. 2019. Post-fire wood mulch for reducing erosion potential increases tree seedlings with few impacts on understory plants and soil nitrogen. *Forest Ecology and Management*, 453: 117567.
- Robichaud, Peter R.; Ashmun, Louise E.; Sims, Bruce D. 2010. Post-fire treatment effectiveness for hill-slope stabilization. Gen. Tech. Rep. RMRS-GTR-240. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 62 p.

Robichaud, P.R., S.A. Lewis, J.W. Wagenbrenner, L.E. Ashmun, and R.E. Brown. 2013. Post-fire mulching for runoff and erosion mitigation. Part I: Effectiveness at reducing hillslope erosion rates. *Catena*, 105: 75–92

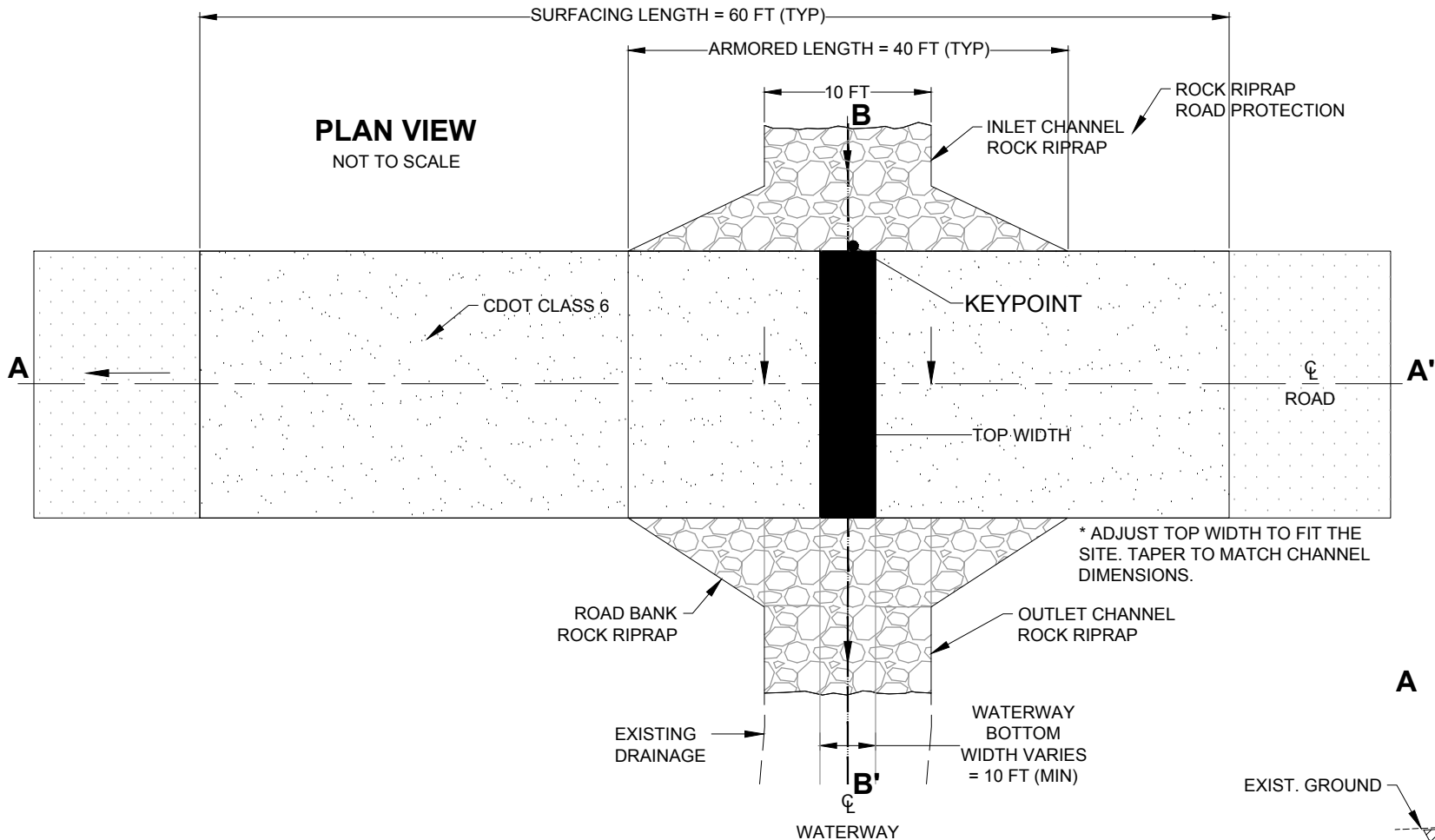
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Parise, M. & Cannon, S.H., 2011, *Wildfire impacts on the processes that generate debris flows in burned watersheds*. National Hazards. March, 2011.

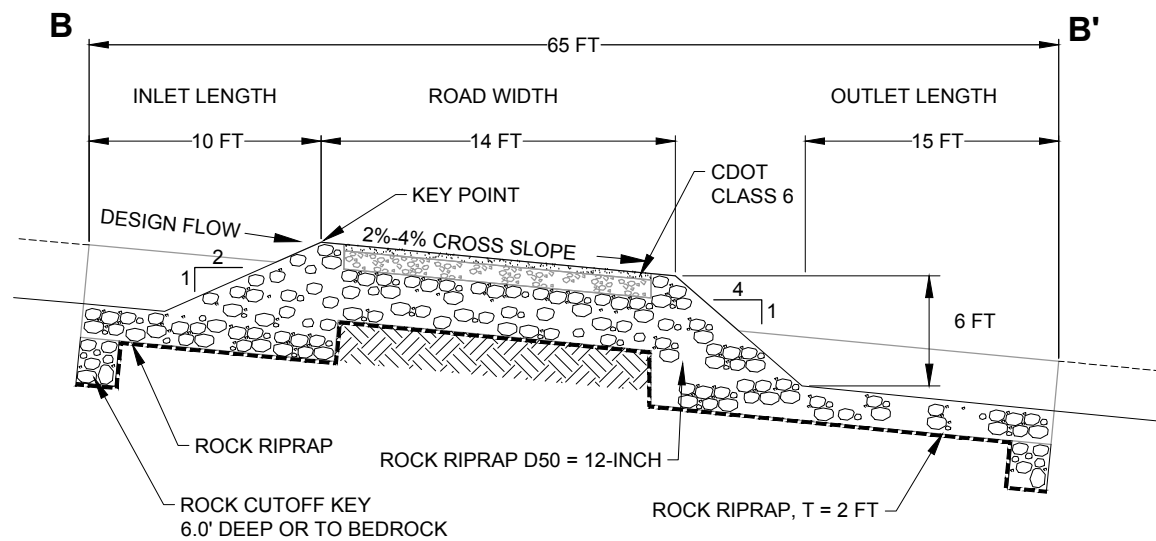
**Appendix A**  
**2022 Cameron Peak Fire Mitigation Design**  
**Concepts**

Drawing Name: I:\36\01\_PROPOSALS AND MARKETING\GREELEY WATER RESOURCES 2022\POST-FIRE MITIGATION\DWG\36-4705.03 SHEEP CREEK DETAILS.DWG Wednesday, October 27, 2021 11:53 AM By: BARRY, COLIN

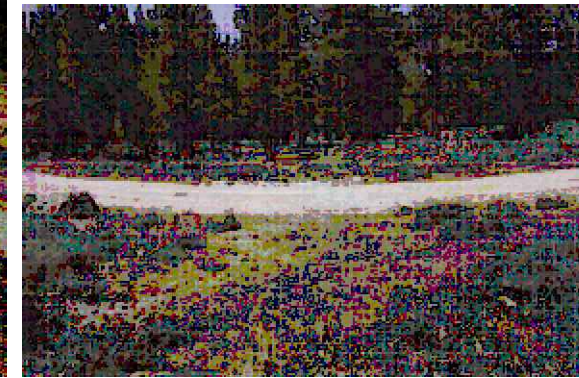


## ARMORED DRAINAGE CROSSING DETAIL

NOT TO SCALE



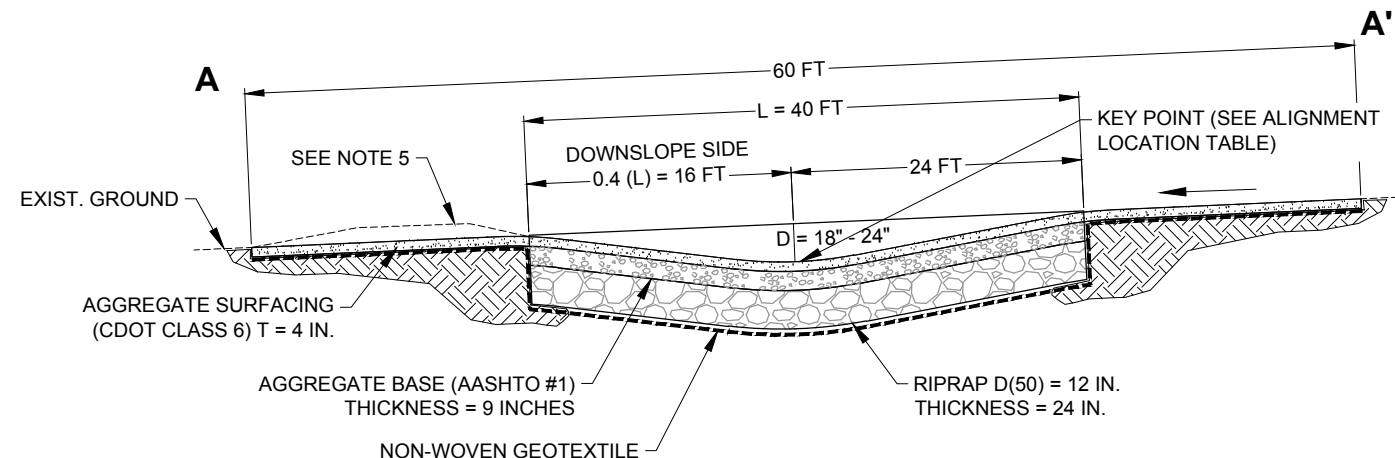
TYPICAL ROLLING DIP ROCK FORD



TYPICAL AT-GRADE ROCK FORD

### CONSTRUCTION NOTES:

1. THIS DETAIL CAN BE USED WITH OR WITHOUT A CULVERT.
2. COORDINATE FIELD ADJUSTMENTS WITH THE ENGINEER.
3. THE DOWNHILL SIDE OF ROAD MAY NEED BUILT UP TO PREVENT WATER FROM FLOWING DOWN THE ROAD.
4. DIMENSIONS MAY VARY BASED ON SITE CONDITIONS. FIELD ADJUSTMENTS MUST BE APPROVED BY ENGINEER.



ONE INCH - IF NOT,  
SCALE ACCORDINGLY

Revisions	Date

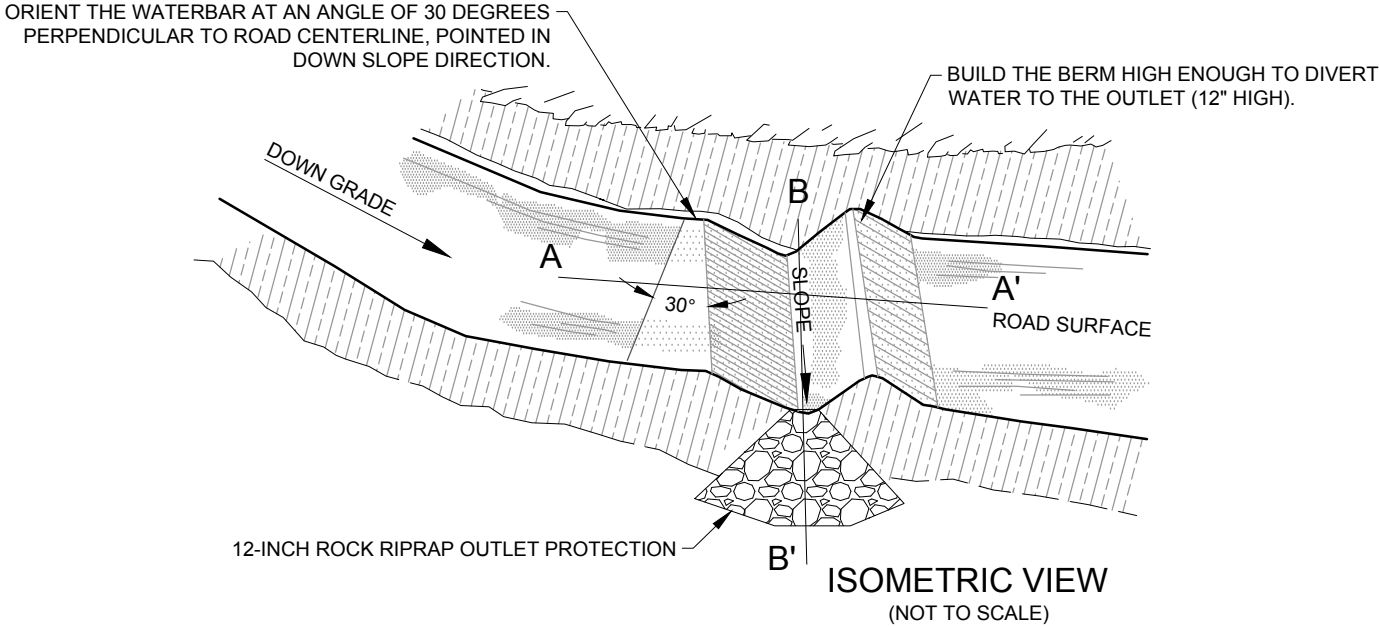
WEST CAMERON PEAK FIRE  
(GREELEY) EWP  
SHEEP CREEK SITE  
CITY OF GREELEY, COLORADO

ARMORED DRAINAGE  
CROSSING

Project Mgr. ABA	Designed By: CHB	Drawn By: RBR	Approved By: WDR	Date: 06/08/2021
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PROJECT NO.  
36-4705.03  
DRAWING NO.

Drawing Name: I:\36\01\_PROPOSALS AND MARKETING\GREELEY WATER RESOURCES 2022 POST-FIRE MITIGATION\DWGS\36-4705.03 SHEEP CREEK DETAILS.DWG Wednesday, October 27, 2021 11:53 AM By: BARRY, COLIN



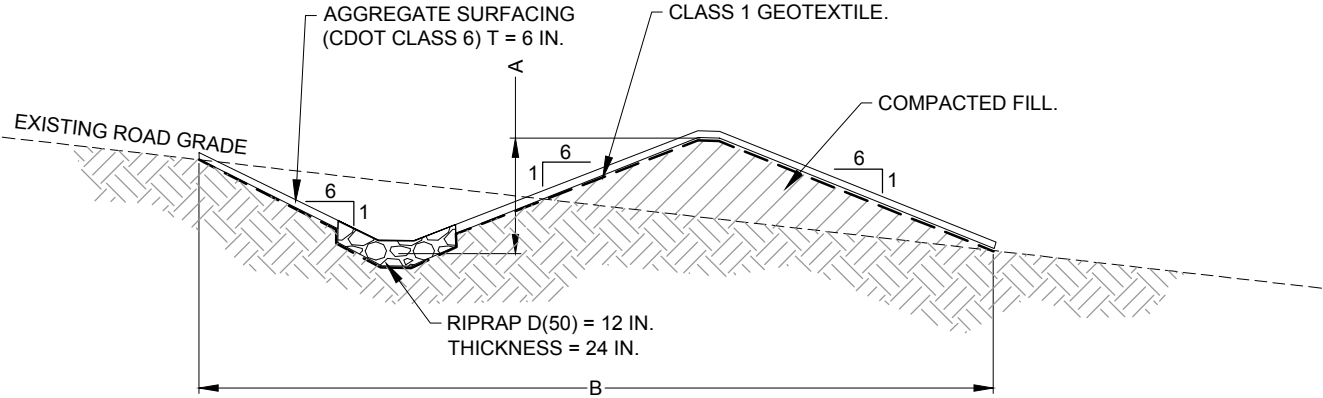
Note to Engineer: Armor the bottom of dip with rock and Class I Drainage Geotextile fabric.

TABLE 2. WATERBAR DIMENSIONS

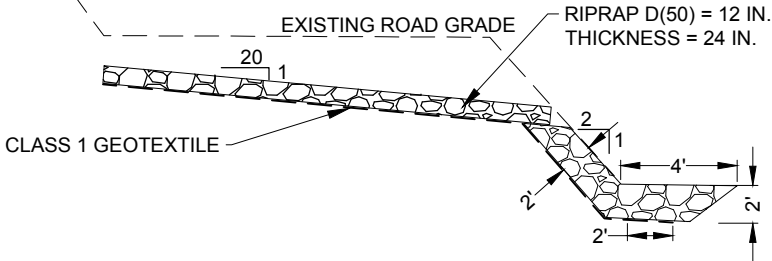
	A	B
TYPE I	1 FT	12 FT
TYPE II	2 FT	24 FT
TYPE III	3 FT	36 FT

NOTES:

- IF THE ROAD HAS A DRAINAGE DITCH, EXTEND THE WATERBAR TO INTERCEPT THE RUNOFF.
- WATERBARS MUST BE INSPECTED AFTER ANY PRECIPITATION EVENT THAT MAY CAUSE EROSION.
- START WATERBARS AT THE INTERSECTION OF THE ROADBED AND CUT SLOPE. EXTEND THE WATERBARS THE ENTIRE WIDTH OF THE ROADBED.
- WATERBARS MUST HAVE FREE-FLOWING ARMORED LAYOUTS
- COMPACTED FILL MUST BE NATIVE MATERIAL COMPACTED TO 95% PER AASHTO T 99 OR SAND, SANDY-GRAVEL, AS APPROVED BY THE ENGINEER



A-A' PROFILE VIEW  
(NOT TO SCALE)



B-B' PROFILE VIEW  
(NOT TO SCALE)

ONE INCH - IF NOT,  
SCALE ACCORDINGLY

Date

Revisions

WEST CAMERON PEAK FIRE  
(GREELEY) EWP  
SHEEP CREEK SITE  
CITY OF GREELEY, COLORADO

WATER BAR

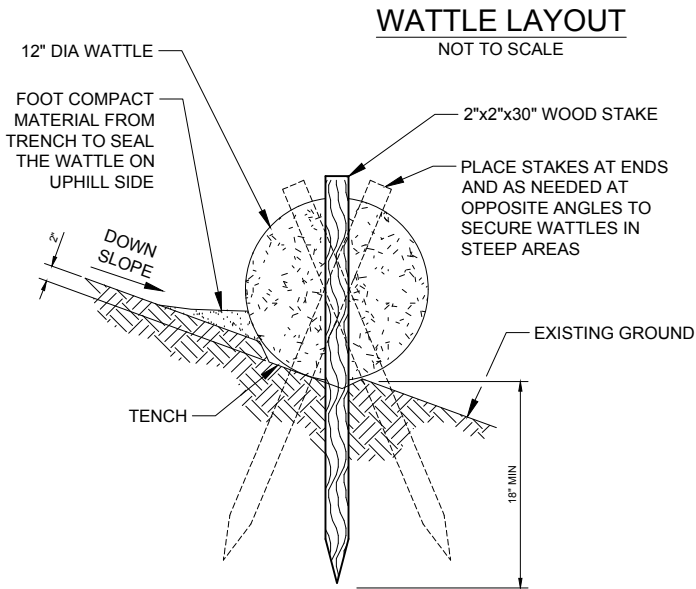
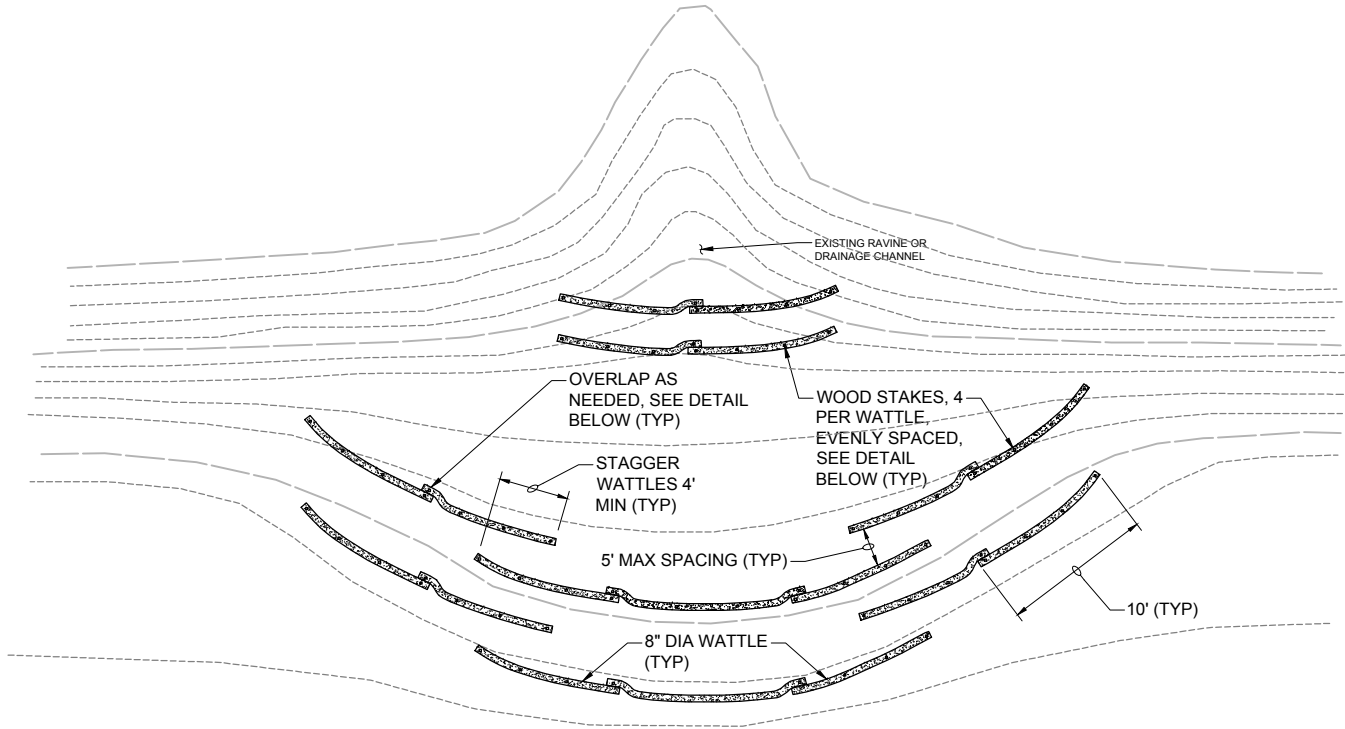
Project Mgr. ABA  
Designed By: CHB  
Drawn By: RBR  
Approved By: WDR  
Date: 06/08/2021

PROJECT NO.  
36-4705.03  
DRAWING NO.

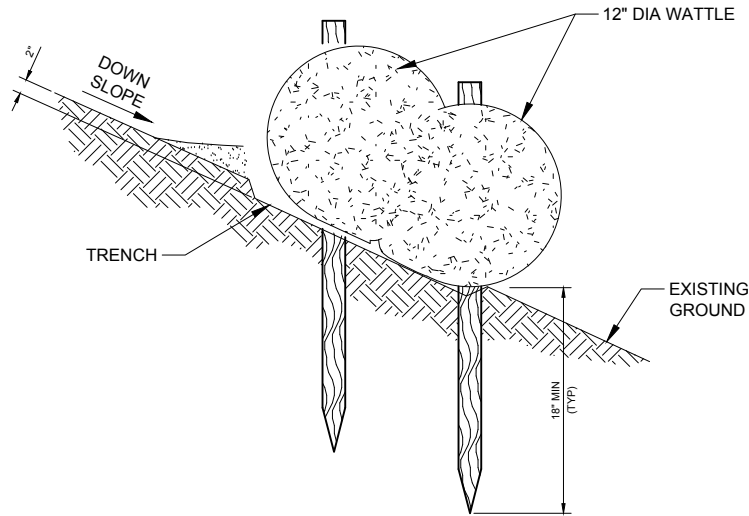
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SHEET 354



Drawing Name: I:\36\01\_PROPOSALS AND MARKETING\GREELEY WATER RESOURCES 2022 POST-FIRE MITIGATION\DWGS\36-4705.03 SHEEP CREEK DETAILS.DWG Wednesday, October 27, 2021 11:53 AM By: BARRY, COLIN



STAKE DETAIL  
NOT TO SCALE



WATTLE OVERLAP DETAIL  
NOT TO SCALE

ONE INCH - IF NOT,  
SCALE ACCORDINGLY

AVRES

3665 JFK Parkway  
Building 2, Suite 100  
Fort Collins, CO 80525  
(970) 223-5556

Revisions

Date

WEST CAMERON PEAK FIRE  
(GREELEY) EWP  
SHEEP CREEK SITE  
CITY OF GREELEY, COLORADO

HILLSLOPE WATTLE  
INSTALLATION & LAYOUT

Project Mgr. ABA  
Designed By: CHB  
Drawn By: RBR  
Approved By: WDR  
Date: 06/08/2021

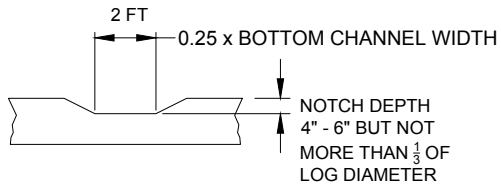
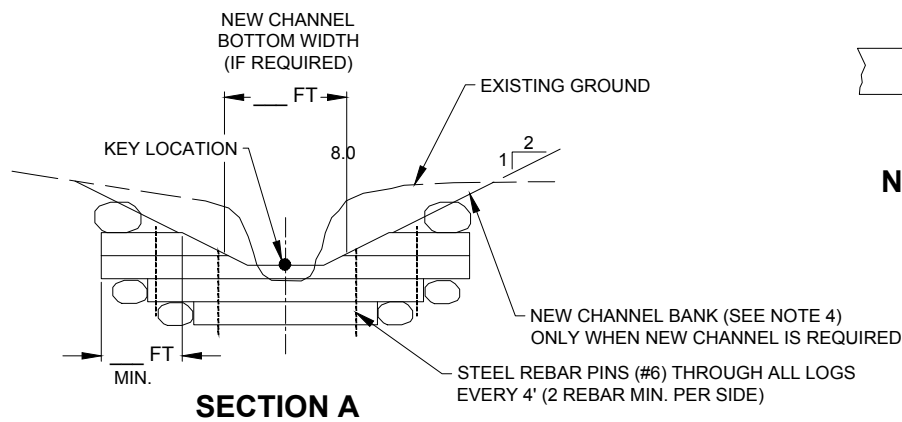
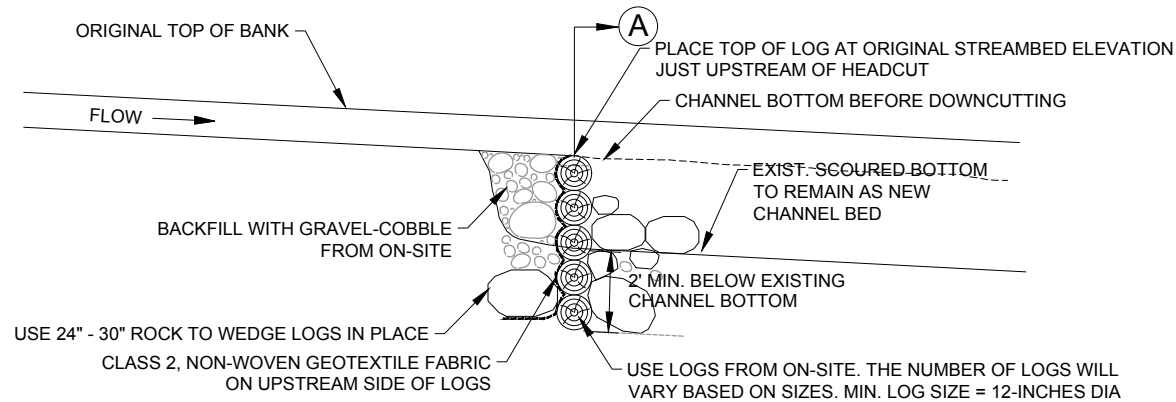
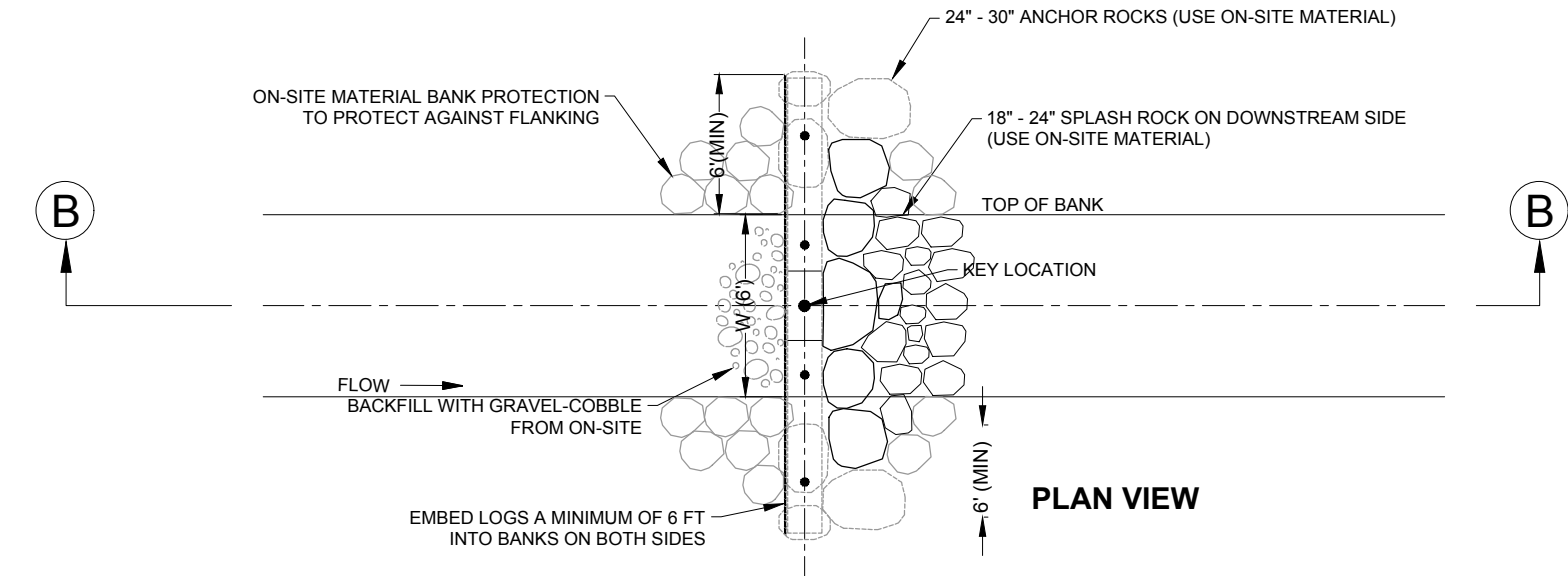
PROJECT NO.  
36-4705.03  
DRAWING NO.

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355



Drawing Name: I:\36\01\_PROPOSALS AND MARKETING\GREELEY WATER RESOURCES 2022 POST-FIRE MITIGATION\DWGS\36-4705.03 SHEEP CREEK DETAILS.DWG Wednesday, October 27, 2021 11:53 AM By: BARRY, COLIN



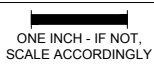
NOTES:

1. ALL ROCK WILL BE SOURCED ON-SITE USING NATIVE BOULDERS AND COBBLE.
2. MINIMUM LOG DIAMETER IS 16 INCHES. MAY USE FEWER LOGS WHEN LARGER DIAMETER LOGS ARE AVAILABLE. THE REQUIRED NUMBER OF LOGS IS AS REQUIRED TO MEET TOP ELEVATION AND MINIMUM EMBEDMENT INTO STREAMBED.
3. USE STRAIGHT LOGS, UNIFORM DIAMETER, FREE OF ROT, DISEASE OR INSECT DAMAGE. USE LOGS FROM ON-SITE WHEN AVAILABLE.
4. FIELD ADJUST BASED ON ENGINEER APPROVAL TO MEET SITE-SPECIFIC CONDITIONS.
5. WHEN NEW CHANNEL BANKS ARE CONSTRUCTED, PROTECT THE DISTURBED SLOPE WITH EROSION CONTROL FABRIC, SEED, & MULCH. SEE SEPARATE DETAIL FOR EROSION CONTROL FABRIC.



LARGE WOODY MATERIAL (LWM) STABILIZATION

NOT TO SCALE



Revisions	Date

WEST CAMERON PEAK FIRE  
(GREELEY) EWP  
SHEEP CREEK SITE  
CITY OF GREELEY, COLORADO

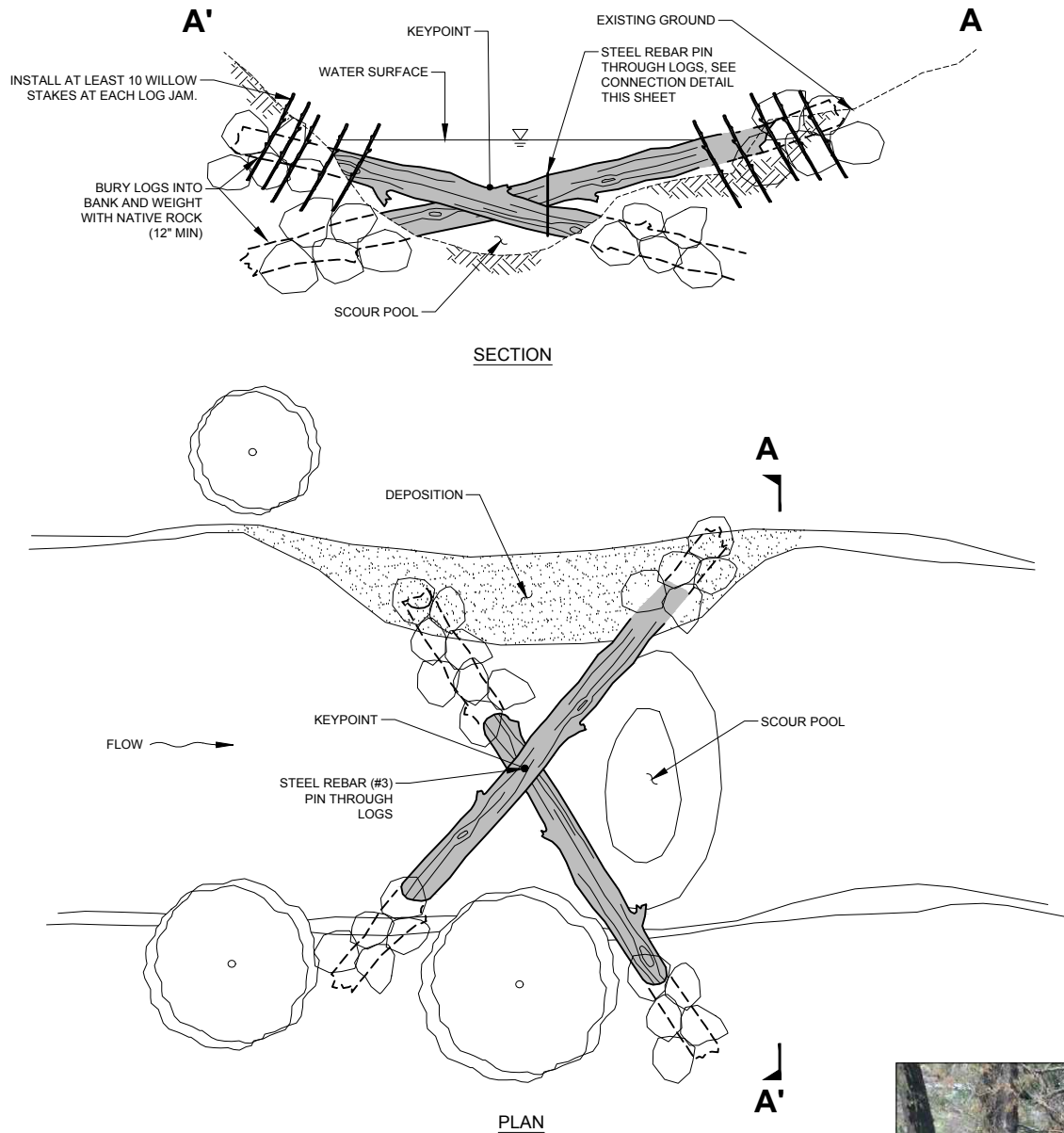
LARGE WOOD MATERIAL (LWM)  
STABILIZATION

Project Mgr. ABA	Designed By: CHB
Drawn By: RBR	Approved By: WDR
Date: 06/08/2021	

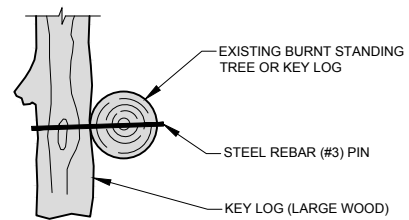
PROJECT NO.  
36-4705.03  
DRAWING NO.



Drawing Name: I:\36\01\_PROPOSALS AND MARKETING\GREELEY WATER RESOURCES 2022 POST-FIRE MITIGATION\DWGS\36-4705.03 SHEEP CREEK DETAILS.DWG Wednesday, October 27, 2021 11:53 AM By: BARRY, COLIN

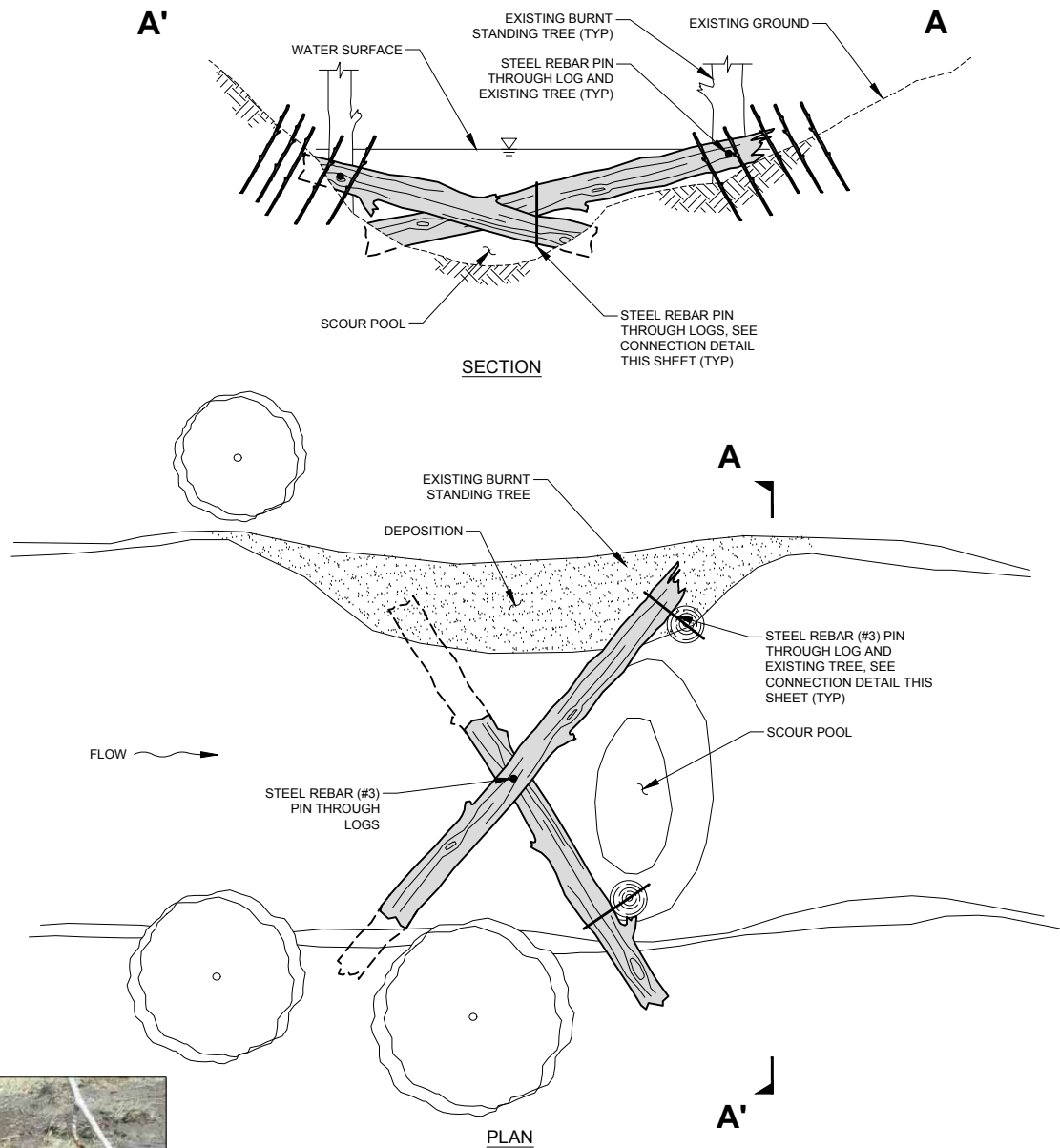


LOG JAM - BANK TIE-INS DETAIL OPTION 1  
NOT TO SCALE



CONNECTION DETAIL  
NOT TO SCALE

MIN LOG DIAMETER (IN)	BANKFULL WIDTH	
	0 TO 15FT	15FT TO 30FT
	MIN LOG LENGTH (FT)	
16	20	43
18	16	36
20	13	30
22	10	26
24	10	23
26	10	20



LOG JAM - BANK TIE-INS DETAIL OPTION 2  
NOT TO SCALE

NOTES:

1. PLACE CUTTINGS UPRIGHT WITHIN THE LOG JAM/ROCKS ON THE BANKS PRIOR TO BACKFILL SUCH THAT AT LEAST  $\frac{2}{3}$  OF THE CUTTING IS BELOW THE GROUND SURFACE AND AT LEAST A PORTION BELOW THE GROUND SURFACE AND AT LEAST A PORTION OF THE CUTTING IS BELOW THE WATER TABLE. BACK FILL OVER AND AROUND CUTTINGS AS CAREFULLY AS POSSIBLE.
2. IF INCISION IS EVIDENT IN THE AREA, PLACE NATIVE ROCK ON THE UPSTREAM SIDE IN THE CHANNEL TO MITIGATE.

ONE INCH - IF NOT,  
SCALE ACCORDINGLY

**AVRES**

3665 JFK Parkway  
Building 2, Suite 100  
Fort Collins, CO 80525  
(970) 223-5556

Date

Revisions

WEST CAMERON PEAK FIRE  
(GREELEY) EWP  
SHEEP CREEK SITE  
CITY OF GREELEY, COLORADO

LOG JAM - KEY LOG  
INSTALLATION

Project Mgr. ABA  
Designed By: CHB  
Drawn By: RBR  
Approved By: WDR  
Date: 06/08/2021

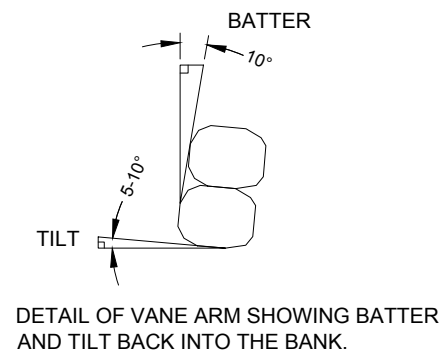
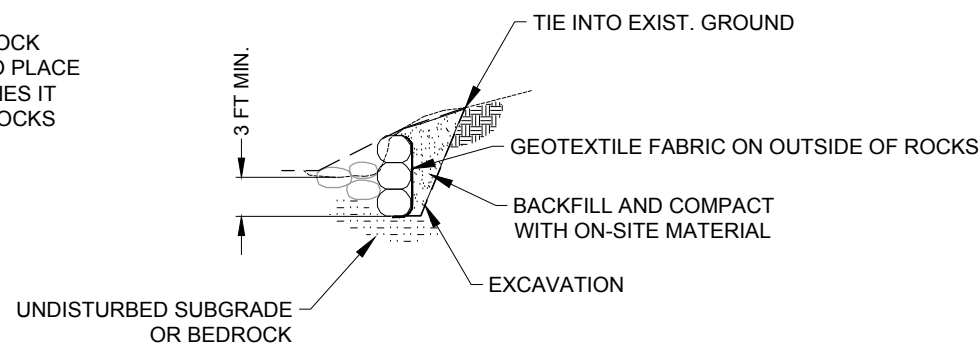
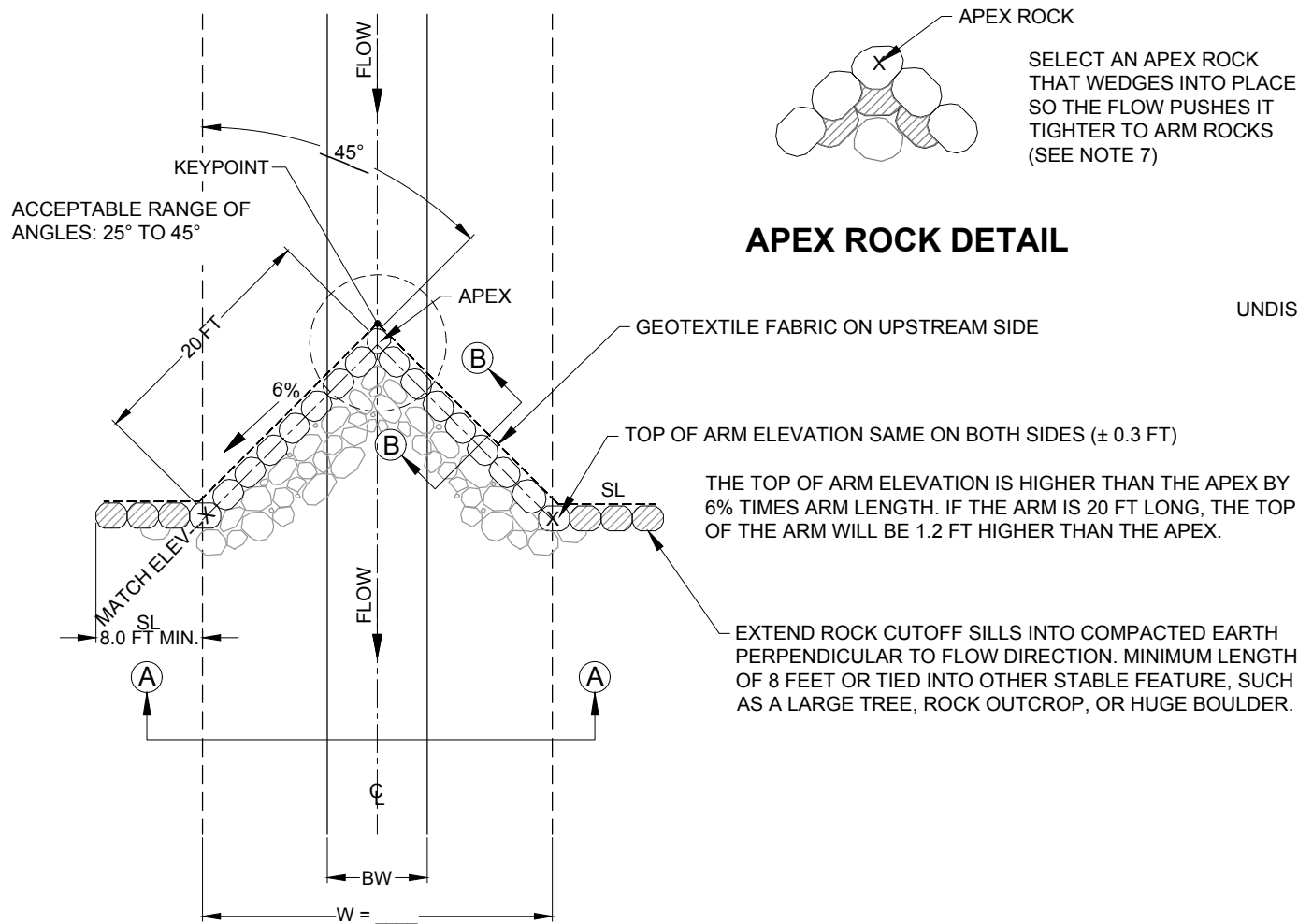
PROJECT NO.  
36-4705.03  
DRAWING NO.

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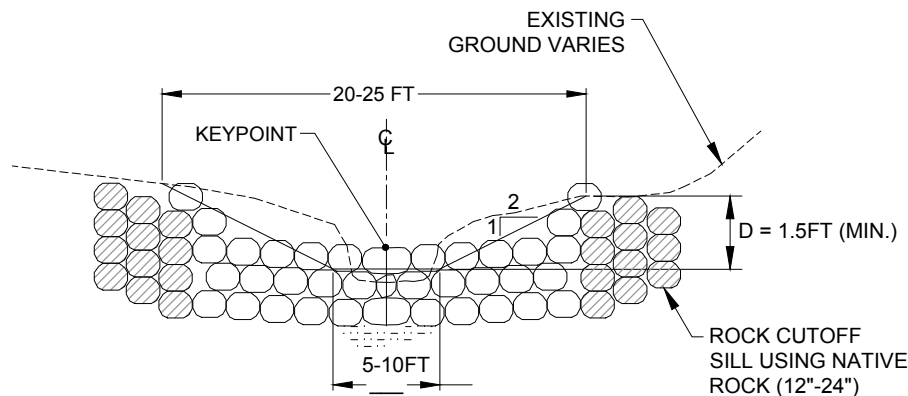
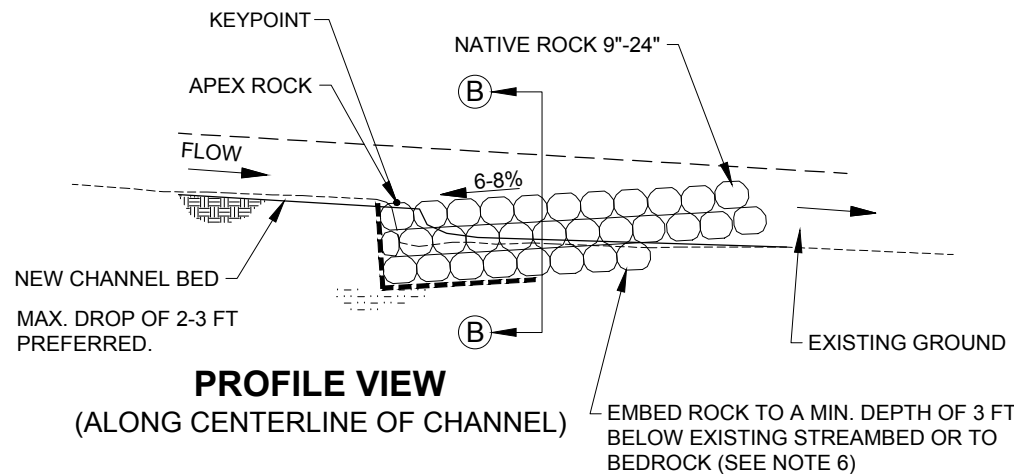
SHEET

357

Drawing Name: I:\36\01\_PROPOSALS AND MARKETING\GREELEY WATER RESOURCES 2022 POST-FIRE MITIGATION\DWGS\36-4705.03 SHEEP CREEK DETAILS.DWG Wednesday, October 27, 2021 11:53 AM By: BARRY, COLIN



**ROCK STABILIZATION STRUCTURE**  
(NOT TO SCALE)



**NOTES:**

1. THIS STRUCTURE IS USED AS A SEDIMENT TRAP AND STABILIZATION AGAINST INCISION ON EPHEMERAL & PERENNIAL STREAMS
2. THE SPLASH ROCK DISSIPATES ENERGY TO REDUCE EROSION ON THE CHANNEL BED. USE SCRAP ROCK SALVAGED ON-SITE ROCK FOR SPLASH ROCK.
3. THE MINIMUM EMBEDMENT DEPTH SHALL BE INTO CONSOLIDATED, UNDISTURBED SUBGRADE, NOT LOOSE SEDIMENT DEPOSITION. IF BEDROCK IS ENCOUNTERED MIN. EMBEDMENT DEPTH CAN BE REDUCED WITH APPROVAL FROM ENGINEER.
4. THE ENGINEER MAY ADJUST THE ARM LENGTHS AND SLOPES TO MATCH THE ACTUAL SITE CONDITIONS. THE RECOMMENDED SLOPE ON THE ARMS IS 4% TO 8%.
5. USE GEOTEXTILE FABRIC AS DESCRIBED IN THE SPECIFICATIONS AND BY DETAIL. PLACE GEOTEXTILE BEHIND THE ARM (UPSTREAM SIDE), DRAPED FROM TOP OF ROCK STRUCTURE TO BOTTOM OF FOOTER ROCK AND EXTEND A MINIMUM OF HALF THE TRENCH BOTTOM WIDTH. TRIM EXCESS OR VISIBLE FABRIC.
6. THE APEX BOULDER IS THE EQUIVALENT OF A KEYSTONE IN AN ARCH STRUCTURE. PLACE IT SO IT IS WEDGED IN PLACE BY THE FORCE OF THE WATER. IT SHOULD BE THE LOWEST BOULDER.
7. PLACE THE ROCKS TO INTERLOCK TOGETHER AND HAND CHINK ANY LARGE VOIDS WITH ROCK THAT WILL NOT DISLODGE DURING HIGH FLOWS.
8. USE THE EXCAVATOR BUCKET TO DUMP ("WASH") WATER ACROSS THE BACKFILL TO CONSOLIDATE IT.

Xref ..\Images\WdR\_Stamp\_08-06-21.dwg

ONE INCH - IF NOT,  
SCALE ACCORDINGLY

Revisions	Date

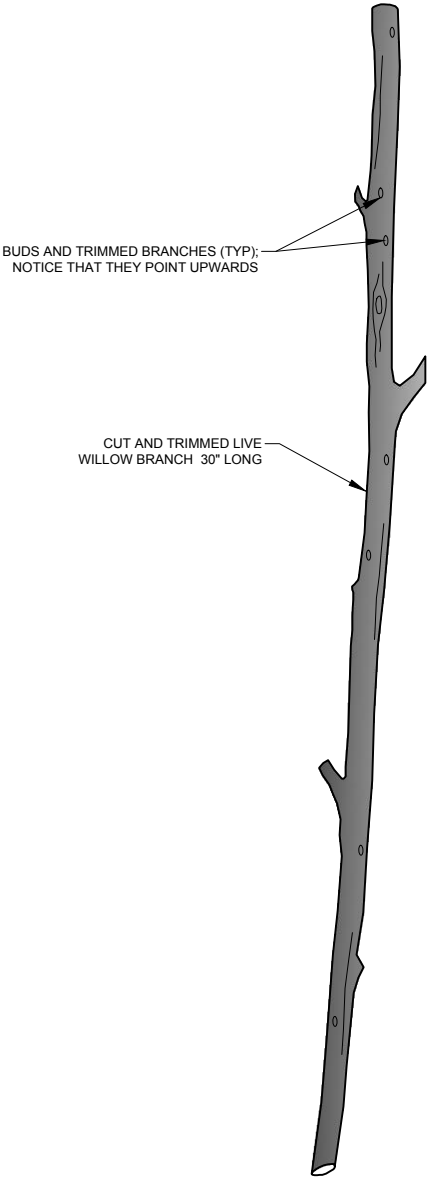
WEST CAMERON PEAK FIRE  
(GREELEY) EWP  
SHEEP CREEK SITE  
CITY OF GREELEY, COLORADO

**ROCK STABILIZATION**

Project Mgr. ABA	Designed By: CHB
Drawn By: RBR	Approved By: WDR
Date: 06/08/2021	

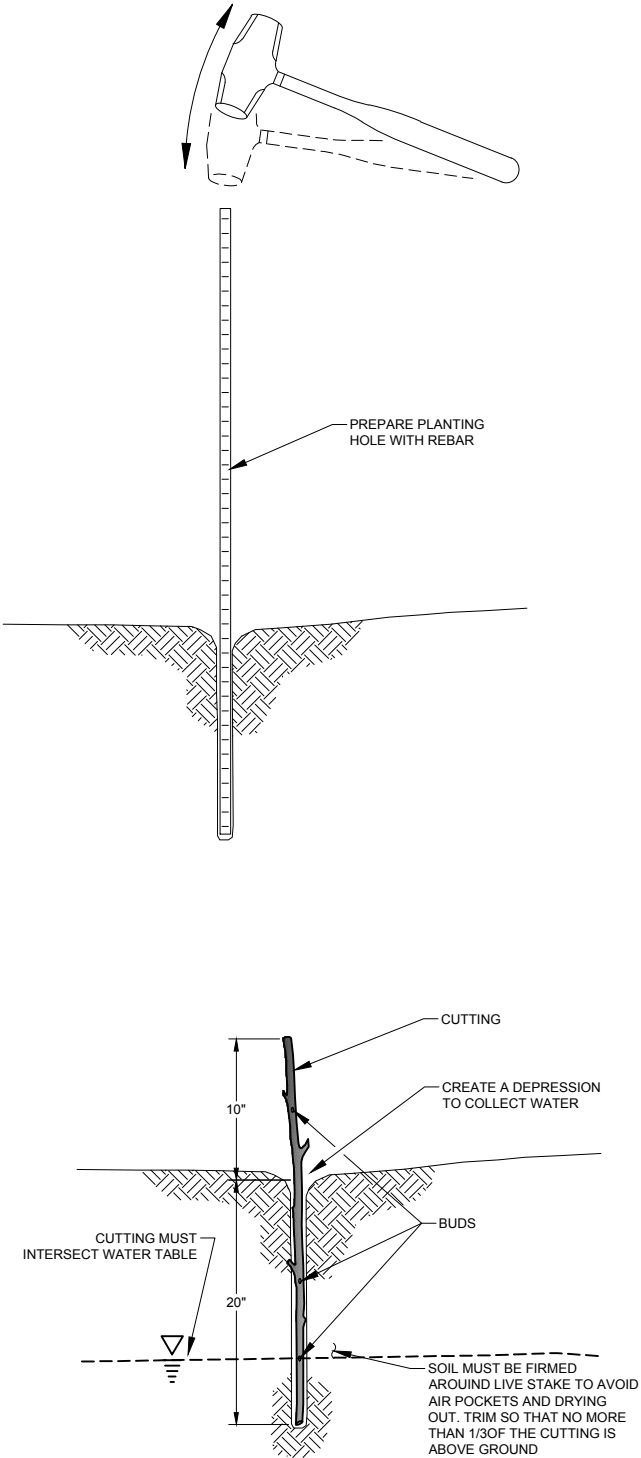
PROJECT NO.  
36-4705.03  
DRAWING NO.

Drawing Name: I: \36\01\_PROPOSALS AND MARKETING\GREELEY WATER RESOURCES 2022 POST-FIRE MITIGATION\DWGS\36-4705.03 SHEEP CREEK DETAILS.DWG Wednesday, October 27, 2021 11:53 AM By: BARRY, COLIN



NOTES:

1. SPACE EACH STAKE 2' TO 4' APART



ONE INCH - IF NOT,  
SCALE ACCORDINGLY

Project Mgr.	ABA
Designed By:	CHB
Drawn By:	RBR
Approved By:	WDR
Date:	06/08/2021

PROJECT NO.  
36-4705.03  
DRAWING NO.

D  
SHEET 359

WEST CAMERON PEAK FIRE  
(GREELEY) EWP  
SHEEP CREEK SITE  
CITY OF GREELEY, COLORADO

WILLOW STAKE  
INSTALLATION

Revisions	Date

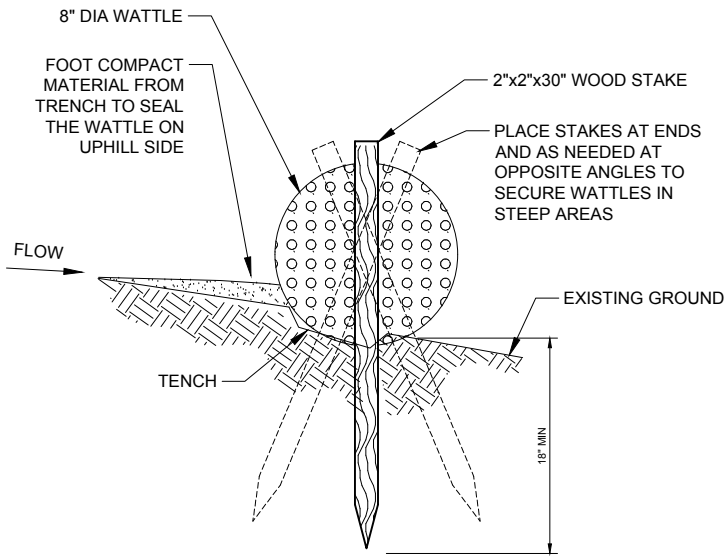
**AVRES**  
3665 JFK Parkway  
Building 2, Suite 100  
Fort Collins, CO 80525  
(970) 223-5556



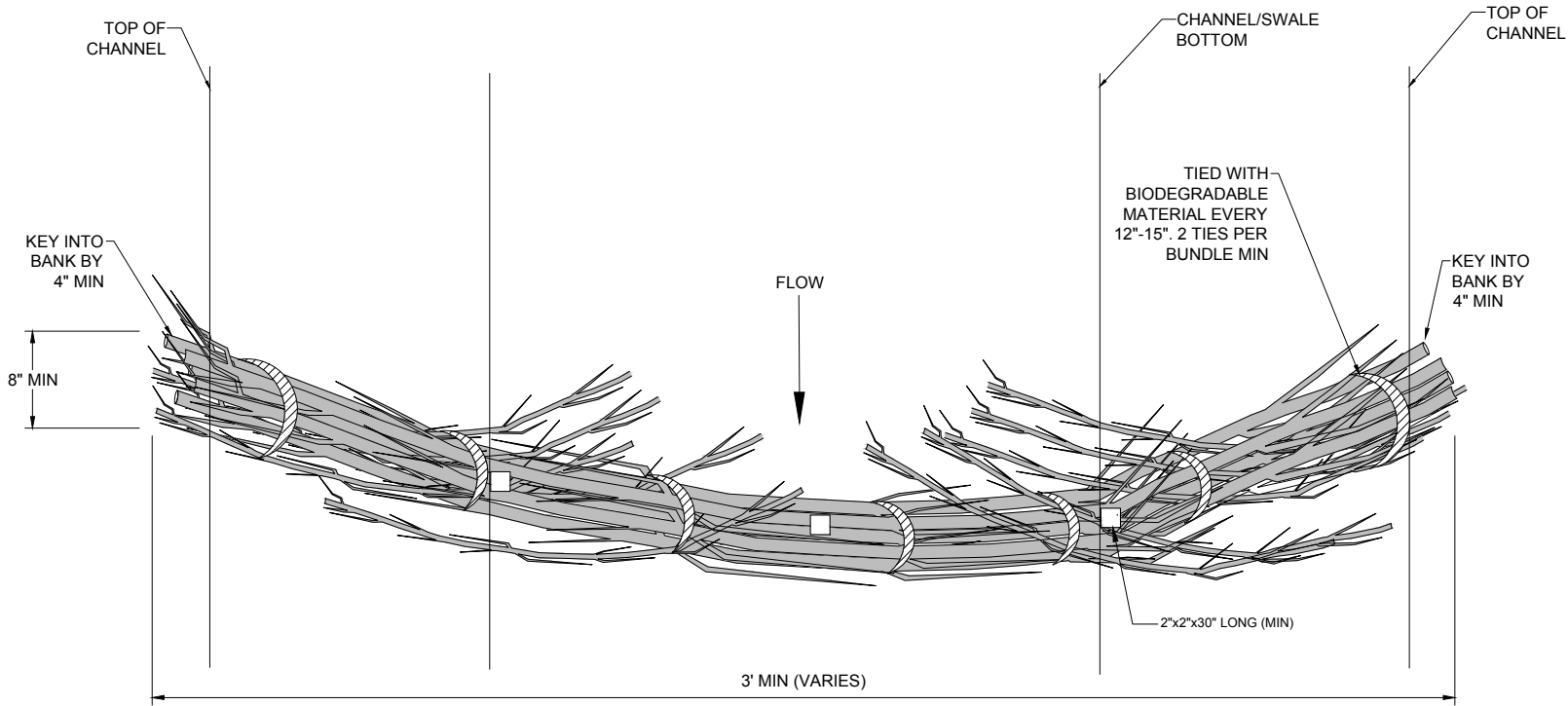
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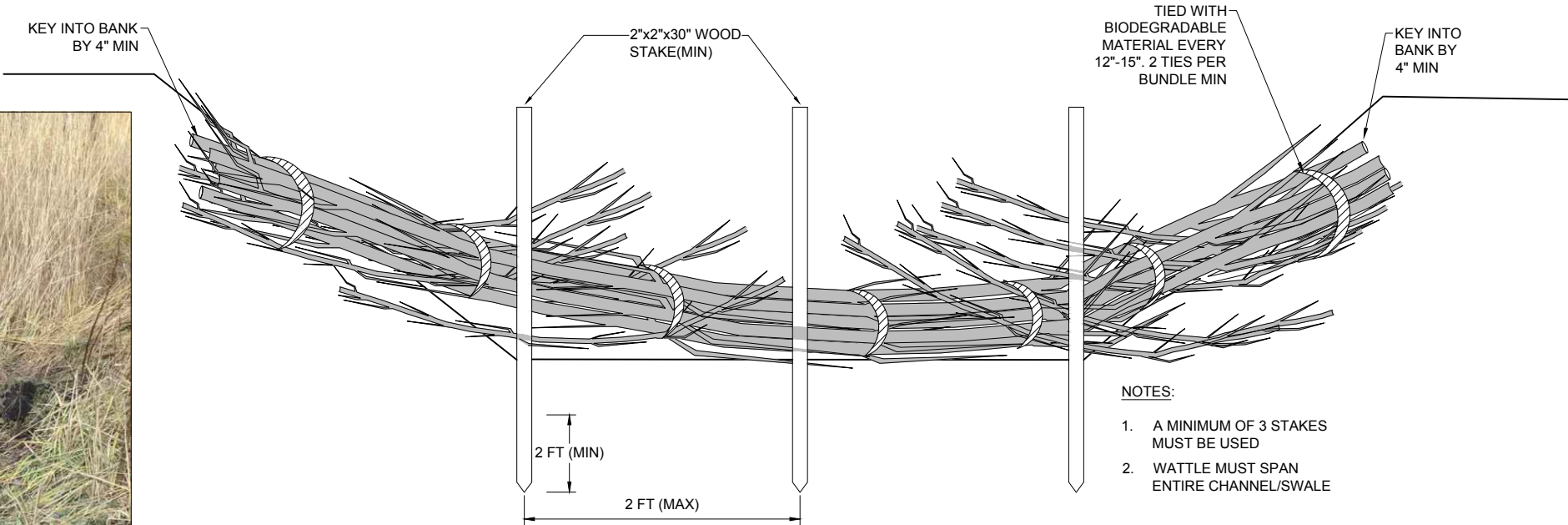
WILLOW WATTLE INSTALLATION  
NOT TO SCALE



STAKE DETAIL  
NOT TO SCALE



PLAN



CROSS SECTION

- NOTES:
1. A MINIMUM OF 3 STAKES MUST BE USED
  2. WATTLE MUST SPAN ENTIRE CHANNEL/SWALE

ONE INCH - IF NOT,  
SCALE ACCORDINGLY

Revisions	Date

WEST CAMERON PEAK FIRE  
(GREELEY) EWP  
SHEEP CREEK SITE  
CITY OF GREELEY, COLORADO

WILLOW WATTLE - FASCINE  
BUNDLE

Project Mgr. ABA	Designed By: CHB
Drawn By: RBR	Approved By: WDR
Date: 06/08/2021	

PROJECT NO.  
36-4705.03  
DRAWING NO.

**Appendix B**  
**CPRW LiDAR Collection Proposal - Larimer Co &**  
**Cache La Poudre Watershed**



January 6<sup>th</sup>, 2022

Shayna Jones  
Post-fire Mitigation & Recovery Program Manager  
Coalition for the Poudre River Watershed  
320 E. Vine Drive, suite 317  
Fort Collins, CO 80524 USA

Re: CPRW Lidar Collection and Processing

Dear Ms. Jones:

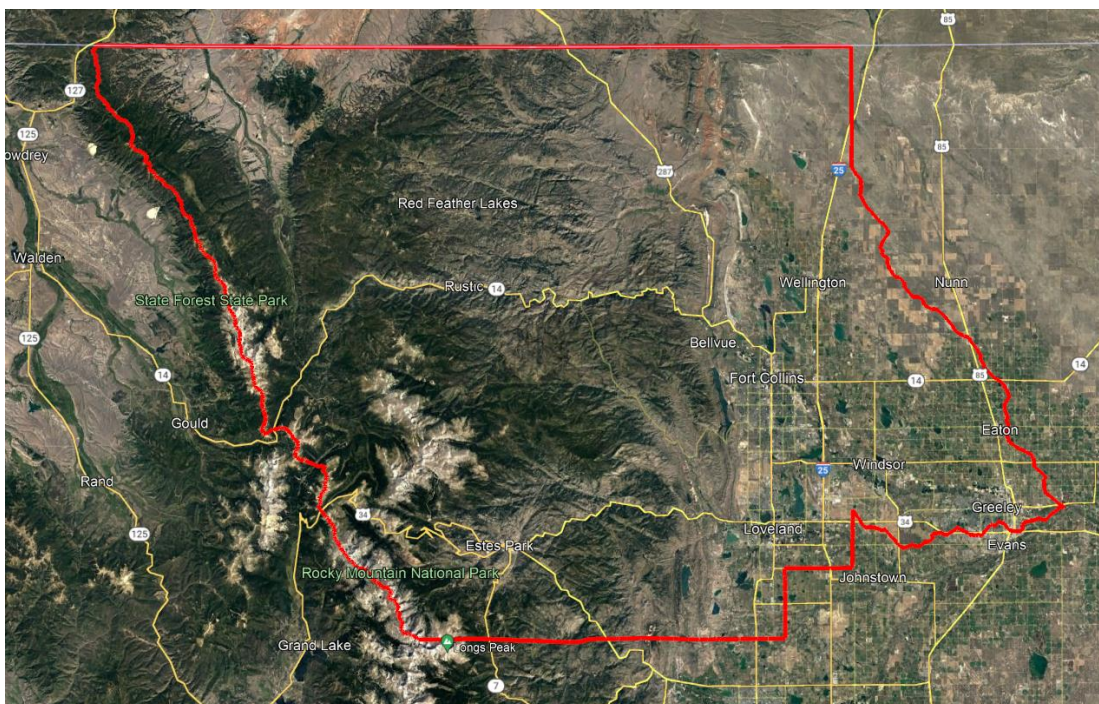
Thank you for the opportunity to submit a proposal for mapping services for the CRPW Lidar project in Larimer and Weld Counties, Colorado. This letter describes our proposed approach and fees for collecting and processing high density Lidar across project area. Ayres Associates appreciates the necessity for accuracy and expedited schedules for your project, and we present this proposal with a commitment to give your project high priority in our production schedule.

### Proposed Scope of Service

For this project, we propose to utilize high density aerial Lidar to derive a project wide digital elevation model and classified point cloud. As a general overview of the project, Ayres will acquire Lidar in the Spring and Summer of 2022 using a calibrated Lidar sensor to support a detailed terrain model over approximately 2,925 square miles covering the Poudre River Watershed.

### Project Area

Aerial Lidar will be captured for the project area shown below. Lidar will be collected and processed for a total of 2,925 square miles



## Lidar Acquisition and Processing

Ayres understands that the proposed Lidar project calls for the development of high accuracy topographic mapping and above ground modeling across the project area. The Lidar data collection will be done using a low altitude fixed wing aircraft equipped with an advanced Lidar sensor and with airborne GNSS/IMU system for accurate georeferencing. The Lidar point cloud will be captured in the Spring - Summer of 2022 during leaf-off state, and when clouds or haze are not present between the aircraft and the ground, and when snow levels have melted to an acceptable level.

For the Lidar acquisition, QL1 Lidar will be collected at 8 points per square meter and will achieve QL1 vertical accuracy Lidar Base Specifications, which equates to 10 cm RMSEz on level or uniformly sloped non-vegetated ground.

The raw lidar point cloud will be calibrated and classified according to the base classification scheme listed below. All collected Lidar points will be retained in the point cloud according to these classifications. High vegetation and building classifications will also be included using automated routines. The point cloud will be in LAS v1.4 format.

Lidar Base Classification Scheme:

- Class 1: Processed, but unclassified
- Class 2: Bare-earth ground
- Class 5: High Vegetation
- Class 6: Buildings
- Class 7: Low Noise
- Class 9: Water
- Class 17: Bridge Decks
- Class 18: High Noise
- Class 20: Ignored ground (breakline proximity)

Breaklines will be collected to constrain the hydro features, a process called hydro-flattening. Ayres will collect additional hydro breaklines to be used in creation of bare earth Digital Elevation Model (DEM) and contours. Hydro-flattened breaklines will be compiled for ponded water that is 2 acre or greater and double line streams that 20 feet in width or greater. A bare earth digital elevation model (DEM) for the project area will be generated from the processed lidar data at a 1-ft pixel resolution and will support the generation of contours at 1-foot contour intervals.

## Lidar Ground Control

Ayres will use the airborne GNSS/IMU data collected at the time of flight. We also will use COCORS data collected during the flight from nearby permanent base stations to calibrate the raw lidar data. Additionally, Ayres will perform all ground control survey necessary across the project area that will be used to validate and calibrate of the raw lidar data. The ground control calibration survey does not include any independent testing on various landcover types.

## Deliverables

In summary, final deliverable products will include:

- Classified point cloud, LAS v1.4 format
- Automated classification of high vegetation and buildings (classes 5 and 6)
- Hydro flattening breaklines (20-ft streams and 2-acre ponds), ESRI shapefile format
- Bare earth DEM (1-ft pixel)
- 1-ft contour dataset (topologically cleaned)
- Intensity imagery, GeoTIFF format
- Digital Surface Model (DSM) of first returns
- Tile schematic, ESRI shapefile format



Additional lidar derivative datasets for consideration (not included in Proposed Fees):

- Bare earth point cloud – class 2 points only
  - Bare earth point clouds in .las format version 1.4 will be created from the Lidar class 2 points.
- 2D building outlines generated from building points
  - Once the Building Classification is performed, Ayres can extract two-dimensional building outlines from the Lidar data. Compiling building outlines from Lidar utilizes points collected from roof surfaces and classified as buildings. These points are then processed through modeling software which employs edge-detection macros to determine the outside extents of buildings. The result is that the building edges are compiled without horizontal displacement.
  - A degree of manual and automated editing will be necessary to help clean up areas where dense vegetation partially obscures buildings. However, limited editing will be applied elsewhere. In order to take advantage of the economic benefits of this approach, the output will be primarily the result of a semi-automated process and constrained to the ability of the Lidar data's ability to detect and geometrically define building detail.
- Tree canopy polygons from high vegetation points
  - Once the Vegetation Classification is performed on the Lidar, extraction of two-dimensional contiguous high vegetation polygons can be performed on the data. Using a series of algorithms and semi-automated extraction techniques, we are able to identify contiguous stands of trees to extract vegetation polygons from the Lidar. This method can be more efficient and cost effective than traditional photogrammetric compilation.
  - Ayres will use the Lidar point clouds to produce a representative 2D layer for a project-wide forest canopy. In order to take advantage of the economic benefits of this approach, the output will be primarily the result of a semi-automated process and constrained to the ability of our algorithms to detect and geometrically define the canopy detail from the Lidar classified data.
- Culvert collection and hydro-enforced DEM
  - The Base Project Lidar DEM will be hydro flattened but not hydro-enforced. To hydro enforce the DEM, Ayres will collect culvert locations using the Lidar. The culvert lines will then be draped to the Lidar point cloud, and the lowest elevation will be applied to the line to create a 3D breakline. We will use the 3D breaklines to reclassify the ground points and cut the DEM, allowing modeled water to flow through the culverts, rather than dam against road banks and other digital dams.
  - The hydro-DEM useful for hydrography modeling and land conservation planning across the project area. The deliverables include a hydro-enforced project-wide DEM in grid or Geotiff format and culvert locations in shapefile format.
- Cloud hosting (Amazon S3) and account management
  - Ayres can provide a cloud-hosting solution for the Lidar point cloud files. This solution helps solve the challenge of making a large amount of geospatial data readily available for project partners to download. The cloud-hosting service will maximize the datasets usage and value to the project partners and ease the burden of data requests on you and your staff.
  - Ayres will streamline the efficient uploading of data into the cloud. We will use Amazon S3 services for storing and hosting your geospatial datasets through our corporate account. Under the cloud hosting services, Ayres will:
    - Create CPRW specific buckets for holding data in Amazon S3 cloud
    - Upload the requested Lidar datasets directly into the proper buckets
    - Properly name and format data files for easy understanding of downloads

- Provide CPRW and project partners with a spreadsheet that has unique URL's for each data tile
  - This is used to point at the data tiles from the public facing map application
- Manage Amazon S3 account and pay monthly invoices on behalf of CPRW
- Track usage and inform the project partners when downloads are approaching their limit for the year
- The proposed fees are not-to-exceed lump sum amounts that are estimated for one year of service. The cloud-hosting services are contracted annually via an amendment to our existing geospatial services Contract. A new amendment will be required to maintain the links once the original amount has been expended. Ayres will work with CPRW to determine a contracting period for cloud-hosting and may contract for more than one year at a time if need be.

Cloud-hosting of 2022 Lidar datasets:

Cloud storage up to 2 TB and 500 GB/month download:	\$ 2,500.00
Initial data set-up and account management (Year 1):	\$ 7,300.00
2022 Annual Cloud-Hosting Budget Total:	\$ 9,800.00

2 TB cloud storage and 500 GB/month download capacity:	\$ 2,900.00
Annual account management:	\$ 2,000.00
2023 Annual Cloud-Hosting Budget Total:	\$ 4,900.00

2 TB cloud storage and 500 GB/month download capacity:	\$ 3,300.00
Annual account management:	\$ 2,200.00
2024 Annual Cloud-Hosting Budget Total:	\$ 5,500.00

- Interactive Lidar Online Viewer
  - Ayres will utilize the 2022 Lidar to develop an online interactive webmap service by optimizing, hosting and storing Lidar derived data layers in ArcGIS Online. We will create a customized web application and provide you with a link to access the online interactive viewer. The interactive webmap will have tools for measuring, basemap selection, and toggling data on and off. The interactive Lidar online viewer is a web browser-based application which will run in current versions of Microsoft Edge, Google Chrome, Mozilla Firefox, and Safari 11 and later.
    - According to ESRI's current guidance, we recommend using the latest versions of Google Chrome or Mozilla Firefox. Microsoft Edge and Safari 11 and later work, however these two do not have WebGL implementation and may not operate as well.
  - Ayres will process the 2022 project area Lidar to into formats compatible with ArcGIS Online. Data layers will be uploaded and hosted in the Ayres' ArcGIS Online account. Ayres will create a customized 3D web application for the project area. When the service is completed, all items will be set for public sharing.
    - Potential Viewing Layers:
      - Slope shade bare earth layer
      - Shaded relief bare earth layer
      - Hillshade bare earth layer
      - Elevation surface layer from Lidar DEM
      - Hydro-enforced DEM
      - Ground lidar point cloud
      - High vegetation lidar point cloud layer
      - Building lidar point cloud layer
      - 1-foot topographic contour layer

- Ayres will provide technical maintenance services for hosted data layers, web scenes and web applications needed for the Ayres Lidar Online service. Data storage fees from ArcGIS Online will be administered by Ayres and are included in the maintenance program. This service is based on ESRI technology and architecture. Ayres is not responsible for changes that ESRI makes to its ArcGIS Online functionality or tools.
- The proposed fees are not-to-exceed lump sum amounts that are estimated for one year of service. The Interactive Lidar Online Viewer services are contracted annually via an amendment to our existing geospatial services Contract. A new amendment will be required to maintain the Online Viewer once the original amount has been expended. Ayres will work with CPRW to determine a contracting period for cloud-hosting and may contract for more than one year at a time if need be.

Interactive Lidar Online Viewer:

Initial web application set-up and account management:	\$ 34,500.00
2023 Annual account maintenance and management:	\$ 12,500.00
2024 Annual account maintenance and management:	\$ 13,200.00

### Proposed Schedule

Ayres will perform the proposed services according to the following schedule:

- Lidar acquisition: will occur in Spring-Summer of 2022, as weather and ground conditions permit.
  - The Eastern Front-Range portion of the project area would be collected earlier in the Spring, as ground conditions permit.
  - The Western Mountains portion of the project area would be collected as ground conditions permit and when snow levels have melted to an acceptable level as determined by CPRW staff and Ayres.
- Lidar Processing: final deliverables will be delivered within 3 months of completion of Aerial Lidar Collection and Survey Ground Control Collection.

## Proposed Fees

We will perform the above services for the following **lump sum** fees:

Aerial Lidar Collection, Processing, Survey (2,925 sq miles):	\$ 506,000.00
Hydro Breaklines (20-ft streams and 2-acre ponds):	\$ 38,000.00
1-ft contour dataset (topologically cleaned):	\$ 22,000.00
Classification of High Vegetation, Buildings (class 5 and 6):	<del>\$ 13,500.00</del>
*Included at no cost with base project	\$ 0.00
Intensity Imagery from Lidar (GeoTIFF):	<del>\$ 4,000.00</del>
*Included at no cost with base project	\$ 0.00
Digital Surface Model (DSM) of first returns:	<del>\$ 15,500.00</del>
*Included at no cost with base project	\$ 0.00

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<b>Total Lump Sum Fees:</b>	<b>\$ 566,000.00</b>
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Additional Lidar derivatives **lump sum** fees:

Bare Earth Point Cloud- Class 2 points only:	\$ 5,000.00
2D building outlines generated from building points	\$ 49,000.00
Tree canopy polygons from high vegetation points	\$ 42,000.00
Culvert collection and hydro-enforced DEM	\$ 108,000.00
Cloud hosting (Amazon S3) and account management (Year 1)	\$ 9,800.00
Year 2	\$ 4,900.00
Year 3	\$ 5,500.00
Interactive Lidar Online Viewer	\$ 34,500.00
Year 2	\$ 12,500.00
Year 3	\$ 13,200.00

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<b>Total Lump Sum Fees for Additional Lidar derivatives:</b>	<b>\$ 284,400.00</b>
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I hope that we have provided the information you require to proceed with your project. In the event that you require additional information or clarification of any issue, please feel free to contact me at 414-467-8891.

Sincerely,

Ayres Associates Inc



Tyler Kaebisch  
Project Manager – Geospatial Services  
Direct: 414-467-8891  
[KaebischT@AyresAssociates.com](mailto:KaebischT@AyresAssociates.com)

**Appendix C**  
**Aerial Mulching Specifications**

## Wood Mulch Technical Specifications

Using the soil burn severity assessment and other data treatment polygons were identified that are located in areas that are in “high” and “moderate” burn severity classes with slopes that range from 20 to 50 percent. The purpose of these post-fire treatments are to provide adequate cover on treatment areas within the Cameron Peak Fire to reduce erosion and sedimentation that may affect water quality, infrastructure and lives of the citizenry located within, adjacent, or down slope of the fire perimeter.

### Aerial Mulch Specifications

Cover Purpose: The mulch material shall vary in size to allow interlocking to provide the most resistance to water runoff, soil erosion and wind removal.

Wood Shred Size and Composition: The size shall consist of a relatively even composition of smaller and larger length strands. At least 70% of the total wood shred volume will have stubble lengths of 4-8 inches typical, have less than 1” diameter and have minimal fines. It is recommended that a horizontal grinder be used on trees and a tub grinder be used for the resulting slash. A screen of 2-4” will be used to meet the desired specifications. Wood shred shall be covered during transportation and when staged to prevent material from blowing around on site.

Source Material: Burned trees from within the burned area would be preferred for generating wood mulch material. There are limited private lands in the burned area and use of burned trees from National Forest Lands is not currently permitted. However, there are some log decks from fire suppression actions that have the potential to be used. The project sponsors will also continue to work on permitting the use of trees from National Forest Lands.

### Aerial Mulch Application Specification:

Targeted Areas: The contractor will mulch 100% of the targeted acres (See additional notes on aerial and broadcast application). Targeted areas are delineated on the treatment map. These polygons have not been field verified and will likely change somewhat after that verification work has been completed. The field verified polygons will be available before the project implementation begins.

Wood Shred Cover: Application rate is anticipated to be about 4 tons/acre. The objective is to attain a coverage rate of at least 70% of the soil surface with an evenly distributed interlocking wood shred, within each delineated polygon identified on the treatment map. Because wood shred moisture content may vary (e.g. live versus dead trees) application rate (tons/acre) may vary to achieve the desired cover of 70%. The helicopter netting will be small enough such that the vast majority of the mulch will not fall through and be lost in flight.

Additional Notes on Aerial and Broadcast Application: Maintain consistent contact with mulching vendor project manager and the pilot to ensure that targeted areas are being met efficiently. Avoid dropping mulch in drainages and over areas covered with substantial rock cover (greater than about 50%) since large rock cover adequately protects the soil from accelerated water erosion. A certain amount of pilot

discretion is recognized to be necessary while in the air to determine appropriate application within the treatment areas. Field inspectors will be made aware of this pilot discretion.

### Aerial Mulch Cover Material Assessment Protocol:

Wood Shred Size and Composition: The material will be screened through an appropriately sized sampling screen (1/2" – 1" opening) needed to meet the size specifications with no more than 30% of any sample comprised of fines less than 1" diameter by volume. All samples with a proportion of "fines" greater than 30% will be considered not acceptable per the material specification. See Additional Notes on Material Specification and Quality Assurance below.

Methodology: The methodology described below will be used to assess the adequacy of the cover material.

1. Draw two lines inside a five gallon bucket with a permanent marker: The first line is drawn 2/3 up from the bottom of the bucket which represents 3.3 gallons; this is the sample volume. Draw the second line at the 1.0 gallon level to demarcate the 30% "fines" sample threshold.
2. With the bucket, collect mulch (material specification sample) to the upper (3.3 gallon) line, noting where the sample was taken from: site/pile identifier, horizontal (i.e. northwest corner, center, etc.) and vertical (i.e. Top, middle or bottom) locations within the pile.
3. In a continuous motion pour and shake the collected material on to the 1/2" - 1" sieve, which is 3 feet above a tarp (or something that effectively catches the material). Agitate the sieve. Material that falls through the sieve is a fine that does not meet the specification. When done, set the wood shred that did not fall through the sieve aside for further assessment if necessary.
4. Pour the sieved "fines" back into the bucket, and level the contents to make an even plane of fines at the bottom of the bucket. If the "fines" exceed the 30% mark (1.0 gallons, lower line) of the bucket after being leveled, then the sample does not pass.

### Additional Notes on Material Specification and Quality Assurance:

Note where all the material specification samples are taken from, e.g. bottom or top, front or back. In the event that material samples fail for wood shred, consider several alternatives before the entire lot or individual pile is rejected.

If material is consistently just below the minimum specification from any given sample location, consider mixing the pile prior to testing additional specification samples. Eventually, either repeat or rescreen and discard enough "fines" from the pile so the specification is met.

If material still does not meet the minimum specification, consider mixing in new additional material that meets the minimum specification and retest.

For wood shred, ensure that the setting in the grinder is consistently producing the specified material. If the out feed conveyor is able to articulate and it is feasible, consider aiming the conveyor out feed into the wind to further separate fines from the specified material.

## Application Assessment Protocol (Cover Assessment Considerations)

Due to the difficulty of the terrain, the time and effort required to gain access to the areas will be intensive. As a result more time will likely be taken to gain the sample points than to actually collect the data. Therefore, it will be advantageous to collect enough data to safely infer the variation of cover within a single treatment polygon. The confidence in data results should constitute no more than “a preponderance of evidence” that the coverage was applied to specification.

All treatment polygons will be given a generalized total cover estimate from afar, either from vantage points or aerial imagery. Additionally, at a minimum, a random sample of a subset of treatment polygons will be selected for a quantitative assessment using line point transects. The NRCS reserves the right to inspect every treatment polygon.

Cover will be estimated and documented utilizing a 100 point step transect. A cover point will be assessed every other step by the inspector to estimate post treatment percent cover of wood shred mulch. A mark on the inspector’s boot will insure consistency. The only time the inspector looks down at the boot is when recording the hit. Transects will be randomly located within treatment polygons via randomly selected transect starting points (identified by a GPS waypoint or mark on a treatment map). Transects will be paced on a random bearing in a straight line. The minimum sampling density will be 1 transect per 100 acres or polygon. The inspector, at their discretion, can do 2 more transects from the same starting point within the polygon if it is not clear that the application has met the 70% criteria. Pictures of the transect will be taken at the time of cover measurement. All transect information will be recorded on the approved inspection form and signed and dated by the inspector. If the 70% criterion is not met, the inspector will notify the vendor representative of the deficiency. The vendor representative will notify the contractor and the contractor will take corrective action as soon as flight and ground operations permit. A timely follow up inspection will occur on the deficient treatment area to insure mulching operations are not unduly impeded.

For sites that cannot be accessed due to landowner permissions or terrain limitations, a visual estimate will have to be employed. This may be from a vantage point or via flights on a helicopter. Please note though, color of wood shred can vary greatly depending on species and whether it is dead/heavily charred, resulting in mistaken “low” estimations of cover across the treatment polygon. Visual inspections from the air or vantage points will also be noted on the approved inspection form. Therefore, all effort will be made to access the polygons on the ground to perform the step point transect method of determining percent cover. The vendor representative will attain load tickets for every treatment polygon to verify that sufficient mulch material has been applied. Vendor representative will provide load tickets to the inspectors on a daily basis. Load tickets will be compared to documented, and attached to the inspection form. NRCS will do a second level review of the inspection form and sign off on the form to insure that the objectives of the mulching have been met per polygon.

Prior to the closing of a staging area and movement to a new staging area all treatment polygons will be signed off by NRCS as being adequate through the second level review process.



The inspectors will consist of trained NRCS, City of Greeley, City of Fort Collins, Coalition for the Poudre River Watershed, JW Associates, and other qualified personnel.

### Wood Mulch Source Material

Wood to be mulched for this project can be transported into the sites. However, there will likely be some opportunity to use burned trees (see below) as mulch source materials. These trees would need to be removed before or during the mulching operations. The amount of material available has not been determined.



FS Agreement No. \_\_\_\_\_

Cooperator Agreement No. \_\_\_\_\_

**PARTICIPATING AGREEMENT**  
**Between The**  
**CITY OF GREELEY**  
**And The**  
**USDA, FOREST SERVICE**  
**ARAPAHO AND ROOSEVELT NATIONAL FORESTS AND PAWNEE NATIONAL**  
**GRASSLAND**

This PARTICIPATING AGREEMENT is hereby entered into by and between the City of Greeley, acting by and through its Water Enterprise, hereinafter referred to as “Greeley,” and the United States Department of Agriculture (USDA), Forest Service, Arapaho and Roosevelt National Forest and Pawnee National Grassland, hereinafter referred to as the “U.S. Forest Service,” under the authority: Wyden Amendment (Public Law 105-277, Section 323 as amended by Public Law 109-54, Section 434, and permanently authorized by Public Law 111-11

Background: In 2020, the Arapaho and Roosevelt National Forests experienced the two largest wildfires in the history of Colorado (Cameron Peak and East Troublesome), in addition to three other significant fires (Williams Fork, Calwood and Lefthand). These fires significantly affected hundreds of thousands of acres of watersheds that are of critical importance for the domestic, agricultural, and municipal water supplies for over one million people.

The 2020 Cameron Peak Fire burned over 200,000 acres in the watersheds of the Cache la Poudre and Big Thompson Rivers, including both public and private properties. The damage to these watersheds continues to pose immediate and future threats to public infrastructure serving Larimer and Weld Counties, including, without limitation, water supply infrastructure.

The fire impacted soils may result in flash flooding and large fluxes in sediment and debris transport. Research shows that burned areas, particularly those at moderate to high severity, are more susceptible to erosion and debris flow events until enough time has lapsed to allow suitable vegetation (grasses, shrubs, trees) to become re-established to better secure the soil in place. As part of the fire recovery effort, priority areas have been identified that are in need of emergency stabilization using wood mulch and other treatments to help limit impacts to watersheds, soil and water resources. The purpose of this management technique is to stabilize soils and promote forest recovery reducing sediment and debris transport from runoff water or precipitation events, which would in-turn protect water infrastructure and water quality. Soil stabilization is also important in facilitating long-term watershed recovery. Actions that encourage soil retention will help promote revegetation, including development of new forests which in turn provide shade for winter snows and resulting longer spring run-off periods.



In 2021 Greeley facilitated the implementation of extensive emergency watershed protection measures with funding to facilitate the mitigation and rehabilitation measures described generally above, via the federal Natural Resource Conservation Service (NRCS) Emergency Watershed Protection Program and the Colorado Department of Natural Resources Watershed Restoration Wildfire Mitigation Program, administered by the Colorado Water Conservation Board (CWCB). Nearly \$6.5 million dollars of EWP mitigation have been invested to-date. These funds were primarily used on private lands with a portion used to stabilize approximately 1,300 acres of heavily impacted soils on the National Forest.

It is critically important to protect these investments by continuing the watershed restoration on all lands affected by the fire, including U.S. Forest Service lands, upstream of the private lands.

Title: Cameron Peak Post-Fire Mitigation and Recovery Project

## **I. PURPOSE:**

The purpose of this agreement is to document the cooperation between the parties to implement watershed recovery and restoration in and adjacent to lands affected by the Cameron Peak Fire in accordance with the following provisions and the hereby incorporated Financial Plan, attached as Exhibit A and Scope of Work attached as Exhibit B. Collaborations within the Scope of Work of this agreement include a wide-variety of watershed restoration actions as described in part, in the “2022 Cameron Peak Fire Recovery Work Plan – Aerial Mulching & Point Mitigation” included as Exhibit C. These types of actions, as well as other related restoration efforts which could include reforestation, road work and similar are expected to continue to be refined as additional information is gathered. This restoration plan will be refined as additional information and site visits occur.

## **II. STATEMENT OF MUTUAL BENEFIT AND INTERESTS:**

The U.S. Forest Service and Greeley enter into this agreement with the mutual goal of watershed protection and restoration. Water is one of the most important natural resources flowing from forests. The U.S. Forest Service manages the largest single source of water in the U.S. with about 18% originating from 193 million acres of land. A network of water and watershed resource specialists support stewardship efforts at all levels of the organization to promote healthy, sustainable watersheds fundamental to ecosystems and people. In order to provide water, stable watersheds are essential. Greeley seeks to partner with the U.S. Forest Service to help improve watersheds located on U.S. Forest Service lands, stabilizing the effects of the Cameron Peak Fire, which benefits the local water providers ability to deliver water to its contract allottees as well as the U.S. Forest Service goal of a healthy ecosystem, and protects investments already made in watershed restoration downstream of U.S. Forest Service lands.



The U.S. Forest Service and Greeley acknowledge that the wildfire mitigation and rehabilitation measures facilitated by Greeley pursuant to this agreement constitute one aspect of a larger regional and national policy objective, that is, to mitigate and rehabilitate the impacts of the Cameron Peak Fire, and that Greeley is facilitating these measures for the benefit of all water users and other parties with an interest in the Cache la Poudre and Big Thompson watersheds. Any grant funding received, passed through, or otherwise managed by Greeley pursuant to this agreement is for the purposes of the greater policy objective and the common benefit of the parties described, and will not result in a revenue subsidy or production of a capital asset for the Water Enterprise of the City of Greeley.

In consideration of the above premises, the parties agree as follows:

### **III. GREELEY SHALL:**

- A. LEGAL AUTHORITY. Greeley shall have the legal authority to enter into this agreement, and the institutional, managerial, and financial capability to ensure proper planning, management, and completion of the project, which includes funds sufficient to pay the non-Federal share of project costs, when applicable.
- B. USE OF GOVERNMENT OWNED VEHICLES. U.S. Forest Service vehicles may be used for official U.S. Forest Service business only accordance with FSH 7109.19, Chapter 60, the requirements established by the region in which performance of this agreement takes place, and the terms of this agreement.
- C. WORK SCOPE. Greeley will implement watershed recovery measures identified in the attached Financial Plan and Scope of Work in coordination with the U.S. Forest Service and other partners.
- D. CONTRACT OVERSIGHT.
  - 1. Greeley will use its procurement process and award contracts with independent contractors to perform the work identified in the Financial Plan and Scope of Work.
  - 2. Greeley will designate Project Managers to administer and oversee the work in accordance with terms and conditions of the contracts.
  - 3. In accordance with its policies and procedures, Greeley will require the independent contractors to: (a) provide a certificate of insurance, evidencing Commercial General Liability and (b) assume responsibility and liability for damages, loss or injury of any kind or nature whatever to persons or property omission, or failure to act when under a duty to act on the part of the independent contractors or any of their officers, agents, employees, or subcontractors in their performance of the work.

### **IV. THE U.S. FOREST SERVICE SHALL:**



- A. PAYMENT/REIMBURSEMENT. The U.S. Forest Service shall reimburse Greeley for the U.S. Forest Service's share of actual expenses incurred, not to exceed \$6,000,000, as shown in the Financial Plan. In order to approve a Request for Reimbursement, the U.S. Forest Service shall review such requests to ensure payments for reimbursement are in compliance and otherwise consistent with the terms of the agreement. The U.S. Forest Service shall make payment upon receipt of Greeley's monthly invoice. Each invoice from Greeley shall display the total project costs for the billing period, separated by U.S. Forest Service and Greeley's share. In-kind contributions must be displayed as a separate line item and must not be included in the total project costs available for reimbursement. The final invoice must display Greeley's full match towards the project, as shown in the financial plan, and be submitted no later than 120 days from the expiration date.

Each invoice must include, at a minimum:

1. Greeley's name, address, and telephone number.
2. U.S. Forest Service agreement number.
3. Invoice date.
4. Performance dates of the work completed (start & end).
5. Total invoice amount for the billing period, separated by the U.S. Forest Service and Greeley share with in-kind contributions displayed as a separate line item.
6. Display all costs, both cumulative and for the billing period, by separate cost element as shown on the financial plan.
7. Cumulative amount of U.S. Forest Service payments to date.
8. Statement that the invoice is a request for payment by "reimbursement".
9. If using SF-270, a signature is required.
10. Invoice Number, if applicable.

The invoice must be forwarded to:

EMAIL: [SM.FS.ASC\\_GA@USDA.GOV](mailto:SM.FS.ASC_GA@USDA.GOV)

FAX: 877-687-4894

POSTAL: USDA Forest Service  
Albuquerque Service Center  
Payments – Grants & Agreements  
101B Sun Ave NE  
Albuquerque, NM 87109



- B. TREATMENT APPROVAL. The U.S. Forest Service will participate with Greeley in the strategic planning of watershed restoration efforts, the selection of treatments at specific sites, and will approve all treatments prior to application on U.S. Forest Service lands.
- C. AREA CLOSURES. The U.S. Forest Service will close treatment areas for safety reasons at the reasonable request of Greeley.
- D. TECHINICAL COORDINATOR. The U.S. Forest Service will select an employee to act as the U.S. Forest Service Technical Coordinator for the project.

**V. IT IS MUTUALLY UNDERSTOOD AND AGREED BY AND BETWEEN THE PARTIES THAT:**

- A. PRINCIPAL CONTACTS. Individuals listed below are authorized to act in their respective areas for matters related to this agreement.

**Principal Cooperator Contacts:**

<b>Cooperator Project Contact</b>	<b>Cooperator Financial Contact</b>
Name: Sean Chambers Address: 1001 11 <sup>th</sup> Avenue, 2 <sup>nd</sup> floor City, State, Zip: Greeley, CO 80631 Telephone: 970-350-9815 FAX: Email: sean.chambers@greeleygov.com	Name: Erik Dial Address: 1001 11 <sup>th</sup> Avenue, 2 <sup>nd</sup> floor City, State, Zip: Greeley, CO 80631 Telephone: 970-350-9893 FAX: Email: erik.dial@greeleygov.com

**Principal U.S. Forest Service Contacts:**

<b>U.S. Forest Service Program Manager Contact</b>	<b>U.S. Forest Service Administrative Contact</b>
Name: Robert Skorkowsky Address: 2150 Centre Avenue Building E City, State, Zip: Fort Collins, CO, 80526 Telephone: 970-819-8980 FAX: Email: <a href="mailto:Robert.Skorkowsky@USDA.Gov">Robert.Skorkowsky@USDA.Gov</a>	Name: Sara Wolff Address: 2840 Kachina Drive City, State, Zip: Pueblo CO, 81008 Telephone: 719-553-1432 FAX: Email: <a href="mailto:Sara.Wolf@USDA.Gov">Sara.Wolf@USDA.Gov</a>

- B. ASSURANCE REGARDING FELONY CONVICTION OR TAX DELINQUENT STATUS FOR CORPORATE ENTITIES. This agreement is subject to the provisions contained in the Department of Interior, Environment, and Related Agencies Appropriations Act, 2012, P.L. No. 112-74, Division E, Section 433 and



434 as continued by Consolidated and Further Continuing Appropriations Act, 2013, P.L. No. 113-6, Division F, Title I Section 1101(a)(3) regarding corporate felony convictions and corporate federal tax delinquencies. Accordingly, by entering into this agreement Greeley acknowledges that it: 1) does not have a tax delinquency, meaning that it is not subject to any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability, and (2) has not been convicted (or had an officer or agent acting on its behalf convicted) of a felony criminal violation under any Federal law within 24 months preceding the agreement, unless a suspending and debarring official of the United States Department of Agriculture has considered suspension or debarment is not necessary to protect the interests of the Government. If Greeley fails to comply with these provisions, the U.S. Forest Service will annul this agreement and may recover any funds Greeley has expended in violation of sections 433 and 434.

- C. NOTICES. Any communications affecting the operations covered by this agreement given by the U.S. Forest Service or Greeley are sufficient only if in writing and delivered in person, mailed, or transmitted electronically by e-mail or fax, as follows:

To the U.S. Forest Service Program Manager, at the address specified in the agreement.

To Greeley, at the address shown in the agreement or such other address designated within the agreement.

Notices are effective when delivered in accordance with this provision, or on the effective date of the notice, whichever is later.

- D. PARTICIPATION IN SIMILAR ACTIVITIES. This agreement in no way restricts the U.S. Forest Service or Greeley from participating in similar activities with other public or private agencies, organizations, and individuals.
- E. ENDORSEMENT. Any of Greeley's contributions made under this agreement do not by direct reference or implication convey U.S. Forest Service endorsement of Greeley's products or activities.
- F. USE OF U.S. FOREST SERVICE INSIGNIA. In order for Greeley to use the U.S. Forest Service Insignia on any published media, such as a Web page, printed publication, or audiovisual production, permission must be granted from the U.S. Forest Service's Office of Communications (Washington Office). A written request will be submitted by the U.S. Forest Service to the Office of Communications Assistant Director, Visual Information and Publishing Services, prior to use of the insignia. The U.S. Forest Service will notify the Greeley when permission is granted.



- G. NON-FEDERAL STATUS FOR COOPERATOR PARTICIPANTS. Greeley agree(s) that any of Greeley's employees, volunteers, and program participants shall not be deemed to be Federal employees for any purposes including Chapter 171 of Title 28, United States Code (Federal Tort Claims Act) and Chapter 81 of Title 5, United States Code (OWCP), as Greeley has hereby willingly agreed to assume these responsibilities.

Further, Greeley shall provide any necessary training to Greeley's employees, volunteers, and program participants to ensure that such personnel are capable of performing tasks to be completed. Greeley shall also supervise and direct the work of its employees, volunteers, and participants performing under this agreement.

- H. NON-FEDERAL STATUS FOR COOPERATOR LIABILITY. Greeley agree(s) that any of Greeley's employees and program participants shall not be deemed to be Federal employees for any purposes including Chapter 171 of Title 28, United States Code (Federal Tort Claims Act) and Chapter 81 of Title 5, United States Code (OWCP), and Greeley hereby willingly agree(s) to assume these responsibilities.

Greeley agree(s) that, except as otherwise provided in this provision below, of Greeley's volunteers shall not be deemed to be Federal employees and shall not be subject to the provisions of law relating to Federal employment, including those relating to hours of work, rates of compensation, leave, unemployment compensation, and Federal employee benefits. When Greeley's volunteers are performing approved tasks identified under this agreement, the following applies:

1. For the purpose of the tort claim provisions of Title 28 of the United States Code, any of Greeley's volunteers shall be considered a federal employee.
2. For the purpose of subchapter I of Chapter 81 of Title 5 of the United States Code, relating to compensation to Federal employees for work injuries, Greeley's volunteers shall be deemed civil employees of the United States within the meaning of the term "employee" as defined in section 8101 of title 5, United States Code, and the provisions of that subchapter shall apply.
3. For the purposes of claims relating to damage to, or loss of, personal property of Greeley's volunteer incident to volunteer service, a volunteer shall be considered a Federal employee, and the provisions of 31 U.S.C 3721 shall apply.

Further, Greeley shall provide any necessary training and support to Greeley's employees, volunteers, and program participants, to ensure that such personnel are capable of performing tasks to be completed. Greeley shall also supervise and direct the work of its employees, volunteers, and program participants performing under this Agreement.

- I. MEMBERS OF CONGRESS. Pursuant to 41 U.S.C. 22, no member of, or delegate to, Congress shall be admitted to any share or part of this agreement, or benefits that may arise therefrom, either directly or indirectly.





- J. **NONDISCRIMINATION.** The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, and so forth.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.
- K. **ELIGIBLE WORKERS.** Greeley shall ensure that all employees complete the I-9 form to certify that they are eligible for lawful employment under the Immigration and Nationality Act (8 USC 1324a). Greeley shall comply with regulations regarding certification and retention of the completed forms. These requirements also apply to any contract awarded under this agreement.
- L. **SYSTEM FOR AWARD MANAGEMENT REGISTRATION REQUIREMENT (SAM).** Greeley shall maintain current information in the System for Award Management (SAM) until receipt of final payment. This requires review and update to the information at least annually after the initial registration, and more frequently if required by changes in information or agreement term(s). For purposes of this agreement, System for Award Management (SAM) means the Federal repository into which an entity must provide information required for the conduct of business as a Cooperative. Additional information about registration procedures may be found at the SAM Internet site at [www.sam.gov](http://www.sam.gov).
- M. **STANDARDS FOR FINANCIAL MANAGEMENT.**

### **1. Financial Reporting**

Greeley shall provide complete, accurate, and current financial disclosures of the project or program in accordance with any financial reporting requirements, as set forth in the financial provisions.

### **2. Accounting Records**

Greeley shall continuously maintain and update records identifying the source and use of funds. The records shall contain information pertaining to the agreement, authorizations, obligations, unobligated balances, assets, outlays, and income.

### **3. Internal Control**



Greeley shall maintain effective control over and accountability for all U.S. Forest Service funds, real property, and personal property assets. Greeley shall keep effective internal controls to ensure that all United States Federal funds received are separately and properly allocated to the activities described in the agreement and used solely for authorized purposes.

#### **4. Source Documentation**

Greeley shall support all accounting records with source documentation. These documentations include, but are not limited to, cancelled checks, paid bills, payrolls, contract and contract documents. These documents must be made available to the U.S. Forest Service upon request.

- N. **LIMITATION OF FUNDS.** U.S. Forest Service funds in the amount of \$ 6,000,000 are currently available for performance of this agreement through 5/1/2027. The U.S. Forest Service's obligation for performance of this agreement beyond this date is contingent upon the availability of appropriated funds from which payment can be made. There is no legal liability on the part of the U.S. Forest Service for any payment may arise for performance under this agreement beyond this amount until Greeley receive(s) notice of availability to be confirmed in a written modification by the U.S. Forest Service.
- O. **INDIRECT COST RATES- PARTNERSHIP.** Indirect costs are approved for reimbursement or as a cost-share requirement and have an effective period applicable to the term of this agreement.
1. If Greeley has never received or does not currently have a negotiated indirect cost rate, they are eligible for a de minimis indirect cost rate up to 10 percent of modified total direct costs (MTDC). MTDC is defined as all salaries and wages, fringe benefits, materials and supplies, services, travel, and contracts up to the first \$25,000 of each contract.
  2. For rates greater than 10 percent and less than 25 percent, Greeley shall maintain documentation to support the rate. Documentation may include, but is not limited to, accounting records, audit results, cost allocation plan, letter of indirect cost rate approval from an independent accounting firm, or other Federal agency approved rate notice applicable to agreements.
  3. For a rate greater than 25 percent, the U.S. Forest Service may require that request a federally approved rate from Greeley's cognizant audit agency no later than 3 months after the effective date of the agreement. Greeley will be reimbursed for indirect costs or allowed to cost-share at the rate reflected in the agreement until the rate is formalized in the negotiated indirect cost rate (NICRA) at which time, reimbursements for prior indirect costs or cost-sharing may be subject to adjustment.



4. Failure to provide adequate documentation supporting the indirect cost rate, if requested, could result in disallowed costs and repayment to the U.S. Forest Service.

P. OVERPAYMENT. Any funds paid to Greeley in excess of the amount entitled under the terms and conditions of this agreement constitute a debt to the Federal Government. The following must also be considered as a debt or debts owed by Greeley to the U.S. Forest Service:

- Any interest or other investment income earned on advances of agreement funds; or
- Any royalties or other special classes of program income which, under the provisions of the agreement, are required to be returned;

If this debt is not paid according to the terms of the bill for collection issued for the overpayment, the U.S. Forest Service may reduce the debt by:

1. Making an administrative offset against other requests for reimbursement.
2. Withholding advance payments otherwise due to Greeley.
3. Taking other action permitted by statute (31 U.S.C. 3716 and 7 CFR, Part 3, Subpart B).

Except as otherwise provided by law, the U.S. Forest Service may charge interest on an overdue debt.

Q. AGREEMENT CLOSE-OUT. Within 120 days after expiration or notice of termination Greeley shall close out the agreement.

Any unobligated balance of cash advanced to Greeley must be immediately refunded to the U.S. Forest Service, including any interest earned in accordance with 7CFR3016.21/2CFR 215.22.

Within a maximum of 120 days following the date of expiration or termination of this agreement, all financial performance and related reports required by the terms of the agreement must be submitted to the U.S. Forest Service by Greeley.

If this agreement is closed out without audit, the U.S. Forest Service reserves the right to disallow and recover an appropriate amount after fully considering any recommended disallowances resulting from an audit which may be conducted later.

R. PROGRAM MONITORING AND PROGRAM PERFORMANCE REPORTS. The parties to this agreement shall monitor the performance of the agreement activities to ensure that performance goals are being achieved.

Performance reports must contain information on the following:



- A comparison of actual accomplishments to the goals established for the period. Wherever the output of the project can be readily expressed in numbers, a computation of the cost per unit of output, if applicable.
- Reason(s) for delay if established goals were not met.
- Additional pertinent information.

Greeley shall submit annual performance reports to the U.S. Forest Service Program Manager. These reports are due 90 days after the reporting period. The final performance report must be submitted either with Greeley's final payment request, or separately, but not later than 120 days from the expiration date of the agreement.

- S. RETENTION AND ACCESS REQUIREMENTS FOR RECORDS. Greeley shall retain all records pertinent to this agreement for a period of no less than 3 years from the expiration or termination date. As used in this provision, records includes books, documents, accounting procedures and practice, and other data, regardless of the type or format. Greeley shall provide access and the right to examine all records related to this agreement to the U.S. Forest Service, Inspector General, or Comptroller General or their authorized representative. The rights of access in this section must not be limited to the required retention period but must last as long as the records are kept.

If any litigation, claim, negotiation, audit, or other action involving the records has been started before the end of the 3-year period, the records must be kept until all issues are resolved, or until the end of the regular 3-year period, whichever is later.

Records for nonexpendable property acquired in whole or in part, with Federal funds must be retained for 3 years after its final disposition.

- T. FREEDOM OF INFORMATION ACT (FOIA). Public access to grant or agreement records must not be limited, except when such records must be kept confidential and would have been exempted from disclosure pursuant to Freedom of Information regulations (5 U.S.C. 552). Requests for research data are subject to 2 CFR 215.36.

Public access to culturally sensitive data and information of Federally-recognized Tribes may also be explicitly limited by P.L. 110-234, Title VIII Subtitle B §8106 (2008 Farm Bill).

- U. TEXT MESSAGING WHILE DRIVING. In accordance with Executive Order (EO) 13513, "Federal Leadership on Reducing Text Messaging While Driving," any and all text messaging by Federal employees is banned: a) while driving a Government owned vehicle (GOV) or driving a privately owned vehicle (POV) while on official Government business; or b) using any electronic equipment supplied by the Government when driving any vehicle at any time. All Cooperators, their Employees, Volunteers, and Contractors are encouraged to adopt and enforce policies that ban text messaging when driving company owned, leased or rented vehicles,



POVs or GOVs when driving while on official Government business or when performing any work for or on behalf of the Government.

- V. PUBLIC NOTICES. It is The U.S. Forest Service's policy to inform the public as fully as possible of its programs and activities. Greeley is/are encouraged to give public notice of the receipt of this agreement and, from time to time, to announce progress and accomplishments. Press releases or other public notices should reference the Agency as follows:

“Arapaho and Roosevelt National Forests and Pawnee National Grassland of the U.S. Forest Service, U.S. Department of Agriculture”

Greeley may call on The U.S. Forest Service's Office of Communication for advice regarding public notices. Greeley is/are requested to provide copies of notices or announcements to the U.S. Forest Service Program Manager and to The U.S. Forest Service's Office of Communications as far in advance of release as possible.

- W. FUNDING EQUIPMENT. Federal funding under this agreement is not available for reimbursement of Greeley's purchase of equipment. Equipment is defined as having a fair market value of \$5,000 or more per unit and a useful life of over one year.
- X. PROPERTY IMPROVEMENTS. Improvements placed by Greeley on National Forest System land at the direction or with the approval of the U.S. Forest Service becomes property of the United States. These improvements are subject to the same regulations and administration of the U.S. Forest Service as would other national forest improvements of a similar nature. No part of this agreement entitles Greeley to any interest in the improvements, other than the right to use them under applicable U.S. Forest Service Regulations.
- Y. CONTRACT REQUIREMENTS. Any contract under this agreement must be awarded following the Greeley's established procurement procedures, to ensure free and open competition, and avoid any conflict of interest (or appearance of conflict). Greeley shall maintain cost and price analysis documentation for potential U.S. Forest Service review. Greeley is/are encouraged to utilize small businesses, minority-owned firms, and women's business enterprises.
- Z. TRAINING, EVALUATION, AND CERTIFICATION OF SAWYERS. Any of the cooperator's employees, and any participants and volunteers engaged on behalf of the cooperator and U.S. Forest Service, who will use chain saws or crosscut saws on National Forest System lands to conduct the program of work contained in this agreement must be trained, evaluated, and certified in accordance with U.S. Forest Service Manual 2358 and U.S. Forest Service Handbook 6709.11, section 22.48b. The cooperator is responsible for providing this training, evaluation, and certification, unless the U.S. Forest Service and the cooperator determine it is not in the best interest of the partnership. In these circumstances, the U.S. Forest Service, upon request and based on availability of Agency funding and personnel, may assist with



developing and conducting training, evaluation, and certification of the cooperator's employees, and any volunteers and participants engaged on behalf of the cooperator and the U.S. Forest Service, who will use chain saws or cross cut saws on National Forest System lands.

- AA. U.S. FOREST SERVICE ACKNOWLEDGED IN PUBLICATIONS, AUDIOVISUALS AND ELECTRONIC MEDIA. Greeley shall acknowledge U.S. Forest Service support in any publications, audiovisuals, and electronic media developed as a result of this agreement.
- BB. NONDISCRIMINATION STATEMENT – PRINTED, ELECTRONIC, OR AUDIOVISUAL MATERIAL. Greeley shall include the following statement, in full, in any printed, audiovisual material, or electronic media for public distribution developed or printed with any Federal funding.

*In accordance with Federal law and U.S. Department of Agriculture policy, this institution is prohibited from discriminating on the basis of race, color, national origin, sex, age, or disability. (Not all prohibited bases apply to all programs.)*

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, 1400 Independence Avenue, SW, Washington, DC 20250-9410 or call toll free voice (866) 632-9992, TDD (800) 877-8339, or voice relay (866) 377-8642.  
USDA is an equal opportunity provider and employer.

If the material is too small to permit the full statement to be included, the material must, at minimum, include the following statement, in print size no smaller than the text:

*"This institution is an equal opportunity provider."*

- CC. REMEDIES FOR COMPLIANCE RELATED ISSUES. If Greeley materially fail(s) to comply with any term of the agreement, whether stated in a Federal statute or regulation, an assurance, or the agreement, the U.S. Forest Service may take one or more of the following actions:

1. Temporarily withhold cash payments pending correction of the deficiency by Greeley or more severe enforcement action by the U.S. Forest Service;
2. Disallow (that is, deny both use of funds and matching credit for) all or part of the cost of the activity or action not in compliance;
3. Wholly or partly suspend or terminate the current agreement for Greeley's program;
4. Withhold further awards for the program, or



5. Take other remedies that may be legally available, including debarment procedures under 2 CFR part 417.

DD. TERMINATION BY MUTUAL AGREEMENT. This agreement may be terminated, in whole or part, as follows:

1. When the U.S. Forest Service and Greeley agree upon the termination conditions, including the effective date and, in the case of partial termination, the portion to be terminated.
2. By 30 days written notification by Greeley to the U.S. Forest Service setting forth the reasons for termination, effective date, and in the case of partial termination, the portion to be terminated. If the U.S. Forest Service decides that the remaining portion of the agreement will not accomplish the purposes for which the agreement was made, the U.S. Forest Service may terminate the agreement in its entirety.

Upon termination of an agreement, Greeley shall not incur any new obligations for the terminated portion of the agreement after the effective date, and shall cancel as many outstanding obligations as possible. The U.S. Forest Service shall allow full credit to Greeley for the U.S. Forest Service share of obligations that cannot be cancelled and were properly incurred by Greeley up to the effective date of the termination. Excess funds must be refunded within 60 days after the effective date of termination.

EE. ALTERNATE DISPUTE RESOLUTION – PARTNERSHIP AGREEMENT. In the event of any issue of controversy under this agreement, the parties may pursue Alternate Dispute Resolution procedures to voluntarily resolve those issues. These procedures may include, but are not limited to conciliation, facilitation, mediation, and fact finding.

FF. DEBARMENT AND SUSPENSION. Greeley shall immediately inform the U.S. Forest Service if they or any of their principals are presently excluded, debarred, or suspended from entering into covered transactions with the Federal Government according to the terms of 2 CFR Part 180. Additionally, should Greeley or any of their principals receive a transmittal letter or other official Federal notice of debarment or suspension, then they shall notify the U.S. Forest Service without undue delay. This applies whether the exclusion, debarment, or suspension is voluntary or involuntary.

GG. PROHIBITION AGAINST INTERNAL CONFIDENTIAL AGREEMENTS. All non federal government entities working on this agreement will adhere to the below provisions found in the Consolidated Appropriations Act, 2016, Pub. L. 114-113, relating to reporting fraud, waste and abuse to authorities:



- (a) The recipient may not require its employees, contractors, or subrecipients seeking to report fraud, waste, or abuse to sign or comply with internal confidentiality agreements or statements prohibiting or otherwise restricting them from lawfully reporting that waste, fraud, or abuse to a designated investigative or law enforcement representative of a Federal department or agency authorized to receive such information.
- (b) The recipient must notify its employees, contractors, or subrecipients that the prohibitions and restrictions of any internal confidentiality agreements inconsistent with paragraph (a) of this award provision are no longer in effect.
- (c) The prohibition in paragraph (a) of this award provision does not contravene requirements applicable to any other form issued by a Federal department or agency governing the nondisclosure of classified information.
- (d) If the Government determines that the recipient is not in compliance with this award provision, it:
  - (1) Will prohibit the recipient's use of funds under this award, in accordance with sections 743, 744 of Division E of the Consolidated Appropriations Act, 2016, (Pub. L. 114-113) or any successor provision of law; and
  - (2) May pursue other remedies available for the recipient's material failure to comply with award terms and conditions.

HH. MODIFICATIONS. Modifications within the scope of this agreement must be made by mutual consent of the parties, by the issuance of a written modification signed and dated by all properly authorized, signatory officials, prior to any changes being performed. Requests for modification should be made, in writing, at least 30 days prior to implementation of the requested change. The U.S. Forest Service is not obligated to fund any changes not properly approved in advance.

II. COMMENCEMENT/EXPIRATION DATE. This agreement is executed as of the date of the last signature and is effective through May 1, 2027 at which time it will expire. The expiration date is the final date for completion of all work activities under this agreement.

JJ. AUTHORIZED REPRESENTATIVES. By signature below, each party certifies that the individuals listed in this document as representatives of the individual parties are authorized to act in their respective areas for matters related to this agreement. In Witness Whereof, the parties hereto have executed this agreement as of the last date written below.





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Raymond C. Lee III, City Manager  
City of Greeley

Date

As to Availability of Funds:

---

John Karner, Director of Finance  
City of Greeley

As to Legal Form:

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Doug Marek, City Attorney  
City of Greeley

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Monte L. Williams, Forest Supervisor  
U.S. Forest Service, Arapaho and Roosevelt National  
Forests and Pawnee National Grassland

Date

The authority and format of this agreement have been reviewed and approved for signature.

---

SARA WOLF  
U.S. Forest Service Grants Management Specialist

Date

Burden Statement

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0596-0217. The time required to complete this information collection is estimated to average 4 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or part of an individual's income is derived from any public assistance. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at 202-720-2600 (voice and TDD).

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, 1400 Independence Avenue, SW, Washington, DC 20250-9410 or call toll free (866) 632-9992 (voice). TDD users can contact USDA through local relay or the Federal relay at (800) 877-8339 (TDD) or (866) 377-8642 (relay voice). USDA is an equal opportunity provider and employer.

# Water & Sewer Agenda Summary

Date: April 20, 2022

Key Staff Contact: Cole Gustafson

## Title:

APPROVE AND RECOMMEND TO CITY COUNCIL DIVESTMENT OF THE BALMER FARM PROPERTY

## Summary:

In 2016, the City of Greeley purchased a 139 +/- acre farm in Weld County, known internally as the “Balmer Farm”. The land was part of the Danielson Farms acquisition, which included two other farms totaling 332 acres along with three shares of the stock in the Water Supply and Storage Company (“WSSC Water Rights”). Only two of the three shares historically irrigated the Balmer Farm. Since 2016, the City has leased the Balmer Farm, along with the WSSC Water Rights, to a tenant farmer in order to maintain the use of the WSSC Water Rights on the historically irrigated land. In 2022, City staff negotiated an offer of \$850,000 to purchase the Balmer Farm. A dry-up covenant, revegetation covenant, and leaseback of the two shares of WSSC Water Rights to the buyer are part of the agreement. Staff recommends the divestment of the Balmer Farm to the potential buyer. Additional details will be presented at the Water and Sewer Board Meeting.

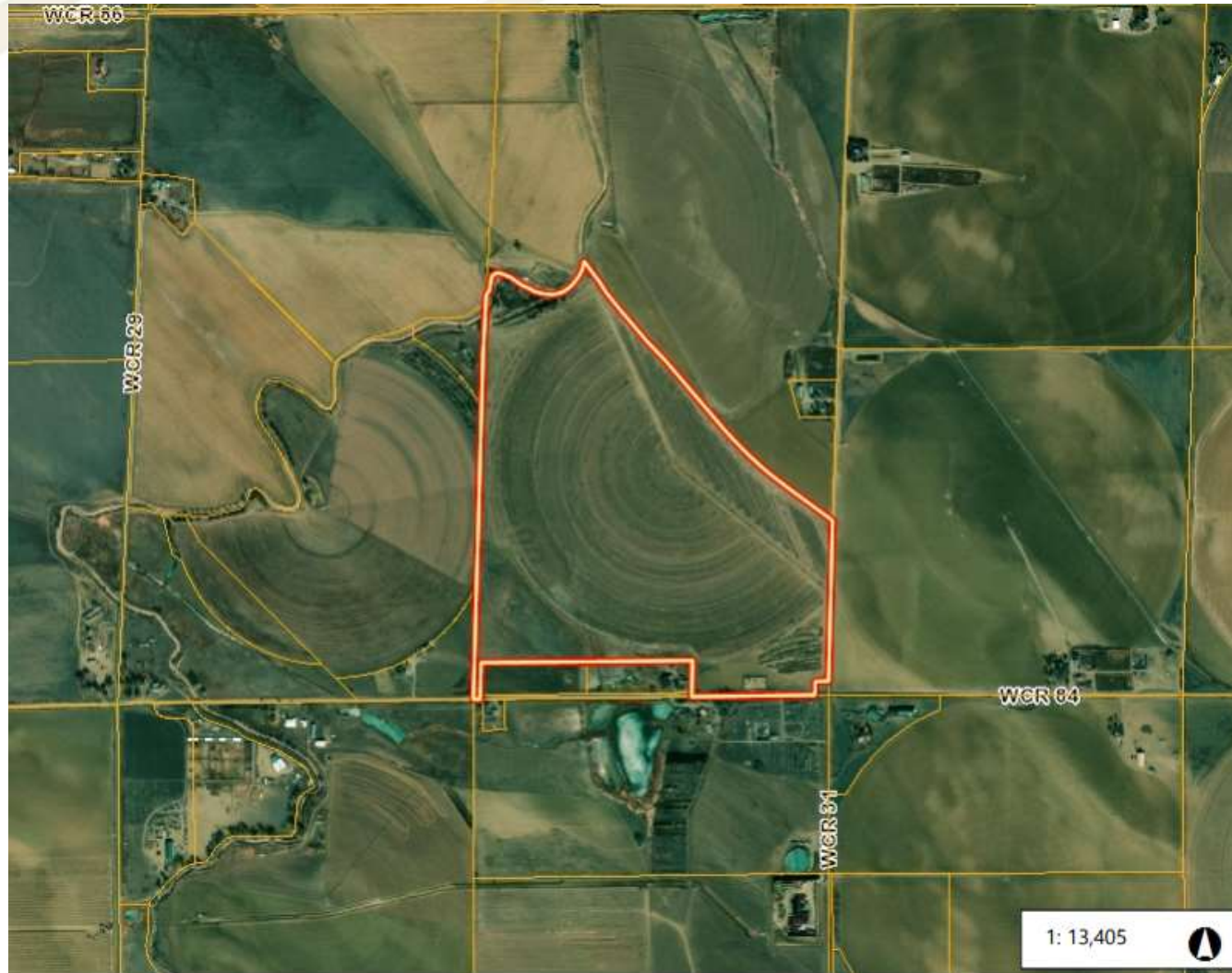
## Recommended Action:

APPROVE AND RECOMMEND TO CITY COUNCIL DIVESTMENT OF THE BALMER FARM

## Attachments:

Presentation, purchase contract, exhibits, and draft City Council Ordinance.

# Balmer Farm Property Divestment



April 20<sup>th</sup>, 2022

# Balmer Farm Property Divestment

- Greeley acquired the 139 +/- acres Balmer Farm in 2016.
  - Part of the Danielson Farms acquisition, which included two other farms totaling 332 acres and 3 shares of Water Supply and Storage (WSSC).
- Total Purchase price in 2016 for 332 acres and 3 shares WSSC: \$3,925,000
  - WSSC – \$1,800,000 (\$600,000 per share)
  - Improvements – \$500,000
  - Land – \$1,625,000 (\$4,890 per acre)
- Current offer for dry land only – \$850,000 (\$6,200 per acre)

# Balmer Farm Property Divestment

- Buyer is acquiring the property as an investment
- \$10,000 earnest money
- 5% brokerage commission
- Buyer pays for most diligence, Greeley pays for title commitment
- City obtains dry-up and revegetation covenants
- Leaseback (2 shares of WSSC)
  - One year lease, with option to renew annually for four additional years

# Recommendation

- Benefits of divestment:
  - Reduces maintenance overhead
  - Could seek to re-appropriate sale proceeds for additional water acquisition
- Staff recommends the Water and Sewer Board approve and recommend to City Council the Balmer Farm divestment



Questions?

**CITY OF GREELEY, COLORADO**  
**ORDINANCE NO. \_\_, 2022**

**AN ORDINANCE AUTHORIZING THE DIVESTMENT OF CITY-OWNED REAL PROPERTY  
LOCATED IN THE EAST HALF OF SECTION 4, TOWNSHIP 7 NORTH, RANGE 66 WEST OF THE 6<sup>TH</sup> P.M.  
IN WELD COUNTY, COLORADO (BALMER FARM)**

WHEREAS, in 2016, the City of Greeley, acting by and through its Water Enterprise, purchased certain real property that has commonly been known as the Balmer Farm, and is more particularly described as Lot B of Recorded Exemption No. 582 and Revision recorded April 27, 1983 at Reception No. 1924815 in Book 994, being located in the E½ of Section 4, Township 7 North, Range 66 West of the 6<sup>th</sup> P.M., County of Weld, State of Colorado; said property is also referred to as Weld County Parcel No. 070704000029 and consists of approximately 138.33 net acres, more or less; and

WHEREAS, since acquiring the Balmer Farm, the City has leased the land along with the associated water rights represented by shares in The Water Supply and Storage Company ("WSSC Shares"), to a tenant farmer in order to sustain historical use of the water rights for a future change of the rights to municipal uses; and

WHEREAS, the City recently received an offer to purchase the Balmer Farm, as is described more particularly in the Contract to Buy and Sell Real Estate (Land) and associated exhibits attached hereto as Exhibit A ("Purchase Contract"); and

WHEREAS, the City will retain any and all water and water rights associated with the Balmer Farm, including, without limitation, the WSSC Shares described above that have historically irrigated the property; and

WHEREAS, Section 17-4(c) of the Charter for the City of Greeley requires that any sale or exchange of water, water and sewer facilities or land, including the sale of real property previously acquired by the Water and Sewer Department with enterprise funds, be approved by City Council; and

WHEREAS, the City Council may authorize by ordinance the divestment of real property that is not being used or held for a governmental purpose; and

WHEREAS, the Water and Sewer Board on April 20, 2022 made a finding that the Balmer Farm is not currently being used or held for a governmental purpose, approved the Purchase Contract, and recommended the same action to City Council; and

WHEREAS, the City Council has determined that the sale of the Balmer Farm, as is described more particularly in the Purchase Contract, is in the best interests of the citizens of the City of Greeley.

**NOW THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL OF GREELEY, COLORADO:**

Section 1. The City Council determines that the Balmer Farm is not being used or held for a



governmental purpose, and is surplus property unnecessary to retain for any governmental purpose.

Section 2. The City Council authorizes the divestment of the Balmer Farm, in accordance with the terms and conditions of the Contract to Buy and Sell Real Estate (Land) and associated exhibits attached hereto as Exhibit A.

Section 3. The City Council authorizes the Director of the Water and Sewer Department, or his designee, to make minor amendments to the Contract to Buy and Sell Real Estate (Land) and associated exhibits, including, without limitation, corrections to property descriptions and contract extensions.

Section 4. Upon the satisfaction of all contract terms and conditions, including any amendments made thereto, the City Council authorizes (i) the Mayor to execute a deed conveying the Balmer Farm, (ii) the Director of the Water and Sewer Department, or his designee, to execute all other documents necessary to complete the transaction contemplated by the Contract to Buy and Sell Real Estate (Land) and associated exhibits, and (iii) the Director of the Water and Sewer Department, or his designee, to undertake all other necessary and appropriate action to complete the transaction.

Section 5. This Ordinance shall take effect immediately after its final publication.

**PASSED AND ADOPTED, SIGNED AND APPROVED ON THIS \_\_\_\_ DAY OF \_\_\_\_\_ 2022.**

**ATTEST**

**CITY OF GREELEY, COLORADO**

\_\_\_\_\_  
**City Clerk**

\_\_\_\_\_  
**Mayor**

The printed portions of this form, except differentiated additions, have been approved by the Colorado Real Estate Commission.  
(CBS4-6-21) (Mandatory 1-22)

**THIS FORM HAS IMPORTANT LEGAL CONSEQUENCES AND THE PARTIES SHOULD CONSULT LEGAL AND TAX OR OTHER COUNSEL BEFORE SIGNING.**

## CONTRACT TO BUY AND SELL REAL ESTATE

**(LAND)**

☒ **Property with No Residences)**

☐ **Property with Residences-Residential Addendum Attached)**

Date: \_\_\_\_\_

### AGREEMENT

**1. AGREEMENT.** Buyer agrees to buy and Seller agrees to sell the Property described below on the terms and conditions set forth in this contract (Contract).

**2. PARTIES AND PROPERTY.**

**2.1. Buyer.** LTS Performance Horses LLC (Buyer) will take title to the Property described below as ☐ ~~Joint Tenants~~ ☐ ~~Tenants In Common~~ ☐ ~~Other~~ \_\_\_\_\_.

**2.2. No Assignability.** This Contract **IS NOT** assignable by Buyer unless otherwise specified in **Additional Provisions**.

**2.3. Seller.** The City of Greeley, Colorado (Seller) is the current owner of the Property described below.

**2.4. Property.** The Property is the following legally described real estate in the County of Weld, Colorado (insert legal description):

Lot B of Recorded Exemption No. 582 and Revision recorded April 27, 1983 at Reception No. 1924815 in Book 994, being located in the E 1/2 of Section 4, Township 7 North, Range 66 West of the 6th P.M., County of Weld, State of Colorado; said Property is also known as Parcel No. 070704000029 and consists of approximately 138.33 net acres, more or less.

known-as: N/A  
Street Address City State Zip

together with the interests, easements, rights, benefits, improvements and attached fixtures appurtenant thereto and all interest of Seller in vacated streets and alleys adjacent thereto, except as herein excluded (Property).

**2.5. Inclusions.** The Purchase Price includes the following items (Inclusions):

**2.5.1. Inclusions.** The following items, whether fixtures or personal property, are included in the Purchase Price unless excluded under **Exclusions**:

One (1) Zimmatic - brand center-pivot irrigation sprinkler system and all associated pumps, motors, pipes, and fuel injection systems located on the Property as of the date this contract is executed.

If any additional items are attached to the Property after the date of this Contract, such additional items are also included in the Purchase Price.

~~**2.5.2. Encumbered Inclusions.** Any Inclusions owned by Seller (i.e., owned solar panels) must be conveyed at Closing by Seller free and clear of all taxes (except personal property and general real estate taxes for the year of Closing), liens and encumbrances, except:~~

~~**2.5.3. Personal Property Conveyance.** Conveyance of all personal property will be by bill of sale or other applicable legal instrument.~~

~~**2.5.4. Leased Items.** The following personal property is currently leased to Seller which will be transferred to Buyer at Closing (Leased Items):~~

2.6. Exclusions. The following items are excluded (Exclusions):

2.6.1 - Any and all rights, title, and interest of the Seller in and to any water and water rights, ditches and ditch rights, reservoirs and reservoir rights, and lateral rights associated with the Property, including, without limitation, those rights represented by shares of stock in The Water Supply and Storage Company.

2.6.2 - Any equipment or personal property located on the Property and owned by or belonging to Leland Lebsack, the tenant occupying the Property pursuant to that certain First Amendment to Farm Lease Agreement dated April 6, 2021.

2.7. ~~Water Rights, Well Rights, Water and Sewer Taps.~~

☐ 2.7.1. ~~Deeded Water Rights.~~ The following legally described water rights:

~~Any deeded water rights will be conveyed by a good and sufficient \_\_\_\_\_ deed at Closing.~~

☐ 2.7.2. ~~Other Rights Relating to Water.~~ The following rights relating to water not included in §§ 2.7.1., 2.7.3., 2.7.4. and 2.7.5., will be transferred to Buyer at Closing:

☐ 2.7.3. ~~Well Rights.~~ Seller agrees to supply required information to Buyer about the well. Buyer understands that if the well to be transferred is a “Small Capacity Well” or a “Domestic Exempt Water Well” used for ordinary household purposes, Buyer must, prior to or at Closing, complete a Change in Ownership form for the well. If an existing well has not been registered with the Colorado Division of Water Resources in the Department of Natural Resources (Division), Buyer must complete a registration of existing well form for the well and pay the cost of registration. If no person will be providing a closing service in connection with the transaction, Buyer must file the form with the Division within sixty days after Closing. The Well Permit # is \_\_\_\_\_.

☐ 2.7.4. ~~Water Stock Certificates.~~ The water stock certificates to be transferred at Closing are as follows:

2.7.5. ~~Water and Sewer Taps.~~ The parties agree that water and sewer taps listed below for the Property are being conveyed as part of the Purchase Price as follows:

~~If any water or sewer taps are included in the sale, Buyer is advised to obtain, from the provider, written confirmation of the amount remaining to be paid, if any, time and other restrictions for transfer and use of the taps.~~

2.7.6. ~~Conveyance.~~ If Buyer is to receive any rights to water pursuant to § 2.7.2. (Other Rights Relating to Water), § 2.7.3. (Well Rights), § 2.7.4. (Water Stock Certificates), or § 2.7.5. (Water and Sewer Taps), Seller agrees to convey such rights to Buyer by executing the applicable legal instrument at Closing.

2.7.7. ~~Water Rights Review.~~ Buyer ☐ Does ☐ Does Not have a Right to Terminate if examination of the Water Rights is unsatisfactory to Buyer on or before the ~~Water Rights Examination Deadline.~~

2.8. Growing Crops. With respect to growing crops, Seller and Buyer agree as follows:

Any growing crops existing on the Property at the time of Closing shall remain the property of Leland Lebsack, pursuant to the First Amendment to Farm Lease Agreement dated April 6, 2021.

3. DATES, DEADLINES AND APPLICABILITY.

3.1. Dates and Deadlines.

Item No.	Reference	Event	Date or Deadline
1	§ 3	<del>Time of Day Deadline</del>	N/A
2	§ 4	Alternative Earnest Money Deadline	3 days after MEC
		Title	
3	§ 8	Record Title Deadline (and Tax Certificate)	14 days after MEC
4	§ 8	Record Title Objection Deadline	21 days after MEC

5	§ 8	Off-Record Title Deadline	14 days after MEC
6	§ 8	Off-Record Title Objection Deadline	21 days after MEC
7	§ 8	Title Resolution Deadline	30 days after MEC
8	§ 8	Third Party Right to Purchase/Approve Deadline	N/A
		<b>Owners' Association</b>	
9	§ 7	Association Documents Deadline	N/A
10	§ 7	Association Documents Termination Deadline	N/A
		<b>Seller's Disclosures</b>	
11	§ 10	Seller's Property Disclosure Deadline	14 days after MEC
12	§ 10	Lead-Based Paint Disclosure Deadline (if Residential Addendum attached)	N/A
		<b>Loan and Credit</b>	
13	§ 5	New Loan Application Deadline	N/A
14	§ 5	New Loan Terms Deadline	N/A
15	§ 5	New Loan Availability Deadline	N/A
16	§ 5	Buyer's Credit Information Deadline	N/A
17	§ 5	Disapproval of Buyer's Credit Information Deadline	N/A
18	§ 5	Existing Loan Deadline	N/A
19	§ 5	Existing Loan Termination Deadline	N/A
20	§ 5	Loan Transfer Approval Deadline	N/A
21	§ 4	Seller or Private Financing Deadline	N/A
		<b>Appraisal</b>	
22	§ 6	Appraisal Deadline	14 days after MEC
23	§ 6	Appraisal Objection Deadline	21 days after MEC
24	§ 6	Appraisal Resolution Deadline	30 days after MEC
		<b>Survey</b>	
25	§ 9	New ILC or New Survey Deadline	14 days after MEC
26	§ 9	New ILC or New Survey Objection Deadline	21 days after MEC
27	§ 9	New ILC or New Survey Resolution Deadline	30 days after MEC
		<b>Inspection and Due Diligence</b>	
28	§ 2	Water Rights Examination Deadline	N/A
29	§ 8	Mineral Rights Examination Deadline	N/A
30	§ 10	Inspection Termination Deadline	35 days after MEC
31	§ 10	Inspection Objection Deadline	30 days after MEC
32	§ 10	Inspection Resolution Deadline	35 days after MEC
33	§ 10	Property Insurance Termination Deadline	30 days after MEC
34	§ 10	Due Diligence Documents Delivery Deadline	14 days after MEC
35	§ 10	Due Diligence Documents Objection Deadline	21 days after MEC
36	§ 10	Due Diligence Documents Resolution Deadline	30 days after MEC
37	§ 10	Environmental Inspection Termination Deadline	30 days after MEC
38	§ 10	ADA Evaluation Termination Deadline	30 days after MEC
39	§ 10	Conditional Sale Deadline	N/A
40	§ 10	Lead-Based Paint Termination Deadline (if Residential Addendum attached)	N/A
41	§ 11	Estoppel Statements Deadline	21 days after MEC
42	§ 11	Estoppel Statements Termination Deadline	30 days after MEC
		<b>Closing and Possession</b>	
43	§ 12	Closing Date	60 days after MEC or by mutual agreement
44	§ 17	Possession Date	Closing Date
45	§ 17	Possession Time	5:00 p.m. U.S. Mountain Time
46	§ 27	Acceptance Deadline Date	N/A
47	§ 27	Acceptance Deadline Time	N/A

105 **3.2. Applicability of Terms.** If any deadline blank in § 3.1. (Dates and Deadlines) is left blank or completed with "N/A",  
106 or the word "Deleted," such deadline is not applicable and the corresponding provision containing the deadline is deleted. Any box

checked in this Contract means the corresponding provision applies. If no box is checked in a provision that contains a selection of “None”, such provision means that “None” applies.

The abbreviation “MEC” (mutual execution of this Contract) means the date upon which both parties have signed this Contract. The abbreviation “N/A” as used in this Contract means not applicable.

### 3.3. Day; Computation of Period of Days; Deadlines.

**3.3.1. Day.** As used in this Contract, the term “day” means the entire day ending at 11:59 p.m., United States Mountain Time (Standard or Daylight Savings, as applicable). Except however, if a **Time of Day Deadline** is specified in § 3.1. (Dates and Deadlines), all Objection Deadlines, Resolution Deadlines, Examination Deadlines and Termination Deadlines will end on the specified deadline date at the time of day specified in the **Time of Day Deadline**, United States Mountain Time. If **Time of Day Deadline** is left blank or “N/A” the deadlines will expire at 11:59 p.m., United States Mountain Time.

**3.3.2. Computation of Period of Days.** In computing a period of days (e.g., three days after MEC), when the ending date is not specified, the first day is excluded and the last day is included.

**3.3.3. Deadlines.** If any deadline falls on a Saturday, Sunday or federal or Colorado state holiday (Holiday), such deadline ☒ **Will** ☐ **Will Not** be extended to the next day that is not a Saturday, Sunday or Holiday. Should neither box be checked, the deadline will not be extended.

## 4. PURCHASE PRICE AND TERMS.

**4.1. Price and Terms.** The Purchase Price set forth below is payable in U.S. Dollars by Buyer as follows:

Item No.	Reference	Item	Amount	Amount
1	§ 4.1.	Purchase Price	\$ 850,000.00	
2	§ 4.3.	Earnest Money		\$ 10,000.00
3	<del>§ 4.5.</del>	<del>New Loan</del>		\$ N/A
4	<del>§ 4.6.</del>	<del>Assumption Balance</del>		\$ N/A
5	<del>§ 4.7.</del>	<del>Private Financing</del>		\$ N/A
6	<del>§ 4.7.</del>	<del>Seller Financing</del>		\$ N/A
7				
8				
9	§ 4.4.	Cash at Closing		\$ 840,000.00
10		<b>TOTAL</b>	\$ 850,000.00	\$ 850,000.00

~~**4.2. Seller Concession.** At Closing, Seller will credit to Buyer \$ \_\_\_\_\_ (Seller Concession). The Seller Concession may be used for any Buyer fee, cost, charge or expenditure to the extent the amount is allowed by the Buyer’s lender and is included in the Closing Statement or Closing Disclosure at Closing. Examples of allowable items to be paid for by the Seller Concession include, but are not limited to: Buyer’s closing costs, loan discount points, loan origination fees, prepaid items and any other fee, cost, charge, expense or expenditure. Seller Concession is in addition to any sum Seller has agreed to pay or credit Buyer elsewhere in this Contract.~~

**4.3. Earnest Money.** The Earnest Money set forth in this Section, in the form of a check, wire transfer, or other Good Funds, will be payable to and held by Land Title Guarantee Company, 4617 West 20th Street, Suite B, Greeley, Colorado 80634 (Earnest Money Holder), in its trust account, on behalf of both Seller and Buyer. The Earnest Money deposit must be tendered, by Buyer, with this Contract unless the parties mutually agree to an **Alternative Earnest Money Deadline** for its payment. The parties authorize delivery of the Earnest Money deposit to the company conducting the Closing (Closing Company), if any, at or before Closing. In the event Earnest Money Holder has agreed to have interest on Earnest Money deposits transferred to a fund established for the purpose of providing affordable housing to Colorado residents, Seller and Buyer acknowledge and agree that any interest accruing on the Earnest Money deposited with the Earnest Money Holder in this transaction will be transferred to such fund.

**4.3.1. Alternative Earnest Money Deadline.** The deadline for delivering the Earnest Money, if other than at the time of tender of this Contract, is as set forth as the **Alternative Earnest Money Deadline**.

**4.3.2. Disposition of Earnest Money.** If Buyer has a Right to Terminate and timely terminates, Buyer is entitled to the return of Earnest Money as provided in this Contract. If this Contract is terminated as set forth in § 24 and, except as provided in § 23 (Earnest Money Dispute), if the Earnest Money has not already been returned following receipt of a Notice to Terminate, Seller agrees to execute and return to Buyer or Broker working with Buyer, written mutual instructions (e.g., Earnest Money Release form), within three days of Seller’s receipt of such form. If Seller is entitled to the Earnest Money, and, except as provided in § 23 (Earnest Money Dispute), if the Earnest Money has not already been paid to Seller, following receipt of an Earnest Money Release form, Buyer agrees to execute and return to Seller or Broker working with Seller, written mutual instructions (e.g., Earnest Money Release form), within three days of Buyer’s receipt.

**4.3.2.1. Seller Failure to Timely Return Earnest Money.** If Seller fails to timely execute and return the Earnest Money Release Form, or other written mutual instructions, Seller is in default and liable to Buyer as set forth in “**If Seller is in Default**”, § 20.2. and § 21, unless Seller is entitled to the Earnest Money due to a Buyer default.

**4.3.2.2. Buyer Failure to Timely Release Earnest Money.** If Buyer fails to timely execute and return the Earnest Money Release Form, or other written mutual instructions, Buyer is in default and liable to Seller as set forth in “**If Buyer is in Default, § 20.1. and § 21**,” unless Buyer is entitled to the Earnest Money due to a Seller Default.

**4.4. Form of Funds; Time of Payment; Available Funds.**

**4.4.1. Good Funds.** All amounts payable by the parties at Closing, including any loan proceeds, Cash at Closing and closing costs, must be in funds that comply with all applicable Colorado laws, including electronic transfer funds, certified check, savings and loan teller’s check and cashier’s check (Good Funds).

**4.4.2. Time of Payment.** All funds, including the Purchase Price to be paid by Buyer, must be paid before or at Closing or as otherwise agreed in writing between the parties to allow disbursement by Closing Company at Closing **OR SUCH NONPAYING PARTY WILL BE IN DEFAULT.**

**4.4.3. Available Funds.** Buyer represents that Buyer, as of the date of this Contract, ☒ **Does** ☐ **Does Not** have funds that are immediately verifiable and available in an amount not less than the amount stated as Cash at Closing in § 4.1.

**4.5. New Loan.**

~~**4.5.1. Buyer to Pay Loan Costs.** Buyer, except as otherwise permitted in § 4.2. (Seller Concession), if applicable, must timely pay Buyer’s loan costs, loan discount points, prepaid items and loan origination fees as required by lender.~~

~~**4.5.2. Buyer May Select Financing.** Buyer may pay in cash or select financing appropriate and acceptable to Buyer, including a different loan than initially sought, except as restricted in § 4.5.3. (Loan Limitations) or § 29 (Additional Provisions).~~

~~**4.5.3. Loan Limitations.** Buyer may purchase the Property using any of the following types of loans:~~  
☐ ~~**Conventional**~~ ☐ ~~**Other**~~

~~**4.6. Assumption.** Buyer agrees to assume and pay an existing loan in the approximate amount of the Assumption Balance set forth in § 4.1. (Price and Terms), presently payable at \$\_\_\_\_\_ per \_\_\_\_\_ including principal and interest presently at the rate of \_\_\_\_\_% per annum and also including escrow for the following as indicated: ☐ **Real Estate Taxes** ☐ **Property Insurance Premium** and ☐ \_\_\_\_\_.~~

~~Buyer agrees to pay a loan transfer fee not to exceed \$\_\_\_\_\_. At the time of assumption, the new interest rate will not exceed \_\_\_\_\_% per annum and the new payment will not exceed \$\_\_\_\_\_ per \_\_\_\_\_ principal and interest, plus escrow, if any. If the actual principal balance of the existing loan at Closing is less than the Assumption Balance, which causes the amount of cash required from Buyer at Closing to be increased by more than \$\_\_\_\_\_, or if any other terms or provisions of the loan change, Buyer has the Right to Terminate under § 24.1. on or before **Closing Date**.~~

~~Seller ☐ **Will** ☐ **Will Not** be released from liability on said loan. If applicable, compliance with the requirements for release from liability will be evidenced by delivery ☐ on or before **Loan Transfer Approval Deadline** ☐ at **Closing** of an appropriate letter of commitment from lender. Any cost payable for release of liability will be paid by \_\_\_\_\_ in an amount not to exceed \$\_\_\_\_\_.~~

**4.7. Seller or Private Financing.**

~~**WARNING:** Unless the transaction is exempt, federal and state laws impose licensing, other requirements and restrictions on sellers and private financiers. Contract provisions on financing and financing documents, unless exempt, should be prepared by a licensed Colorado attorney or licensed mortgage loan originator. Brokers should not prepare or advise the parties on the specifics of financing, including whether or not a party is exempt from the law.~~

~~**4.7.1. Seller Financing.** If Buyer is to pay all or any portion of the Purchase Price with Seller financing, ☐ **Buyer** ☐ **Seller** will deliver the proposed Seller financing documents to the other party on or before \_\_\_\_\_ days before **Seller or Private Financing Deadline**.~~

~~**4.7.1.1. Seller May Terminate.** If Seller is to provide Seller financing, this Contract is conditional upon Seller determining whether such financing is satisfactory to the Seller, including its payments, interest rate, terms, conditions, cost, and compliance with the law. Seller has the Right to Terminate under § 24.1., on or before **Seller or Private Financing Deadline**, if such Seller financing is not satisfactory to Seller, in Seller’s sole subjective discretion.~~

~~**4.7.2. Buyer May Terminate.** If Buyer is to pay all or any portion of the Purchase Price with Seller or private financing, this Contract is conditional upon Buyer determining whether such financing is satisfactory to Buyer, including its availability, payments, interest rate, terms, conditions, and cost. Buyer has the Right to Terminate under § 24.1., on or before **Seller or Private Financing Deadline**, if such Seller or private financing is not satisfactory to Buyer, in Buyer’s sole subjective discretion.~~

**TRANSACTION PROVISIONS**

**5. FINANCING CONDITIONS AND OBLIGATIONS.**

~~**5.1. New Loan Application.** If Buyer is to pay all or part of the Purchase Price by obtaining one or more new loans (New Loan), or if an existing loan is not to be released at Closing, Buyer, if required by such lender, must make an application verifiable by such lender, on or before **New Loan Application Deadline** and exercise reasonable efforts to obtain such loan or approval.~~

~~**5.2. New Loan Terms; New Loan Availability.**~~



~~5.2.1. **New Loan Terms.** If Buyer is to pay all or part of the Purchase Price with a New Loan, this Contract is conditional upon Buyer determining, in Buyer's sole subjective discretion, whether the proposed New Loan's payments, interest rate, conditions and costs or any other loan terms (New Loan Terms) are satisfactory to Buyer. This condition is for the sole benefit of Buyer. Buyer has the Right to Terminate under § 24.1., on or before **New Loan Terms Deadline**, if the New Loan Terms are not satisfactory to Buyer, in Buyer's sole subjective discretion.~~

~~5.2.2. **New Loan Availability.** If Buyer is to pay all or part of the Purchase Price with a New Loan, this Contract is conditional upon Buyer's satisfaction with the availability of the New Loan based on the lender's review and underwriting of Buyer's New Loan Application (New Loan Availability). Buyer has the Right to Terminate under § 24.1., on or before the **New Loan Availability Deadline** if the New Loan Availability is not satisfactory to Buyer. Buyer does not have a Right to Terminate based on the New Loan Availability if the termination is based on the New Loan Terms, Appraised Value (defined below), the Lender Property Requirements (defined below), Insurability (§ 10.5. below) or the Conditional Upon Sale of Property (§ 10.7. below). **IF SELLER IS NOT IN DEFAULT AND DOES NOT TIMELY RECEIVE BUYER'S WRITTEN NOTICE TO TERMINATE, BUYER'S EARNEST MONEY WILL BE NONREFUNDABLE**, except as otherwise provided in this Contract (e.g., Appraisal, Title, Survey).~~

~~5.3. **Credit Information.** If an existing loan is not to be released at Closing, this Contract is conditional (for the sole benefit of Seller) upon Seller's approval of Buyer's financial ability and creditworthiness, which approval will be in Seller's sole subjective discretion. Accordingly: (1) Buyer must supply to Seller by **Buyer's Credit Information Deadline**, at Buyer's expense, information and documents (including a current credit report) concerning Buyer's financial, employment and credit condition; (2) Buyer consents that Seller may verify Buyer's financial ability and creditworthiness; and (3) any such information and documents received by Seller must be held by Seller in confidence and not released to others except to protect Seller's interest in this transaction. If the Cash at Closing is less than as set forth in § 4.1. of this Contract, Seller has the Right to Terminate under § 24.1., on or before Closing. If Seller disapproves of Buyer's financial ability or creditworthiness, in Seller's sole subjective discretion, Seller has the Right to Terminate under § 24.1., on or before **Disapproval of Buyer's Credit Information Deadline**.~~

~~5.4. **Existing Loan Review.** If an existing loan is not to be released at Closing, Seller must deliver copies of the loan documents (including note, deed of trust and any modifications) to Buyer by **Existing Loan Deadline**. For the sole benefit of Buyer, this Contract is conditional upon Buyer's review and approval of the provisions of such loan documents. Buyer has the Right to Terminate under § 24.1., on or before **Existing Loan Termination Deadline**, based on any unsatisfactory provision of such loan documents, in Buyer's sole subjective discretion. If the lender's approval of a transfer of the Property is required, this Contract is conditional upon Buyer obtaining such approval without change in the terms of such loan, except as set forth in § 4.6. If lender's approval is not obtained by **Loan Transfer Approval Deadline**, this Contract will terminate on such deadline. Seller has the Right to Terminate under § 24.1., on or before Closing, in Seller's sole subjective discretion, if Seller is to be released from liability under such existing loan and Buyer does not obtain such compliance as set forth in § 4.6.~~

## 6. APPRAISAL PROVISIONS.

**6.1. Appraisal Definition.** An "Appraisal" is an opinion of value prepared by a licensed or certified appraiser, engaged on behalf of Buyer or Buyer's lender, to determine the Property's market value (Appraised Value). The Appraisal may also set forth certain lender requirements, replacements, removals or repairs necessary on or to the Property as a condition for the Property to be valued at the Appraised Value.

**6.2. Appraised Value.** The applicable appraisal provision set forth below applies to the respective loan type set forth in § 4.5.3., or if a cash transaction (i.e., no financing), § 6.2.1. applies.

**6.2.1. Conventional/Other.** Buyer has the right to obtain an Appraisal. If the Appraised Value is less than the Purchase Price, or if the Appraisal is not received by Buyer on or before **Appraisal Deadline** Buyer may, on or before **Appraisal Objection Deadline**:

**6.2.1.1. Notice to Terminate.** Notify Seller in writing, pursuant to § 24.1., that this Contract is terminated;

or

**6.2.1.2. Appraisal Objection.** Deliver to Seller a written objection accompanied by either a copy of the Appraisal or written notice from lender that confirms the Appraised Value is less than the Purchase Price (Lender Verification).

**6.2.1.3. Appraisal Resolution.** If an Appraisal Objection is received by Seller, on or before **Appraisal Objection Deadline** and if Buyer and Seller have not agreed in writing to a settlement thereof on or before **Appraisal Resolution Deadline**, this Contract will terminate on the **Appraisal Resolution Deadline**, unless Seller receives Buyer's written withdrawal of the Appraisal Objection before such termination, (i.e., on or before expiration of **Appraisal Resolution Deadline**).

~~**6.3. Lender Property Requirements.** If the lender imposes any written requirements, replacements, removals or repairs, including any specified in the Appraisal (Lender Property Requirements) to be made to the Property (e.g., roof repair, repainting), beyond those matters already agreed to by Seller in this Contract, this Contract terminates on the earlier of three days following Seller's receipt of the Lender Property Requirements, or Closing, unless prior to termination: (1) the parties enter into a written agreement to satisfy the Lender Property Requirements; (2) the Lender Property Requirements have been completed; or (3) the satisfaction of the Lender Property Requirements is waived in writing by Buyer.~~

**6.4. Cost of Appraisal.** Cost of the Appraisal to be obtained after the date of this Contract must be timely paid by ☒ **Buyer** ☐ **Seller**. The cost of the Appraisal may include any and all fees paid to the appraiser, appraisal management company, lender's agent or all three.

~~**7. OWNERS' ASSOCIATIONS.** This Section is applicable if the Property is located within one or more Common Interest Communities and subject to one or more declarations (Association).~~

~~**7.1. Common Interest Community Disclosure.** THE PROPERTY IS LOCATED WITHIN A COMMON INTEREST COMMUNITY AND IS SUBJECT TO THE DECLARATION FOR THE COMMUNITY. THE OWNER OF THE PROPERTY WILL BE REQUIRED TO BE A MEMBER OF THE OWNERS' ASSOCIATION FOR THE COMMUNITY AND WILL BE SUBJECT TO THE BYLAWS AND RULES AND REGULATIONS OF THE ASSOCIATION. THE DECLARATION, BYLAWS AND RULES AND REGULATIONS WILL IMPOSE FINANCIAL OBLIGATIONS UPON THE OWNER OF THE PROPERTY, INCLUDING AN OBLIGATION TO PAY ASSESSMENTS OF THE ASSOCIATION. IF THE OWNER DOES NOT PAY THESE ASSESSMENTS, THE ASSOCIATION COULD PLACE A LIEN ON THE PROPERTY AND POSSIBLY SELL IT TO PAY THE DEBT. THE DECLARATION, BYLAWS AND RULES AND REGULATIONS OF THE COMMUNITY MAY PROHIBIT THE OWNER FROM MAKING CHANGES TO THE PROPERTY WITHOUT AN ARCHITECTURAL REVIEW BY THE ASSOCIATION (OR A COMMITTEE OF THE ASSOCIATION) AND THE APPROVAL OF THE ASSOCIATION. PURCHASERS OF PROPERTY WITHIN THE COMMON INTEREST COMMUNITY SHOULD INVESTIGATE THE FINANCIAL OBLIGATIONS OF MEMBERS OF THE ASSOCIATION. PURCHASERS SHOULD CAREFULLY READ THE DECLARATION FOR THE COMMUNITY AND THE BYLAWS AND RULES AND REGULATIONS OF THE ASSOCIATION.~~

~~**7.2. Association Documents to Buyer.** Seller is obligated to provide to Buyer the Association Documents (defined below), at Seller's expense, on or before **Association Documents Deadline**. Seller authorizes the Association to provide the Association Documents to Buyer, at Seller's expense. Seller's obligation to provide the Association Documents is fulfilled upon Buyer's receipt of the Association Documents, regardless of who provides such documents.~~

~~**7.3. Association Documents.** Association documents (Association Documents) consist of the following:~~

~~**7.3.1.** All Association declarations, articles of incorporation, bylaws, articles of organization, operating agreements, rules and regulations, party wall agreements and the Association's responsible governance policies adopted under § 38-33.3-209.5, C.R.S.;~~

~~**7.3.2.** Minutes of: (1) the annual owners' or members' meeting and (2) any executive boards' or managers' meetings; such minutes include those provided under the most current annual disclosure required under § 38-33.3-209.4, C.R.S. (Annual Disclosure) and minutes of meetings, if any, subsequent to the minutes disclosed in the Annual Disclosure. If none of the preceding minutes exist, then the most recent minutes, if any (§§ 7.3.1. and 7.3.2., collectively, Governing Documents); and~~

~~**7.3.3.** List of all Association insurance policies as provided in the Association's last Annual Disclosure, including, but not limited to, property, general liability, association director and officer professional liability and fidelity policies. The list must include the company names, policy limits, policy deductibles, additional named insureds and expiration dates of the policies listed (Association Insurance Documents);~~

~~**7.3.4.** A list by unit type of the Association's assessments, including both regular and special assessments as disclosed in the Association's last Annual Disclosure;~~

~~**7.3.5.** The Association's most recent financial documents which consist of: (1) the Association's operating budget for the current fiscal year, (2) the Association's most recent annual financial statements, including any amounts held in reserve for the fiscal year immediately preceding the Association's last Annual Disclosure, (3) the results of the Association's most recent available financial audit or review, (4) list of the fees and charges (regardless of name or title of such fees or charges) that the Association's community association manager or Association will charge in connection with the Closing including, but not limited to, any fee incident to the issuance of the Association's statement of assessments (Status Letter), any rush or update fee charged for the Status Letter, any record change fee or ownership record transfer fees (Record Change Fee), fees to access documents, (5) list of all assessments required to be paid in advance, reserves or working capital due at Closing and (6) reserve study, if any (§§ 7.3.4. and 7.3.5., collectively, Financial Documents);~~

~~**7.3.6.** Any written notice from the Association to Seller of a "construction defect action" under § 38-33.3-303.5, C.R.S. within the past six months and the result of whether the Association approved or disapproved such action (Construction Defect Documents). Nothing in this Section limits the Seller's obligation to disclose adverse material facts as required under § 10.2. (Disclosure of Adverse Material Facts; Subsequent Disclosure; Present Condition) including any problems or defects in the common elements or limited common elements of the Association property.~~

~~**7.4. Conditional on Buyer's Review.** Buyer has the right to review the Association Documents. Buyer has the Right to Terminate under § 24.1., on or before **Association Documents Termination Deadline**, based on any unsatisfactory provision in any of the Association Documents, in Buyer's sole subjective discretion. Should Buyer receive the Association Documents after **Association Documents Deadline**, Buyer, at Buyer's option, has the Right to Terminate under § 24.1. by Buyer's Notice to Terminate received by Seller on or before ten days after Buyer's receipt of the Association Documents. If Buyer does not receive the Association Documents, or if Buyer's Notice to Terminate would otherwise be required to be received by Seller after **Closing**~~



~~Date, Buyer's Notice to Terminate must be received by Seller on or before Closing. If Seller does not receive Buyer's Notice to Terminate within such time, Buyer accepts the provisions of the Association Documents as satisfactory and Buyer waives any Right to Terminate under this provision, notwithstanding the provisions of § 8.6. (Third Party Right to Purchase/Approve).~~

## 8. TITLE INSURANCE, RECORD TITLE AND OFF-RECORD TITLE.

### 8.1. Evidence of Record Title.

☒ **8.1.1. Seller Selects Title Insurance Company.** If this box is checked, Seller will select the title insurance company to furnish the owner's title insurance policy at Seller's expense. On or before **Record Title Deadline**, Seller must furnish to Buyer, a current commitment for an owner's title insurance policy (Title Commitment), in an amount equal to the Purchase Price, or if this box is checked, ☐ ~~an Abstract of Title certified to a current date.~~ Seller will cause the title insurance policy to be issued and delivered to Buyer as soon as practicable at or after Closing.

☐ ~~**8.1.2. Buyer Selects Title Insurance Company.** If this box is checked, Buyer will select the title insurance company to furnish the owner's title insurance policy at Buyer's expense. On or before **Record Title Deadline**, Buyer must furnish to Seller, a current commitment for owner's title insurance policy (Title Commitment), in an amount equal to the Purchase Price. If neither box in § 8.1.1. or § 8.1.2. is checked, § 8.1.1. applies.~~

**8.1.3. Owner's Extended Coverage (OEC).** The Title Commitment ☒ **Will** ☐ ~~Will Not~~ contain Owner's Extended Coverage (OEC). If the Title Commitment is to contain OEC, it will commit to delete or insure over the standard exceptions which relate to: (1) parties in possession, (2) unrecorded easements, (3) survey matters, (4) unrecorded mechanics' liens, (5) gap period (period between the effective date and time of commitment to the date and time the deed is recorded) and (6) unpaid taxes, assessments and unredeemed tax sales prior to the year of Closing. Any additional premium expense to obtain OEC will be paid by ☐ ~~Buyer~~ ☐ ~~Seller~~ ☒ **One-Half by Buyer and One-Half by Seller** ☐ ~~Other~~ \_\_\_\_\_.

Regardless of whether the Contract requires OEC, the Title Insurance Commitment may not provide OEC or delete or insure over any or all of the standard exceptions for OEC. The Title Insurance Company may require a New Survey or New ILC, defined below, among other requirements for OEC. If the Title Insurance Commitment is not satisfactory to Buyer, Buyer has a right to object under § 8.7. (Right to Object to Title, Resolution).

**8.1.4. Title Documents.** Title Documents consist of the following: (1) copies of any plats, declarations, covenants, conditions and restrictions burdening the Property and (2) copies of any other documents (or, if illegible, summaries of such documents) listed in the schedule of exceptions (Exceptions) in the Title Commitment furnished to Buyer (collectively, Title Documents).

**8.1.5. Copies of Title Documents.** Buyer must receive, on or before **Record Title Deadline**, copies of all Title Documents. This requirement pertains only to documents as shown of record in the office of the clerk and recorder in the county where the Property is located. The cost of furnishing copies of the documents required in this Section will be at the expense of the party or parties obligated to pay for the owner's title insurance policy.

**8.1.6. Existing Abstracts of Title.** Seller must deliver to Buyer copies of any abstracts of title covering all or any portion of the Property (Abstract of Title) in Seller's possession on or before **Record Title Deadline**.

**8.2. Record Title.** Buyer has the right to review and object to the Abstract of Title or Title Commitment and any of the Title Documents as set forth in § 8.7. (Right to Object to Title, Resolution) on or before **Record Title Objection Deadline**. Buyer's objection may be based on any unsatisfactory form or content of Title Commitment or Abstract of Title, notwithstanding § 13, or any other unsatisfactory title condition, in Buyer's sole subjective discretion. If the Abstract of Title, Title Commitment or Title Documents are not received by Buyer on or before the **Record Title Deadline**, or if there is an endorsement to the Title Commitment that adds a new Exception to title, a copy of the new Exception to title and the modified Title Commitment will be delivered to Buyer. Buyer has until the earlier of Closing or ten days after receipt of such documents by Buyer to review and object to: (1) any required Title Document not timely received by Buyer, (2) any change to the Abstract of Title, Title Commitment or Title Documents, or (3) any endorsement to the Title Commitment. If Seller receives Buyer's Notice to Terminate or Notice of Title Objection, pursuant to this § 8.2. (Record Title), any title objection by Buyer is governed by the provisions set forth in § 8.7. (Right to Object to Title, Resolution). If Seller has fulfilled all Seller's obligations, if any, to deliver to Buyer all documents required by § 8.1. (Evidence of Record Title) and Seller does not receive Buyer's Notice to Terminate or Notice of Title Objection by the applicable deadline specified above, Buyer accepts the condition of title as disclosed by the Abstract of Title, Title Commitment and Title Documents as satisfactory.

**8.3. Off-Record Title.** Seller must deliver to Buyer, on or before **Off-Record Title Deadline**, true copies of all existing surveys in Seller's possession pertaining to the Property and must disclose to Buyer all easements, liens (including, without limitation, governmental improvements approved, but not yet installed) or other title matters not shown by public records, of which Seller has actual knowledge (Off-Record Matters). This Section excludes any **New ILC** or **New Survey** governed under § 9 (New ILC, New Survey). Buyer has the right to inspect the Property to investigate if any third party has any right in the Property not shown by public records (e.g., unrecorded easement, boundary line discrepancy or water rights). Buyer's Notice to Terminate or Notice of Title Objection of any unsatisfactory condition (whether disclosed by Seller or revealed by such inspection, notwithstanding § 8.2. (Record Title) and § 13 (Transfer of Title), in Buyer's sole subjective discretion, must be received by Seller on or before **Off-Record Title Objection Deadline**. If an Off-Record Matter is received by Buyer after the **Off-Record Title Deadline**, Buyer has until the earlier of Closing or ten days after receipt by Buyer to review and object to such Off-Record Matter. If Seller receives Buyer's Notice

to Terminate or Notice of Title Objection pursuant to this § 8.3. (Off-Record Title), any title objection by Buyer is governed by the provisions set forth in § 8.7. (Right to Object to Title, Resolution). If Seller does not receive Buyer's Notice to Terminate or Notice of Title Objection by the applicable deadline specified above, Buyer accepts title subject to such Off-Record Matters and rights, if any, of third parties not shown by public records of which Buyer has actual knowledge.

**8.4. Special Taxing Districts. SPECIAL TAXING DISTRICTS MAY BE SUBJECT TO GENERAL OBLIGATION INDEBTEDNESS THAT IS PAID BY REVENUES PRODUCED FROM ANNUAL TAX LEVIES ON THE TAXABLE PROPERTY WITHIN SUCH DISTRICTS. PROPERTY OWNERS IN SUCH DISTRICTS MAY BE PLACED AT RISK FOR INCREASED MILL LEVIES AND TAX TO SUPPORT THE SERVICING OF SUCH DEBT WHERE CIRCUMSTANCES ARISE RESULTING IN THE INABILITY OF SUCH A DISTRICT TO DISCHARGE SUCH INDEBTEDNESS WITHOUT SUCH AN INCREASE IN MILL LEVIES. BUYERS SHOULD INVESTIGATE THE SPECIAL TAXING DISTRICTS IN WHICH THE PROPERTY IS LOCATED BY CONTACTING THE COUNTY TREASURER, BY REVIEWING THE CERTIFICATE OF TAXES DUE FOR THE PROPERTY AND BY OBTAINING FURTHER INFORMATION FROM THE BOARD OF COUNTY COMMISSIONERS, THE COUNTY CLERK AND RECORDER, OR THE COUNTY ASSESSOR.**

**8.5. Tax Certificate.** A tax certificate paid for by ☐ Seller ☒ Buyer, for the Property listing any special taxing districts that affect the Property (Tax Certificate) must be delivered to Buyer on or before **Record Title Deadline**. If the Property is located within a special taxing district and such inclusion is unsatisfactory to Buyer, in Buyer's sole subjective discretion, Buyer may terminate, on or before **Record Title Objection Deadline**. Should Buyer receive the Tax Certificate after **Record Title Deadline**, Buyer, at Buyer's option, has the Right to Terminate under § 24.1. by Buyer's Notice to Terminate received by Seller on or before ten days after Buyer's receipt of the Tax Certificate. If Buyer does not receive the Tax Certificate, or if Buyer's Notice to Terminate would otherwise be required to be received by Seller after **Closing Date**, Buyer's Notice to Terminate must be received by Seller on or before Closing. If Seller does not receive Buyer's Notice to Terminate within such time, Buyer accepts the provisions of the Tax Certificate and the inclusion of the Property in a special taxing district, if applicable, as satisfactory and Buyer waives any Right to Terminate under this provision. If Buyer's loan specified in § 4.5.3. (Loan Limitations) prohibits Buyer from paying for the Tax Certificate, the Tax Certificate will be paid for by Seller.

~~**8.6. Third Party Right to Purchase/Approve.** If any third party has a right to purchase the Property (e.g., right of first refusal on the Property, right to purchase the Property under a lease or an option held by a third party to purchase the Property) or a right of a third party to approve this Contract, Seller must promptly submit this Contract according to the terms and conditions of such right. If the third party holder of such right exercises its right this Contract will terminate. If the third party's right to purchase is waived explicitly or expires, or the Contract is approved, this Contract will remain in full force and effect. Seller must promptly notify Buyer in writing of the foregoing. If the third party right to purchase is exercised or approval of this Contract has not occurred on or before **Third Party Right to Purchase/Approve Deadline**, this Contract will then terminate. Seller will supply to Buyer, in writing, details of any Third Party Right to Purchase the Property on or before the **Record Title Deadline**.~~

**8.7. Right to Object to Title, Resolution.** Buyer has a right to object or terminate, in Buyer's sole subjective discretion, based on any title matters including those matters set forth in § 8.2. (Record Title), § 8.3. (Off-Record Title), § 8.5. (Special Taxing District) and § 13 (Transfer of Title). If Buyer exercises Buyer's rights to object or terminate based on any such title matter, on or before the applicable deadline, Buyer has the following options:

**8.7.1. Title Objection, Resolution.** If Seller receives Buyer's written notice objecting to any title matter (Notice of Title Objection) on or before the applicable deadline and if Buyer and Seller have not agreed to a written settlement thereof on or before **Title Resolution Deadline**, this Contract will terminate on the expiration of **Title Resolution Deadline**, unless Seller receives Buyer's written withdrawal of Buyer's Notice of Title Objection (i.e., Buyer's written notice to waive objection to such items and waives the Right to Terminate for that reason), on or before expiration of **Title Resolution Deadline**. If either the Record Title Deadline or the Off-Record Title Deadline, or both, are extended pursuant to § 8.2. (Record Title) or § 8.3. (Off-Record Title) the Title Resolution Deadline also will be automatically extended to the earlier of Closing or fifteen days after Buyer's receipt of the applicable documents; or

**8.7.2. Title Objection, Right to Terminate.** Buyer may exercise the Right to Terminate under § 24.1., on or before the applicable deadline, based on any title matter unsatisfactory to Buyer, in Buyer's sole subjective discretion.

**8.8. Title Advisory.** The Title Documents affect the title, ownership and use of the Property and should be reviewed carefully. Additionally, other matters not reflected in the Title Documents may affect the title, ownership and use of the Property, including, without limitation, boundary lines and encroachments, set-back requirements, area, zoning, building code violations, unrecorded easements and claims of easements, leases and other unrecorded agreements, water on or under the Property and various laws and governmental regulations concerning land use, development and environmental matters.

**8.8.1. OIL, GAS, WATER AND MINERAL DISCLOSURE. THE SURFACE ESTATE OF THE PROPERTY MAY BE OWNED SEPARATELY FROM THE UNDERLYING MINERAL ESTATE AND TRANSFER OF THE SURFACE ESTATE MAY NOT NECESSARILY INCLUDE TRANSFER OF THE MINERAL ESTATE OR WATER RIGHTS. THIRD PARTIES MAY OWN OR LEASE INTERESTS IN OIL, GAS, OTHER MINERALS, GEOTHERMAL ENERGY OR WATER ON OR UNDER THE SURFACE OF THE PROPERTY, WHICH INTERESTS MAY GIVE THEM RIGHTS TO ENTER AND USE THE SURFACE OF THE PROPERTY TO ACCESS THE MINERAL ESTATE, OIL, GAS OR WATER.**

**8.8.2. SURFACE USE AGREEMENT. THE USE OF THE SURFACE ESTATE OF THE PROPERTY TO ACCESS THE OIL, GAS OR MINERALS MAY BE GOVERNED BY A SURFACE USE AGREEMENT, A MEMORANDUM OR OTHER NOTICE OF WHICH MAY BE RECORDED WITH THE COUNTY CLERK AND RECORDER.**

**8.8.3. OIL AND GAS ACTIVITY. OIL AND GAS ACTIVITY THAT MAY OCCUR ON OR ADJACENT TO THE PROPERTY MAY INCLUDE, BUT IS NOT LIMITED TO, SURVEYING, DRILLING, WELL COMPLETION OPERATIONS, STORAGE, OIL AND GAS, OR PRODUCTION FACILITIES, PRODUCING WELLS, REWORKING OF CURRENT WELLS AND GAS GATHERING AND PROCESSING FACILITIES.**

**8.8.4. ADDITIONAL INFORMATION. BUYER IS ENCOURAGED TO SEEK ADDITIONAL INFORMATION REGARDING OIL AND GAS ACTIVITY ON OR ADJACENT TO THE PROPERTY, INCLUDING DRILLING PERMIT APPLICATIONS. THIS INFORMATION MAY BE AVAILABLE FROM THE COLORADO OIL AND GAS CONSERVATION COMMISSION.**

**8.8.5. Title Insurance Exclusions.** Matters set forth in this Section and others, may be excepted, excluded from, or not covered by the owner's title insurance policy.

~~**8.9. Mineral Rights Review.** Buyer ☐ Does ☐ Does Not have a Right to Terminate if examination of the Mineral Rights is unsatisfactory to Buyer on or before the Mineral Rights Examination Deadline.~~

## **9. NEW ILC, NEW SURVEY.**

**9.1. New ILC or New Survey.** If the box is checked, (1) ☐ ~~New Improvement Location Certificate (New ILC);~~ or, (2) ☒ **New Survey** in the form of ALTA; is required and the following will apply:

**9.1.1. Ordering of New ILC or New Survey.** ☐ ~~Seller~~ ☒ **Buyer** will order the New ILC or New Survey. The New ILC or New Survey may also be a previous ILC or survey that is in the above-required form, certified and updated as of a date after the date of this Contract.

**9.1.2. Payment for New ILC or New Survey.** The cost of the New ILC or New Survey will be paid, on or before Closing, by: ☐ ~~Seller~~ ☒ **Buyer** or:

**9.1.3. Delivery of New ILC or New Survey.** Buyer, Seller, the issuer of the Title Commitment (or the provider of the opinion of title if an Abstract of Title) and \_\_\_\_\_ will receive a New ILC or New Survey on or before **New ILC or New Survey Deadline**.

**9.1.4. Certification of New ILC or New Survey.** The New ILC or New Survey will be certified by the surveyor to all those who are to receive the New ILC or New Survey.

**9.2. Buyer's Right to Waive or Change New ILC or New Survey Selection.** Buyer may select a New ILC or New Survey different than initially specified in this Contract if there is no additional cost to Seller or change to the **New ILC or New Survey Objection Deadline**. Buyer may, in Buyer's sole subjective discretion, waive a New ILC or New Survey if done prior to Seller incurring any cost for the same.

**9.3. New ILC or New Survey Objection.** Buyer has the right to review and object based on the New ILC or New Survey. If the New ILC or New Survey is not timely received by Buyer or is unsatisfactory to Buyer, in Buyer's sole subjective discretion, Buyer may, on or before **New ILC or New Survey Objection Deadline**, notwithstanding § 8.3. or § 13:

**9.3.1. Notice to Terminate.** Notify Seller in writing, pursuant to § 24.1., that this Contract is terminated; or

**9.3.2. New ILC or New Survey Objection.** Deliver to Seller a written description of any matter that was to be shown or is shown in the New ILC or New Survey that is unsatisfactory and that Buyer requires Seller to correct.

**9.3.3. New ILC or New Survey Resolution.** If a **New ILC or New Survey Objection** is received by Seller, on or before **New ILC or New Survey Objection Deadline** and if Buyer and Seller have not agreed in writing to a settlement thereof on or before **New ILC or New Survey Resolution Deadline**, this Contract will terminate on expiration of the **New ILC or New Survey Resolution Deadline**, unless Seller receives Buyer's written withdrawal of the New ILC or New Survey Objection before such termination (i.e., on or before expiration of **New ILC or New Survey Resolution Deadline**).

## **DISCLOSURE, INSPECTION AND DUE DILIGENCE**

## **10. PROPERTY DISCLOSURE, INSPECTION, INDEMNITY, INSURABILITY, DUE DILIGENCE AND SOURCE OF WATER.**

**10.1. Seller's Property Disclosure.** On or before **Seller's Property Disclosure Deadline**, Seller agrees to deliver to Buyer the most current version of the applicable Colorado Real Estate Commission's Seller's Property Disclosure form completed by Seller to Seller's actual knowledge and current as of the date of this Contract.

**10.2. Disclosure of Adverse Material Facts; Subsequent Disclosure; Present Condition.** Seller must disclose to Buyer any adverse material facts actually known by Seller as of the date of this Contract. Seller agrees that disclosure of adverse material facts will be in writing. In the event Seller discovers an adverse material fact after the date of this Contract, Seller must timely



disclose such adverse fact to Buyer. Buyer has the Right to Terminate based on the Seller's new disclosure on the earlier of Closing or five days after Buyer's receipt of the new disclosure. Except as otherwise provided in this Contract, Buyer acknowledges that Seller is conveying the Property to Buyer in an "As Is" condition, "Where Is" and "With All Faults."

**10.3. Inspection.** Unless otherwise provided in this Contract, Buyer, acting in good faith, has the right to have inspections (by one or more third parties, personally or both) of the Property, Leased Items, and Inclusions (Inspection), at Buyer's expense. If (1) the physical condition of the Property, including, but not limited to, the roof, walls, structural integrity of the Property, the electrical, plumbing, HVAC and other mechanical systems of the Property, (2) the physical condition of the Inclusions and Leased Items, (3) service to the Property (including utilities and communication services), systems and components of the Property (e.g., heating and plumbing), (4) any proposed or existing transportation project, road, street or highway, or (5) any other activity, odor or noise (whether on or off the Property) and its effect or expected effect on the Property or its occupants is unsatisfactory, in Buyer's sole subjective discretion, Buyer may:

**10.3.1. Inspection Termination.** On or before the **Inspection Termination Deadline**, notify Seller in writing, pursuant to § 24.1., that this Contract is terminated due to any unsatisfactory condition, provided the Buyer did not previously deliver an Inspection Objection. Buyer's Right to Terminate under this provision expires upon delivery of an Inspection Objection to Seller pursuant to § 10.3.2.; or

**10.3.2. Inspection Objection.** On or before the **Inspection Objection Deadline**, deliver to Seller a written description of any unsatisfactory condition that Buyer requires Seller to correct.

**10.3.3. Inspection Resolution.** If an Inspection Objection is received by Seller, on or before **Inspection Objection Deadline** and if Buyer and Seller have not agreed in writing to a settlement thereof on or before **Inspection Resolution Deadline**, this Contract will terminate on **Inspection Resolution Deadline** unless Seller receives Buyer's written withdrawal of the Inspection Objection before such termination (i.e., on or before expiration of **Inspection Resolution Deadline**). Nothing in this provision prohibits the Buyer and the Seller from mutually terminating this Contract before the Inspection Resolution Deadline passes by executing an Earnest Money Release.

**10.4. Damage, Liens and Indemnity.** Buyer, except as otherwise provided in this Contract or other written agreement between the parties, is responsible for payment for all inspections, tests, surveys, engineering reports, or other reports performed at Buyer's request (Work) and must pay for any damage that occurs to the Property and Inclusions as a result of such Work. Buyer must not permit claims or liens of any kind against the Property for Work performed on the Property. Buyer agrees to indemnify, protect and hold Seller harmless from and against any liability, damage, cost or expense incurred by Seller and caused by any such Work, claim, or lien. This indemnity includes Seller's right to recover all costs and expenses incurred by Seller to defend against any such liability, damage, cost or expense, or to enforce this Section, including Seller's reasonable attorney fees, legal fees and expenses. The provisions of this Section survive the termination of this Contract. This § 10.4. does not apply to items performed pursuant to an Inspection Resolution.

**10.5. Insurability.** Buyer has the Right to Terminate under § 24.1., on or before **Property Insurance Termination Deadline**, based on any unsatisfactory provision of the availability, terms and conditions and premium for property insurance (Property Insurance) on the Property, in Buyer's sole subjective discretion.

**10.6. Due Diligence.**

**10.6.1. Due Diligence Documents.** Seller agrees to deliver copies of the following documents and information pertaining to the Property and Leased Items (Due Diligence Documents) to Buyer on or before **Due Diligence Documents Delivery Deadline**: any documents and materials in Seller's possession that are responsive to this Section 10.6.1.

**10.6.1.1. Occupancy Agreements.** All current leases, including any amendments or other occupancy agreements, pertaining to the Property. Those leases or other occupancy agreements pertaining to the Property that survive Closing are as follows (Leases):

First Amendment to Farm Lease Agreement with Leland Lebsack, dated April 6, 2021. Seller shall assign, and Buyer shall assume, at Closing that portion of the First Amendment to Farm Lease Agreement concerning the Property. As described above, Seller is reserving for itself any and all water and water rights associated with the Property. However, Seller agrees to continue leasing the two (2) shares of WSSC that historically irrigated the Property to Mr. Lebsack for irrigation of the Property through December 31, 2022.

~~**10.6.1.2. Leased Items Documents.** If any lease of personal property (§ 2.5.4., Leased Items) will be transferred to Buyer at Closing, Seller agrees to deliver copies of the leases and information pertaining to the personal property to Buyer on or before **Due Diligence Documents Delivery Deadline**. Buyer ☐ **Will** ☐ **Will Not** assume the Seller's obligations under such leases for the Leased Items (§ 2.5.4., Leased Items).~~

~~**10.6.1.3. Encumbered Inclusions Documents.** If any Inclusions owned by Seller are encumbered pursuant to § 2.5.2. (Encumbered Inclusions) above, Seller agrees to deliver copies of the evidence of debt, security and any other documents creating the encumbrance to Buyer on or before **Due Diligence Documents Delivery Deadline**. Buyer ☐ **Will** ☐ **Will Not** assume the debt on the Encumbered Inclusions (§ 2.5.2., Encumbered Inclusions).~~

**10.6.1.4. Other Documents.** If the respective box is checked, Seller agrees to additionally deliver copies of the following:

☐ **10.6.1.4.1.** ~~All contracts relating to the operation, maintenance and management of the Property;~~

☐ **10.6.1.4.2.** ~~Property tax bills for the last \_\_\_\_\_ years;~~

☐ ~~10.6.1.4.3. As-built construction plans to the Property and the tenant improvements, including architectural, electrical, mechanical and structural systems; engineering reports; and permanent Certificates of Occupancy, to the extent now available;~~

☒ **10.6.1.4.4.** A list of all Inclusions to be conveyed to Buyer;

☐ ~~10.6.1.4.5. Operating statements for the past \_\_\_\_\_ years;~~

☐ ~~10.6.1.4.6. A rent roll accurate and correct to the date of this Contract;~~

☐ ~~10.6.1.4.7. A schedule of any tenant improvement work Seller is obligated to complete but has not yet completed and capital improvement work either scheduled or in process on the date of this Contract;~~

☐ ~~10.6.1.4.8. All insurance policies pertaining to the Property and copies of any claims which have been made for the past \_\_\_\_\_ years;~~

☒ **10.6.1.4.9.** Soils reports, surveys and engineering reports or data pertaining to the Property (if not delivered earlier under § 8.3.);

☒ **10.6.1.4.10.** Any and all existing documentation and reports regarding Phase I and II environmental reports, letters, test results, advisories and similar documents respective to the existence or nonexistence of asbestos, PCB transformers, or other toxic, hazardous or contaminated substances and/or underground storage tanks and/or radon gas. If no reports are in Seller's possession or known to Seller, Seller warrants that no such reports are in Seller's possession or known to Seller;

☐ ~~10.6.1.4.11. Any Americans with Disabilities Act reports, studies or surveys concerning the compliance of the Property with said Act;~~

☐ ~~10.6.1.4.12. All permits, licenses and other building or use authorizations issued by any governmental authority with jurisdiction over the Property and written notice of any violation of any such permits, licenses or use authorizations, if any; and~~

☐ **10.6.1.4.13.** Other:

**10.6.2. Due Diligence Documents Review and Objection.** Buyer has the right to review and object based on the Due Diligence Documents. If the Due Diligence Documents are not supplied to Buyer or are unsatisfactory, in Buyer's sole subjective discretion, Buyer may, on or before **Due Diligence Documents Objection Deadline**:

**10.6.2.1. Notice to Terminate.** Notify Seller in writing, pursuant to § 24.1., that this Contract is terminated; or

**10.6.2.2. Due Diligence Documents Objection.** Deliver to Seller a written description of any unsatisfactory Due Diligence Documents that Buyer requires Seller to correct.

**10.6.2.3. Due Diligence Documents Resolution.** If a Due Diligence Documents Objection is received by Seller, on or before **Due Diligence Documents Objection Deadline** and if Buyer and Seller have not agreed in writing to a settlement thereof on or before **Due Diligence Documents Resolution Deadline**, this Contract will terminate on **Due Diligence Documents Resolution Deadline** unless Seller receives Buyer's written withdrawal of the Due Diligence Documents Objection before such termination (i.e., on or before expiration of **Due Diligence Documents Resolution Deadline**).

**10.6.3. Zoning.** Buyer has the Right to Terminate under § 24.1., on or before **Due Diligence Documents Objection Deadline**, based on any unsatisfactory zoning and any use restrictions imposed by any governmental agency with jurisdiction over the Property, in Buyer's sole subjective discretion.

**10.6.4. Due Diligence – Environmental, ADA.** Buyer has the right to obtain environmental inspections of the Property including Phase I and Phase II Environmental Site Assessments, as applicable. ☐ ~~Seller~~ ☒ **Buyer** will order or provide **Phase I Environmental Site Assessment, Phase II Environmental Site Assessment** (compliant with most current version of the applicable ASTM E1527 standard practices for Environmental Site Assessments) and/or \_\_\_\_\_, at the expense of ☐ ~~Seller~~ ☒ **Buyer** (Environmental Inspection). In addition, Buyer, at Buyer's expense, may also conduct an evaluation whether the Property complies with the *Americans with Disabilities Act* (ADA Evaluation). All such inspections and evaluations must be conducted at such times as are mutually agreeable to minimize the interruption of Seller's and any Seller's tenants' business uses of the Property, if any.

If Buyer's Phase I Environmental Site Assessment recommends a Phase II Environmental Site Assessment, the **Environmental Inspection Termination Deadline** will be extended by mutual agreement of the parties \_\_\_\_\_ days (Extended Environmental Inspection Objection Deadline) and if such Extended Environmental Inspection Objection Deadline extends beyond the **Closing Date**, the **Closing Date** will be extended a like period of time. In such event, ☐ ~~Seller~~ ☒ **Buyer** must pay the cost for such Phase II Environmental Site Assessment.

Notwithstanding Buyer's right to obtain additional environmental inspections of the Property in this § 10.6.4., Buyer has the Right to Terminate under § 24.1., on or before **Environmental Inspection Termination Deadline**, or if applicable, the Extended

Environmental Inspection Objection Deadline, based on any unsatisfactory results of Environmental Inspection, in Buyer's sole subjective discretion.

Buyer has the Right to Terminate under § 24.1., on or before **ADA Evaluation Termination Deadline**, based on any unsatisfactory ADA Evaluation, in Buyer's sole subjective discretion.

~~**10.7. Conditional Upon Sale of Property.** This Contract is conditional upon the sale and closing of that certain property owned by Buyer and commonly known as \_\_\_\_\_, Buyer has the Right to Terminate under § 24.1. effective upon Seller's receipt of Buyer's Notice to Terminate on or before **Conditional Sale Deadline** if such property is not sold and closed by such deadline. This Section is for the sole benefit of Buyer. If Seller does not receive Buyer's Notice to Terminate on or before **Conditional Sale Deadline**, Buyer waives any Right to Terminate under this provision.~~

~~**10.8. Source of Potable Water (Residential Land and Residential Improvements Only).** Buyer ☐ Does ☐ Does Not acknowledge receipt of a copy of Seller's Property Disclosure or Source of Water Addendum disclosing the source of potable water for the Property. ☐ There is No Well. Buyer ☐ Does ☐ Does Not acknowledge receipt of a copy of the current well permit. **Note to Buyer: SOME WATER PROVIDERS RELY, TO VARYING DEGREES, ON NONRENEWABLE GROUND WATER. YOU MAY WISH TO CONTACT YOUR PROVIDER (OR INVESTIGATE THE DESCRIBED SOURCE) TO DETERMINE THE LONG-TERM SUFFICIENCY OF THE PROVIDER'S WATER SUPPLIES.**~~

**10.9. Existing Leases; Modification of Existing Leases; New Leases.** Seller states that none of the Leases to be assigned to the Buyer at the time of Closing contain any rent concessions, rent reductions or rent abatements except as disclosed in the Lease or other writing received by Buyer. Seller will not amend, alter, modify, extend or cancel any of the Leases nor will Seller enter into any new leases affecting the Property without the prior written consent of Buyer, which consent will not be unreasonably withheld or delayed.

~~**10.10. Lead-Based Paint.** [Intentionally Deleted - See Residential Addendum if applicable]~~

~~**10.11. Carbon Monoxide Alarms.** [Intentionally Deleted - See Residential Addendum if applicable]~~

~~**10.12. Methamphetamine Disclosure.** [Intentionally Deleted - See Residential Addendum if applicable]~~

## **11. TENANT ESTOPPEL STATEMENTS.**

**11.1. Estoppel Statements Conditions.** Buyer has the right to review and object to any Estoppel Statements. Seller must request from all tenants of the Property and if received by Seller, deliver to Buyer on or before **Estoppel Statements Deadline**, statements in a form and substance reasonably acceptable to Buyer, from each occupant or tenant at the Property (Estoppel Statement) attached to a copy of the Lease stating:

**11.1.1.** The commencement date of the Lease and scheduled termination date of the Lease;

**11.1.2.** That said Lease is in full force and effect and that there have been no subsequent modifications or amendments;

**11.1.3.** The amount of any advance rentals paid, rent concessions given and deposits paid to Seller;

**11.1.4.** The amount of monthly (or other applicable period) rental paid to Seller;

**11.1.5.** That there is no default under the terms of said Lease by landlord or occupant; and

**11.1.6.** That the Lease to which the Estoppel Statement is attached is a true, correct and complete copy of the Lease demising the premises it describes.

**11.2. Seller Estoppel Statement.** In the event Seller does not receive from all tenants of the Property a completed signed Estoppel Statement, Seller agrees to complete and execute an Estoppel Statement setting forth the information and documents required § 11.1. above and deliver the same to Buyer on or before **Estoppel Statements Deadline**.

**11.3. Estoppel Statements Termination.** Buyer has the Right to Terminate under § 24.1., on or before **Estoppel Statements Termination Deadline**, based on any unsatisfactory Estoppel Statement, in Buyer's sole subjective discretion, or if Seller fails to deliver the Estoppel Statements on or before **Estoppel Statements Deadline**. Buyer also has the unilateral right to waive any unsatisfactory Estoppel Statement.

## **CLOSING PROVISIONS**

## **12. CLOSING DOCUMENTS, INSTRUCTIONS AND CLOSING.**

**12.1. Closing Documents and Closing Information.** Seller and Buyer will cooperate with the Closing Company to enable the Closing Company to prepare and deliver documents required for Closing to Buyer and Seller and their designees. If Buyer is obtaining a loan to purchase the Property, Buyer acknowledges Buyer's lender is required to provide the Closing Company, in a timely manner, all required loan documents and financial information concerning Buyer's loan. Buyer and Seller will furnish any additional information and documents required by Closing Company that will be necessary to complete this transaction. Buyer and Seller will sign and complete all customary or reasonably required documents at or before Closing.

**12.2. Closing Instructions.** Colorado Real Estate Commission's Closing Instructions ☐ Are ☒ Are Not executed with this Contract.

**12.3. Closing.** Delivery of deed from Seller to Buyer will be at closing (Closing). Closing will be on the date specified as the **Closing Date** or by mutual agreement at an earlier date. ~~At Closing, Seller agrees to deliver a set of keys for the Property to Buyer.~~ The hour and place of Closing will be as designated by mutual agreement of the Seller and Buyer.

**12.4. Disclosure of Settlement Costs.** Buyer and Seller acknowledge that costs, quality and extent of service vary between different settlement service providers (e.g., attorneys, lenders, inspectors and title companies).

**12.5. Assignment of Leases.** Seller must assign to Buyer all Leases at Closing that will continue after Closing and Buyer must assume Seller's obligations under such Leases. Further, Seller must transfer to Buyer all Leased Items and assign to Buyer such leases for the Leased Items accepted by Buyer pursuant to § 2.5.4. (Leased Items).

**13. TRANSFER OF TITLE.** Subject to Buyer's compliance with the terms and provisions of this Contract, including the tender of any payment due at Closing, Seller must execute and deliver the following good and sufficient deed to Buyer, at Closing: ☒ special warranty deed ☐ ~~general warranty deed~~ ☐ ~~bargain and sale deed~~ ☐ ~~quit claim deed~~ ☐ ~~personal representative's deed~~ ☐ ~~\_\_\_\_\_ deed.~~ Seller, provided another deed is not selected, must execute and deliver a good and sufficient special warranty deed to Buyer, at Closing.

Unless otherwise specified in § 29 (Additional Provisions), if title will be conveyed using a special warranty deed or a general warranty deed, title will be conveyed "subject to statutory exceptions" as defined in §38-30-113(5)(a), C.R.S.

**14. PAYMENT OF LIENS AND ENCUMBRANCES.** Unless agreed to by Buyer in writing, any amounts owed on any liens or encumbrances securing a monetary sum against the Property and Inclusions, including any governmental liens for special improvements installed as of the date of Buyer's signature hereon, whether assessed or not, and previous years' taxes, will be paid at or before Closing by Seller from the proceeds of this transaction or from any other source.

**15. CLOSING COSTS, FEES, ASSOCIATION STATUS LETTER AND DISBURSEMENTS, TAXES AND WITHHOLDING.**

**15.1. Closing Costs.** Buyer and Seller must pay, in Good Funds, their respective closing costs and all other items required to be paid at Closing, except as otherwise provided herein.

**15.2. Closing Services Fee.** The fee for real estate closing services must be paid at Closing by ☐ Buyer ☐ Seller ☒ ~~One-Half by Buyer and One-Half by Seller~~ ☐ ~~Other \_\_\_\_\_~~.

~~**15.3. Association Fees and Required Disbursements.** At least fourteen days prior to Closing Date, Seller agrees to promptly request that the Closing Company or the Association deliver to Buyer a current Status Letter, if applicable. Any fees associated with or specified in the Status Letter will be paid as follows:~~

~~**15.3.1. Status Letter Fee.** Any fee incident to the issuance of Association's Status Letter must be paid by ☐ Buyer ☐ Seller ☐ ~~One-Half by Buyer and One-Half by Seller~~ ☐ ~~N/A.~~~~

~~**15.3.2. Record Change Fee.** Any Record Change Fee must be paid by ☐ Buyer ☐ Seller ☐ ~~One-Half by Buyer and One-Half by Seller~~ ☐ ~~N/A.~~~~

~~**15.3.3. Assessments, Reserves or Working Capital.** All assessments required to be paid in advance (other than Association Assessments as defined in § 16.2. (Association Assessments), reserves or working capital due at Closing must be paid by ☐ Buyer ☐ Seller ☐ ~~One-Half by Buyer and One-Half by Seller~~ ☐ ~~N/A.~~~~

~~**15.3.4. Other Fees.** Any other fee listed in the Status Letter as required to be paid at Closing will be paid by ☐ Buyer ☐ Seller ☐ ~~One-Half by Buyer and One-Half by Seller~~ ☐ ~~N/A.~~~~

**15.4. Local Transfer Tax.** Any Local Transfer Tax must be paid at Closing by ☐ Buyer ☐ Seller ☒ ~~One-Half by Buyer and One-Half by Seller~~ ☐ ~~N/A.~~

**15.5. Sales and Use Tax.** Any sales and use tax that may accrue because of this transaction must be paid when due by ☒ Buyer ☐ Seller ☐ ~~One-Half by Buyer and One-Half by Seller~~ ☐ ~~N/A.~~

~~**15.6. Private Transfer Fee.** Any private transfer fees and other fees due to a transfer of the Property, payable at Closing, such as community association fees, developer fees and foundation fees, must be paid at Closing by ☐ Buyer ☐ Seller ☐ ~~One-Half by Buyer and One-Half by Seller~~ ☐ ~~N/A.~~~~

~~**15.7. Water Transfer Fees.** Water Transfer Fees can change. The fees, as of the date of this Contract, do not exceed \$\_\_\_\_\_ for:~~

☐ ~~Water Stock/Certificates~~

☐ ~~Water District~~

☐ ~~Augmentation Membership~~

☐ ~~Small Domestic Water Company~~

~~and must be paid at Closing by ☐ Buyer ☐ Seller ☐ ~~One-Half by Buyer and One-Half by Seller~~ ☐ ~~N/A.~~~~

**15.8. Utility Transfer Fees.** Utility transfer fees can change. Any fees to transfer utilities from Seller to Buyer must be paid by ☒ Buyer ☐ Seller ☐ ~~One-Half by Buyer and One-Half by Seller~~ ☐ ~~N/A.~~

**15.9. FIRPTA and Colorado Withholding.**

**15.9.1. FIRPTA.** The Internal Revenue Service (IRS) may require a substantial portion of the Seller's proceeds be withheld after Closing when Seller is a foreign person. If required withholding does not occur, the Buyer could be held liable for the amount of the Seller's tax, interest and penalties. If the box in this Section is checked, Seller represents that Seller ☐ **IS** a foreign person for purposes of U.S. income taxation. If the box in this Section is not checked, Seller represents that Seller is not a foreign



person for purposes of U.S. income taxation. Seller agrees to cooperate with Buyer and Closing Company to provide any reasonably requested documents to verify Seller's foreign person status. If withholding is required, Seller authorizes Closing Company to withhold such amount from Seller's proceeds. Seller should inquire with Seller's tax advisor to determine if withholding applies or if an exemption exists.

**15.9.2. Colorado Withholding.** The Colorado Department of Revenue may require a portion of the Seller's proceeds be withheld after Closing when Seller will not be a Colorado resident after Closing, if not otherwise exempt. Seller agrees to cooperate with Buyer and Closing Company to provide any reasonably requested documents to verify Seller's status. If withholding is required, Seller authorizes Closing Company to withhold such amount from Seller's proceeds. Seller should inquire with Seller's tax advisor to determine if withholding applies or if an exemption exists.

## 16. PRORATIONS AND ASSOCIATION ASSESSMENTS.

**16.1. Prorations.** The following will be prorated to the **Closing Date**, except as otherwise provided:

**16.1.1. Taxes.** Personal property taxes, if any, special taxing district assessments, if any, and general real estate taxes for the year of Closing, based on ☒ **Taxes for the Calendar Year Immediately Preceding Closing** ☐ **Most Recent Mill Levy and Most Recent Assessed Valuation**, ☐ **Other** \_\_\_\_\_.

**16.1.2. Rents.** Rents based on ☐ **Rents Actually Received** ☒ **Accrued**. At Closing, Seller will transfer or credit to Buyer the security deposits for all Leases assigned to Buyer, or any remainder after lawful deductions, and notify all tenants in writing of such transfer and of the transferee's name and address.

~~**16.1.3. Other Prorations.** Water and sewer charges, propane, interest on continuing loan and \_\_\_\_\_.~~

**16.1.4. Final Settlement.** Unless otherwise specified in Additional Provisions, these prorations are final.

~~**16.2. Association Assessments.** Current regular Association assessments and dues (Association Assessments) paid in advance will be credited to Seller at Closing. Cash reserves held out of the regular Association Assessments for deferred maintenance by the Association will not be credited to Seller except as may be otherwise provided by the Governing Documents. Buyer acknowledges that Buyer may be obligated to pay the Association, at Closing, an amount for reserves or working capital. Any special assessment assessed prior to **Closing Date** by the Association will be the obligation of ☐ **Buyer** ☐ **Seller**. Except however, any special assessment by the Association for improvements that have been installed as of the date of Buyer's signature hereon, whether assessed prior to or after Closing, will be the obligation of Seller unless otherwise specified in Additional Provisions. Seller represents there are no unpaid regular or special assessments against the Property except the current regular assessments and \_\_\_\_\_.~~ Association Assessments are subject to change as provided in the Governing Documents.

**17. POSSESSION.** Possession of the Property and Inclusions will be delivered to Buyer on **Possession Date** at **Possession Time**, subject to the Leases as set forth in § 10.6.1.1.

If Seller, after Closing occurs, fails to deliver possession as specified, Seller will be subject to eviction and will be additionally liable to Buyer, notwithstanding § 20.2. (If Seller is in Default), for payment of \$ 50.00 per day (or any part of a day notwithstanding § 3.3., Day) from **Possession Date** and **Possession Time** until possession is delivered.

## GENERAL PROVISIONS

**18. CAUSES OF LOSS, INSURANCE; DAMAGE TO INCLUSIONS AND SERVICES; CONDEMNATION; AND WALK-THROUGH.** Except as otherwise provided in this Contract, the Property, Inclusions or both will be delivered in the condition existing as of the date of this Contract, ordinary wear and tear excepted.

**18.1. Causes of Loss, Insurance.** In the event the Property or Inclusions are damaged by fire, other perils or causes of loss prior to Closing (Property Damage) in an amount of not more than ten percent of the total Purchase Price and if the repair of the damage will be paid by insurance (other than the deductible to be paid by Seller), then Seller, upon receipt of the insurance proceeds, will use Seller's reasonable efforts to repair the Property before **Closing Date**. Buyer has the Right to Terminate under § 24.1., on or before **Closing Date**, if the Property is not repaired before **Closing Date**, or if the damage exceeds such sum. Should Buyer elect to carry out this Contract despite such Property Damage, Buyer is entitled to a credit at Closing for all insurance proceeds that were received by Seller (but not the Association, if any) resulting from damage to the Property and Inclusions, plus the amount of any deductible provided for in the insurance policy. This credit may not exceed the Purchase Price. In the event Seller has not received the insurance proceeds prior to Closing, the parties may agree to extend the **Closing Date** to have the Property repaired prior to Closing or, at the option of Buyer, (1) Seller must assign to Buyer the right to the proceeds at Closing, if acceptable to Seller's insurance company and Buyer's lender; or (2) the parties may enter into a written agreement prepared by the parties or their attorney requiring the Seller to escrow at Closing from Seller's sale proceeds the amount Seller has received and will receive due to such damage, not exceeding the total Purchase Price, plus the amount of any deductible that applies to the insurance claim.

**18.2. Damage, Inclusions and Services.** Should any Inclusion or service (including utilities and communication services), system, component or fixture of the Property (collectively Service) (e.g., heating or plumbing), fail or be damaged between the date of this Contract and Closing or possession, whichever is earlier, then Seller is liable for the repair or replacement of such Inclusion or Service with a unit of similar size, age and quality, or an equivalent credit, but only to the extent that the maintenance or



replacement of such Inclusion or Service is not the responsibility of the Association, if any, less any insurance proceeds received by Buyer covering such repair or replacement. If the failed or damaged Inclusion or Service is not repaired or replaced on or before Closing or possession, whichever is earlier, Buyer has the Right to Terminate under § 24.1., on or before **Closing Date**, or, at the option of Buyer, Buyer is entitled to a credit at Closing for the repair or replacement of such Inclusion or Service. Such credit must not exceed the Purchase Price. If Buyer receives such a credit, Seller's right for any claim against the Association, if any, will survive Closing.

**18.3. Condemnation.** In the event Seller receives actual notice prior to Closing that a pending condemnation action may result in a taking of all or part of the Property or Inclusions, Seller must promptly notify Buyer, in writing, of such condemnation action. Buyer has the Right to Terminate under § 24.1., on or before **Closing Date**, based on such condemnation action, in Buyer's sole subjective discretion. Should Buyer elect to consummate this Contract despite such diminution of value to the Property and Inclusions, Buyer is entitled to a credit at Closing for all condemnation proceeds awarded to Seller for the diminution in the value of the Property or Inclusions, but such credit will not include relocation benefits or expenses or exceed the Purchase Price.

**18.4. Walk-Through and Verification of Condition.** Buyer, upon reasonable notice, has the right to walk through the Property prior to Closing to verify that the physical condition of the Property and Inclusions complies with this Contract.

~~**18.5. Home Warranty. [Intentionally Deleted]**~~

**18.6. Risk of Loss – Growing Crops.** The risk of loss for damage to growing crops by fire or other casualty will be borne by the party entitled to the growing crops as provided in § 2.8. and such party is entitled to such insurance proceeds or benefits for the growing crops.

**19. RECOMMENDATION OF LEGAL AND TAX COUNSEL.** By signing this Contract, Buyer and Seller acknowledge that their respective broker has advised that this Contract has important legal consequences and has recommended: (1) legal examination of title; (2) consultation with legal and tax or other counsel before signing this Contract as this Contract may have important legal and tax implications; (3) to consult with their own attorney if Water Rights, Mineral Rights or Leased Items are included or excluded in the sale; and (4) to consult with legal counsel if there are other matters in this transaction for which legal counsel should be engaged and consulted. Such consultations must be done timely as this Contract has strict time limits, including deadlines, that must be complied with.

**20. TIME OF ESSENCE, DEFAULT AND REMEDIES.** Time is of the essence for all dates and deadlines in this Contract. This means that all dates and deadlines are strict and absolute. If any payment due, including Earnest Money, is not paid, honored or tendered when due, or if any obligation is not performed timely as provided in this Contract or waived, the non-defaulting party has the following remedies:

**20.1. If Buyer is in Default:**

☒ **20.1.1. Specific Performance.** Seller may elect to cancel this Contract and all Earnest Money (whether or not paid by Buyer) will be paid to Seller and retained by Seller. It is agreed that the Earnest Money is not a penalty, and the parties agree the amount is fair and reasonable. Seller may recover such additional damages as may be proper. Alternatively, Seller may elect to treat this Contract as being in full force and effect and Seller has the right to specific performance or damages, or both.

~~**20.1.2. Liquidated Damages, Applicable. This § 20.1.2. applies unless the box in § 20.1.1. is checked.** Seller may cancel this Contract. All Earnest Money (whether or not paid by Buyer) will be paid to Seller and retained by Seller. It is agreed that the Earnest Money amount specified in § 4.1. is LIQUIDATED DAMAGES and not a penalty, which amount the parties agree is fair and reasonable and (except as provided in §§ 10.4. and 21), such amount is SELLER'S ONLY REMEDY for Buyer's failure to perform the obligations of this Contract. Seller expressly waives the remedies of specific performance and additional damages.~~

**20.2. If Seller is in Default:**

**20.2.1. Specific Performance, Damages or Both.** Buyer may elect to treat this Contract as canceled, in which case all Earnest Money received hereunder will be returned to Buyer and Buyer may recover such damages as may be proper. Alternatively, in addition to the per diem in § 17 (Possession) for failure of Seller to timely deliver possession of the Property after Closing occurs, Buyer may elect to treat this Contract as being in full force and effect and Buyer has the right to specific performance or damages, or both.

**20.2.2. Seller's Failure to Perform.** In the event Seller fails to perform Seller's obligations under this Contract, to include, but not limited to, failure to timely disclose Association violations known by Seller, failure to perform any replacements or repairs required under this Contract or failure to timely disclose any known adverse material facts, Seller remains liable for any such failures to perform under this Contract after Closing. Buyer's rights to pursue the Seller for Seller's failure to perform under this Contract are reserved and survive Closing.

**21. LEGAL FEES, COST AND EXPENSES.** Anything to the contrary herein notwithstanding, in the event of any arbitration or litigation relating to this Contract, prior to or after **Closing Date**, the arbitrator or court must award to the prevailing party all reasonable costs and expenses, including attorney fees, legal fees and expenses.

**22. MEDIATION.** If a dispute arises relating to this Contract (whether prior to or after Closing) and is not resolved, the parties must first proceed, in good faith, to mediation. Mediation is a process in which the parties meet with an impartial person who helps

to resolve the dispute informally and confidentially. Mediators cannot impose binding decisions. Before any mediated settlement is binding, the parties to the dispute must agree to the settlement, in writing. The parties will jointly appoint an acceptable mediator and will share equally in the cost of such mediation. The obligation to mediate, unless otherwise agreed, will terminate if the entire dispute is not resolved within thirty days of the date written notice requesting mediation is delivered by one party to the other at that party's last known address (physical or electronic as provided in § 26). Nothing in this Section prohibits either party from filing a lawsuit and recording a *lis pendens* affecting the Property, before or after the date of written notice requesting mediation. This Section will not alter any date in this Contract, unless otherwise agreed.

**23. EARNEST MONEY DISPUTE.** Except as otherwise provided herein, Earnest Money Holder must release the Earnest Money following receipt of written mutual instructions, signed by both Buyer and Seller. In the event of any controversy regarding the Earnest Money, Earnest Money Holder is not required to release the Earnest Money. Earnest Money Holder, in its sole subjective discretion, has several options: (1) wait for any proceeding between Buyer and Seller; (2) interplead all parties and deposit Earnest Money into a court of competent jurisdiction (Earnest Money Holder is entitled to recover court costs and reasonable attorney and legal fees incurred with such action); or (3) provide notice to Buyer and Seller that unless Earnest Money Holder receives a copy of the Summons and Complaint or Claim (between Buyer and Seller) containing the case number of the lawsuit (Lawsuit) within one hundred twenty days of Earnest Money Holder's notice to the parties, Earnest Money Holder is authorized to return the Earnest Money to Buyer. In the event Earnest Money Holder does receive a copy of the Lawsuit and has not interpleaded the monies at the time of any Order, Earnest Money Holder must disburse the Earnest Money pursuant to the Order of the Court. The parties reaffirm the obligation of § 22 (Mediation). This Section will survive cancellation or termination of this Contract.

#### **24. TERMINATION.**

**24.1. Right to Terminate.** If a party has a right to terminate, as provided in this Contract (Right to Terminate), the termination is effective upon the other party's receipt of a written notice to terminate (Notice to Terminate), provided such written notice was received on or before the applicable deadline specified in this Contract. If the Notice to Terminate is not received on or before the specified deadline, the party with the Right to Terminate accepts the specified matter, document or condition as satisfactory and waives the Right to Terminate under such provision.

**24.2. Effect of Termination.** In the event this Contract is terminated, and all Earnest Money received hereunder is timely returned to Buyer, the parties are relieved of all obligations hereunder, subject to §§ 10.4. and 21.

**25. ENTIRE AGREEMENT, MODIFICATION, SURVIVAL; SUCCESSORS.** This Contract, its exhibits and specified addenda, constitute the entire agreement between the parties relating to the subject hereof and any prior agreements pertaining thereto, whether oral or written, have been merged and integrated into this Contract. No subsequent modification of any of the terms of this Contract is valid, binding upon the parties, or enforceable unless made in writing and signed by the parties. Any right or obligation in this Contract that, by its terms, exists or is intended to be performed after termination or Closing survives the same. Any successor to a party receives the predecessor's benefits and obligations of this Contract.

#### **26. NOTICE, DELIVERY AND CHOICE OF LAW.**

**26.1. Physical Delivery and Notice.** Any document or notice to Buyer or Seller must be in writing, except as provided in § 26.2. and is effective when physically received by such party, any individual named in this Contract to receive documents or notices for such party, Broker, or Brokerage Firm of Broker working with such party (except any notice or delivery after Closing must be received by the party, not Broker or Brokerage Firm).

**26.2. Electronic Notice.** As an alternative to physical delivery, any notice may be delivered in electronic form to Buyer or Seller, any individual named in this Contract to receive documents or notices for such party, Broker or Brokerage Firm of Broker working with such party (except any notice or delivery after Closing, cancellation or Termination must be received by the party, not Broker or Brokerage Firm) at the electronic address of the recipient by ~~facsimile~~, email or \_\_\_\_\_.

**26.3. Electronic Delivery.** Electronic Delivery of documents and notice may be delivered by: (1) email at the email address of the recipient, (2) a link or access to a website or server provided the recipient receives the information necessary to access the documents, ~~or (3) facsimile at the facsimile number (Fax No.) of the recipient.~~

**26.4. Choice of Law.** This Contract and all disputes arising hereunder are governed by and construed in accordance with the laws of the State of Colorado that would be applicable to Colorado residents who sign a contract in Colorado for real property located in Colorado.

**27. NOTICE OF ACCEPTANCE, COUNTERPARTS.** This proposal will expire unless accepted in writing, by Buyer and Seller, as evidenced by their signatures below and the offering party receives notice of such acceptance pursuant to § 26 on or before **Acceptance Deadline Date** and **Acceptance Deadline Time**. If accepted, this document will become a contract between Seller and

880 Buyer. A copy of this Contract may be executed by each party, separately and when each party has executed a copy thereof, such  
881 copies taken together are deemed to be a full and complete contract between the parties.

882 **28. GOOD FAITH.** Buyer and Seller acknowledge that each party has an obligation to act in good faith including, but not limited  
883 to, exercising the rights and obligations set forth in the provisions of **Financing Conditions and Obligations; Title Insurance,**  
884 **Record Title and Off-Record Title; New ILC, New Survey; and Property Disclosure, Inspection, Indemnity, Insurability Due**  
885 **Diligence and Source of Water.**

886 **ADDITIONAL PROVISIONS AND ATTACHMENTS**

887 **29. ADDITIONAL PROVISIONS.** (The following additional provisions have not been approved by the Colorado Real Estate  
888 Commission.)

889 **29.1 - Buyer shall deliver, or cause to be delivered, at or before Closing duly executed and acknowledged copies of the Restrictive Covenants (No**  
890 **Irrigation and Revegetation) in the form attached hereto as Exhibit A and the Irrigation Water Lease in the form attached hereto as Exhibit B. The**  
891 **Restrictive Covenants (No Irrigation and Revegetation) shall be recorded in the real property records of Weld County immediately after the deed**  
892 **conveying the property to Buyer is recorded. The Irrigation Water Lease is not intended to run with the land and shall not be recorded.**

893 **29.2 - The obligations of the Seller herein, including the obligation to convey the Property to Buyer, are expressly subject to the authorization of this**  
894 **divestment of real property by the City of Greeley Water & Sewer Board and the City of Greeley City Council. In the event that the Board and City**  
895 **Council do not approve this agreement and authorize the divestment at least 14 days before Closing, this contract is of no legally binding effect, the**  
896 **Earnest Money shall be returned to the Buyer, and neither party shall have any further obligation to the other regarding the subject matter herein.**

900 **30. OTHER DOCUMENTS.**

901 **30.1. Documents Part of Contract.** The following documents **are a part** of this Contract:

- 902 Exhibit A - Form of Restrictive Covenants (No Irrigation and Revegetation)  
903 Exhibit B - Form of Irrigation Water Lease Agreement

904 **30.2. Documents Not Part of Contract.** The following documents have been provided but are **not** a part of this Contract:

909 **SIGNATURES**

910

Buyer's Name: LTS Performance Horses LLC ~~Buyer's Name:~~ \_\_\_\_\_

DocuSigned by:  
Dakota Rathbun 4/5/2022  
5D1446405EA9414...

Buyer's Signature \_\_\_\_\_ Date \_\_\_\_\_ ~~Buyer's Signature~~ \_\_\_\_\_ ~~Date~~ \_\_\_\_\_

Address: 796 Abrams Way ~~Address:~~ \_\_\_\_\_

Loveland CO 80537 \_\_\_\_\_

Phone No.: \_\_\_\_\_ ~~Phone No.:~~ \_\_\_\_\_

~~Fax No.:~~ \_\_\_\_\_ ~~Fax No.:~~ \_\_\_\_\_

Email Address: \_\_\_\_\_ ~~Email Address:~~ \_\_\_\_\_

911 **[NOTE: If this offer is being countered or rejected, do not sign this document.]**

Seller's Name: The City of Greeley, Colorado ~~Seller's Name:~~ \_\_\_\_\_

***[SEE ATTACHED SIGNATURE PAGE]***

~~Seller's Signature~~ \_\_\_\_\_ ~~Date~~ \_\_\_\_\_ ~~Seller's Signature~~ \_\_\_\_\_ ~~Date~~ \_\_\_\_\_

Address: 1001 11th Avenue, 2nd Floor  
Greeley, Colorado 80631  
Email Address: daniel.biwer@greeleygov.com  
Email Address: copy to: cole.gustafson@greeleygov.com  
Email Address: copy to: adam.jokerst@greeleygov.com

Address: \_\_\_\_\_  
Phone No.: \_\_\_\_\_  
Fax No.: \_\_\_\_\_  
Email Address: \_\_\_\_\_

END OF CONTRACT TO BUY AND SELL REAL ESTATE

BROKER’S ACKNOWLEDGMENTS AND COMPENSATION DISCLOSURE.

A. Broker Working With Buyer

Broker ☐ Does ☐ Does Not acknowledge receipt of Earnest Money deposit. Broker agrees that if Brokerage Firm is the Earnest Money Holder and, except as provided in § 23, if the Earnest Money has not already been returned following receipt of a Notice to Terminate or other written notice of termination, Earnest Money Holder will release the Earnest Money as directed by the written mutual instructions. Such release of Earnest Money will be made within five days of Earnest Money Holder’s receipt of the executed written mutual instructions, provided the Earnest Money check has cleared.

Broker is working with Buyer as a ☐ Buyer’s Agent ☐ Transaction-Broker in this transaction.

☐ Customer. Broker has no brokerage relationship with Buyer. See § B for Broker’s brokerage relationship with Seller.

Brokerage Firm’s compensation or commission is to be paid by ☐ Listing Brokerage Firm ☐ Buyer ☐ Other \_\_\_\_\_.  
This Broker’s Acknowledgements and Compensation Disclosure is for disclosure purposes only and does NOT create any claim for compensation. Any compensation agreement between the brokerage firms must be entered into separately and apart from this provision.

Brokerage Firm’s Name: \_\_\_\_\_  
Brokerage Firm’s License #: \_\_\_\_\_  
Broker’s Name: \_\_\_\_\_  
Broker’s License #: \_\_\_\_\_

Broker’s Signature \_\_\_\_\_ Date \_\_\_\_\_

Address: \_\_\_\_\_  
Phone No.: \_\_\_\_\_  
Fax No.: \_\_\_\_\_  
Email Address: \_\_\_\_\_

B. Broker Working with Seller

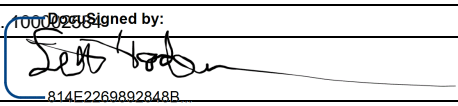
Broker ☐ Does ☒ Does Not acknowledge receipt of Earnest Money deposit. Broker agrees that if Brokerage Firm is the Earnest Money Holder and, except as provided in § 23, if the Earnest Money has not already been returned following receipt of a Notice to Terminate or other written notice of termination, Earnest Money Holder will release the Earnest Money as directed by the written mutual instructions. Such release of Earnest Money will be made within five days of Earnest Money Holder’s receipt of the executed written mutual instructions, provided the Earnest Money check has cleared.

Broker is working with Seller as a ☒ **Seller's Agent** ☐ **Transaction-Broker** in this transaction.

☐ **Customer.** Broker has no brokerage relationship with Seller. See § A for Broker's brokerage relationship with Buyer.

Brokerage Firm's compensation or commission is to be paid by ☒ **Seller** ☐ **Buyer** ☐ **Other** \_\_\_\_\_.

This Broker's Acknowledgements and Compensation Disclosure is for disclosure purposes only and does NOT create any claim for compensation. Any compensation agreement between the brokerage firms must be entered into separately and apart from this provision.

Brokerage Firm's Name:	Hayden Outdoors Real Estate
Brokerage Firm's License #:	EC. 100004181
Broker's Name:	Seth Hayden
Broker's License #:	EA. 10000286
	Signed by:  4/5/2022
	814E2269892848B
Broker's Signature	Date

Address:	501 Main Street, Windsor, CO 80550
Phone No.:	(970) 674-1990
Fax No.:	(970) 674-5090
Email Address:	admin@haydenoutdoors.com

914

**CITY OF GREELEY SIGNATURE PAGE**  
**Contract to Buy and Sell Real Estate**  
**Between LTC Performance Horses, LLC, Buyer, and City of Greeley, Seller**

**THE CITY OF GREELEY, COLORADO**

By: \_\_\_\_\_  
City Manager

Dated: \_\_\_\_\_

**AS TO LEGAL FORM:**

By: \_\_\_\_\_  
City Attorney

**AS TO AVAILABILITY OF FUNDS:**

By: \_\_\_\_\_  
Director of Finance

**AS TO WATER AND SEWER BOARD APPROVAL:**

By: \_\_\_\_\_  
Chairman

**EXHIBIT A****FORM  
DO NOT EXECUTE****RESTRICTIVE COVENANTS (NO IRRIGATION AND REVEGETATION)**

FOR GOOD AND VALUABLE CONSIDERATION, the receipt of which is hereby acknowledged, and in order to provide the City of Greeley, a Colorado home rule municipal corporation ("Greeley"), with the maximum benefit available from the present and future use of water pursuant to the water rights described in Exhibit 1 attached hereto and incorporated herein ("Water Rights"), LTC PERFORMANCE HORSES, LLC, a Colorado limited liability company ("Declarant"), agrees, warrants and covenants, and the undersigned leaseholder and lienholder, if any, acknowledges and approves, on Declarant's own behalf and on behalf of all successors in interest, that upon notice from Greeley, Declarant shall cease irrigation on the lands owned by Declarant and described in Exhibit 2 attached hereto and incorporated herein ("Land").

Upon receipt of one hundred and eighty (180) days prior written notice from Greeley, thereafter Declarant and Declarant's successor in interest shall not irrigate the Land. These covenants shall not prohibit Declarant or Declarant's successor in interest from irrigating the Land (i) with other water rights which may in the future be transferred to such lands and judicially approved for such use through an appropriate Water Court proceeding, and in accordance with any future water rights applications filed by Greeley or a successor in interest to the Water Rights; (ii) with water from an existing well or wells to be constructed in the future which are authorized to pump pursuant to a Water Court-approved plan for augmentation; (iii) with water which is not tributary to the South Platte River or any of its tributaries; (iv) or with treated potable water supplied by a municipal or quasi-municipal government water provider ("Alternate Water Rights").

Unless so irrigated, then within two and one half (2½) years from the date Declarant ceases to irrigate the Land or any portion thereof with Alternate Water Rights, Declarant or Declarant's successors in interest shall establish, at Declarant's or Declarant's successors in interest's expense, a ground cover of plant life, as such is defined in C.R.S. § 37-92-103(10.5), on the previously irrigated portions of the Land to satisfy any applicable revegetation and noxious weed management provisions as may be required in a final decree obtained by Greeley, or a successor in interest to the Water Rights, from the District Court for Water Division No. 1, State of Colorado, or a successor court, changing certain water rights from agricultural irrigation purposes to other beneficial purposes, pursuant to C.R.S. § 37-92-305(4.5). Previously irrigated portions of the Land means portions of the Land not occupied by roads, buildings, or other structures, which land was cultivated with crops in accordance with these covenants. Declarant, or Declarant's successors in interest, shall provide notice to Greeley when such revegetation of the Land has been established. Declarant agrees the Land subject to these covenants shall not be planted with crops that are capable of extending roots into the underlying groundwater, including, but not limited to, alfalfa.

Should Declarant or Declarant's successor in interest fail to comply with its obligations hereunder, Greeley shall have the right to come upon the Land and take all measures necessary to accomplish the Declarant's obligations hereunder, including but not limited to revegetation and/or noxious weed management on the Land, provided that Greeley shall also have the right to receive full reimbursement of all of its expenses of accomplishing such revegetation or weed management from Declarant or Declarant's successor in interest. Any and all fees and costs incurred in any necessary action to enforce these covenants by Greeley, including reasonable attorney fees, shall be paid by Declarant. Additionally, Greeley shall have the right to come upon the Land to verify Declarant's compliance with its obligations hereunder, with any such inspections being at the sole expense of Greeley. All rights to enter upon the Land granted herein shall terminate upon a final determination by the District Court for Water Division No. 1, State of Colorado, under the court's retained jurisdiction, that no further actions will be necessary in order to satisfy Declarant's revegetation obligations.



**EXHIBIT A**

The foregoing covenants shall burden, attach to, and run with the Land and shall be binding upon Declarant and Declarant's successors, assigns and any other person who acquires an ownership or leasehold interest in all or part of the Land; such covenants also shall benefit, attach to, and run with the Water Rights and shall inure to the benefit of Greeley's successors, assigns, and any other person who acquires an ownership interest in the Water Rights. Declarant warrants and represents such covenants shall entitle Greeley to the first and prior right to claim credit for the dry-up or non-irrigation of the Land.

The terms and provisions of these covenants shall not expire and shall be perpetual unless specifically released in writing by Greeley or its successors in interest. The terms and provisions of these covenants may not be terminated, modified, or amended without prior written consent of Greeley or its successors in interest. Any notice may be sent to the Declarant by prepaid U.S. Mail to the Declarant at: 36401 County Road 43, Eaton, Colorado 80615.

IN WITNESS WHEREOF, the Declarant have executed this instrument on the \_\_\_\_\_ day of \_\_\_\_\_, 2022.

Declarant  
LTC PERFORMANCE HORSES, LLC

Leaseholder  
LELAND LEBSACK

By: \_\_\_\_\_

By: \_\_\_\_\_

Name: \_\_\_\_\_

Title: \_\_\_\_\_

STATE OF COLORADO )  
 ) ss.  
COUNTY OF \_\_\_\_\_ )

The foregoing instrument was acknowledged before me this \_\_\_\_ day of \_\_\_\_\_ 2022 by \_\_\_\_\_, as an authorized representative of LTC Performance Horses, LLC.

Witness my hand and official seal.

\_\_\_\_\_  
Notary Public  
My commission expires: \_\_\_\_\_

STATE OF COLORADO )  
 ) ss.  
COUNTY OF \_\_\_\_\_ )

The foregoing instrument was acknowledged before me this \_\_\_\_ day of \_\_\_\_\_ 2022 by Leland Lebsack, in his individual capacity.

Witness my hand and official seal.

\_\_\_\_\_  
Notary Public  
My commission expires: \_\_\_\_\_



EXHIBIT A

EXHIBIT 1  
RESTRICTIVE COVENANT (NO IRRIGATION AND REVEGETATION)  
(Description of the Water Rights)

Any and all water and water rights, ditches and ditch rights, reservoirs and reservoir rights, and all other rights and interests represented by two (2) shares of the two and one-half (2½) shares capital stock in The Water Supply and Storage Company evidenced by Stock Certificate No. 6728.

EXHIBIT A

EXHIBIT 2  
RESTRICTIVE COVENANT (NO IRRIGATION AND REVEGETATION)  
(Description of the Land)

Lot B of Recorded Exemption No. 582 and Revision recorded April 27, 1983 at Reception No. 1924815 in Book 994, being located in the E 1/2 of Section 4, Township 7 North, Range 66 West of the 6<sup>th</sup> P.M., County of Weld, State of Colorado; said Property is also known as Parcel No. 070704000029 and consists of approximately 138.33 net acres, more or less.

**EXHIBIT B**

# FORM DO NOT EXECUTE

## IRRIGATION WATER LEASE AGREEMENT

This IRRIGATION WATER LEASE AGREEMENT (“Agreement”) is entered into this 1<sup>st</sup> day of January 2023, by and between THE CITY OF GREELEY, a Colorado home rule municipal corporation acting by and through its Water Enterprise, whose address is 1001 11<sup>th</sup> Avenue, Second Floor, Greeley, Colorado 80631 (“Greeley”), and LTS PERFORMANCE HORSES, LLC, a Colorado limited liability company whose address is 36401 County Road 43, Eaton, Colorado 80615 (“Lessee”).

### RECITALS

WHEREAS, Greeley owns those certain water rights represented by two (2) shares of capital stock in The Water Supply and Storage Company, evidenced by a portion of Stock Certificate No. 6728 (“Water Rights”); and

WHEREAS, Lessee desires to lease the Water Rights from the Greeley for agricultural irrigation on a parcel of real property consisting of approximately 138.33 acres located in Weld County and more particularly described as Lot B of Recorded Exemption No. 582, and Revision recorded April 27, 1983 at Reception No. 1924815 in Book 994, being located in the E½ of Section 4, Township 7 North, Range 66 West of the 6<sup>th</sup> P.M., County of Weld, State of Colorado; said real property also being known as Parcel No. 070704000029 (“Property”); and

WHEREAS, Greeley is willing to lease the Water Rights to Lessee for agricultural irrigation on the Property;

NOW THEREFORE, for good and valuable consideration, the receipt and adequacy of which are hereby acknowledged, Greeley and Lessee agree as follows.

### AGREEMENT

1. Water Rights Lease. Greeley hereby leases to Lessee, and Lessee hereby leases from the Greeley, the above-described Water Rights for the purpose of agricultural irrigation on the Property.

2. Term of Lease. The term of this Agreement begins on the date of mutual execution and expires on December 31, 2023 (“Initial Term”). At the end of this Initial Term, this Agreement shall renew automatically on an annual basis for four (4) subsequent terms of one (1) year each (“Renewal Terms”), unless Greeley or Lessee transmits written notice of nonrenewal on or before November 1 of the preceding calendar year. Additionally, refer to Section 12 for provisions relating to termination for cause.

3. Annual Lease Amount and Administrative Fee. Lessee shall pay to Greeley an Annual Lease Amount equal to all assessments, charges, and other expenses due and attributable to the Water Rights paid by Greeley to The Water Supply and Storage Company. The Annual Lease Amount shall not be reduced to reflect rebates or other credits attributable to leasing transmountain return flows associated with the Water Rights. Lessee shall also pay to Greeley an Annual Administrative Fee equal to ten percent of that year’s Annual Lease Amount, provided, however, that the Annual Administrative Fee shall not exceed five-hundred dollars (\$500.00). Greeley will provide an invoice of the Annual Lease Amount and Annual Administrative Fee to Lessee, and Lessee shall deliver payment of that total amount to Greeley no later than (i) May 15 of the then current irrigation year, or (ii) within fifteen days of receipt of such invoice from Greeley. Lessee shall also remit to Greeley an additional charge

**EXHIBIT B**

equal to fifteen percent of the Annual Lease Amount for every thirty days that payment required under this Agreement is late.

4. Use of Water Rights. Lessee shall use the water delivered pursuant to the Water Rights only for agricultural irrigation on the Property. Lessee shall not use the Water Rights for any other uses. Lessee shall not use the water delivered pursuant to the Water Rights on any land other than the Property. Lessee shall use the Water Rights in accordance with all rules, regulations, bylaws and policies of The Water Supply and Storage Company. Lessee shall comply with Title 20 (or any successor section) of the Greeley Municipal Code, and all rules, regulations, and laws of the State of Colorado pertaining to use of the Water Rights. Lessee shall take and use the water delivered pursuant to the Water Rights to the fullest extent possible, and shall undertake no action that could be construed as abandonment of the Water Rights or could cause in part or in whole a reduction in the use of the Water Rights. Lessee shall provide advance written notice to Greeley of at least thirty days if it no longer intends to irrigate the entirety of the Property with the Water Rights. Absent written consent from Greeley, Lessee shall not use any water, water rights, ditches, ditch rights, wells, well rights, well permits, carriage rights, reservoirs, or reservoir rights to irrigate the Property, other than water yielded pursuant to the Water Rights.

5. Affidavit of Beneficial Use and Water Court Proceedings. Lessee agrees to deliver to Greeley, on or before May 15 of each calendar year, a completed Beneficial Use Affidavit and Questionnaire, in the form attached hereto as Exhibit A. Lessee acknowledges that Greeley may have a pending application to change the use of the Water Rights with the Division 1 Water Court for the State Colorado during the term of this Agreement. Lessee agrees to cooperate with Greeley and its agents or representatives in the review and analysis of the historical use of the Water Rights. Upon request from Greeley, Lessee shall provide information regarding use of the Water Rights and reasonable access to the Property during and in preparation for any proceeding before the Division 1 Water Court.

6. Restriction on Sublease and Assignment. Lessee shall not rent, sublet, or otherwise convey the right to use the Water Rights. Lessee shall not assign this Agreement, except to a successive owner or operator of the Property for agricultural irrigation of the Property, and only with written consent from Greeley. Lessee shall request consent from Greeley prior to any purported assignment of this Agreement by advance written notice of at least thirty days. Such consent may be given or withheld in the sole discretion of Greeley.

7. No Vested Interest in Shares or Joint Venture. This Agreement is made expressly subject to Section 17-4 of the Charter of the City of Greeley. Greeley grants no interest in the Water Rights to the Lessee other than as explicitly set forth in this Agreement. Lessee shall make no claim to any rights, title, or interest in the Water Rights other than as explicitly set forth in this Agreement. This Agreement does not create a partnership or joint venture of any kind between the parties, and the Lessee shall bear the entirety of any loss, cost, or expense incurred through their use of the Water Rights on the Property.

8. No Guarantee of Yield. Lessee is entitled to receive the amount of water yielded by the Water Rights, subject to the terms and conditions in this Agreement. Greeley makes no warranty, guarantee, or representation of any kind regarding the quality or physical yield of water to be delivered pursuant to the Water Rights. Lessee shall not hold Greeley liable for any failure in delivery of the water pursuant to the Water Rights, including, but not limited to, that caused by force of nature or failure of water supply infrastructure.

9. Maintenance of Infrastructure. Lessee shall maintain the lateral ditches, headgates, and other personal property necessary to deliver water pursuant to the Water Rights at Lessee's own cost and expense. Lessee shall make all repairs and restorations necessary to keep the lateral ditches, headgates, and other personal property in good working condition during the term of this Agreement.

10. Indemnification; Immunity. Lessee agrees to exercise Lessee's rights under this Agreement at Lessee's own risk. Lessee shall indemnify and hold harmless Greeley from and against any cost, expense, or liability

**EXHIBIT B**

arising out of this Agreement or related activities. Nothing in this Agreement is intended to constitute a waiver, express or implied, of any of the immunities, rights, benefits, protections or other provisions, of the Colorado Governmental Immunity Act, C.R.S. §§ 24-10-101 et seq., as applicable now or hereafter amended.

11. Notice. All notices to be given under this Agreement shall be (1) sent by certified or registered mail, return receipt requested, or (2) hand-delivered at the addresses set forth above. Lessee shall provide written notice to Greeley if the appropriate contact information changes.

12. Default and Termination. If either Greeley or Lessee fails to comply with a term or condition herein, such failure constitutes a default of this Agreement. The non-defaulting party may declare the default by providing written notice to the defaulting party in accordance with Paragraph 11 above. Upon receipt of this notice of default, the defaulting party will have fifteen days within which to cure the default. If, in the sole discretion of the non-defaulting party, the default remains uncured after the aforementioned fifteen-day cure period, or after any written extension thereof mutually agreed upon by the parties, the non-defaulting party may declare the Agreement terminated by written notice in accordance with Paragraph 11 above.

(a) Notwithstanding the above, failure by the Lessee to comply with the terms and conditions of Paragraphs 3, 4 or Paragraph 6 of this Agreement constitutes a material breach. In the event that the Lessee commits a material breach, Greeley may immediately terminate this Agreement by written notice to Lessee.

(b) The failure of either party to declare a default or material breach does not establish a precedent or constitute an implied waiver of any subsequent breach of the terms and conditions in this Agreement.

13. Cessation of Irrigation. Upon expiration or termination of this Agreement, Lessee shall immediately cease agricultural irrigation of the Property with the Water Rights.

14. No Third Party Beneficiaries. Nothing in this Agreement, express or implied, is intended to confer any rights or remedies upon any parties other than Lessee and Greeley, or their respective permissible successors in interest.

15. Recovery of Costs and Fees. In addition to any remedies otherwise available, a party that is successful in a legal action commenced against the other due to a default or material breach of this Agreement may recover from the defaulting party reasonable costs and attorneys' fees incurred during the course of such legal action.

16. Governing Law and Venue. This Agreement shall be governed by and enforced in accordance with the laws of the State of Colorado. Proper venue for any action arising out of this Agreement is the District Court for Weld County, Colorado, or the Division 1 Water Court for the State of Colorado.

17. Severability. In the event a provision of this Agreement is held invalid or unenforceable by a court of competent jurisdiction, such holding will not invalidate any other provision herein, and the remainder of the Agreement should be interpreted in accordance with the intent of the parties.

18. Integration. This Agreement constitutes a complete integration of the understanding and agreement between Greeley and Lessee with respect to the subject matter herein, and supersedes all other lease agreements regarding the Water Rights. No representations, negotiations, or warranties, express or implied, exist between Greeley and Lessee except as explicitly set forth in this Agreement. This Agreement may only be modified in a written form duly authorized, approved, and executed by Greeley and Lessee.

19. Counterparts. This Agreement may be executed in counterparts, each of which shall be deemed an original, and all of which together shall constitute one and the same instrument. Executed copies of this Agreement



EXHIBIT B

EXHIBIT A  
IRRIGATION WATER LEASE AGREEMENT  
(Beneficial Use Affidavit and Questionnaire)

ANNUAL AFFIDAVIT OF BENEFICIAL USE OF WATER RIGHTS

DESCRIPTION OF WATER RIGHTS:

Ditch or Reservoir Company: \_\_\_\_\_  
Shares or Interest: \_\_\_\_\_

Name and address of owner and user of water rights:

Owner: City of Greeley  
Water and Sewer Department  
1001 11<sup>th</sup> Avenue, Second Floor  
Greeley, Colorado 80631

User(s): \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Year water rights were used as described: \_\_\_\_\_

DESCRIPTION OF IRRIGATED LAND:

Legal description and size/acreage of land irrigated by above-mentioned water rights:

\_\_\_\_\_.

Name and address of owner(s) of above-mentioned irrigated land if different from owner or user of the water rights:\_\_\_\_\_.

I have not intended to abandon the aforementioned water rights during my period of use. I state that the information contained here and in the attached Questionnaire Regarding Use of Water Shares, which is incorporated herein by reference, is known to me and is correct.

The undersigned \_\_\_\_\_, having personal knowledge of the irrigation of the above described lands by virtue of being the owner and/or person who has farmed and irrigated those lands, being first duly sworn, hereby states that the information provided in this statement is true and accurate.

Signed and dated this \_\_\_\_ day of \_\_\_\_\_, 20\_\_.

\_\_\_\_\_  
[AFFIANT]

ACKNOWLEDGMENT

STATE OF COLORADO )  
 ) ss.  
COUNTY OF \_\_\_\_\_ )

**EXHIBIT B**

The foregoing instrument was acknowledged before me this \_\_\_\_ day of \_\_\_\_\_ 20\_\_ by \_\_\_\_\_.

Witness my hand and official seal.

\_\_\_\_\_  
Notary Public

My commission expires: \_\_\_\_\_

**QUESTIONNAIRE REGARDING USE OF WATER SHARES**

*The person completing this questionnaire need not necessarily be the Lessee,  
but must have personal knowledge of the information provided*

1. Name: \_\_\_\_\_  
Mailing Address: \_\_\_\_\_  
\_\_\_\_\_  
Telephone: \_\_\_\_\_  
Facsimile: \_\_\_\_\_  
Email Address: \_\_\_\_\_

2. The information provided below pertains to \_\_\_\_ shares of the \_\_\_\_\_ Company, represented by Certificate No. \_\_\_\_\_ (hereinafter "Shares").

3. Did you use the Shares pursuant to a Lease Agreement? \_\_\_\_\_  
Date of the Lease: \_\_\_\_\_  
Name of Lessee (if different from Question 1): \_\_\_\_\_  
Name of Lessor: \_\_\_\_\_

4. The information in this questionnaire relates to my use of the Shares during the [20\_\_] irrigation season (hereinafter "Lease Year").

5. Do you still own the farm or parcel irrigated by these Shares? \_\_\_\_\_

6. Was your use of the Shares during the Lease Year consistent with all terms and conditions of the Lease Agreement and with the bylaws, rules, regulations, and policies of the ditch company? \_\_\_\_\_

7. What is the legal description of the farm or parcel on which these Shares were used?

8. What is the total size of the farm or parcel? \_\_\_\_\_ acres.

9. What is the size of the area(s) on the farm or parcel that was irrigated? \_\_\_\_\_ acres.

10. What is the size of the area(s) on the farm or parcel that was irrigated using water from the Shares?  
\_\_\_\_\_ acres.



**EXHIBIT B**

11. Please provide the following information regarding how the water from these Shares is delivered.

- Location and ID Number of the head gate at the main ditch: \_\_\_\_\_  
\_\_\_\_\_.
- Name and general location of any lateral(s) delivering the water to the land historically irrigated:  
\_\_\_\_\_.
- Identification of any carrier or lateral ditch stock required to deliver these rights:  
\_\_\_\_\_.
- Approximate location of pumps, if used: \_\_\_\_\_  
\_\_\_\_\_.
- Approximate location and size of storage ponds or reservoirs, including tail water ponds, if used:  
\_\_\_\_\_.

12. How was water applied during the Lease Year? Sprinkler \_\_\_\_\_ Furrow \_\_\_\_\_ Flood \_\_\_\_\_  
Other/Combination (Describe): \_\_\_\_\_.

13. What was the irrigation season for the Lease Year? Start Date: \_\_\_\_\_ Stop Date: \_\_\_\_\_

14. During the Lease Year, did you divert and irrigate with all water available under the Shares? \_\_\_\_\_.  
If no, please explain the reason why all water was not taken, approximately how much was not taken, and for how long: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_.

15. Other than the Shares leased, was any other water (including other shares that are in the same Company as the Shares that are the subject of this questionnaire) used to irrigate the farm or parcel on which the Shares are/were used during the Lease Year? If so, please provide the following information.

- Number of shares: \_\_\_\_\_
- Ditch Company: \_\_\_\_\_
- Number of any Irrigation Wells: \_\_\_\_\_
- Identification and Permit No. of any Irrigation Wells: \_\_\_\_\_  
\_\_\_\_\_.
- Capacity of Irrigation Wells: \_\_\_\_\_
- Approximate location of Irrigation Wells: \_\_\_\_\_  
\_\_\_\_\_.
- Any other water used: \_\_\_\_\_

16. Describe how the water has been used, including the estimated percentage of the total irrigation supply provided by such water: \_\_\_\_\_  
\_\_\_\_\_.

17. During the Lease Year, what crops were grown on the land irrigated by the Shares?

1. Crop: \_\_\_\_\_ Percentage: \_\_\_\_\_ Location: \_\_\_\_\_
2. Crop: \_\_\_\_\_ Percentage: \_\_\_\_\_ Location: \_\_\_\_\_

**EXHIBIT B**

3. Crop: \_\_\_\_\_ Percentage: \_\_\_\_\_ Location: \_\_\_\_\_  
4. Crop: \_\_\_\_\_ Percentage: \_\_\_\_\_ Location: \_\_\_\_\_  
5. Crop: \_\_\_\_\_ Percentage: \_\_\_\_\_ Location: \_\_\_\_\_  
6. Crop: \_\_\_\_\_ Percentage: \_\_\_\_\_ Location: \_\_\_\_\_

18. Were the lands on which the Shares were used subirrigated? Yes \_\_\_\_\_ No \_\_\_\_\_

19. If possible, please provide a map, sketch, or aerial photograph showing locations of (*check if included*):

\_\_\_\_\_ Farm or Parcel  
\_\_\_\_\_ Areas irrigated by the Shares during the Lease Year  
\_\_\_\_\_ Areas irrigated with other water  
\_\_\_\_\_ Lateral ditches, wells, pumps, pipelines, storage reservoirs, or tail water ponds

I understand that I may be required to sign an affidavit attesting to the accuracy, to the best of my knowledge, of the information provided herein.

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

# Water & Sewer Agenda Summary

Date: April 20, 2022

Key Staff Contact: Carolyn Burr

**Title:** Legal Report

**Summary:**

**Recommended Action:** Legal Report

**Attachments:**

- I. Statements of Opposition:** Based on a review of the February 2022 Water Court Resume, staff and water counsel recommend that the Board file statements of opposition in the following cases:
- a. Case Number: **22CW3022:** Central Colorado Water Conservancy District and the Ground Water Management Subdistrict application to change 6.5 shares of the Greeley Canal No. 3 and Fossil Creek Reservoir. Central is proposing to change the shares based on the Poudre Prairie decree methodology. However, the allocation of shares to particular use categories is complex. We recommend that Greeley file a statement of opposition to ensure that the change of GIC shares is consistent with other GIC change decrees, that appropriate dry up is ensured and that there is no injury to Greeley's GIC share interests.
  - b. Case Number: **22CW3024:** Application by Central and GMS for diligence and to make partially absolute the Geisert Reservoir water rights located on the Poudre. Central is claiming just over 19 cfs of the 55 cfs decreed fill rate absolute, and they are claiming that 1,957 AF of the 2200 AF initial fill have been made absolute. We recommend filing a statement of opposition to ensure that the amounts claimed by Central as absolute are accurate. Greeley has an ongoing interest in the Geisert Reservoir in that it leases augmentation water to Weld County for Weld County's interest in Geisert.
- II. Proposed Motion Language:** "I move that the Board authorize the filing of statements of opposition in Case Nos. 22CW3022 and 22CW3024, and for staff and legal counsel to seek resolution of issues raised by these cases consistent with Water and Sewer Board Resolution No. 3-15."

# Water & Sewer Agenda Summary

Date: April 20, 2022

Key Staff Contact: Sean Chambers, Water & Sewer Director

**Title:** Director's Report

## **Summary:**

The Director will provide a summary overview of several items of Board interest:

- Recognition and appreciation for Windy Gap Firming, Chimney Hollow Tour
- Water Treatment Facilities construction activity update
- Cameron Peak Fire burn area stabilization and watershed recovery funding
  - 2022 work plan, financial resources, permits and coordination
  - 2023 funding opportunities and federal appropriations request
- Water Meter Replacement Project Update
- IJA (Infrastructure Bill) grant opportunities and application strategy
  - CDM supporting on revolving fund programs for all W&S systems
  - Stantec supporting wastewater collections and treatment for all other grants
  - AECOM supporting water infrastructure, resources, and efficiency projects for all other grant opportunities
- Water Education Colorado (WECO) South Platte Basin Tour
  - <https://www.watereducationcolorado.org/programs-events/tours-workshops/>
  - South Platte Basin Education Video: <https://vimeo.com/654954080/1691291801>

## **Recommended Action:**

Non-action informational items

## **Attachments:**

2023 Federal Budget Appropriations Requests to Bennett for Wildfire Recovery



Date: April 8, 2020

**Requesting Party:**

Sean Chambers  
Director of Water Utilities  
1001 11th Ave. Ste 200  
Greeley, Colorado 80631  
970-397-4215 | [Sean.Chambers@Greeleygov.com](mailto:Sean.Chambers@Greeleygov.com)

Representing collaborative wildfire recovery for efforts for the City of Greeley, City of Fort Collins, Northern Water Conservancy District, City of Loveland, and Grand County, of Colorado

**Request:** Programmatic Funding

**Account:** USFS Vegetation and Watershed Management

**Agency:** USDA

US Forest Service

Interior, Environment, and Related Agencies

Existing Acct. Funding Level: \$ 30,000,000.00 (USFS Vegetation and Watershed Management Acct.)  
Requested increase to the Acct.: \$200,000,000.00

**Background and Context of Appropriations Request:**

Watershed recovery and vegetation restoration is critical to the severely burned forest watersheds across the West. A warming climate and aridification of our forested watersheds has led to record wildfire seasons. The burn areas continue to plague communities with flooding, water supply and water quality challenges. Sedimentation and debris is filling rivers and reservoirs and causing havoc on water treatment infrastructure. The process for recovering forested watersheds is costly but shown to be effective, and the funding needs remain very large and urgent with a short window for mitigating work in the watersheds while they are not snow covered. Local communities, municipal water utilities, State governments and the federal Emergency Watershed protection program have all stepped up with significant recovery resources, but our National Forest burn areas remain largely untreated and these forested watersheds are in urgent need of recovery. Resolving the funding gap is time sensitive and I urge you to prioritize the appropriation of funds to the USFS Vegetation and Watershed Management budget where the resources can be promptly deployed towards the restoration of watersheds and rehabilitation of our forests.

**Specific Funding Language Requested:**

The Committee has provided an increase of \$200,000,000 in the Vegetation and Watershed Management activity to address wildfire recovery efforts for fires occurring between August 1st of 2020 and January 1, of 2021. The Committee expects the entirety of this funding be utilized for on the ground impact mitigation activities such as mulching, seeding, debris management, debris removal, sedimentation encashments and other watershed protection activities in coordination with existing recovery partners to protect drinking water supplies

Additional Information:

Wildfire recovery efforts across the Rocky Mountain West remain an urgent matter. Climate change is driving the aridification of our forests, rangeland and the watersheds our communities and agriculture depend upon. The majority of critical watershed lies on federal lands, and a sound long-range strategy must include both wildfire prevention measures and rehabilitating programs with funding to recovery critical forested watersheds.

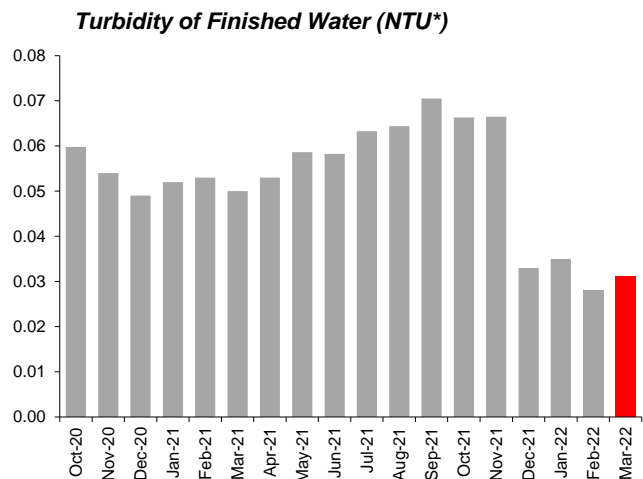
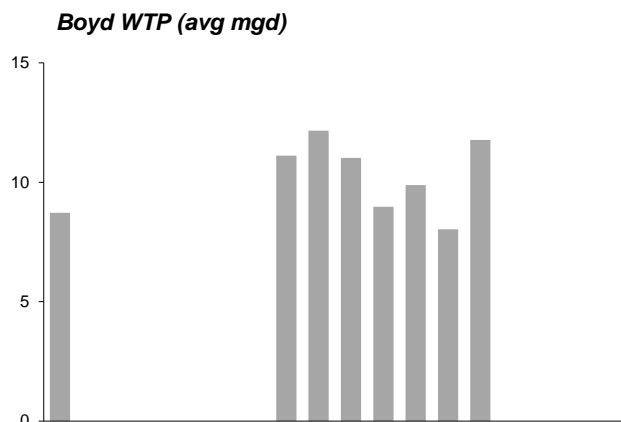
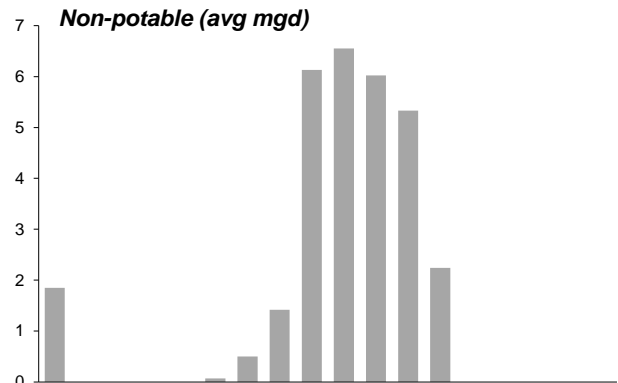
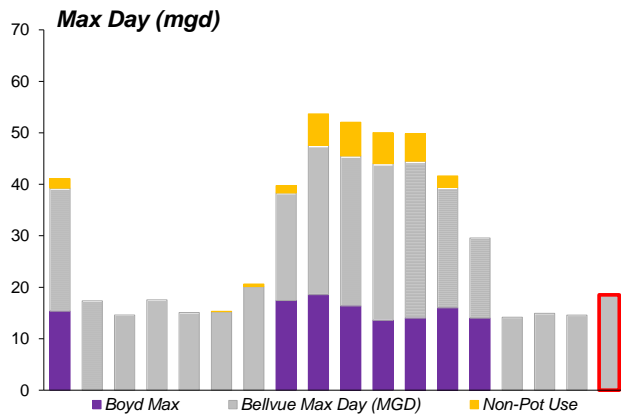
Request submitted April 8, 2022  
Sean P. Chambers, Director of Water Utilities

## Water Treatment

Bellvue Water Treatment Plant operates year-round with a transmission capacity of 29.1 million gallons per day (mgd) (plant capacity is 32 to 35 mgd). Water sources include Poudre River direct flows, Colorado-Big Thompson (C-BT), Windy Gap, High Mountain Reservoirs, Laramie-Poudre Tunnel, and Water Supply and Storage. Average volume is 19,000 acre-feet a year (2000-2011). The plant was built in 1907, with its last treatment upgrade in 2009. Solar panels were added in 2014.

Boyd Water Treatment Plant operates normally from April to October with a plant capacity of 38 mgd (transmission capacity is 40 mgd). Water sources include Greeley-Loveland Irrigation Company, C-BT, and Windy Gap. Average Volume is 8,200 acre-feet (2000-2011). The current plant was built in 1974, with its last treatment upgrade in 1999. Solar panels were added at Boyd in 2014. In 2016, tube settlers and plate settlers were replaced in the sedimentation basins. In 2018, all old existing chemical lines were replaced with new lines and the piping was up-sized to carry more chemical. A PLC upgrade was done on the SCADA system. Sludge pumps were replaced and hooked into the Trac Vac system that pulls sludge out of the sedimentation basins.

Combined, Bellvue and Boyd can treat a maximum of 70-73 million gallons per day.



Starting May 2016 Bellvue turbidity measurements will use a new method resulting in more accurate readings.

\*Turbidity limit: 95% of samples must be below 0.3 NTU.

Turbidity is the measure of relative clarity of a liquid. Clarity is important when producing drinking water for human consumption and in many manufacturing uses. Turbidity is measured in Nephelometric Turbidity Units (NTU).



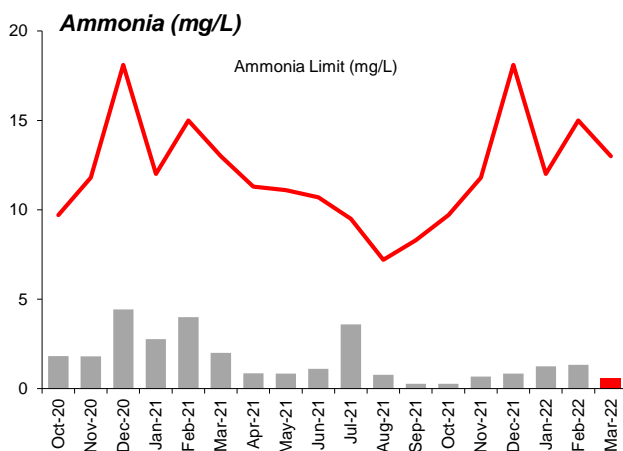
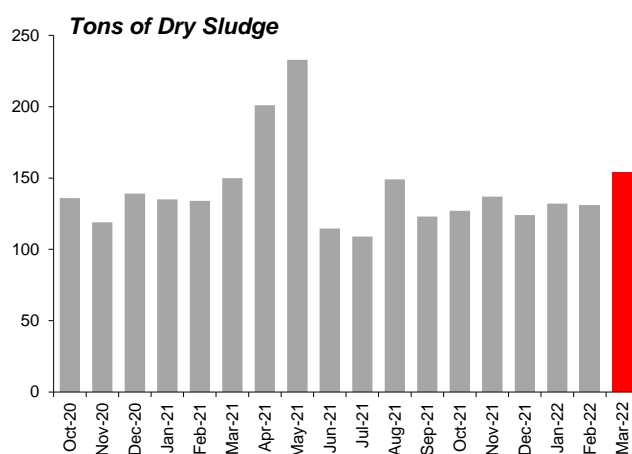
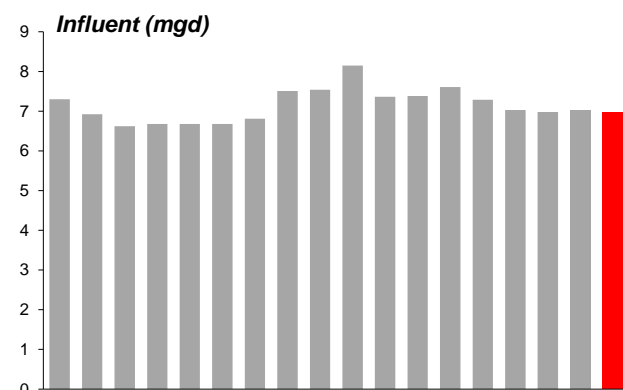
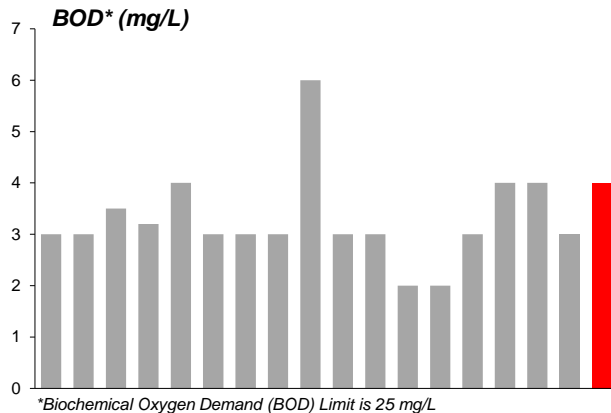
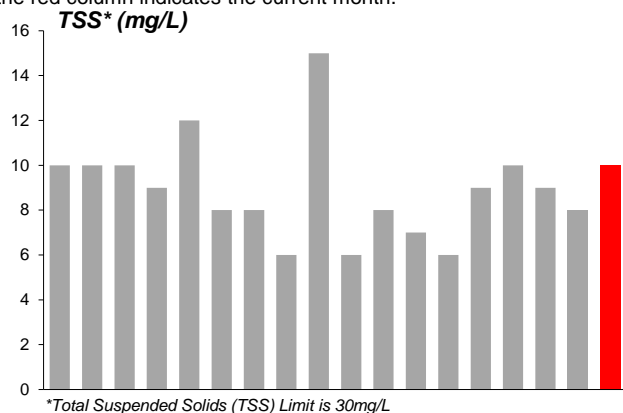


## Wastewater Treatment

The Water Pollution Control Facility (WPCF) staff are dedicated environmental professionals who provide quality, safe and cost-effective wastewater treatment services for the citizens of Greeley. The WPCF treats wastewater to meet or exceed Environmental Protection Agency (EPA) and Colorado Department of Public Health & Environment requirements.

In 2011, the WPCF received an Xcel Energy Custom Efficiency Achievement Award for saving 2.78 million kWh and reducing CO2 emissions by 1,584 tons. In 2012, the WPCF received the Rocky Mountain Water Environment Association's (RMWEA) Sustainability Award for Colorado demonstrating excellence in programs that enhanced the principles of sustainability. A Certificate of Achievement from the Colorado Industrial Energy Challenge program managed through the Colorado Energy Office was received in the same year. In 2013, the plant received the City of Greeley's Environmental Stewardship Award for outstanding efforts to reduce energy (watts), conserve energy and water, reduce air and water pollution, and educate and encourage others to be environmental stewards. Also, in 2013, the plant was the recipient of a Bronze Award from the Colorado Environmental Leadership Program. In 2015, after having 5 years without a plant violation, the plant received the 2015 National Association of Clean Water Agencies (NACWA) Platinum Peak Performance award for the City of Greeley Water and Sewer Department.

Note: the red column indicates the current month.



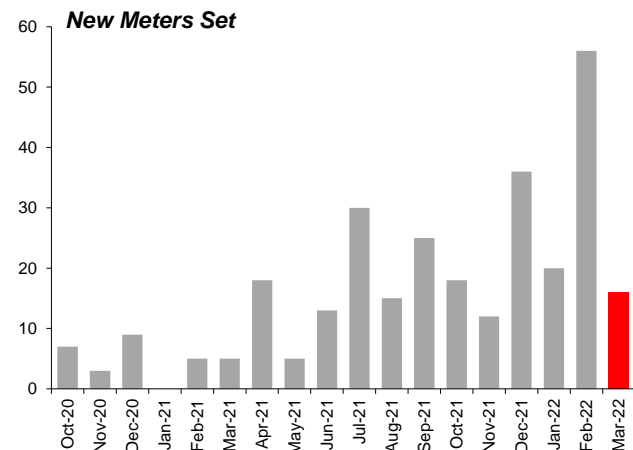
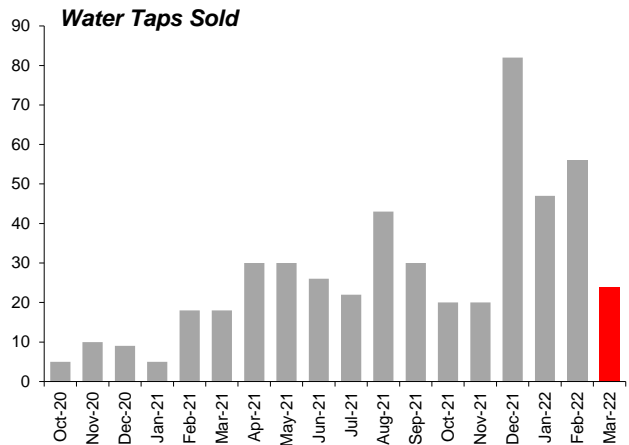
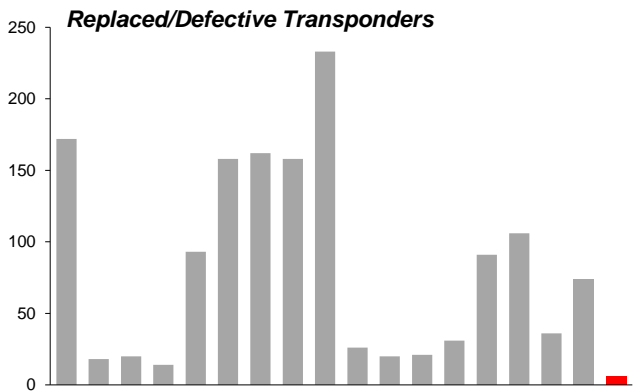
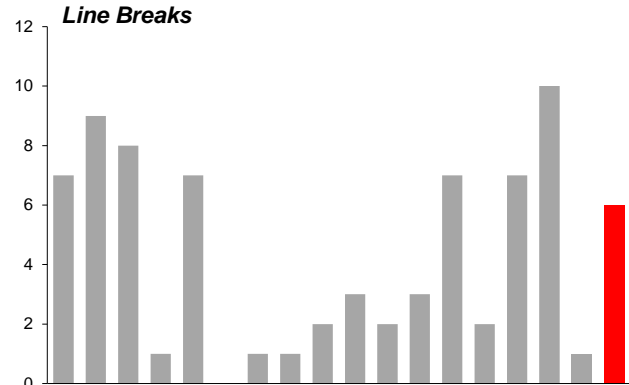
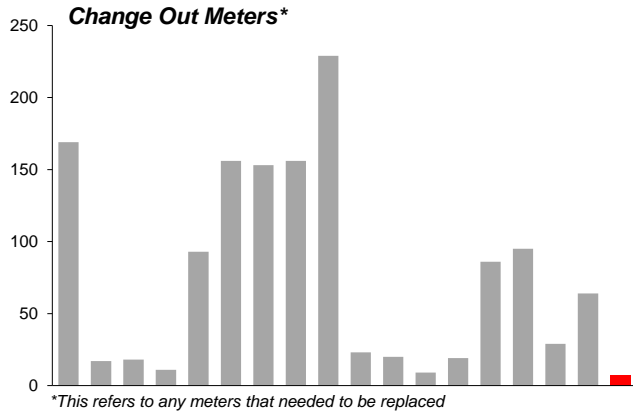
## Water Distribution

The Greeley water distribution system consists of various sizes of pipes that generally follow the streets within the City. The distribution system serves residences and businesses in Greeley, Evans and Garden City, and the system is divided into four pressure zones.

There are 69.75 million gallons of potable water storage in Greeley. The water is stored within three covered reservoirs and one elevated tank; 23rd Avenue - 37.5 million gallons, Mosier Hill - 15 million gallons, and Gold Hill - 15 million gallons. The system also has 476 miles of pipeline, 24,233 water meters and 3,378 fire hydrants.

The water pipes in the distribution system vary in size from 4" to 36". Pipe material is steel, ductile iron, cast iron, or polyvinyl chloride. The age of the pipes varies from the 1890's to new installations.

Note: the red column indicates the current month.



## Wastewater Collection

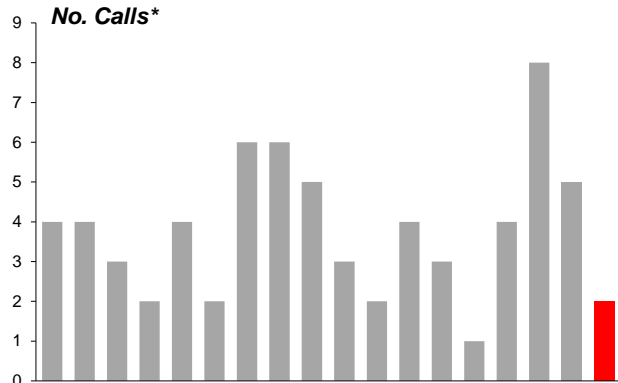
The mission of the Wastewater Collection Division of the Water and Sewer Department is to protect community health by transporting wastewater away from homes and businesses. This includes respecting property values and public safety by reducing the frequency of blockages in the sanitary sewer lines.

A wide variety of work is performed including routine cleaning of sewer lines, inspection of sewer lines, maintenance of the sewage pumping stations, rehabilitation of the system and responding to emergencies.

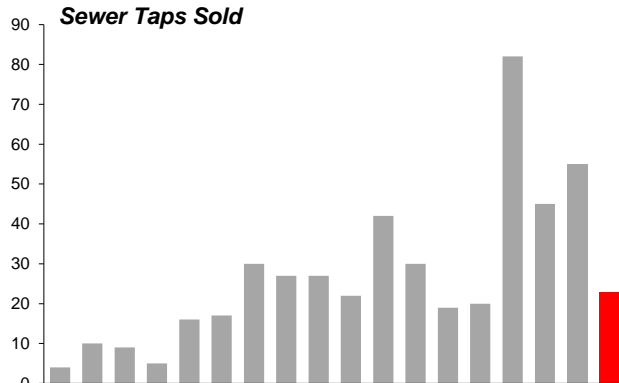
The wastewater collection system dates back to 1889. At the end of 2017, the system had a total of 364.8 miles of line and 10 sewage pumping stations. The sewer service area is approximately 51 square miles. Over the last 10 years, the system has grown by 17 miles.

Note: the red column indicates the current month.

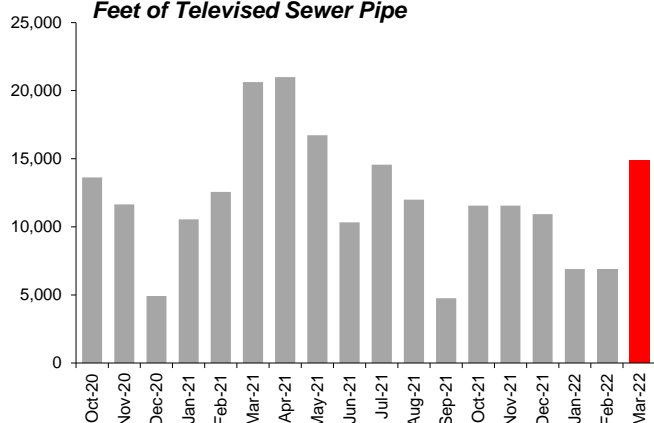
**No. Calls\***



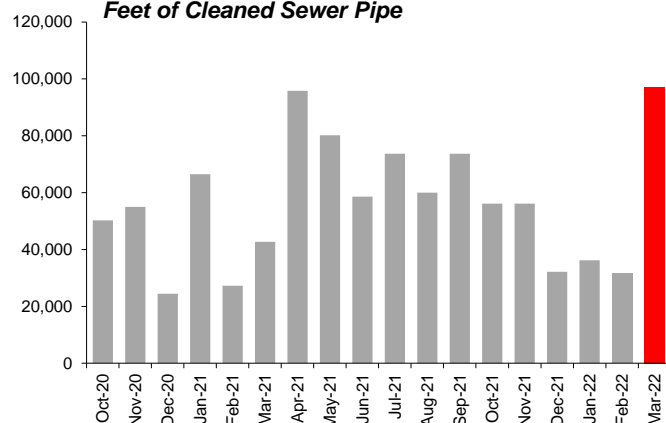
**Sewer Taps Sold**



**Feet of Televised Sewer Pipe**



**Feet of Cleaned Sewer Pipe**

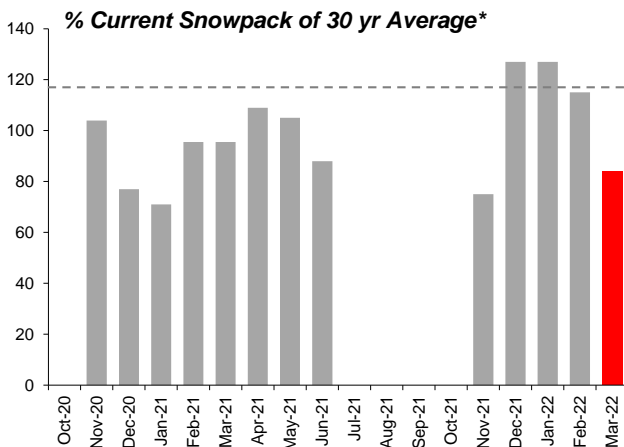
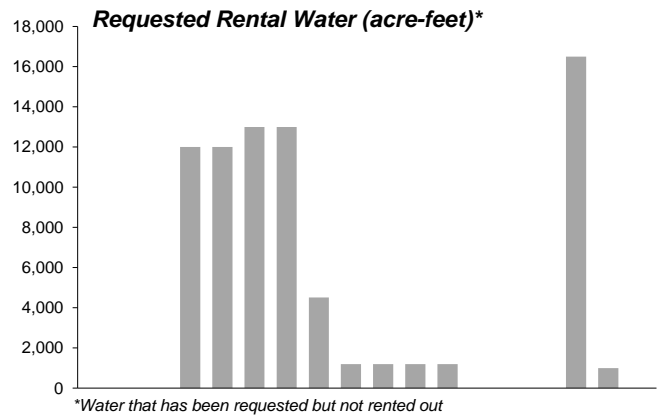
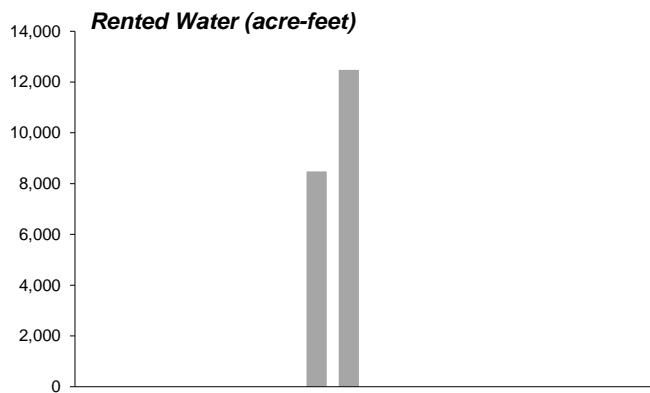
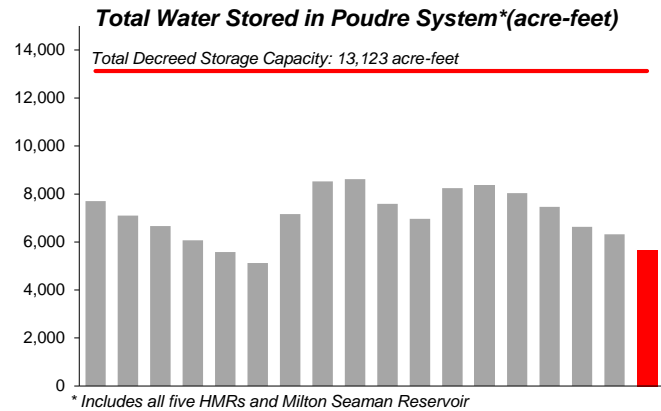
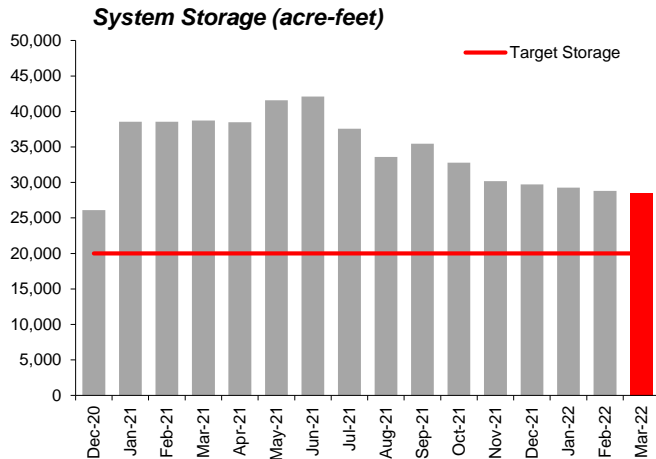


## Water Resources

Greeley has numerous water rights in four river basins; the Upper Colorado River, Cache La Poudre, Big Thompson and Laramie River. The Water Resource staff must account for all of this water and comply with the rules of the Colorado Water Court and the State Engineer's Office which is in charge of allocating all of Colorado's water resources. Approximately one-third of the City's water supply comes from agricultural water rights. These water rights must be formally changed to municipal use by a special legal process through the Water Court. In this court, Water Resource staff and attorneys also defend the City's water rights against adverse claims from other parties.

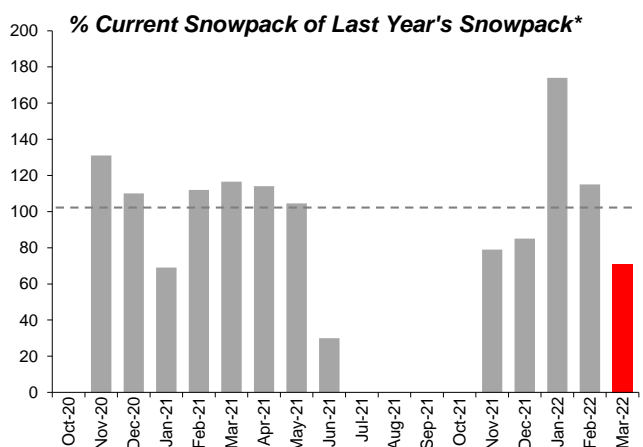
Greeley's goal is to have enough water in carry-over storage to sustain Greeley through a 50-year critical drought. Water in excess of this carry-over drought supply can be leased to agriculture, both for revenue and to support our local agricultural community. Modeling has shown that, given existing population and demand factors, Greeley will have sufficient water for citizens, if at the beginning of the 6-year long, 50-year critical drought, there is 20,000 acre-feet in storage on April 1st of the following year.

Note: the red column indicates the current month.



\*Data is from the 1st of the month

\*\*Average of Deadman Hill and Joe Wright



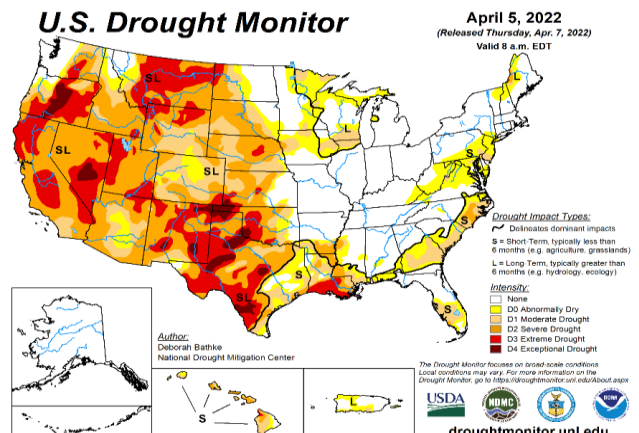
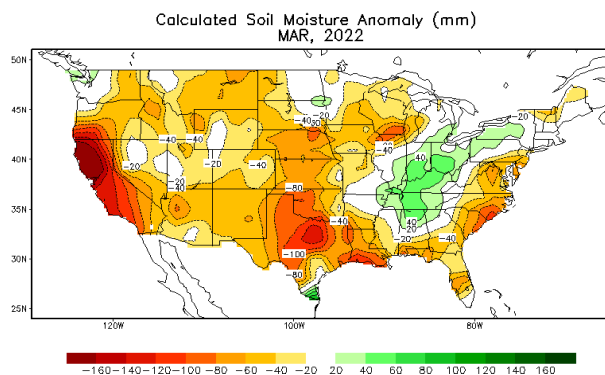
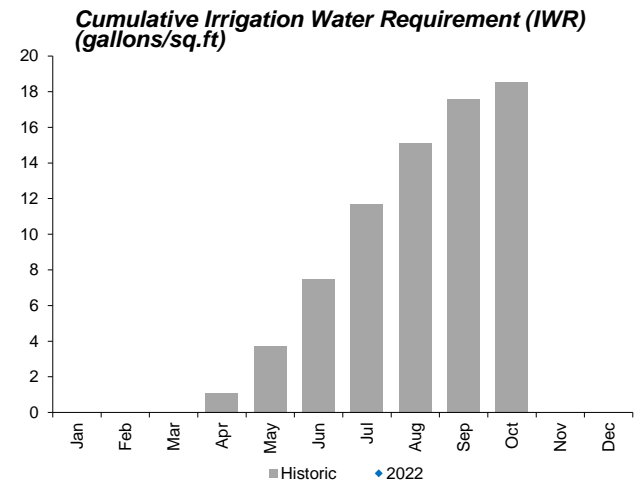
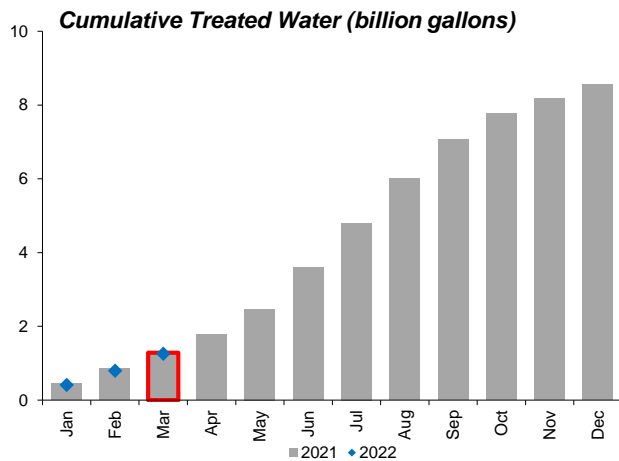
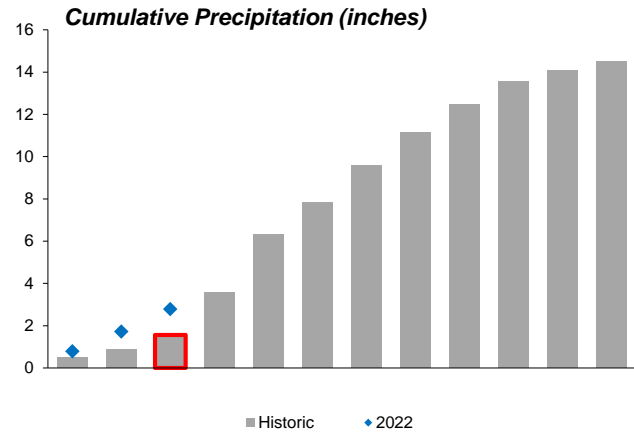
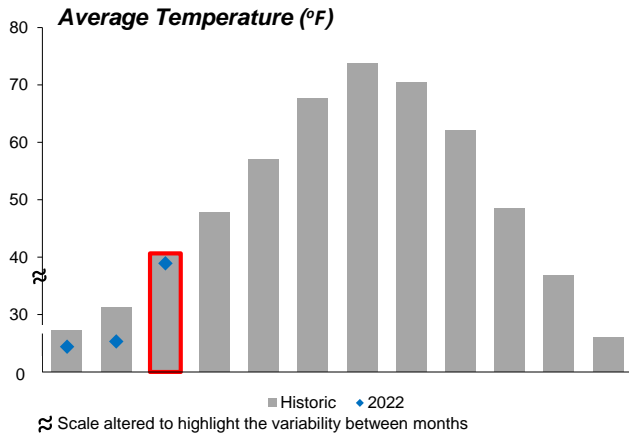
\*Data is from the 1st of the month

\*\*Average of Deadman Hill and Joe Wright

## Treated Water and Weather Data

January 2022 average temperature was 24.38°F, approximately 2.8°F cooler than average. February also brought colder temperatures averaging 25.23°F. In March the average temperature was 38.94°F, slightly cooler than the historical average.

Greeley precipitation was 0.79 inches in January, which is slightly above average (0.43 inches). February had high precipitation at 0.93 inches. March brought 1.07 inches of precipitation, setting Greeley 1.23 inches over the historical cumulative precipitation for March.



### 2015 Conservation Program Summary

Month	Residential Audit Requests (indoor/outdoor)	Residential Completed Outdoor Audits	Commercial & Residential Indoor Audits	Commercial Completed Outdoor Audits	Commercial Rebates (indoor/outdoor)	Residential Outdoor Rebates	Residential Toilet Rebates	Residential Washer Rebates	Variances	Violations	Rebate \$ Spent per month
January	45	0	20	0	0	1	12	20	8	0	\$2,618.00
February	33	0	24	0	33	1	11	12	8	0	\$4,498.00
March	63	0	29	0	9	3	30	20	10	0	\$4,185.50
April	58	19	20	1	0	7	25	22	23	14	\$3,975.00
May	32	32	2	4	1	7	11	12	34	25	\$3,354.00
June	47	38	7	6	1	9	24	14	42	51	\$3,625.00
July	30	69	14	14	5	18	20	4	32	145	\$4,151.15
August	29	28	0	6	3	3	13	5	34	71	\$6,521.84
September	16	36	5	8	1	25	18	4	37	19	\$3,079.59
October	19	14	30	2	2	12	17	1	31	7	\$4,604.68
November	8	0	5	0	4	8	20	2	25	0	\$3,339.61
December	2	0	8	0	0	3	21	6	23	0	\$2,432.80
TOTAL	382	236	164	41	59	97	222	122	307	332	\$46,385.17

### 2014 Conservation Program Summary

Month	Residential Audit Requests (indoor/outdoor)	Residential Completed Outdoor Audits	Commercial & Residential Indoor Audits	Commercial Completed Outdoor Audits	Commercial Rebates (indoor/outdoor)	Residential Outdoor Rebates	Residential Toilet Rebates	Residential Washer Rebates	Variances	Violations	Rebate \$ Spent per month
January	34	0	1	0	1	6	21	33	8	0	\$6,209.86
February	40	0	4	0	1	2	6	33	8	0	\$4,350.00
March	176	0	19	0	1	11	18	28	8	0	\$5,067.78
April	176	37	13	2	33	1	14	21	19	15	\$14,940.00
May	16	62	0	2	6	3	14	38	42	29	\$5,409.25
June	11	38	1	6	2	8	16	27	49	33	\$4,358.97
July	6	39	1	6	46	11	12	21	39	30	\$6,038.32
August	6	54	0	2	12	8	15	26	29	34	\$7,602.82
September	9	11	2	5	3	9	13	28	27	16	\$9,679.98
October	16	5	7	3	1	1	6	15	20	2	\$2,136.50
November	30	0	12	0	0	0	9	13	15	0	\$1,975.00
December	12	0	13	0	2	1	28	31	14	0	\$6,115.00
TOTAL	532	246	73	26	108	61	172	314	278	159	\$73,883.48

### 2013 Conservation Program Summary

Month	Residential Audit Requests (indoor/outdoor)	Residential Completed Outdoor Audits	Commercial & Residential Indoor Audits	Commercial Completed Outdoor Audits	Commercial Rebates (indoor/outdoor)	Residential Outdoor Rebates	Residential Toilet Rebates	Residential Washer Rebates	Variances	Violations	Rebate \$ Spent per month
January	5		2				24	25	8		\$4,675.00
February	33		7		1		22	22	8		\$3,575.00
March	22	2	4				21	18	10		\$3,025.00
April	19	9	4	2	1		25	36	23	6	\$5,025.00
May	65	45	5	1		19	20	32	59	21	\$4,486.59
June	11	27	3	14	0	5	7	15	89	61	\$2,217.20
July	40	42	0	3	0	13	24	53	80	59	\$8,413.75
August	23	34	0	10	4	15	15	33	60	40	\$8,336.26
September	13	28	1	7	7	6	19	49	55	21	\$13,523.16
October	39	12	19	3	11	6	22	39	44	5	\$7,344.95
November	4	0	12	0	0	9	19	30	28	0	\$4,966.14
December	0	0	4	0	3	1	29	46	27	0	\$7,639.49
TOTAL	274	199	61	40	27	74	247	398	491	213	\$73,227.54

### 2012 Conservation Program Summary

Month	Residential Audit Requests (indoor/outdoor)	Residential Completed Outdoor Audits	Commercial & Residential Indoor Audits	Commercial Completed Outdoor Audits	Commercial Rebates (indoor/outdoor)	Residential Outdoor Rebates	Residential Toilet Rebates	Residential Washer Rebates	Variances	Violations	Rebate \$ Spent per month
January	2		26		3		30	24	7		\$7,834.98
February	3		15				20	16	7		\$3,100.00
March	2		2		1		27	23	10	1	\$4,225.00
April	33	4		4		48	19	14	67	17	\$3,175.75
May	38	39	2	5	5	1	23	35	113	46	\$19,492.77
June	27	27	1	4	28	26	37	22	113	51	\$34,368.61
July	32	23	1	8	1	48	26	27	84	67	\$5,414.00
August	12	25	6	4	9	21	39	30	73	38	\$13,749.95
September	18	41	5	1		1	48	21	87	12	\$5,634.21
October	7	8	2	2		3	40	18	67	3	\$4,858.25
November	15		9		3		39	26	41	1	\$7,100.00
December	4		4		2	1	43	44	36		\$9,800.00
TOTAL	193	167	73	28	52	149	391	300	705	236	\$118,788.03

Date	X-Range (F or Larger)	Number of Meters Released	Radio Transmitter (Deductive Transmitters)	New Concentration in Meters	Small (10-15) Meters Change Only	Large (16-25) Meters Change Only	Number of Line Breaks	Water Taps Sold	total change in meters
Jan-95				25	34	0			0
Feb-95				43	22	0			0.54
Mar-95				43	22	0			0
Apr-95				24	41	0			1.25
May-95				34	33	0			0.95
Jun-95				33	20	0			
Jul-95				33	19	386	24		
Aug-95				33	38	302	44		
Sep-95	0	1	26	44	27	205	15		
Oct-95	0	1	44	44	205	43			
Nov-95	0	7	26	65	167	74			
Dec-95	0	7	50	20	63				
Jan-96	0	6	66	65	335	34			
Feb-96	0	2	66	43	303	53			
Mar-96	0	2	26	53	362	30			
Apr-96	0	2	26	20	331	4			
May-96	0	2	26	47	211	0			
Jun-96	0	2	26	47	174	2			
Jul-96	0	0	19	36	321	1			
Aug-96	0	0	38	307	0				
Sep-96	1	1	14	66	305	0			
Oct-96	0	4	51	201	0				
Nov-96	0	4	127	65	321	0			
Dec-96	0	2	61	246	0				
Jan-97	0	0	62	62	325	1			
Feb-97	0	0	43	331	0				
Mar-97	0	2	109	54	183	1			
Apr-97	0	0	33	278	0				
May-97	0	0	123	26	123	0			
Jun-97	0	0	123	150	0				
Jul-97	0	2	127	47	155	0			
Aug-97	0	2	127	47	155	0			
Sep-97	0	2	127	47	155	0			
Oct-97	0	2	127	47	155	0			
Nov-97	0	2	127	47	155	0			
Dec-97	0	2	127	47	155	0			
Jan-98	0	2	127	47	155	0			
Feb-98	0	2	127	47	155	0			
Mar-98	0	2	127	47	155	0			
Apr-98	0	1	14	44	140	0			
May-98	0	1	14	44	119	0			
Jun-98	0	5	64	65	13	0			
Jul-98	0	1	64	65	13	0			
Aug-98	0	5	64	65	13	0			
Sep-98	0	5	64	65	13	0			
Oct-98	0	3	12	36	1	0			
Nov-98	0	3	12	36	1	0			
Dec-98	0	2	12	62	2	0			
Jan-99	0	2	12	62	2	0			
Feb-99	0	2	12	102	5	2			
Mar-99	0	4	102	100	4	0			
Apr-99	0	6	102	81	8	2			
May-99	0	0	67	11	2	0			
Jun-99	0	2	67	11	2	0			
Jul-99	0	2	67	11	2	0			
Aug-99	0	2	67	11	2	0			
Sep-99	0	2	67	11	2	0			
Oct-99	0	2	67	11	2	0			
Nov-99	0	2	67	11	2	0			
Dec-99	0	2	67	11	2	0			
Jan-00	0	1	67	11	2	0			
Feb-00	0	1	67	11	2	0			
Mar-00	0	2	67	11	2	0			
Apr-00	0	3	67	11	2	0			
May-00	0	3	67	11	2	0			
Jun-00	0	1	67	11	2	0			
Jul-00	0	1	67	11	2	0			
Aug-00	0	1	67	11	2	0			
Sep-00	0	1	67	11	2	0			
Oct-00	0	1	67	11	2	0			
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Dec-00	0	1	67	11	2	0			
Jan-01	0	3	67	11	2	0			
Feb-01	0	4	67	11	2	0			
Mar-01	0	4	67	11	2	0			
Apr-01	0	4	67	11	2	0			
May-01	0	4	67	11	2	0			
Jun-01	0	8	67	11	2	0			
Jul-01	0	2	72	4	1	0			
Aug-01	0	8	62	26	0	0			
Sep-01	0	8	62	26	0	0			
Oct-01	0	0	54	4	1	0			
Nov-01	0	0	54	4	1	0			
Dec-01	0	0	54	4	1	0			
Jan-02	0	8	53	9	1	0			
Feb-02	0	8	84	7	0	0			
Mar-02	0	7	121	5	0	0			
Apr-02	0	7	121	5	0	0			
May-02	0	2	120	7	2	0			
Jun-02	0	2	120	7	2	0			
Jul-02	0	2	120	7	2	0			
Aug-02	0	0	76	8	0	0			
Sep-02	0	0	128	70	12	0			
Oct-02	0	10	62	43	16	0			
Nov-02	0	10	62	43	16	0			
Dec-02	0	1	98	11	0	0			
Jan-03	0	1	98	11	0	0			
Feb-03	0	1	98	11	0	0			
Mar-03	0	1	98	11	0	0			
Apr-03	0	3	98	11	0	0			
May-03	0	3	98	11	0	0			
Jun-03	0	6	108	81	12	0			
Jul-03	0	0	143	46	9	1			
Aug-03	0	0	143	46	9	1			
Sep-03	0	5	127	38	3	1			
Oct-03	0	5	127	38	3	1			
Nov-03	0	5	127	38	3	1			
Dec-03	0	5	127	38	3	1			
Jan-04	0	4	127	38	3	1			
Feb-04	0	7	126	72	17	0			
Mar-04	0	3	126	64	12	0			
Apr-04	0	3	126	64	12	0			
May-04	0	3	126	64	12	0			
Jun-04	0	3	126	64	12	0			
Jul-04	0	3	126	64	12	0			
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Mar-05	0	3	126	64	12	0			
Apr-05	0	3	126	64	12	0			
May-05	0	3	126	64	12	0			
Jun-05	0	3	126	64	12	0			
Jul-05	0	3	126	64	12	0			
Aug-05	0	3	126	64	12	0			
Sep-05	0	3	126	64	12	0			
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Apr-08	0	3	126	64	12	0			
May-08	0	3	126	64	12	0			
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Nov-08	0	3	126	64	12	0			
Dec-08	0	3	126	64	12	0			
Jan-09	0	3	126	64	12	0			
Feb-09	0	3	126	64	12	0			
Mar-09	0	3	126	64	12	0			
Apr-09	0	3	126	64	12	0			
May-09	0	3	126	64	12	0			

0 0.54

1.25

0.95

Date	X-Range (F or Larger) Meters Change	Mooring Position Meters Change	Radio Transmitter Frequency (Deductive Transmitter) Meters Change	New Concentration Meters Change	Small S&B Meters Change	CPD (1.0-2.0) Meters Change	Mooring Position Meters Change	Number of Line Breaks	Water Tap Meters Change	Total change Meters
Jun-09	0	0	218	13	42	1	25	4	13	
Jul-09	7	7	186	8	37	2	22	2	2	
Aug-09	13	1	242	10	88	2	21	2	2	
Sep-09	0	0	124	1	60	20	2	2	2	
Oct-09	0	0	99	2	30	1	4	4	4	
Nov-09	2	0	44	2	37	1	2	2	2	
Dec-09	0	1	71	0	34	3	3	3	3	
Jan-10	0	0	87	1	53	3	3	3	3	
Feb-10	0	0	87	14	51	0	1	1	1	
Mar-10	0	0	87	1	35	26	1	1	1	
Apr-10	0	1	93	13	21	3	2	2	2	
May-10	0	0	98	18	86	8	3	3	3	
Jun-10	1	1	112	8	74	5	3	3	3	
Jul-10	0	0	144	13	53	3	2	2	2	
Aug-10	0	0	124	10	63	0	3	3	3	
Sep-10	0	0	133	5	79	0	3	3	3	
Oct-10	0	0	87	4	38	0	3	3	3	
Nov-10	0	0	47	0	4	0	3	3	3	
Dec-10	2	2	127	0	28	3	3	3	3	
Jan-11	1	0	82	1	37	0	3	3	3	
Feb-11	3	0	124	0	89	0	3	3	3	
Mar-11	0	0	114	10	84	0	3	3	3	
Apr-11	0	7	84	6	50	1	3	3	3	
May-11	0	0	205	4	72	0	3	3	3	
Jun-11	0	0	383	7	63	1	3	3	3	
Jul-11	0	0	480	0	7	0	3	3	3	
Aug-11	0	1	228	0	79	4	0	0	0	
Sep-11	0	0	172	1	9	0	3	3	3	
Oct-11	0	0	84	0	12	0	3	3	3	
Nov-11	0	0	87	4	55	0	3	3	3	
Dec-11	0	0	6	1	28	0	3	3	3	
Jan-12	0	0	172	0	55	0	3	3	3	
Feb-12	4	1	124	4	45	0	3	3	3	
Mar-12	1	0	87	0	88	0	3	3	3	
Apr-12	0	2	127	8	104	1	3	3	3	
May-12	0	0	127	8	104	1	3	3	3	
Jun-12	0	0	278	0	8	0	3	3	3	
Jul-12	1	1	277	11	80	2	3	3	3	
Aug-12	0	2	38	3	48	3	3	3	3	
Sep-12	0	2	38	4	38	2	3	3	3	
Oct-12	0	2	38	3	48	3	3	3	3	
Nov-12	0	2	38	4	38	2	3	3	3	
Dec-12	4	0	88	3	20	0	3	3	3	
Jan-13	0	2	127	0	4	47	3	3	3	
Feb-13	0	2	127	7	27	0	3	3	3	
Mar-13	0	0	127	14	84	0	3	3	3	
Apr-13	0	1	127	0	48	0	3	3	3	
May-13	0	0	224	46	72	0	3	3	3	
Jun-13	0	0	103	16	31	0	3	3	3	
Jul-13	0	0	188	23	80	0	3	3	3	
Aug-13	2	2	208	22	86	3	3	3	3	
Sep-13	0	0	127	8	73	0	3	3	3	
Oct-13	0	1	171	15	44	1	3	3	3	
Nov-13	0	0	87	19	73	0	3	3	3	
Dec-13	9	1	278	17	22	0	3	3	3	
Jan-14	0	0	278	20	55	0	3	3	3	
Feb-14	0	0	257	25	50	0	3	3	3	
Mar-14	0	0	494	42	48	0	3	3	3	
Apr-14	0	3	177	23	40	8	3	3	3	
May-14	1	1	147	17	46	38	3	3	3	
Jun-14	1	1	147	30	38	0	3	3	3	
Jul-14	0	0	208	41	47	0	3	3	3	
Aug-14	0	0	491	20	4	1	3	3	3	
Sep-14	3	0	436	69	41	1	3	3	3	
Oct-14	0	0	102	11	38	0	3	3	3	
Nov-14	0	0	102	11	38	0	3	3	3	
Dec-14	2	2	127	40	28	1	3	3	3	
Jan-15	0	2	384	17	33	0	3	3	3	
Feb-15	0	2	384	47	38	0	3	3	3	
Mar-15	0	0	384	86	38	0	3	3	3	
Apr-15	0	1	72	52	39	0	3	3	3	
May-15	0	2	208	23	86	0	3	3	3	
Jun-15	0	2	208	27	81	0	3	3	3	
Jul-15	0	0	188	34	38	0	3	3	3	
Aug-15	0	0	188	53	37	0	3	3	3	
Sep-15	0	0	127	40	38	0	3	3	3	
Oct-15	0	0	127	59	44	0	3	3	3	
Nov-15	0	0	127	54	32	0	3	3	3	
Dec-15	0	0	63	30	32	0	3	3	3	
Jan-16	0	0	63	34	32	0	3	3	3	
Feb-16	0	0	63	38	20	0	3	3	3	
Mar-16	0	0	63	42	20	0	3	3	3	
Apr-16	0	0	63	67	0	0	3	3	3	
May-16	0	1	63	53	0	0	3	3	3	
Jun-16	0	1	63	29	28	1	3	3	3	
Jul-16	0	0	18	18	5	0	3	3	3	
Aug-16	0	1	63	21	53	1	3	3	3	
Sep-16	3	0	127	30	74	0	3	3	3	
Oct-16	0	0	127	10	109	3	3	3	3	
Nov-16	0	0	127	13	43	0	3	3	3	
Dec-16	0	1	127	14	33	0	3	3	3	
Jan-17	0	0	127	16	113	0	3	3	3	
Feb-17	0	0	127	27	47	0	3	3	3	
Mar-17	0	0	127	18	113	0	3	3	3	
Apr-17	0	1	28	25	48	3	3	3	3	
May-17	0	0	127	17	46	0	3	3	3	
Jun-17	0	0	127	15	72	1	3	3	3	
Jul-17	0	0	127	17	46	0	3	3	3	
Aug-17	0	0	127	14	100	2	3	3	3	
Sep-17	0	0	127	12	89	0	3	3	3	
Oct-17	2	2	127	17	38	1	3	3	3	
Nov-17	0	0	127	12	89	0	3	3	3	
Dec-17	0	0	127	2	59	1	3	3	3	
Jan-18	0	0	127	14	35	0	3	3	3	
Feb-18	0	0	127	16	33	0	3	3	3	
Mar-18	0	0	127	20	69	0	3	3	3	
Apr-18	0	0	127	11	33	0	3	3	3	
May-18	2	0	127	30	86	0	3	3	3	
Jun-18	0	0	127	30	33	1	3	3	3	
Jul-18	0	0	127	60	72	0	3	3	3	
Aug-18	0	0	127	60	95	0	3	3	3	
Sep-18	0	1	127	6	32	1	3	3	3	
Oct-18	0	0	127	78	10	0	3	3	3	
Nov-18	3	0	127	12	7	0	3	3	3	
Dec-18	0	0	127	18	18	0	3	3	3	
Jan-19	0	0	127	61	18	0	3	3	3	
Feb-19	0	0	127	38	18	0	3	3	3	
Mar-19	0	0	127	28	28	1	3	3	3	
Apr-19	0	3	127	18	18	0	3	3	3	
May-19	0	3	127	20	28	1	3	3	3	
Jun-19	0	0	127	15	30	0	3	3	3	
Jul-19	0	2	147	8	62	1	3	3	3	
Aug-19	0	0	128	36	52	0	3	3	3	
Sep-19	0	0	108	0	11	0	3	3	3	
Oct-19	0	0	108	0	11	0	3	3	3	
Nov-19	0	0	108	0	11	0	3	3	3	
Dec-19	0	0	108	0	11	0	3	3	3	
Jan-20	0	0	108	0	11	0	3	3	3	
Feb-20	0	0	108	0	11	0	3	3	3	
Mar-20	0	0	108	0	11	0	3	3	3	
Apr-20	0	0	108	0	11	0	3	3	3	
May-20	0	0	108	0	11	0	3	3	3	
Jun-20	0	0	108	0	11	0	3	3	3	
Jul-20	0	0	108	0	11	0	3	3	3	
Aug-20	0	0	108	0	11	0	3	3	3	
Sep-20	0	0	108	0	11	0	3	3	3	
Oct-20	0	0	172	7	189	0	3	3	3	
Nov-20	0	0	172	7	17	0	3	3	3	
Dec-20	0	0	172	9	18	0	3	3	3	
Jan-21	0	0	172	9	17	0	3	3	3	
Feb-21	0	0	172	9	32	1	3	3	3	
Mar-21	0	0	182	18	153	0	3	3	3	
Apr-21	0	0	182	18	156	0	3	3	3	
May-21	0	0	233	13	227	2	3	3	3	
Jun-21	0	0	233	30	23	0	3	3	3	
Aug-21	0	0	233	15	20	0	3	3	3	
Sep-21	0	0	233	15	20	0	3	3	3	
Oct-21	0	0	233	15	18	1	3	3	3	
Nov-21	0	0	233	12	86	0	3	3	3	
Dec-21	0	0	233	36	35	0	3	3	3	
Jan-22	0	0	233	20	20	0	3	3	3	
Feb-22	0	0	233	64	0	0	3	3	3	
Mar-22	0	0	233	7	0	0	3	3	3	
Apr-22	0	0	233	7	0	0	3	3	3	
May-22	0	0	233	7	0	0	3	3	3	





	X-charge (F or Large) Meters Changed	Alarm Program Tested OK Meters	Radio Transmitter Requirements (Defective Transmitters)	New Construction in Meters Set	Small (1/2") Meter Change Out	CRP (1/2") Meter Change Out	Water Pk Inspections	Number of Line Breaks	Water Taps Sold	total change out meters
Date										

Date	Boyd Max Day (MGD)	Bellvue Max Day (MGD)	Non-potable Use (MGD)	Boyd Avg Day (MGD)	Bellvue Avg Day (MGD)	Boyd Turbidity
Jan-94						
Feb-94						
Mar-94						
Apr-94						
May-94						
Jun-94						
Jul-94						
Aug-94						
Sep-94						
Oct-94						
Nov-94						
Dec-94						
Jan-95		14.34			13.466	
Feb-95		14.42			13.774	
Mar-95		16.79			14.982	
Apr-95	8.95	18.91		5.27	15.85	0.20
May-95	7.69	19.09		4.69	15.57	0.17
Jun-95	16.42	18.68		10.58	16.97	0.21
Jul-95	25.80	18.71		18.19	18.09	0.25
Aug-95	24.93	19.06		21.43	18.81	0.20
Sep-95	21.44	18.93		14.88	17.98	0.21
Oct-95	7.85	18.02		5.33	16.80	0.17
Nov-95		14.30			13.94	
Dec-95		14.31			13.66	
Jan-96		14.78			13.65	
Feb-96		15.24			14.32	
Mar-96		15.86			14.69	
Apr-96	15.04	18.22		7.40	17.49	0.23
May-96	23.30	18.93		14.94	18.48	0.22
Jun-96	19.33	19.09		13.79	19.14	0.10
Jul-96	24.31	19.34		14.61	18.97	0.14
Aug-96	22.21	19.22		16.89	19.24	0.20
Sep-96	17.37	19.17		10.34	17.79	0.20
Oct-96	11.26	17.70		8.37	16.56	0.21
Nov-96	4.18	13.89		3.51	13.77	0.27
Dec-96		13.87			13.41	
Jan-97	2.15	14.03		1.78	13.93	0.19
Feb-97	2.06	14.02		1.72	13.63	0.16
Mar-97	6.44	13.82		1.21	13.97	0.13
Apr-97	13.78	13.87		3.72	13.29	0.23
May-97	20.71	18.79		11.89	16.64	0.15
Jun-97	20.53	18.60		10.69	18.23	0.18
Jul-97	27.58	18.77		21.75	18.72	0.21
Aug-97	19.30	19.09		11.37	17.64	0.18
Sep-97	18.63	18.92		10.77	18.56	0.16
Oct-97	12.89	18.90		6.04	16.91	0.14
Nov-97	4.35	12.57		1.89	12.27	0.15
Dec-97	2.805	12.44		1.13	12.371	0.15
Jan-98	2.96	14.97		1.06	12.573	0.15
Feb-98		16.975			14.245	
Mar-98		16.825			14.179	

Apr-98	11.169	19.335		2.623	17.27	0.15
May-98	23.399	19.53		11.905	18.229	0.13
Jun-98	27.656	19.65		16.175	18.783	0.13
Jul-98	28.074	19.68		22.912	19.43	0.13
Aug-98	22.37	19.69		17.549	19.69	0.13
Sep-98	22.607	19.69		15	19.724	0.13
Oct-98	11.661	19.73		6.529	16.986	0.13
Nov-98		15.46			14.633	
Dec-98		15.488			13.572	
Jan-99		17.623			15.529	
Feb-99		14.637			14.428	
Mar-99		19.909			16.63	
Apr-99	9.323	19.72		6.388	17.794	14
May-99	17.507	19.267		8.925	17.358	15
Jun-99	25.779	19.784		16.33	19.329	0.13
Jul-99	26.837	19.784		20.924	19.62	0.15
Aug-99	21.564	19.645		13.971	19.551	0.13
Sep-99	14.824	16.431		10.666	17.016	0.14
Oct-99	9.087	18.07		6.046	16.52	0.14
Nov-99	0	19.501		0	16.785	0
Dec-99	0	16.751		0	14.789	0
Jan-00	0	17.046		0	14.819	0
Feb-00	0	17.229		0	15.469	0
Mar-00	0	18.941		0	15.94	0
Apr-00	13.575	19.852		8.131	19.249	0.1
May-00	21	20.338		13.509	20.415	0.11
Jun-00	25.6	20.606		19.012	20.03	0.11
Jul-00	28.5	21.048		24.636	20.962	0.11
Aug-00	27.5	21.009		19.94	21.057	0.12
Sep-00	21.59	20.45		14.537	19.642	0.12
Oct-00	8.212	19.249		7.457	17.211	0.13
Nov-00	2.549	17.222		2.549	15.115	0.13
Dec-00	0	15.918		0	14.723	0
Jan-01	0	17.289		0	15.077	0
Feb-01	0	16.988		0	15.226	0
Mar-01	0	16.612		0	14.794	0
Apr-01	7.527	18.315		5.828	17.416	0.1
May-01	21.828	19.569		12.637	17.989	0.13
Jun-01	29.68	20.203		19.746	18.337	0.12
Jul-01	26.504	20.321		18.571	20.645	0.11
Aug-01	23.507	21.067		19.564	21.064	0.12
Sep-01	21.65	21.04		14.726	18.619	0.11
Oct-01	16.528	16.966		7.506	17.24	0.1
Nov-01	6.807	17.13		3.931	10.884	0.09
Dec-01	0	16.503		0	14.812	0
Jan-02	0	15.915		0	15.128	0
Feb-02	0	16.106		0	15.263	0
Mar-02	0	17.761		0	13.61	0
Apr-02	18.789	20.099		10.076	17.764	0.12
May-02	19.722	20.45		13.126	19.332	0.07
Jun-02	23.429	20.352		18.534	19.115	0.06
Jul-02	23.485	20.161		17.685	21.422	0.07
Aug-02	21.349	20.63		15.841	20.792	0.06
Sep-02	18.951	20.841		11.709	20.184	0.06
Oct-02	7.964	20.052		5.804	18.265	0.07

Nov-02	0	16.132		0	14.3	0
Dec-02	0	14.906		0	14.117	0
Jan-03	0	14.945		0	13.57	0
Feb-03	0	13.845		0	13.523	0
Mar-03	0	16.312		0	13.982	0
Apr-03	0	17.004		0	15.862	0
May-03	16.115	20.96		7.205	17.739	0.09
Jun-03	17.903	19.575		10.342	18.745	0.07
Jul-03	26.234	20.005		20.079	20.009	0.1
Aug-03	24.605	20.101		18.22	19.818	0.12
Sep-03	16.53	18.314		11.114	17.294	0.1
Oct-03	13.097	17.255		9.225	17.281	0.08
Nov-03	0	16.038		0	14.044	0
Dec-03	0	14.71		0	13.76	0
Jan-04	0	17.606		0	15.278	0
Feb-04	0	13.475		0	13.335	0
Mar-04	0	18.121	0.25	0	15.686	0
Apr-04	11.668	18.718	0.79	5.321	16.759	0.09
May-04	22.873	20.104	1.74	10.757	18.954	0.07
Jun-04	23.094	20.764	2.56	15.192	18.279	0.07
Jul-04	26.048	20.992	3.50	17.016	19.477	0.1
Aug-04	24.976	19.746	2.84	16.168	18.452	0.08
Sep-04	18.342	18.585	2.31	11.99	18.118	0.07
Oct-04	6.46	16.472	0.95	4.084	16.36	0.08
Nov-04	0	15.761	0.08	0	14.228	0
Dec-04	0	15.825	0.00	0	13.988	0
Jan-05	0	15.036	0.00	0	13.673	0
Feb-05	0	14.279	0.00	0	13.854	0
Mar-05	0	16.093	0.15	0	14.399	0
Apr-05	9.305	20.018	1.04	6.689	17.992	0.09
May-05	26.423	17.759	2.03	15.825	16.465	0.07
Jun-05	31.265	16.375	3.57	19.271	16.224	0.07
Jul-05	32.332	21.431	4.90	27.932	19.687	0.09
Aug-05	29.14	21.388	3.29	20.526	19.102	0.07
Sep-05	26.33	18.031	4.20	18.734	17.994	0.09
Oct-05	18.239	18.174	1.16	9.619	16.352	0.08
Nov-05	0	14.134	0.04	0	13.199	0
Dec-05	0	13.538	0.00	0	12.763	0
Jan-06	0	13.755	0.00	0	13.027	0
Feb-06	0	15.102	0.00	0	13.366	0
Mar-06	0	16.536	0.05	0	14.2	0
Apr-06	14.918	20.862	2.19	9.518	19.581	0.08
May-06	23.056	22.303	4.35	15.372	21.788	0.05
Jun-06	30.967	22.129	6.63	23.521	22.212	0.06
Jul-06	25.026	21.94	5.46	19.51	21.132	0.05
Aug-06	23.187	20.586	4.73	16.835	20.641	0.05
Sep-06	16.918	20.364	3.05	10.493	20.317	0.05
Oct-06	13.269	20.596	1.12	10.882	16.98	0.05
Nov-06	0	14.019	0.00	0	13.202	0
Dec-06	0	14.052	0.00	0	13.183	0
Jan-07	0	15.628	0.00	0	13.842	0
Feb-07	0	15.804	0.00	0	14.607	0
Mar-07	0	16.063	0.06	0	14.721	0
Apr-07	7.8	19.658	0.81	5.983	17.81	0.07
May-07	18.33	20.818	3.34	10.653	20.821	0.06

Jun-07	27.274	22.929	4.98	19.058	21.593	0.11
Jul-07	28.737	22.954	5.81	22.585	22.752	0.12
Aug-07	29.294	22.863	4.05	16.681	21.363	0.08
Sep-07	21.439	20.731	3.36	13.861	21.078	0.08
Oct-07	12.306	21.127	1.19	7.031	14.731	0.09
Nov-07	5.285	15.979	-0.01	3.892	14.233	0.1
Dec-07	0	15.253	0.00	0	13.865	0
Jan-08	0	15.491	0.00	0	14.483	0
Feb-08	0	15.191	0.00	0	14.267	0
Mar-08	0	15.976	0.10	0	14.681	0
Apr-08	15.017	19.559	1.32	7.268	16.206	0.12
May-08	20.487	20.889	3.39	12.483	19.861	0.09
Jun-08	23.705	23.012	4.67	17.876	20.917	0.06
Jul-08	25.723	23.391	3.98	20.23	22.919	0.07
Aug-08	23.649	23.305	3.28	15.099	22.35	0.07
Sep-08	11.532	22.523	2.34	8.457	21.906	0.06
Oct-08	10.157	22.012	0.65	8.259	19.069	0.06
Nov-08	0	17.098	0	0	14.352	0
Dec-08	0	15.03	0	0	13.446	0
Jan-09	0	14.258	0	0	13.38	0
Feb-09	0	15.469	0	0	14.057	0
Mar-09	0	17.754	0.21	0	14.986	0
Apr-09	9.422	20.594	0.71	5.509	15.432	0.08
May-09	18.145	23.691	2.72	9.752	20.01	0.06
Jun-09	18.305	23.229	2.85	9.229	20.383	0.05
Jul-09	21.309	23.229	4.12	12.263	20.383	0.05
Aug-09	18.494	21.004	3.89	13.357	19.756	0.05
Sep-09	21.786	20.005	3	12.896	17.464	0.05
Oct-09	9.86	19.001	0.66	7.267	15.545	0.06
Nov-09	0	15.061	0	0	13.163	0
Dec-09	0	14.999	0	0	13.717	0
Jan-10	0	14.478	0	0	13.146	0
Feb-10	0	13.993	0	0	13.193	0
Mar-10	0	14.043	0	0	13.377	0
Apr-10	2.344	20.211	0.76	2.05	16.999	0.07
May-10	12.825	20.967		6.228	19.521	0.06
Jun-10	21.564	21.05	4.35	14.329	20.281	0.05
Jul-10	21.895	22.038	4.92	16.172	21.213	0.06
Aug-10	20.370	22.358	4.86	14.914	22.224	0.06
Sep-10	17.374	22.323	3.96	13.516	22.257	0.06
Oct-10	11.879	22.295	2.02	8.204	19.024	0.06
Nov-10	0	15.036	0	0	13.483	0
Dec-10	0	14.02	0	0	13.464	0
Jan-11	0	16.963	0	0	13.839	0
Feb-11	0	15.1	0	0	13.529	0
Mar-11	0	16.463	0	0	14.22	0
Apr-11	0	20.849	1.21	0	18.391	0
May-11	15.128	22.666	2.07	7.161	19.551	0.07
Jun-11	24.901	22.792	4.7	16.583	20.469	0.06
Jul-11	22.711	22.773	4.99	17.021	20.902	0.07
Aug-11	21.549	22.566	5.62	17.254	22.176	0.08
Sep-11	15.723	22.801	3.56	10.201	22.538	0.08
Oct-11	11.884	22.78	1.52	7.767	19.035	0.07
Nov-11	0	15.292	0	0	13.578	0
Dec-11	0	15.985	0	0	13.554	0

Jan-12	0	14.022	0	0	13.121	0
Feb-12	0	16.073	0	0	13.955	0
Mar-12	0	22.647	0	0	16.553	0
Apr-12	12.599	23.978	2.55	7.126	23.101	0.06
May-12	19.265	23.766	3.76	10.995	22.646	0.06
Jun-12	27.635	23.393	6.13	20.499	21.11	0.05
Jul-12	30.033	23.606	6.16	22.203	19.425	0.04
Aug-12	27.901	17.86	5.75	23.22	16.439	0.07
Sep-12	23.52	21.471	3.49	13.909	18.923	0.06
Oct-12	10.03	18.05	0.44	7.301	15.94	0.06
Nov-12	0	14.6	0	0	13.321	0
Dec-12	0	15.018	0	0	13.301	0
Jan-13	0	13.515	0	0	12.465	0
Feb-13	0	14.576	0	0	12.998	0
Mar-13	0	14.198	0	0	12.879	0
Apr-13	0	17.375	0.25	0	13.893	0
May-13	16.462	23.018	1.79	10.474	19.088	0.08
Jun-13	22.6	23.491	6.02	17.78	23.152	0.06
Jul-13	23.278	23.522	5.46	16.963	22.298	0.05
Aug-13	18.198	23.278	4.36	13.317	22.351	0.05
Sep-13	17.616	23.542	1.76	9.235	16.966	0.05
Oct-13	10.261	16.245	0.38	5.384	14.884	0.07
Nov-13	0	15.567	0	0	14.519	0
Dec-13	0	15.316	0	0	14.269	0
Jan-14	0	15.268	0	0	14.227	0
Feb-14	0	15.275	0	0	14.499	0
Mar-14	0	15.272	0	0	14.009	0
Apr-14	6.16	22.435	1.01	4.087	18.18	0.013
May-14	11.165	23.24	2.08	7.65	20.813	0.07
Jun-14	14.856	23.337	3.58	8.652	23.112	0.06
Jul-14	17.76	23.297	4.24	12.596	23.095	0.05
Aug-14	13.958	23.178	3.7	10.033	22.755	0.07
Sep-14	10.113	23.115	2.91	7.258	22.451	0.07
Oct-14	5.442	23.075	0.72	4.788	17.851	0.08
Nov-14	0	15.06	0	0	13.568	0
Dec-14	0	14.543	0	0	13.175	0
Jan-15	0	14.981	0	0	13.293	0
Feb-15	0	14.1	0	0	13.085	0
Mar-15	0	18.07	0	0	14.493	0
Apr-15	3.419	22.724	0.97	3.045	18.503	0.08
May-15	3.534	20.009	0.78	2.97	16.989	0.05
Jun-15	23.453	19.082	2.62	12.168	16.171	0.04
Jul-15	27.448	16.079	5.42	22.321	16.044	0.04
Aug-15	27.931	16.35	5.37	23.125	16.077	0.05
Sep-15	24.013	19.95	4.52	18.59	16.834	0.05
Oct-15	12.885	18.189	1.06	5.662	15.704	0.05

Nov-15	9.995	13.624	0	5.025	13.417	0.05
Dec-15	0	14.093	0	0	13.564	0
Jan-16	0	15.548	0	0	14.148	0
Feb-16	0	14.937	0	0	13.766	0
Mar-16	0	15.237	0	0	14.215	0
Apr-16	5.387	17.045	0.32	3.635	15.844	0.06
May-16	7.995	17.791	1.13	4.423	19.399	0.05
Jun-16	22.913	21.517	5.14	16.43	20.938	0.05
Jul-16	28.285	21.694	5.65	21.076	21.39	0.05
Aug-16	23.916	21.832	4.36	16.557	20.88	0.06
Sep-16	15.387	20.745	3.62	11.091	20.663	0.05
Oct-16	11.279	21.11	1.2	6.402	19.554	0.06
Nov-16	0	16.476	0	0	14.998	0
Dec-16	0	15.493	0	0	13.973	0
Jan-17	0	18.743	0	0	13.981	0
Feb-17	0	14.486	0	0	13.613	0
Mar-17	0	17.828	0.04	0	14.718	0
Apr-17	12.366	16.574	1.49	8.13	14.773	0.05
May-17	14.532	15.048	1.78	7.766	14.71	0.05
Jun-17	30.34	14.901	5.7	22.824	14.764	0.05
Jul-17	30.868	15.301	5.77	25.978	15.117	0.05
Aug-17	27.455	15.34	3.48	18.351	15.319	0.05
Sep-17	26.548	15.346	3.38	17.801	15.212	0.05
Oct-17	9.683	15.424	0.33	4.119	15.237	0.07
Nov-17	0	15.723	0	0	15.165	0
Dec-17	0	15.65	0	0	14.074	0
Jan-18	0	15.012	0	0	14.071	0
Feb-18	0	15.033	0	0	14.283	0
Mar-18	0	17.312	0.09	0	14.898	0
Apr-18	0	26.317	1.09	0.0	18.511	0
May-18	11.08	28.226	2.70	5.5	23.554	0.06
Jun-18	21.48	27.456	5.97	14.4	26.337	0.04
Jul-18	20.55	27.51	5.79	11.0	26.259	0.05
Aug-18	18.68	27.314	5.03	12.5	23.46	0.051
Sep-18	17.46	21.243	4.8	13.0	21.007	0.057
Oct-18	14.91	22.544	0.8	7.1	16.898	0.056
Nov-18	9.90	14.347	0	5.3	13.632	0.056
Dec-18	0.00	17.98	0	0.0	14.311	0
Jan-19	0.00	15.899	0	0.0	14.192	0
Feb-19	0.00	16.059	0	0.0	13.927	0
Mar-19	0.00	15.915	0.01	0.0	14.295	0
Apr-19	0.00	24.315	1.1	0.0	17.913	0
May-19	6.50	25.684	2.13	4.3	21.443	0.12
Jun-19	16.41	22.854	3.85	9.6	21.261	0.055
Jul-19	21.39	24.076	6.33	13.8	23.128	0.05
Aug-19	18.06	24.642	6.41	14.6	24.02	0.053
Sep-19	17.14	24.76	4.27	11.1	22.795	0.053
Oct-19	16.24	22.014	1.12	10.4	9.672	0.053
Nov-19	0.00	14.937	0	0.0	12.336	0
Dec-19	0.00	14.464	0	0.0	13.653	0
Jan-20	0.00	15.780	0	0.0	13.878	0
Feb-20	0.00	15.413	0	0.0	14.01	0
Mar-20	0.00	15.157	0	0.0	13.54	0
Apr-20	0.00	25.304	1.2	0.0	15.609	0
May-20	14.01	28.464	3.44	7.8	25.823	0.075



Jun-20	24.49	28.388	6.17	16.0	24.338	0.054
Jul-20	28.055	28.312	7.3	20.557	23.337	0.055
Aug-20	17.795	28.834	6.67	13.349	27.543	0.061
Sep-20	16.528	27.666	4.1	11.582	22.494	0.078
Oct-20	15.345	23.892	1.85	8.724	18.135	0.074
Nov-20	0	17.358	0	0	14.521	0
Dec-20	0	14.6	0	0	13.876	0
Jan-21	0	17.548	0	0	14.623	0
Feb-21	0	15.086	0	0	14.33	0
Mar-21	0	15.256	0.07	0	13.884	0
Apr-21	0	20.123	0.5	0	16.345	0
May-21	17.42	20.895	1.42	11.111	15.229	0.065
Jun-21	18.561	28.989	6.13	12.16	25.446	0.063
Jul-21	16.37	29.137	6.55	11.025	27.65	0.074
Aug-21	13.568	30.447	6.02	8.968	28.271	0.072
Sep-21	14	30.488	5.33	9.886	25.764	0.077
Oct-21	15.999	23.383	2.24	8.037	16.547	0.069
Nov-21	13.999	15.565	0	11.771	13.401	0.067
Dec-21	0	14.172	0	0	13.581	0
Jan-22	0	14.929	0	0	13.585	0
Feb-22	0	14.584	0	0	14.281	0
Mar-22	0	18.521	0	0	15.217	0
Apr-22						
May-22						

Bellvue Turbidity	NTU = Turbidity of Finished Water	Treatment Capacity	MGD - Influent	Biosolids Hauled (Dry Tons)	TSS Effluent	BOD Effluent	Ammonia- Effluent
		70	7.80	91.7	19	9	
		70	7.72	65.3	17	8	
		70	7.97	99.3	20	9	
		70	8.36	55.1	22	11	
		70	8.18	103.1	17	11	
		70	8.96	91.5	10	6	
		70	8.74	112.2	8	4	
		70	9.24	106.6	12	7	
		70	9.26	86.7	18	11	
		70	9.29	67.6	24	13	
		70	8.89	79.4	18	10	
		70	8.34	85.3	14	8	
0.1	0.10	70	8.43	97.2	18	8	
0.07	0.07	70	8.06	60.5	16	8	
0.08	0.08	70	7.66	93.3	20	11	
0.07	0.10	70	8.37	66.0	13	10	
0.07	0.09	70	8.99	45.0	13	9	
0.10	0.14	70	12.18	112.9	19	10	
0.08	0.17	70	9.94	84.6	26	13	
0.09	0.15	70	9.34	98.0	10	7	
0.08	0.14	70	9.98	66.3	21	11	
0.07	0.09	70	9.74	81.4	24	13	
0.07	0.07	70	9.14	85.2	18	10	
0.08	0.08	70	8.45	76.4	25	15	
0.07	0.07	70	8.16	82.3	22	12	
0.06	0.06	70	8.00	73.0	16	11	
0.06	0.06	70	8.05	114.8	12	10	
0.08	0.12	70	8.53	76.8	17	11	
0.09	0.15	70	9.08	55.0	25	13	
0.06	0.08	70	9.65	97.2	11	14	
0.06	0.09	70	9.74	89.9	12	8	
0.05	0.12	70	9.57	93.6	10	9	
0.06	0.11	70	9.76	68.0	9	5	
0.05	0.10	70	9.84	99.3	17	8	
0.06	0.10	70	10.26	82.3	9	4	
0.07	0.07	70	10.13	96.1	13	5	
0.07	0.08	70	10.51	82.4	16	7	
0.10	0.11	70	8.66	76.4	11	7	
0.05	0.06	70	7.85	76.2	10	7	
0.05	0.09	70	7.85	108.4	11	7	
0.06	0.10	70	7.22	59.0	9	6	
0.04	0.09	70	9.11	105.5	12	8	
0.04	0.13	70	8.08	97.7	12	6	
0.06	0.11	70	8.84	310.9	7	5	
0.05	0.09	70	9.07	217.6	8	5	
0.08	0.10	70	9.32	55.7	15	8	
0.13	0.13	70	9.58	90.2	14	10	
0.10	0.10	70	8.65	125.6	8	5	
0.08	0.09	70	8.51	99.2	11	6	
0.09	0.09	70	8.24	86.6	12	6	
0.09	0.09	70	8.08	97	11	6	

0.11	0.12	70	7.85	94.4	10	5	
0.06	0.09	70	7.88	107	16	7	
0.05	0.09	70	8.16	140.9	15	7	
0.05	0.09	70	8.45	136.08	9	5	
0.05	0.09	70	8.56	103.93	9	4	
0.05	0.08	70	8.91	81.83	6	4	
0.05	0.07	70	8.7	106.15	12	6	
0.07	0.07	70	8.63	75.36	18	8	
0.07	0.07	70	8.51	116.8	29	10	
0.07	0.07	70	8.4	105.51	18	8	
0.06	0.06	70	8.05	55.39	18	9	
0.07	0.07	70	7.58	110.41	9	6	
0.06	3.74	70	7.93	103.43	11	6	
0.07	5.14	70	10.98	144.54	10	5	
0.05	0.09	70	10.04	140.35	10	4	
0.07	0.11	70	8.7	121.29	11	5	
0.07	0.10	70	8.85	80.27	10	5	
0.06	0.09	70	9.34	100.34	19	8	
0.05	0.07	70	8.82	88.48	9	5	
0.09	0.09	70	8.68	94.96	14	7	
0.07	0.07	70	8.24	115.17	15	8	
0.07	0.07	70	8.15	96.65	8	5	7.51
0.06	0.06	70	8.05	79.55	7	5	8.61
0.06	0.06	70	7.76	105.92	9	5	8.59
0.08	0.09	70	7.85	89.73	6	4.5	7.36
0.11	0.11	70	7.73	73.68	7	4	7.58
0.04	0.07	70	7.96	107.78	6	4	7.44
0.03	0.07	70	8.01	103.8	4	3	3.23
0.03	0.07	70	8.4	113.99	5	3	4.52
0.03	0.07	70	8.39	114.95	5	3	4.45
0.03	0.06	70	8.51	87.36	6	3	2.97
0.06	0.07	70	8.28	112.47	6	3	3.16
0.07	0.07	70	7.8	103.5	6	3	3.58
0.05	0.05	70	8.18	109.6	6	3	4.92
0.05	0.05	70	8.03	119.45	4	3	6.57
0.03	0.03	70	7.63	86.15	6	3.0	2.53
0.04	0.06	70	7.75	112.79	7	4.0	5.45
0.05	0.08	70	8.49	126.87	7	3.0	4.83
0.03	0.08	70	8.39	113.13	9	3.0	3.4
0.03	0.07	70	8.95	113.53	5	3.0	2.74
0.02	0.07	70	8.71	158.17	6	4.0	10.11
0.03	0.07	70	8.58	93.77	7	5.0	8.91
0.02	0.04	70	8.88	114.69	6	3.0	4.5
0.02	0.04	70	8.63	84.94	8	4.0	2.01
0.09	0.09	70	8.57	118.34	10	3.0	3.77
0.09	0.09	70	7.99	161.86	8	3.3	4.84
0.09	0.09	70	8.51	130.48	9.5	3.6	4.71
0.08	0.08	70	8.06	52.2	12	5.2	3.12
0.07	0.09	70	8.35	171.13	14.1	4.0	6.81
0.07	0.07	70	8.11	136.98	9.4	5.1	7.48
0.06	0.06	70	8.23	128.56	7	4.1	9.41
0.07	0.07	70	8.47	123.7	4.6	2.7	8.34
0.038	0.05	70	8.45	129.93	5.8	3	5.88
0.05	0.05	70	8.64	131.27	3.9	2.6	7.41
0.053	0.06	70	8.47	130.7	4	2.6	6.78

0.05	0.05	70	8.41	100.17	5.9	3.2	6.39
0.054	0.05	70	8.34	115.36	6.5	3.6	5.13
0.056	0.06	70	8.03	127.56	5	3	6.88
0.053	0.05	70	8.13	92.71	5.3	2.5	3.76
0.05	0.05	70	7.87	100.72	3.8	2.2	3.19
0.062	0.06	70	8.07	147.91	4.6	3.4	3.85
0.09	0.09	70	7.64	159.37	8.4	4.6	5.13
0.071	0.07	70	7.67	108.04	7.8	4.2	4.65
0.06	0.08	70	7.72	133.17	5.2	3	3.94
0.056	0.09	70	8.39	110.99	5.4	3.1	5.1
0.054	0.07	70	8.63	113.32	7	4.4	5.92
0.052	0.06	70	7.73	90.94	3.5	2.9	3.03
0.06	0.06	70	7.61	101.29	8.1	4.9	6.48
0.06	0.06	70	7.59	147.87	5.6	4.2	5.15
0.097	0.10	70	7.66	90.92	12.4	7.1	5.83
0.059	0.06	70	7.7	113.52	5.7	5.2	6.83
0.05	0.05	70	7.67	99.18	4.1	4.3	3.2
0.052	0.06	70	7.54	108.84	4	4	4.47
0.054	0.06	70	7.22	131.43	4.8	3.5	3.61
0.08	0.08	70	7.32	137.55	4.8	3.6	5.1
0.057	0.08	70	7.28	117.17	4.2	3	3.81
0.065	0.07	70	7.88	189.76	5.6	4	4.59
0.056	0.06	70	7.85	136.02	5.4	3.4	2.62
0.055	0.06	70	8.18	101.52	6	3.7	3.39
0.058	0.06	70	7.69	102.42	5.7	3	3.07
0.056	0.06	70	7.37	113.41	6.5	3.9	3.76
0.061	0.06	70	7.39	100.81	5.6	3.2	7.49
0.063	0.06	70	7.31	111.67	4.6	3	5.28
0.062	0.06	70	7.2	120.61	4.9	3	4.13
0.066	0.07	70	7.74	97.61	9.7	4.3	6.25
0.063	0.07	70	8.3	125.45	7.2	3.8	4.86
0.064	0.07	70	9.29	125.14	8	4	4.28
0.066	0.08	70	8.84	116.62	6.5	4	4.86
0.065	0.07	70	8.93	176.75	4.6	2.5	2.96
0.064	0.08	70	8.97	80.08	7.4	4.5	4.52
0.064	0.07	70	8.37	116.9	6.6	3.3	3.29
0.58	0.58	70	7.85	66.54	6.1	3.3	2.36
0.067	0.07	70	7.52	87.64	7.05	5.2	5.3
0.066	0.07	70	7.21	86.85	6	3.3	4.67
0.063	0.06	70	7.15	109.43	4.2	2.7	4.76
0.07	0.07	70	7.13	119.74	4.7	2.3	4.35
0.06	0.07	70	7.5	112.15	6.8	3.5	4.24
0.064	0.06	70	7.25	120.74	7.8	3.1	5.22
0.08	0.07	70	7.39	97.05	6.2	3.6	6.17
0.068	0.06	70	7.5	104.44	5.7	3.7	4.02
0.07	0.06	70	7.46	115.87	6.5	3.3	4.91
0.073	0.07	70	7.44	79.11	6.9	3	4.67
0.068	0.06	70	7.54	69.37	5.7	2.9	4.66
0.066	0.07	70	7.31	113.87	7.3	3.1	6.29
0.067	0.07	70	7.28	100.41	9.5	4.7	8.68
0.065	0.07	70	7.23	122.7	8.3	4.5	11.11
0.069	0.07	70	8.16	99.28	6	3.6	9
0.07	0.07	70	7.93	120.19	4.8	3	4.42
0.063	0.06	70	7.83	131.01	8.2	4.9	4.36
0.068	0.07	70	7.66	138.94	5.6	3.3	8.24

0.068	0.09	70	7.53	124.23	8.8	4.9	8.26
0.067	0.09	70	7.67	108.314	4.9	3.4	4.72
0.062	0.07	70	8.14	112.74	5.1	2.5	4.23
0.061	0.07	70	8.06	99.61	8.6	3.2	5.36
0.061	0.07	70	7.89	114.24	6.3	3.2	6.54
0.068	0.07	70	7.26	110.28	6.1	3.4	6.75
0.062	0.06	70	7.29	100.35	11.9	5	7.42
0.062	0.06	70	7.48	117.27	15.1	5.7	8.72
0.062	0.06	70	7.32	87.07	15.1	4.6	5.32
0.106	0.11	70	7.32	97.64	11.1	3.6	5.46
0.105	0.11	70	7.36	117.25	11.2	4	3.25
0.067	0.08	70	7.33	108.31	9	4	5.46
0.064	0.06	70	7.59	98.7	6.7	2.9	3.51
0.062	0.07	70	7.72	102.85	6	2.7	2.05
0.06	0.06	70	8.69	118.36	6.8	2.5	4.71
0.062	0.06	70	8.24	88.62	4.2	2	1.95
0.063	0.06	70	7.77	94.55	5.7	3.3	4.02
0.066	0.07	70	7.63	124.13	6.9	3.1	6.03
0.067	0.07	70	7.26	120.75	6.7	3.7	5.52
0.062	0.06	70	7.25	118.52	6.1	3	6.87
0.062	0.06	70	7.22	112.62	4.9	2.2	7.05
0.063	0.06	70	7.1	109.34	5.4	2.5	6.95
0.08	0.08	70	7.44	106.36	7.1	2.9	6.59
0.067	0.06	70	7.51	100.87	11.6	3.4	7.55
0.068	0.06	70	8.38	120.28	6.9	2.2	3.53
0.068	0.06	70	7.9	111.53	5.5	2.3	1.97
0.076	0.07	70	8.16	115.5	5.6	2	1.25
0.065	0.06	70	7.89	85.84	5.7	1.5	4.32
0.062	0.06	70	7.57	91	11.1	3.2	8.1
0.066	0.07	70	7.41	92.63	12	3.4	6.31
0.066	0.07	70	7.21	95.4	11.5	4.3	9.9
0.051	0.05	70	7.2	76.56	11	5	11.25
0.056	0.06	70	7.06	60.6	11.1	4.2	6.3
0.060	0.06	70	7.13	131.96	8.6	2.8	5.54
0.056	0.06	70	7.48	98.12	13	4.5	8.62
0.055	0.06	70	8.45	124.11	11.1	3.8	13.97
0.055	0.05	70	10.42	120.75	7.1	2.3	0.8
0.062	0.06	70	8.55	131.13	6.5	2.2	0.27
0.059	0.06	70	8.27	154.63	8.6	2.6	2.68
0.053	0.06	70	7.84	89.12	18.1	4.5	11.61
0.059	0.06	70	7.69	87.35	16	5.8	12.68
0.061	0.06	70	7.36	60.77	17.2	6	10.5
0.069	0.07	70	6.97	81.51	24.9	9.1	5.62
0.062	0.06	70	7.08	122.11	14	6	3.45
0.053	0.05	70	7.12	128.65	11.1	4.4	5.8
0.056	0.06	70	7.04	144.07	11.3	4.8	5.41
0.059	0.06	64.6	7.32	96.8	10.6	4.3	6.19
0.059	0.06	64.6	7.93	103.63	6.2	2.4	2.81
0.06	0.06	64.6	9.67	98.62	6.5	2	2.94
0.067	0.07	64.6	9.05	102.76	4.9	1.8	1.26
0.065	0.07	64.6	8.55	112.12	7.2	2.6	1.1
0.061	0.07	64.6	8.28	117.52	9.3	2.7	1.51
0.062	0.06	64.6	8.19	91.87	7.9	2.5	0.92
0.063	0.06	64.6	7.96	95.93	6.3	2	0.87
0.079	0.08	64.6	7.31	122.81	8.3	3.1	0.35

0.063	0.06	64.6	7.15	141.72	8.8	4.1	6.25
0.063	0.06	64.6	7.32	113.91	9.2	3.1	4.08
0.063	0.06	64.6	7.19	158.7	7.6	2.5	7.67
0.065	0.06	64.6	7.34	112.44	6.9	2.8	5.79
0.062	0.06	64.6	7.32	117.95	8.3	3.3	5.77
0.064	0.06	64.6	7.36	117.95	6.6	2.3	4.41
0.078	0.06	64.6	7.65	91.85	4	2.2	2.11
0.084	0.08	64.6	7.62	109.87	4	1.7	4.81
0.075	0.07	64.6	7.74	121.71	6	2.6	3.16
0.069	0.07	64.6	7.66	111.49	7.1	2.9	4.71
0.068	0.07	64.6	7.29	96.29	7.9	3	9.36
0.076	0.08	64.6	7.31	102.19	9.6	3.2	8.42
0.075	0.08	64.6	7.34	111.98	9.1	3.2	9.67
0.076	0.08	64.6	7.34	71.91	9	3	10.58
0.075	0.08	64.6	7.39	112.12	7	3	9.67
0.076	0.08	64.6	7.48	127.9	8	2	8.85
0.069	0.07	64.6	7.71	117.5	5	3	5.1
0.072	0.07	64.6	7.58	157.72	6	2	4.8
0.074	0.06	64.6	7.77	134.71	5.7	2	3
0.074	0.07	64.6	7.96	125.61	5.3	2.3	3.4
0.076	0.07	64.6	9.18	114	4.8	2.2	5.1
0.072	0.07	64.6	7.93	134	5.2	2.9	3.1
0.069	0.07	64.6	7.87	130	6.6	3	7
0.069	0.07	64.6	7.83	149	8.3	2.9	8.4
0.06	0.06	64.6	7.09	89	4.9	3	10.4
0.061	0.06	64.6	7.19	115	8.1	3.9	6
0.079	0.08	64.6	7.29	184	10.7	3.8	3.4
0.063	0.05	64.6	7.3	194	8.2	3.9	1.7
0.066	0.07	64.6	8.2	128	4.8	2.4	2.1
0.07	0.07	64.6	10.9	112	6.8	3.9	2.6
0.067	0.06	64.6	8.3	121	5.4	2	0.8
0.067	0.07	64.6	8	38	4	2	0.8
0.066	0.07	64.6	7.9	133	4.4	1.7	2.1
0.065	0.07	64.6	7.1	124	5.4	2.2	2.2
0.068	0.07	64.6	7.4	102	10	3	3
0.064	0.06	64.6	7.1	185	15	5	6.5
0.063	0.06	64.6	7.4	127	14	5	3.7
0.062	0.06	64.6	7.4	181	16	6	6.1
0.061	0.06	64.6	7.1	199	24	8	10.3
0.069	0.07	64.6	7.3	167	16	6	5.3
0.075	0.07	64.6	9.2	134	6.5	2.9	3.9
0.100	0.07	64.6	10.4	155	11.3	4	7.3
0.088	0.06	64.6	8.0	140	5.3	2	1.7
0.081	0.06	64.6	7.7	85	5.3	4	5.6
0.079	0.06	64.6	7.7	133	4	1.6	1.7
0.069	0.06	64.6	7.6	145	5	1.9	2.8

0.065	0.06	64.6	8.0	130	13	4	5.87
0.062	0.06	64.6	8.0	193	13	5	5.8
0.060	0.06	64.6	7.4	171	11	5.1	7.1
0.059	0.06	64.6	7.4	137	8	4	4.8
0.061	0.06	64.6	7.2	155	12	5	3.5
0.075	0.07	64.6	7.4	169	7	3	3
0.038	0.04	64.6	8.3	144	6	2	3
0.073	0.06	64.6	8.5	152	10	3	4
0.067	0.06	64.6	7.8	99	6	3	0.5
0.067	0.06	64.6	7.9	163	10	5	1.5
0.065	0.06	64.6	7.7	127	9	4	1.8
0.062	0.06	64.6	7.5	105	8	4	2.4
0.059	0.06	64.6	7.4	137	8.4	4	1.6
0.051	0.05	64.6	7.7	153	13.4	5.5	5.7
0.047	0.05	64.6	7.4	134	13	5.7	6.3
0.037	0.04	64.6	7.3	148	14	4.3	5.1
0.04	0.04	64.6	7.1	164	17	5.8	3.8
0.047	0.05	64.6	7.2	139	16	4.8	2.6
0.052	0.05	64.6	8	139	12	5	2.7
0.051	0.05	64.6	8	158	7	3.1	0.9
0.067	0.06	64.6	7.9	90	10	3.8	0.6
0.059	0.05	64.6	8.5	61	12	3.9	0.9
0.065	0.06	64.6	8.4	136	6	2.4	1.5
0.052	0.06	64.6	8.5	174	12	4	2.5
0.044	0.04	64.6	8.1	145	10	4	3
0.043	0.04	64.6	7.6	142	10	4.8	2.2
0.044	0.04	64.6	7.7	130	12	4.3	0.7
0.041	0.04	64.6	7.7	121	14	4.8	0.9
0.0425	0.04	64.6	7.1	150	25	11.3	2.4
0.042	0.04	64.6	7.9	149	9	3.5	2
0.046	0.05	64.6	7.9	189	9	4.8	0.6
0.049	0.05	64.6	7.4	144	7	2.9	0.97
0.055	0.05	64.6	7.4	125	6	2.3	2.3
0.054	0.05	64.6	7.5	77	12	3.8	1.4
0.05	0.05	64.6	7.5	127	6	2.4	1.2
0.063	0.06	64.6	6.9	137	9	3.3	1.3
0.051	0.05	64.6	7.2	118	10	3.6	3.3
0.046	0.05	64.6	6.9	125	7	3.6	4
0.045	0.05	64.6	7.0	156	9	3.9	2.1
0.046	0.05	64.6	7.0	131	9	4.3	5.9
0.049	0.05	64.6	6.95	124	12	4.8	7.7
0.055	0.06	64.6	7.1	167	8	3.4	0.6
0.054	0.06	64.6	7.2	183	12	4.7	1.7
0.055	0.06	64.6	7.51	133	5	2.3	1.1
0.055	0.05	64.6	7.56	155	8	2.8	1.1
0.055	0.05	64.6	7.77	159	9	3.7	3.8
0.051	0.05	64.6	7.7	158	9	3.3	1.8
0.053	0.05	64.6	7.4	171	9	3.2	3.8
0.055	0.06	64.6	7.4	150	14	3.2	5.8
0.055	0.06	64.6	7.2	143	14	5.6	8.2
0.049	0.05	64.6	7.1	157	9	3.9	5.1
0.051	0.05	64.6	7.2	141	12	4.8	4.7
0.051	0.05	64.6	7.1	135	11	4.6	3
0.052	0.05	64.6	6.9	135	12	4.2	3.3
0.049	0.06	64.6	7.1	116	9	2.8	1

0.052	0.05	64.6	7.3	106	9	3	0.8
0.055	0.06	64.6	7.4	123	7	2.4	0.6
0.059	0.06	64.6	7.5	134	11	5	2.84
0.059	0.07	64.6	7.44	131	10	3	1.1
0.053	0.06	64.6	7.3	136	10	3	1.81
0.054	0.05	64.6	6.92	119	10	3	1.8
0.049	0.05	64.6	6.62	139	10	3.5	4.43
0.052	0.05	64.6	6.68	135	9	3.2	2.77
0.053	0.05	64.6	6.68	134	12	4	4
0.05	0.05	64.6	6.68	150	8	3	2
0.053	0.05	64.6	6.81	201	8	3	0.85
0.054	0.06	64.6	7.51	233	6	3	0.84
0.056	0.06	64.6	7.54	115	15	6	1.108
0.059	0.06	64.6	8.15	109	6	3	3.59
0.062	0.06	64.6	7.36	149	8	3	0.776
0.068	0.07	64.6	7.38	123	7	2	0.26
0.065	0.07	64.6	7.61	127	6	2	0.265
0.066	0.07	64.6	7.29	137	9	3	0.677
0.033	0.03	64.6	7.03	124	10	4	0.834
0.035	0.04	64.6	6.98	132	9	4	1.241
0.028	0.03	64.6	7.01	131	8	3	1.326
0.031	0.03	64.6	6.96	154	10	4	0.569





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Date	Feet of Sewer Cleaned	Feet of Sewer Televised (inspected)	Calls	Repairs (calls corrected)	Sewer Taps Sold
Jan-94	61,710	12,128	16	2	54
Feb-94	25,695	8,991	10	3	55
Mar-94	127,210	12,680	14	1	60
Apr-94	117,455	8,648	17	6	69
May-94	97,550	15,550	14	1	48
Jun-94	142,495	16,971	11	3	75
Jul-94	161,635	0	10	0	61
Aug-94	132,140	0	14	1	55
Sep-94	82,075	21,897	12	2	42
Oct-94	138,665	11,440	17	3	60
Nov-94	93,990	19,557	14	5	49
Dec-94	62,580	11,132	9	2	43
Jan-95	41,791	15,591	12	1	20
Feb-95	48,468	0	18	2	26
Mar-95	98,455	0	13	4	28
Apr-95	62,280	3,375	4	4	47
May-95	138,680	0	11	1	0
Jun-95	108,470	0	8	4	0
Jul-95	114,590	0	6	2	0
Aug-95	165,373	0	12	3	0
Sep-95	105,415	16,867	12	1	0
Oct-95	147,960	23,679	8	2	0
Nov-95	77,984	19,381	7	2	0
Dec-95	113,765	13,454	8	0	0
Jan-96	84,347	9,693	19	4	0
Feb-96	92,320	18,357	15	3	0
Mar-96	60,295	15,858	11	3	0
Apr-96	112,853	10,655	14	4	0
May-96	100,860	5,444	5	0	0
Jun-96	107,541	6,790	6	1	0
Jul-96	120,645	1,129	6	1	0
Aug-96	88,430	16,257	9	0	0
Sep-96	112,850	0	12	3	0
Oct-96	86,871	6,996	12	2	0
Nov-96	60,730	12,677	19	5	0
Dec-96	68,730	15,774	13	4	0
Jan-97	57,050	15,594	17	2	0
Feb-97	72,140	12,939	13	2	0
Mar-97	100,171	15,163	11	4	0
Apr-97	169,601	27,518	14	2	0

May-97	141,760	2,155	11	2	0
Jun-97	106,035	11,802	23	1	0
Jul-97	138,938	25,726	11	1	0
Aug-97	83,695	6,172	14	2	0
Sep-97	78,760	12,046	12	2	0
Oct-97	79,170	12,908	15	1	0
Nov-97	77,160	397	16	5	0
Dec-97	84,040	9,870	18	4	0
Jan-98	101,591	15,976	12	0	0
Feb-98	105,000	3,673	11	2	0
Mar-98	142,817	20,069	7	1	0
Apr-98	120,180	25,775	14	2	0
May-98	77,205	15,414	7	1	0
Jun-98	138,360	8,993	13	3	0
Jul-98	118,130	8,970	10	0	0
Aug-98	129,395	5,341	10	1	0
Sep-98	106,130	15,266	13	2	0
Oct-98	127,585	10,002	14	4	0
Nov-98	129,625	16,033	12	1	0
Dec-98	127,120	8,431	14	2	0
Jan-99	109,710	6,636	13	2	0
Feb-99	111,300	5,424	5	1	0
Mar-99	177,255	9,217	8	2	0
Apr-99	197,150	12,744	8	2	0
May-99	182,915	9,038	7	1	0
Jun-99	212,237	25,946	6	2	0
Jul-99	153,620	19,545	3	0	0
Aug-99	208,175	7,233	8	1	0
Sep-99	164,078	8,462	9	0	0
Oct-99	115,970	10,657	14	2	0
Nov-99	104,325	9,083	9	1	0
Dec-99	117,819	4,958	13	1	0
Jan-00	128,980	11,287	10	2	0
Feb-00	111,275	1,372	2	1	0
Mar-00	114,360	18,444	11	3	0
Apr-00	135,850	21,719	13	2	0
May-00	236,465	9,344	12	0	0
Jun-00	140,995	16,226	7	2	0
Jul-00	198,995	23,047	5	0	0
Aug-00	135,985	31,772	8	0	0
Sep-00	76,454	23,567	8	0	0
Oct-00	123,200	15,417	12	2	0
Nov-00	115,875	9,525	13	1	0

Dec-00	75,735	2,398	13	3	0
Jan-01	91,422	7,001	6	1	0
Feb-01	65,975	10,762	14	2	0
Mar-01	194,650	13,821	14	0	0
Apr-01	157,155	15,013	9	0	0
May-01	185,042	14,492	10	1	0
Jun-01	136,638	20,216	7	0	0
Jul-01	143,563	13,837	5	0	0
Aug-01	232,128	23,881	6	1	0
Sep-01	137,177	5,619	6	1	0
Oct-01	144,347	18,999	7	0	0
Nov-01	122,616	17,367	7	2	0
Dec-01	130,862	18,628	6	0	0
Jan-02	108,893	6,774	7	0	0
Feb-02	123,990	12,717	4	1	0
Mar-02	64,338	8,742	4	0	0
Apr-02	173,389	20,652	7	2	0
May-02	227,983	23,416	7	0	0
Jun-02	192,762	11,030	7	0	0
Jul-02	211,099	10,119	5	0	0
Aug-02	226,892	22,263	7	1	0
Sep-02	194,821	31,202	7	0	0
Oct-02	208,878	31,202	5	1	0
Nov-02	108,281	17,930	10	2	0
Dec-02	163,705	22,623	14	2	0
Jan-03	119,232	20,216	9	0	0
Feb-03	115,958	17,700	6	1	0
Mar-03	235,419	3,339	4	0	0
Apr-03	168,467	13,230	2	0	0
May-03	157,878	18,743	5	1	0
Jun-03	122,718	24,170	2	0	0
Jul-03	175,479	16,034	5	1	0
Aug-03	136,513	26,987	0	0	0
Sep-03	181,960	26,579	5	1	0
Oct-03	196,762	14,645	4	0	0
Nov-03	173,712	16,244	8	1	0
Dec-03	181,311	11,818	9	0	0
Jan-04	131,015	8,345	2	1	0
Feb-04	103,869	11,753	6	1	0
Mar-04	160,034	17,586	6	1	0
Apr-04	147,209	15,576	8	0	0
May-04	112,216	23,561	4	1	0
Jun-04	145,735	23,388	7	1	0

Jul-04	127,740	23,488	4	0	0
Aug-04	192,810	22,893	5	2	0
Sep-04	176,090	21,494	9	1	0
Oct-04	137,599	24,181	1	0	0
Nov-04	93,516	15,462	6	0	51
Dec-04	119,069	14,564	6	2	54
Jan-05	113,548	14,255	8	0	55
Feb-05	127,944	15,636	2	1	60
Mar-05	238,341	24,753	7	1	69
Apr-05	186,024	19,851	3	0	48
May-05	142,874	22,353	9	1	75
Jun-05	157,658	28,621	2	0	61
Jul-05	153,572	24,613	4	0	55
Aug-05	144,347	24,354	7	0	42
Sep-05	178,690	18,096	3	0	60
Oct-05	144,319	23,436	3	0	49
Nov-05	121,390	13,060	11	0	43
Dec-05	111,822	9,195	3	0	20
Jan-06	145,681	23,078	6	0	26
Feb-06	113,343	18,422	6	1	28
Mar-06	138,323	25,632	3	0	47
Apr-06	217,213	22,516	3	0	36
May-06	205,272	20,488	7	2	57
Jun-06	151,320	24,930	5	0	29
Jul-06	161,179	20,158	3	0	27
Aug-06	155,743	26,390	1	0	16
Sep-06	156,886	20,193	8	0	13
Oct-06	123,184	23,019	3	0	34
Nov-06	153,123	21,437	2	0	24
Dec-06	82,064	9,748	9	1	5
Jan-07	13,217	0	9	0	17
Feb-07	44,577	0	9	3	15
Mar-07	163,234	20,023	4	1	23
Apr-07	158,723	23,126	7	2	17
May-07	135,730	24,785	2	0	19
Jun-07	159,227	14,560	2	0	45
Jul-07	220,231	27,192	4	0	40
Aug-07	189,537	27,755	1	0	40
Sep-07	181,693	9,405	3	0	35
Oct-07	174,360	26,511	0	0	24
Nov-07	104,410	21,407	6	1	20
Dec-07	59,981	9,216	5	0	20
Jan-08	59,451	14,699	3	0	18



Feb-08	85,720	21,966	4	0	10
Mar-08	151,693	19,479	3	0	13
Apr-08	145,921	20,612	5	2	17
May-08	98,290	14,556	3	0	7
Jun-08	122,072	19,631	1	0	34
Jul-08	111,620	19,007	0	0	7
Aug-08	137,413	23,400	2	1	13
Sep-08	103,896	19,161	2	0	7
Oct-08	150,569	18,676	1	0	15
Nov-08	98,420	21,335	3	0	4
Dec-08	70,731	6,503	1	0	7
Jan-09	154,708	13,067	1	0	3
Feb-09	131,002	20,052	0	0	2
Mar-09	128,808	15,197	3	0	5
Apr-09	178,101	22,750	1	0	10
May-09	129,614	25,262	4	0	14
Jun-09	175,099	23,999	2	1	12
Jul-09	203,089	12,875	0	1	22
Aug-09	173,261	22,734	2	0	2
Sep-09	154,726	14,369	3	0	3
Oct-09	163,059	24,823	1	2	8
Nov-09	136,756	19,817	3	0	4
Dec-09	48,534	6,563	4	0	5
Jan-10	95	16,151	5	1	24
Feb-10	131,913	15,648	2	0	0
Mar-10	239,948	20,206	4	0	38
Apr-10	172,711	17,538	3	0	30
May-10	154,844	20,550	2	0	13
Jun-10	214,879	11,736	6	0	8
Jul-10	148,801	20,178	2	0	12
Aug-10	187,267	1,424	2	0	14
Sep-10	193,706	3,177	3	0	15
Oct-10	173,542	8,626	4	0	4
Nov-10	158,088	12,468	3	0	4
Dec-10	135,229	4,466	2	0	1
Jan-11	133,697	0	3	0	0
Feb-11	66,878	3,356	3	0	0
Mar-11	210,536	11,826	3	0	15
Apr-11	132,183	18,026	2	0	3
May-11	112,914	12,191	1	0	8
Jun-11	204,372	11,671	2	0	2
Jul-11	194,320	14,820	1	0	0
Aug-11	177,427	23,150	3	0	1

Sep-11	230,501	16,590	1	0	5
Oct-11	153,598	26,651	1	0	3
Nov-11	103,546	2,548	4	0	1
Dec-11	98,417	8,749	3	0	4
Jan-12	140,661	20,667	2	0	1
Feb-12	145,832	16,725	0	0	2
Mar-12	192,877	17,427	1	0	7
Apr-12	210,423	15,097	5	0	7
May-12	227,747	21,871	3	0	5
Jun-12	179,372	24,637	4	0	2
Jul-12	197,531	15,018	7	0	9
Aug-12	225,580	8,858	3	0	11
Sep-12	181,861	9,130	1	0	6
Oct-12	158,145	17,844	3	0	5
Nov-12	121,742	17,246	2	0	3
Dec-12	82,665	5,821	4	0	4
Jan-13	93,776	9,678	2	0	11
Feb-13	89,149	10,582	2	0	10
Mar-13	101,509	11,518	2	0	5
Apr-13	117,484	791	5	0	16
May-13	148,560	741	5	0	20
Jun-13	190,071	0	2	0	11
Jul-13	217,332	4,188	2	0	17
Aug-13	187,968	15,569	4	0	21
Sep-13	136,562	4,414	1	1	17
Oct-13	187,024	2,241	1	0	12
Nov-13	131,594	0	3	0	29
Dec-13	92,470	7,964	3	0	23
Jan-14	104,608	12,675	2	0	29

Date	Requested Rented Water	DWR Snow Course % of Average	DWR Snow Course % of Last Year Average	100%	Milton- Seaman( Randy)	Chambers (Randy)	Comanche( Randy)	Hourglass (Randy)	Barnes (Randy)	Peterson (Randy)	Twin Lakes	From Alex, Rented Water by month (not cumulative)	Decreed Storage
Jan-09	0	114	123	100	1962	840.6		0	1370	0	0	0	13123
Feb-09	800	100	94	100	1962	1021.1		0	1170	0	0	0	13123
Mar-09	330	94	95	100	1962	509.4		0	999	0	0	0	13123
Apr-09	835	113	98	100	4461	331		54	1370	224	28	6600	13123
May-09	0	0	0	100	5008	1343		243	2040	518	80	0	13123
Jun-09	1,500	0	0	100	5008	2629		1400	2349	1118	184	200	13123
Jul-09	0	0	0	100	5008	2540		1385	2328	1151	0	0	13123
Aug-09	0	0	0	100	5008	1775		1192	2296	1183	0	0	13123
Sep-09	0	0	0	100	5008	982		623	2349	1172	0	0	13123
Oct-09	0	0	0	100	5008	255		0	2345	627	0	0	13123
Nov-09	0	0	0	100	5008	1881		0	2328	0	0	0	13123
Dec-09	0	0	0	100	5008	1728.1		0	2136	0	0	0	13123
Jan-10	9,095	82	71	100	5008	1508.1		0	1959	0	0	0	13123
Feb-10	0	79	78	100	5008	1093		0	1818	0	0	4000	13123
Mar-10	36	81	86	100	5008	769.7		0	1598	0	0	0	13123
Apr-10	1,300	93	82	100	5008	613.2		0	1686	0	0	1200	13123
May-10	700	0	0	100	5008	1070		185	2274	513	68	0	13123
Jun-10	200	0	0	100	5008	2629		1490	0	1183	252	200	13123
Jul-10	0	0	0	100	4407	2629		1585	2338	1183	271	0	13123
Aug-10	0	0	0	100	3417	2547		687	2306	1178	79	0	13123
Sep-10	40	0	0	100	3081	2000		0	2263	617	0	40	13123
Oct-10	65	0	0	100	4056	2000		0	2263	0	0	65	13123
Nov-10	0	0	0	100	5008	1500		0	2094	0	0	0	13123
Dec-10	0	0	0	100	5008	1152.4		0	1887	0	0	0	13123
Jan-11	5,400	140	173	100	5008	771.6		0	1682	0	0	0	13123
Feb-11	3,300	143	185	100	5008	452.8		0	1508	0	0	0	13123
Mar-11	1,150	143	178	100	5008	0		0	1360	0	0	0	13123
Apr-11	0	191	202	100	1962	0		0	1161	0	0	4200	13123
May-11	50	0	0	100	4572	0		0	1877	0	0	50	13123
Jun-11	0	0	0	100	5008	1118		1179	2349	1134	201	50	13123
Jul-11	0	0	0	100	5008	2000		1366	2349	1183	269	50	13123
Aug-11	50	0	0	100	1958	2020		1362	2317	1183	247	50	13123
Sep-11	0	0	0	100	615	2000		780	2285	1183	0	0	13123
Oct-11	0	0	0	100	611	2108		125	2279	1183	0	0	13123
Nov-11	0	0	0	100	615	1715		0	2015	1183	0	0	13123
Dec-11	0	0	0	100	611	1352.1		0	1867	521	0	0	13123
Jan-12	5,454	98	70	100	611	899.5		0	1877	0	0	0	13123
Feb-12	9,454	102	71	100	611	497.6		0	1887	0	0	0	13123
Mar-12	10,454	61	42	100	611	88		0	1913	0	0	0	13123
Apr-12	7,300	23	12	100	2760	0		0	2094	77	0	0	13123
May-12	8,003	0	0	100	3186	2000		0	2349	562	0	3823	13123
Jun-12	7,853	0	0	100	3354	2000		0	2349	583	0	4515	13123
Jul-12	0	0	0	100	3593	2000		0	2317	493	0	700	13123

	1995			1996			1997			1998			1995		1996		1997		1998		19
	Flow	Cum Flow	Cum Flow/ 1000	Flow	Cum Flow	Cum Flow/ 1000	Flow	Cum Flow	Cum Flow/ 1000	Flow	Cum Flow	Cum Flow/ 1000	Precip .	CUM	Precip.	CUM	Precip.	CUM	Precip.	CUM	Precip.
Jan	417.44	417.44	0.42	423.23	423.23	0.42	444.36	444.36	0.44	422.66	422.66	0.42	0.06	0.06	0.76	0.76	0.82	0.82	0.3	0.3	0.38
Feb	385.68	803.12	0.80	415.27	838.50	0.84	391.90	836.26	0.84	398.86	821.52	0.82	0.88	0.94	0.08	0.84	0.48	1.30	0.25	0.55	0.11
Mar		803.12	0.80	455.22	1293.72	1.29	470.61	1306.87	1.31	439.54	1261.06	1.26	0.44	1.38	0.94	1.78	0.46	1.76	1.1	1.65	0.41
Apr	512.41	1315.53	1.32	650.44	1944.16	1.94	532.28	1839.15	1.84	596.78	1857.84	1.86	2.85	4.23	0.67	2.45	1.49	3.25	1.5	3.15	7.41
May	524.97	1840.50	1.84	961.36	2905.52	2.91	884.24	2723.39	2.72	922.21	2780.05	2.78	4.14	8.37	2.49	4.94	1.61	4.86	2.34	5.49	1.61
Jun	699.60	2540.10	2.54	977.23	3882.75	3.88	867.56	3590.95	3.59	1048.73	3828.77	3.83	4.00	12.37	1.65	6.59	2.33	7.19	0.63	6.12	1.03
Jul	1124.80	3664.89	3.66	1026.38	4909.13	4.91	1254.55	4845.50	4.85	1312.60	5141.37	5.14	0.57	12.94	2.55	9.14	2.30	9.49	1.45	7.57	2.29
Aug	1247.40	4912.29	4.91	1119.96	6029.09	6.03	899.44	5744.95	5.74	1154.40	6295.77	6.30	0.23	13.17	0.65	9.79	2.98	12.47	0.47	8.04	1.87
Sep	851.63	5763.92	5.76	771.60	6800.69	6.80	879.85	6624.79	6.62	1026.71	7322.48	7.32	2.86	16.03	1.75	11.54	0.83	13.30	0.56	8.6	2.46
Oct	590.24	6354.16	6.35	672.32	7473.01	7.47	711.18	7335.97	7.34	624.51	7946.99	7.95	0.48	16.51	0.45	11.99	2.07	15.37	1.98	10.58	0.3
Nov	418.14	6772.29	6.77	434.09	7907.09	7.91	424.92	7760.89	7.76	439.00	8385.99	8.39	0.46	16.97	0.41	12.40	0.45	15.82	0.29	10.87	0.28
Dec	423.35	7195.64	7.20	415.71	8322.80	8.32	417.42	8178.31	8.18	420.72	8806.71	8.81	0.10	17.07	0.00	12.40	0.32	16.14	0.65	11.52	0.1
	7195.639	42382.991		8322.803	52729.701								17.07	120.04	12.4	84.62	16.14	101.77	11.52	74.44	18.25

February
March
April
May
June
July
August
September
October
November
December

99	2000		2001		2002		2003		2004			2005			35 YEAR	2006			Historical Precipitation	Annual	Annual	2007			2008		
CUM	Precip	CUM	Precip	CUM	PRECIP	CUM	PRECIP	CUM	UNC	West	Cum	UNC	West	Cum		UNC	West	Cum		Avg. Monthly	Avg. Monthly	UNC	West	Precip	UNC	West	Precip
0.38	0.14	0.14	0.58	0.58	0.85	0.85	0.06	0.06	0.50	0.11	0.11	0.81	0.18	0.18		0.36	0.03	0.01		0.01	0.50	0.50	0.50	0.77	0.34	0.34	0.14
0.49	0.13	0.27	0.43	1.01	0.29	1.14	0.61	0.67	0.27	0.50	0.61	0.32	0.20	0.38	0.32	0.51	0.08	0.09	0.37	0.37	0.87	0.15	0.08	0.42	0.10	0.16	0.24
0.9	1.26	1.53	0.73	1.74	0.51	1.65	1.78	2.45	0.01	0.07	0.68	0.43	0.65	1.03	1.02	0.68	0.68	0.77	1.08	1.08	1.95	1.33	1.17	1.59	0.51	0.61	0.75
8.31	0.34	1.87	2.77	4.51	0	1.65	2.11	4.56	1.46	1.57	2.25	1.99	1.5	2.53	1.58	0.26	0.33	1.1	1.79	1.79	3.74	2.73	1.63	3.22	0.83	0.52	1.58
9.92	2.44	4.31	3.45	7.96	1.88	3.53	2.53	7.09	1.62	1.41	3.66	1.3	1.48	4.01	2.67	1.78	0.43	1.53	2.45	2.45	6.19	2.47	1.08	4.30	1.93	1.22	3.51
10.95	0.84	5.15	1.14	9.1	2.37	5.9	1.67	8.76	2.15	2.30	5.96		3.63	7.64	2.1	0.37	0.24	1.77	1.90	1.90	8.09	2.30	0.61	4.91	1.91	1.94	5.42
13.24	0.02	5.17	6.12	15.22	0.83	6.73	0.69	9.45	0.94	0.76	6.72	0.56	0.45	8.09	1.8	2.12	2.15	3.92	1.48	1.48	9.57	2.33	0.94	5.85	0.63	1.72	6.05
15.11	0.63	5.8	0.44	15.66	0.91	7.64	2.82	12.27	1.40	2.90	9.62	0.75	0.71	8.80	1.39	0.53	0.96	4.88	1.15	1.15	10.72	2.69	2.54	8.39	7.02	6.30	13.07
17.57	1.41	7.21	1.00	16.66	0.59	8.23	0.16	12.43	3.77	1.64	11.26	0.17	0.22	9.02	1.27	0.39	0.53	5.41	1.11	1.11	11.83	1.30	1.24	9.63	1.83	1.90	14.90
17.87	0.71	7.92	0.23	16.89	1.06	9.29	0.12	12.55	1.33	1.04	12.3	3.76	3.45	12.47	0.93	1.22	1.43	6.84	0.96	0.96	12.79	0.55	0.57	10.20	0.88	0.57	15.78
18.15	0.64	8.56	0.96	17.85	0.36	9.65	0.3	12.85	0.88	0.11	12.41	0.42	0.31	12.78	0.6		0.17	7.01	0.79	0.79	13.58	0.24	0.18	10.38	0.24	0.18	16.02
18.25	0.45	9.01	0.05	17.9	0.01	9.66	0.37	13.22	0.13	0.10	12.51	0.00	0.08	12.86	0.39	2.80	0.20	7.21	0.41	0.41	13.99	0.25	0.22	10.60	0.22	0.22	16.24
131.14	9.01	56.94	17.9	125.08	9.66	65.92	13.22	96.36	14.46	12.51	12.51		12.86	12.86	14.43		7.21		13.99	13.99	93.82						93.7

	2007
Janua	0.77
March	1.33
April	2.73
May	2.47
June	2.30
July	2.33
August	2.69
Sept	1.30
Octob	0.55
Nov	0.24
Dec	0.25

2009			2010			2011		2012		Long-term (1967-2011?)		2011	
UNC	West	Precip	UNC	West	Precip	UNC (Doris)	Cum Precip	UNC	Cum Precip	Average Precip	Cum Avg Annual Precip	Flow	2011 Cum. Treated Water (MG)
0.43	0.04	0.43	0.14	0.05	0.14	0.58	0.58	0.1	0.10	0.48	0.48	422.837	422.837
0.10	0.05	0.53	0.62	0.32	0.76	0.48	1.06	0.54	0.64	0.37	0.85	381.547	804.384
1.19	0.24	1.72	1.07	0.46	1.83	0.12	1.18	0.01	0.65	1.07	1.92	445.193	1249.577
2.84	3.16	4.56	3.54	3.88	5.37	1.26	2.44	0.98	1.63	1.79	3.71	550.236	1799.813
2.42	2.19	6.98	1.78	2.12	7.15	3.58	6.02	1.31	2.94	2.45	6.16	773.875	2573.688
3.08	3.17	10.06	4.09	2.24	11.24	0.59	6.61	0.30	3.24	1.90	8.06	1095.21	3668.894
2.78	3.64	12.84	1.24	1.86	12.48	1.25	7.86	1.63	4.87	1.48	9.54	1177.69	4846.584
2.71	1.32	15.55	1.50	1.15	13.98	1.13	8.99	0.04	4.91	1.15	10.69	1105.31	5951.892
0.87	0.87	16.42	0.03	0.07	14.01	0.75	9.74	1.32	6.23	1.11	11.80	959.001	6910.893
2.02	0.69	18.44	0.56	0.38	14.57	2.46	12.20	1.35	7.58	1.03	12.83	675.575	7586.468
0.78	0.26	19.22	0.73	0.82	15.30	0.95	13.15	0.52	8.10	0.78	13.61	410.781	7997.249
0.98	0.08	20.20	0.41	0.00	15.71	0.82	13.97	0.34	8.44	0.41	14.02	417.66	8414.909

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30yr Avg Based on Smoothed Data  
[www.wrcc.dri.edu/](http://www.wrcc.dri.edu/)

2008	2009	2010
0.14	0.43	0.14
0.51	1.19	1.07
0.83	2.84	3.54
1.93	2.42	1.78
1.91	3.08	4.09
0.63	2.78	1.24
7.02	2.71	1.50
1.83	0.87	0.03
0.88	2.02	0.56
0.24	0.78	0.73
0.22	0.98	0.41

SEND #'s to Frank

\*where does the

Day	Historic Avg Temp	2022 Temps	Month	Day	*Need to refresh
1-Jan	16.69	2.96	1	1	
2-Jan	19.60	6.14	1	2	
3-Jan	23.49	18.55	1	3	
4-Jan	22.53	35.23	1	4	Row Labels
5-Jan	24.80	11.54	1	5	1
6-Jan	24.11	4.10	1	6	2
7-Jan	24.39	16.60	1	7	3
8-Jan	27.88	31.25	1	8	4
9-Jan	26.95	22.73	1	9	5
10-Jan	24.49	23.79	1	10	6
11-Jan	25.48	26.69	1	11	7
12-Jan	23.05	30.54	1	12	8
13-Jan	26.06	33.98	1	13	9
14-Jan	27.68	34.49	1	14	10
15-Jan	26.61	27.47	1	15	11
16-Jan	27.09	32.32	1	16	12
17-Jan	28.86	30.67	1	17	(blank)
18-Jan	32.17	34.16	1	18	Grand Total
19-Jan	31.44	21.39	1	19	
20-Jan	30.92	20.58	1	20	
21-Jan	29.23	30.03	1	21	
22-Jan	27.69	30.15	1	22	
23-Jan	29.02	31.88	1	23	
24-Jan	29.32	33.30	1	24	
25-Jan	30.12	26.32	1	25	
26-Jan	30.42	17.67	1	26	
27-Jan	30.67	23.19	1	27	
28-Jan	31.02	18.39	1	28	
29-Jan	31.62	24.66	1	29	
30-Jan	30.55	26.31	1	30	
31-Jan	28.32	28.73	1	31	
1-Feb	25.48	24.05	2	1	
2-Feb	25.87	8.13	2	2	
3-Feb	28.73	-1.93	2	3	
4-Feb	28.65	12.15	2	4	
5-Feb	31.35	29.17	2	5	
6-Feb	30.78	30.22	2	6	
7-Feb	30.13	27.99	2	7	
8-Feb	28.67	39.24	2	8	
9-Feb	29.30	35.72	2	9	
10-Feb	30.03	39.43	2	10	
11-Feb	29.06	33.85	2	11	
12-Feb	30.61	25.92	2	12	
13-Feb	34.54	33.44	2	13	
14-Feb	32.27	34.42	2	14	
15-Feb	30.55	38.29	2	15	
16-Feb	32.03	27.59	2	16	
17-Feb	33.08	20.28	2	17	
18-Feb	32.96	28.02	2	18	
19-Feb	34.58	34.88	2	19	
20-Feb	32.61	42.18	2	20	
21-Feb	32.96	23.77	2	21	
22-Feb	34.29	2.61	2	22	
23-Feb	32.76	3.42	2	23	

24-Feb	32.88	9.91	2	24
25-Feb	30.77	13.33	2	25
26-Feb	31.82	19.65	2	26
27-Feb	32.68	30.60	2	27
28-Feb	33.44	42.55	2	28
1-Mar	34.84	47.50	3	1
2-Mar	33.26	47.86	3	2
3-Mar	36.23	48.96	3	3
4-Mar	35.87	45.05	3	4
5-Mar	35.80	30.73	3	5
6-Mar	39.06	21.60	3	6
7-Mar	35.82	22.57	3	7
8-Mar	36.27	27.05	3	8
9-Mar	37.28	12.91	3	9
10-Mar	37.76	7.49	3	10
11-Mar	38.82	16.77	3	11
12-Mar	41.62	35.25	3	12
13-Mar	42.28	43.62	3	13
14-Mar	42.03	44.42	3	14
15-Mar	42.96	45.94	3	15
16-Mar	43.58	43.81	3	16
17-Mar	42.70	35.53	3	17
18-Mar	40.57	38.38	3	18
19-Mar	40.91	44.47	3	19
20-Mar	41.62	48.44	3	20
21-Mar	42.56	38.63	3	21
22-Mar	45.62	36.48	3	22
23-Mar	44.22	44.50	3	23
24-Mar	41.76	50.28	3	24
25-Mar	42.15	45.35	3	25
26-Mar	43.81	52.30	3	26
27-Mar	44.24	45.37	3	27
28-Mar	44.87	54.88	3	28
29-Mar	43.65	46.55	3	29
30-Mar	43.24	37.23	3	30
31-Mar	45.15	47.13	3	31
1-Apr	46.69		4	1
2-Apr	44.08		4	2
3-Apr	42.53		4	3
4-Apr	44.85		4	4
5-Apr	48.90		4	5
6-Apr	46.48		4	6
7-Apr	45.83		4	7
8-Apr	47.03		4	8
9-Apr	46.37		4	9
10-Apr	44.97		4	10
11-Apr	47.24		4	11
12-Apr	49.34		4	12
13-Apr	50.92		4	13
14-Apr	50.60		4	14
15-Apr	47.37		4	15
16-Apr	44.79		4	16
17-Apr	47.29		4	17
18-Apr	48.66		4	18
19-Apr	49.24		4	19



20-Apr	47.89	4	20
21-Apr	49.56	4	21
22-Apr	49.19	4	22
23-Apr	49.62	4	23
24-Apr	48.60	4	24
25-Apr	48.24	4	25
26-Apr	49.16	4	26
27-Apr	49.88	4	27
28-Apr	51.39	4	28
29-Apr	49.76	4	29
30-Apr	49.41	4	30
1-May	47.89	5	1
2-May	48.52	5	2
3-May	52.57	5	3
4-May	54.54	5	4
5-May	55.20	5	5
6-May	56.55	5	6
7-May	54.92	5	7
8-May	54.42	5	8
9-May	54.57	5	9
10-May	53.97	5	10
11-May	51.16	5	11
12-May	52.78	5	12
13-May	55.88	5	13
14-May	55.88	5	14
15-May	56.69	5	15
16-May	57.87	5	16
17-May	57.91	5	17
18-May	58.44	5	18
19-May	58.00	5	19
20-May	58.52	5	20
21-May	61.22	5	21
22-May	60.40	5	22
23-May	58.87	5	23
24-May	57.81	5	24
25-May	58.61	5	25
26-May	60.23	5	26
27-May	62.31	5	27
28-May	64.40	5	28
29-May	62.45	5	29
30-May	61.39	5	30
31-May	62.19	5	31
1-Jun	64.06	6	1
2-Jun	65.52	6	2
3-Jun	62.77	6	3
4-Jun	61.37	6	4
5-Jun	62.63	6	5
6-Jun	66.30	6	6
7-Jun	66.48	6	7
8-Jun	65.45	6	8
9-Jun	65.77	6	9
10-Jun	66.39	6	10
11-Jun	65.97	6	11
12-Jun	65.30	6	12
13-Jun	64.52	6	13

14-Jun	65.90	6	14
15-Jun	66.84	6	15
16-Jun	65.90	6	16
17-Jun	66.80	6	17
18-Jun	68.35	6	18
19-Jun	69.36	6	19
20-Jun	68.50	6	20
21-Jun	70.15	6	21
22-Jun	69.75	6	22
23-Jun	71.06	6	23
24-Jun	71.75	6	24
25-Jun	71.86	6	25
26-Jun	71.45	6	26
27-Jun	71.00	6	27
28-Jun	71.77	6	28
29-Jun	73.00	6	29
30-Jun	71.96	6	30
1-Jul	72.81	7	1
2-Jul	73.51	7	2
3-Jul	72.84	7	3
4-Jul	73.56	7	4
5-Jul	73.37	7	5
6-Jul	72.14	7	6
7-Jul	72.02	7	7
8-Jul	72.30	7	8
9-Jul	72.40	7	9
10-Jul	73.02	7	10
11-Jul	73.85	7	11
12-Jul	73.45	7	12
13-Jul	75.20	7	13
14-Jul	75.32	7	14
15-Jul	74.64	7	15
16-Jul	74.34	7	16
17-Jul	75.22	7	17
18-Jul	75.81	7	18
19-Jul	76.13	7	19
20-Jul	75.91	7	20
21-Jul	74.98	7	21
22-Jul	74.47	7	22
23-Jul	74.76	7	23
24-Jul	73.93	7	24
25-Jul	72.73	7	25
26-Jul	72.18	7	26
27-Jul	72.85	7	27
28-Jul	72.69	7	28
29-Jul	72.18	7	29
30-Jul	72.59	7	30
31-Jul	73.70	7	31
1-Aug	72.53	8	1
2-Aug	72.76	8	2
3-Aug	71.89	8	3
4-Aug	70.45	8	4
5-Aug	71.27	8	5
6-Aug	71.79	8	6
7-Aug	71.75	8	7

8-Aug	72.55	8	8
9-Aug	70.94	8	9
10-Aug	70.37	8	10
11-Aug	71.55	8	11
12-Aug	70.65	8	12
13-Aug	69.80	8	13
14-Aug	70.36	8	14
15-Aug	69.64	8	15
16-Aug	69.12	8	16
17-Aug	68.92	8	17
18-Aug	69.03	8	18
19-Aug	67.66	8	19
20-Aug	69.81	8	20
21-Aug	71.09	8	21
22-Aug	70.76	8	22
23-Aug	70.71	8	23
24-Aug	70.84	8	24
25-Aug	70.05	8	25
26-Aug	71.34	8	26
27-Aug	70.25	8	27
28-Aug	69.65	8	28
29-Aug	69.64	8	29
30-Aug	70.25	8	30
31-Aug	68.34	8	31
1-Sep	68.32	9	1
2-Sep	68.03	9	2
3-Sep	67.72	9	3
4-Sep	67.46	9	4
5-Sep	67.56	9	5
6-Sep	67.08	9	6
7-Sep	64.33	9	7
8-Sep	64.09	9	8
9-Sep	64.79	9	9
10-Sep	64.50	9	10
11-Sep	64.39	9	11
12-Sep	63.59	9	12
13-Sep	61.24	9	13
14-Sep	60.71	9	14
15-Sep	61.18	9	15
16-Sep	62.62	9	16
17-Sep	61.92	9	17
18-Sep	61.56	9	18
19-Sep	60.91	9	19
20-Sep	60.14	9	20
21-Sep	58.56	9	21
22-Sep	56.62	9	22
23-Sep	57.58	9	23
24-Sep	57.34	9	24
25-Sep	58.42	9	25
26-Sep	59.53	9	26
27-Sep	58.53	9	27
28-Sep	57.69	9	28
29-Sep	58.06	9	29
30-Sep	57.84	9	30
1-Oct	56.97	10	1

2-Oct	55.17	10	2
3-Oct	54.10	10	3
4-Oct	51.30	10	4
5-Oct	51.55	10	5
6-Oct	50.81	10	6
7-Oct	52.06	10	7
8-Oct	51.57	10	8
9-Oct	49.47	10	9
10-Oct	49.00	10	10
11-Oct	51.24	10	11
12-Oct	48.64	10	12
13-Oct	49.58	10	13
14-Oct	49.99	10	14
15-Oct	49.80	10	15
16-Oct	48.51	10	16
17-Oct	48.07	10	17
18-Oct	47.90	10	18
19-Oct	47.98	10	19
20-Oct	48.42	10	20
21-Oct	46.71	10	21
22-Oct	46.11	10	22
23-Oct	47.79	10	23
24-Oct	47.18	10	24
25-Oct	46.58	10	25
26-Oct	42.96	10	26
27-Oct	42.03	10	27
28-Oct	43.86	10	28
29-Oct	45.95	10	29
30-Oct	41.54	10	30
31-Oct	41.38	10	31
1-Nov	42.16	11	1
2-Nov	39.05	11	2
3-Nov	40.22	11	3
4-Nov	39.96	11	4
5-Nov	39.82	11	5
6-Nov	40.92	11	6
7-Nov	40.95	11	7
8-Nov	41.62	11	8
9-Nov	38.98	11	9
10-Nov	38.50	11	10
11-Nov	36.65	11	11
12-Nov	36.94	11	12
13-Nov	38.66	11	13
14-Nov	38.80	11	14
15-Nov	37.75	11	15
16-Nov	37.42	11	16
17-Nov	38.10	11	17
18-Nov	39.60	11	18
19-Nov	36.56	11	19
20-Nov	34.81	11	20
21-Nov	34.58	11	21
22-Nov	35.88	11	22
23-Nov	33.66	11	23
24-Nov	33.14	11	24
25-Nov	33.10	11	25

26-Nov	32.68	11	26
27-Nov	32.23	11	27
28-Nov	32.09	11	28
29-Nov	30.75	11	29
30-Nov	30.60	11	30
1-Dec	30.83	12	1
2-Dec	31.47	12	2
3-Dec	29.47	12	3
4-Dec	26.42	12	4
5-Dec	25.78	12	5
6-Dec	24.87	12	6
7-Dec	25.24	12	7
8-Dec	25.32	12	8
9-Dec	25.19	12	9
10-Dec	25.32	12	10
11-Dec	26.48	12	11
12-Dec	25.97	12	12
13-Dec	27.64	12	13
14-Dec	28.11	12	14
15-Dec	25.68	12	15
16-Dec	25.53	12	16
17-Dec	25.37	12	17
18-Dec	24.79	12	18
19-Dec	24.83	12	19
20-Dec	25.72	12	20
21-Dec	23.41	12	21
22-Dec	21.34	12	22
23-Dec	21.46	12	23
24-Dec	21.68	12	24
25-Dec	22.99	12	25
26-Dec	23.85	12	26
27-Dec	26.11	12	27
28-Dec	28.86	12	28
29-Dec	29.04	12	29
30-Dec	29.44	12	30
31-Dec	26.04	12	31

pivot table after entering data

Average of Historic Avg Temp	Average of 2022 Temps
27.17	24.38
31.17	25.32
40.66	38.94
47.86	
56.97	
67.60	
73.71	
70.51	
62.08	
48.52	
36.87	
25.94	
49.19	29.69

11/28/12: wrong year highlighted in system storage chart