GREELEY FIRE DEPARTMENT


# DEVELOPMENT & ENGINEERING GUIDE

PROFESSIONAL | COMPASSIONATE | SERVICE

GREELEY FIRE DEPT.

City of Greeley Colorado

CONTACT
970-350-9510

WEBSITE
www.greeleyfire.com/divisions/safety

E-mail
FirePrevention@greeleygov.com

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## ABOUT THE GREELEY FIRE DEPARTMENT

The Greeley Fire Department (GFD) is an all-hazards, all-response career fire department dedicated to protecting the lives and property of residents, businesses, and visitors in Greeley, Colorado.

The Greeley Fire Department provides:

- Fire Protection Services
- Emergency Medical Services (Advanced Life Support – ALS non-transport)
- Specialty Rescue Services
- Water Rescue and Hazardous Materials Response
- Fire Inspections and Code Enforcement
- Public Education and Prevention Programs
- Fire Investigations

Greeley Fire Department operates under an intergovernmental agreement to provide fire and emergency services to the Western Hills Fire Protection District, a special district primarily located east of the City of Greeley, including Garden City. The City of Greeley also contracts with UCHealth for Emergency Medical Transport Services, which provides Advanced Life Support (ALS) transport throughout the Greeley Fire Response area.
Greeley Fire consists of 138 personnel operating from seven strategically located fire stations across 64.5 square miles. It responds to more than 17,200 calls for service annually. The women and men of Greeley Fire are committed to maintaining the highest level of professionalism and efficiency in service to the community.

**Our Vision**
The Greeley Fire Department is a world-class organization committed to community excellence.
**Core Tenets**
Prevention. Preparedness. Response.
**Our Mission**
Professional. Compassionate. Service.
**Operational Priorities**
Operational Effectiveness. Organizational Excellence. Community Excellence.
**Guiding Principles**
Dedication, Excellence, Honor, Integrity, Respect, and Safety.

## GFD DEVELOPMENT & ENGINEERING GUIDE OVERVIEW

The goal of development review is the same for the Greeley Fire Department as it is for property owners, building designers, and construction contractors: to create structures that are attractive and functional; safe for occupants and firefighters throughout their lifespan; and cost-effective to build.

This Development & Engineering Guide offers guidance on applying the 2021 International Fire Code (IFC), along with locally adopted standards, National Standards, Greeley Fire Department policies, and best practices for property development design. It is intended for licensed design professionals, contractors, and business owners. Applying the 2021 IFC and local amendments ensures clarity and consistency in requirements and ensures that buildings meet the minimum life-safety standards for occupants.

### IMPORTANT NOTICE

**THIS GUIDE ADDRESSES THE MOST COMMONLY ASKED DEVELOPMENT QUESTIONS. IT DOES NOT CREATE OR REPLACE CODE PROVISIONS. THE REQUIREMENTS PROVIDED MEET THE MINIMUM LIFE-SAFETY STANDARDS. HOWEVER, BECAUSE EACH PROJECT IS UNIQUE AND CARRIES ASSOCIATED RISKS, ADDITIONAL REQUIREMENTS MAY BE NECESSARY TO SAFEGUARD THE STRUCTURE(S) AND OCCUPANT(S). READERS ARE ADVISED THAT THE INFORMATION IN THIS GUIDE MAY NOT APPLY TO THEIR SPECIFIC SITUATION AND THAT THE GREELEY FIRE DEPARTMENT (GFD), AS THE AUTHORITY HAVING JURISDICTION (AHJ), RETAINS FINAL AUTHORITY TO DETERMINE COMPLIANCE.**

# GETTING STARTED: PLANNING & BUILDING PERMIT PROCESSES

For most commercial and residential development projects, including new construction and building additions, the process begins with approval of planning documents such as site development plans, plats, and public improvement construction plans. Once those are approved, the next step is to review and receive approval of the building permit construction drawings.

Before starting any new construction or remodeling project, the applicant, whether an owner, developer, or contractor, must coordinate with the appropriate Planning and Building Departments to obtain the required planning approvals and building permits.

## Contact Information

For questions or guidance, please contact the appropriate department below:

**City of Greeley Building Inspection**
970-350-9830
Email: Building.inspection@greeleygov.com
COG Inspections

**City of Greeley Economic Development & Urban Revitalization**
970-350-9382
Email: Ecodevo@greeleygov.com
COG EDU

**City of Greeley Engineering Development Review**
Email: Edr.comdev@greeleygov.com
COG EDR

**City of Greeley Fire Prevention Bureau**
970-350-9510
Email: FirePrevention@greeleygov.com
GFD FPB

**City of Greeley Planning and Zoning**
970-350-9780
Email: Planning@greeleygov.com
COG Planning

**City of Greeley Public Works**
970-350-9881
COG Public Works

**City of Greeley Water and Sewer**
970-350-9811
Email: Water@greeleygov.com
COG Water Dept.

## GETTING STARTED: PLANNING & BUILDING PERMIT PROCESSES

**Weld County Building Department**
970-400-6100
Weld Co. Bldg. Dept.

**Burn Permits**
**Weld County Environmental Health Services**
970-400-6415
Weld Co. Burn Permits

**Keep in mind that starting a business may require additional approvals, such as a sales tax license, utility service setup, liquor licensing, food vendor permits, or signage approvals. Planning or Building staff in either jurisdiction can help you navigate these requirements and answer any questions.**

## FIRE PROTECTION SYSTEM REQUIREMENTS & PERMITTING

During the development review process, fire protection requirements are evaluated for each project. This includes determining whether systems such as fire alarms and fire suppression are required, based on the locally adopted International Fire Code (IFC) and International Building Code (IBC).

The Greeley Fire Department provides building permit review comments that outline when fire protection systems are required and identify any permits required for their installation.

Fire protection systems may include fire sprinklers, fire alarm systems, spray booths (for painting or flammable finishes), commercial kitchen extinguishing systems, clean-agent suppression systems, fire pumps, and related equipment.

**FIRE PROTECTION SYSTEM PERMITS ARE REQUIRED PRIOR TO THE INSTALLATION OF ANY NEW SYSTEM OR THE MODIFICATION OF AN EXISTING SYSTEM.**
**ALL APPLICATIONS, INCLUDING DRAWINGS AND MATERIAL SPECIFICATIONS, MUST BE SUBMITTED DIRECTLY TO THE GREELEY FIRE DEPARTMENT FIRE PREVENTION BUREAU. THE SUBMITTING CONTRACTOR MUST HOLD A CURRENT STATE OF COLORADO CONTRACTOR LICENSE, AND ALL PLANS MUST BE STAMPED BY A NICET LEVEL III OR IV TECHNICIAN OR A LICENSED PROFESSIONAL ENGINEER (P.E.).**

## 2021 INTERNATIONAL FIRE CODE

The Greeley Fire Department enforces the fire protection system requirements from the 2021 International Fire Code within the City of Greeley and the Western Hills Fire Protection District, as well as the most current edition of NFPA standards.

The 2021 International Fire Code (IFC) is a model code that establishes minimum requirements for fire prevention, life safety, and property protection from fire and explosion hazards. It governs fire protection systems, emergency access, and fire safety provisions for buildings and development.

**Free access to the 2021 IFC can be found at the links below:**

2021 IFC

**Local amendments to the 2021 IFC can be found at this link:**

Local Amendments

## NFPA STANDARDS

NFPA standards are nationally recognized codes developed by the National Fire Protection Association that establish minimum requirements for fire protection systems, life safety, and hazard mitigation. These standards guide the design, installation, inspection, and maintenance of fire protection features.

**Access to the NFPA Standards can be found here:**

NFPA Free Access

## GFD REVIEW & PERMITTING

Permit fee estimates for Building Permits, Fire Protection System Permits, and Impact Fees are available on the City of Greeley website or upon request through the Fire Prevention Bureau. These are estimates only and not formal cost quotes. Project valuation and fee schedules are subject to change. It is the responsibility of the applicant or contractor to confirm final permit fees with Community Development, if desired, prior to payment and permit issuance.

**To obtain a fee estimate for Greeley Fire Department permits, please visit:**

GFD Fee Estimate

# GFD DEVELOPMENT DESIGN GUIDANCE (2021 IFC-BASED)

This guide is intended for informational purposes only and does not create or replace code provisions. The requirements outlined reflect the minimum life safety standards of the 2021 International Fire Code.
Each project is unique, and based on associated risks, additional requirements may be necessary to protect the structure(s) and occupant(s). The information provided may not apply to every situation.

**The Greeley Fire Department, as the Authority Having Jurisdiction (AHJ), retains final authority in determining compliance.**

# EMERGENCY VEHICLE ACCESS

**Obstruction of Fire Apparatus Access Roads:**
Fire apparatus access roads shall not be obstructed in any way, including by parking vehicles. The minimum requirements established in Section 503 and Appendix D shall be always maintained.

**Fire Apparatus Access Road Width and Vertical Clearance:**
Fire apparatus access roads shall have an unobstructed driving surface width of at least 20 feet, exclusive of shoulders, and an unobstructed vertical clearance of at least 13 feet 6 inches. This includes public streets, private streets, private drives, and parking lot drive aisles. An Emergency Access Easement may be required to be dedicated on non-public roadways.

**Fire Apparatus Access Road Width and "Fire Lane No Parking" Signs:**
Roads 20 to 26 feet wide shall be posted on both sides as fire lanes. Roads 26 to 32 feet wide shall be posted on one side as a fire lane. Roads wider than 32 feet typically do not require fire lane signage.

**Aerial Fire Apparatus Road:**
When the vertical distance between the grade plane and the highest roof surface exceeds 30 feet, approved aerial fire apparatus access roads shall be provided. The highest roof surface is measured to the eave of a pitched roof, the roof-to-exterior-wall intersection, or the top of parapet walls, whichever is greater.

**Aerial Fire Apparatus Road Width:**
Aerial fire apparatus access roads shall have a minimum unobstructed driving surface width of 26 feet in the immediate vicinity of the building. This includes public streets, private streets, private drives, and parking lot drive aisles. An Emergency Access Easement may be required for non-public roadways.

**Aerial Fire Apparatus Road Proximity to Building:**
At least one required aerial fire apparatus access route shall be located 15 to 30 feet from the building and positioned parallel to at least one full-length side of the building, with openings suitable for firefighter entry. Examples of such openings include windows, balconies, and smoke tower landings. The side(s) of the building with aerial access shall be approved by the Fire Code Official.

**Fire Lane - No Parking Signs and/or Painted Curbs:**
Where required by the Fire Code Official, fire apparatus access roadway curbs shall be painted red at approved locations, and/or approved Fire Lane – No Parking signs shall be installed. Paint and signs shall be installed and maintained by the property owner. Signs shall be installed with a clear space of 7 feet above grade and positioned at a 45-degree angle to the flow line. Signs shall read "NO PARKING – FIRE LANE," measure 12 inches by 18 inches, and feature red lettering on a white reflective background.

# EMERGENCY VEHICLE ACCESS

### City of Greeley Design Criteria:

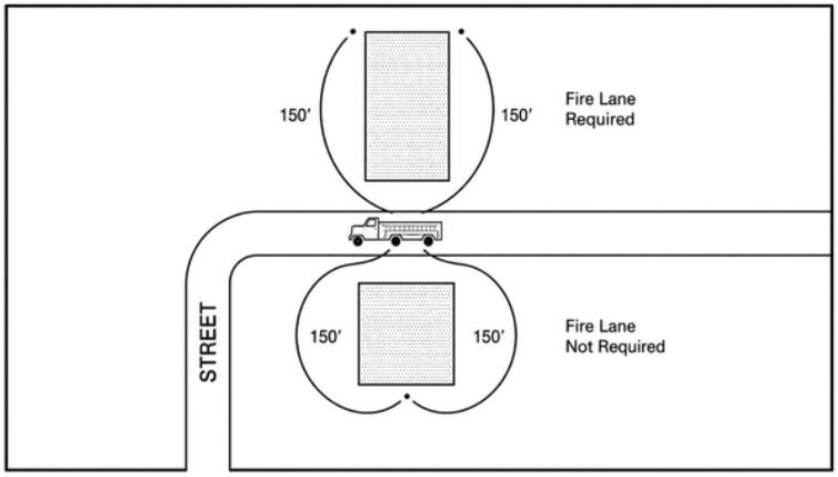
COG Design Criteria

### Fire Apparatus Access Road Distance from Buildings:

An approved fire apparatus access road shall be located within 150 feet of all portions of the first-story exterior wall of any building, measured along an approved route around the building's exterior. See Drawing 1.

***Exception: For buildings equipped with an approved automatic fire sprinkler system, the distance may be increased to 300 feet.***

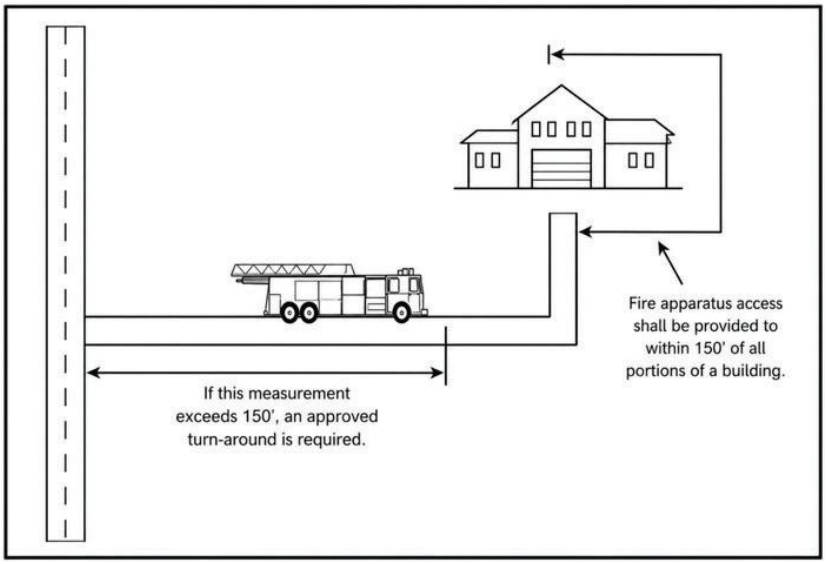
**Drawing 1: Fire Apparatus Access Road Distance from Buildings**




### Dead-End Roads:

Dead-end fire apparatus access roads exceeding 150 feet in length shall be provided with an approved turnaround. **See Drawing 2.**

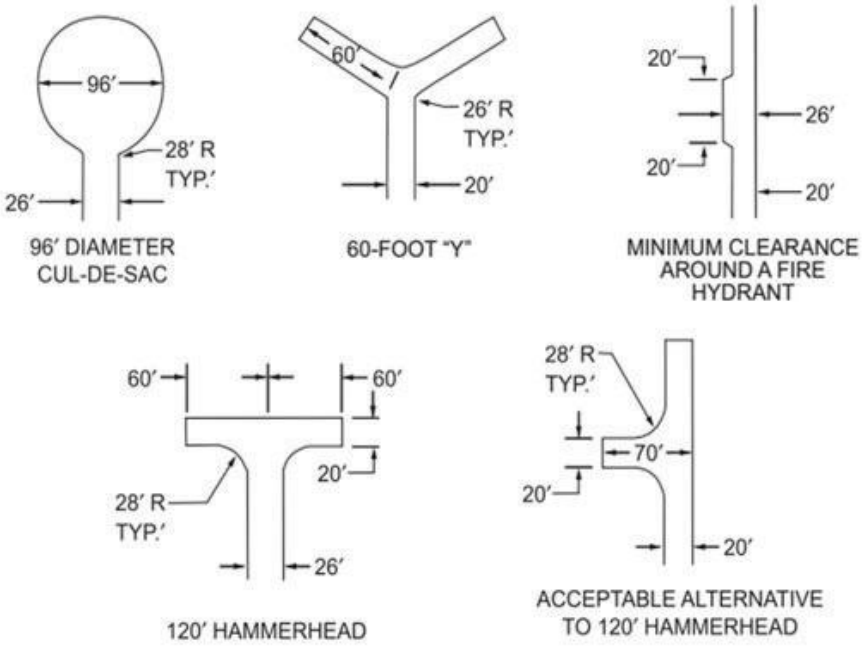
**Drawing 2: Dead-end Roads**



# EMERGENCY VEHICLE ACCESS

**Turnaround Dimensions:**
See below for approved turnaround options. Drawing 3 shows the turnaround dimensions.

**Drawing 3: Turnaround Dimensions**




**Surface and Load Capacities:**
Fire apparatus access roads shall have an all-weather surface (concrete, asphalt, or another approved driving surface) that is easily distinguishable from the surrounding area and capable of supporting a live load of at least 82,000 pounds (gross vehicle weight). The Greeley Fire Department may require documentation from a registered engineer confirming that the finished construction complies with the approved plans or the 2021 IFC requirements.

**Turning Radii:**
The inside and outside turning radii shall be at least 28 feet and 60 feet, respectively, measured from the same center point.

**Vehicle Design Specifications:**
The Greeley Fire Department apparatus specifications include the following:

- Wheelbase: 297 inches
- Front axle to rear axle: 245 inches
- Front axle to rear axle: 295.5 inches
- Total length: 47 feet 6 inches
- Total width at front tires: 109 inches
- Total width (including mirrors): 122 inches
- Total height: 12 feet (IFC minimum overhead clearance is 13 feet 6 inches)
- Weight: 82,000 pounds

## EMERGENCY VEHICLE ACCESS

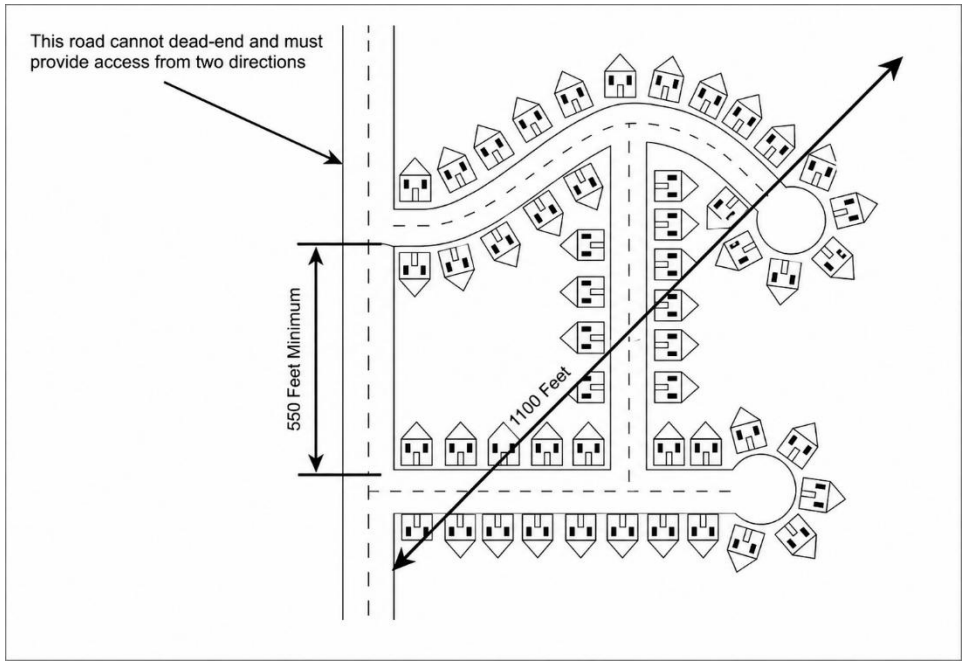
**Grade:**
Fire apparatus access roadway grades shall not exceed 10 percent. Intersections and turnarounds shall be level, except for crowning to facilitate water runoff.

**Traffic-Calming Devices**:
Traffic-calming devices must be approved by a Fire Code Official. This includes, but is not limited to, speed bumps, speed humps, speed cushions, traffic circles, and neckdowns

**Multiple Access Roads:**
Approved fire apparatus access roads are required for every facility, building, or portion of a building constructed or relocated within the jurisdiction. A minimum of two fire apparatus access roads shall be provided unless installation is not feasible due to property location, terrain, topography, waterways, non-negotiable grades, or similar constraints. In such cases, an approved alternative means of fire protection should be provided.

**Multiple Access Roads Separation:**
When two access roads are required, they shall be separated by a distance of at least one-half of the property's or area's maximum overall diagonal dimension, measured in a straight line between two access points. The Fire Code Official may approve a reduction in the required separation where all buildings served by the access roads are fully equipped throughout with an automatic sprinkler system, and site constraints prevent full compliance. **See Drawing 4 for Multiple Access Roads Separation.**

**Drawing 4: Multiple Access Roads Separation**




**Cul-de-Sac:**
If two fire apparatus access roads cannot be provided and a cul-de-sac exceeds 660 feet in length, all buildings located more than 660 feet from the entrance to the cul-de-sac (measured along the

roadway centerline) must be protected by an approved automatic fire sprinkler system. Within the City of Greeley, when commercial or residential structures are equipped with fire sprinkler systems, the Fire Marshal may approve a maximum cul-de-sac length of 1,000 feet before a second access is required.

**Bridges and Elevated Surfaces:**
When a bridge or elevated surface is part of a fire apparatus access road, whether public or private, it shall be constructed and maintained in accordance with the State of Colorado Department of Transportation and the American Association of State Highway and Transportation Officials Standard Specifications for Highway Bridges. Bridges and elevated structures shall be designed to support a live load sufficient to carry the imposed loads of fire apparatus. Vehicle load limits shall be posted at both entrances to bridges when required by the Fire Code Official. Where elevated surfaces designed for emergency vehicle use are adjacent to surfaces not designed for such use, approved barriers, approved signage, or both shall be installed and maintained when required by the Fire Code Official. The design engineer may be required to provide the Greeley Fire Department with written final approval of the bridge upon completion of construction. Maintenance of the bridge shall be the responsibility of the party(ies) using it for access to their property(ies). The Greeley Fire Department may, at any time and for cause, require a registered engineer to inspect the bridge for structural stability and soundness, at the expense of the property owner(s) served by the bridge.

**Gates:**
Gates securing fire apparatus roads shall comply with all the following:

- Minimum unobstructed width of 20 feet
- Gates serving one- or two-family dwellings shall be at least 12 feet wide
- Gates shall be set back at least 30 feet from the intersecting roadways and shall be of the swinging or sliding type
- Manual operation shall be capable of being performed by a single person
- Gate components shall always be maintained in an operable condition and replaced or repaired when defective
- Gates intended for automatic operation shall be designed, constructed, and installed in accordance with ASTM F 2200 requirements
- Electric gate operators, when required, shall be listed in accordance with UL 325
- Electric gates shall be equipped with a means for operation by fire department personnel with a Knox Key Switch - GFD will not accept access via a private keypad alone
- Manual opening gates shall not be padlocked unless they can be opened
- using forcible entry tools.
    - All locking devices must be approved by GFD
    - A Knox Padlock or Knox Box may be required to ensure rapid access for fire personnel

## EMERGENCY VEHICLE ACCESS

**Fire Apparatus Access Road Exception for Automatic Sprinkler Protection:**
When buildings are protected throughout by an approved automatic fire sprinkler system (NFPA 13, NFPA 13R, or NFPA 13D, as required by the IFC), the requirements for fire apparatus access may be modified upon the Fire Code Official’s approval.

## FIRE LINE INSTALLATION REQUIREMENTS

**Underground Fire Line Installation:**
Information should be provided regarding the appropriate Civil Drawings. All such work SHALL be performed by a contractor holding a current, valid permit and license to perform such work within the City of Greeley.

**A FIRE LINE PERMIT APPLICATION MUST BE COMPLETED AND SUBMITTED WITH PLANS TO THE GREELEY FIRE DEPARTMENT'S FIRE PREVENTION BUREAU.**

The plans shall be drawn to scale and include:

- The size and location of the city water main(s) supplying the underground fire line(s)
- The type, class, burial depth, and location of all new underground fire lines piping
- The location(s) and type of on-site fire hydrant(s)
- The location(s) of fire sprinkler(s) and/or standpipe riser(s), and monitor nozzles (if applicable), to be supplied by the underground fire line(s)

Location and distance dimensions shall be provided for all existing fire hydrants on city mains within 300 feet of the site property lines.

The plans shall indicate that underground fire lines are NOT located within retention basins or public utility easements.

A metallic warning tape shall be installed in accordance with the manufacturer’s instructions for every underground fire line.

The plans include the appropriate fire line connection detail for backflow prevention assemblies, underground check valves, and fire department connections (FDC).

Street valve box/boxes for fire line(s) shall have a FIRE lid installed. Once installed, the Fire Line shall undergo a visual inspection and a pressure test by the Greeley Fire Department’s Fire Prevention Bureau.


**ALL DUCTILE IRON, RETAINING RODS, AND NON-CORROSIVE RESISTANT COMPONENTS SHALL BE EXTERNALLY COATED FOR CORROSION OR POLY WRAPPED.**

# FIREFIGHTING WATER SUPPLY

**Multi-Family and Commercial Buildings Fire Flow:**
The minimum required fire flow and flow duration for buildings other than one- and two-family dwellings shall be determined in accordance with Appendix B and Tables B105.1 and B105.2 (see the following page), as adopted in the local amendments. The required fire flow for a building shall not exceed the available water supply, in gallons per minute (GPM), at 20 psi in the water delivery system.

**EXCEPTION: A REDUCTION IN REQUIRED FIRE FLOW OF UP TO 25 PERCENT, AS APPROVED, IS ALLOWED IF THE BUILDING IS EQUIPPED WITH AN APPROVED AUTOMATIC FIRE SPRINKLER SYSTEM INSTALLED IN ACCORDANCE WITH 903.3.1.1 OR 903.3.1.2. THE RESULTING FIRE FLOW SHALL NOT BE LESS THAN 1,500 GPM FOR THE PRESCRIBED DURATION SPECIFIED IN TABLE B105.1**.

**Fire Flow Requirements for One- and Two-Family Dwellings, Group R-3 and R-4 Buildings, and Townhouses:**

In urban fire flow areas, the minimum fire flow and flow duration requirements for one- and two-family dwellings, Group R-3 and R-4 buildings, and townhouses up to 3,600 square feet in area shall be 1,000 gpm for 1 hour. In rural fire flow areas, the minimum fire flow and flow duration shall be 500 gpm for 1 hour for one and two-family dwellings, Group R-3 and R-4, and townhomes with less than 3,600 square feet in area. For any one and two-family dwellings, Group R-3 and R-4, and townhouses exceeding 3,600 square feet in area, regardless of location, the minimum fire flow and flow duration requirements shall be as specified in Table B105.1.

**EXCEPTION: THE FIRE CODE OFFICIAL IS AUTHORIZED TO REDUCE THE MINIMUM REQUIRED FIRE FLOW AND DURATION FOR ONE- AND TWO-FAMILY DWELLINGS, GROUP R-3 AND R-4 BUILDINGS, AND TOWNHOUSES PROTECTED BY AN APPROVED AUTOMATIC SPRINKLER SYSTEM.**

**Calculation of the Fire Flow:**
The required fire flow for the site shall be calculated and shown on the site plan. Verification of the needed fire flow (NFF) is available on site. (IFC TABLES B105.2, B105.1, and B105.1).

**Fire Flow Testing:**
To schedule hydrant flow testing, contact the City of Greeley Water Department at 970-350-9805. Approved test documentation shall be submitted to the Greeley Fire Department prior to final approval of the water supply system.

**Fire Flow Water Availability:**
When the project includes a new structure or an increase in the floor area of an existing structure, applicants shall provide documentation of a fire hydrant flow test or flow test modeling demonstrating water availability from the local water purveyor. For commercial tests shall be conducted at a fire hydrant within 300 feet; for residential development, within 600 feet. Flow tests will be accepted if performed within one year, provided no adverse modifications have been made to the water supply system.

# FIREFIGHTING WATER SUPPLY

## TABLE B 105.1

### Area, Fire Flow, and Duration

| FIRE-FLOW CALCULATION AREA (square feet) | | | | | FIRE-FLOW (gallons per minute)[b] | FLOW DURATION (hours) |
|---|---|---|---|---|---|---|
| Type IA and IB[a] | Type IIA and IIIA[a] | Type IV and V-A[a] | Type IIB and IIIB[a] | Type V-B[a] | | |
| 0-22,700 | 0-12,700 | 0-8,200 | 0-5,900 | 0-3,600 | 1,500 | 2 |
| 22,701-30,200 | 12,701-17,000 | 8,201-10,900 | 5,901-7,900 | 3,601-4,800 | 1,750 | |
| 30,201-38,700 | 17,001-21,800 | 10,901-12,900 | 7,901-9,800 | 4,801-6,200 | 2,000 | |
| 38,701-48,300 | 21,801-24,200 | 12,901-17,400 | 9,801-12,600 | 6,201-7,700 | 2,250 | |
| 48,301-59,000 | 24,201-33,200 | 17,401-21,300 | 12,601-15,400 | 7,701-9,400 | 2,500 | |
| 59,001-70,900 | 33,201-39,700 | 21,301-25,500 | 15,401-18,400 | 9,401-11,300 | 2,750 | |
| 70,901-83,700 | 39,701-47,100 | 25,501-30,100 | 18,401-21,800 | 11,301-13,400 | 3,000 | 3 |
| 83,701-97,700 | 47,101-54,900 | 30,101-35,200 | 21,801-25,900 | 13,401-15,600 | 3,250 | |
| 97,701-112,700 | 54,901-63,400 | 35,201-40,600 | 25,901-29,300 | 15,601-18,000 | 3,500 | |
| 112,701-128,700 | 63,401-72,400 | 40,601-46,400 | 29,301-33,500 | 18,001-20,600 | 3,750 | |
| 128,701-145,900 | 72,401-82,100 | 46,401-52,500 | 33,501-37,900 | 20,601-23,300 | 4,000 | 4 |
| 145,901-164,200 | 82,101-92,400 | 52,501-59,100 | 37,901-42,700 | 23,301-26,300 | 4,250 | |
| 164,201-183,400 | 92,401-103,100 | 59,101-66,000 | 42,701-47,700 | 26,301-29,300 | 4,500 | |
| 183,401-203,700 | 103,101-114,600 | 66,001-73,300 | 47,701-53,000 | 29,301-32,600 | 4,750 | |
| 203,701-225,200 | 114,601-126,700 | 73,301-81,100 | 53,001-58,600 | 32,601-36,000 | 5,000 | |
| 225,201-247,700 | 126,701-139,400 | 81,101-89,200 | 58,601-65,400 | 36,001-39,600 | 5,250 | |
| 247,701-271,200 | 139,401-152,600 | 89,201-97,700 | 65,401-70,600 | 39,601-43,400 | 5,500 | |
| 271,201-295,900 | 152,601-166,500 | 97,701-106,500 | 70,601-77,000 | 43,401-47,400 | 5,750 | |
| 295,901-Greater | 166,501-Greater | 106,501-115,800 | 77,001-83,700 | 47,401-51,500 | 6,000 | |
| — | — | 115,801-125,500 | 83,701-90,600 | 51,501-55,700 | 6,250 | |
| — | — | 125,501-135,500 | 90,601-97,900 | 55,701-60,200 | 6,500 | |
| — | — | 135,501-145,800 | 97,901-106,800 | 60,201-64,800 | 6,750 | |
| — | — | 145,801-156,700 | 106,801-113,200 | 64,801-69,600 | 7,000 | |
| — | — | 156,701-167,900 | 113,201-121,300 | 69,601-74,600 | 7,250 | |
| — | — | 167,901-179,400 | 121,301-129,600 | 74,601-79,800 | 7,500 | |
| — | — | 179,401-191,400 | 129,601-138,300 | 79,801-85,100 | 7,750 | |
| — | — | 191,401-Greater | 138,301-Greater | 85,101-Greater | 8,000 | |

For SI: 1 square foot = 0.0929 $m^2$, 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.

a. Types of construction are based on the *International Building Code*.

b. Measured at 20 psi residual pressure.

**B105.2 Buildings other than one- and two-family dwellings.**

The minimum fire-flow and flow duration for buildings other than one- and two-family *dwellings* shall be as specified in Table B105.1.

## TABLE B105.2

### Required Fire Flow for Buildings Other Than One- and Two-Family Dwellings, Group R-3 and R-4 Buildings, and Townhouses

| AUTOMATIC SPRINKLER SYSTEM (Design standard) | MINIMUM FIRE FLOW (gallons per minute) | FLOW DURATIONS (hours) |
|---|---|---|
| No automatic sprinkler system | Value in Table B105.1 | Duration in Table B105.1 |
| Section 903.1.1 of the International Fire Code | 25% of the value in Table B105.1[a] | Duration in Table B105.1 at the reduced flow rate |
| Section 903.3.1.2 of the International Fire Code | 25% of the value in Table B105.1[b] | Duration in Table B105.1 at the reduced flow rate |

a. The reduced fire flow shall not be less than 1,000 gallons per minute.

b. The reduced fire flow shall not be less than 1,500 gallons per minute.

# FIREFIGHTING WATER SUPPLY

## Fire Hydrant Location & Spacing

Where streets have median dividers that prevent firefighters from crossing with hose lines, or where streets are designated as arterial roadways, fire hydrants shall be spaced at an average of 350 feet on each side of the street and installed on an alternating basis.

Where new water mains are extended along streets that do not require hydrants for building protection or other similar fire hazards, fire hydrants shall be installed at intervals not exceeding 1,000 feet to provide protection for transportation-related hazards.

For buildings equipped with a Fire Department Connection (FDC), a fire hydrant shall be located within 150 feet of the FDC, measured along an approved, unobstructed route. The hydrant and FDC shall be located on the same side of the fire apparatus access road or parking lot drive aisle, unless otherwise approved by the Fire Code Official.

**Minimum number of hydrants shall be as follows:**

TABLE C102.1
REQUIRED NUMBER AND SPACING OF FIRE HYDRANTS[h]

| FIRE-FLOW REQUIREMENT (gpm) | MINIMUM NUMBER OF HYDRANTS | AVERAGE SPACING BETWEEN HYDRANTS[a, b, c, f, g] (feet) | MAXIMUM DISTANCE FROM ANY POINT ON STREET OR ROAD FRONTAGE TO A HYDRANT[d, f, g] |
|---|---|---|---|
| 1,750 or less | 1 | 500 | 250 |
| 1,751–2,250 | 2 | 450 | 225 |
| 2,251–2,750 | 3 | 450 | 225 |
| 2,751–3,250 | 3 | 400 | 225 |
| 3,251–4,000 | 4 | 350 | 210 |
| 4,001–5,000 | 5 | 300 | 180 |
| 5,001–5,500 | 6 | 300 | 180 |
| 5,501–6,000 | 6 | 250 | 150 |
| 6,001–7,000 | 7 | 250 | 150 |
| 7,001 or more | 8 or more[e] | 200 | 120 |

For SI: 1 foot = 304.8 mm, 1 gallon per minute = 3.785 L/m.

a. Reduce by 100 feet for dead-end streets or roads.

b. Where streets are provided with median dividers that cannot be crossed by fire fighters pulling hose lines, or where arterial streets are provided with four or more traffic lanes and have a traffic count of more than 30,000 vehicles per day, hydrant spacing shall average 500 feet on each side of the street and be arranged on an alternating basis.

c. Where new water mains are extended along streets where hydrants are not needed for protection of structures or similar fire problems, fire hydrants shall be provided at spacing not to exceed 1,000 feet to provide for transportation hazards.

d. Reduce by 50 feet for dead-end streets or roads.

e. One hydrant for each 1,000 gallons per minute or fraction thereof.

f. A 50-percent spacing increase shall be permitted where the building is equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1 of the *International Fire Code*.

g. A 25-percent spacing increase shall be permitted where the building is equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.2 or 903.3.1.3 of the *International Fire Code* or Section P2904 of the *International Residential Code*.

h. The fire code official is authorized to modify the location, number and distribution of fire hydrants based on site-specific constraints and hazards.

**Consideration for Locating Hydrants:**
Existing hydrants in the area may be counted toward the required number of hydrants as approved. Hydrants on adjacent properties shall not be considered available unless fire apparatus access roads extend between properties and easements are established to prevent obstructions of those roads.

## FIREFIGHTING WATER SUPPLY

Hydrants separated from the subject building by railroad tracks, bridges, arterial streets, or differing grades shall not count toward the required number of hydrants unless approved by the Fire Code Official.
Hydrants separated from the subject building by interstate highways or divided highways shall not count toward the required number of hydrants.

**Physical Protection:**
Where fire hydrants are subject to impact from motor vehicles, guard posts, bollards, or other approved means of protection shall be provided.

**Undeveloped Areas:**
Where new water mains are extended along streets where hydrants are not required to protect structures or similar hazards, hydrants shall be installed at intervals not exceeding 1,000 feet to address transportation hazards.

**Fire Department Connection:**
Sprinkler and standpipe Fire Department Connections (FDCs) shall consist of a 5-inch Storz connection with a 30-degree downward bend for NFPA 13 systems, or a single 2.5-inch connection for NFPA 13R systems. Hydrants and FDCs shall be located on the same side of the fire apparatus access roadway as the building being protected. The location of the FDC shall be approved by the Fire Code Official.

**Fire Hydrant Proximity to Fire Department Connection:**
A fire hydrant shall be located within 150 feet of an automatic sprinkler or a standpipe Fire Department Connection (FDC).
FDC Signage Required:

A permanent sign shall be installed at the FDC indicating “fire sprinkler,” “sprinkler and standpipe,” or “standpipe,” as applicable. Where an FDC serves multiple addresses and/or only portions of a building (such as a basement or a standpipe), additional permanent signage shall be installed to identify the areas served by the FDC.

- **Height:** The letters "FDC" must be at least 6 inches tall, and other words must be at least 2 inches tall
- **Mounting:** The sign must be mounted on the building's street side
- **Arrow:** FDC signs with arrows are required to indicate the location of the fire department connection
- **Approval:** The sign must be approved by the Fire Code Official
- **Visibility:** The sign must always remain unobstructed to ensure it is visible to the fire apparatus

## FIREFIGHTING WATER SUPPLY


# ADDRESSING

**Approved Street Names in the City of Greeley:**
The City of Greeley's Municipal Code designates street-name categories for the city's geographic areas.
These requirements can be found in Sections 18-93 through 18-124:
MUNICODE

**Premises Identification:**
New and existing buildings shall be provided with approved address numbers, building numbers, or other approved building identification, placed so they are clearly legible and visible from the street or road fronting the property. The numbers shall contrast with the background. Address numbers shall consist of Arabic numerals or letters. Numbers shall be of a minimum size and stroke width appropriate to the structure's size. Where access is by means of a private road and the building cannot be viewed from the public way, a monument, pole, sign, or other approved means shall be used to identify the structure.

**Addressing and Premises Identification Requirements:**
New and existing buildings or facilities shall be provided with approved address identification. Address identification shall be legible and positioned so it is clearly visible from the street or road fronting the property. Address identification characters shall contrast with the background. Address numerals shall consist of Arabic numbers, and street names, when required to be displayed with the numerals, shall consist of letters. Numbers shall not be spelled out using letters. Address identification shall be maintained.

- Addresses shall be assigned by the governmental entity with jurisdiction (the City of Greeley or Weld County) and shall comply with the City of Greeley Street Naming and Addressing Standards.
- Approved address numerals shall be visible from the street fronting the property and posted against a contrasting background. Bronze or brass numerals shall not be mounted on a brick background.
- Address numerals for commercial or industrial buildings shall be installed at a height clearly visible from the street. Where required by the Fire Code Official, address identification shall be provided at additional approved locations to facilitate emergency response.
- When access is provided by a private road and the building is not visible from the public way, a monument, pole, sign, or other approved means shall be used to identify the structure.
- Commercial or multifamily buildings shall have address numerals with a minimum height of 6 inches and a minimum stroke width of 1/2 inch. Buildings three or more stories tall, or with a total floor area of 15,000 to 50,000 square feet, shall have numerals with a minimum height of 8 inches and a minimum stroke width of 1 inch. Buildings with a total floor area of 50,000 square feet or greater shall have numerals with a minimum height of 12 inches and a minimum stroke width of 1.5 inches.

## ADDRESSING

- Residential buildings with no more than two dwelling units shall have address numerals at least 4 inches tall and at least 1/2 inch in stroke width.
- Individual suite or unit addresses shall be displayed with numerals having a minimum height of 4 inches and a minimum stroke width of 1/2 inch.
- Monument signs shall not be used in place of address numerals on the building.
- Buildings with multiple suites, apartments, or units shall have each suite, apartment, or unit assigned an individual identification number in an approved sequential order. Suites, apartments, or units on the first floor shall be identified by numbers in the 100 or 1000 series; those on the second floor shall be identified by numbers in the 200 or 2000 series; those on the third floor shall be identified by numbers in the 300 or 3000 series. Higher floors shall follow the same numbering scheme. Floors below grade shall be identified with numerals in the 0100 series for the first floor below grade and the 0200 series for the second floor below grade; additional lower floors shall follow the same numbering pattern.
- Buildings, whether individually or as part of a multi-building complex, that have emergency access lanes on sides other than the side facing the addressed street may be required to display address numerals and the street name on each side that fronts the fire lane(s).
- Buildings addressed on one street but accessible from an adjoining street may be required to display address numerals and the street name on each side that is adjacent to the other street(s).
- Approved signage shall be provided in conspicuous locations on or within buildings to clearly direct responders to any suite, apartment, or unit within the building.
- Multiple-building complexes shall be provided with approved signage, as necessary, to direct first responders to individual buildings.

**Street or Road Signs:**
Streets and roads shall be identified with approved signage. Temporary signs shall be installed at each street intersection when construction of new roadways allows vehicle access. Signs shall be of an approved size, weather-resistant, and maintained until replaced by permanent signage.

# KEY BOXES

### Knox Boxes - When Required:

Where access to or within a structure or area is restricted by secured openings, or where immediate access is necessary for life safety or firefighting purposes, the Fire Code Official is authorized to require the installation of a key box in an accessible location. The key box shall be of an approved type, listed in accordance with UL 1037, and shall contain keys necessary to provide access as required by the Fire Code Official.

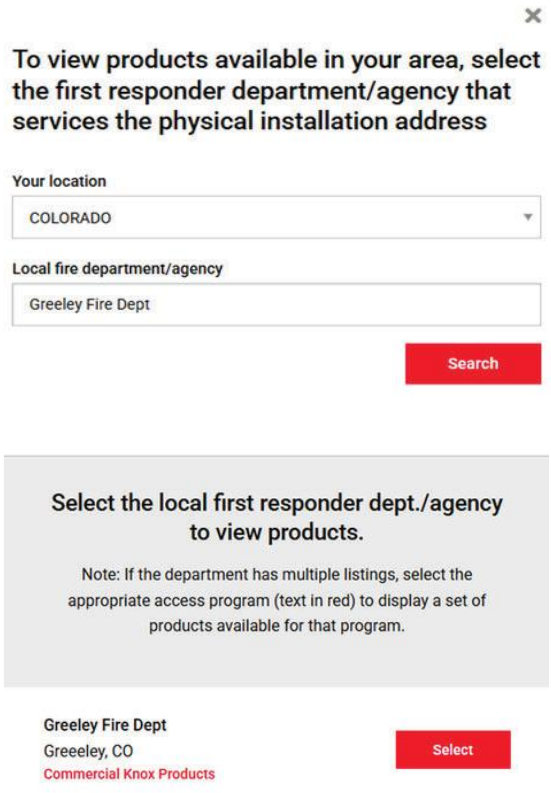
### Locations:

The Greeley Fire Department shall designate the approved location(s) for Knox box installation. More than one Knox box may be required based on the size or use of the structure. The number of required Knox boxes shall be determined during site or building permit review. The top of the key box shall be installed 60 to 72 inches above finished grade.

### Information regarding Knox products or ordering can be found at:

KNOXBOX

- **Choose state: Colorado**
- **Choose fire department: Greeley Fire Department**
- **Search will prompt to confirm the Greeley Fire Department**




- **Select will provide all the available products associated with the Greeley Fire Department**

# PUBLIC SAFETY RADIO AMPLIFICATION SYSTEM

### Emergency Responder Radio Coverage:

All new buildings shall be provided with approved radio coverage for emergency responders within the building, based on the existing coverage levels of the jurisdiction’s public safety communication systems, as required by Chapter 5 of the IFC. Existing buildings shall be provided with approved radio coverage for emergency responders as required by Chapter 11 of the IFC. Buildings and structures that cannot support the required level of radio coverage shall be equipped with a radiating cable system, a distributed antenna system with Federal Communications Commission (FCC)-certified signal boosters, or other systems approved by the Fire Code Official to achieve the required level of coverage. Public safety radio amplification systems shall be designed and installed in accordance with the criteria specified in the IFC.

# HAZARDOUS MATERIALS ANALYSIS

**Hazardous Materials Impact Statement:**

Proposed structures that contain materials posing a health or physical hazard (as defined in the IFC), and that are used, stored, or handled on site, shall have a Hazardous Materials Impact Statement (HMIS) completed and submitted to GFD at the time of building permit application. The analysis shall be prepared by a licensed design professional in accordance with Chapter 50 – General Provisions/Hazardous Materials, Appendix E Hazard Categories, and Tables 5003.1.1(1) through 5003.1.1(4).

**The HMIS shall include the following:**

- Product name
- Component
- Chemical Abstract Service (CAS) number
- Location where stored or used
- Container size
- Hazard classification
- Amount in storage (stored only, not in use)
- Amount in use – closed systems (no vapors escaping to the atmosphere)
- Amount in use – open systems (vapors escape to the atmosphere)
- Maximum Allowable Quantity (MAQ)
- MAQ exceeded (Yes or No)

**Hazmat Design Worksheets:**

**The Greeley Fire Department provides worksheets to assist design professionals in submitting required hazardous materials information. These worksheets are based on four tables in Chapter 50 of the IFC and provide guidance on determining the occupancy group for the structure or specific areas.**

**The worksheets can be accessed via the Excel link below:**

**GFD WORKSHEET C**

## REQUIREMENTS DURING CONSTRUCTION & DEMOLITION

### Vehicle Access and Water Supply During Construction:

When fire apparatus access roads or a water supply for fire protection is required, such protection should be installed and made serviceable prior to and during construction, unless approved alternative methods of protection are provided. Approved vehicle access shall be provided to all construction and demolition sites. Vehicle access shall extend to within 100 feet of temporary or permanent Fire Department Connections (FDCs). Access shall be provided by either temporary or permanent roads capable of supporting vehicle loads under all weather conditions. Vehicle access shall be maintained until permanent fire apparatus access roads are available. An approved water supply for fire protection, either temporary or permanent, shall be available as soon as combustible materials arrive on site.

### Temporary Address Sign:

Temporary address sign(s), including both numeric address and street name, shall be installed at the entrance to construction sites in a manner that is readily visible to vehicle traffic. Numerals and letters shall be of sufficient size and contrasting color to be visible from the street.

### Standpipes:

In buildings required to have standpipes in accordance with Section 905, not less than one standpipe shall be provided for use by the fire department during construction. Standpipes shall be installed when the progress of construction reaches not more than 40 feet in height above the lowest level of fire department vehicle access. Fire department connections should be provided at accessible locations adjacent to usable stairways. Standpipes shall be extended as construction progresses to within one floor of the highest point of construction, with decking or flooring secured. Standpipes shall be installed in accordance with Sections 905 and 3314 of the IFC.

**ADDITIONAL REQUIREMENTS ARE SET FORTH IN IFC CHAPTER 33 – FIRE SAFETY DURING CONSTRUCTION AND DEMOLITION.**

# APPENDIX A

# FIRE PROTECTION SIGNAGE

## A.1 Electrical Control Panel Rooms

Doors to electrical control panel rooms shall be marked with a clearly visible and legible sign stating “ELECTRICAL ROOM” or similar approved wording.




## A.2 Fire Alarm Control Panel (FACP)

“FIRE ALARM CONTROL PANEL” or “FACP” – NFPA 72 (2007 ed.), Section 4.4.6.3. Rooms containing the fire alarm control panel shall be provided with 4-inch-high by 6-inch-wide signs bearing 0.5-inch-thick white reflective letters on a red background. The sign shall be provided on the door leading to the fire alarm control panel(s) unless otherwise approved by the Office of the Fire Marshal.


## Fire Sprinkler Riser Room

“SPRINKLER CONTROL ROOM”: 2007 ed. NFPA 13, Sections 6.7.4 and 7.7.1.5: Rooms containing the “FIRE SPRINKLER RISER ROOM” shall be provided with signage measuring 4 inches high by 6-inches-wide, with a 0.5-inch letter stroke, in white reflective letters on a red background, and shall be provided on the door leading to the Sprinkler Riser Room unless otherwise approved by the Office of the Fire Marshal.



## Combined Fire Alarm & Sprinkler Control Room

If the sprinkler riser/control valve and the fire alarm control panel are in the same room, the sign should read “FIRE ALARM & SPRINKLER CONTROL ROOM or “FACP & SPRINKLER CONTROL ROOM.”


## Fire Pumps and Piping

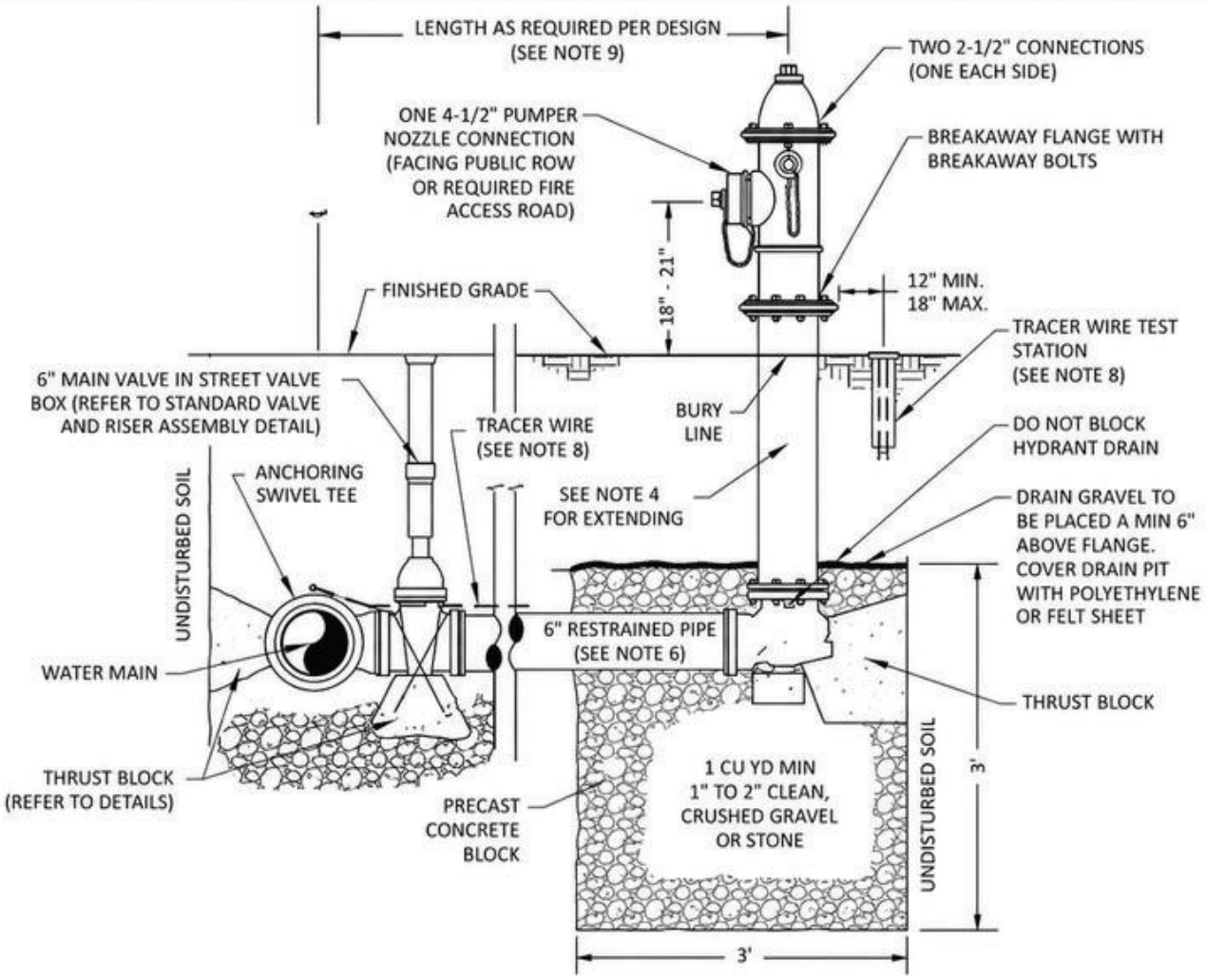
Rooms containing the “FIRE PUMP ROOM” shall be provided with signage that measures 4 inches high by 6 inches wide, with a 0.5-inch letter stroke, using white reflective letters on a red background, and shall be permanently attached to the interior of the door of the Sprinkler Riser room at normal eye level.

The sign shall be provided on the door leading to the pump room unless otherwise approved by the Office of the Fire Marshal.

# APPENDIX B

# FIRE LINE AND THRUST BLOCK REQUIREMENTS

# FIRE HYDRANT ASSEMBLY




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 SUPPLIED BY CONTRACTOR AND SHALL BE IN ACCORDANCE WITH WATER & SEWER DEPARTMENT (W&S) CONSTRUCTION SPECIFICATIONS AND APPROVED MANUFACTURERS.
4. ONLY A SINGLE FIRE HYDRANT EXTENSION IS PERMITTED. FIRE HYDRANT EXTENSION MAY BE UP TO 36" (MAX) PER WATER & SEWER SPECIFICATIONS (W&S).
5. GRADELOCK EXTENSIONS WILL BE ALLOWED FOR UP TO 2' MAXIMUM ELEVATION ADJUSTMENTS. ANY OTHER EXTENSIONS MUST BE APPROVED BY W&S DEPARTMENT.
6. ALL BURIED VALVES, FITTINGS, AND APPURTENANCES SHALL BE RESTRAINED AND INSTALLED PER W&S SPECIFICATIONS, LATEST REVISION.
7. ONLY D.I.P. IS ACCEPTABLE FOR HYDRANT LATERAL PIPE MATERIAL.
8. BEDDING AND BACKFILL SHALL BE PLACED PER W&S SPECIFICATIONS.
9. INSTALL TEST STATION AND TRACER WIRE ACCORDING TO W&S SPECIFICATIONS AND UTILITY LOCATING ("UL") STANDARD DETAILS, LATEST REVISION OF EACH.
10. HYDRANT DISTANCE FROM MAIN SHALL BE SUCH THAT THE MINIMUM FIRE FLOW AND PRESSURE MEETS WATER & SEWER DESIGN CRITERIA, LATEST REVISION. THE MAXIMUM DISTANCE A HYDRANT MAY BE FROM THE MAIN SHALL NOT EXCEED 150 FT UNLESS FURTHER HYDRAULIC ANALYSIS IS PERFORMED AND APPROVED BY THE CITY OF GREELEY WATER & SEWER DEPARTMENT.

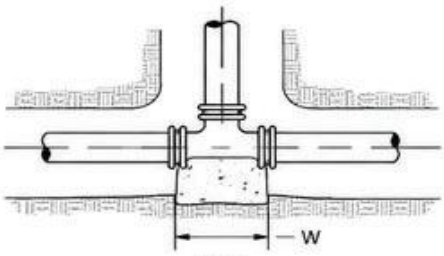
City of Greeley Colorado

FIRE HYDRANT ASSEMBLY

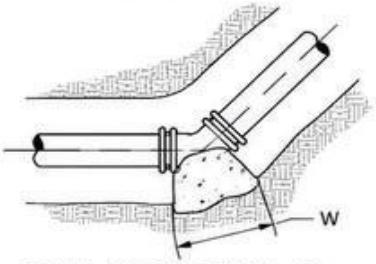
DETAIL W-1

DATE: JULY 2024 SCALE: N.T.S.

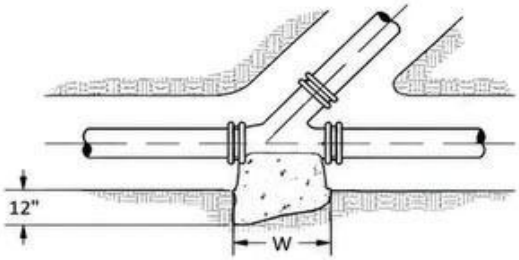
# HORIZONTAL THRUST BLOCKS



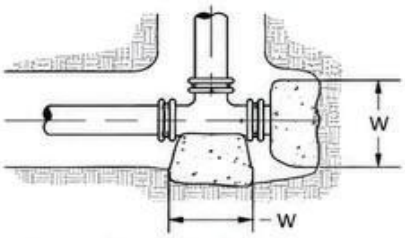

TEE



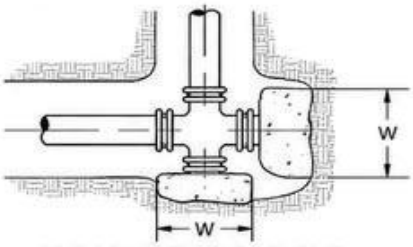

BEND–HORIZONTAL OR BOTTOM OF VERTICAL



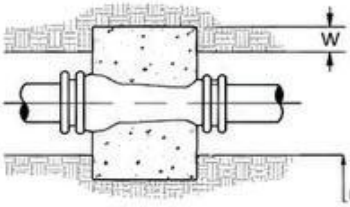

WYE




TEE W/DEAD END ON RUN

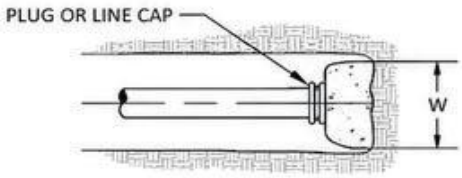



CROSS WITH DEAD END BRANCHES

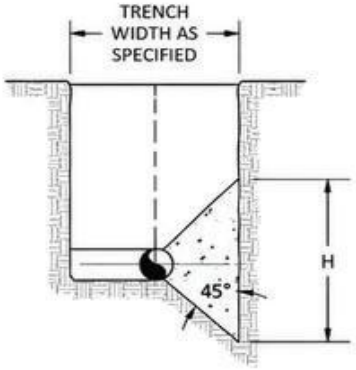



REDUCER

UNDISTURBED EARTH VARIES REFER TO EQUATION ON DETAIL W-4




DEAD END




SECTION (TYPICAL)

NOTES:

1. SEE TABLE ON W-2B 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.

City of Greeley Colorado

HORIZONTAL THRUST BLOCKS

DETAIL W-2A

DATE: JULY 2024

SCALE: N.T.S.

# HORIZONTAL THRUST BLOCKS

## THRUST BLOCK BEARING AREAS (SQ-FT) FOR INTERNAL STATIC PRESSURE OF 150 PSI, DIP I.D., SOIL BEARING CAPACITY OF 1000 PSF AND 1.5 SAFETY FACTOR (S.F.)

| PIPE SIZE | 90° BEND | 45° BEND | 22½° BEND | 11¼° BEND | DEAD ENDS, VALVES & TEES, PLUGGED CROSS BRANCHES |
|---|---|---|---|---|---|
| 4" | 3.3 | 2.5 | 1.3 | 0.6 | 3.3 |
| 6" | 10.2 | 5.5 | 2.8 | 1.4 | 7.2 |
| 8" | 18.3 | 9.9 | 5.0 | 2.5 | 12.9 |
| 12" | 39.9 | 21.6 | 11.0 | 5.5 | 28.2 |
| 16" | 70.5 | 38.2 | 19.5 | 9.8 | 49.9 |
| 20" | SPECIAL DESIGN REQUIRED | | | | |
| 24" | | | | | |

UNDISTURBED EARTH [FT²] = W [FT] X H [FT]

THRUST FORCE FOR REDUCERS [LB] =TEST PRESSURE [PSI] X ($A_{LARGE}$ [IN²] - $A_{SMALL}$ [IN²])

$\therefore$ GRAVITY BLOCK SIZE FOR REDUCERS [FT²] =0.225 X ($A_{LARGE}$ [IN²] - $A_{SMALL}$ [IN²])

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 2500 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. NO LESS THAN 150 PSI TEST PRESSURE SHALL BE USED FOR THRUST BLOCK CALCULATIONS.
7. BEARING AREAS FOR ANY PRESSURE AND SOIL BEARING CAPACITY MAY BE OBTAINED BY MULTIPLYING THE TABULATED BEARING AREAS BY A CORRECTION FACTOR "F":

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

8. EXAMPLE: CALCULATE THE BEARING AREA FOR 8"-90° BEND WITH A TEST PRESSURE OF 200 PSI AND SOIL BEARING CAPACITY OF 3000 PSF.

FROM TABLE BEARING AREA = 18.3 SF

$$F = \frac{(200\ \text{PSI})/(150\ \text{PSI})}{(3000\ \text{PSF})/(1000\ \text{PSF})} = 0.44$$

REQUIRED BEARING AREA ON UNDISTURBED SOIL = (0.44)(18.3 SF) = 8.1 SF

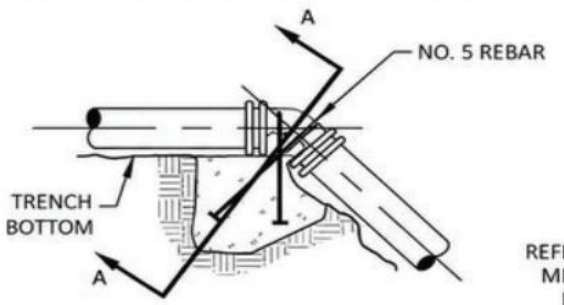
City of Greeley Colorado

HORIZONTAL THRUST BLOCKS

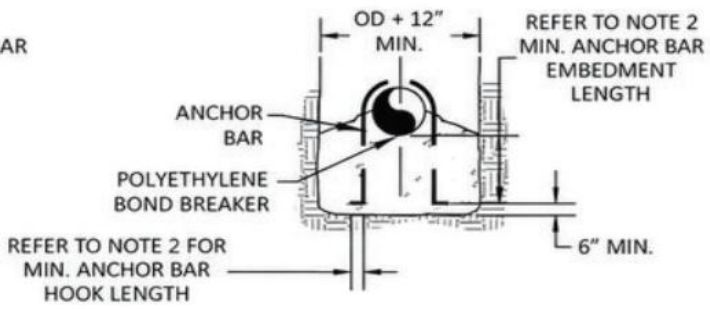
DETAIL W-2B

DATE: JULY 2024 SCALE: N.T.S.

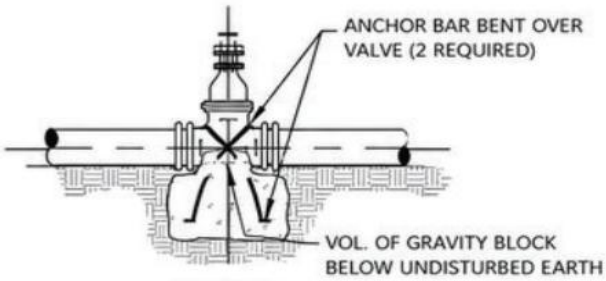
# GRAVITY THRUST BLOCKS



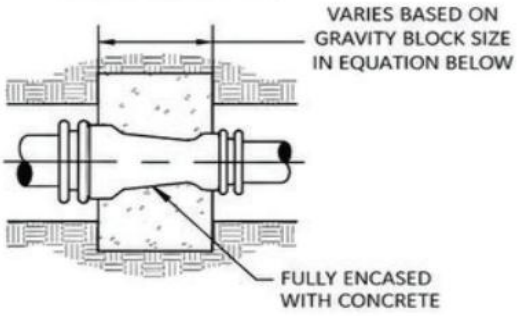

TOP OF VERTICAL BEND




SECTION A-A




VALVE
(GATE OR BUTTERFLY)




REDUCER

VOL. OF GRAVITY CONCRETE BLOCK (CU FT)

| PIPE SIZE | BENDS | | |
|---|---|---|---|
| | 45° | 22½° | 11¼° |
| 4" | 16.7 | 8.5 | 4.3 |
| 6" | 36.9 | 18.8 | 9.5 |
| 8" | 65.9 | 33.6 | 16.9 |
| 12" | 144.1 | 73.4 | 36.9 |
| 16" | 254.5 | 129.7 | 65.2 |
| 20" | SPECIAL DESIGN REQUIRED | | |
| 24" | | | |

NOTES:

1. POLYETHYLENE BOND BREAKER SHALL BE INSTALLED BETWEEN ALL FITTINGS AND CONCRETE.
2. ALL ANCHOR BARS SHALL BE EPOXY COATED NO. 5 REBAR AND SHALL BE EMBEDDED IN CONCRETE TO WITHIN 6" OF END OF CONCRETE BLOCK AND SHALL HAVE MINIMUM 6" HOOK LENGTH.

GRAVITY CONCRETE BLOCK SIZES SHOWN IN TABLE ARE BASED ON 150 LB/FT$^3$ DENSITY FOR CONCRETE, 150 PSI TEST PRESSURE, AND A SAFETY FACTOR OF 1.5.

$$\text{GRAVITY BLOCK SIZE [FT}^3\text{]} = \frac{\text{SAFETY FACTOR X THRUST FORCE [LB]}}{\text{DENSITY OF BLOCK MATERIAL [LB/FT}^3\text{]}}$$

$$\text{THRUST FORCE FOR REDUCERS [LB]} = \text{TEST PRESSURE [PSI]} \times (A_{LARGE}\ [\text{IN}^2] - A_{SMALL}\ [\text{IN}^2])$$

$$\therefore\ \text{GRAVITY BLOCK SIZE FOR REDUCERS [FT}^3\text{]} = 1.5 \times (A_{LARGE}\ [\text{IN}^2] - A_{SMALL}\ [\text{IN}^2])$$

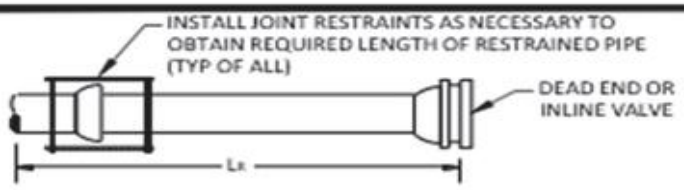
City of Greeley Colorado

GRAVITY THRUST BLOCKS

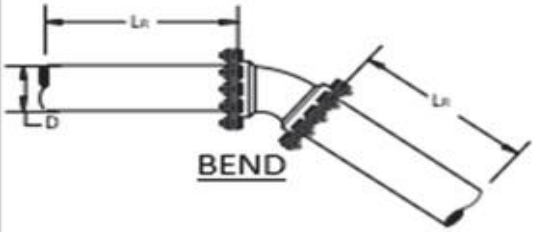
DETAIL W-3

DATE: JULY 2024 SCALE: N.T.S.

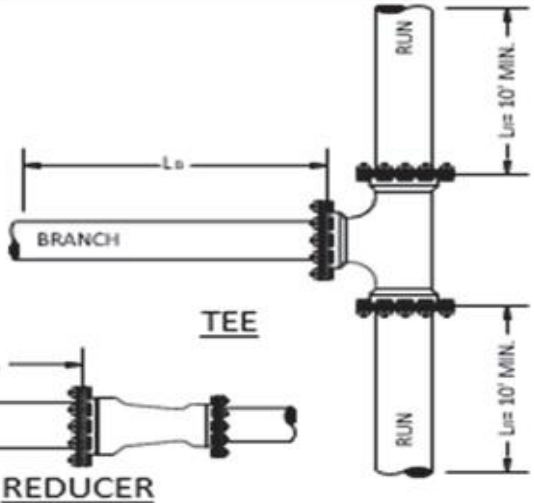
# HORIZONTAL PIPE RESTRAINT




DEAD ENDS OR INLINE VALVES




BEND




REDUCER

| DI PIPE (POLYETHYLENE-ENCASED): MINIMUM LENGTHS OF RESTRAINED PIPE - IN FEET | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| PIPE SIZES (D") | | BENDS ($L_R$) | | | | TEE ($L_B$) | DEAD ENDS/ INLINE VALVES ($L_R$) | REDUCERS ($L_{RD}$) |
| RUN | BRANCH | 11¼° BEND | 22½° BEND | 45° BEND | 90° BEND | | | |
| 4" | 4" | 5 | 5 | 10 | 15 | 5 | 50 | - |
| 6" | 4" | - | - | - | - | 5 | - | 40 |
| | 6" | 5 | 5 | 10 | 20 | 5 | 70 | - |
| 8" | 4" | - | - | - | - | 5 | - | 65 |
| | 6" | - | - | - | - | 5 | - | 40 |
| | 8" | 5 | 10 | 15 | 30 | 15 | 90 | - |
| 12" | 4" | - | - | - | - | 5 | - | 115 |
| | 6" | - | - | - | - | 5 | - | 95 |
| | 8" | - | - | - | - | 5 | - | 70 |
| | 12" | 5 | 10 | 20 | 40 | 55 | 130 | - |
| 16" | 4" | - | - | - | - | 5 | - | 155 |
| | 6" | - | - | - | - | 5 | - | 140 |
| | 8" | - | - | - | - | 5 | - | 120 |
| | 12" | - | - | - | - | 24 | - | 70 |
| | 16" | 5 | 10 | 20 | 50 | 90 | 165 | - |

NOTES:

1. RESTRAINED LENGTHS SHOWN IN CHARTS ARE MINIMUM LENGTHS.
2. RESTRAINT SYSTEMS ON PIPE LARGER THAN 16-INCH DIAMETER SHALL BE DESIGNED FOR CONDITIONS EXISTING AT INSTALLATION SITE.
3. THE CHARTS ARE BASED ON THE FOLLOWING ASSUMPTIONS:
   A. 150 PSI TEST PRESSURE
   B. 1.5 SAFETY FACTOR
   C. 4-FT BURY DEPTH
   D. SOIL TYPE: ML, AS DEFINED BY AWWA M23 AND M41
   E. TRENCH TYPE: #4, AS DEFINED BY AWWA M23 AND M41.
4. THE DESIGN ENGINEER IS RESPONSIBLE FOR VERIFYING THE ACTUAL SITE CONDITIONS WITH RESPECT TO THE ASSUMPTIONS LISTED ABOVE.
5. IF LENGTHS CANNOT BE MET FOR DEAD ENDS AND/OR TEES, DESIGN ENGINEER SHALL SPECIFY RESTRAINED LENGTHS OR A COMBINATION OF THRUST BLOCKS AND RESTRAINTS.
6. BOTH ENDS OF INLINE VALVES SHALL BE RESTRAINED AT THE SPECIFIED RESTRAINT LENGTH ($L_R$) SHOWN IN TABLE.

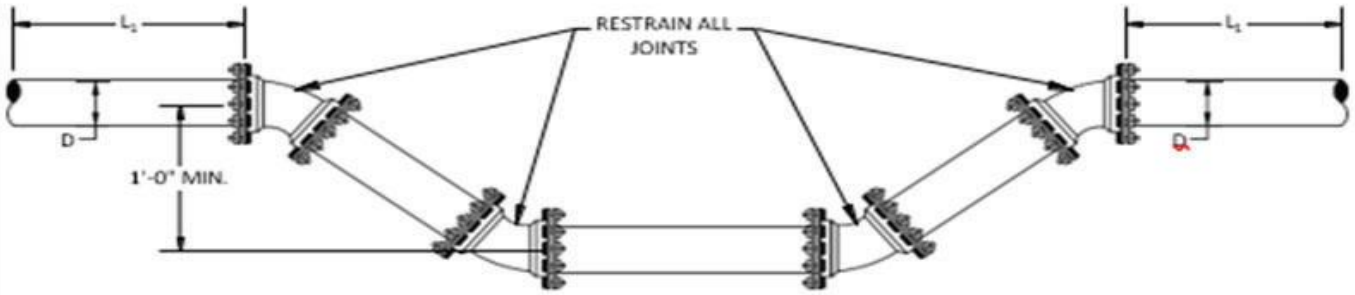
City of Greeley Colorado

HORIZONTAL PIPE RESTRAINT

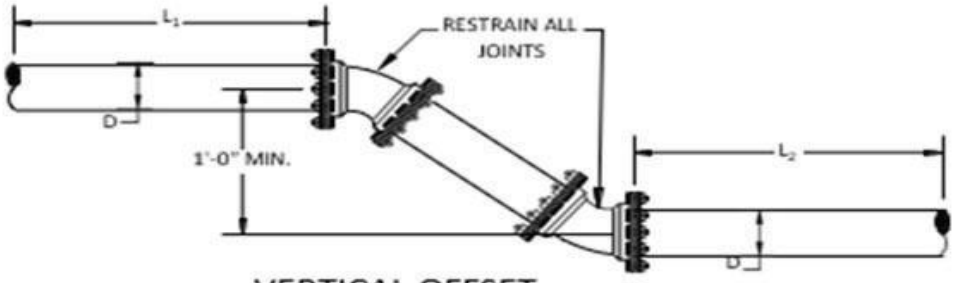
DETAIL W-4A

DATE: JULY 2024 SCALE: N.T.S.

# VERTICAL PIPE RESTRAINT




VERTICAL LOWERING




VERTICAL OFFSET

| DI PIPE (POLYETHYLENE-ENCASED): MINIMUM LENGTHS OF RESTRAINED PIPE - IN FEET | | | | | | |
|---|---|---|---|---|---|---|
| PIPE SIZES (D") | VERTICAL BENDS | | | | | |
| | 11¼" BEND | | 22½" BEND | | 45° BEND | |
| | $L_1$ | $L_2$ | $L_1$ | $L_2$ | $L_1$ | $L_2$ |
| 4" | 5 | 5 | 10 | 5 | 25 | 5 |
| 6" | 10 | 5 | 15 | 5 | 30 | 10 |
| 8" | 10 | 5 | 20 | 5 | 40 | 10 |
| 12" | 15 | 5 | 30 | 10 | 55 | 15 |
| 16" | 20 | 5 | 35 | 10 | 70 | 20 |

NOTES:

1. RESTRAINED LENGTHS SHOWN IN CHARTS ARE MINIMUM LENGTHS.
2. RESTRAINT SYSTEMS ON PIPE LARGER THAN 16-INCH DIAMETER SHALL BE DESIGNED FOR CONDITIONS EXISTING AT INSTALLATION SITE.
3. THE CHARTS ARE BASED ON THE FOLLOWING ASSUMPTIONS:
   A. 150 PSI TEST PRESSURE
   B. 1.5 SAFETY FACTOR
   C. 4-FT BURY DEPTH
   D. SOIL TYPE: ML, AS DEFINED BY AWWA M23 AND M41
   E. TRENCH TYPE: #4, AS DEFINED BY AWWA M23 AND M41
4. THE DESIGN ENGINEER IS RESPONSIBLE FOR VERIFYING THE ACTUAL SITE CONDITIONS WITH RESPECT TO THE ASSUMPTIONS LISTED ABOVE.
5. IF LENGTHS CANNOT BE MET FOR DEAD ENDS AND/OR TEES, DESIGN ENGINEER SHALL SPECIFY RESTRAINED LENGTHS OR A COMBINATION OF THRUST BLOCKS AND RESTRAINTS.

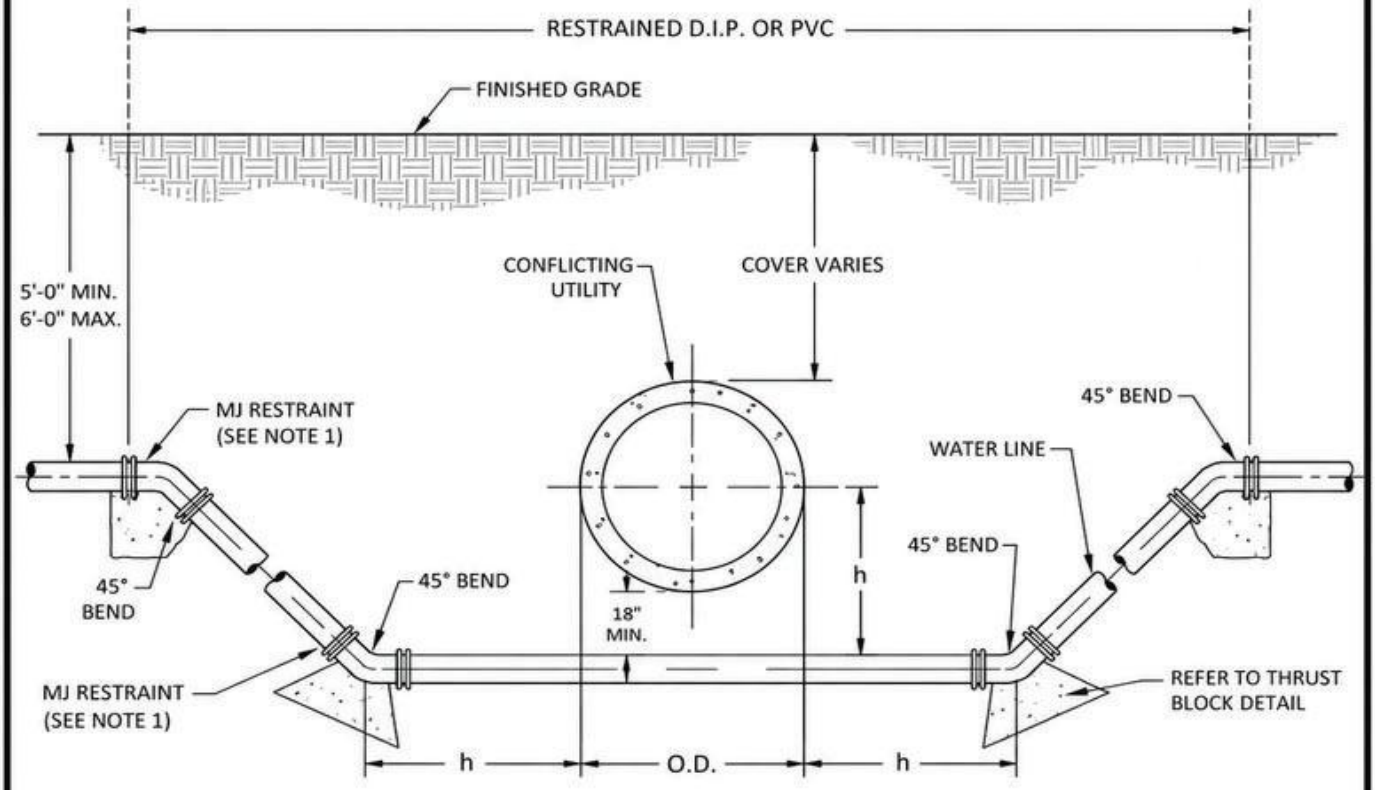
City of Greeley Colorado

VERTICAL PIPE RESTRAINT

DETAIL W-4B

DATE: JULY 2024 SCALE: N.T.S.

# VERTICAL PIPE LOWERING




ELEVATION VIEW

NOTES:

1. ALL FOUR VERTICAL 45-DEGREE 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 WATER & SEWER (W&S) SPECIFICATIONS, LATEST REVISION.
2. INSTALL TRACER WIRE ACCORDING TO WATER & SEWER SPECIFICATIONS AND STANDARD UTILITY LOCATING ("UL") DETAILS, LATEST REVISION OF EACH.
3. MINIMUM CLEARANCE FROM CONFLICTING UTILITY SHALL BE NO LESS THAN 18 INCHES AT THE NEAREST DIMENSION OR ENCLOSED PER DETAIL WS-3.
4. 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 W&S SPECIFICATIONS, LATEST REVISION OF EACH.

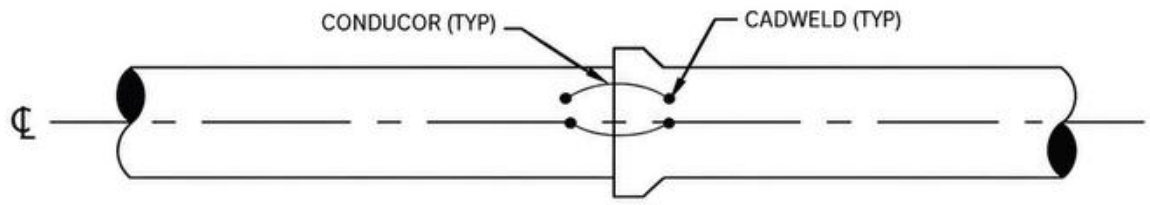
City of Greeley Colorado

VERTICAL PIPE LOWERING

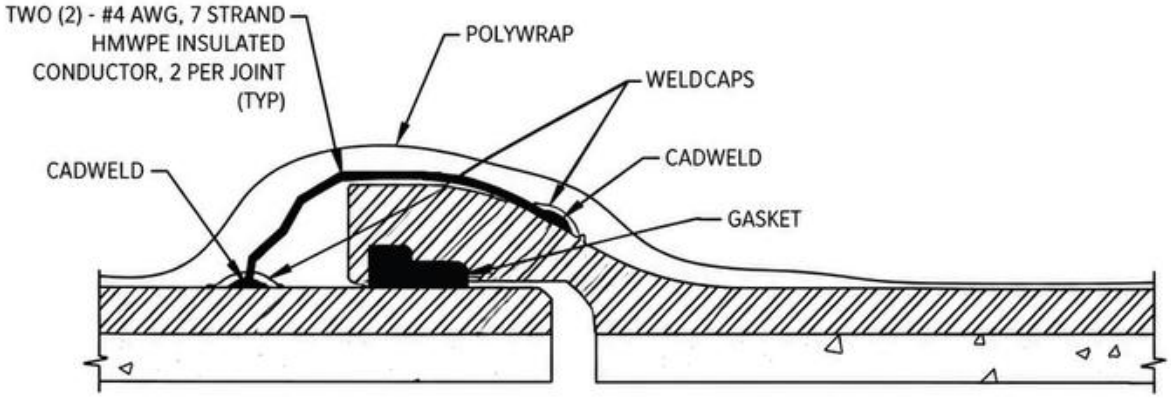
DETAIL W-5

DATE: JULY 2024 SCALE: N.T.S.

# DUCTILE IRON PIPE JOINT BONDING




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.

City of Greeley Colorado

DUCTILE IRON PIPE JOINT BONDING

DETAIL W-6

DATE: JULY 2024 SCALE: N.T.S.

# POLYETHYLENE WRAP INSTALLATION ON STANDARD DUCTILE IRON FITTINGS & GENERAL NOTES

## 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:

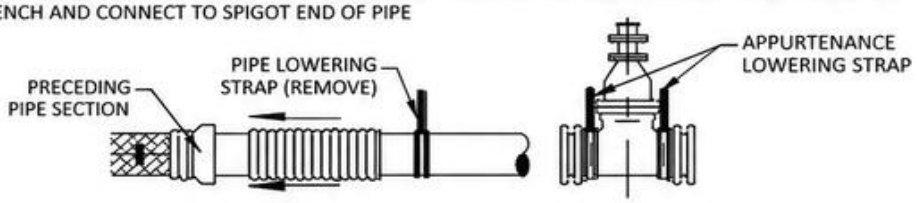
1. COVER BENDS, REDUCERS, OFFSETS, AND OTHER PIPE-SHAPED APPURTENANCES WITH PE IN SAME MANNER AS PIPE ON W&S DETAIL W-13B, LATEST REVISION.

## ODD-SHAPED APPURTENANCES:

1. 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:

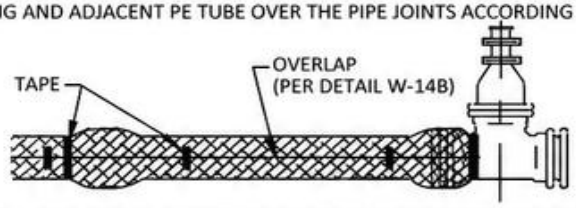
STEP 1

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



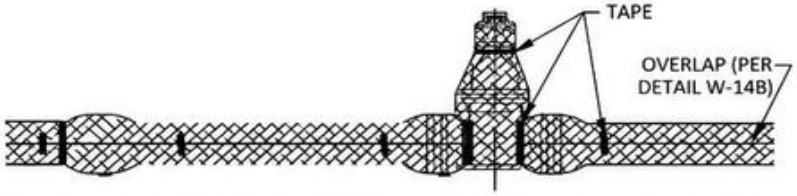

STEP 2

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 SLACE IN THE TUBE AT THE JOINT. AVOID DAMAGING THE TUBE WHEN USING TAMPING DEVICES.

City of Greeley Colorado

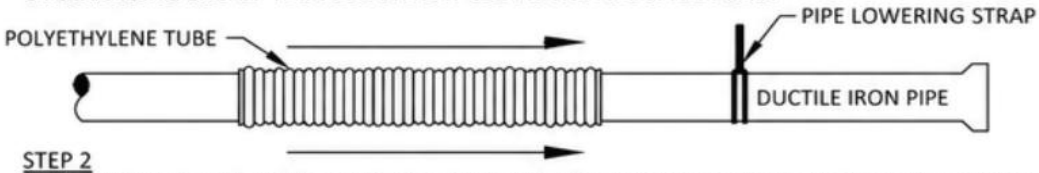
POLYETHYLENE WRAP INSTALLATION
ON STANDARD DUCTILE IRON FITTINGS
& GENERAL NOTES
DETAIL W-7

DATE: JULY 2024 SCALE: N.T.S.

# POLYETHYLENE WRAP INSTALLATION ON STANDARD DUCTILE IRON PIPE

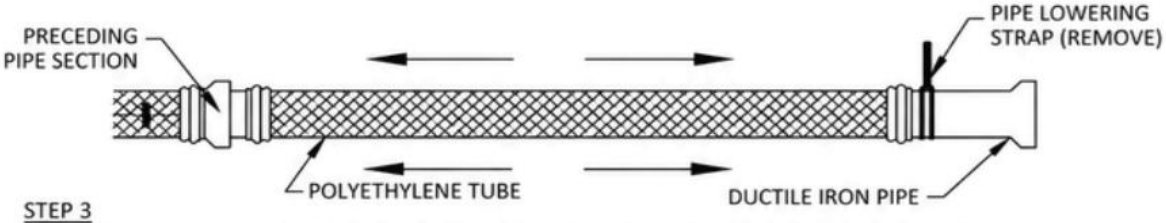
STEP 1

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.



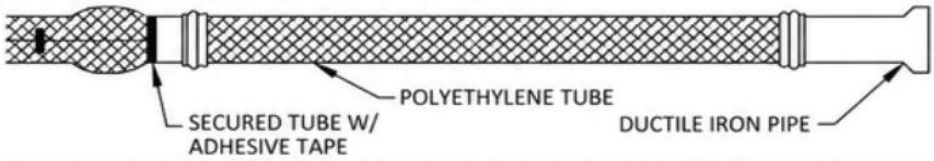

STEP 2

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.



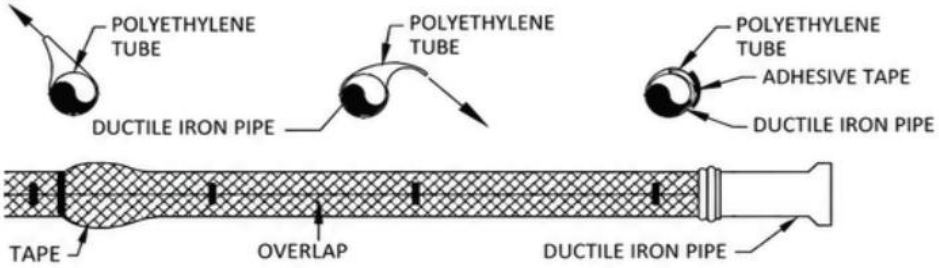

STEP 3

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.

City of Greeley Colorado

POLYETHYLENE WRAP INSTALLATION ON STANDARD DUCTILE IRON PIPE

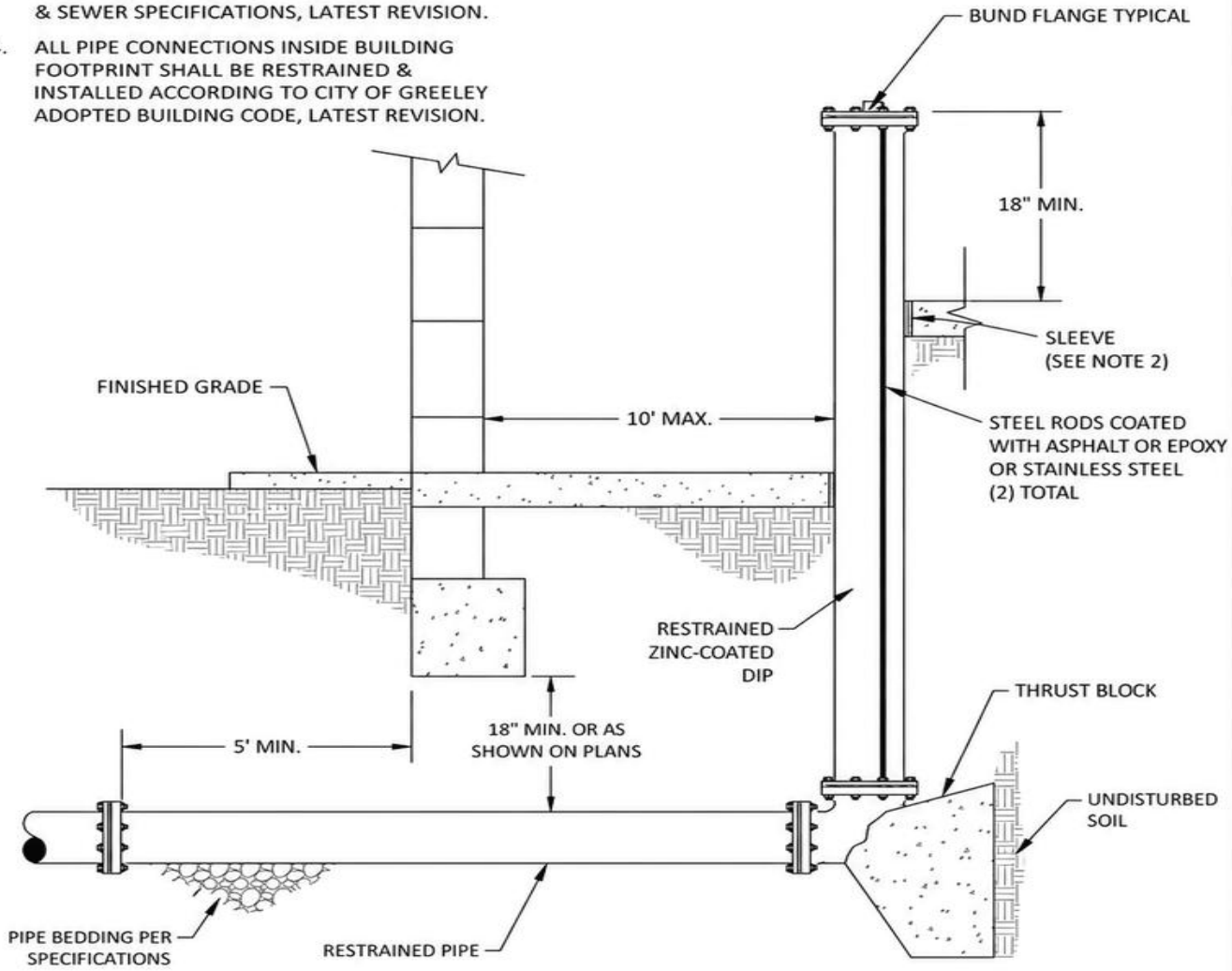
DETAIL W-8

DATE: JULY 2024 SCALE: N.T.S.

# FIRE RISER INSTALLATION

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. 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.



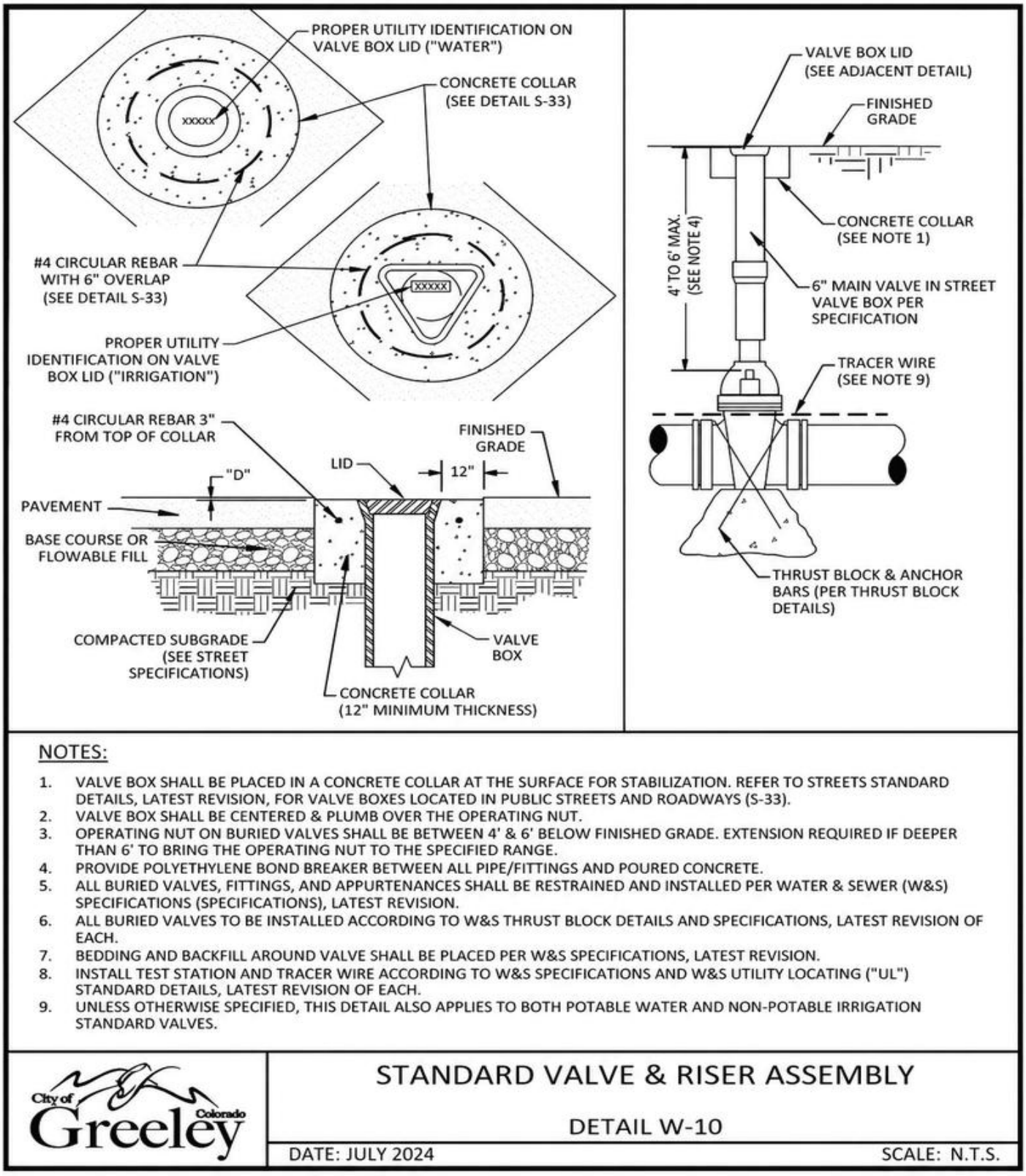

City of Greeley Colorado

FIRE RISER INSTALLATION

DETAIL W-9

DATE: JULY 2024 SCALE: N.T.S.

# STANDARD VALVE & RISER ASSEMBLY




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 (S-33).
2. VALVE BOX SHALL BE CENTERED & PLUMB OVER THE OPERATING NUT.
3. 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.
4. PROVIDE POLYETHYLENE BOND BREAKER BETWEEN ALL PIPE/FITTINGS AND POURED CONCRETE.
5. ALL BURIED VALVES, FITTINGS, AND APPURTENANCES SHALL BE RESTRAINED AND INSTALLED PER WATER & SEWER (W&S) SPECIFICATIONS (SPECIFICATIONS), LATEST REVISION.
6. ALL BURIED VALVES TO BE INSTALLED ACCORDING TO W&S THRUST BLOCK DETAILS AND SPECIFICATIONS, LATEST REVISION OF EACH.
7. BEDDING AND BACKFILL AROUND VALVE SHALL BE PLACED PER W&S SPECIFICATIONS, LATEST REVISION.
8. INSTALL TEST STATION AND TRACER WIRE ACCORDING TO W&S SPECIFICATIONS AND W&S UTILITY LOCATING ("UL") STANDARD DETAILS, LATEST REVISION OF EACH.
9. UNLESS OTHERWISE SPECIFIED, THIS DETAIL ALSO APPLIES TO BOTH POTABLE WATER AND NON-POTABLE IRRIGATION STANDARD VALVES.

City of Greeley Colorado

STANDARD VALVE & RISER ASSEMBLY

DETAIL W-10

DATE: JULY 2024 SCALE: N.T.S.