

INSTALLATION DESIGN GUIDE



Fort Carson, Colorado

Installation Design Guide

August 2015

Effective Date: Aug 14 2015

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Section 1 – General	1-1	2.3-D Water Distribution Main	2-42
1.1 Introduction	1-1	2.3-E General Notes	2-44
1.1-A Objectives and Compliance	1-1	2.3-F References and Point of contact	2-45
1.1-B Permits	1-2		
1.1-C Requests	1-3	2.4 Sewer	2-46
1.1-D Engineering Requirements	1-4	2.5 Stormwater	2-46
1.1-E Fire Department Information	1-4	2.6 Circulation	2-47
1.1-F IDG Contact Information	1-5	2.6-A Roadway Design	2-47
1.2 Summary of Changes	1-5	2.6-B Roadway Crossing Standards	2-48
1.3 Installation Profile	1-5	2.6-C Fire Lanes and Access	2-50
1.3-A History	1-5	2.6-D Traffic Calming	2-50
1.3-B Temperature	1-6	2.6-E Pedestrian Circulation	2-50
1.3-C Precipitation	1-7	2.6-F Tactical Vehicle Trails	2-51
1.3-D Wind	1-7	2.7 Engineering Details	2-52
1.3-E Hydrology	1-7		
1.3-F Wetlands	1-10		
1.3-G Wildlife	1-10	Section 3 – Site	3-1
1.3-H Cultural Resources	1-10	3.1 Circulation	3-1
1.3-I Historic Preservation	1-10	3.1-A Parking	3-1
1.4 Net Zero Goals	1-11	3.1-B Bikeways	3-4
1.4-A Net Zero Energy	1-11	3.2 Grading & Drainage	3-4
1.4-B Net Zero Water	1-11	3.2-A Soil Erosion Control	3-4
1.4-C Net Zero Waste	1-11	3.2-B Rainwater	3-5
1.5 Primary Land Use Map	1-12	3.3 Irrigation Standards	3-5
		3.3-A Design	3-5
		3.4 Landscaping	3-7
Section 2 – Infrastructure.....	2-1	3.4-A General	3-7
2.1 Natural Gas Service	2-1	3.4-B Performance Info. for Turf	3-7
2.1-A Purpose	2-1	3.4-C Irrigation Systems	3-10
2.1-B Applicability	2-1	3.4-D Green Infrastructure Zones	3-10
2.1-C General Policy Information	2-1	3.4-E Landscaping Zones	3-13
2.1-D Pipe Installation	2-2	3.4-F Acceptable Plants List	3-20
2.1-E Tracer Wire / Warning Tape	2-3	3.5 Furnishings	3-24
2.1-F Cathodic Protection	2-8	3.6 Lighting	3-24
2.1-G Testing Requirements	2-9	3.7 Signs	3-24
2.1-H Meters, Regulators, Pipe Risers	2-10	3.7-A General	3-25
2.1-I Materials	2-12	3.7-B Parking Signs	3-27
2.1-J References & POCs	2-13	3.7-C New Sign Requests	3-29
2.2 Electrical Dist. and Installation	2-14	3.7-D Sign Change Requests	3-29
2.2-A General System Information	2-14		
2.2-B General Design Information	2-14	Section 4 – Buildings	4-1
2.2-C Electric Meter Requirements	2-16	4.1 Architectural	4-1
2.2-D Roadway Street Lighting & Parking Lot Lighting	2-17	4.1-A Visual Themes	4-1
2.2-E Labeling and Equipment Identification	2-17	4.1-B Visual Theme Boundaries	4-3
2.2-F Temporary Services	2-18	4.1-C Visual theme Categories	4-3
2.2-G Additional Information	2-18	4.1-D Keyed Access entry Control	4-18
2.3 Water	2-38	4.1-E Building Signage	4-19
2.3-A Water Service Taps ¾” to 2”	2-38	4.2 Interior Design	4-20
2.3-B Water Service Taps 4” and Larger	2-40	4.2-A Interior Finishes	4-20
2.3-C Water Service Fire Protection	2-41	4.2-B Furnishings	4-21
		4.3 Structural	4-21
		4.3-A Foundations	4-21
		4.4 Mechanical	4-21

4.4-A General	4-21	6.1 General	6-1
4.4-B Domestic Hot Water Heaters	4-21	6.1-A Guidance	6-1
4.4-C Hot Water or Steam Boilers	4-22	6.1-B Coordination	6-1
4.4-D Air Conditioning	4-22	6.2 Building Siting and Design	6-1
4.4-E Air Distribution	4-22	6.2-A Minimum Standoff Distances and Building Separation	6-1
4.4-F Radiant Heat Systems	4-22	6.2-B Building Orientation	6-2
4.4-G Ventilation	4-23	6.3 Landscape Considerations	6-3
4.4-H Control systems	4-22	6.3-A Vegetation	6-3
4.5 Plumbing	4-23	6.3-B Fences	6-4
4.5-A Interior Plumbing Systems	4-23	6.4 Physical Security	6-4
4.6 electrical	4-23	6.4-A Lighting	6-4
4.6-A Electric Meters	4-23	6.4-B Berms	6-4
4.6-B Conductors	4-24	6.4-C Physical Security Equipment	6-4
4.6-C Energy-Efficient Lighting	4-24	6.4-D Area Specifications 151	6-5
4.6-D Occupancy Sensors	4-25	6.4-E Arms Storage	6-5
4.7 Fire Alarm Systems	4-25	6.5 Gates and ACPs	6-5
4.8 Energy Management Control system ...	4-25		
4.8-A EMCS Scheduling Procedure	4-25	Section 7 – Fire Protection	7-1
4.8-B Naming Conventions	4-26	7.1 General Information	7-1
4.8-C History extensions	4-26	7.2 Fire Extinguishers	7-1
4.8-D Metering	4-27	7.3 General Project Guidelines	7-2
4.8-E System Graphics	4-27	7.3-A Site Maintenance During Construction	7-2
Section 5 - Environmental	5-1	7.3-B Special System Plans	7-2
5.1 General Information	5-1	7.3-C System Tests	7-3
5.1-A Environmental Compliance Assessment Team	5-1	7.3-D Inspection, Test & Permit Request Information	7-3
5.1-B National Environmental Policy	5-1	7.3-E Projects With Special Consideration	7-4
5.1-C Spill Control	5-1	7.4 Water Supply	7-4
5.2 Environmentally Sensitive Areas ...	5-1	7.5 Fire Hydrant Clearances	7-4
5.2-A Wetlands	5-1	7.5-A General notes	7-4
5.2-B Wildlife	5-2	7.5-B Fire Department Access	7-5
5.2-C Cultural Resources	5-2	7.5-C Sign Specifications	7-6
5.2-D Forestry Program	5-2	7.5-D Addresses, Street Names, signs	7-6
5.3 Air Quality	5-2	7.6 Approved Turn-Around & Cul-de- Sac	7-7
5.3-A Air Program	5-2	7.6-A Aerial Fire Truck Info	7-7
5.4 Water Quality	5-3	7.6-B Approved Fire Access Surfaces	7-7
5.4-A Water Quality Program	5-3	7.7 NFPA 704 Placarding	7-8
5.4-B Water Rights	5-3	7.8 Fire Alarm System Plans & Submittal Requirements	7-8
5.5 Petroleum & Soils Management	5-3	7.8-A General Guidance	7-8
5.5-A Above Ground Storage Tanks	5-3	7.8-B Drawings	7-9
5.5-B Underground Storage Tanks	5-3	7.8-C Attachments to Drawings	7-9
5.5-C Restoration Program	5-3	7.9 Fire Alarm Notification Location Requirements	7-9
5.5-D Pest Management	5-4	7.10 Automatic Fire Sprinkler System Requirements	7-10
5.6 Contaminates	5-4	7.11 Post Indicator Valve	7-12
5.6-A Asbestos, Lead and Toxics	5-4		
5.6-B Hazardous Waste Storage	5-4		
5.6-C Household Hazardous Waste Disposal Facility	5-4		
Section 6 - Force Protection	6-1		

7.12 Commercial Cooking Fire Extinguisher Systems..... 7-13
7.13 High-Piled Stock 7-13
7.14 Exit Sign Requirements 7-14
7.15 Rapid Entry Equipment 7-14
7.16 Mass Notification 7-15

Section 8 - Development Plans 8-1

8.1 Butts Army Airfield 8-1
 8.1-A Objectives.....173
 8.1-B Goals173
8.2 10th Special Forces Group175
8.3 Iron Horse Park177
 8.3-A Overview177
 8.3-B Goals.....178
8.4 Energy and Water Master Plan180
 8.4-A Vision and Coals180
8.5 Central Core181
 8.5-A Central Core Planning Vision ...181
 8.5-B Goals181
8.6 Banana Belt183
 8.6-A Area Description.....183
8.7 Green Infrastructure Plan185
 8.7-A Purpose185
 8.7-B Benefits185

List of Figures188

Section 8 and list of figures is under revision

IDG SECTION 1 GENERAL

1.1 Introduction

1.1-A Objectives and Compliance

- The Fort Carson Installation Design Guide (IDG) provides guidance for standards and improvements in the quality and environment of the installation. This includes the visual impact of existing features on the installation, and the impact of future projects on the total built and natural environment. The IDG incorporates standards and guidelines for the design issues of site planning, architectural character, colors and materials, vehicular and pedestrian circulation, and landscape elements, and utilities.
- Provide general design standards and guidelines that define color, materials, style, signage, and other aspects of design for all visual elements.
- Provide specifications and requirements for facility and infrastructure projects to incorporate into existing installation wide systems, such as irrigation, EMCS, and utility systems.
- Provide standards and guidelines for the selection of materials for new construction, renovation, maintenance, and repair projects.
- Provide guidance for sustainable development.
- Provide a structured methodology for establishing the visual imagery of the installation.
- Provide guidance to integrate ATFP standards.

1.1-A.1 Compliance: The IDG is to be used by all individuals involved in decision making, design, construction, and maintenance of facilities on Fort Carson and Pinion Canyon Maneuver Site.

1.1-A.2 Variations: Variances from standards will be reviewed and adjudicated by the Master Planning Division, Directorate of Public Works and the Garrison Commander. Final decisions rest with the Garrison Commander, who will chair Real Property Planning Board (RPPB) to review and approve variances.

1.1-A.3 Conflicts

1.1-A.1(A) Contracts for projects which involve the use of the IDG are controlled by a variety of different organizations. Ultimately, design and construction contracts control how closely compliance is maintained. It is imperative that all organizations understand the relevance on compliance with the IDG prior to contract solicitation.

1.1-A.1(B) When a contractor's contract conflicts with the standards set forth in this IDG, the contractor, in coordination with the Contracting Officer (and/or Contracting Officer's Representative), shall make every reasonable effort to comply with the IDG.

1.1-A.1(C) Where flagrant or obvious deviations from the IDG occur, referral to the Garrison Commander for guidance may be required. All referrals to the Garrison Commander will be the decision of the Director of Public Works.

1.1-B Permits

1.1-B.1 Dig Permits

Per Fort Carson Regulation 420-20, any type or depth of digging or excavation requires prior approval from DPW and a proper dig permit which specifically addresses the work to be conducted for the project. After an approved DA Form 4283 is obtained from the DPW Business Operations and Integration Division, contact the DPW, Operations and Maintenance (O&M) Contractor to submit a dig permit request.

Fort Carson Support Services
Utility Office, Building 1225
(719) 302-0157

Per Fort Carson Regulation 420-19, any utility outages or roadway closures or detours require a Fort Carson Scheduled Utility Outage. The requestor must submit the outage request no later than 72 hours prior to the outage. The outage request form will be obtained from and submitted to the Utility Office listed above.

1.1-B.2 Stormwater Permits

1.1-B.2(A) USEPA Construction General Permit (COR1200F)

Fort Carson's Stormwater Program is regulated by the Federal USEPA, and not the State of Colorado. Some of the implementation and enforcement of the USEPA's Construction General Permit (CGP), COR1200F, has been delegated to the Fort Carson Stormwater Program via the Fort Carson's Municipal Separate Storm Sewer System (MS4) permit (COR042001).

Coverage under the USEPA's CGP is required for the development and re-development that results in a land disturbance (which includes the laydown area) of greater than or equal to 1 acre or disturbs less than 1 acre if the development or redevelopment is part of a larger common plan.

If the project does require coverage under the USEPA's CGP, a Stormwater Pollution Prevention Plan must be created in compliance with the CGP. The SWPPP must be submitted and approved by the Fort Carson Stormwater Program Manager.

The site construction manager should allow 7 to 10 days for Fort Carson's review process.

Once a SWPPP is approved by the Stormwater Office, a Notice of Intent (NOI) can be filed on the USEPA website. The site construction manager should allow 14 days to receive the NOI. Ground disturbance cannot be executed without an approved SWPPP and approved NOI.

The site construction manager is required to perform self inspection by either a trained on-site employee or by a qualified subcontractor as described in the sites SWPPP. Also, site inspections on Fort Carson will be performed, at a minimum, quarterly by the Fort Carson Stormwater Team to verify compliance with the SWPPP and CGP.

All requirements of the CGP must be met regarding final stabilization. Both Fort Carson and PCMS are located in semi-arid environments and need to follow the semi-arid caveats within the CGP. Final stabilization applies to any and all areas that were disturbed during

construction which were not stabilized by permanent structures and which were under the contractor site control during the construction activities.

When the project is complete and site stabilized according to the site SWPPP and USEPA CGP, the contractor must file a Notice of Termination (NOT) with the USEPA. The USEPA NOT cannot be completed without the Fort Carson Stormwater Program Manager's written acceptance of the following:

- Meeting the intent of EISA07, Section 438 (USEPA 2009)
- Correct placement and utilization of BMPs as depicted in the site specific SWPPP
- Removal of all temporary BMPs
- As-built drawings of all permanent BMPs
- A GIS map depicting the new surface contours
- O&M plan for each permanent BMPs
- Final stabilization achieved on any and all areas disturbed during construction

Some construction projects qualify for a Rainfall Erosivity Waiver. The Rainfall Erosivity Waiver allows permitting authorities to waive those sites that do not have adverse water quality impacts. Erosivity describes the potential for soil to wash off disturbed, devegetated earth into waterways during storms. Low-Erosivity Waivers are only available for 1- to 5-acre projects with short durations that take place during specific times of year. Detailed instructions for calculating a project R-factor and determining if a project qualifies for a waiver, which were derived from USEPA Fact Sheet 3.1.

If the site contractor is noncompliant, the contractor will be responsible for any fines and penalties assessed by the USEPA in addition to Fort Carson enforcement actions.

The Stormwater Program Manager can be contacted by phone at 719-526-1697 or through email at: usarmy.carson.imcom-central.list.dpw-ed-storm-water@mail.mil

More information about the Stormwater Program can be found the following website:

<http://www.carson.army.mil/DPW/environmental/stormwater/index.html>

1.1-C Requests

1.1-C.1 Maps, Utilities, Infrastructure, As-Built Drawings

Requests for detailed information must be supported by a DPW or US Army Corps of Engineer's project number or construction solicitation document. These requests must show a justifiable need for the information and how it relates to the project. Detailed maps and production products are official correspondence and will not be shared with any organization not related to the specific project. To obtain existing site information and/or as-built drawings, please contact:5

CAD/GIS Technology Associate
Building 1219, 1st Floor, Room 132
Engineering Support Branch, DPW
(719) 524-1085

The Engineering Support Branch will be consulted for any questions relating to procedures (719) 526-9218/9217.

1.1-D Engineering Requirements

1.1-D.1 As-Built Drawings

1.1-D.1(A) All project drawings will conform to Spatial Data Standards for Facilities Infrastructure and Engineering, SDSFIE (formerly known as Tri-Service Spatial Data Standards) or A/E/C CADD Standards. The Engineering Support Branch will be consulted for any questions relating to procedure.

1.1-D.1(B) All primary projects will provide record drawings in both paper and electronic (i.e. Micro-station) format.

1.1-D.1(C) All projects must provide completed record drawings before being considered finished.

1.1-D.1(D) Repair/alterations to any exterior utility that changes system configuration or location will be reported within 72 hours via red line or electronic media. GPS support from DPW Engineering may be requested to establish accurate survey locations. (719) 526-9218/9217

1.1-D.1(E) The submittal register shall include requirements for record drawings (As-Built) be submitted prior to final project close-out.

1.1-D.2 Utility Maps. In the interest of safety and the accuracy of the Utility Maps, the following requirements apply:

1.1-D.2(A) *Utilities redlines must be submitted prior to the activation of that utility. This is to include service and distribution systems.*

1.1-D.2(B) Interim redline drawings with accurate measurements are required every 30 days for any project or phase of a project, which will exceed 30 days.

1.1-D.2(C) Complete As-Built drawings will be submitted per contracted.

1.1-E Fire Department Design Information

1.1-E.1 Fort Carson Fire and Emergency Services encourage preplanning consultations to discuss projects before plans are finished. Please contact their office to request an appointment and feel free to call any time with any questions.

1.1-E.2 Fort Carson Fire and Emergency Services has developed a information packet for Development and Construction. A copy can be requested from the following:

FORT CARSON FIRE & EMERGENCY SERVICES
6510 Wetzel Ave.
FIRE PREVENTION DIVISION
FORT CARSON, CO 80913-5023

Phone: (719-526-9355)

*This packet is also incorporated into this design guide as Section 7 - Fire Protection.

1.1-F IDG Contact Information

Information regarding compliance with the Installation Design Guide, or any issues related to this document can be directed to the following:

Thomas Wiersma
Building 1219, 3rd Floor, Room 309
Master Planning Division, DPW
(719) 526- 4265

1.2 Summary of Changes

Various changes and updates have been made throughout this document to provide new and revised information. This document is intended to be user friendly so that information can be located quickly without having to sift through common design principles adhered to in the professional community.

1.3 Installation Profile

1.3-A History

Camp Carson was established on 6 January 1942 as a temporary training camp to prepare soldiers for combat during World War II. A primary consideration that influenced this location for the training camp was the ideal climate for year-round training. Fort Carson was developed using a standard design of the early 1940's and is similar to other installations constructed in that period. The main cantonment area of was modified from that standard layout to conform to the natural terrain and wrap around the hill mass on the eastern side of the cantonment area.



Figure 1.1-a Fort Carson WWII Facilities

Hundreds of buildings were rapidly constructed to respond to the immediate wartime necessity for mobilization. These buildings were of an extremely utilitarian design that supported expedient construction. These original wood structures were then, and still are some 65 years later, considered to be only "temporary" in nature. The later development and replacement of the temporary structures with permanent masonry facilities occurred over the next six decades. The permanent facilities have been built through annual construction funding.

After training over 100,000 soldiers at Camp Carson during World War II, in 1954 the government decided to make the camp a permanent installation and changed the name to Fort Carson. Since 1962, Fort Carson has housed and supported mechanized infantry training activities.

The challenges of training a mechanized division triggered the need for more land. In 1965, Fort Carson acquired 24,577 acres of state land (leased since 1942) by trading it for federal land east of Denver. In 1965 and 1966, a total of 78,741 acres of land were acquired south of the original reservation at a cost of approximately \$3.5 million. This consisted of 45,236 acres purchased from private individuals, 22,694 acres of state land traded for more land at the Lowry Bombing Range, and 7,668 acres purchased from the Colorado School of Mines. An additional 2,871 acres were acquired without cost from the Department of the Interior in trade for Camp Hale. These additions brought Fort Carson to its current size of 138,523 acres. On March 7, 1966, Camp Red Devil was opened. The camp was the first year-round training area at Fort Carson for soldiers in a field environment. The base camp, which could accommodate as many as 950 soldiers, is located south of the main post off Highway 115.

The Pinon Canyon Maneuver Site (PCMS), located 150 miles southeast of Fort Carson, was opened in 1985 to provide critical maneuver lands for larger units on the installation and from other installations in the area. Its 235,896 acres, combined with Fort Carson's training areas, comprise maneuver training lands second only to the National Training Center at Fort Irwin, California in size. Fort Carson, with 97,201 acres of range land, supports limited battalion-size and smaller training exercises.

1.3-B TEMPERATURE

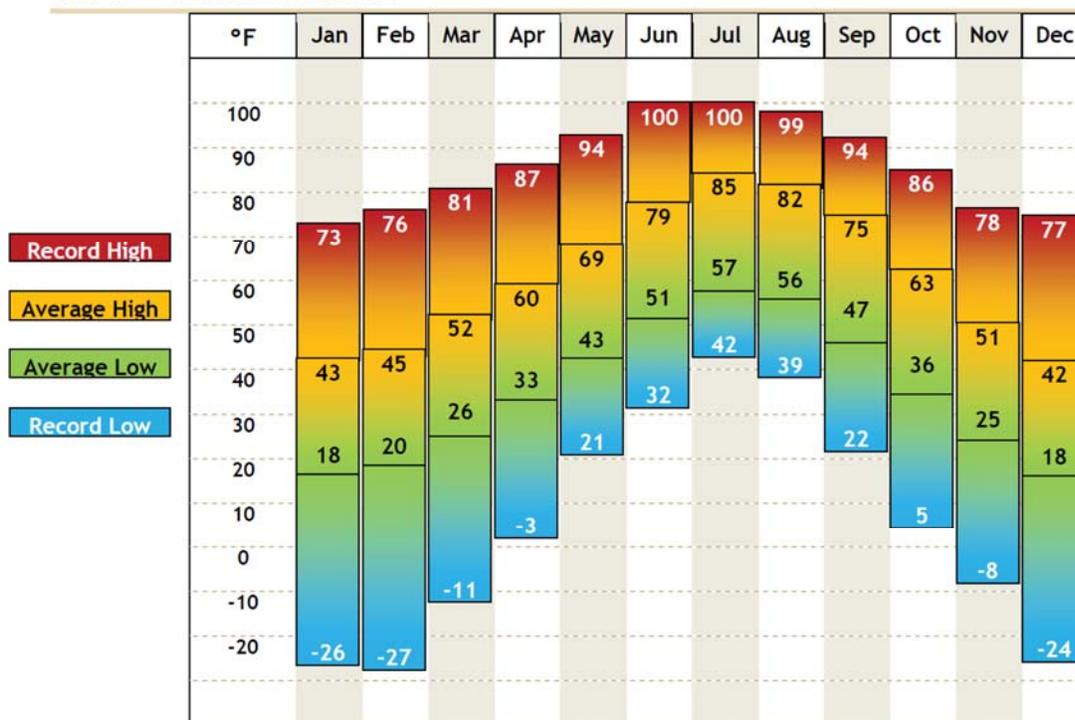


Figure 1.3-b Fort Carson Temperature Averages
Source: The Weather Channel, LLC; weather.com®

1.3-C PRECIPITATION



Figure 1.3-c Fort Carson Precipitation Averages
 Source: The Weather Channel, LLC; weather.com®

Fort Carson and Pinon Canyon Maneuver Site have semi-arid climates with an annual average precipitation of about 17 in per year.

1.3-D Winds The prevailing winds on post are generally mild; however, wind speeds of 100 miles per hour or more have been recorded in the fall, winter, and spring due to the west-to east Chinook winds. These damaging winds are clearly the exception; however, protected building entries and windbreaks can be effective elements.

1.3-E Hydrology Fort Carson is located in the Fountain Creek and Upper Arkansas River watersheds. Fountain Creek discharges into the Arkansas River just south of Fort Carson within the city of Pueblo. The cantonment area (that include B Ditch, Clover Ditch, Central Unnamed Ditch (CUD), and Rock Creek) and most of the eastern training lands of Fort Carson drains into Fountain Creek, while watersheds in the southwest drain into the Arkansas River. Figure 3 illustrates the Fort Carson watersheds.

1.3-E.1 Surface Water Quality

1.3-E.1(A) The Water Pollution Control Act (Clean Water Act (CWA)) requires states to design a Total Maximum Daily Load (TMDL) process to meet the goals of the CWA. The TMDL process is a method of analyzing pollution sources and allocating responsibility among those sources. The CWA requires that states submit to the USEPA a list of known impaired waters not meeting water quality standards and therefore need of a TMDL. The list of impaired waterways is called the states Section 303(d) list. 5CCR 1002-93 establishes Colorado’s 303(d) list. In Colorado, this list is updated every four years by the Colorado Department of Public Health and Environment (CDPHE) Water Quality Control Commission (WQCC.)

1.3-E.1(B) CDPHE WQCC also establishes Colorado’s Monitoring and Evaluation List (M&E List). This list identifies water bodies where there is reason to suspect water quality problems, even though there is also uncertainty regarding one or more factors, such as the representative nature of data.

1.3-E.1(C) Currently, there are not TMDLs that relate to the waterways on Fort Carson. Fort Carson has three water body segments listed on the CDPHE’s 303d and M&E list. These segments are shown in the following table:

WBID	Segment Description	Portion	Colorado’s Monitoring & Evaluation Parameter(s)	Clean Water Act Section 303(d) Impairment	303(d) Priority
COARFO04	All tributaries to Fountain Creek, which are not on National Forest or Air Force Academy Land	all		E. coli	H
COARMA04a	Wildhorse Creek	all	NO2	E. coli	H
COARUA14b	Tributaries to the Arkansas River, from Pueblo Reservoir to Colorado Canal headgate	Teller Reservoir	Aquatic Life Use (Hg FCA)		

Figure 1.3-d Fort Carson Impaired Waterways

Fort Carson Watershed Map

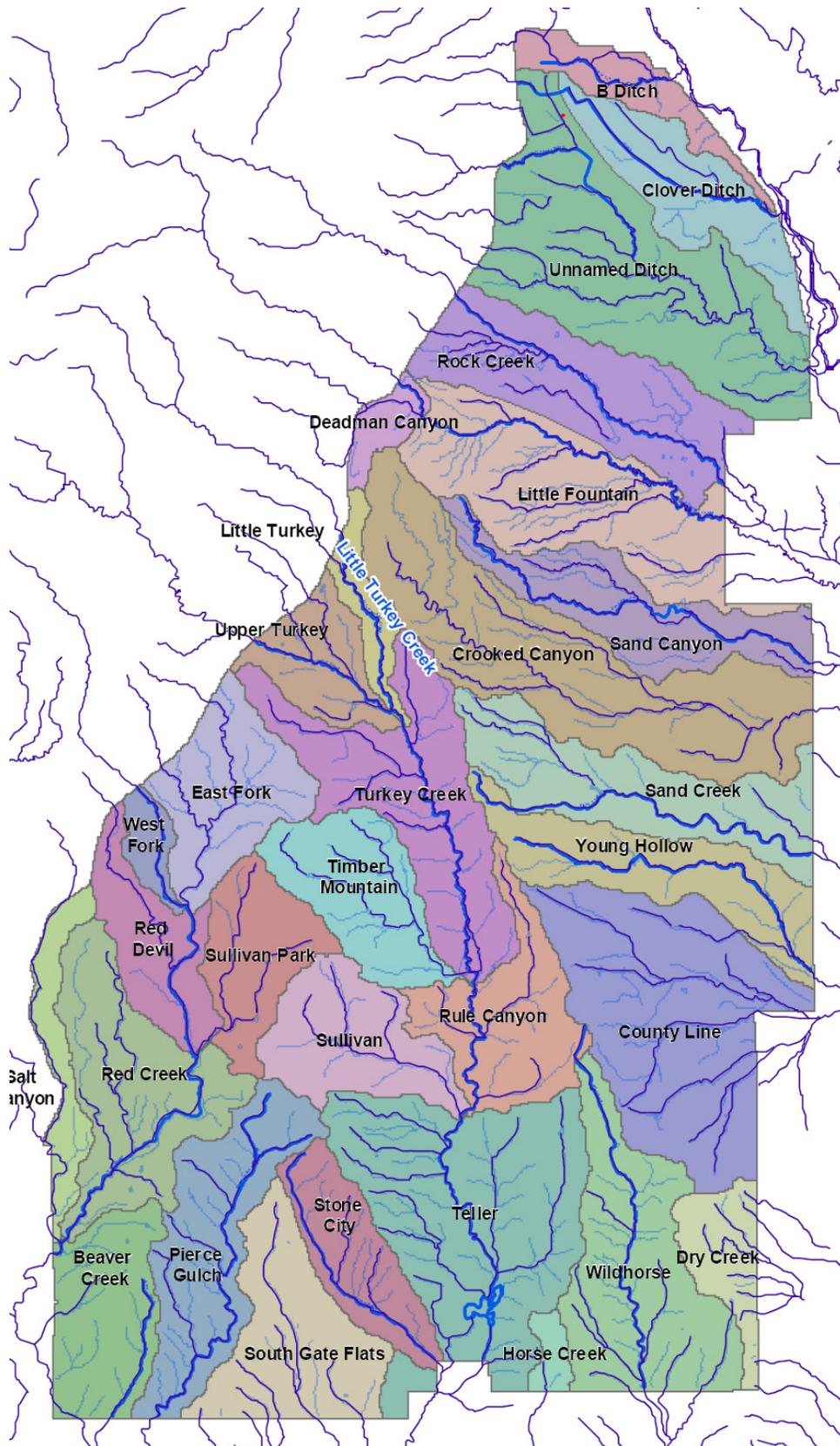


Figure 1.3-e Fort Carson Watershed Map

1.3-F Wetlands

1.3-F.1 Fort Carson's and the Army's goal is to have no net loss of wetlands. To achieve this goal the Directorate of Environmental Compliance and Management (Environmental Division of DPW) is managing and monitoring the Fort Carson and Piñon Canyon Maneuver Site wetlands.

1.3-F.2 The Environmental Division of DPW will work closely with the DPW to minimize impacts to wetlands and to serve as a liaison to the US Army Corps of Engineers (USACE) when having to mitigate wetland loss. Whenever possible, avoid impacting wetlands. If unavoidable, coordinate closely with the Environmental Division of DPW wetland staff

1.3-F.3 The Environmental Division of DPW will work with DPW staff in preparing the appropriate documents required by the Corps of Engineers. State authorization and permitting applies. For more information contact the Resource Compliance Branch at (719) 526-1693.

1.3-G Wildlife

1.3-G.1 The State of Colorado owns the wildlife resources on the installation, and the Army co-manages those resources. This involves public hunting and non-consumptive wildlife use. Installation activities and development can easily come into conflict with these interests.

1.3-G.2 The U.S. Fish and Wildlife Service also has interests in migratory birds, and species that have specific protections. The Installation has many species that have compliance requisites before a site can be used, altered, or developed.

1.3-G.3 All proposed activities, including impacts to urban wildlife, must be reviewed by Installation wildlife managers to ensure regulatory compliance and sustainability of wildlife resources.

1.3-H Cultural Resources

1.3-H.1 Cultural resources management on Fort Carson and the PCMS encompasses conservation of resources of significance to the history or prehistory of the United States or of traditional, religious, or cultural importance to Native Americans. Three general stages of prehistory have been delineated for southeastern Colorado: the Paleoindian, Archaic, and Late Prehistoric. These periods span from approximately 11,500 B.P. to 225 B.P. (before present). The historic era of southeastern Colorado spans the first European incursions into the area in the 16th century to the present, including occupation during the Spanish, Mexican, and Euro-American eras.

1.3-H.2 Cultural resources have been identified in the following categories: districts, buildings, structures, and historic, prehistoric, and multi-component archaeological sites. Management of cultural resources hinges on the identification and eligibility for inclusion in the National Register of Historic Places

1.3-I Historic Preservation

All work to be considered within the 2 Fort Carson National Historic Districts (Turkey Creek Ranch and Incinerator Complex) should be coordinated with the DPW-Environmental Division, Cultural Resources Management Program. All work within these Historic Districts will most likely require a continuation of the existing architectural and landscaping theme. Additionally, any

proposed change to the architectural or landscaping themes will require Section 106 consultation per the National Historic Preservation Act."

1.4 Net Zero Goals



TRIPLE NET 0

Fort Carson was designated as a pilot Triple Net Zero Installation by the Assistant Secretary of the Army for Installation, Energy and Environment (ASA IE&E) in April 2011. The target of this pilot program is for Fort Carson to attain each of the three Net Zero goals by 2020.

A Triple Net Zero Installation applies an integrated approach to managing energy, water, and waste to capture and commercialize the resource value and/or enhance the ecological productivity of land, water, and air. Fort Carson is one of two pilot installations chosen to implement Triple Net Zero.

1.4-A Net Zero energy



A Net Zero Energy Installation produces as much energy on site as it uses, over the course of a year.

- 1st Priority: Energy Efficiency
- 2nd Priority: Renewable Energy
- 3rd Priority: Awareness and Behavioral Impacts

1.4-B Net Zero Water



A Net Zero Water Installation limits the consumption of freshwater resources & returns water back to the same watershed so as not to deplete the region's groundwater and surface water resources in quantity or quality.

- 1st Priority: Conservation
- 2nd Priority: Reuse
- 3rd Priority: Awareness and Behavioral Impacts

1.4-C Net Zero Waste

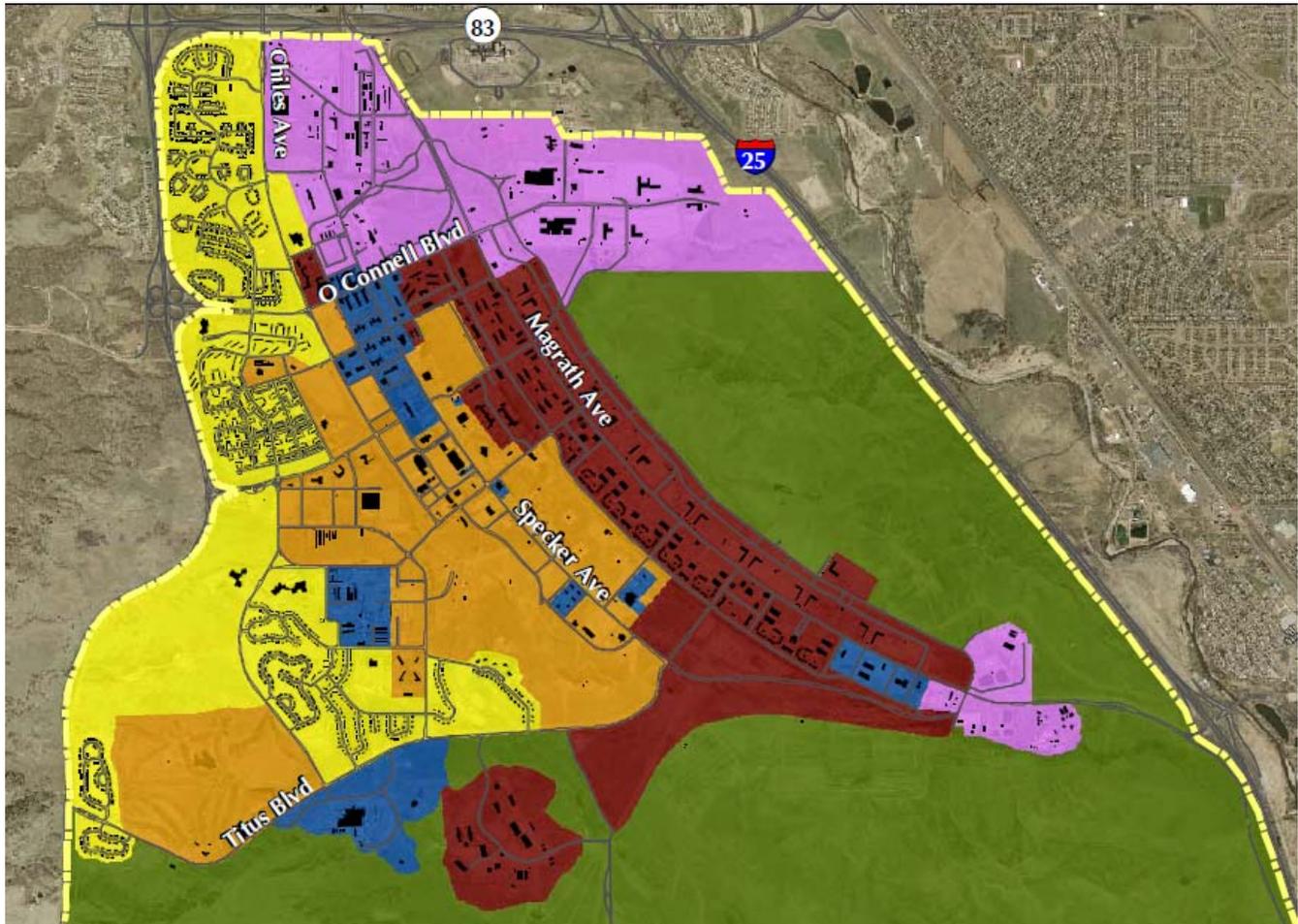


A Net Zero Waste Installation is an installation that reduces, reuses, and recovers waste streams with zero solid waste to landfills.

- 1st Priority: Reduction
- 2nd Priority: Recycling
- 3rd Priority: Re-use on site

1.1 PRIMARY LAND USE MAP

This map is used for Master Planning of the installation. The boundaries shown vary depending upon specific circumstances. This map is shown for reference only.



- Residential
- Community
- Industrial
- Professional / Institutional
- Troop
- Training

Figure 1.5-a Fort Carson Primary Land Use Map

IDG SECTION 2 INFRASTRUCTURE

2.1 Natural Gas Service and Distribution

2.1-A.1 Purpose

The purpose is to ensure that requirements established in the U.S. Department of Transportation Minimum Federal Safety Standards for Natural Gas Pipelines (49 CFR Part 192), are adhered to by all persons engaged in design and/or construction of natural gas lines. These standards are provided as a guide for gas service and gas main line extensions and put forth as the standards for material and construction.

2.1-A.2 Applicability

These standards apply to all gas line work on Fort Carson and Pinion Canyon Maneuver Site. This applies to the Directorate of Public Works (DPW) contracts and contractors, Corps of Engineers contracts and contractors, and the Fort Carson Family Housing contracts and contractors.

2.1-A.3 General Policy Information

2.1-A.3(A) The contractor shall provide the duly authorized employees of the Directorate of Public Works (DPW and the DPW Operations and Maintenance (O&M) contractor full and free access to the site at all reasonable hours. This access will be for the purpose of installing, reading, inspecting, adjusting, repairing, maintaining, replacing or removing any Fort Carson utility facilities on the premises of the contractor or for any other purpose incidental to the gas service.

2.1-A.3(B) The contractor will not bypass, tamper with, engage in any unauthorized metering, or otherwise interfere with the proper operation of Fort Carson utility meter or other equipment or in any way interfere with the proper metering registration.

2.1-A.3(C) Devices or attachments will not be connected to Fort Carson utility facilities in such a manner as to permit use of unmetered energy without prior written consent of Fort Carson DPW Operations and Maintenance Division.

2.1-A.3(D) All polyethylene gas line heat fusion will be accomplished by a certified technician. Gas line fitter certification can be obtained by attending a training course; and passing a written exam; and successfully completing a practical hands-on heat fusion test. Any bona fide certification card will be accepted by Fort Carson DPW Operations and Maintenance Division.

2.1-A.3(E) Utility lines shall be bored or jacked beneath streets and pavements. DPW Engineering Division may approve requests to cut and patch pavements in select areas where such damage is considered to be of minimal consequence. Refer to the design engineer's recommendations for pipe casing requirements.

2.1-A.3(F) The contractor is required to meet the standards of The National Fuel Gas Code (NFPA 58) and the Army's Unified Facilities Guide Specifications (UFC 33 51 15) for any other items not mentioned in this design guide.

2.1-B Pipe Installation

2.1-B.1 Guidance

2.1-B.1(A) All gas service lines shall be installed in the most direct, straightest and practical path possible from the gas service stub location to the gas service riser.

2.1-B.1(B) Each separate building shall be served by a single and separate gas service line. An underground isolation valve is required for each building service line. This valve should be located as close as practical to the gas main tap connection.

2.1-B.1(C) Gas service lines shall not be installed under any building/structure. Underground and surface structures include, but are not limited to foundation and basement walls, patios or other sealed surfaces, which abut a building, or its foundation. Excluded from this category are public sidewalks and unavoidable structures where a protective sleeve is required.

2.1-B.1(D) HDPE gas service line piping shall be joined by socket heat or electro fusion only. NOTE: Due to the thermal expansion & contraction of polyethylene, sufficient pipe length shall be provided by installer (polyethylene pipe changes in length one inch for every 100 feet for every 10 degrees Fahrenheit).

2.1-B.1(E) For HDPE gas service line(s) no more than 2 socket fusion couplings between the gas service stub and the gas service riser shall be allowed.

2.1-B.1(F) All gas service lines should have at least three feet (3') of horizontal separation from other buried utilities and underground structures which run parallel to the gas service line. However, where this distance cannot be maintained, a reasonable separation distance will be considered at the discretion of Fort Carson DPW, O&M Division. A one foot (1') vertical separation shall be required for all unavoidable utility crossings and when crossing under a retaining wall or footing.

2.1-B.1(G) Where buried utilities and/or underground structures prohibit adherence to separation requirements, a polyethylene protective sleeve must be installed. The protective sleeve shall have an inside diameter sufficient for insertion of the gas line without causing undue resistance. The protective sleeve shall extend a minimum of three feet (3') beyond the perimeter of the conflicting structure.

2.1-B.1(H) Prefabricated service line assemblies, anodeless risers, are the standard for gas risers.

2.1-B.1(I) All gas service lines shall be properly supported on well-compacted soil prior to back-filling. Prior to back-filling, a fine padding material (bedding sand), equal to manufactured sand shall be used to:

- Line bottom (below pipe) of the Joint Trench with a minimum of six inches (6") of fine padding sand.

- Place over the pipe an additional 6 inches of fine padding material. Back-fill material shall be free of all foreign debris such as bricks, concrete, asphalt, wood, and trash that may damage the gas service line.

2.1-B.1(J) If gas service stubs are damaged such that greater than 10 percent of the wall thickness is gouged, stripping back of the trench shall be required in order to replace the entire portion of damaged pipe.

2.1-B.1(K) Service gas line depths shall be a minimum of twenty-four inches (24”) and a maximum of forty-eight (48”) below existing grade and proposed final grade, including the required padding.

2.1-B.1(L) All taps must be made using the wet tap method, unless other methods are approved. Use experienced workers to make direct taps with tools in good repair and proper adapters for size of pipe being tapped. Before any utility is activated, the contractor installing that utility (Electric, Gas, Water, etc.) shall contact the DPW, O&M Contractor and provide (2) two sets of as-built (red line) drawing representative of the as-built condition before any utility is energized.

Any utility put into use without meeting the AS-Built drawing requirement WILL BE SHUT OFF and LOCKED OUT by the O&M Contractor without prior notification.

2.1-C Tracer Wire/Warning Tape

2.1-C.1 The following items shall be applied to tracer wires and utility warning tape:

2.1-C.1(A) Tracer Wire:

Gas lines; #6 AWG type, RHW, RHW-2, or HMWPE (wet locations) stranded or solid copper, colored yellow, installed 6” above the pipe.

2.1-C.1(B) All other utilities

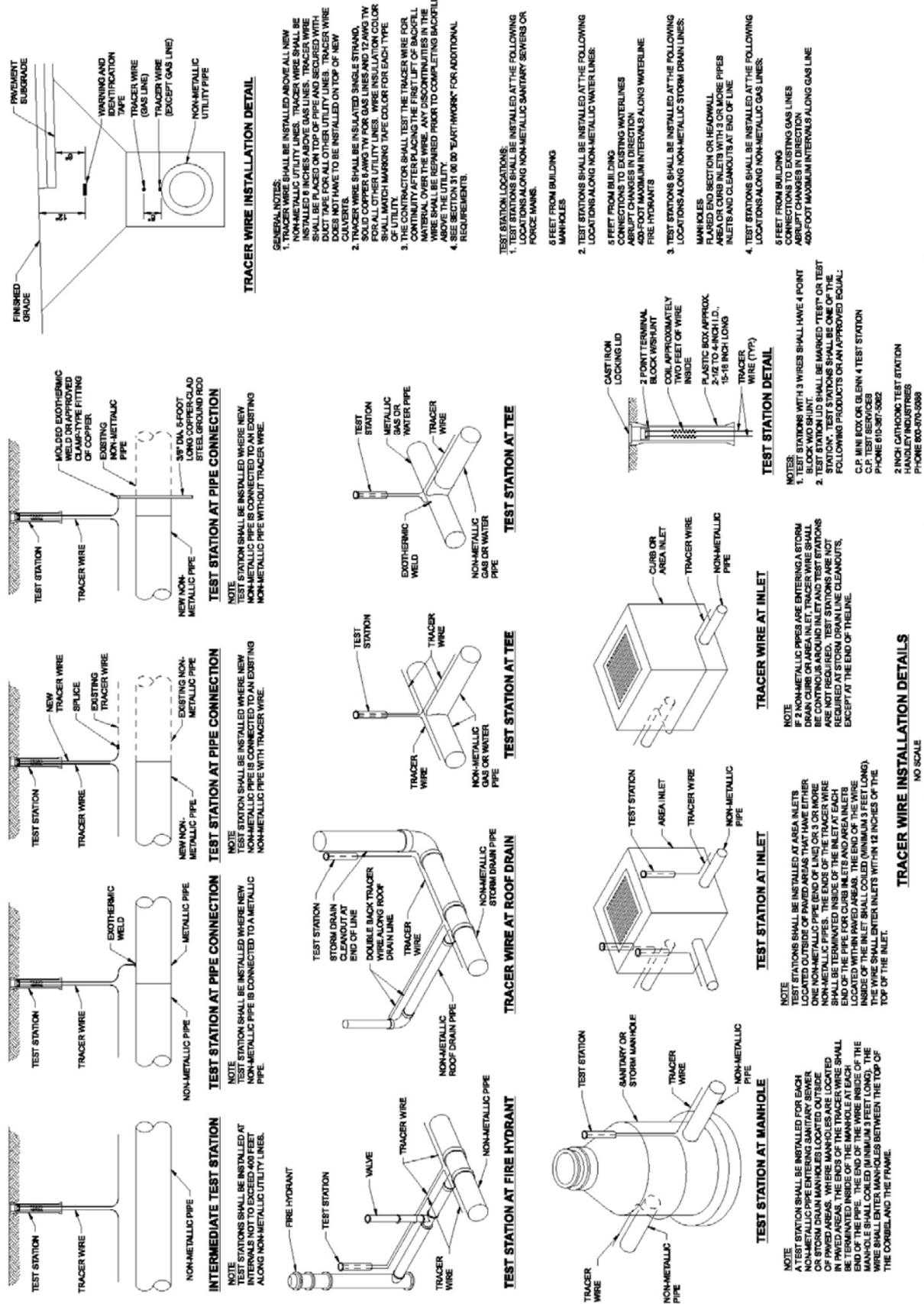
#12 AWG type RHW, RHW-2, or HMWPE (wet locations) solid copper installed along top surface of the utility, wire color to match warning tape color, placed on top of the utility. Tracer wire should be secured to the utility pipe every 3 feet with duct tape (except gas) to hold it in place during backfilling.

<u>Wire / Warning Tape Color</u>	<u>Utility</u>
Red or White	Electric
Yellow	Gas, Oil, Dangerous Materials
Orange	Telephone/Communications
Blue	Water Systems
Green	Sewer Systems
Purple	Non-potable Water Systems

2.1-C.2 Tracer Wire Details

Tracer wire leads shall be brought up, identified, and protected by test stations of the flush-curb-box type; H-20 rated, and shall be the standard product of a recognized manufacturer (HANDLEY or equal). Test stations shall have a cast iron lid and be mounted in 18 inches of concrete. [Where possible combine the Cathodic Test Station, Valve Box, and Tracer Wire Test Stations in the same concrete pad.] Test stations shall not be placed further than 400-ft apart. Contractor shall coil 18-inches of extra wire into the test stations for maintenance. See standard detail 2.1-a Fort Carson UTILITY TRACER WIRE INSTALLATION DETAILS on the following page.

A.1



SECTION 2
 INFRASTRUCTURE

Figure 2.1-a Tracer Wire Installation Details

2.1-D Cathodic Protection

The information in this guide is designed to provide general guidance to designers and contractors who will be performing work for Fort Carson Director of Public Works. Additional Codes, References & guidelines: UFC-3-570-06 Operation and Maintenance Cathodic Protections Systems, NACE International (NACE), ASTM International, DOT Part 192.451 thru Part 192.491, NFPA 70, FC Reg 420-19, FC Reg 420-20. There are many more codes and references not listed. The designer/contractor is responsible to research all applicable codes for each project and meet codes and provide a safe useable system installed in a professional and workman link manor.

Please direct all inquires regarding this section of the Instalation Design Guide to:

Utility Engineering
(719) 526-2943 or (719) 526-6673

2.1-D.1 General System Information

Fort Carson protects all underground metallic utility lines with the use of Cathodic Protection. This guide covers cathodic protection for metallic underground utilities (i.e. water, sewer, industrial waste, gas & storm drainage) that are in direct contact with an electrolyte (i.e. the soil). Cathodic protection limits corrosion by shifting the structure to electrolyte potential to a level proven to control corrosion. The designer or contractor shall design, furnish and install a complete, operating, magnesium sacrificial anode or impressed current (whichever is more appropriate) cathodic protection system. The services require planning, installation, adjusting, and testing of the system. If there are opportunities outside of the utility systems listed above (i.e. fire protection lines, their connectors, & lines / fittings under the slab or foundation) the contractor shall be responsible for analyzing and development of a Cathodic Protection Plan that will meet the protection requirements for that specific applications.

Designers & Contractors shall coordinate design and proposed installations with the Base Operations and Maintenance Division Utilities for project review.

2.1-D.2 General Design Information

2.1-D.2(A) The design, installation, testing and inspection of Cathodic Protection systems shall done by or under direct supervision of a “corrosion expert” to supervise, inspect, and test the installations and performance of the cathodic protection system. The “corrosion experts” name and qualifications shall be certified in writing to the DPW operations division utility representative prior to the start of construction. Such a person must be certified by the National Association of Corrosion Engineers (NECE) as a NACE Accredited Corrosion Technologist or a NACE certified Cathodic Protection (CCP) Specialist or be a registered professional engineer who has certification or licensing that includes education and experience in corrosion control of buried or submerged metallic piping and tank system.

2.1-D.2(B) Certification shall be submitted giving the name of the firm, the number of years of experience, and a list of not less than five (5) of the firm's installations three (3) or more years old that have been tested and found satisfactory.

2.1-D.2(C) Services of "Corrosion Expert" The "Corrosion expert" shall make at least 3 visits to the project site. The first of these visits shall include reviewing the requirements with the installation contractor, review and approve the equipment and materials to be used, and review or prepare installation drawings for the cathodic protection required. Once the submittals are approved and the materials delivered, the "corrosion expert" shall revisit the site to ensure the Contractor understands installation practices, conduct onsite training of contractor personnel, laying out the components and initial testing. The third visit shall involve testing the installed cathodic protection systems and training applicable personnel on proper maintenance techniques. The "corrosion expert" shall monitor the installation verify the contractor's installation procedures, and complete the final testing of all cathodic protection installed.

2.1-D.2(D) All cathodic systems installed must meet a 20 year anode life expectancy based on final test readings. All work must meet the applicable NACE Standards and Practices. Final test results must meet one of the NACE criteria described in the applicable Standards and Practices

2.1-D.3 INSTALLATION INSTRUCTIONS

2.1-D.3(A) All equipment shall be installed in accordance with the manufacture recommendations. All uncoated flange bolts, uncoated mechanical fitting bolts, any other uncoated bolts and uncoated flanges or fittings with metallic composition shall be protected with wax-tap primer and #1 wax-tape. (Trenton Corporation, 313-426-3955 Wax-tape primer / #1 Wax-tape or approved equal) Do not wrap plastic around any metallic water line appurtenances for corrosion protection.

2.1-D.3(B) Package anodes shall be installed completely dry, in native soil, installed horizontally to the depth at least as deep as the bottom of the pipe, and shall be lowered into holes by rope sling or by grasping the cloth gather. The anode lead wire shall not be used in lowering the anodes. The hole shall be backfilled with fine native soil in 6-inch layers and each layer shall be hand-tamped around the anode. Care must be exercised not to strike the anode or lead wire with the tamper. If immediate testing is to be performed, water shall be added only after backfilling and tamping has been completed to a point 6 inches above the anode (leaving a pocket above the anode). Approximately 5 gallons of water may be poured into the hole. After the water has been absorbed by the soil, backfilling and tamping may be completed to the top of the hole.

2.1-D.3(C) Anodes shall be installed a minimum of 3-feet and a maximum of 10-feet from the protected fitting. The anode may be laid in the same trench adjacent to non-metallic pipe, in native soil, and a depth below the pipeline but no closer than 6-inches to the pipe.

2.1-D.3(D) Single anodes shall be connected through a test station allowing adequate slack in the connecting wire to compensate for movement during backfill operation and future maintenance testing.

2.1-D.3(E) Connections to ferrous pipe or fittings shall be made by exothermic weld methods manufactured for the type of pipe or fittings being used. The connection area shall be prepared to bare metal by means of filing, grinding or other approved methods recommended by the manufacture of the exothermic weld. After the wire or test lead to the fitting connections have been made they shall be capped with petroleum caps (Handi-caps by Royston) and covered with wax sealant.

2.1-D.3(F) The test leads shall be installed in PVC conduit to protect them from physical damage and routed to the base of the test station allowing adequate slack (12") in the connecting wire to compensate for movement during backfill operation and future maintenance testing.

2.1-D.4 MATERIALS AND PRODUCTS

2.1-D.4(A) Anodes: Galvanic anode shall be high potential magnesium. Impressed current anodes shall be selected by the Corrosion Expert as appropriate for the structure being protected.

2.1-D.4(B) Artificial Backfill: Galvanic anodes shall be factory packaged with an artificial backfill in a water-permeable fabric sack or cardboard container. Impressed current backfill shall be determined by the Corrosion Expert as appropriate for the selected anode.

2.1-D.4(C) Galvanic Anode Connection Wire: Connect one (1) each No. 12 AWG Stranded copper listed for direct bury wire colored black, not less that 10-feet long, un-spliced, factory installed with the place of emergence from the anode in a cavity sealed flush with a dielectric-sealing compound.

2.1-D.4(D) Metallic appurtenances Connection Wire: Connect two (2) each No. 12 AWG stranded copper, listed for direct bury wires, color red, cad-welded to each appurtenance, not less than 10 feet long, un-spliced. In cases were more than one solid metallic component are being protected as one system two NO. 8 AWG copper HMWPE coated for direct bury wires shall be cad-welded (or approved alternate method) between each component (i.e. pipe to Mega Lug to valve).

2.1-D.4(E) JOINT, PATCH, SEAL, AND REPAIR COATINGS: Coating compound shall be cold-applied wax based material. Wax-tape primer and #1 wax-tape shall be used to cover bolts and exposed uncoated metal fittings. (Trenton Corporation, 313-426-3955, Wax-tape primer/ #1 Wax-tape or approved equal). Wire brush the surface clean of loose mill scale, rust, paint and other foreign matter. Apply a thin film of Wax-Tape Primer. If the surface is wet, cold or rusty, rub and press on Primer firmly to displace the moisture and to ensure adhesion. Then wrap #1 Wax-Tape using a 1 inch overlap. While wrapping, press and mold the tape into conformity, ensuring that there are no air pockets or voids, so that the tape in intimate contact with the surface. Also, press and smooth out lap seams to ensure that they are sealed, Because there is no drying or curing time, backfilling can take place immediately.

2.1-D.4(F) TEST STATIONS: Test stations shall be of the flush-curb-box type; 5" shaft, heavy duty, H-20 rated and shall be the standard product of a recognized manufacture (Bingham and Taylor P525RD TEST or equal). They are to be installed in an 18- inch concrete ring 6-inch thick at final grade. The test stations shall be provided with a lockable cover and

shall have an embossed legend; "C.P. Test" A minimum of two (2) leads is required to the metallic object from each test station. Other conductors shall be provided for each anode. Contractors shall splice wires together from the anode to the metallic object at one point connection with a .1 ohm shunt inside the test station. Contractor shall coil 18-inches of extra wire into the station for maintenance. Test station shall be of sufficient size to accommodate the number of wires from the anode/s and fitting/s. The location of the test station shall not be greater than (10) ten feet Test Stations shall be installed flush mounted in concrete 18 inch round 6 inch thick, all test station hardware such as machine screws, washer, and hex nuts shall be brass or stainless steel.

- Test station shall be installed with color-coded covers to identify the system on which it is installed as specified in this specification. Identify the fitting size and control wires in the test station with a tag/label. (Panduit PAN-TY PN: PLF1MA-C or similar may be used)
- Flush mount test station shall be installed in low or no traffic areas.
- Test stations shall be installed with color-coded covers to identify the system on which it is installed. Refer to Section 2.1-C.1(b) for color codes.

2.1-D.5 DOCUMENTATION: The Contractor shall provide GPS coordinates in Lat/Lon hddd.ddddd WGS 84 decimal degrees for all test station locations installed, as-built drawing showing the location and design of installation, photos of installation taken prior to backfilling.

2.1-D.6 FINAL TESTING: The "corrosion expert" verifies the contractor's installation procedures, and completes the final testing of all cathodic protection. Values obtained must include the following but not limited to:

- Date readings taken
- Location of test station
- Structure Native potential
- Structure ON potential
- Structure Instant Off potential
- Anode only potential
- Current output of anode (used to calculate 20 year life expectancy)
- Final potential readings shall meet NACE criteria for cathodic protection.

2.1-E Testing Requirements:

2.1-E.1 Prior to acceptance and initial operation, all piping installations shall be inspected and pressure tested to determine that the materials, design, fabrication, and installation practices comply with code requirements.

2.1-E.2 Connection points between the new piping and the existing piping shall be tested with a noncorrosive leak-detecting fluid or approved leak-detecting device.

2.1-E.3 The test medium shall be air, nitrogen, carbon dioxide, or an inert gas.

OXYGEN SHALL NEVER BE USED.

2.1-E.4 Test Preparation:

2.1-E.4(A) Pipe joints, including welds, shall be left exposed for examination during the test.

2.1-E.4(B) Appliances and equipment that are not to be included in the test shall be either disconnected from the piping or isolated by blanks, blind flanges, or caps.

2.1-E.4(C) All testing of piping systems shall be done with due regard for the safety of employees and the public during the test. Bulkheads, anchorage, and bracing suitably designed to resist test pressure shall be installed if necessary. Prior to testing, the interior of the pipe shall be cleared of all foreign material.

2.1-E.5 Test Pressure

2.1-E.5(A) Test pressure shall be measured with a monometer or with a pressure measuring device designed and calibrated to read, record, or indicate a pressure loss due to leakage during the pressure test period. The source of pressure shall be isolated before the pressure tests are made. Mechanical gauges used to measure test pressures shall have a range such that the highest end of the scale is not greater than 5 times the test pressure.

2.1-E.5(B) The test pressure to be used shall be no less than 1 ½ times the proposed maximum working pressure, but not less than 3 PSI (20kPa), irrespective of the design pressure. Where the test pressure exceeds 125 PSI (862 kPa), the test pressure shall not exceed a value that produces a hoop stress in the piping greater than 50 percent of the specified minimum yield strength of the pipe.

2.1-E.5(C) Test duration shall be not less than ½ hour for each 500 cubic feet of pipe volume or fraction thereof. When testing a system having a volume less than 10 cubic feet or a system in a single-family dwelling, the test duration shall be a minimum of 10 minutes. The duration of the test shall not be required to exceed 24 hours.

2.1-E.5(D) The piping system shall withstand the test pressure specified without showing any evidence of leakage or other defects. Any reduction of test pressures as indicated by pressure gauges shall be deemed to indicate the presence of a leak.

2.1-F Meters, Regulators and Pipe Risers

2.1-F.1 Meters

2.1-F.1(A) Diaphragm type meter shall be used on facilities that use 1,400 cubic feet of gas per hour or less. These meters require a minimum ¾-inch riser.

2.1-F.1(B) Rotary type meters shall be used on facilities that use more than 1,400 cubic feet of gas per hour. Rotary meters shall be pulse type, Lon Works compatible and be pressure/temperature corrected. These meters require a minimum 1 ¼-inch riser.

2.1-F.1(C) A “Y” type gas strainer must be installed immediately upstream of all gas meters.

2.1-F.1(D) Provide meters with a pulse switch indicator capable of operating up to speeds of 500 maximum pulses per minute with no false pulses and requiring no field adjustments. Provide not less than one pulse per 100 cubic feet of gas.

2.1-F.1(F) Gas meters shall be supported or connected to rigid piping so as not to exert a strain on the meter.

2.1-F.2 Regulators

2.1-F.2(A) Building service regulators shall be installed outside the building on the buildings pipe riser assembly.

2.1-F.2(B) The regulator vent shall be designed and installed to prevent the entry of water, insects, snow, or other foreign materials that could cause blockage of the vent port.

2.1-F.2(C) The regulator vent shall terminate at least 3 feet from any source of ignition.

2.1-F.2(D) The regulator shall be installed with a 3 foot vertical clearance from any doors, windows or air intake apparatuses.

2.1-F.2(E) The regulator vent shall be designed and installed to prevent the entry of water, insects, or other foreign materials that could cause a blockage and cause the regulator to malfunction.

2.1-F.3 Pipe Risers

2.1-F.3(A) All gas riser shut off valves shall be located a minimum of 12-inches above the finished grade.

2.1-F.3(B) Fuel gas piping entering the facility shall be installed between 30 and 40 inches above the finished grade.

2.1-F.3(C) All gas risers shall extend a minimum of 12-inches above the finished grade.

2.1-F.3(D) All gas risers shall be located between 8 and 18 inches out from the building’s exterior finish.

2.1-F.3(A) Refer to the figure on page 12 for typical riser installations.

2.1-F.3(A) The minimum size for gas riser piping shall be $\frac{3}{4}$ -inch.

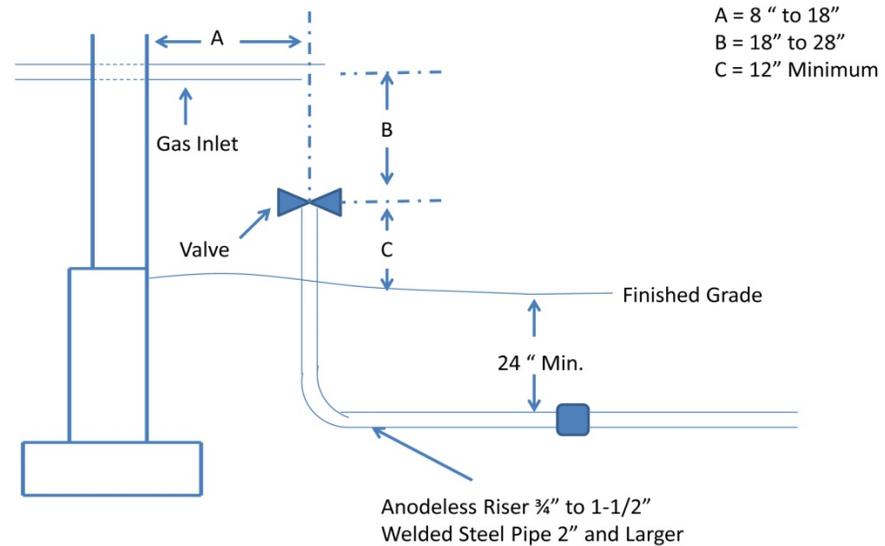


Figure 2.2-b Typical Service Riser Detail

2.1-G Materials

All materials shall be new and free from obvious or visible defects and shall meet NFPA 54 standards.

2.1-G.1 Pipe

2.1-G.1(A) Underground gas piping 2-inch and smaller shall be PE 2406 MDPE or PE 3408 HDPE SRD 11 type pipe

2.1-G.1(B) Underground gas piping larger than 2-inch shall be PE 3408 HDPE SDR 11 type pipe.

2.1-G.2 Risers

2.1-G.2(A) Gas risers 3/4-inch through 2-inch diameter shall be a prefabricated insert type anodeless riser, IPS, SDR 11 with aboveground NPT threads.

2.1-G.2(B) Gas risers larger than 2-inch diameter shall be a welded standard weight, schedule 40 steel pipe riser.

CLEARANCE MATRIX FOR TYPICAL FORT CARSON UNDERGROUND UTILITIES

All separations shown are the clear horizontal distance between two objects measured surface to surface (All dimensions are in feet)

TYPE OF UTILITY	Potable Water	Non-Potable Water	Wastewater	Storm Sewer	Gas Main	Gas Service	Primary Electric	Secondary Electric	Communication Lines
Potable Water		10	10	10	6	3	10	10	10
Non-Potable Water	10		10	10	6	3	10	10	10
Wastewater	10	10		5	6	3	10	5	5
Storm Sewer	10	10	5		6	3	10	5	5
Gas Main	6	6	6	6		3	6	6	6
Gas Service	3	3	3	3	3		3	1	1
Primary Electric	10	10	10	10	6	3		1	1
Secondary Electric	10	10	5	5	6	1	1		1
Communication Lines	10	10	5	5	6	1	1	1	

CLEARANCE MATRIX FOR TYPICAL FORT CARSON UNDERGROUND UTILITY CROSSINGS

All separations shown are the clear vertical distance between two objects measured surface to surface (All dimensions are in feet)

TYPE OF UTILITY	Potable Water	Non-Potable Water	Wastewater	Storm Sewer	Gas Main	Gas Service	Primary Electric	Secondary Electric	Communication Lines
Potable Water		1.5	1.5	1.5	1	1	1	1	1
Non-Potable Water	1.5		1.5	1.5	1	1	1	1	1
Wastewater	1.5	1.5		1.5	1	1	1	1	1
Storm Sewer	1.5	1.5	1.5		1	1	1	1	1
Gas Main	1	1	1	1		1	1	1	1
Gas Service	1	1	1	1	1		1	1	1
Primary Electric	1	1	1	1	1	1		1	1
Secondary Electric	1	1	1	1	1	1	1		1
Communication Lines	1	1	1	1	1	1	1	1	

Any deviations from the above clearances must be approved by the DPW, Operations and Maintenance Division

** Note: A potable water service line (Less than 3-inch Diameter) may be placed in a common trench with non-potable water/sewer building service under the following condition.

"The water service must be placed on a solid shelf excavated at one side of the common trench a minimum 1-foot over and above the top of the sewer pipe or non-potable water pipe plus 1-foot lateral separation."

2.1-F References

- National Fire Protection Association NFPA-54
- Department of Transportation (DOT) Pipeline Safety Regulations Part 191 and 192
- Colorado Springs Utilities Construction Guides
- International Plumbing Code
- Unified Facilities Guide Specification, UFGS-33-51-15, Natural Gas/ LP Gas Distribution.

2.1-F Point of Contact

- Point of Contact for this section of the Design Guide is:

Utilities-Gas Engineer Technician
 Directorate of Public Works
 Operations & Maintenance Division
 Building 1219, Fort Carson, CO 80913

(719) 526-9243

2.2 Exterior Electrical Distribution & Installation

The following information is provided as general guidance to designers and contractors who will be performing work for Fort Carson Directorate of Public Works. Additional Codes, References & guidelines:

UFC 3-560-01, UFC-550-01 ANSI C-2 NESC, NFPA 70, TI 800-1, AR 420-19,
TM 5-682, TM 5-684, Colorado Springs Utilities electric standards,
FC Reg 420-19, FC Reg 420-20.

There are many more codes and references not listed. The designer/contractor is responsible to research all applicable codes for each project and meet codes and provide a safe useable system installed in a professional and workman link manor.

DPW Operations and Maintenance Division:
Electrical Engineering: (719) 526-6673
usarmy.carson.imcom-central.list.dpw-electrical@mail.mil

2.2-A General System Information:

Fort Carson has a 12470GY/7200 Volt, 4 wire grounded Wye distribution system (grounded neutral). The system is owned by the US Government DPW and operated by the DPW Operations & Maintenance Contractor. Fort Carson has three Electrical substations, O'Connell Substation #1, Titus Substation #4 & Minick Substation #3 with a peak demand of about 42 Megawatts.

Designers & Contractors must coordinate electrical system connection point with the DPW Operations and Maintenance Division at 719-526-6673 or at usarmy.carson.imcom-central.list.dpw-electrical@mail.mil and must provide load data sheet of the estimated building load.

2.2-B General Design Information

2.2-B.1 All Electrical distribution designs shall be laid out in such a way to allow for switching and sectionalizing to be achieved from above ground.

2.2-B.2 Fort Carson Operations and Maintenance Contractor will energize all new 15kv systems IAW Fort Carson Regulation 420-19.

2.2-B.3 Fort Carson installs medium voltage 15kv exterior power lines underground in conduits, utilizing S&C PMH style pad mounted switches, 200 amp sectionalizing vaults and pad mounted transformers. Sectionalizing vaults shall be 4'x7'8"x 4' with torsion assist lid, 200 amp 4 point load break junctions and steps.

2.2-B.4 Manholes shall be 6'x 12'6"x7'. Manholes are to be used in areas of new development for splices, pad mounted switches, capacitor banks, meter stations and pull points. Manhole spacing shall be determined per cable pulling limitations and design, in no case shall they be spaced more than 800' max' apart. Manholes require two ringed lids unless a switch is mounted on top, all feed through man holes shall have a service loop in the cable, racked to the wall and grounded IAW NESC 97A(Ground 4 times a mile). Maximum 4 circuits allowed in Manholes.

- 2.2-B.5 Main circuit distribution feeders on the 600 amp system are 350 MCM Aluminum with 1/3 concentric neutral installed in 6" conduit and shall be designed with alternate loop feeds from other circuits.
- 2.2-B.6 Sub feeders tap to the 200 amp system are 4/0 Aluminum with 1/3 concentric neutral installed in 4" conduit and shall be designed in loop feed or with provisions for future loop connection.
- 2.2-B.7 Radial Building feeds tapped from Pad mounted switches or 200 amp sectionalizing vaults are #2 AWG, Aluminum with full neutral in 4" conduit. (Increased to 4/0 for 1000+ kva and larger facilities).
- 2.2-B.8 200 amp Sub feeders with multiple 4x7 sectionalizing vaults shall have 4/0 Aluminum with 1/3 concentric neutral conductors between vaults, All 4x7 vaults shall have 200 amp 4 point junction point and spaced between 500' to 800' feet maximum, and shall be designed in a loop layout that allows alternate feeds or provision for future extension. All 15Kv power circuits shall be installed in conduit, Direct buried conduits sand bedded at a buried at a depth of 42" to 48" with red warning marking tape 12" above conduits & conductors. Concrete encased raceways can be installed at NESC/NEC burial depths per design.
- 2.2-B.9 Direct buried conductors require written permission of DPW Operations & Maintenance Division.
- 2.2-B.10 All elbows and separable connectors shall have test points, Fault indicators may be required in 200 amp vaults or feed through systems..
- 2.2-B.11 Fort Carson is standardizing on three styles of S&C Pad mounted PMH mounted lighting arrestors. Inner Barriers Panels secured by recessed pentahead bolts, Interlocks are not required and must be removed if equipped before energizing the switch. Contact DPW Operations and Maintenance Division for switch fusing sizing for system protective coordination.
- 2.2-B.11(A) PMH-9, Two Fused Compartments, Two Switch Compartments. Options: P1 Arrestor Provisions, G7 Inner Barriers.
- 2.2-B.11(B) PMH-10, Four Switch Compartments. Options: P1 Arrestor Provisions.
- 2.2-B.11(C) G7 Inner Barriers.
- 2.2-B.11(D) PMH-11, One Fused Compartment, Three Switch Compartments. Options: P1 Arrestor Provisions, G7 Inner Barriers.
- 2.2-B.11(E) Cooper RVAC switch "KPRV10T32" switch is acceptable for use in main line sectionalizing upon approval of DPW Operations and Maintenance Division.
- 2.2-B.12 Three Phase transformers shall be internal loop feed type, dead-front, compartmentalized, 200A 15kV bushing wells and standard inserts, three (3) Bay-O-Net oil immersed in series w/ ELS-P Current limiting fuses, three (3) load break switches with a minimum current rating of 200A each, "3 Switch" 200 amp load break internal type switch, internal tap changer w/taps 2 @ 2.5% above and below nominal voltage rating, oil temperature gauge, liquid level gauge, pressure vacuum gauge, 1" drain valve, Surge three (3) elbow

arrestors (8.40 MCOV for Solidly Grounded Neutral Circuits), Danger High Voltage decal(s). DOE 2010 Transformer efficiency standards. Less-flammable biodegradable fluid with no detectable level of PCB, Aluminum or Copper windings are acceptable, Delta-Wye. TRANSFORMER SECONDARY must have: "CLOCK WISE ROTATION".

2.2-B.13 Single Phase transformers shall be ANSI TYPE 1 loop feed, dead-front, 200A 15 kV bushing wells and standard inserts, internal one (1) Bay-O-Net in series w/ ELS-P Current limiting fuse, one (1) loadbreak switch with a minimum current rating of 200A, "1" 200 amp load break internal type switch, internal tap changer w/taps 2 @ 2.5% above and below nominal voltage rating, oil temperature gauge, liquid level gauge, pressure vacuum gauge, 1" drain valve, Surge one (1) elbow arrestor (8.40 MCOV for Solidly Grounded Neutral Circuits), Danger High Voltage decal(s). DOE 2010 Transformer efficiency standards. Less-flammable biodegradable fluid with no detectable level of PCB, Aluminum or Copper windings are acceptable. Primary voltage for 1PH padmount transformers shall be 12470GY/7200.

2.2-B.14 After installation of the 15Kv cable feeding transformers all load break elbow are to be placed on insulated parking bushings attached to the transformer parking stand. The DPW Operations and Maintenance Contractor will check for operation and energize the transformer. (Insulated Parking stand will be provided by DPW upon request.)

2.2-B.15 15Kv Phase color coding is Phase A-1 "RED", Phase B-2 "YELLOW", Phase 3-C "BLUE".

2.2-B.16 All Grounding conductors shall be compression style crimps "No split bolts allowed" see design guide details for minimum grounding size.

2.2-C Electric Meter Requirements Electric services are required to be metered. Services 200 amp single phase and less can be dial or digital S-base type meter. Services 200 amps and larger, single or three-phase require digital LCD meter, transformer rated CT meters, factory programmed for "1-to-1" ratio with registers reading Kwh and Kwd 15 minute demand interval. Meter communication shall meet standard ANSI/CEA-709.1b protocol LONworks protocol using Standard Network Variable Types (SNVTs) for measured values. If no UCS is in the building a smart electric meter with pulse inputs capable of Lon over IP, BackNEt over IP or Modbus over IP. Recommended model Electro Industries Shark 200 T or compatible. Meters utilizing CT shall have meter base that will automatically shut the CT upon meter removal. Buildings 29,000 sq feet and 500KVA larger shall be connected to Utility control system (UCS) with a smart meter LONworks compatible with communication connection to the building EMCS/UMCS JACE controller. Meters mounted on transformers will be by permission only and shall have 3/4" conduit with cat 6 shielded cable to EMCS/UMCS JACE controller. All meters shall be Revenue Grade +/- 0.2% at unity power factor, +/- 0.5% at 0.5 power factor and shall provide the following values. See appendix for meter values.

2.2-C.1(A) Electric meter values building over 30,000 square feet:

KWH	Power factor 3 phase (coincidence)
KWD	Power factor 3 phase maximum date & time
Current phase A-B-C, current unbalance, (coincidence)	3 Phase real power (coincidence)
Current Average phase A-B-C	3 Phase reactive power (coincidence)
Current Maximum, date & time, phase A-B-C	3 Phase apparent power (coincidence)
Voltage coincidence A-B-C	Demand 15 min intervals
Voltage minimum maximum A-B-C date & time	3 Phase real power demand date & time
Phasor angle voltage A-B-C	3 Phase reactive power demand date & time
Phasor angle current A-B-C	3 Phase apparent power demand date & time

SECTION 2
INFRASTRUCTURE

2.2-D Roadway Street Lighting & Parking Lot Lighting Requirements

2.2-D.1 Road way Street lighting is HPS, Full-cutoff Cobra Head type, Tapered aluminum poles, with Helix base top of base at grade level, 120-240 volt, 2" PVC conduits. Photo cell each fixture. 400 watt 30' mounting height 250' to 300' pole spacing all ungrounded conductors shall fused in base, Street light circuits shall originate from transformer with an inline insulated fuse holder inside transformer, conductors shall be #4 copper, conductor colors shall be Black, Red, White, and Green. Maximum circuit distance 1700' from source.

2.2-D.2 Parking lot lighting is generally HPS, Shoebox type or MH check with DPW for lighting in the surrounding areas. Square pole, Helix base (Preferred) top of base at ground level installed in Islands. Parking lot lighting circuits shall be feed from building main electrical room; provide Astronomical time clock with overriding photo cell hand off auto switch.

Note: Fort Carson has encountered pole failures on 40' poles and would prefer 35' or less pole height, Square steel pole shall have vibration dampeners factory installed.

2.2-D.3 Inline fusing is required to be installed in each ungrounded conductor at the light pole base (Mersen FEB-21-21 or equal). Connections and splices shall be installed with clear insulated multiple tap connector burndy unitap or equal. All poles must have access door in the base to allow access to fuses. Buried junction boxes are not allowed.

2.2-E Need to add walkway light section.

Walkway lighting should match lighting in the surrounding areas and is generally HPS or MH . The use of LED lighting is recommended.

2.2-F Labeling and Equipment Identification

2.2-F.1 All underground circuits shall be labeled with a ½" large Black text on white P-Touch tyle label or equal.

2.2-F.2 Contractor shall contact DPW Operations & Maintenance Contractor's electric shop two weeks in advance to obtain the permanent asset identification number to label new switches, vaults, transformers and all underground cables.

2.2-G Temporary Services All temporary electrical services shall be metered and meet the outdoor power rack detail drawing or be an approved electrical pedestal designed for the purpose. Contractor shall coordinate and install at their expense then submit for FC 420-19 outage request form to have the new service connected by the Operations & Maintenance Contractor. All temporary services shall have utility agreement set up for utility payment if needed. The service agreement can be set up by calling 719-526-2927. or email usarmy.carson.imcom-central.list.dpw-electrical@mail.mil Contractor Qualification for Medium Voltage Work & Mechanical Execution of Work

2.2-G.1 Medium voltage cable pulling, termination and splicing shall be performed by qualified person with 4 years medium voltage cable pulling, splicing and termination experience. OR under direct supervision of a qualified person with 4 years cable pulling, splicing termination.

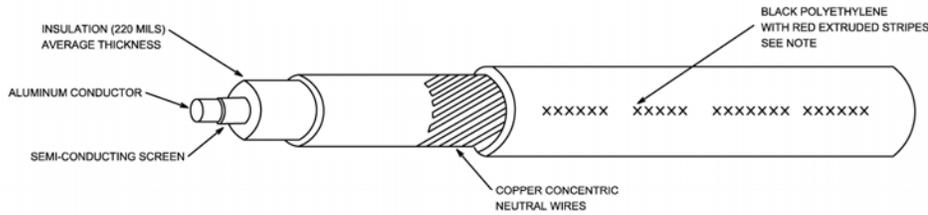
2.2-G.2 The Mechanical Execution of work shall be installed in a neat and workmanlike manner. As described in ANSI/NECA, Standard Practices for Good Workmanship in electrical contracting and other ANSI approved installation standards.

2.2-H Additional Resources & Details

System fault current and CAD drawing details available by email request at:

usarmy.carson.imcom-central.list.dpw-electrical@mail.mil

FORT CARSON APPROVED CABLE



CONDUCTOR: Uncoated aluminum, class B stranded per ASTM b-231, Continuous operating temperatures 105 C, Short circuit rating 250C.

INSULATION: Ethylene-propylene (EPR), not less than 220 mils average thickness (200 mils minimum thickness), 133% insulation level with and extruded semi-conducting screen

CONCENTRIC

NEUTRAL: Bare copper wires spaced uniformly around insulation screen, number and size as shown

JACKET: Black Polyethylene with red extruded stripes. Sunlight resistant. Suitable for wet or dry locations, in conduit, underground duct systems, direct buried, aerial installations.

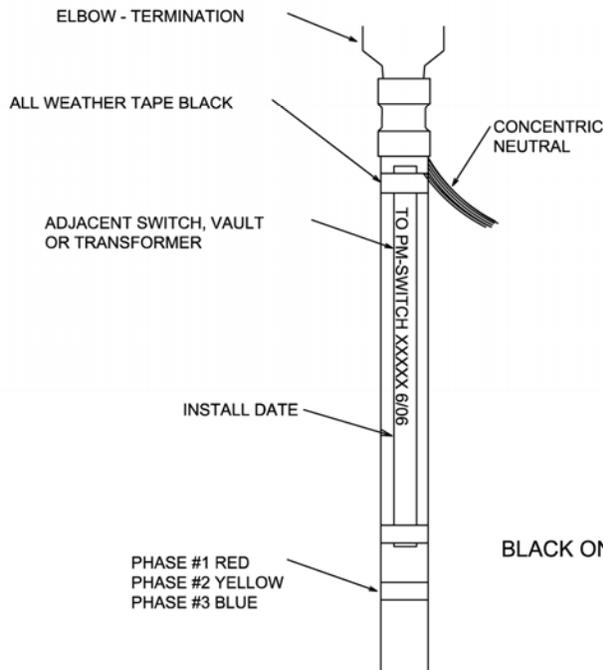
FACTORY TESTS: Cable shall meet the requirements of ICEA S-68-516, AIEC CS6, UL 1072.

Size	Number of Strands	Ampacity	Approximate Diameter over Insulation	Copper Neutral (No. x AWG)	Maximum Outside Diameter	Conduit
350 (1/3 neutral)	37	305	1.18 (in.)	18 x 14	1.52 (in.)	6"
4/0 (1/3 neutral)	19	200	1.02 (in.)	12 x 14	1.33 (in.)	4"
#2 (full neutral)	7	100	0.78 (in.)	10 x 14	1.09 (in.)	2" - 4"

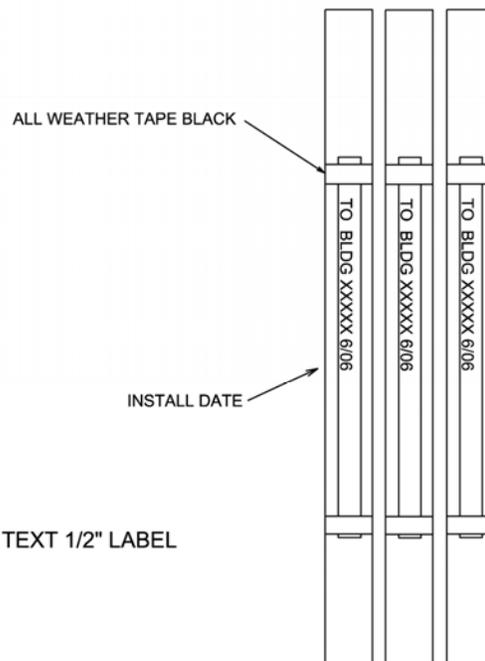
NOTE:

A durable marking shall be provided on the surface of the cable at intervals not exceeding 24 inches. Marking shall include manufacturer's name, insulation type, conductor size, voltage, insulation level, footage and date of manufacture

15 KV CABLE LABELING

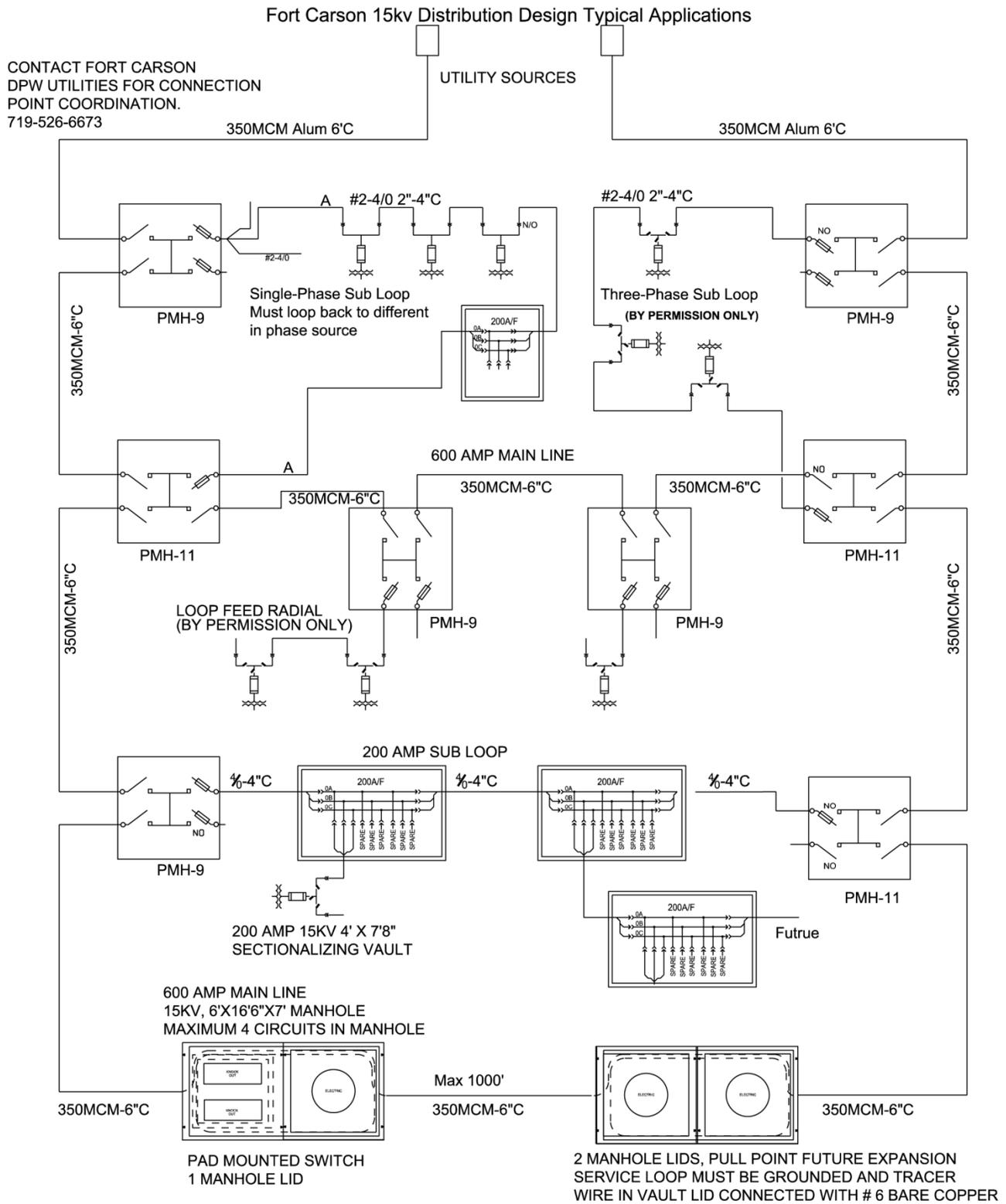


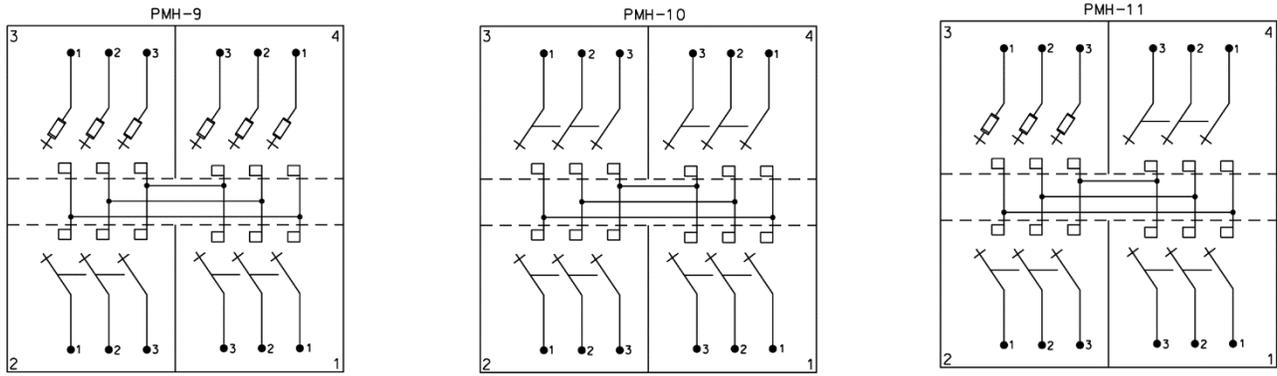
SECONDARY UG WIRE LABELING



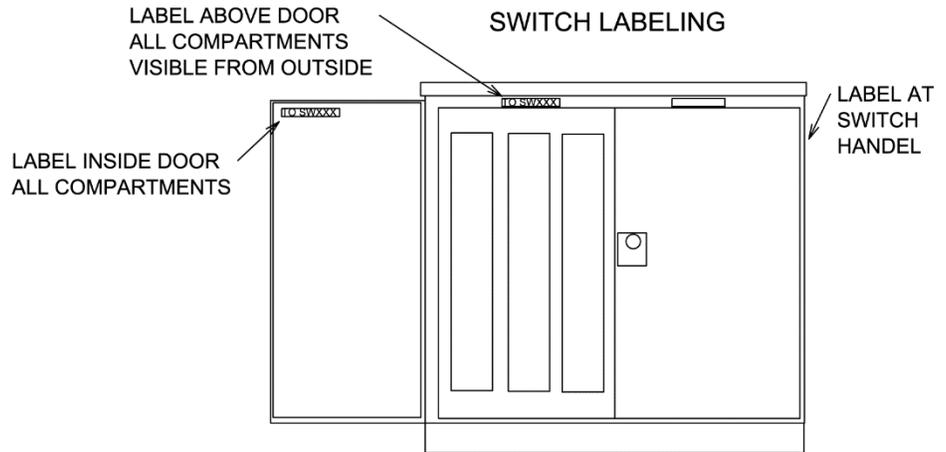
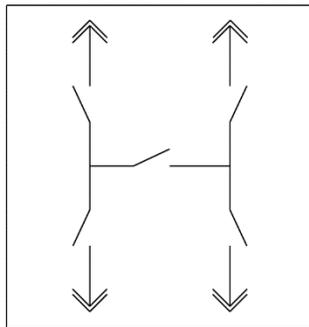
BLACK ON WHITE TEXT 1/2" LABEL

Figure 2.2-a Fort Carson Approved Cable





COOPER RVAC10T32



2 GROUND RODS #2/0 BCU GROUND LOOP TYP BOX PAD, VAULT LID & RETRO FIT, C-CRIMP ALL CONNECTIONS CONNECT ALL FOUR CORNERS WITH APPROVED CONNECTOR

PROVIDE MOUNTING PROVISION FOR BASE MOUNTED SURGE ARRESTERS AT SWITCH & BUSS TERMINALS

PROVIDE INNER BARRIER PANELS SECURED BY RECESSED PENTAHEAD BOLT FOR LIVE FRONT SWITCH

P7 KEY INTERLOCK ARE NOT ALLOWED.

NESC RULE 350F BOND ALL ABOVE GROUND METALLIC POWER AND COMMUNICATION CASES/PEDESTALS THAT ARE SEPARATED BY 6 FEET OR LESS. USE #6 BARE COPPER

SWITCH MUST HAVE FULL SERVICE LOOP IN THE PRIMARY CABLE FOR BOX PAD INSTALLATIONS

INSTALL BLACK TEXT ON WHITE BACKGROUND 1/2" LABEL ON THE INSIDE OF THE SWITCH DOOR, OUTSIDE ABOVE SWITCH DOOR AND INSIDE OF ALL SWITCH HANDLE ACCESS POINTS TO IDENTIFY LOAD OR FEEDER

SWITCH GROUND RING AND CABLE TERMINATION SHALL BE INSTALLED IN A MANNER TO ALLOW THE REMOVAL OF THE SWITCH BY UNBOLTING WITHOUT CUTTING ANY CONDUCTORS.

Figure 2.2-c Approved Pad Mounted Switch

COMPRESSION C-CRIMP ALL GROUND CONNECTIONS

TRAIN CABLE IAW MANUFACTURES SPECIFICATIONS

BOND ALL METAL ENCLOSURES FOR PHONE, CABLE, LIGHTS ETC WITHIN '6 WITH #6 BCU 18" DIRECT BURIED NESC RULE 350F
2 EACH 3/4" X 10' GROUND RODS WITH 2/0 STRANDED BARE COPPER GROUND LOOP FOR BOX PAD

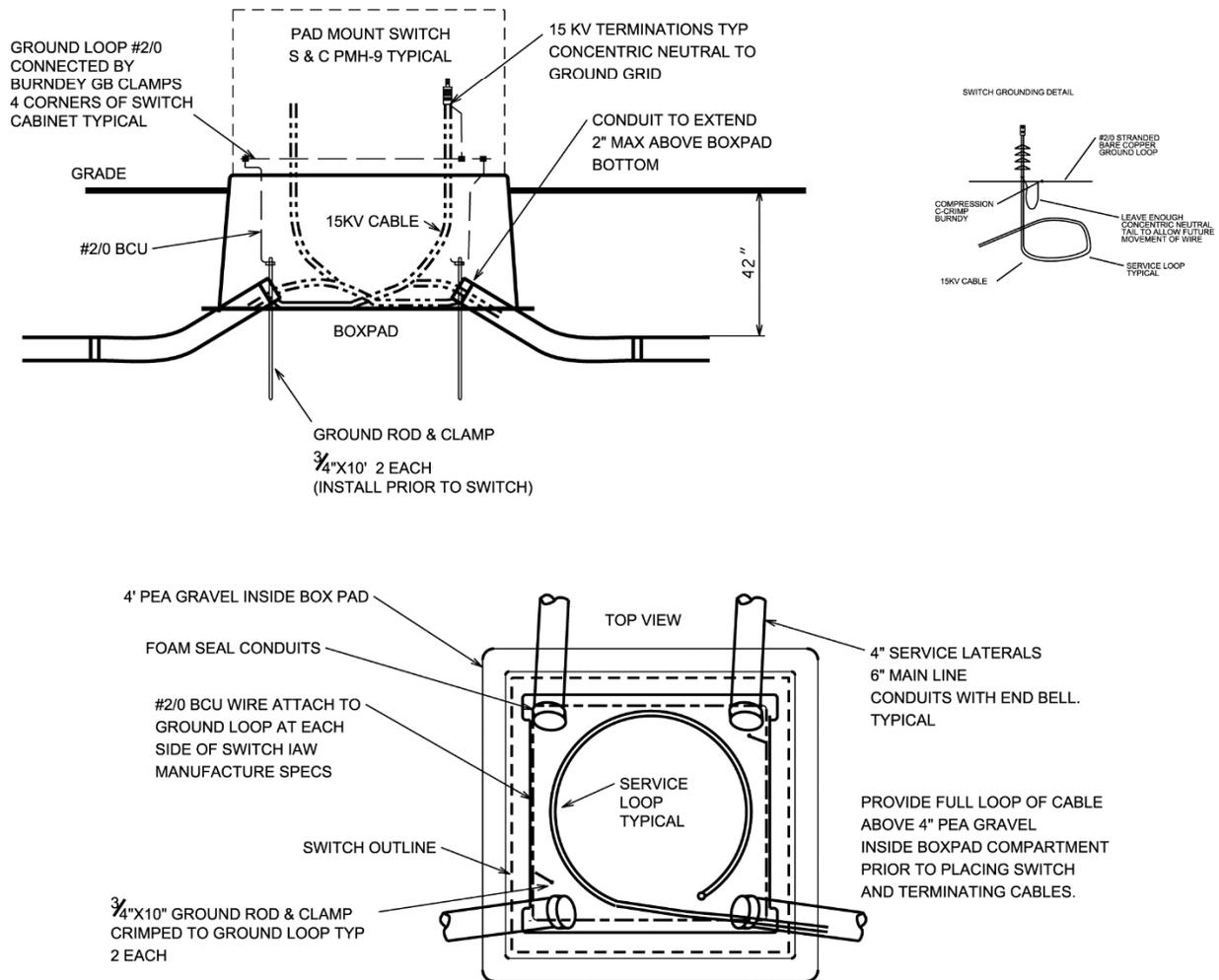
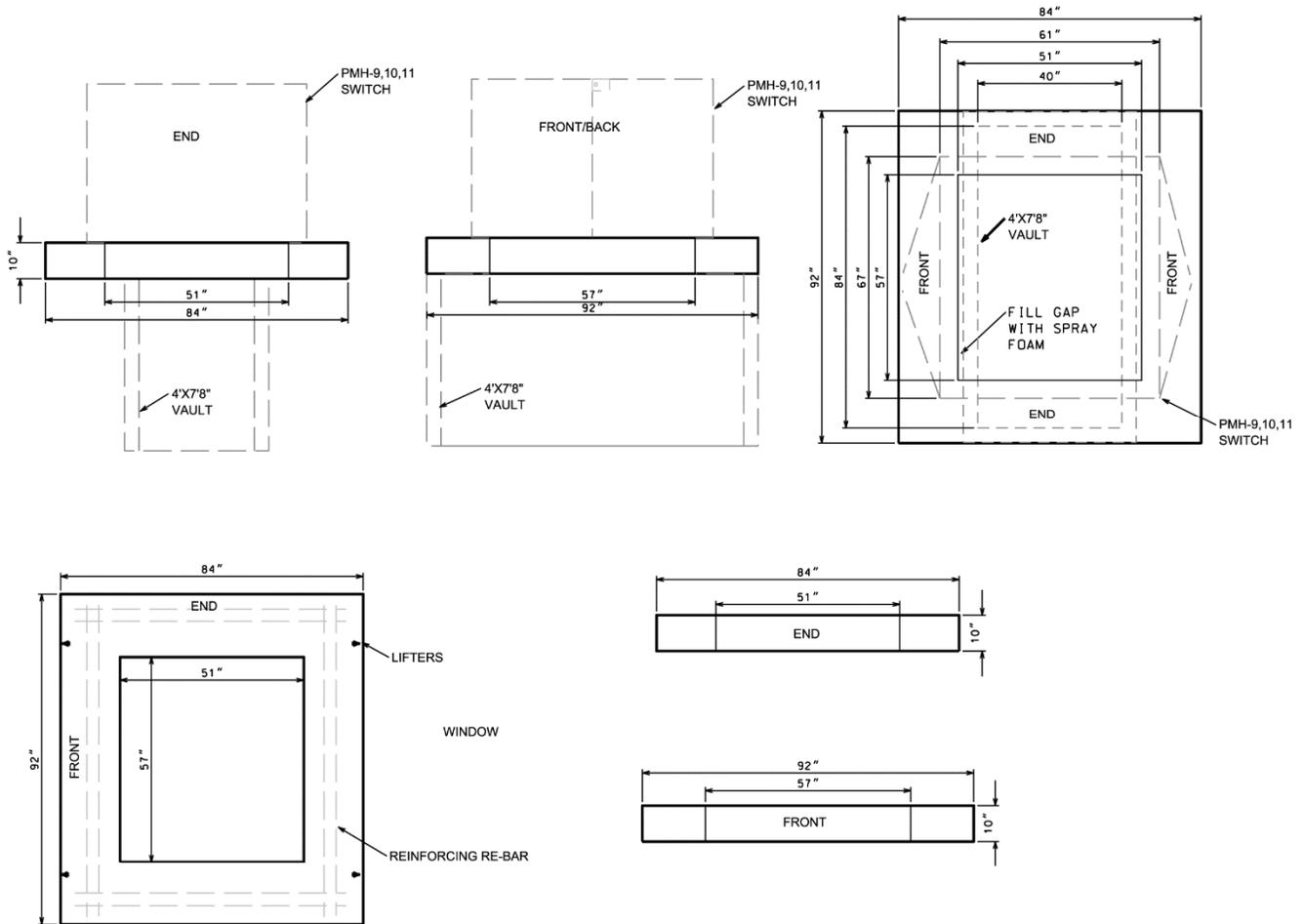


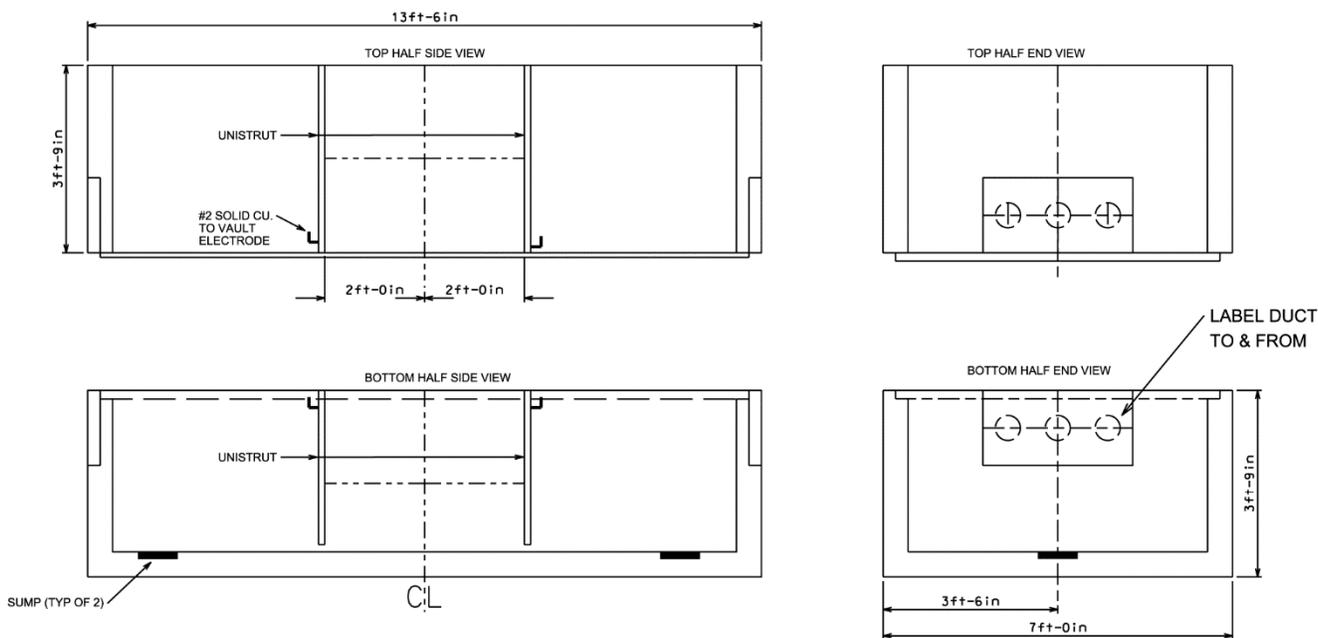
Figure 2.2-d Boxpad M7ounted Switch



SPECIAL ORDER PRE CAST
TYPE I/II CEMENT WITH FLY ASH
4000 PSI CONCRETE AT 28 DAYS
WITH REINFORCING RE -BAR RING

- NOTES:
1. SEAL BETWEEN EXISTING VAULT AND NEW PRE CAST CONCRETE PAD WITH FOAM SEALER TO SEAL BETWEEN CONCRETE.
 2. INSTALL ADDITIONAL GROUND RODS IF NONE ARE PRESENT.
 3. ADD FILL DIRT AROUND PRE CAST PAD TO BRING GRADE LEVEL TO BOTTOM OF PAD.

Figure 2.2-e Vault to PMH-9,10,11 Padmounted Switch Retro Fit Conversion Pad



6' WIDE 16'6 LONG 7' HIGH
VAULT LID OPTIONS

Contractor shall verify proper vault lid style and size to ensure pad mounted switch doors can open freely and switch fits properly

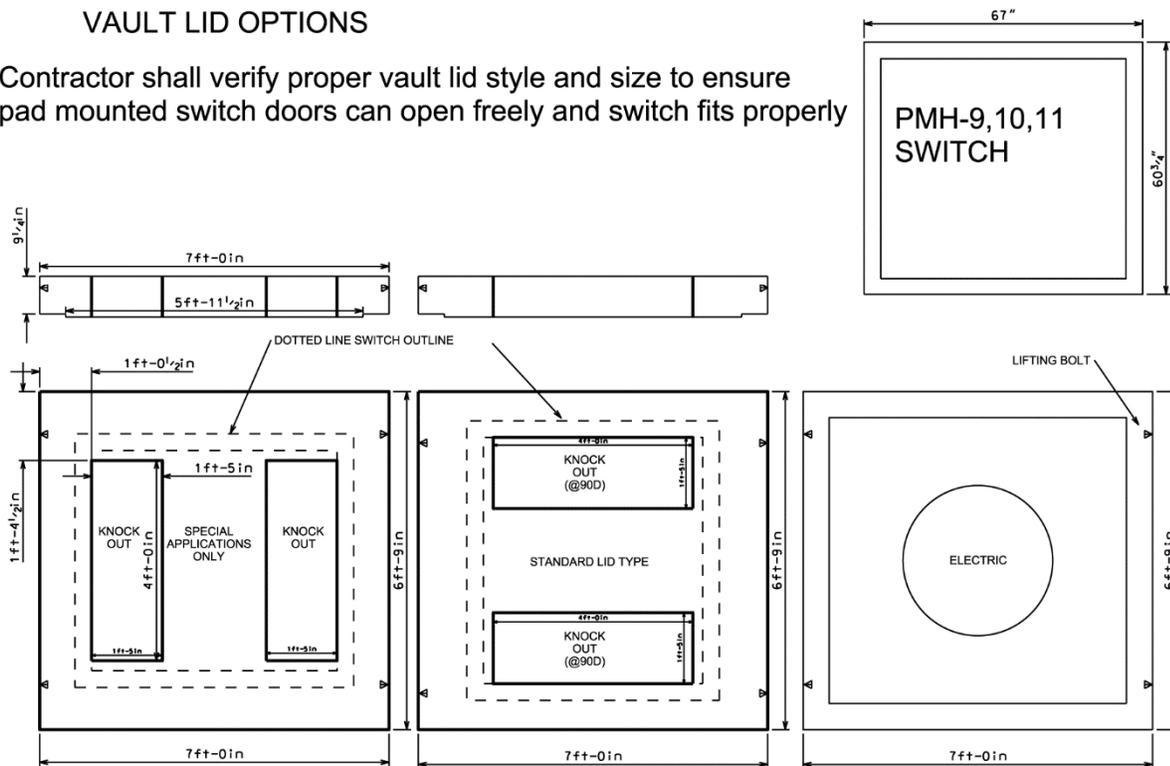
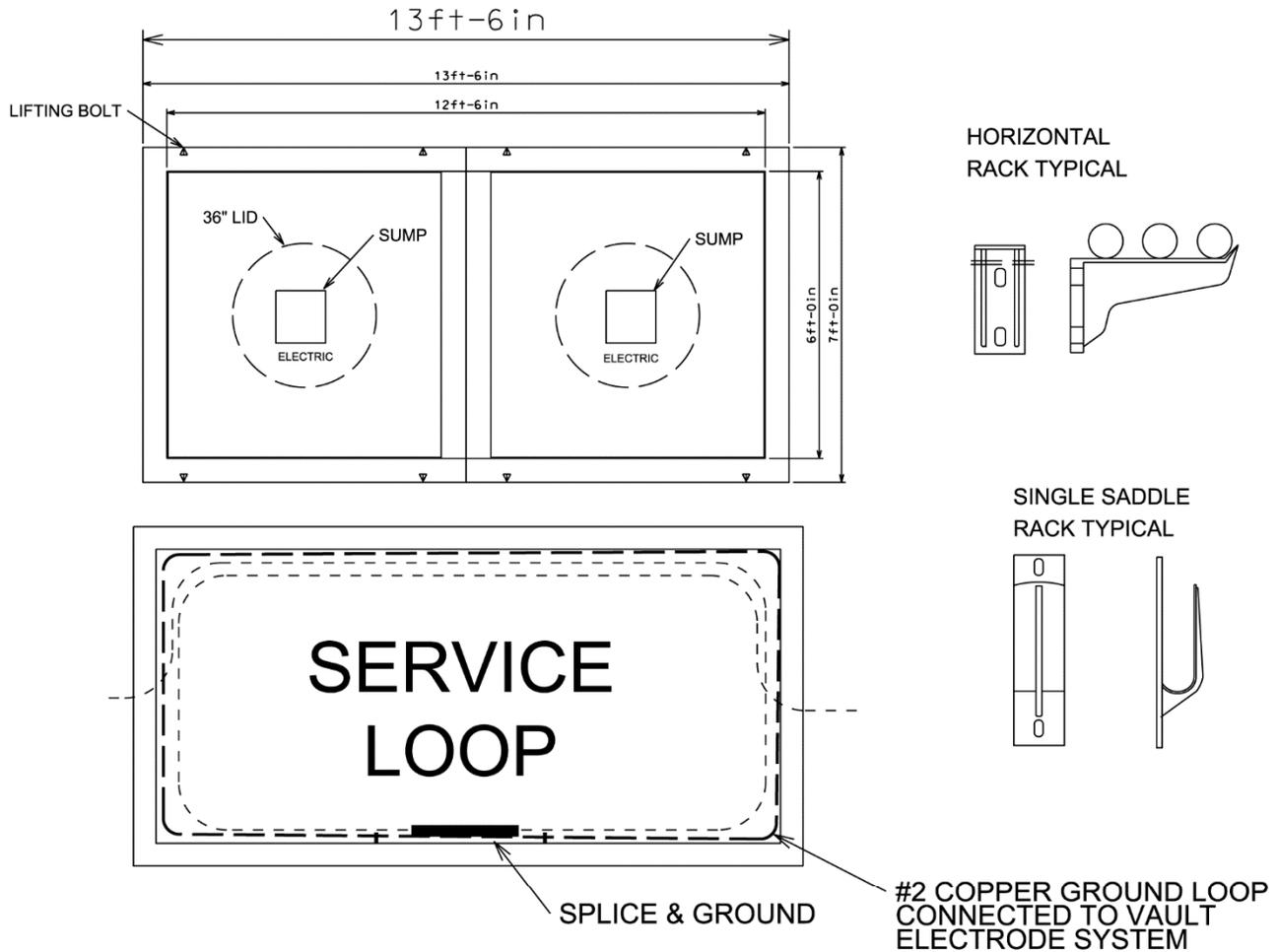


Figure 2.2-f 6'w x 12'-6"l x 7'h Vault



SECTION 2
INFRASTRUCTURE

NOTE:

1. TWO RINGED MAN HOLE LIDS ARE REQUIRED FOR PULL POINT VAULTS, CONTRACTOR TO VERIFY VAULT LID FOR PADMOUNTED SWITCH WILL ACCOMMODATE THE PMH9, 10, 11 SWITCH
2. NESC RULE 350 BOND ALL ABOVE GROUND METALLIC POWER AND COMMUNICATIONS PEDESTALS THAT ARE SEPARATED BY SIX (6') FEET OR LESS: USE MINIMUM #6 BARE COPPER DIRECT BURIED A MINIMUM 18" BELOW GRADE AND CONNECT TO LID AT SIDE NUTS USING LUG.
3. PROVIDE SERVICE LOOP IN THE CABLE FOR ALL VAULTS RACK AND SUPPORT CABLES TO VAULTS SIDE WALLS AS NEEDED TO SUPPORT CABLES.
5. FIRE TAPE AND LABEL ALL CONDUCTORS WITH PHASE TAPE AND CABLE IDENTIFICATION

Figure 2.2-g 6'w x 12'-6"l x 7'h Vault

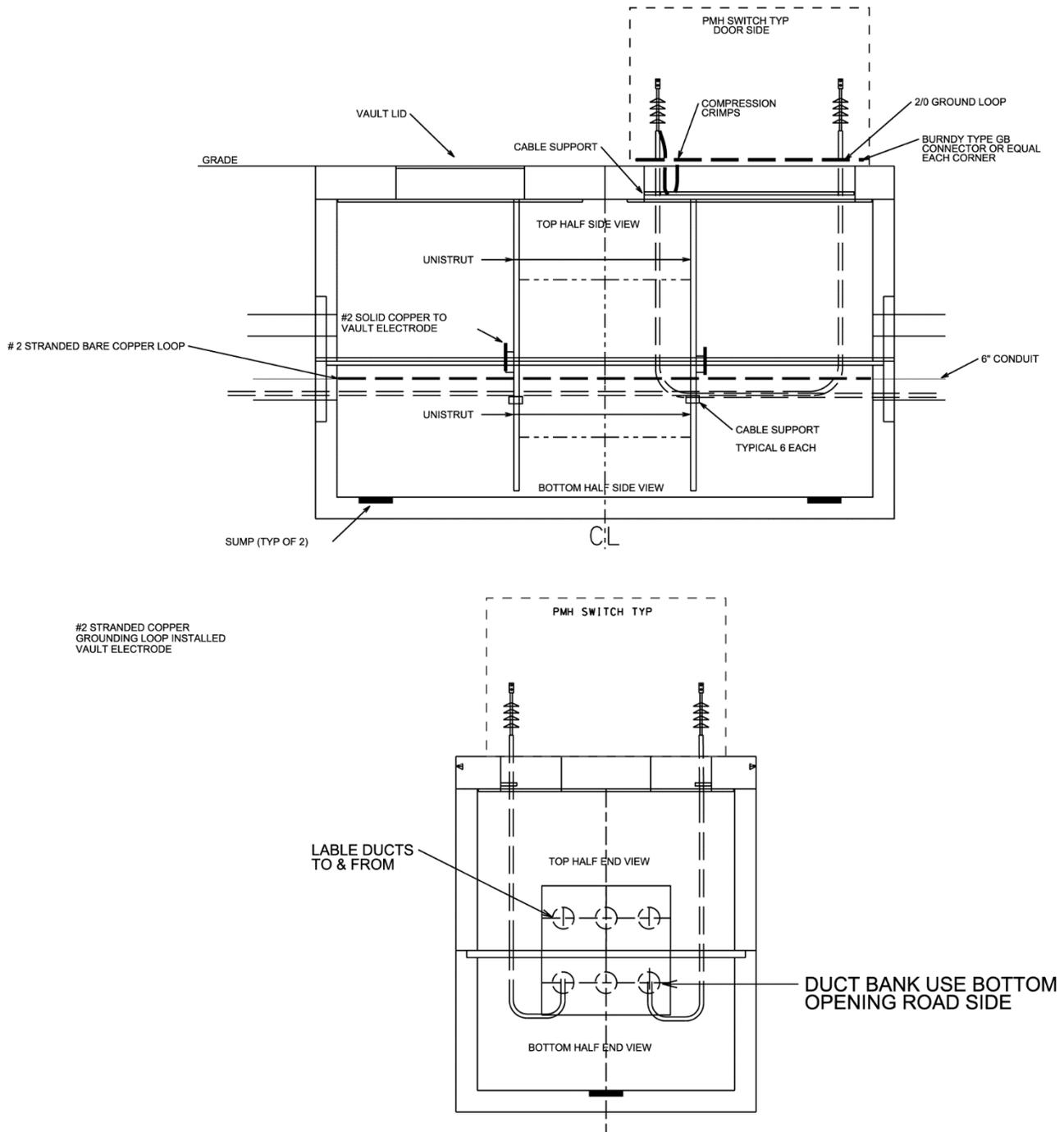
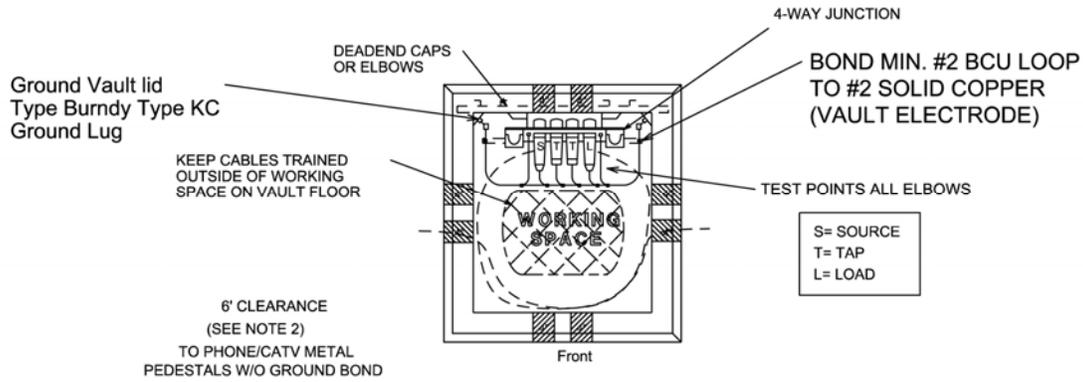


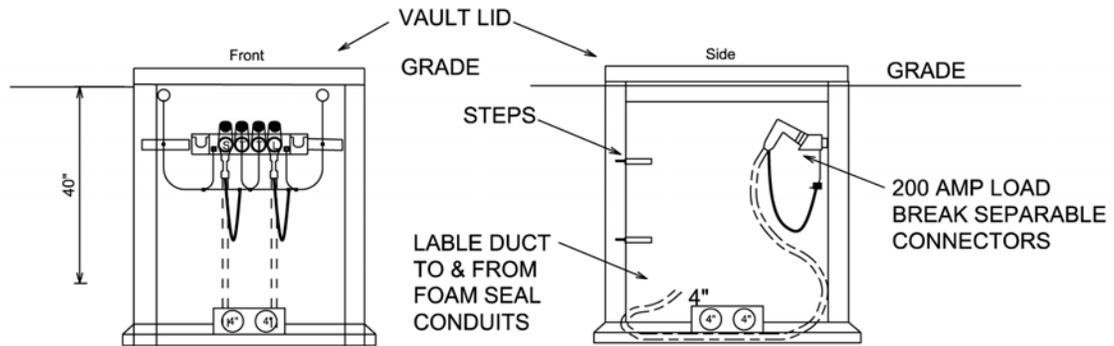
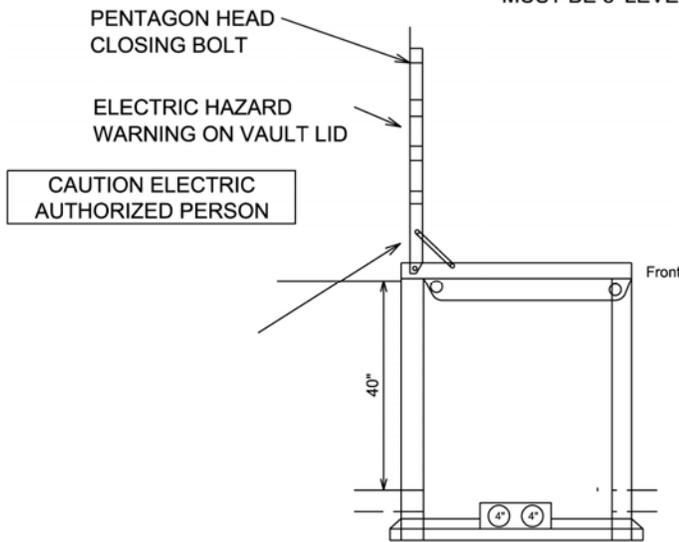
Figure 2.2-h 6'w x 12.5'l x 7'h Vault with Pad Mount Switch

200 AMP 4'X4' VAULT



SECTION 2
INFRASTRUCTURE

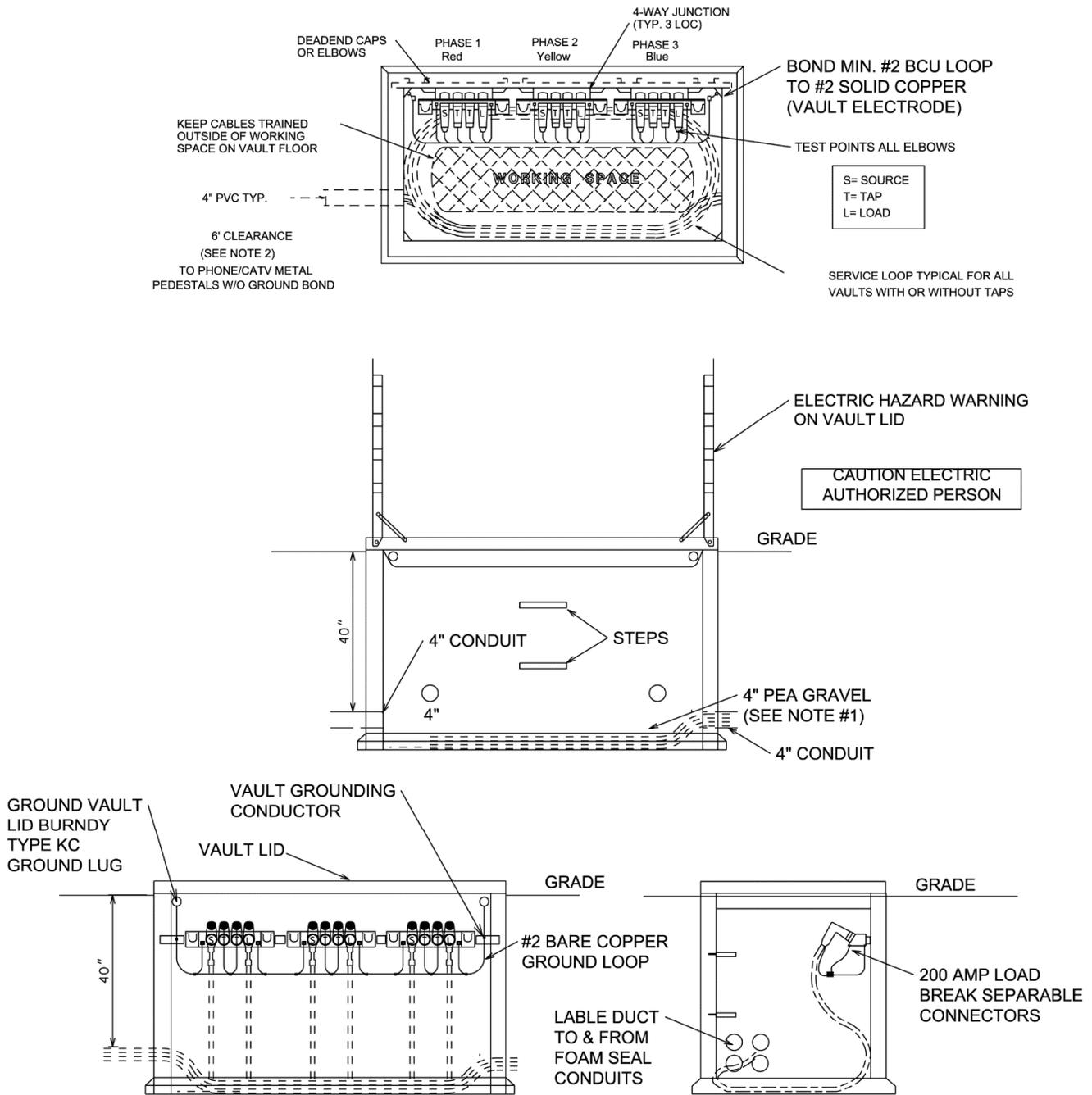
FRONT OF VAULT IS TYPICALLY TOWARDS STREET FOR OPERATIONS ACCESS
MUST BE 8' LEVEL CLEAR WORKING SPACE



NOTE:

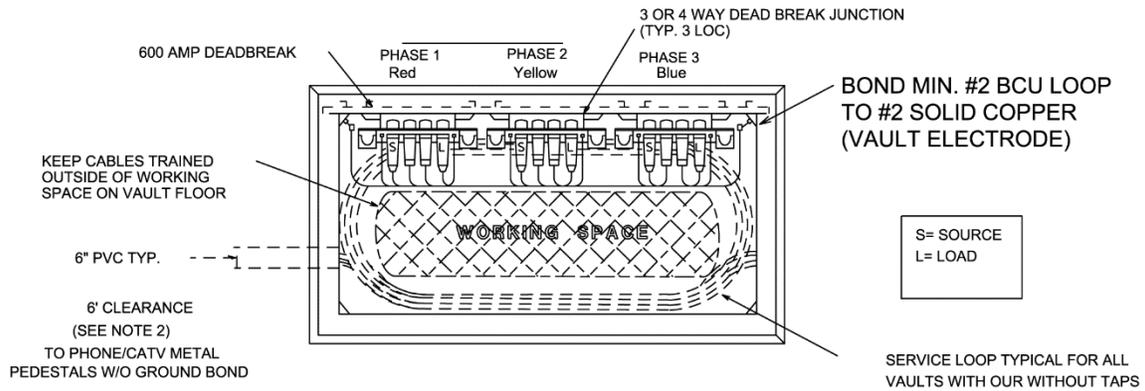
1. PROVIDE 3/8" DIA PEA GRAVEL, 4" THICK INSIDE VAULT BOTTOM FOR DRAINAGE (ONE TON WILL COVER APPROXIMATELY 4-1/2 VAULTS)
2. NESC RULE 350 BOND ALL ABOVE GROUND METALLIC POWER AND COMMUNICATION PEDESTALS THAT ARE SEPARATED BY SIX (6') FEET OR LESS: USE MINIMUM #6 BARE COPPER DIRECT BURIED A MINIMUM 18" BELOW GRADE AND CONNECT TO LID AT SIDE NUT USING LUG

Figure 2.2-i 200 Amp 4' x 4' Vault

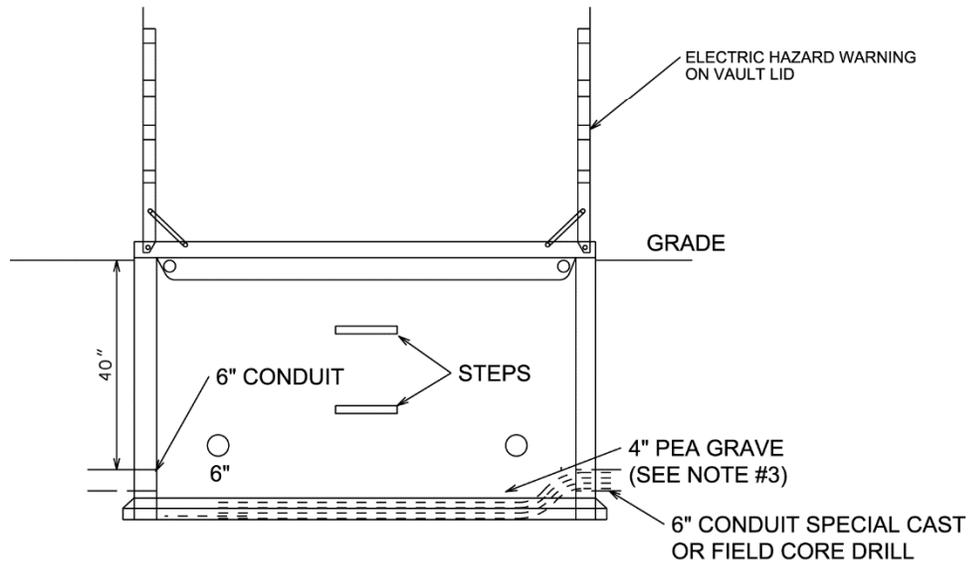


- NOTE:
1. PROVIDE 3/8" DIA PEA GRAVEL, 4" THICK INSIDE VAULT BOTTOM FOR DRAINAGE (ONE TON WILL COVER APPROXIMATELY 2-1/2 VAULTS)
 2. NESC RULE 350 BOND ALL ABOVE GROUND METALLIC POWER AND COMMUNICATION PEDESTALS THAT ARE SEPARATED BY SIX (6') FEET OR LESS: USE MINIMUM #6 BARE COPPER DIRECT BURIED A MINIMUM 18" BELOW GRADE AND CONNECT TO LID AT SIDE NUT USING LUG

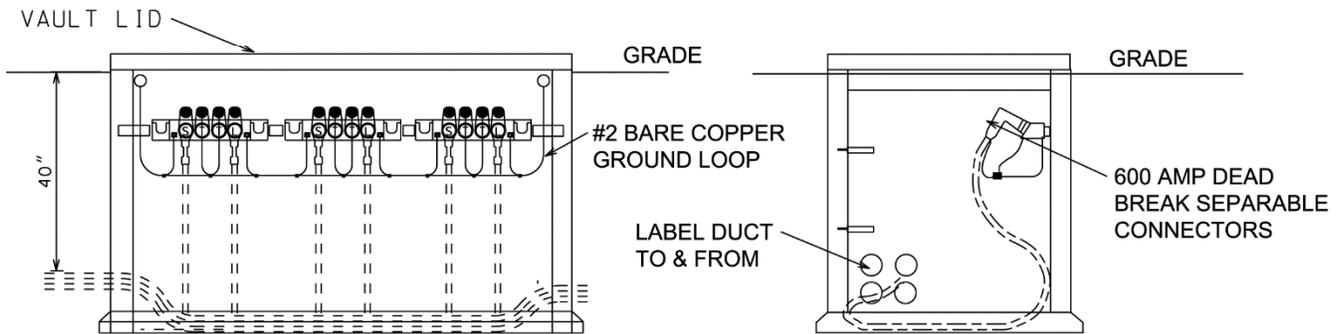
Figure 2.2-j 200 Amp 4' x 7'-8" Vault



BY PERMISSION ONLY



BY PERMISSION ONLY



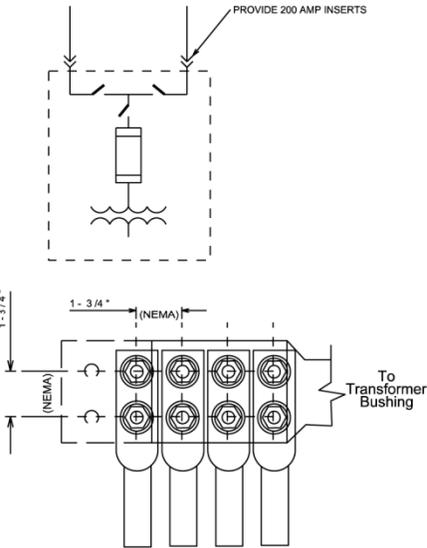
- NOTE:
1. PROVIDE 3/8" DIA PEA GRAVEL, 4" THICK INSIDE VAULT BOTTOM FOR DRAINAGE (ONE TON WILL COVER APPROXIMATELY 2-1/2 VAULTS)
 2. NESC RULE 350 BOND ALL ABOVE GROUND METALLIC POWER AND COMMUNICATION PEDESTALS THAT ARE SEPARATED BY SIX (6') FEET OR LESS: USE MINIMUM #6 BARE COPPER DIRECT BURIED A MINIMUM 18" BELOW GRADE AND CONNECT TO LID AT SIDE NUT USING LUG

BY PERMISSION ONLY

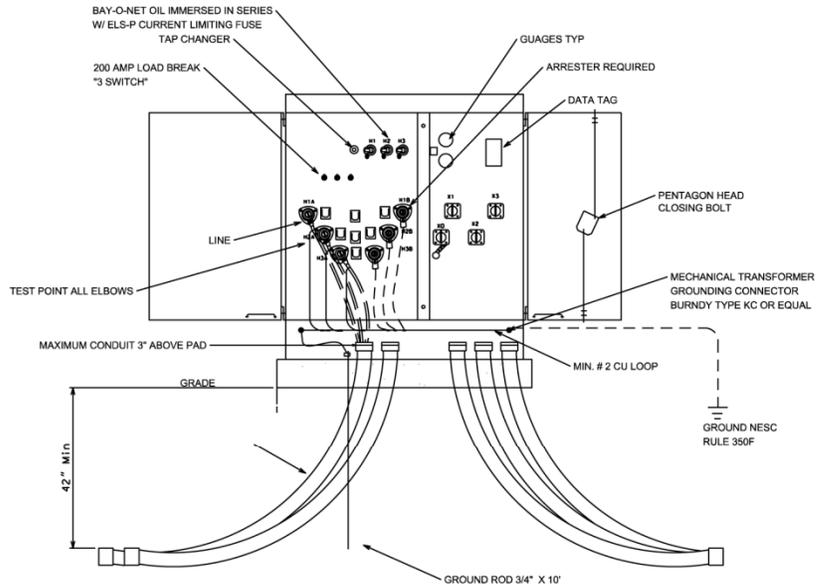
Figure 2.2-k 600 Amp 4' x 7'-8" x 4' Vault

3 PHASE PAD MOUNTED TRANSFORMER

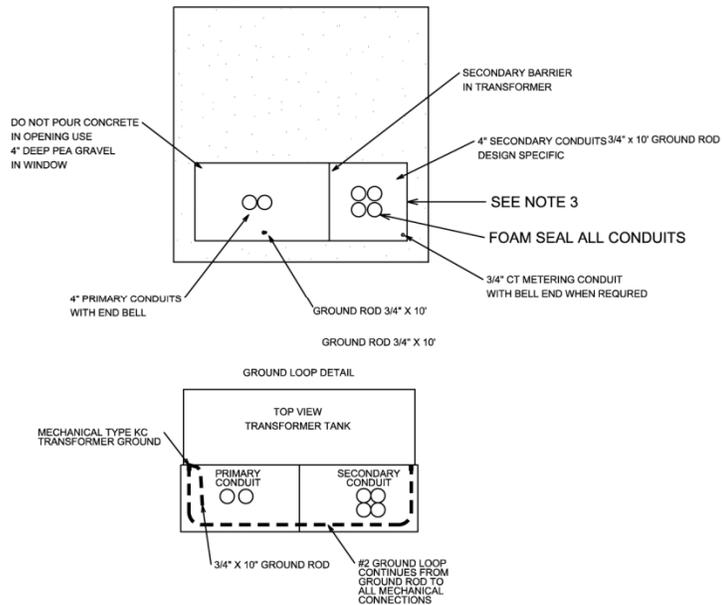
INTERNAL LOOP FEED
3 LOAD BREAK SWITCHES
INTERNAL BAY-O-NET FUSING
W/E LSP CURRENT LIMITING FUSE



- Max 1" Bolt Protrusion After Torqued
- 1 / 2" Plated Steel Bolt
- Flat Washer 1 5/8" OD
- Lock Washer
- Plated Steel Hex Nut



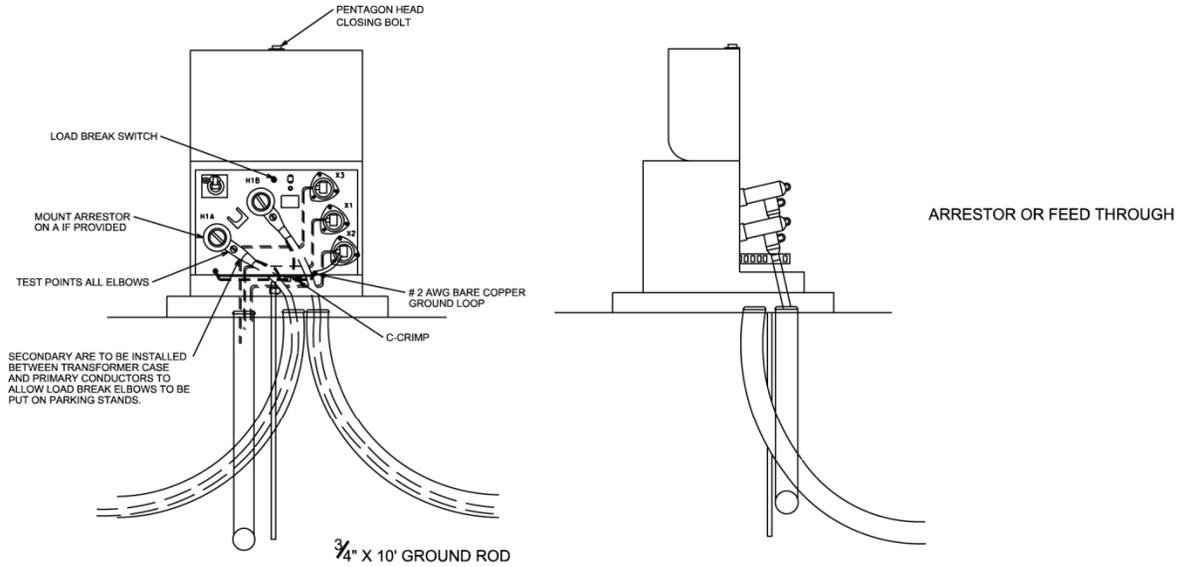
PAD & CONDUIT LAYOUT (TYP)



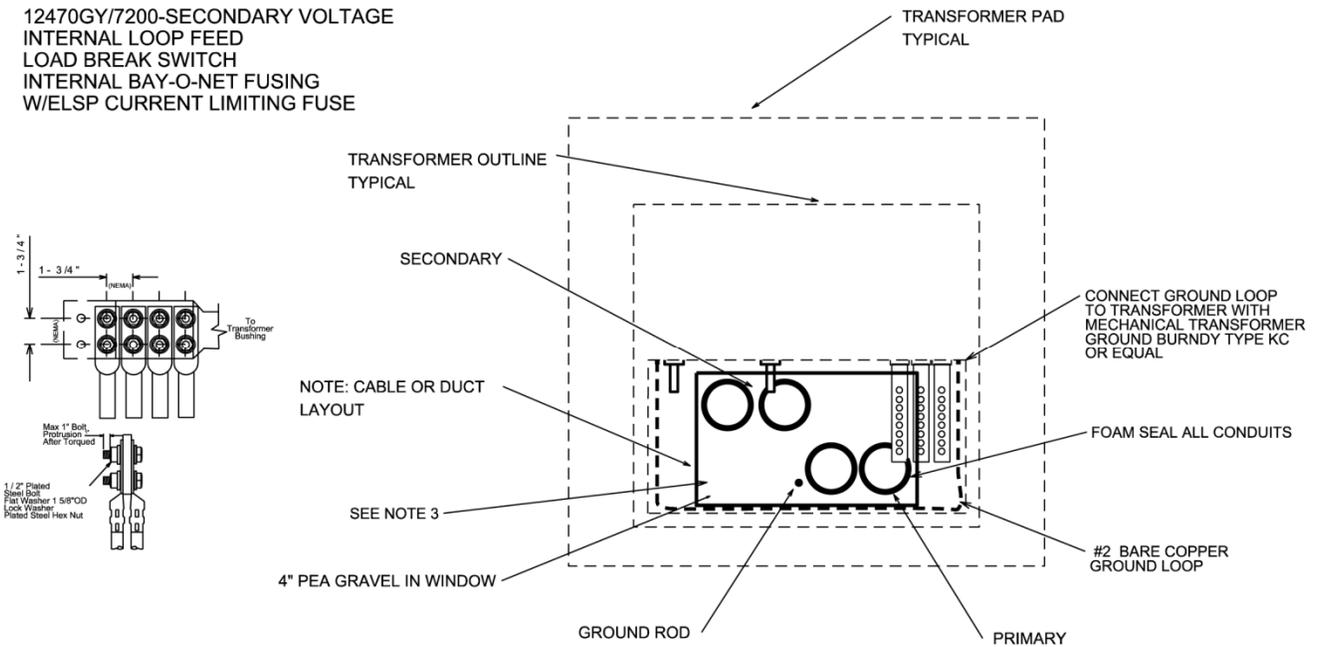
- NOTE:
1. CONTRACTOR SHALL SIZE PAD TO TRANSFORMER, (PRE-CAST PAD PREFERRED)
 2. ELBOW CONNECTORS SHALL BE PLACED ON INSULATED PARKING STANDS PRIOR TO THE DPW OPERATIONS & MAINTENANCE CONTRACTOR ENERGIZING TRANSFORMER.
 3. PROVIDE 4" OF 3/8" PEA GRAVEL IN TRANSFORMER WINDOW
 4. TRANSFORMERS SHOULD BE PLACED 30' FROM BUILDINGS TO MEET FORCE PROTECTION GUIDELINES.
 5. 8' CLEAR LEVEL WORKING SPACE IN FRONT OF TRANSFORMER

Figure 2.2-1 3 Phase Pad Mounted Transformer

SINGLE PHASE TRANSFORMER & PAD

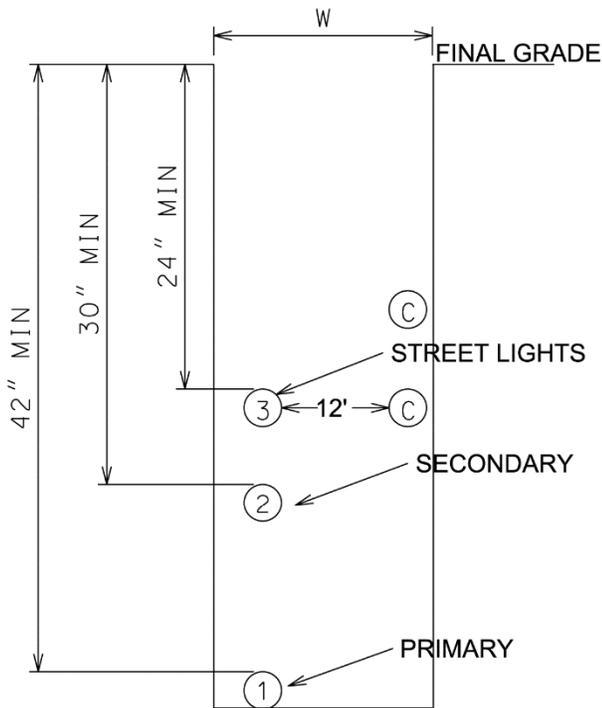


12470GY/7200-SECONDARY VOLTAGE
INTERNAL LOOP FEED
LOAD BREAK SWITCH
INTERNAL BAY-O-NET FUSING
W/ELSP CURRENT LIMITING FUSE



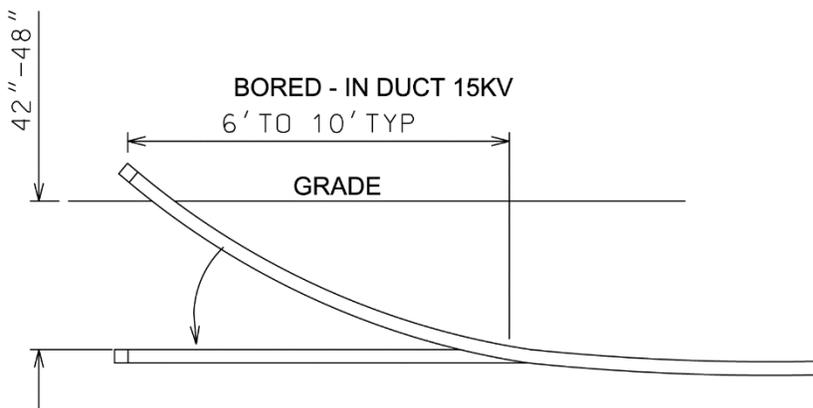
- NOTE:
1. CONTRACTOR SHALL SIZE PAD TO TRANSFORMER, (PRE-CAST PAD PREFERRED)
 2. ELBOW CONNECTORS SHALL BE PLACED ON INSULATED PARKING STANDS PRIOR TO THE DPW OPERATIONS & MAINTENANCE CONTRACTOR ENERGIZING TRANSFORMER.
 3. PROVIDE 4" OF 3/8" PEA GRAVEL IN TRANSFORMER WINDOW.
 4. 8' CLEAR LEVEL WORKING SPACE IN FRONT OF TRANSFORMER.

Figure 2.2-m Single Phase Transformer & Pad



- NOTES:
1. MAINTAIN NESC CLEARANCE FROM OTHER UTILITIES MINIMUM 12".
 2. TRENCH WIDTH TO BE A MINIMUM OF 3" EACH SIDE OF CONDUIT OR CONDUCTOR TO PROVIDE FOR PROPER BACKFILL & COMPACTION.
 3. JOINT TRENCH VERIFY DEPTH WITH COMMUNICATION COMPANY

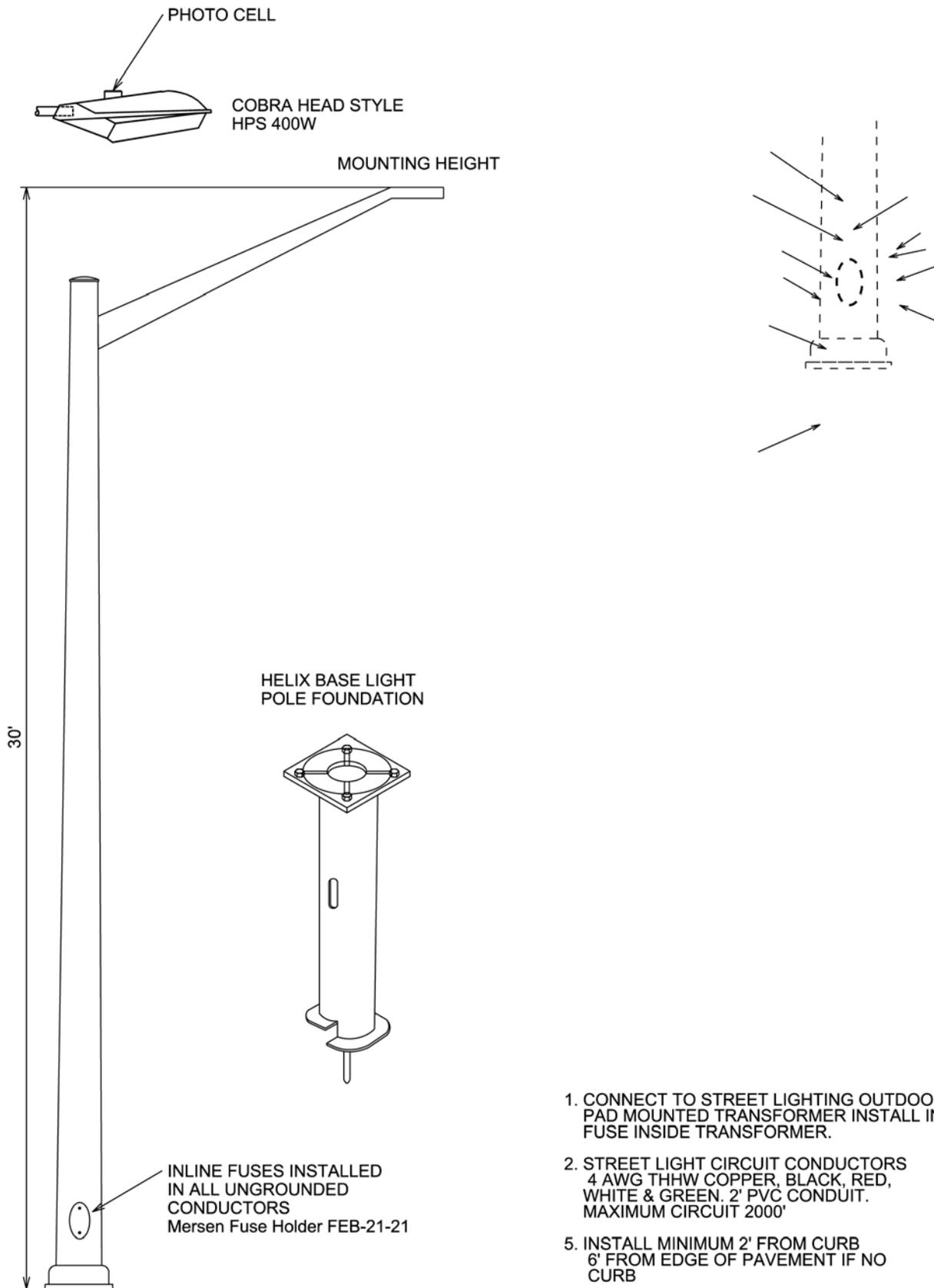
CABLE CIRCUIT TYPE	TYPICAL TRENCH	D		W	VOLTAGE
1	PRIMARY	42"MIN	24"	24"	601-12470 VOLT PHASE TO PHASE
2	SECONDARY	30"MIN	6"	6"	0-600 VOLT PHASE TO PHASE
3	STREET LIGHT FEEDS	24"MIN	6"	6"	0-480 VOLT PHASE TO PHASE



NOTE: FOR ALL BORE DEPTH ABOVE OR BELOW 42" TO 48" PROVIDE BORE LOG DEPTHS ON AS BUILT DRAWINGS

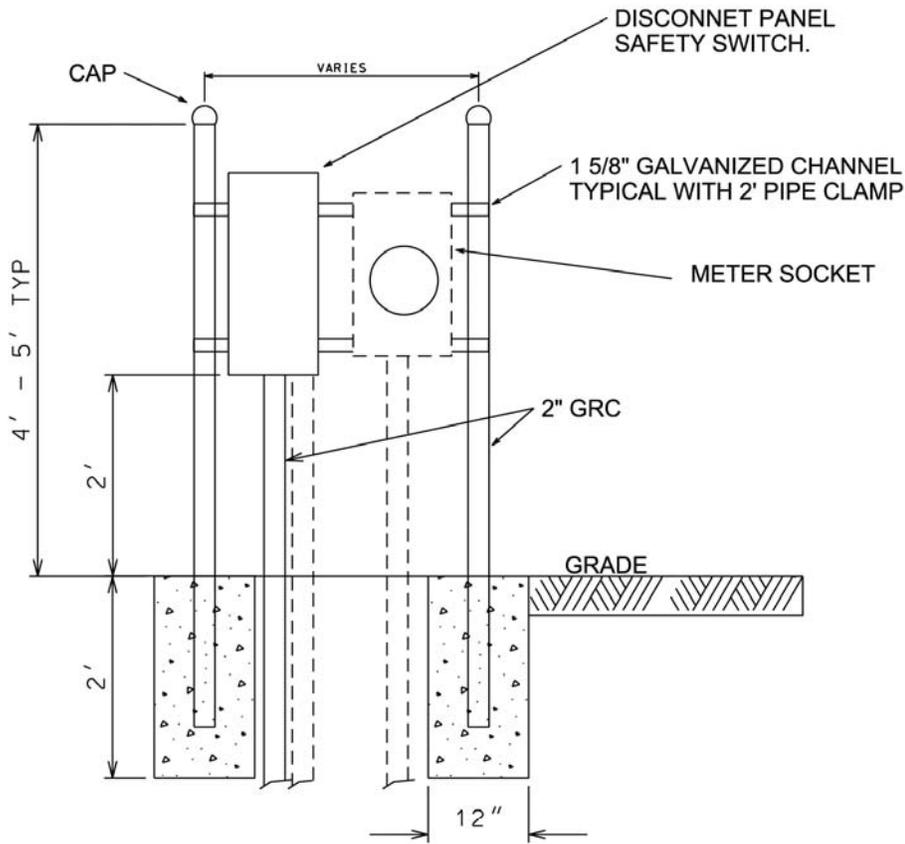
Figure 2.2-n Joint Trench & Bore

ROADWAY STREET LIGHTING



SECTION 2
INFRASTRUCTURE

Figure 2.2-o Roadway Street Lighting



HAND/PULL BOX
TYPICAL

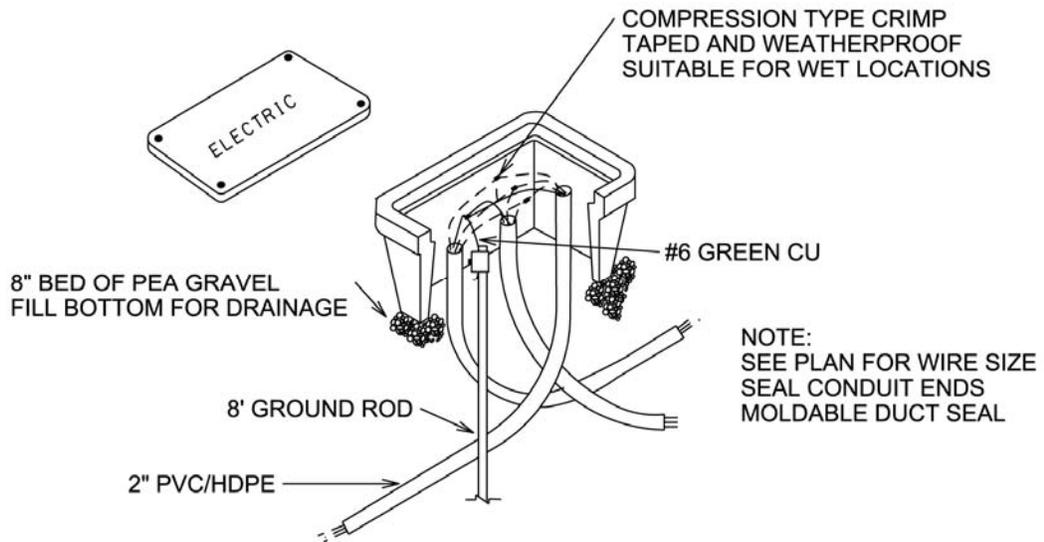


Figure 2.2-p Outdoor Power Rack (Typical)

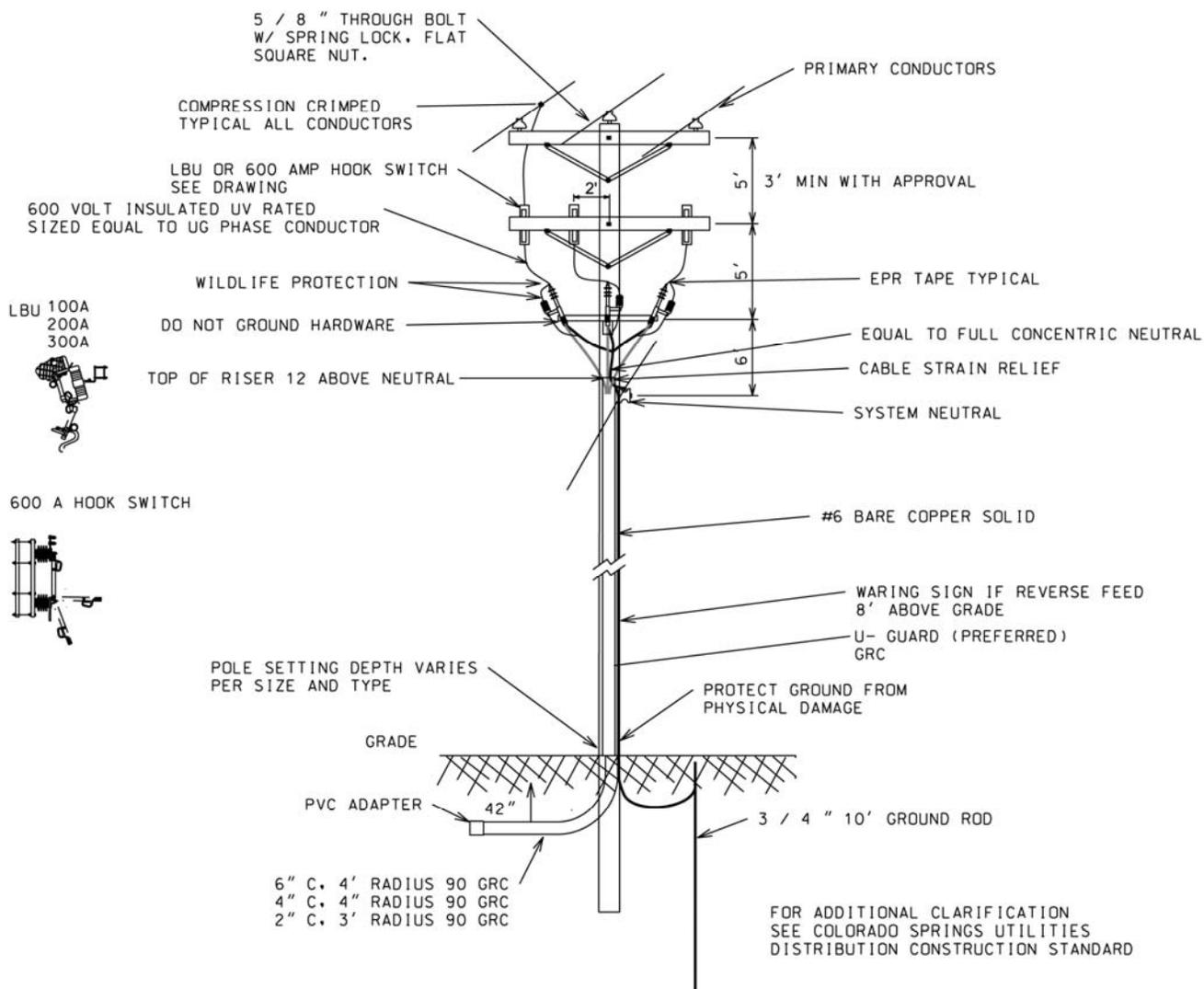
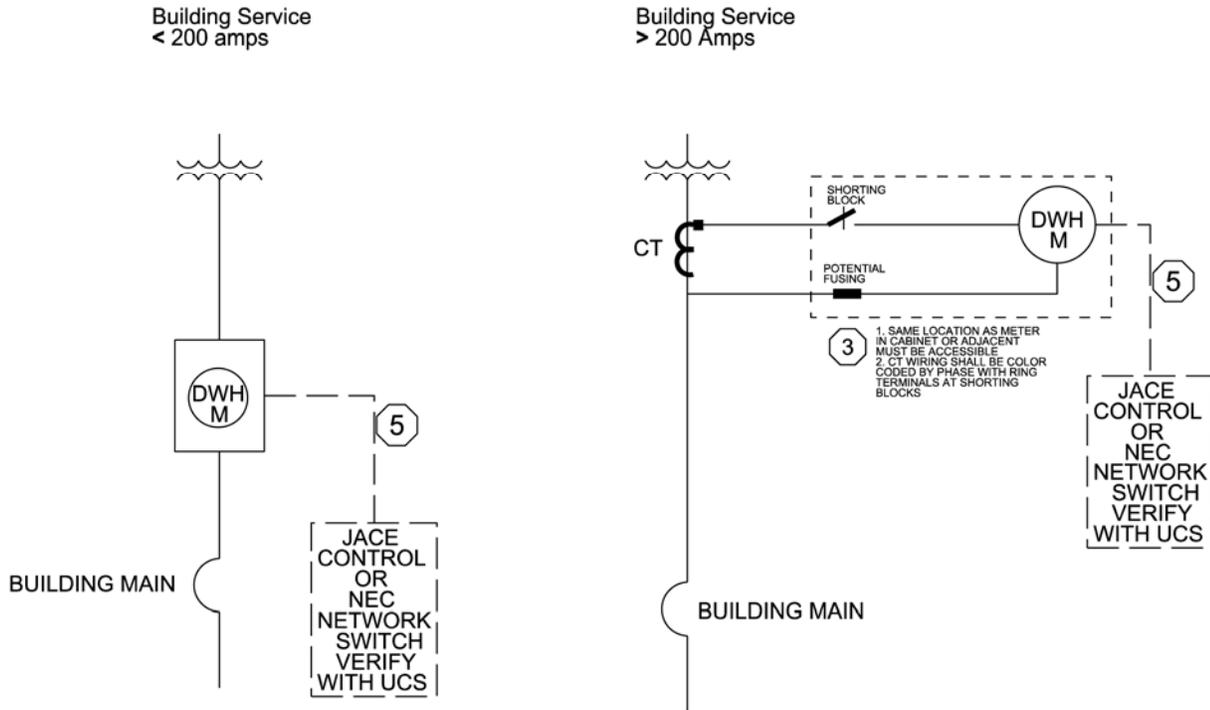


Figure 2.2-q Three Phase Riser Pole

FORT CARSON ELECTRIC METER CRITERIA



METER TYPES:

1. Smart Meter (>) 29,000sq ft or 500 Kva
 - a. Shark 200
 - b. E-MON Class 5000
 - c. Any meter LONworks capable using SNVT's
2. Digital Meters (<) 29,000 sq ft or <500 Kva
 - a. Shark 200
 - b. E-MON Class 5000
 - c. Landis-Gyr S4 or equal

GENERAL NOTES:

1. Buildings > 29,000 sq ft or 500 kva and above shall have electric smart meter that meet standard ANSI/CEA-709.1b LONworks protocol using Standard Network Variable Types (SNVTs) for measured values
2. If no JACE/UCS in the building <29,000 sq ft or <500kva a digital electric meter with pulse output capable of LONworks over IP or BackNet over IP or Modbus over IP can be used.
3. Instrument meters shall have CT's shorting device and potential fusing installed in a lockable accessible location internal or adjacent to the electric meter
4. Meters and CT's mounted at transformers are allowed by written permission only that must be obtained from DPW Operation & Maintenance Division prior to installation.
If approved there must be a conduit with a cat 6 shielded cable to the JACE or NEC network switch for connection to the UCS.
5. Metering communication conductors shall be Cat 6 cable between Meter and NEC network switch or 18ga twisted pair for connection between meter and JACE controller

Figure 2.2-r Electric Meter Criteria

Fort Carson DPW Electric Load Data Form

PROJECT: _____

PROJECT NUMBER: _____

PROJECT LOCATION: _____

PROJECT POC: _____

SECTION 2
INFRASTRUCTURE

BUILDING SERVICE INFORMATION

VOLTAGE: _____

AMPERAGE: _____

BUILDING SQUARE FT: _____

TYPE OF OCCUPANCY: _____

HEAT: (GAS) (ELECTRIC) (OTHER)

ESTIMATED KW LOAD: _____

A/C: (YES) (NO)

ESTIMATED KW LOAD: _____

ELECTRIC REIMBURSEMENT ACCOUNT NEEDED: (YES) (NO)

PROVIDE THIS COMPLETED FORM TO
usarmy.carson.imcom-central.list.dpw-electrical@mail.mil
Water



2.3 Water

2.3-A Water Service Taps ¾" to 2"

Service Line Installation and Material - all new and replacement service lines.

2.3-A.1 Potable water service lines shall be a minimum of three-fourths (¾") inch in diameter. Non-potable water service lines shall be a minimum of one and one half (1 ½") inch in diameter.

2.3-A.2 A corporation stop shall be provided at the point of tap to the water main. A curb stop shall be provided on each service line. The location of the curb stop is normally between the street curbing and the building as close to the main as possible. Curb stops shall have a cast iron valve box and water lid for access. The top of the valve box shall be set at ground level and not extend more than 1-inch above the finished ground grade. They shall be surrounded by a 12 to 18-inch concrete ring 4-inch thick at final grade. When located in a paved area the top of the valve box shall be flush with the finished grade.

2.3-A.3 Type "K" copper is approved for water service lines from three-fourths (¾") inch up to two (2") inches in diameter. Copper water service lines shall have flared joints between the corporation stop and the curb stop valves. Between the curb stop and the structure, flared joints or silver brazing joints may be used. No flared joints shall be placed under a vertical foundation wall or footer. Copper service pipe shall not be in direct contact with concrete. An expansion loop shall be used at the corporation stop connection for copper service pipe sizes of ¾" and 1" to allow for expansion and contraction of the pipe line.

2.3-A.4 Poly Ethylene (PE) DR9, CTS (Copper Tubing Size), 200 PSI or PE 3408, AWWA C901, ASTM D2737 is approved for water service lines for pipe sizes one (1"), one and one half (1 ½"), and two (2") inch service lines only. The PE service line shall be the same size as the corporation stop. An expansion loop shall be used at the corporation stop connection for all PE service pipe sizes to allow for expansion and contraction of the pipe line. PE service pipe shall not be in direct contact with concrete. A No. 12 copper clad steel insulated tracer wire shall be used to locate the pipe. The tracer wire shall be taped to the top of the pipe at every two (2) feet. A stainless steel CTS insert is required at all PE connections to fittings. Refer to the following drawings for a typical PE service line and building entry detail.

2.3-A.5 The following pipe material shall not be used for water service lines ¾-inch to 2-inch in size. PVC schedule 40, PVC schedule 80, galvanized steel pipe, black iron steel pipe, Ductile Iron and PEX plastic tubing.

2.3-A.6 A minimum ground cover of 60 inches for any water line is required. Water lines shall have a maximum depth of 84 inches. (Frost depth = approximately 60 inches [5 feet] in the Pikes Peak area). Depth of bury shall be determined from the finished street grade and finished grade of the property being served. No curb stop shall be less than sixty (60") inches but not more than seven (7') feet in depth at finished grade.

2.3-A.7 All underground water lines shall have a 3 to 6-inch wide, non-detectable warning tape, buried 12 to 18-inches below the surface of the ground. Warning tape shall be blue in color and have the utility being identified written in discernable, non-degrading letters spaced in increments of not more than 3 feet.

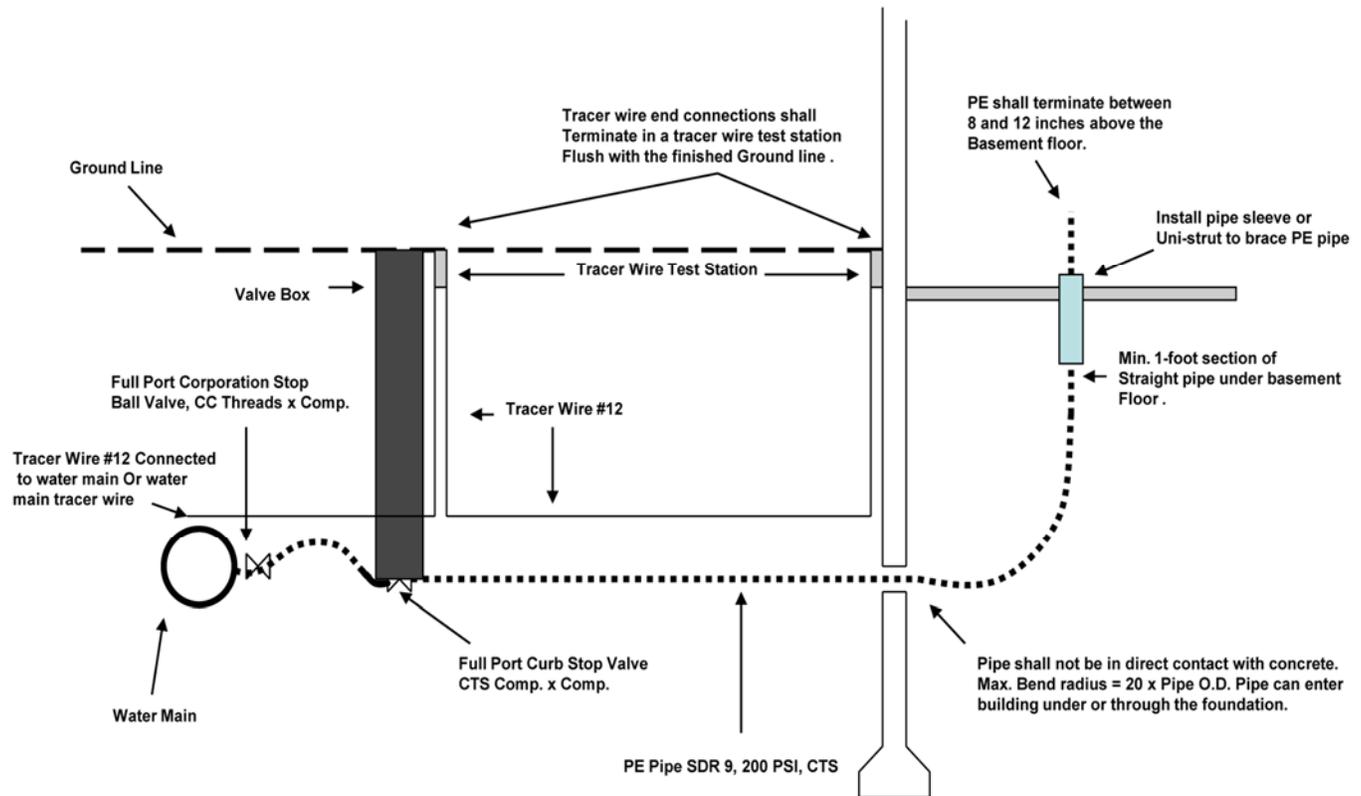


Figure 2.3-a PE Service Line and Building Entry Detail

2.3-A.8 Where a water service line crosses another utility or any underground structure, the service line shall preferably pass over the other utility or structure, but in no instance shall there be less than six inches (6") clearance between the potable water service and the other utility or structure. Where a water service line passes under a sanitary or storm sewer line the water service line shall be centered and install in a six inch (6") schedule 80 PVC pipe sleeve. The pipe sleeve shall extend a minimum of 3 feet (3') beyond each side of the sewer line being crossed.

2.3-A.9 All fittings used on a water service line shall have a 200 PSI minimum working pressure. All ferrous fittings shall be epoxy coated and all bolts, nuts, and non epoxy coated surfaces shall be wrapped in wax tape. Do not wrap any fittings with polyethylene plastic. Any metallic fittings used underground shall have proper cathodic protection installed.

2.3-A.10

All water service lines shall be disinfected and flushed according to AWWA (American Water Works Association) standards. A bacteriological test (Bac-T) shall be performed on all new and repaired service lines. The Bac-T result shall be negative before any new water service line activation. The Bac-T test results are valid only for 5 calendar days from the time the sample was taken. If the water service line is not activated within this time frame another Bac-T test shall be required before line activation. Only the base operation and maintenance contractor shall turn open any water service lines connected into Fort Carson's water distribution system.

2.3-B Water Service Taps 4" and Larger

Service Line Installation and Material - all new and replacement service lines.

2.3-B.1 Water service lines sizes 4 inch (4") and larger can be ductile iron, plastic (PVC, AWWA C-900 or C-905, Class 200, DR 14) or HDPE (DR 13.5) only. PVC is not allowed under the structure foundation or slab. They shall transition to ductile iron or HDPE pipe no closer than 5 feet (5') of the structure they service. Ductile iron pipe shall have cathodic protection installed. HDPE pipe must terminate with-in five (5) feet after penetrating the exterior (crawlspace) wall, or slab on grade. Water service piping shall not come in contact with the buildings concrete foundation or slab. A pressure rated plastic casing is required to protect the pipe as it passes through any concrete structure. Plastic water service lines sizes 4 inch (4") and larger shall have a No. 12 copper clad steel insulated tracer wire used to locate the pipe. The tracer wire shall be taped to the top of the pipe at every two (2) feet. Stainless steel inserts are required at all HDPE connections to fittings.

2.3-B.2 Water service lines 4 inch (4") and larger shall only be tapped into the water main with an epoxy coated mechanical joint tee fitting or a mechanical joint tapping sleeve (Mueller H-615 or equal) except for asbestos cement pipe. Only a mechanical joint tee is allowed for asbestos cement water taps larger than 2-inches in diameter. Full circle stainless steel tapping clamps are prohibited for use on PVC, HDPE, cast iron, and asbestos cement water mains for taps larger than 2-inches in diameter. Attached to the tee or mechanical joint tapping sleeve shall be an open left resilient seat gate valve. The operating nut shall be 2 inch (2") square. This gate valve shall have a cast iron valve box and water lid for access. The top of the valve box shall be set at ground level and shall not extend more than 1-inch above the finished ground grade. When located in a paved area the top of the valve box shall be flush with the finished grade. Any metallic fittings used underground shall have proper cathodic protection installed.

2.3-B.3 The following pipe material shall not be used for water service lines: PVC schedule 40, PVC schedule 80, galvanized steel pipe, black iron steel pipe, and PEX plastic tubing.

2.3-B.4 A minimum ground cover of 60 inches for any water line is required. Water lines shall have a maximum depth of 84 inches. (Frost depth = approximately 60 inches [5 feet] in the Pikes Peak area). Depth of bury shall be determined from the finished street grade and finished grade of the property being served. No under ground valve shall be less than sixty (60") inches but not more than seven (7') feet in depth at finished grade. Under no circumstances shall any section or portion of a water line exceed 18 feet (18') in depth to the bottom of the pipe.

2.3-B.5 All underground water lines shall have a 3 to 6-inch wide, non-detectable warning tape, buried 12 to 18-inches below the surface of the ground. Warning tape shall be blue in color and have the utility being identified written in discernable, non-degrading letters spaced in increments of not more than 3 feet.

2.3-B.6 Where a water service line crosses another utility or any underground structure, the service line shall preferably pass over the other utility or structure, but in no instance shall there be less than 18 inches (18") clearance between the potable water service and the other utility or structure. Where a water service line passes under a sanitary or storm sewer line the

water service line shall be centered and install in a pipe sleeve. The pipe sleeve shall extend a minimum of five (5) feet beyond each side of the sewer line being crossed.

2.3-B.7 All fittings used on a water service line shall have a minimum working pressure of 200 PSI and all metallic fittings shall have cathodic protection installed. All ferrous fittings shall be epoxy coated and all bolts, nuts, and non epoxy coated surfaces shall be wrapped in wax tape. Do not wrap any fittings with polyethylene plastic. Any metallic fittings used underground shall have proper cathodic protection installed.

2.3-B.8 All water service lines shall be disinfected and flushed according to AWWA (American Water Works Association) standards. A bacteriological test (Bac-T) shall be performed on all new and repaired service lines. The Bac-T result shall be negative before any new water service line activation. The Bac-T test results are valid only for 5 calendar days from the time the sample was taken. If the water service line is not activated within this time frame another Bac-T test shall be required before line activation. Only the base operation and maintenance contractor shall turn open any water service lines connected into Fort Carson's water distribution system.

2.3-C Water Service Fire Protection

Installation and Material Underground Fire Protection Systems - all new and replacement fire service lines.

2.3-C.1 Except for post indicator valve requirements, all fire service lines shall meet the same requirements as domestic water service lines for material and installation standards and specifications.

2.3-C.2 Fire suppression systems must have plans pre-approved by the Fort Carson Fire Department and be installed according to NFPA standards.

2.3-C.3 Building fire suppression and domestic service lines shall have an independent tap connection to the main water line when the fire suppression line is less than 100 linear feet from the system riser.

2.3-C.4 Building fire suppression and domestic service lines shall share the same supply piping when the fire suppression line is greater than 100 linear feet from the system riser. The connection point for the domestic water supply shall be made upstream and just prior to the fire system's post indicator valve.

2.3-C.5 All fire, commercial potable water and irrigation service connections shall have the proper backflow prevention assembly installed inside the mechanical room.

2.3-C.6 Fire hydrants shall be highly visible and free of any screening. They shall be painted the IMA specified equipment yellow luminous paint. The hydrant bonnet shall be painted the appropriate NFPA / AWWA color to indicate tested water flow. (Do not wrap plastic around hydrant for corrosion protection. Wax tape or equal shall be used and the hydrant shall be cathodically protected.

2.3-C.7 There must be a fire hydrant located within 150 feet from the buildings fire department connection.

2.3-C.8 Fire hydrant branches (from the main to the hydrant) shall not be less than 6-inches in diameter and as short in length as possible, preferably not longer than 50-feet from the main. A fire hydrant isolation valve and valve box is required at the tap point for each new or relocated fire hydrant.

2.3-C.9 Unified Facilities Criteria UFC 3-600-01 Hydrant Color Coding:

2.3-C.9(A) At facilities which have hydrants on both potable and non-potable water systems, fire hydrants must be color coded to avoid cross-connections during firefighting. Hydrant barrels shall be red for non-potable water and equipment yellow for potable water. Regardless of water source, hydrant bonnet color shall be in accordance with NFPA 291, Fire Flow and Marking of Hydrants, based on flow capacity.

2.3-C.9(B) Public Fire Hydrants-Marking Color and Flows Fire hydrants should be marked with some type of distinguishing marking or color to denote flow capability. This marking/color will assist the local organization and provide assistance to any mutual aid organization, if the marking/color system is uniform and understood throughout the mutual aid association.

2.3-C.9(C) Classification and Color Marking:

- Class AA - Capacity of 1500 GPM - Blue
- Class A - Capacity of 1000-1499 GPM - Green
- Class B - Capacity of 500-999 GPM - Orange
- Class C - Capacity less than 500 GPM - Red

2.3-C.10 Fire Hydrant information: Fire Hydrant information: Open left, dry barrel, traffic type hydrants shall be used. Barrel size shall be 5 ¼-inch. Waterous Pacer or Mueller Centurion model hydrants are preferred. Fire hydrants must have two (2) each two and one half (2-1/2) inch hose outlets and one (1) four and one half (4-1/2) inch suction connection with national standard fire hose threads in accordance with NFPA 24 standards. The top operation nut of the fire hydrant shall be the standard “pentagon” (five (5) sided style. A concrete thrust block meeting AWWA C502 standards shall be used behind the hydrant shoe. To ensure hydrant draining, 3 cubic yards of river rock shall be used around the hydrant base. Fire hydrants shall be installed according to manufacturer specifications; however, the center of the (4-1/2) inch suction connection shall be not less than 18-inches above final grade.

2.3-C.11 All water fire protection service lines shall be disinfected and flushed according to AWWA (American Water Works Association) standards. A bacteriological test (Bac-T) shall be performed on all new and repaired service lines. The Bac-T result shall be negative before any new water service line activation. The Bac-T test results are valid only for 5 calendar days from the time the sample was taken. If the water service line is not activated within this time frame another Bac-T test shall be required before line activation. Only the base operation and maintenance contractor shall turn open any water service lines connected into Fort Carson’s water distribution system.

2.3-D Water Distribution Main

Water Main Installation and Material - all new and replacement main lines.

2.3-D.1 Water main lines sizes 6 inch (6”) and larger shall be non-metallic PVC or HDPE whenever possible. Metallic water main piping can be utilized under certain circumstances however pipe specifications shall be submitted and approved by the DPW Operation Division prior to installation. Polyvinyl Chloride (PVC) pressure pipe shall be (Slip Joint) elastomeric gasket joint type. PVC pipe six (6) inch through twelve (12) inch shall be pressure Class 305 (DR-14), AWWA C900. PVC pipe fourteen (14) inch through twenty (24) inch shall be Pressure Class 235 (DR-18), AWWA C905 (Transmission-Pipe Pressure Rating). High Density Polyethylene Pipe (HDPE) shall be SDR 13.5, AWWA C906, PE 3408, ductile iron pipe size (DIPS). Plain end pipe and fittings for HDPE pipe shall be made by heat butt fusion. Stainless steel HDPE stiffener insert shall be installed within the HDPE pipe when an OD compression mechanical coupling is used and when connecting plain end HDPE pipe to a mechanical joint pipe, fittings or appurtenance. Mechanical joint pipe restraints shall be used for all mechanical joint pipe fittings, valves and hydrants. Concrete thrust blocks and/or tie rods shall also be required at all tee connections, fire hydrants, 90 degree bends and where indicated on construction plans and standard drawings.

2.3-D.2 A minimum ground cover of 60 inches for any water line is required. Water lines shall have a maximum depth of 84 inches. Exceeding the maximum depth must be approved by the DPW Operations and Maintenance Division and will be granted for unusual circumstances only.

2.3-D.3 The horizontal separation between water pipes and sanitary sewers shall be 10 feet. Water mains and sewers must not be installed in the same trench. If conditions prevent a horizontal separation of 10 feet, a minimum horizontal spacing of 6 feet may be allowed, but the bottom of the water main must be at least 12-inches above the top of the sewer. The minimum horizontal separation between water pipes and storm sewers shall be 5 feet.

2.3-D.4 Where water mains and sewers must cross, the sewer will have no joint within 3 feet of the water main unless the sewer is encased in concrete for a distance of at least 10 feet each side of the crossing. If special conditions dictate that a water main be laid under a gravity-flow sewer, the sewer pipe should be fully encased in concrete for a distance of 10 feet each side of the crossing, or should be made of pressure pipe with no joint located within 3 feet horizontally of the water main, as measured perpendicular to the water main. The sewer must be adequately supported to prevent settling. Sewer force main pressure piping shall always cross beneath water pipe. A minimum vertical separation of 18-inches shall be maintained between the sewer and water main piping.

2.3-D.5 When circumstances require a metallic water main to be installed it shall be coated and have impressed current cathodic protection to include test points every 200 feet. Each joint shall have a #2 copper stranded jumper cable installed over each joint. Each end of the jumper cable shall be cad welded to the pipe. Each cad weld shall be cleaned, primed and covered with a Roystom type handy cap.

2.3-D.6 Water line valves will be gate valves, with non-rising stems and 2” operating nuts. They will be epoxy coated internal and external and open left operated. (Do not wrap plastic around valve for corrosion protection.. Wax tape or equal shall be used and valve shall be cathodically protected. Valve boxes made of cast iron will be used, the cap will identifying the utility, to cover the operating nut.

2.3-D.7 Pressure Regulating Valves (PRV) shall be single-seated, hydraulically operated, pilot controlled, diaphragm type globe valves. CLA-VAL brand will be used. Refer to the diagram on the next page for our preferred design of a typical PRV station.

2.3-E General Notes

2.3-E.1 Utility lines shall be bored or jacked beneath streets and pavements. DPW may approve requests to cut and patch pavements in select areas where such damage is considered to be of minimal consequence. Refer to the design engineer's recommendations for pipe casing requirements. A pipe casing is not required for HDPE water lines; however, to avoid road collapse recommend the HDPE pipe be bored at a 7-foot depth under existing roadways. All underground utility lines going under railroad tracks, streams, creeks or rivers shall be installed in a pipe casing.

2.3-E.2 All water lines will be underground. Fort Carson requires all new underground utilities to be non-metallic whenever possible.

2.3-D.3 Cathodic Protection General Requirements. Refer to the Fort Carson Installation Design Guide for specific cathodic protection requirements.

2.3-E.4 If there are opportunities outside of the utility systems listed above (i.e. fire protection lines, their connectors, & lines / fittings under the slab or foundation) the contractor shall be responsible for analyzing and development of a Cathodic Protection Plan the will meet the protection requirements for that specific applications.

2.3-E.5 Nonmetallic Pipe System. ALL metallic components on a nonmetallic pipe system shall be protected with cathodic protection. Copper water lines and fittings do not require any cathodic protection.

2.3-E.6 Metallic Components and Typical. Each metallic water line appurtenances shall be cathodically protected with magnesium anode(s) with calculations that show at least a 25-year continuous life expectancy or greater.

2.3-E.7 Bedding and cover for underground utilities shall be sand, river gravel or select fill with rocks no more than 1" diameter.

2.3-E.8 Care shall be taken to prevent contaminating materials from entering the water mains during construction or repair. Such materials that may accidentally enter the main shall be removed by flushing. This flushing shall be done prior to disinfection unless tablet method of disinfection used.

2.3-E.9 Tracer wire leads shall be brought up, identified, and protected by test stations of the flush-curb-box type; H-20 rated, and shall be the standard product of a recognized manufacturer (HANDLEY or equal). Test stations shall have a cast iron lid and be mounted in 18 inches of concrete. [Where possible combine the Cathodic Test Station, Valve Box, and Tracer Wire Test Stations in the same concrete pad.] Test stations shall not be placed further that 400-ft apart. Contractor shall coil 18-inches of extra wire into the test stations for maintenance. See standard detail C1-29a Fort Carson UTILITY TRACER WIRE INSTALLATION DETAILS.

2.3-E.10 Tracer Wire and Warning Tape:

2.3-E.10(A) Tracer Wire:

- Gas lines; #6 AWG type TW, RHW, RHW-2, THHW, THW, XHHW-2 or HMWPE (wet locations) stranded or solid copper, colored yellow, installed 6” above the pipe.
- All other utilities; #12 AWG type TW, RHW, RHW-2, THHW, THW, XHHW-2 or HMWPE (wet locations) solid copper installed along top surface of the utility, wire color to match warning tape color, placed on top of the utility. Tracer wire should be secured to the utility pipe every 3 feet with duct tape (except gas) to hold it in place during backfilling.
- Protect underground utility tracer wires with a 1 lb anode for every 400-feet of wire.

<u>Wire / Warning Tape Color</u>	<u>Utility</u>
Red or White	Electric
Yellow	Gas, Oil, Dangerous Materials
Orange	Telephone & Other Communications
Blue	Water System
Purple	Grey Water
Green	Sewer System

2.3-E.11 All taps must be made using the wet tap method, unless other methods are approved. Use experienced workers to make direct taps with tools in good repair and proper adapters for size of pipe being tapped. Before any utility is activated, the contractor installing that utility (Electric, Gas, Water, etc.) shall contact the DPW, Base Operations Division and provide (2) two sets of as-built (red line) drawing representative of the as-built condition before any utility is energized. Water lines shall be disinfected in accordance with AWWA Standard C651-92, “Disinfection Water Mains”

ANY UTILITY PUT INTO USE WITHOUT MEETING THE AS-BUILT DRAWING REQUIREMENT WILL BE SHUT OFF AND LOCKED OUT BY BASE OPERATIONS WITHOUT PRIOR NOTIFICATION.

2.3-F References and Point of Contact

2.3-F.1 References:

- National Fire Protection Association NFPA-24
- Water Distribution System Operation and Maintenance A Field Study Training Program Manual Approved by: U.S. Environmental Protection Agency Colorado Department of Public Health & Environment
- Colorado Springs Utilities Construction Guides
- International Plumbing Code
- U.S. Army Technical Manual TM 5-813-5/AFM 88-10 Water Supply and Water Distribution

2.3-F.2 Point of Contact:

Utility Engineering Technician
Directorate of Public Works
Operations & Maintenance Division
719-526-9243

2.4 Sewer

2.4-A.1 All sewer lines shall be underground.

2.4-A.2 See Detail Figure 2.8-A12 for Typical Sanitary Sewer Detail.

2.4-A.3 Bedding for underground utilities shall be sand, river gravel, or select fill with rocks no more than 1" diameter

2.5 Storm Water:

2.5-A Fort Carson Stormwater Program

The Fort Carson Stormwater Program is designed to protect our surface waters from pollution when precipitation flows over the ground. Stormwater runoff can pick up feces, debris, sediment and chemical pollutants and flow into a storm sewer system or directly to a pond, creek, river or wetland. Anything that enters a storm sewer system is discharged untreated into the water bodies we use for swimming, fishing, and providing drinking water to people that live downstream. Fort Carson has been issued three permits, these permits are managed by the Stormwater Office to protect stormwater quality under the Environmental Protection Agency's (EPA) National Pollutant Discharge Elimination System (NPDES). All documents can be found at:



<http://www.carson.army.mil/DPW/environmental/stormwater/index.html>

2.5-A.1 Stormwater Inlets and Manholes. All stormwater sewer inlets or manholes must be labeled:

“No Dumping. Drains into Creek.”

2.5-A.2 Stormwater Permits, General Construction Permit (EISA07 Section 428)

2.5-A.2(A) Construction projects at Fort Carson with a footprint that exceeds 5,000 square feet shall use site planning, design, construction, and maintenance strategies for the property to maintain or restore, to the maximum extent technically feasible, the pre-development hydrology of the property with regard to the temperature, rate, volume, and duration of flow. These calculations are for use with post-construction BMP or permanent BMPs to meet the requirements of EISA07.

2.5-A.2(B) Volume calculations for LID storm water infiltration are required to be submitted and approved by Fort Caron's stormwater team prior to the contractor submitting the Construction General Permit Notice of Intent (NOI). These calculations are for use with post-construction BMP or permanent BMPs designs to meet the requirements of EISA07. Fort

Carson requires Low Impact Development design technique for EISA compliance. Typical detention ponds are not acceptable unless specially approved by the DPW Stormwater Office.

2.5-A.2(C) Guidelines for the EISA07 requirement can be found online at:

<http://www.epa.gov/greeningepa/stormwater/requirements.htm#guidance>

2.6 Circulation:

2.6-A General: The goal for the circulation system on the installation is to establish a sustainable system that promotes aesthetic appeal and environmental preservation while providing safe and efficient circulation. Pedestrian traffic should be treated with the same importance as roadways. It is the intent of Fort Carson to develop walkways and bikeways that influence people to use means other than the automobile to travel to a destination. Therefore, walkways and bikeways should not necessarily follow roadways, but should be built along paths that a normal human would take from point A to point B, which includes may include paths through other sites.

2.6-B Sustainable Transportation: The long term goal is to reduce automobile dependency and provide balanced land use and transportation systems by 2027. The desired state is to enhance quality of life and support rapid deployment, increase viable alternatives to urban sprawl and associated single occupancy vehicles, decrease on and off post travel time, and reduce air emissions.

2.6-C Roadway Design. For the most part, Fort Carson follows standards set forth by the Military Surface Deployment and Distribution Command Transportation Engineering Agency (SDDCTEA). Refer to UFC 3-120-01, Design: Sign Standards, for traffic engineering. Refer to UFC 3-120-01, Design: Sign Standards, for traffic signs and markings.

2.6-C.1 Primary Roadway Preferred Design

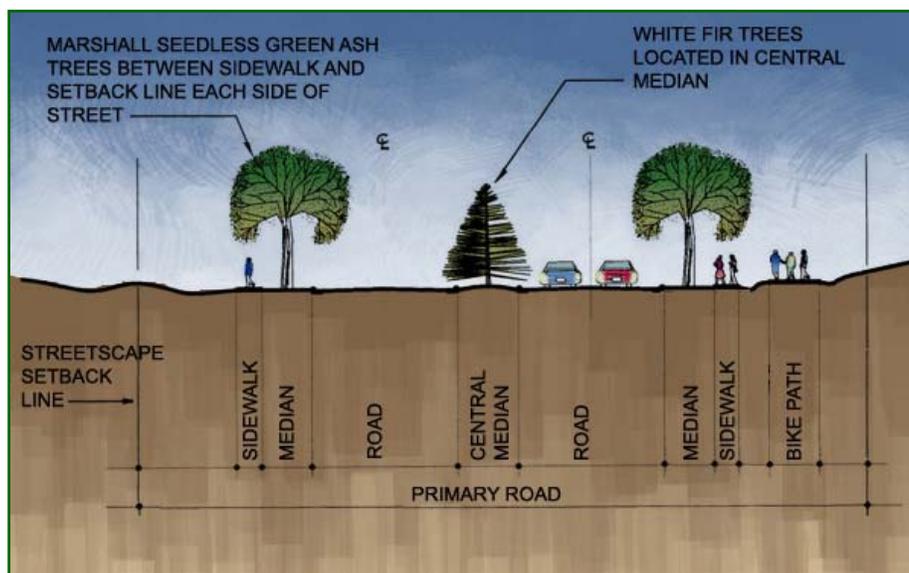


Figure 2.6-a Primary Roadway Preferred Design

2.6-C.2 Secondary Roadway Preferred Design

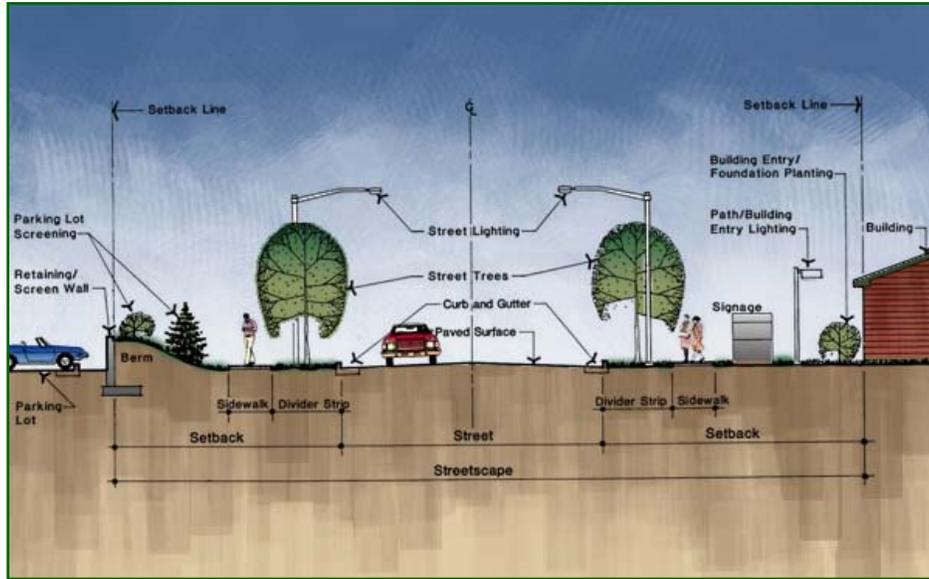


Figure 2.6-b Secondary Roadway Preferred Design

2.6-D Roadway Crossing Standards

2.6-D.1 Tier 1 Crossing

2.6-D.1(A) Features

- Curb Ramps Per City COS, Std D-8, detectable warning shall be pavers only.
- Crosswalk Striping, per MUTCD Fig. 3B-19, bottom option. Lines shall be 24" wide, and as long as sidewalk width, but 6' minimum. Spacing of lines shall be selected to avoid wheelpath.
- Stopbar shall be placed prior to the crosswalk.

2.6-D.1(B) Locations

- Intersections serviced with sidewalks, regardless of configuration of traffic control devices.
 - 2 way stop
 - All way stop
 - Yield control
 - Signalized

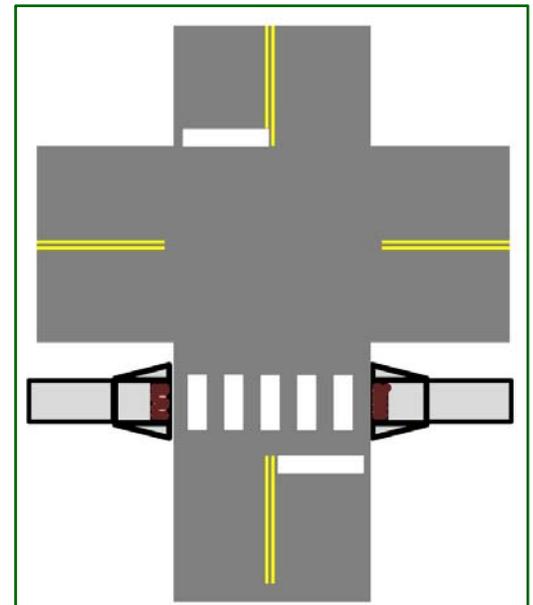


Figure 2.6-c Tier 1 Crossing Roadway Preferred Design

2.6-D.2 Tier 2 Crossing

2.6-D.2(A) Features

- Curb Ramps Per City COS, Std D-8.
- Crosswalk Striping, per Tier 1 crossing Detail
- Pedestrian Crossing Signs, W11-2, 30"x30" & W16-7P - yellow
- * Advance signage is optional and used at engineer's judgement

2.6-D.2(A) Locations. Mid block crossings.

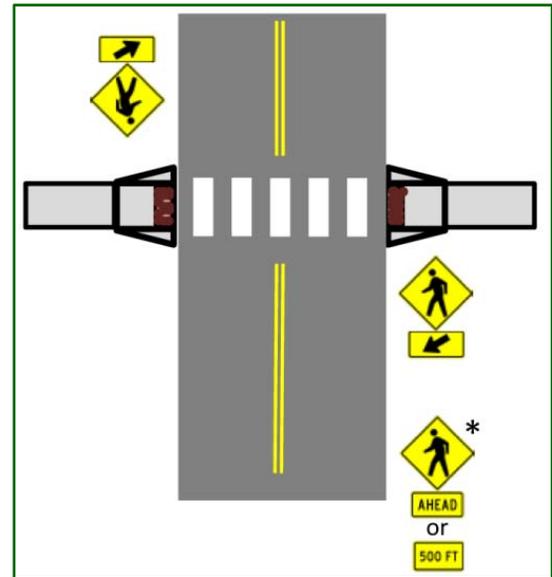


Figure 2.6-d Tier 2 Crossing Roadway Preferred Design

2.6-D.3 Tier 3 Crossing

2.6-D.2(A) Features

- Curb Ramps Per City COS, Std D-8
- Crosswalk Striping, per Tier 1 Crossing Detail
- Pedestrian Activated Crossing Signals, W11-2, 30"x30", & W16-7P, FYG, with LED Strobes, solar powered, and RF comm. link.
- Provide Ped Push Button for each sidewalk approach.
- Advanced signage is required.

2.6-D.2(B) Locations

- Crossing requiring special driver attention (school, shopette) at Mid-block or Intersection crossing
- Sight Distance at crossing is inadequate.
- Traffic volume will cause undesirable delay for pedestrians.
- See MUTCD, Section 4C.06 Warrant 5, School Crossing for warrant and design information.

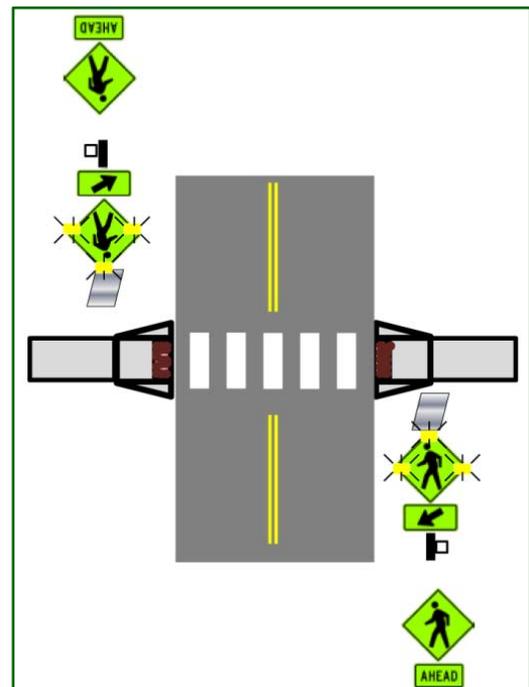


Figure 2.6-e Tier 3 Crossing Roadway Preferred Design

2.6-E Fire Lanes and Access

2.6-E.1 Fire lanes shall be provided for all buildings that are setback more than 150ft from a public road or exceed 30ft in height and are setback over 50ft from a public way. In addition, if a building does not have 360 degree access, a fire lane shall be provided to the rear of the building. This fire lane may be a sidewalk with a minimum width of 20ft of drivable surface.

2.6-E.2 Fire lanes shall be not less than 20ft of unobstructed width, able to withstand live loads of fire apparatus and have a minimum of 13ft 6in of vertical clearance.

2.6-E.3 An approved turnaround for fire apparatus shall be provided where an access road is a dead end and is in excess of 150ft in length. The turn around shall have a minimum centerline radius of 50ft.

2.6-E.4 The grade of the fire lane shall be within the limits established by Fire Prevention.

2.6-F Traffic Calming

2.6-F.1 Traffic Calming in high pedestrian areas. Traffic Calming is the use of physical measures to address speeding and high-volume cut through traffic in residential or other high pedestrian districts. Traffic Calming may be employed in these districts to improve both real and perceived safety of pedestrians and bicyclists, and to improve the quality of life and walk-ability in the affected area. When actual or anticipated traffic conditions reduce pedestrian accessibility or create unacceptable risk of accidents, engineers shall employ Traffic Calming measures designed in accordance with SDDCTEA Pamphlet 55-17, Better Military Traffic Engineering -2011, Chapter 14.

2.6-F.2 Traffic Calming at Access Control Points. The installation shall perform vulnerability assessments of all Access Control Points. If required, based on the design threat and assessed risk, engineers shall employ speed management features designed in accordance with SDDCTEA Pamphlet 55-15 Traffic Safety Engineering for Better Entry Control Facilities - 2009, Section 4 Speed management Issues.

2.6-F.3 Exclusions. Hazardous features such as transverse ridges, speed bumps, or dips on pavement surfaces will not be installed or maintained as a means of controlling or reducing the speed of traffic, per AR 420-72 Transportation Infrastructure and Dams, section 2-17. Speed Humps, Speed Tables, or other raised pavement surfaces are also not permitted on Fort Carson streets, roads or parking lots. Raised surfaces are effective at controlling the speed at that area only. However, these types of Traffic Calming measures have been determined to be ineffective at controlling speeds along traffic corridors. They have also proven to be detrimental to the response of emergency vehicles and impede snow removal.

2.6-G Pedestrian Circulation

2.6-G.1 Pedestrian Crossings. Being an Army installation, soldiers engage in jogging and/or running activities throughout the installation. Pedestrian traffic is heaviest during the

morning, when vehicular traffic is also at its greatest, thus necessitating great care during design of roadways and pedestrian path crossings.

2.6-G.2 Crossings will be designed in accordance with the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and the Uniform Federal Accessibility Standards (UFAS).

2.6-G.3 Detectable pavers. Fort Carson utilizes detectable pavers at road crossings. Designers are encouraged to use these whenever possible. Designers may also propose alternate means of increasing the safety of pedestrians by means other than detectable pavers.

2.6-G.4 UFC 3-120-01, Design: Sign Standards, Change 2, 1 October 2014 (Including subsequent changes after the date of this document).

2.6-G.5 Curb and Gutter. See figure 2.87-g for typical curb and gutter details used on Fort Carson.

2.6-H Tactical Vehicle Trails.

2.6-H.1 The paved tank trails provide alternative access for armored vehicles and other vehicles utilized in combat readiness training. These trails provide one-lane access for vehicles between motor pools and maneuver areas.

2.6-H.2 It is recommended that these trails be hard-surfaced within developed areas with concrete of a thickness to withstand the weight of armored vehicles. The hard service will reduce dust pollution. These trails should be designed to provide as direct access as possible while minimizing crossings with primary, secondary, or tertiary roads. All crossings with the other roadway systems should be paved with concrete to support the weight of the vehicles and clearly marked with signage on both the tank trail and the roadway.

2.7 DETAILS

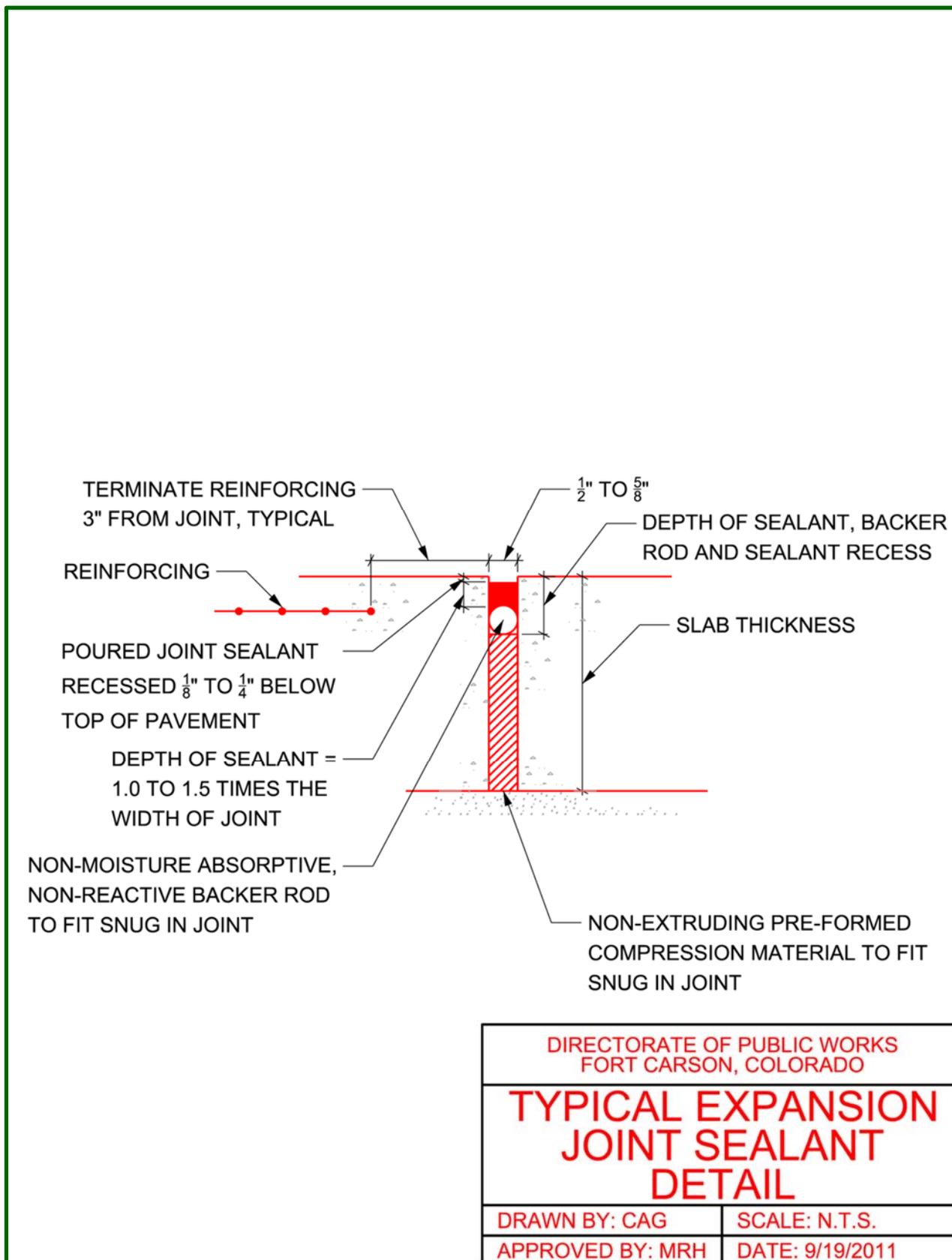


Figure 2.7-a Typical Expansion Joint Detail

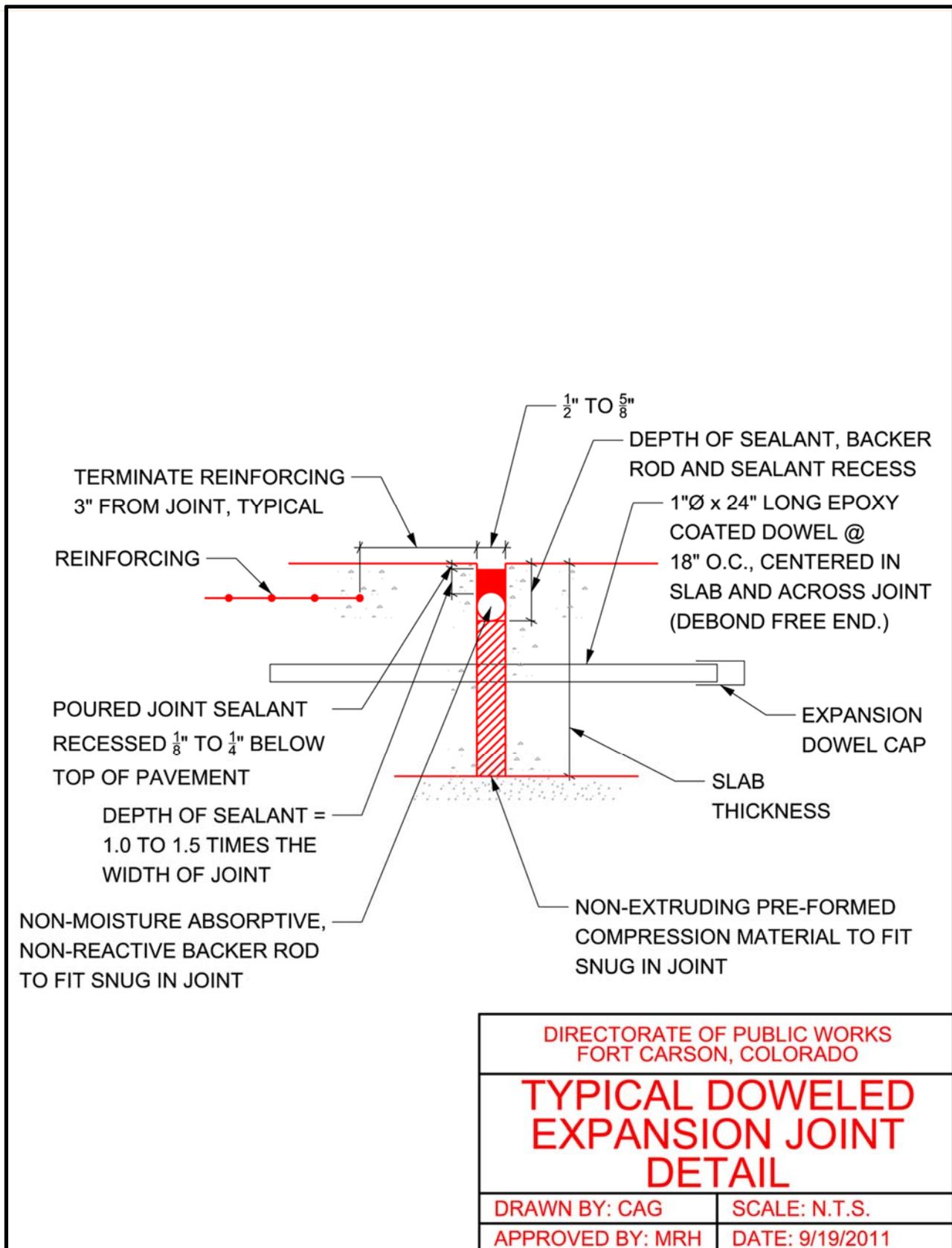


Figure 2.7-b Typical Doweled Expansion Joint Detail

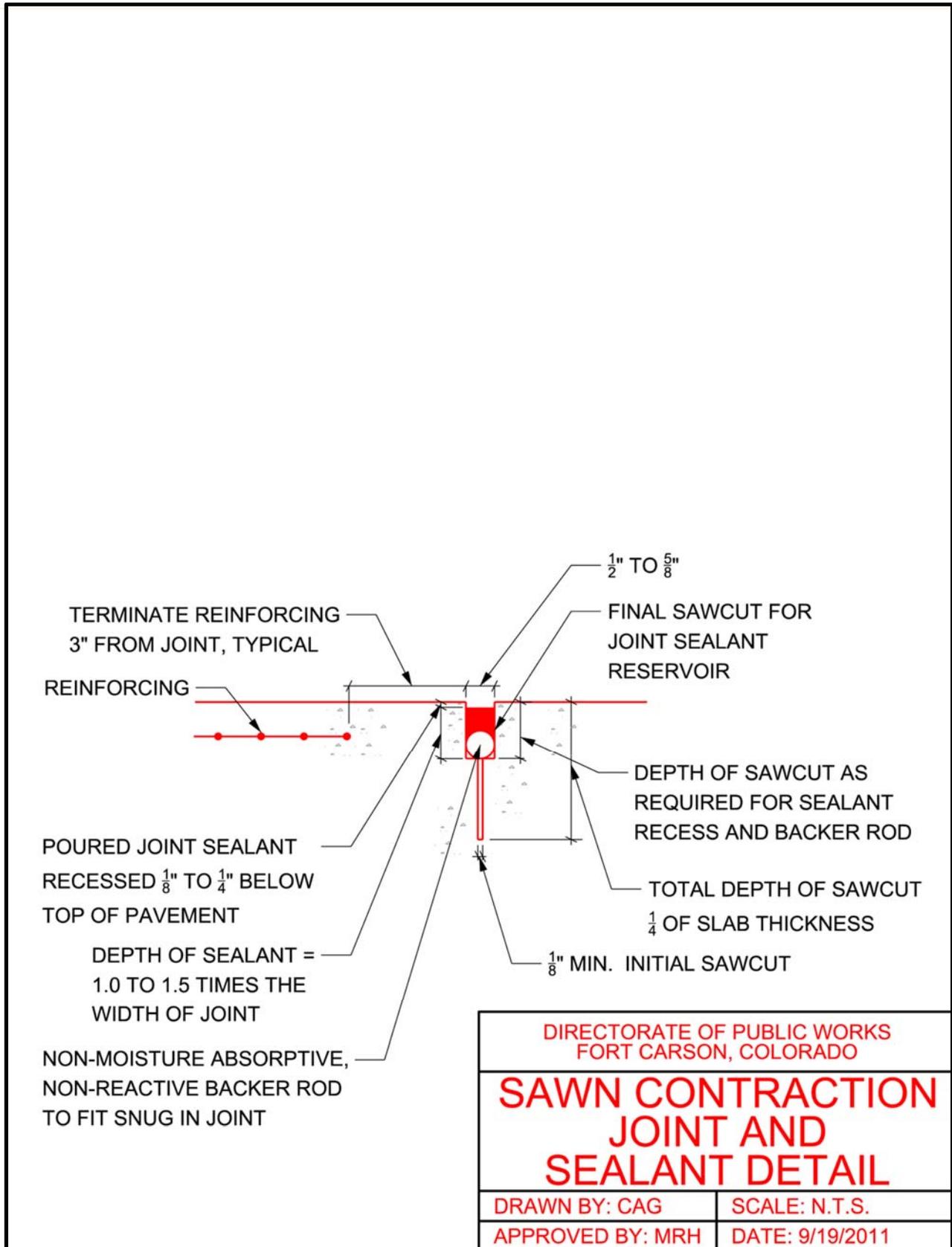
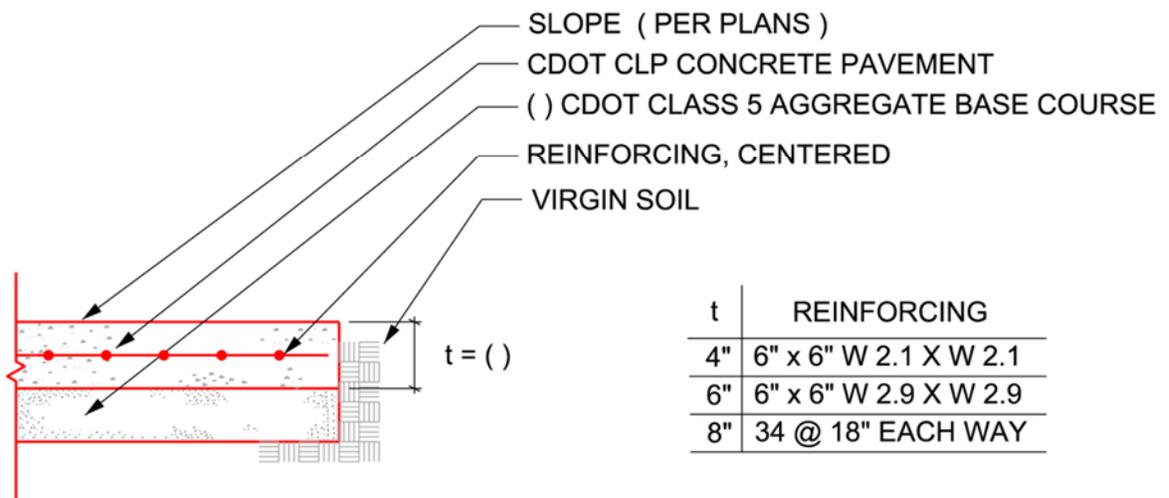


Figure 2.7-c Sawn Contraction Joint and Sealant Detail



DIRECTORATE OF PUBLIC WORKS
FORT CARSON, COLORADO

**TYPICAL SLAB
DETAIL**

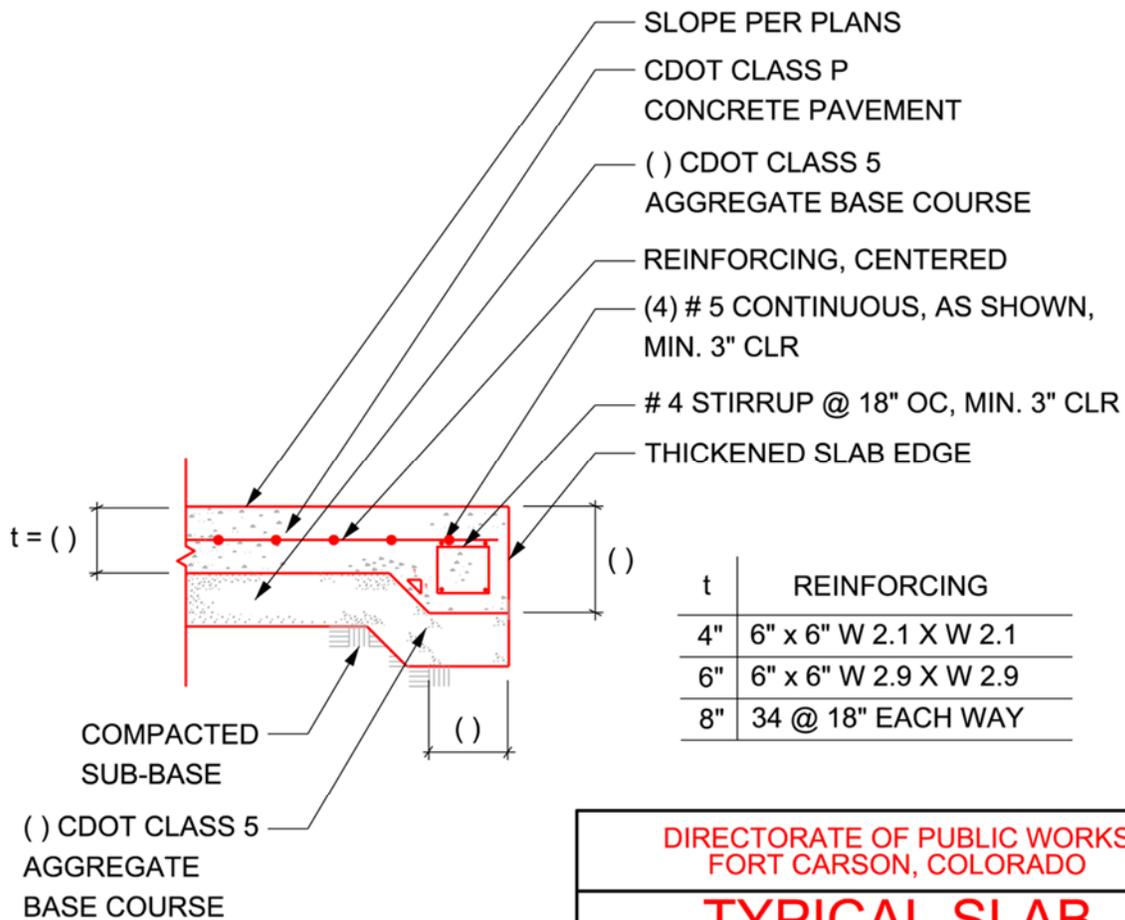
DRAWN BY: CAG

SCALE: N.T.S.

APPROVED BY: MRH

DATE: 9/19/2011

Figure 2.7-d Typical Slab Detail

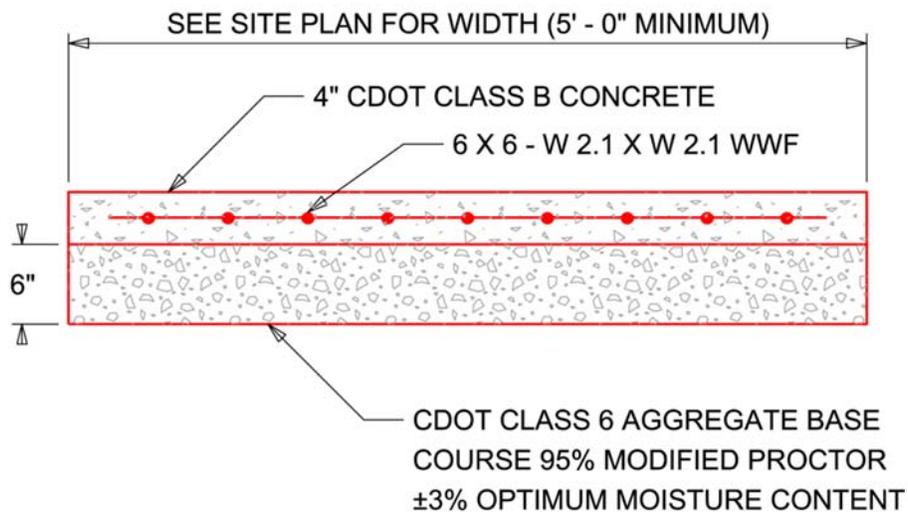


DIRECTORATE OF PUBLIC WORKS
FORT CARSON, COLORADO

TYPICAL SLAB THICKENED EDGE DETAIL

DRAWN BY: CAG	SCALE: N.T.S.
APPROVED BY: MRH	DATE: 9/19/2011

Figure 2.7-e Typical Slab Thickened Edge Detail



NOTES:

1. 1" DEEP TRANSVERSE CONTROL JOINTS EVERY 6 LF
2. 1/2" EXPANSION JOINT EVERY 48 LF
3. ALL JOINTS REQUIRE BACKER ROD AND SEALANT

DIRECTORATE OF PUBLIC WORKS
FORT CARSON, COLORADO

**TYPICAL SIDEWALK
DETAIL**

DRAWN BY: RCR

SCALE: 1" = 1'

APPROVED BY: MRH

DATE: 8/18/2011

Figure 2.7-f Typical Sidewalk Detail

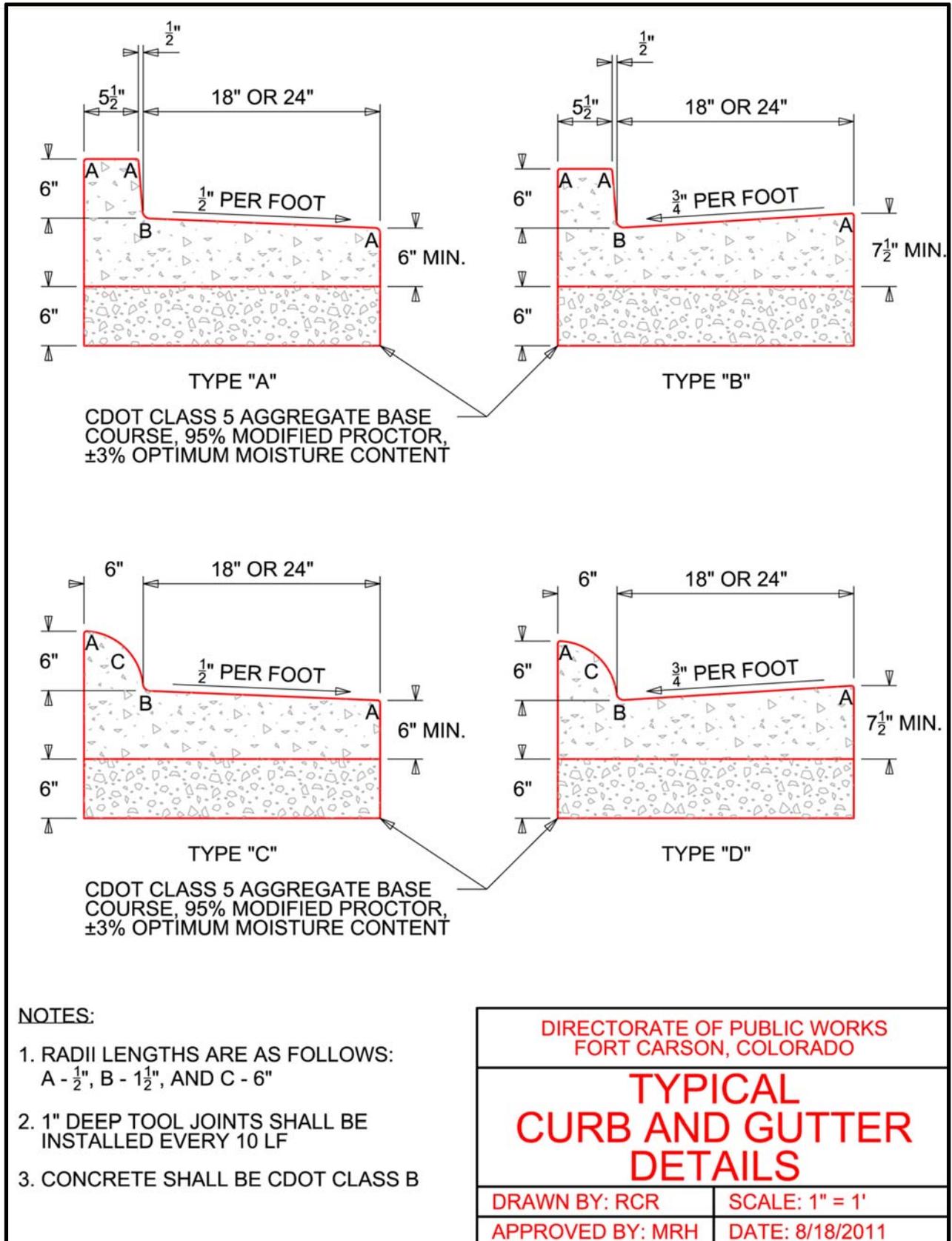
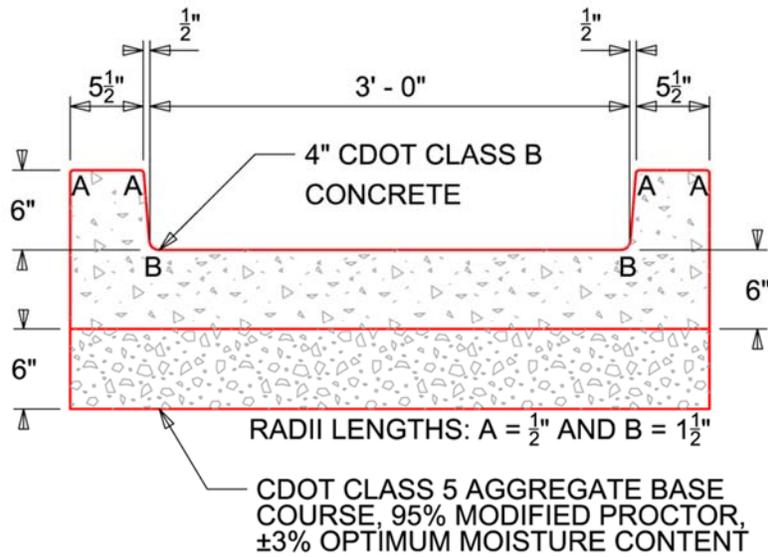


Figure 2.7-g Typical Curb and Gutter Details



NOTES:

1. RADI LENGTHS ARE AS FOLLOWS:
A - 1/2" AND B - 1 1/2"
2. 1" DEEP TOOL JOINTS SHALL BE INSTALLED EVERY 10 LF
3. CONCRETE SHALL BE CDOT CLASS B

DIRECTORATE OF PUBLIC WORKS
FORT CARSON, COLORADO

**TYPICAL
BEAVER SLIDE
DETAIL**

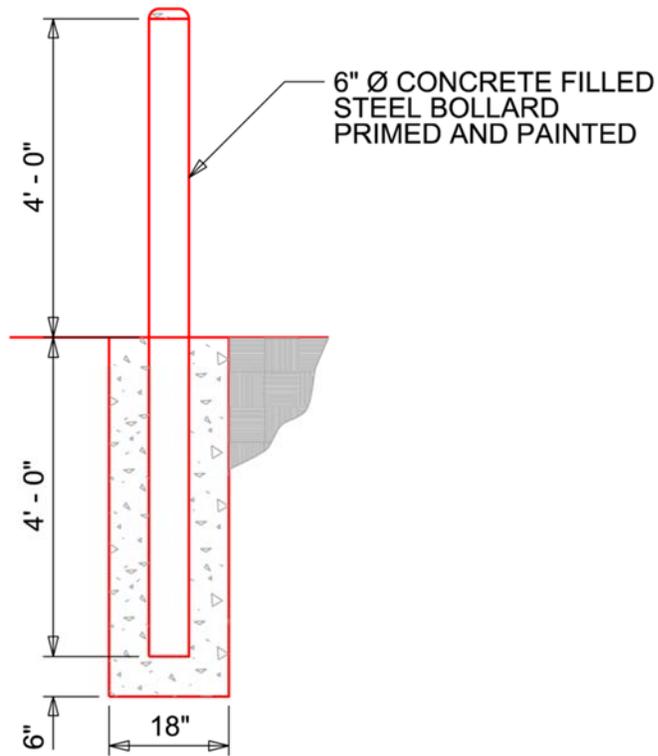
DRAWN BY: RCR

SCALE: 1" = 1'

APPROVED BY: MRH

DATE: 8/18/2011

Figure 2.7-h Typical Beaver Slide Detail



NOTES:

1. STEEL SHALL BE HSS 6.0 X .125
2. CONCRETE SHALL BE CDOT CLASS B
3. DOME CONCRETE ABOVE PIPE TO PREVENT PONDING WATER

DIRECTORATE OF PUBLIC WORKS
FORT CARSON, COLORADO

**TYPICAL BOLLARD
DETAIL**

DRAWN BY: RCR

SCALE: $\frac{1}{2}'' = 1'$

APPROVED BY: MRH

DATE: 8/18/2011

Figure 2.7-i Typical Bollard Detail

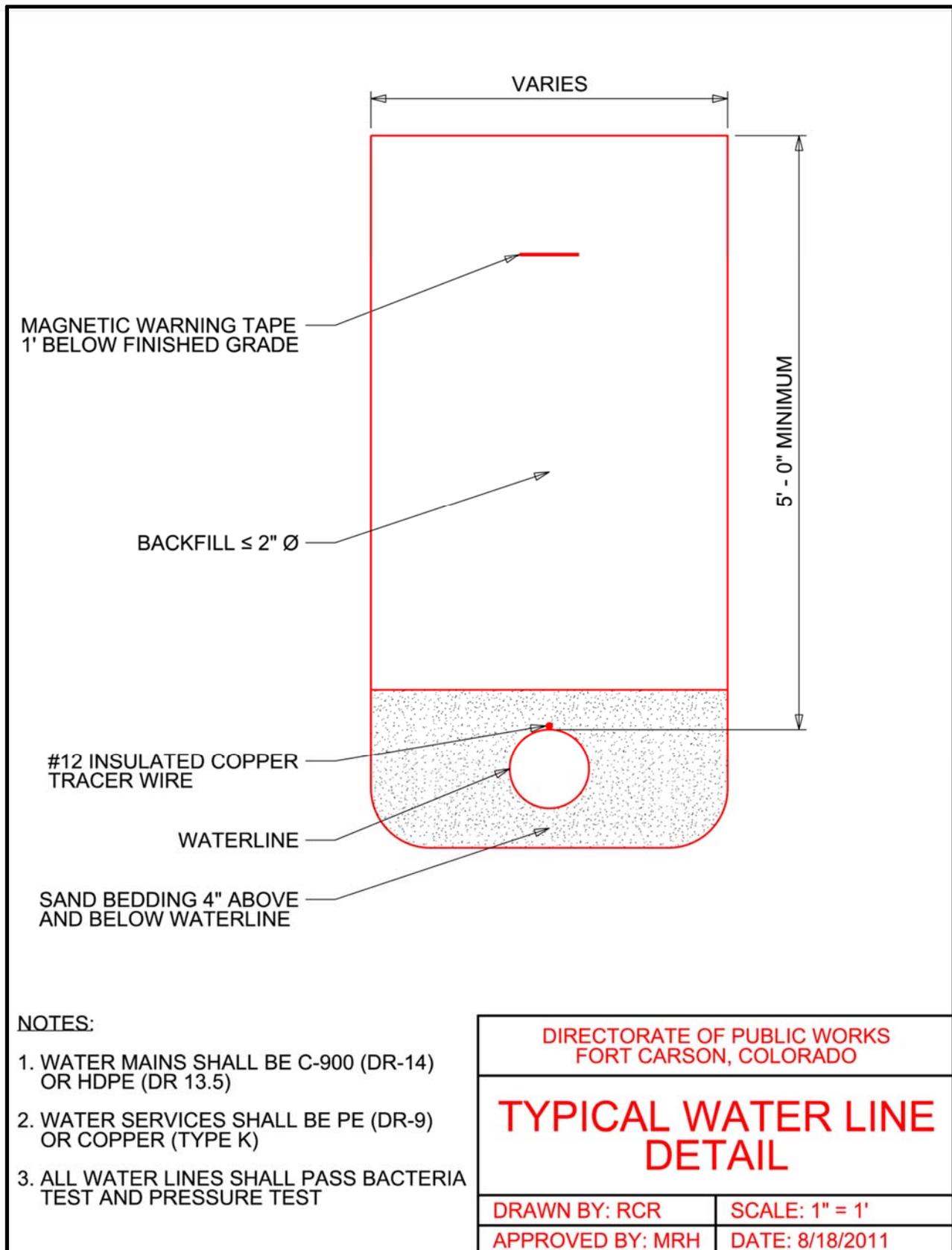


Figure 2.7-j Typical Water Line Detail

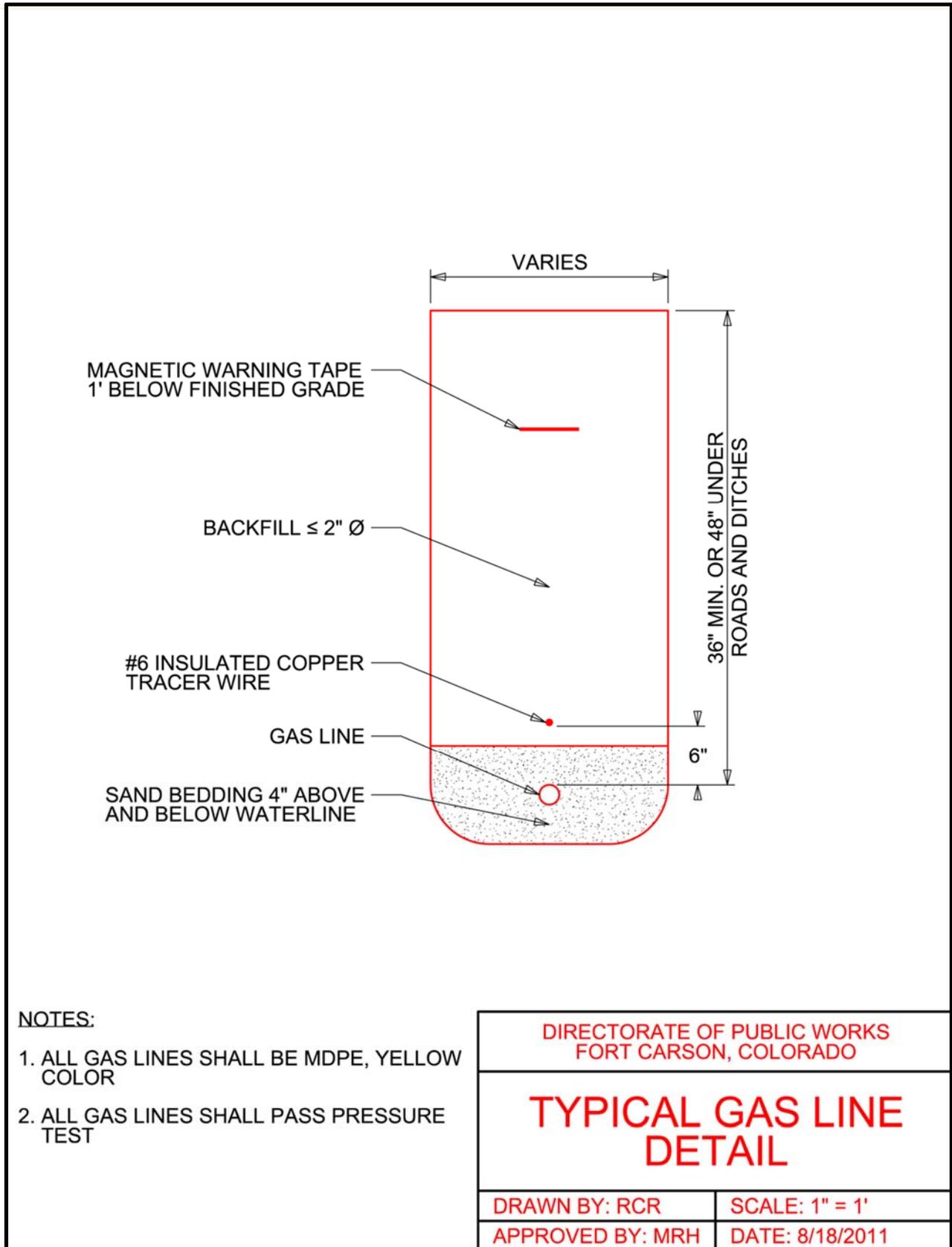


Figure 2.7-k Typical Gas Line Detail

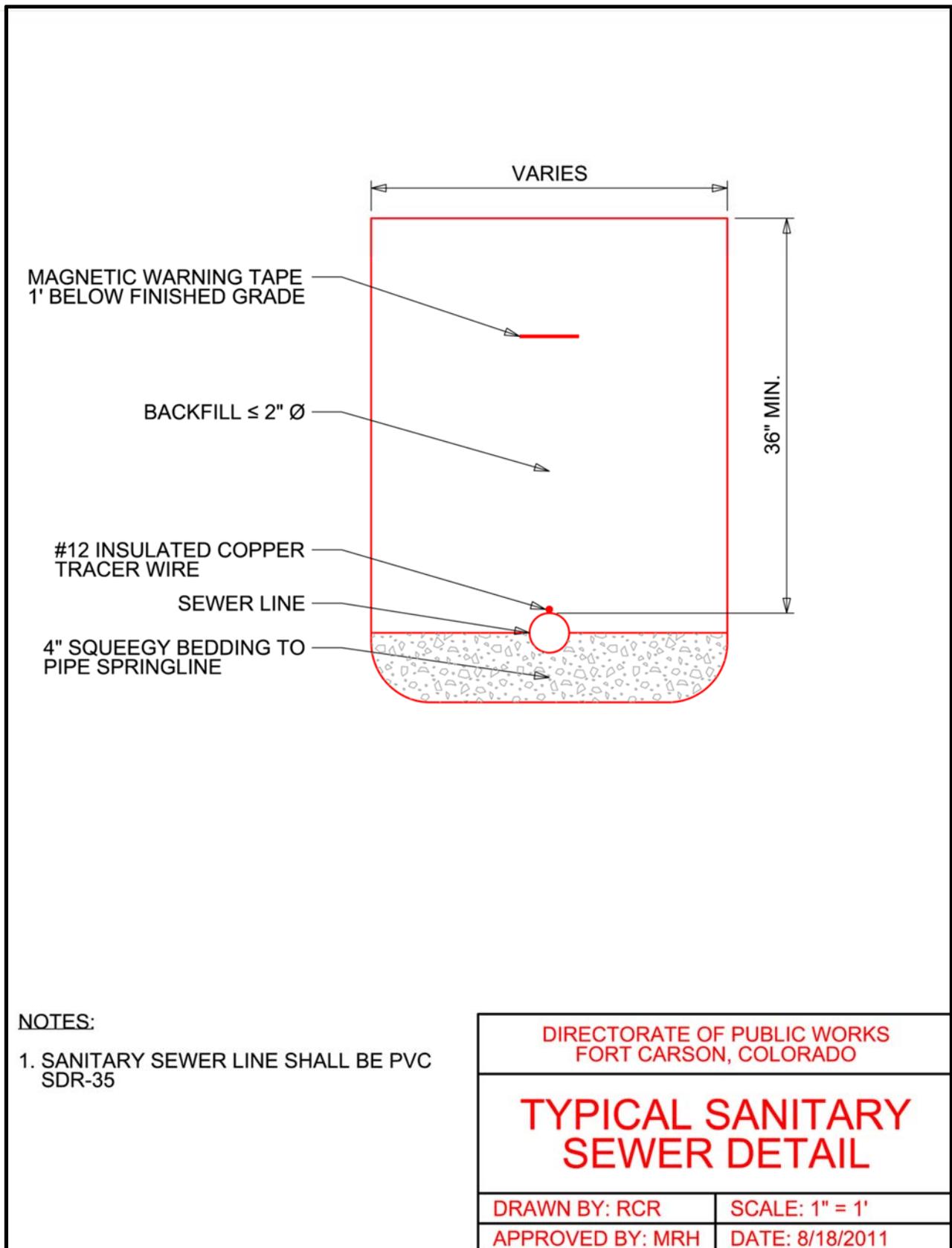


Figure 2.7-1 Typical Sanitary Sewer Detail

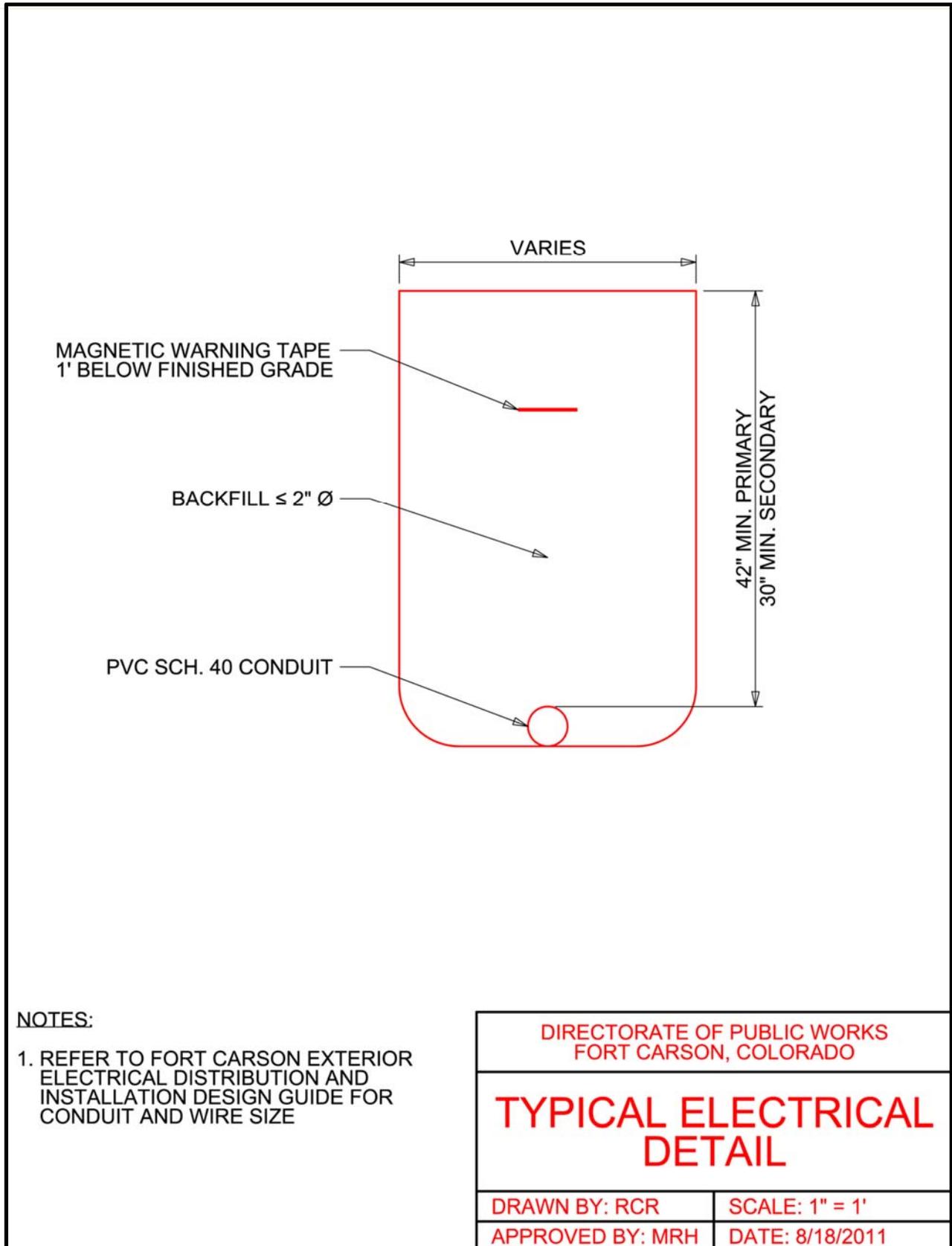


Figure 2.7-m Typical Electrical Detail

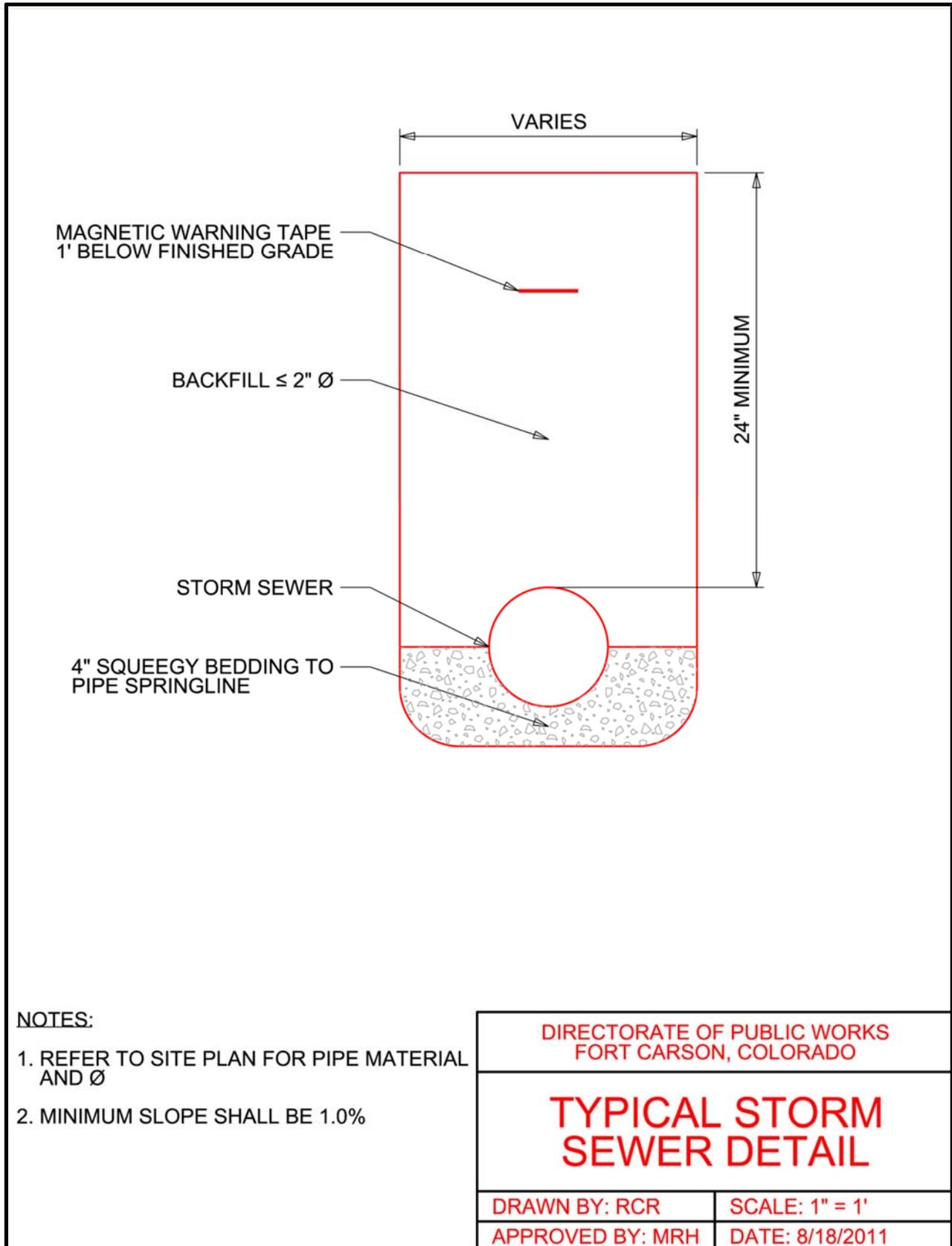
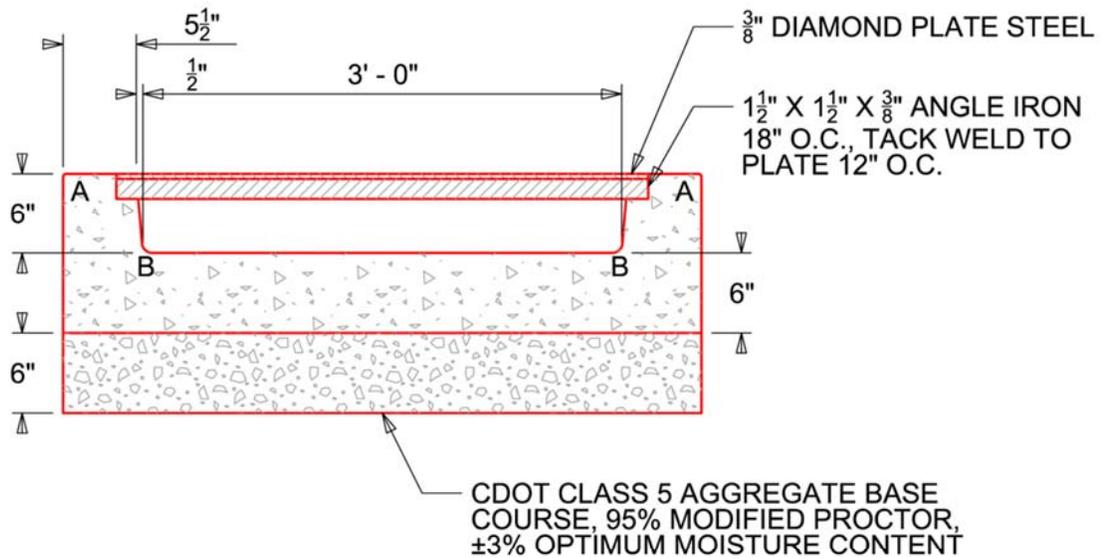


Figure 2.7-n Typical Storm Sewer Detail

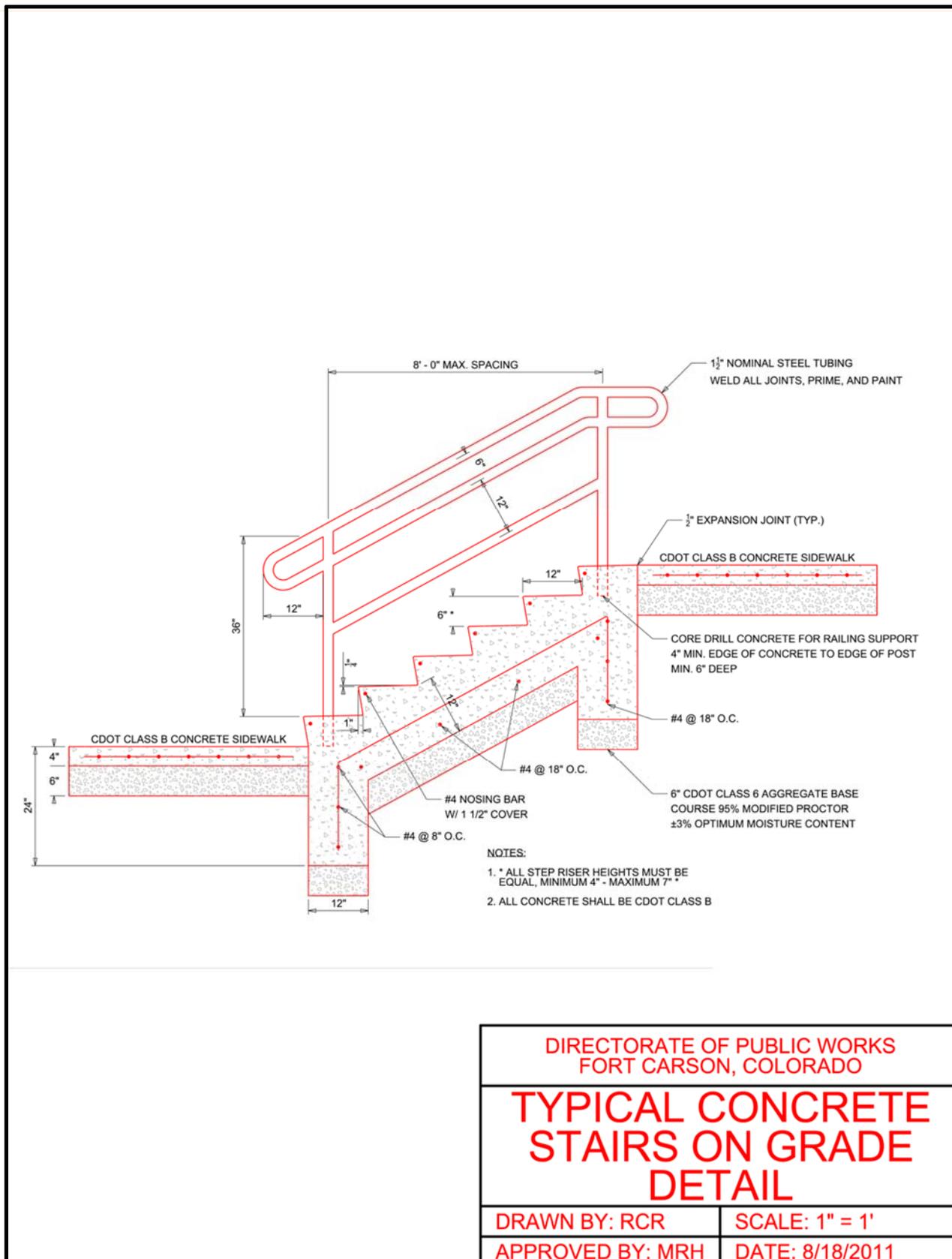


NOTES:

1. RADII LENGTHS ARE AS FOLLOWS:
A - 1/2" AND B - 1 1/2"
2. CONCRETE SHALL BE CDOT CLASS B

DIRECTORATE OF PUBLIC WORKS FORT CARSON, COLORADO	
TYPICAL SIDEWALK CHASE DETAIL	
DRAWN BY: RCR	SCALE: 1" = 1'
APPROVED BY: MRH	DATE: 8/18/2011

Figure 2.7-o Typical Sidewalk Chase Detail



DIRECTORATE OF PUBLIC WORKS
FORT CARSON, COLORADO

**TYPICAL CONCRETE
STAIRS ON GRADE
DETAIL**

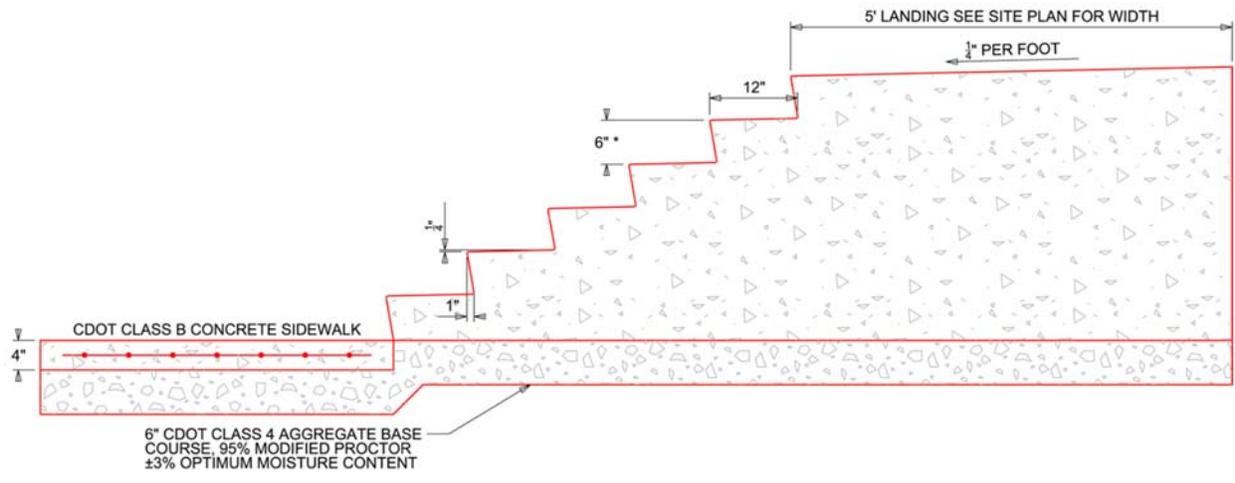
DRAWN BY: RCR

SCALE: 1" = 1'

APPROVED BY: MRH

DATE: 8/18/2011

Figure 2.7-p Typical Concrete Stairs on Grade Detail



- NOTES:
- * ALL STEP RISER HEIGHTS MUST BE EQUAL, MINIMUM 4" - MAXIMUM 7" *
 - ALL CONCRETE SHALL BE CDOT CLASS B

DIRECTORATE OF PUBLIC WORKS FORT CARSON, COLORADO	
<h1 style="color: red;">TYPICAL CONCRETE STAIRS DETAIL</h1>	
DRAWN BY: RCR	SCALE:
APPROVED BY: MRH	DATE: 8/18/2011

Figure 2.7-q Typical Concrete Stairs Detail

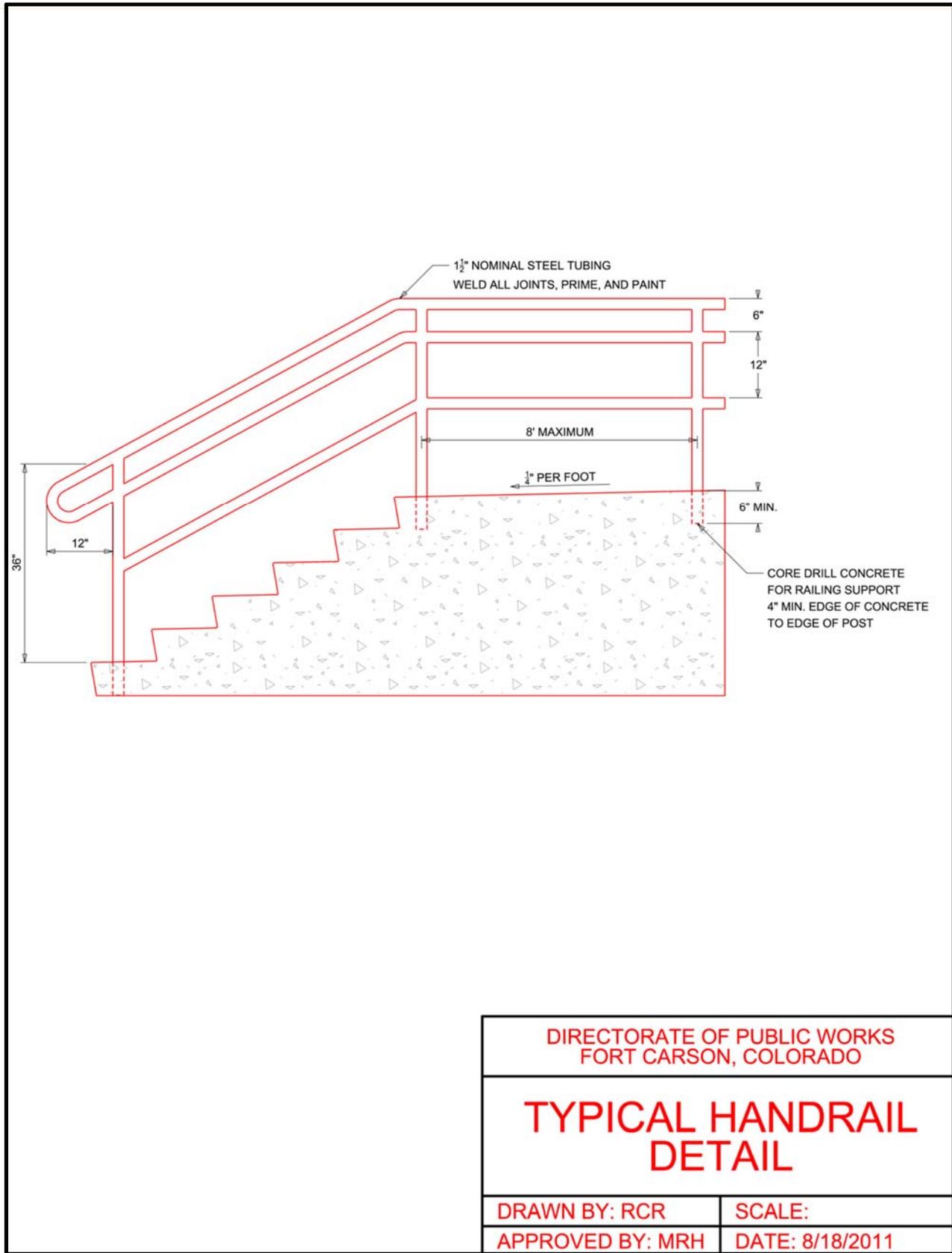
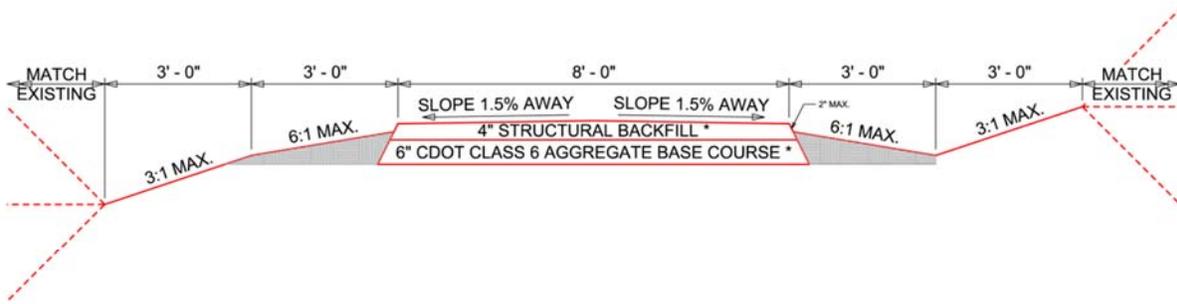


Figure 2.7-r Typical Handrail Detail



NOTES:

- 1. SCARIFY AND COMPACT SUBGRADE
- 2. * COMPACT TO 95% MODIFIED PROCTOR
±3% OPTIMUM MOISTURE CONTENT

DIRECTORATE OF PUBLIC WORKS FORT CARSON, COLORADO	
<h1 style="color: red;">TYPICAL RUNNING TRAIL DETAIL</h1>	
DRAWN BY: RCR	SCALE:
APPROVED BY: MRH	DATE: 8/18/2011

Figure 2.7-s Typical Running Trail Detail

IDG SECTION 3 SITE

3.1 Circulation

3.1-A Parking

3.1-A.1 Design

3.1-A.1(A) Islands

Internal islands shall be provided within parking lots to help control traffic, and to provide turning radii between parking aisles and intersecting drives at the ends of aisles. The primary use is for landscaping. This avoids the appearance of large parking lots and maintains a more enjoyable environment. In all islands, utilities should be located along an edge to enable landscaping. Provide a 4" PVC pipe to all landscaped islands from the edge of the parking lot for an irrigation system.

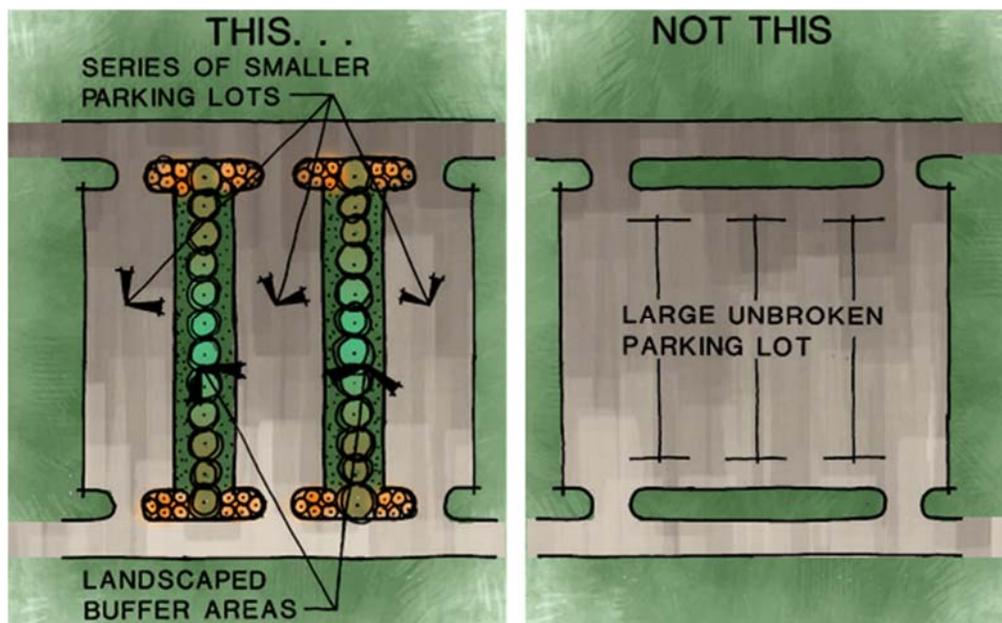


Figure 3.1-a Parking Lot Preferred Design

3.1-A.1(B) Parking Lot Landscaping

Landscape screening, such as shrubs, around the perimeter of a parking lot is encouraged as a way to visually separate and screen the parking lot from roads, pedestrian paths, and other facilities, and is highly encouraged. See Section 3.3 Planting for recommended plant types.

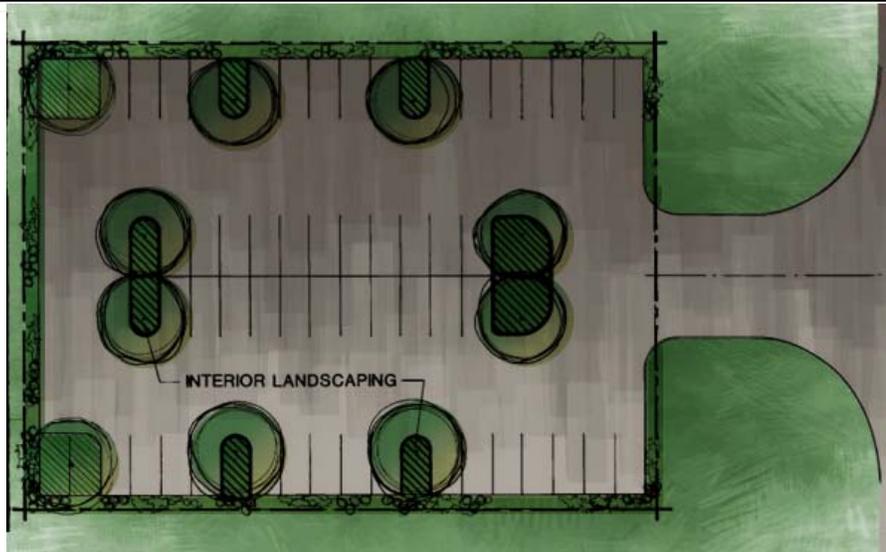


Figure 3.1-b Parking Lot Landscaping

Fort Carson approves the use of berms and other grade changes to assist in screening of parking areas and buildings. However, pedestrian paths must maintain a level path, or handicap compliant grade change.

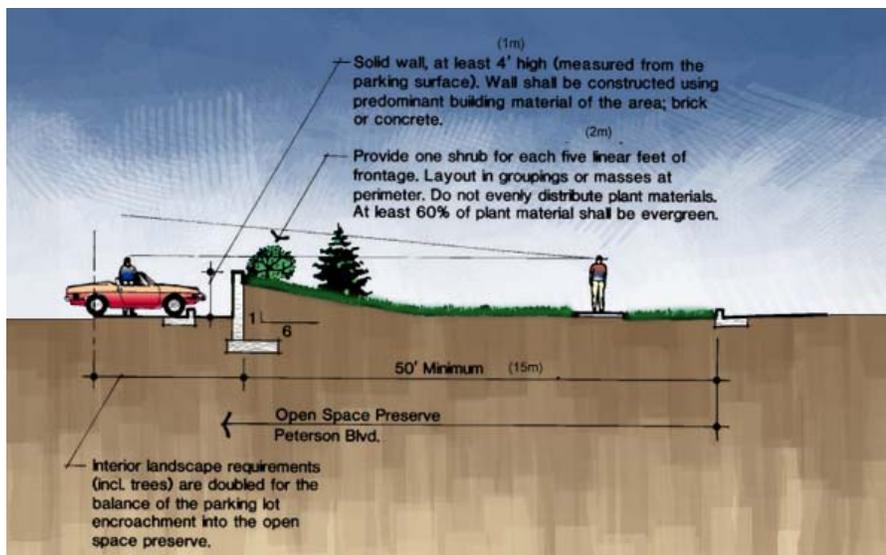


Figure 3.1-c Parking Lot Screening Technique

3.1-A.1(C) Parking Lot Pedestrian Paths

Pedestrian paths throughout parking lots shall be established to direct pedestrians from the parking lot to the associated facility. A change in the surface patterns will help draw attention to the walkway surface and help alert motorists to the pedestrian presence. This common design technique of contrasting color, material, and texture is needed where there is a safety concern at vehicular and pedestrian crossings.

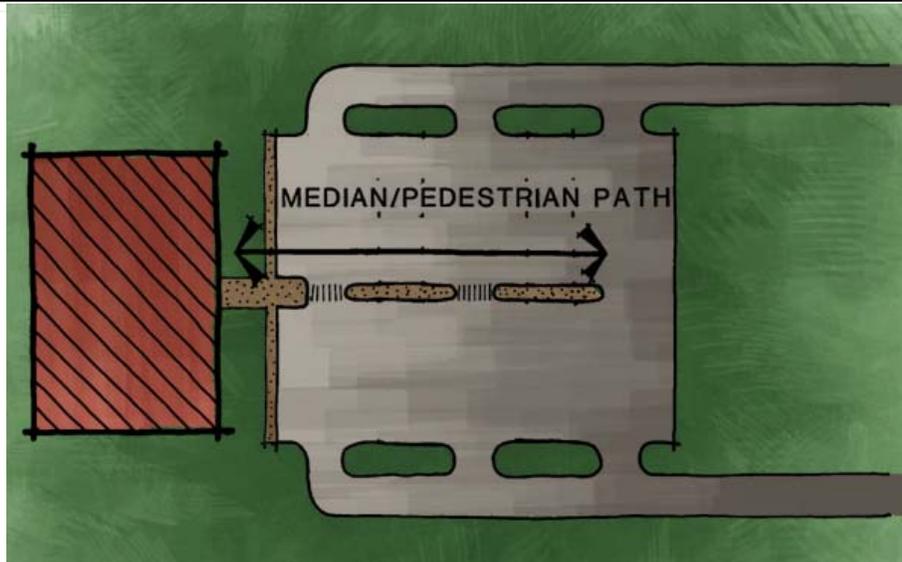


Figure 3.1-d Parking Lot Pedestrian Paths

3.1-A.1(D) Parking Blocks

Parking Blocks or car stops are required when the pedestrian path is directly adjacent to the parking area. Overhang is not allowed unless the pedestrian path is 8' or wider, or the pedestrian path is offset from the parking curb.

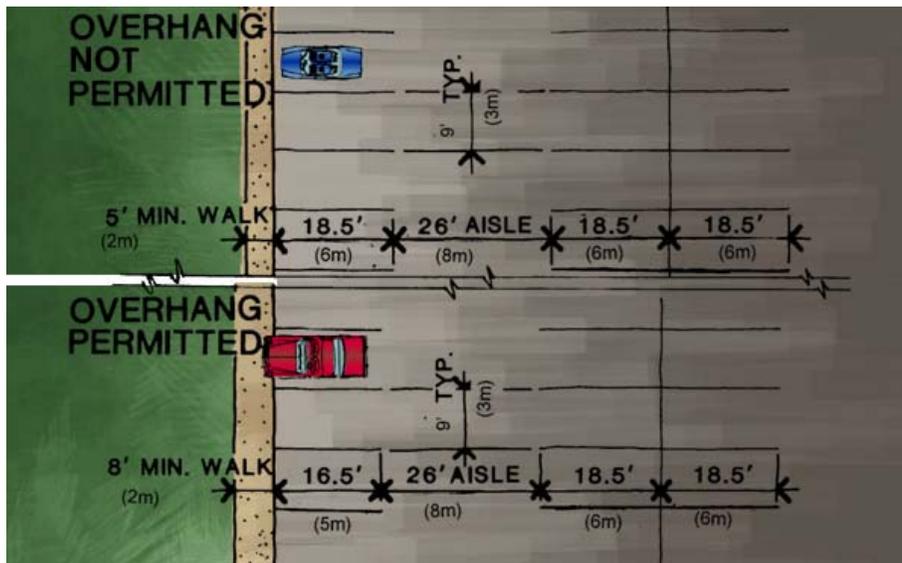


Figure 3.1-e Parking Lot Design

3.1-A.2 Parking Lot Striping

3.1-A.2(A) Units who need to re-stripe parking areas can acquire authorization by bringing a memorandum, signed by the Unit Commander, describing what the white paint will be used for, to the DPW, Troop Construction, phone 526-4204/2859

3.1-A.2(B) Painting new parking areas requires a DA Form 4283 Facilities Engineering Work Request be submitted to the DPW, Business Management Division, Customer Service, Building 1219, room 124, phone 526-2867.

3.1-A.2(C) Along with the DA Form 4283, an area map showing the number of spaces and/or handicap spaces, motorcycle spaces, etc. must be attached to the work request. For further information contact the DPW, Customer Service at 526-2867.

3.1-A.3 Other Striping

3.1-A.3(A) Units who need to re-stripe the motor pool bay areas can acquire authorization by bringing a memorandum, signed by the Unit Commander, describing what the traffic yellow paint will be used for, to the DPW, Troop Construction, phone 526-4204/2859.

3.1-A.3(B) Once authorization has been obtained, units may go to the DPW, Supply, Building 217, phone 526-5165/3987 to pick-up the paint. For new striping, a DA Form 4283 Facilities Engineering Work Request is required, along with an area map showing where the stripes need to be painted.

3.1-A.3(C) Red paint can be used around fire extinguisher areas (authorized by DPW, Troop Construction).

3.1-A.3(D) Bollards must be painted yellow, or brown with yellow reflective tape striping.

3.1-A.4 Pavers and Porous Pavements

Porous pavements are still under review by DPW, and therefore a recommendation as to the feasibility of this type of parking cannot be made at this time. This type of parking is currently allowed to be proposed as part of the design of new facilities.

3.1-A.5 Gravel Parking and Driveways

Whenever funding and other factors dictate, unimproved parking and driveways are permitted. Proper grading and surface material must be utilized.

3.1-B Bikeways

Fort Carson has established bicycle lanes on some primary roadway. Pedestrian paths and activity trails are designed to accommodate bicycle traffic.

3.2 Grading & Drainage

3.2-A Soil Erosion Control

3.2-A.1 Soil Erosion Control Blanket

Soil Erosion Control Blanket shall be used on slopes greater than 3:1 with moderate to heavy runoff conditions. It shall consist of a machine produced mat of biodegradable material. The erosion control blanket shall be a uniform thickness, with all material evenly distributed over the blanket. The blanket shall be covered on one side with either plastic netting or twisted kraft paper cord netting. Plastic netting shall be polypropylene extracted plastic net with 1 to 2 percent carbon black and shall have a 1/2-inch to 3/4-inch mesh opening. Twisted kraft paper cord netting shall have a mesh size not to exceed 1-1/2 inches by 3 inches. The blanket shall be composed of either, biodegradable straw, coconut, or wood fiber of any approved mixture. Twisted kraft paper cord netting shall have a mesh size not to exceed 1 1/2 inches by 3 inches. No blanket with paper as the major component shall be used unless prior approval is obtained from the DPW Conservation Branch. The blanket shall be laid in a 1 foot trench, stapled every 1/2 yard, and covered with soil on the entire length of its' upper slope. The erosion control blanket shall then be securely stapled to the site using staples as described in section 4.7.2., and

depicted in TE-1. All manufacture's specifications shall be supplied to the Contracting Officer prior to application for approval.

3.2-A.1 Staples

Staples shall be made of 11 gauge or heavier steel wire, "U" shaped with a 1-inch crown, and legs a minimum of eight inches in length, and being 11 gauge metal or heavier. These staples shall be placed according to the slope gradient and length, as specified on the Staples Pattern Guide attached in TE-1. Channel lining shall be placed across the channel, not down the length. The staple pattern utilized shall be as depicted in the Staple Pattern Guide in TE-1. The fabric utilized shall meet the manufacturer's recommendations for the proposed use. The Contracting Officer shall be provided the manufacturer's specifications prior to application.

3.3B Rainwater

Colorado state laws severely restrict rainwater collection for commercial purposes. Rainwater may not be held for longer than 72 hours. Therefore, rainwater collection is discouraged, unless it can be shown that any rainwater collected will be dispersed within the 72 hour limit. When rainwater collection is proposed on any facility, consultation with the Environmental Division is a necessary step in the design process.

3.3 Irrigation Standards

3.3-A Design

To help Fort Carson meet NET ZERO water reduction goals, an Evapotranspiration Irrigation System is utilized.

3.3-A.1 WeatherTRAK.net Central 7.0

It is a requirement that all installed irrigation systems connect to this system. Any questions should be directed to DPW Business Operation and Maintenance Division. Contact Info is Building 1219 Room 211 A. Office phone 526-9271 or Cell 491-8603.

3.3-A.2 Standard Irrigation Parts for Fort Carson

- I20 Hunter Rotor Irrigation Heads
- I40 Hunter Rotor Irrigation Heads
- PGP Hunter Rotor Irrigation Heads
- Rain Bird Impact Irrigation Heads
- Rain Bird Pop Up Spray Irrigation Heads
- Rain Bird Valves
- Rain Bird Irrigation Controllers
- Febco or Watts Back Flows

3.3-A.3 Weather Trak Irrigation Parts

3.3-A.3(A) WALL

<u>Clocks</u>	<u>Stations</u>	<u>Flow Sensor (Part # and Size)</u>	
WTPROS-C-12-CWM	12 AND SMALLER	735pv0706-1201	3/4
WTPROS-C-18-CWM	18 TO 12	735pv1006-1201	1
WTPROS-C-24-CWM	24 TO 18	DATIR220P112	1.5
WTPROS-C-30-CWM	30 TO 24	DATIR220P2	2
WTPROS-C-36-CWM	36 TO 30	DATIR220P3	3
WTPROS-C-42-CWM	42 TO 36	228PV4006-1211	4
WTPROS-C-48-CWM	48 TO 42	220BR0006-1211	6

3.3-A.3(B) PEDESTAL

<u>Clocks</u>	<u>Stations</u>	
WTPROS-C-12-SPH	12 AND SMALLER	*Brass Master Valves*
WTPROS-C-18-SPH	18 TO 13	
WTPROS-C-24-SPH	24 TO 19	
WTPROS-C-30-SPH	30 TO 25	
WTPROS-C-36-SPH	36 TO 31	
WTPROS-C-42-SPH	42 TO 37	
WTPROS-C-48-SPH	48 TO 43	

3.3-A.3(C) 2-WIRE

<u>Clocks</u>	<u>Stations</u>
WTPROS-C-12-SPH-2W	12 AND SMALLER
WTPROS-C-18-SPH-2W	18 TO 12
WTPROS-C-24-SPH-2W	24 TO 18
WTPROS-C-30-SPH-2W	30 TO 24
WTPROS-C-36-SPH-2W	36 TO 30
WTPROS-C-42-SPH-2W	42 TO 36
WTPROS-C-48-SPH-2W	48 TO 42

3.3-A.3(D) Heads

I-20	I-40	PGJ
HUNTER- PRS-30	HUNTER- PRS-40	HUNTER- PRS

3.3-A.3(E) Nozzles

Mp-Rotators only
No MPR nozzles

**** Ball valves on every Zone****

3.4 Landscaping

3.4-A General

3.4-A.1 Due to the expansive clay material commonly found on the post, it is recommended that no foundation plantings occur within at least 10'-0" from building foundations.

3.4-A.2 For all new landscaping, or changes to existing, the landscape design shall conform with the look of the rest of the Post. All landscaping entails the need for a DA Form 4283 (Facility Engineering Work Request) to be submitted to the DPW for approval.

3.4-A.3 When excavation deeper than 6" is necessary, a Dig Permit, FC Form 86, will be required.

3.4-A.4 Units and/or Organizations will provide a Landscaping Plan for the project. Surface area disturbance and tree removal will be minimized. Trees to be retained will be incorporated in the Landscaping Plan.

3.4-A.5 Trees, shrubs, plants, etc. shall be guaranteed for a period of one (1) year from time of planting.

3.4-B Performance Information for Turf

3.4-B.1 Soil Preparation

3.4-B.1(A) As soon after the site has been stripped of topsoil and vegetation and rough grading has been completed reduce and eliminate weed growth with mowing. Do not allow weeds to grow more than 6 inches tall in any areas. Temporary seeding of an annual cover crop shall be provided with an annual grass seed mix to reduce soil erosion and reduce weed growth for rough graded areas that will not be finish graded and have final seeding or sodding for an extended length of time with an annual grass seed mix to reduce soil erosion and reduce weed growth. Fine grade and seed all areas as soon as possible to reduce soil erosion and reduce weed growth.

3.4-B.1(B) Prior to seeding or sodding, scarify all surface soils to a minimum depth of 6 inches and break up soils to a fine, workable texture suitable for seeding and sodding. Remove rocks larger than 3/4" diameter.

3.4-B.1(C) Topsoil shall be existing topsoil stripped from the site prior to construction or imported from off site and be weed free and without visible plant remains, roots, stalks and grass. Representative sample(s) of the topsoil material shall be submitted for laboratory soil analysis and evaluation of the soils suitability for establishment of the approved native seed and/or sod. An acceptable topsoil shall have a loam, sandy loam, clay loam, or silt loam texture; a neutral pH; a low salt content; an organic matter content >2%; and appropriate nutrients to support the native grasses. If the topsoil does not meet these criteria, soil amendments (such as compost) shall be required to meet the specification. In general, areas within the limits of seeding and sodding shall have 5 cubic yards per 1,000 square feet of well composted organic matter thoroughly worked into the top 6 inches of soil with a rototiller or similar mechanical equipment as approved by the Contracting Officer's Representative

3.4-B.1(D) After soils have been amended and topsoiled, fine grade all areas to a smooth even surface with no low spots to allow water to puddle. Prepared seed or sod bed areas shall be approved by the Contracting Officer's Representative prior to seeding or sodding.

3.4-B.2 Permanent Seeding and Sodding

Permanent seeding and sodding shall be installed in areas as shown on contract drawings and IAW the "Fort Carson Landscaping Strategy August 2012". Permanent native seeding is intended for use in areas that receive no supplemental irrigation. Sod and turfgrass is intended for use in areas that will receive permanent spray irrigation.

3.4-B.3 Grass Seeding

3.4-B.3(A) The contractor shall develop seed mix design(s) for Government Approval in accordance with the guidance provided in "Plant Materials Technical Note No. 59 (Revised), dated February 23, 2012" (U.S. Department of Agriculture Natural Resources Conservation Service). Mix design shall be based on the NRCS Major Land Resource Area of the site (see <http://www.cei.psu.edu/mlra/>). NOTE: There are several approved seed mixes listed at the end of the Acceptable Plants List in Section 3.4-F. Do not use only annual grasses for the final grass landscape planting. With Government Approval, annual grass species may be used in limited amounts as a nurse crop to improve the micro environment for establishment of the final perennial grass cover, reduce erosion by wind and water, and compete with weeds. Choice of annual grass shall be based on its inability to create excessive competition with the growth and development of the final cover of perennial grass. The various annual grass species and cultivars have preferred seasons of use and seeding rates for proper use as nurse crops. Natural death and removal from the stand due to low or high temperatures (winter kill or summer heat) are the preferred methods of removal. Mowing the excessive top growth where practical is acceptable. Some possible annual grasses for use as nurse crops are wheat, oats, German millet, and (sterile hybrids) 'Quickguard' and 'Regreen'. All seed shall be bagged and labeled with seed tags on site and available for inspection prior to use.

3.4-B.3(B) Each seed mix and planting design shall include 5 appropriate warm and/or 5 cool season grasses adapted to the expected climate, soil texture, and minimum maintenance., and It shall specify seeding rates, seeding methods, seeding dates, fertilization rates/frequency, watering requirements, approved herbicides and methods for controlling broadleaf weed and undesirable grass growth, and lifecycle maintenance criteria. A design analysis shall be provided that clearly describes the process used to arrive at the given mix design(s). It will be expected that the landscape contractor understands and applies correct agronomic principles in order to achieve an acceptable permanent stand of grass.

3.4-B.4 Seeding Dates

Seeding dates shall be as specified in the mix design.

3.4-B.5 Seeding Methods

Seeding methods shall be as specified in the mix design. Seeding shall be performed with mechanical drill methods subject to approval of the Contracting Officer's Representative. Broadcast seeders may be approved for use in small areas less than 100 square feet and/or areas with restrictive slopes (steeper than 3:1) subject to approval of the Contracting Officer's Representative. Hydroseeding is not acceptable.

3.4-B.6 Fertilizing

Type, quantity and frequency of fertilizer application shall be determined based on a laboratory soil analysis on the final amended seed/sod bed soils. In general, all seeded and sodded areas shall be fertilized at a rate of 1 pound of fertilizer per 1,000 square feet every 3 months until the maintenance period is complete. The contractor's mix design for the given seed/sod type shall dictate final fertilization requirements.

3.4-B.7 Mulching

Use weed-free native hay, weed-free straw, virgin wood fiber hydro-mulch or erosion control blankets to mulch seeded areas and promote germination and seedling establishment. Apply hydro-mulch using the recommended rate of an organic tackifier. Use erosion control blankets to protect slopes 3:1 or greater and along drainage areas and drainage swales. Grass seed will not be mixed with hydro-mulch.

3.4-B.8 Weed and Pesticide Control

3.4-B.8(A) Herbicide. If weed competition becomes abundant (approximately 10% or more of the stand) on the seeded areas use an appropriate herbicide for the type of grass seeded to remove the weeds. However, comply with all federal, state and base requirements for the use of herbicides and they must be approved on the Installation Pesticide Use Proposal (PUP) list. Herbicides must be specifically approved for the type of grasses seeded.

3.4-B.8(B) Pesticide. Pesticide applications on Fort Carson or the Pinon Canyon Maneuver Site shall follow all Federal, State and Department of Defense rules and regulations. In addition, the contractor shall coordinate with the Fort Carson Pest Management Coordinator (PMC) at least 30 calendar days prior to the application of any pesticides. The PMC will ensure that the applicators are appropriately licensed and that the proposed pesticide is approved for use on the installation. Only Colorado State Certified Operators under the direct supervision of a Colorado State Qualified Supervisor are permitted to apply pesticides on Fort Carson and the Pinon Canyon Maneuver Site.

3.4-B.9 Mowing

Mow turf grass and sodded areas to a height of 2-1/2 inches when the height of the grass become 3-1/2 inches. Mow all seeded and mulched areas during the establishment and maintenance period per requirements specified in the mix design.

3.4-B.10 Reseeding

If a partial or total seeding failure is apparent more than 20 days after seed installation, reseed failed areas in the same manner described above during suitable planting period. If the project schedule does not coincide with the preferred seeding periods, or there are unsuitable site conditions, then soil stabilization and/ or storm water Best Management Practices (BMPs) shall be implemented to stabilize the area until the next appropriate seeding date. Any seeding conducted outside the preferred months shall be approved by the Contracting Officer's Representative. Use appropriate site preparation practices used to create a suitable seedbed for planting, but any established native vegetation shall be

undisturbed. Areas that erode and lose seed before establishment shall be immediately reseeded during the next suitable planting period.

3.4-B.11 Sod

Provide sod that is state-certified as classified by applicable state laws. Provide sod that is locally grown and is comprised of a mixture of improved varieties of turf-type tall fescues or bluegrass depending on the application. Sod shall be required if damaged or removed in areas where an irrigation system exists. If provided as replacement for areas disturbed by the contractor's operations, match the sod type as closely as possible to the existing variety. All sod is required to be supported by sprinkler systems. Provide sod that is free of thatch, diseases, nematodes, soil-borne insects, weeds or undesirable plants, stones larger than 3/4 inches in diameter, woody plant roots and other material detrimental to a healthy stand of grass. Reject dry moldy, yellow, irregularly shaped, torn or uneven end sod pieces. Machine cut sod to a uniform thickness of 1 inch within a tolerance of 0.25 inches, excluding top growth and thatch. Measurement for thickness shall exclude top growth and thatch. Use sod anchors for sloped areas as recommended by the sod supplier. If sod is provided as replacement for areas disturbed by the Contractor's operations, assure that the existing irrigation system is shut-off in the affected operations area, but still functions properly in adjacent areas. When operations are complete and replacement sod is installed, reconnect the existing system to assure watering of newly sodded areas as required.

3.4-B.12 Grass Establishment and Maintenance

Once a healthy stand of grass is established, the maintenance period is one year after establishment which includes irrigating, mowing to the required heights, fertilizing, controlling weed and crabgrass growth as described in the mix design. The maintenance period will restart at one year for those areas that require reseeding or repair. One-year warranty provisions for the landscaped areas will commence once the maintenance period is completed, or at a time determined suitable by the Contracting Officer's Representative.

3.4-C Irrigation Systems

Irrigate turf and sod areas and landscape plantings with a permanent underground irrigation system, in accordance with the requirements of the approved mix design seed/sod. Irrigate native seed areas with a temporary irrigation system as necessary in accordance with the approved mix design seed. The contractor shall demonstrate that native vegetation areas will survive without supplemental irrigation for a minimum of 90 days during the maintenance period. Contractor shall meter irrigation water and shall pay for use during the maintenance period.

3.4-D Green Infrastructure Zones

- These zones specify the landscaping and maintenance strategy of permanent green infrastructure zones. Development is closely managed within green infrastructure zones.
- The requirements of the Green Infrastructure Zones shall be met for any new construction or repair project undertaken by any construction agency. Separate roadway, parking lot or pedestrian projects shall also develop or restore affected areas per these zone requirements

3.4-D.1 ZONE A -GREEN ZONE

3.4-D.1(A) Purpose

Parade Fields, Sports Fields, Sports Complexes, Recreation Areas, and Parks

3.4-D.1(B) Strategy

- Develop, improve and sustain as premium landscaped areas with wearable turf and decorative trees and shrubs as focal points for sports, recreation, and ceremonies and at key installation facilities.
- The limits of Green Zones are delineated on the Landscaping and Streetscape Zoning Map. The limits generally encompass existing parade fields, sports fields, parks and recreation fields in their entirety.

3.4-D.1(C) Maintenance Requirements

Perform routine Grounds Maintenance and landscaping repair to include mowing, fertilizing, pruning, sod repair and plant replacement. Improve and expand landscaping footprint if practical.

3.4-D.1(D) Development

Prohibited, except for compatible ceremonial, sports and recreational facilities.

3.4-D.1(E) Landscaping Types

- TURF: Kentucky Bluegrass Sod, athletic sods, or artificial turf per determination from a life cycle cost analysis and soil type analysis
- ROCK MULCH: 1-1/2" Colorado Red or other Government approved rock.
- TREES: See acceptable plants list
- SHRUBS/BUSHES: See acceptable plants list
- FEATURES: Boulders, other decorative rock areas, benches, site lighting

3.4-D.1(F) Irrigation

Permanent Irrigation Zones are required. Spray Irrigation is required for all turfs and drip systems for all trees and shrubs.

See Section 3.3 for Irrigation System Standards.

3.4-D.2 RIPARIAN ZONE**3.4-D.2(A) Purpose**

Natural or Man-Made Drainage Ways

3.4-D.2(B) Strategy

- Maintain as native riparian waterway and open space.
- The limits of Riparian Zones are delineated on the Landscaping and Streetscape

- Zoning Map. The limits generally encompass existing natural or man-made drainage ways and floodways, extending from the natural centerline to at least the embankment crest.

3.4-D.2(C) Maintenance Requirements

Perform routine Drainage-way Maintenance and noxious weed removal. Mowing is not required.

3.4-D.2(A) Development

Prohibited, except for compatible pedestrian or low-impact vehicle trails and bridges.

3.4-D.2(A) Landscaping Types

Existing Native grasses, forbs, shrubs and trees

3.4-D.2(A) Irrigation

Temporary irrigation or watering is required to meet establishment performance standard.

3.4-D.2(A) Design Notes

- Restore to native species in kind.
- No further improvement, addition or maintenance to existing grasses, forbs, shrubs or trees required.

3.4-D.3 OPEN SPACE ZONE

3.4-D.3(A) Purpose

Running Trails

3.4-D.3(A) Strategy

Maintain as native open space for buffer zones, running trails and utility corridors. The limits of Open Space Zones are delineated on the Landscaping and Streetscape Zoning Map. The limits generally encompass existing open spaces around boundaries of developed parcels, the installation perimeter, service roads, utility corridors, parks and recreation fields in their entirety.

3.4-D.3(A) Maintenance Requirements

Mow 6' wide buffer along running trails or other pedestrian facilities. Otherwise, there are no maintenance requirements for ground or vegetation, with exception of noxious weed removal. Perform routine maintenance and repair of running trails in Open Space.

3.4-D.3(A) Development

Prohibited, except for compatible pedestrian or low-impact vehicle trails and bridges.

3.4-D.3(A) Landscaping Types

Existing native grasses, forbs, shrubs and trees

3.4-D.3(A) Irrigation

None

3.4-D.3(A) Design Notes

No further improvement, addition or maintenance of existing grasses, forbs, shrubs or trees required.

3.4-E LANDSCAPING ZONES

3.4-E.1(A) These zones specify the site restoration and landscaping strategy of developed parcels. They provide guidelines to designers on the scale, variety and type of landscaping effort at certain locations. There are three key points of the strategy's intent:

- The zone requirements and their locations on the installation will place the greatest effort at high density and contiguous areas, while minimizing effort at geographically separated and isolated areas.
- The zone requirements will concentrate and minimize turfs with high water and maintenance requirements. It places high water and high maintenance turfs at prominent facilities with aesthetic and durability demands and places lesser turfs at facilities where aesthetics and prominence are not concerns.
- The zones will create streetscapes along corridors that transverse the installation's main core area. These corridors will create continuous and consistent landscaping, rather than sporadic landscaped island at random facilities.

3.4-E.1(B) The general approach at organizing the landscaping zones is to consolidate landscaping effort along main corridors and zones rather than an sporadic islands across the installation. This approach will allow the installation to more efficiently allocate initial and recurring resources on the massed and concentrated landscaping features in the distinct zones. This will minimize costs and maintenance effort since there will be less effort required at geographically separated and diverse areas that are outside the main core.

3.4-E.1(C) The requirements of the Landscaping Zones shall be met for any new building construction or repair project undertaken by any construction agency. Separate roadway, parking lot or pedestrian projects shall also develop or restore affected areas per these zone requirements.

3.4-E.2 STREETSCAPE ZONE

3.4-E.2(A) Purpose

Premium "streetscape" landscaping package to create continuous streetscape along selected main thoroughfares.

3.4-E.2(B) Strategy

- Develop, improve and sustain as premium landscaped areas with wearable turf and decorative trees and shrubs. Aesthetics of the landscape package is of prime importance in this zone. It is intended that the "streetscape" be continuous and coordinated along the entire Streetscape Zone.

- Zones are delineated on the Landscaping and Streetscape Zoning Map. The limits generally encompass the street frontage along identified green thoroughfares. On developed parcels, the zone shall extend from edge of street to the front building edge. On undeveloped parcels, the zone shall extend from the edge of pavement to a limit line that is 82' from and parallel to the pavement edge.

- Streetscape Zones are also identified on the Landscaping and Streetscape Zoning Map at geographically separated intersections of main roadways that are not otherwise zoned as Streetscapes.

3.4-E.2(C) Maintenance Requirements

Perform routine Grounds Maintenance and landscaping repair to include mowing, fertilizing, pruning, sod repair and plant replacement. Improve and expand landscaping within zone if practical.

3.4-E.2(D) Development

Permitted, per land use zoning.

3.4-E.2(E) Landscaping Types

- TURF: Kentucky Bluegrass Sod, athletic sods, or artificial turf per determination from a life cycle cost analysis and soil type analysis
- ROCK MULCH: 1-1/2" Colorado Red or Government approved rock.
- TREES: See acceptable plants list
- SHRUBS/BUSHES: See acceptable plants list
- FEATURES: Boulders, decorative rock areas, benches, site lighting

3.4-E.2(F) Irrigation

Permanent Irrigation Zones are required. Spray Irrigation is required for all turfs and drip systems for all trees and shrubs. See Section__ for Performance standards and Irrigation System Standards.

3.4-E.2(G) Design Notes

- Place Tree Lawns on rock mulch along main thoroughfares
- Design landscaping, edging, and paths to eliminate pedestrian traffic on sod and landscaped areas.
- Utilize layered landscaping to visually screen any adjacent Managed or Native Zones from the green thoroughfare sightline.

3.4-E.3 CENTRAL CANTONMENT ZONE

3.4-E.3(A) Purpose

“Minimal” landscaping package to present a finished and orderly appearance within the central core area (or business district) of “Main Post”, that requires minimal initial and life cycle costs.

3.4-E.3(B) Strategy

- Create a restored and finished landscaping area, but less than the premium requirements of a Streetscape Zone. The desired landscaping package will require less effort of installation and maintenance than the premium landscaping.
- Aesthetics is less important than in the Green Link Zone since this zone is not readily visible from main thoroughfares. The primary difference between Zones D and E are sod versus seed, and the increased density and variety of trees and plantings.
- This zone is generally comprised of areas along side and rear yards of facilities, visible only to the occupants or visitors of those buildings. The limits of Managed Zones are delineated on the Landscaping and Streetscape Zoning Map. The limits generally encompass the main cantonment area (bounded by O’Connell, Barkely, Chiles, Prussman) and not otherwise zoned as Streetscape Zone or a Green Infrastructure Zone.

3.4-E.3(C) Maintenance Requirements

Scheduled Grounds Maintenance and landscaping repair to include mowing, fertilizing, pruning, over-seeding and plant replacement.

3.4-E.3(D) Development

Permitted, per land use zoning

3.4-E.3(E) Landscaping Types

- TURF: Buffalo grass seed or other low-water usage seed per determination from a life cycle cost analysis and soil type analysis
- ROCK MULCH: 1-1/2” Colorado Red or Government approved rock.
- TREES: See acceptable plants list
- SHRUBS/BUSHES: See acceptable plants list
- FEATURES: Boulders, other decorative rock areas

3.4-E.3(F) Irrigation

Permanent Irrigation Zones are required. Spray Irrigation is required for all turfs and drip systems are required for all trees and shrubs. See Section __ for Performance standards and Irrigation System Standards.

3.4-E.3(G) Design Notes

- Place Tree Lawns on rock mulch along main thoroughfares

- Place 5' landscape rock band against curbs for roadways and parking lot edges for neat buffer line.
- Design sidewalk network, and landscaping layout to minimize pedestrian traffic on seeded areas.
- Utilize landscape rock for heavy pedestrian use areas that are not otherwise paved.

3.4-E.4 NATIVE ZONE

3.4-E.3(A) Purpose

Restore disturbed areas to match as existing and unmanaged Native High Plains Grassland and create hardy utility areas.

3.4-E.3(A) Strategy

Restore disturbed areas in the industrial and concentrated troop areas with hardy vegetation and site improvements that are sustainable in the native climate without maintenance and irrigation and will not require repair from excessive foot or unauthorized vehicular traffic. Aesthetics is least important in the industrial and troop areas. Importance is placed on a maintenance free and hardy site restoration package. The limits of Native Zones are delineated on the Landscaping and Streetscape Zoning Map. The limits generally areas outside of the main cantonment area (bounded by O'Connell, Barkely, Chiles, Prussman) and not otherwise zoned as Streetscape Zone or a Green Infrastructure Zone.

3.4-E.3(A) Maintenance Requirements

No maintenance requirements for ground or vegetation, with exception of noxious weed removal.

3.4-E.3(A) Development

Permitted, per land use zoning

3.4-E.3(A) Landscaping Types

- TURF: Restore site with native grass seed mix or other low-water usage seed per determination from a life cycle cost analysis and soil type analysis
- ROCK MULCH: 1-1/2" Colorado Red or Government approved rock.
- TREES: See acceptable plants list
- SHRUBS/BUSHES: None
- FEATURES: None

3.4-E.3(A) Irrigation

Temporary Watering for site stabilization. Permanent irrigation systems are not required for seeded areas, trees or plants.

3.4-E.3(A) Design Notes

- 5' landscape rock band against curbs for roadways and parking lot edges for neat buffer line.
- Utilize landscape rock or pavers for heavy pedestrian use areas.
- Design landscaping and edging to minimize pedestrian traffic on seeded areas.

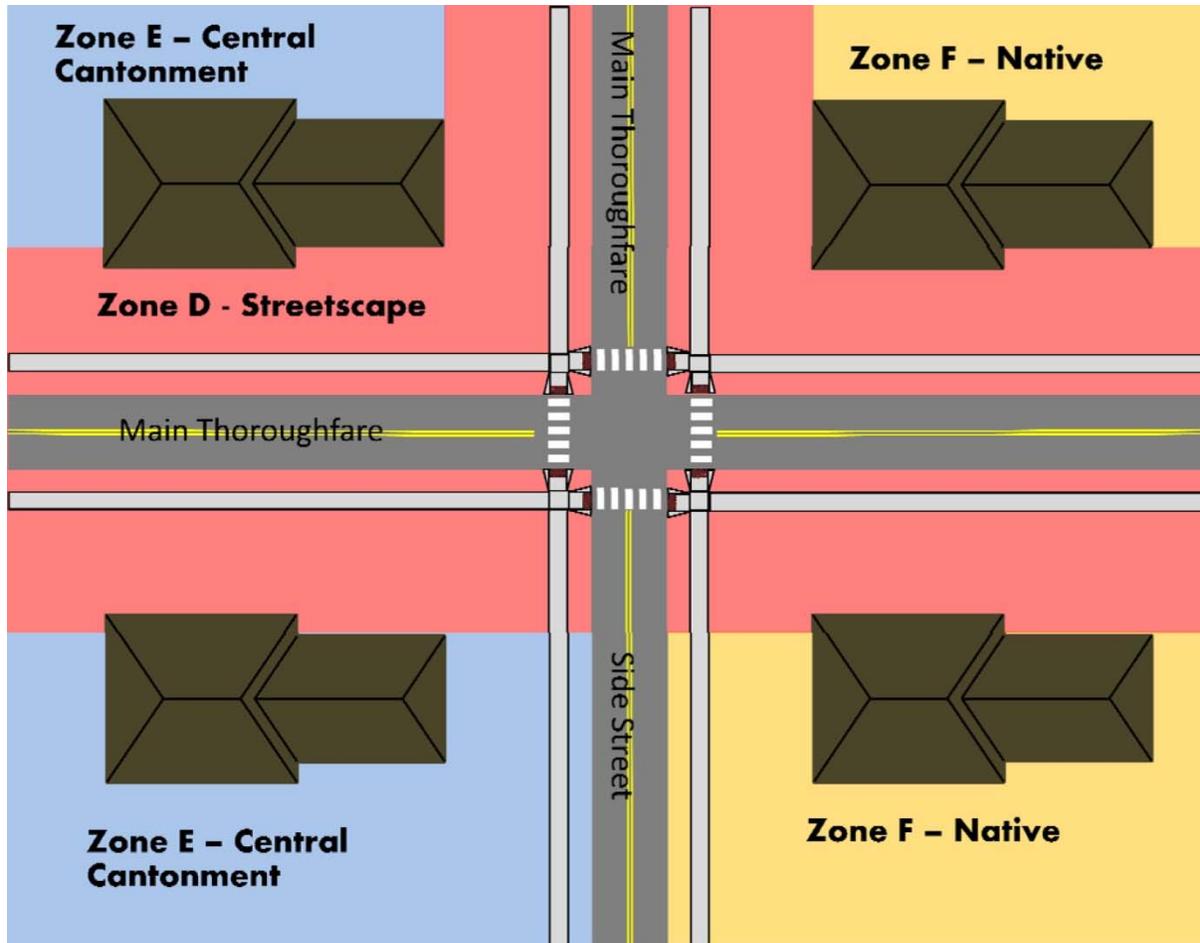


Figure 3.4-a Landscape Zones

SECTION 3
SITE



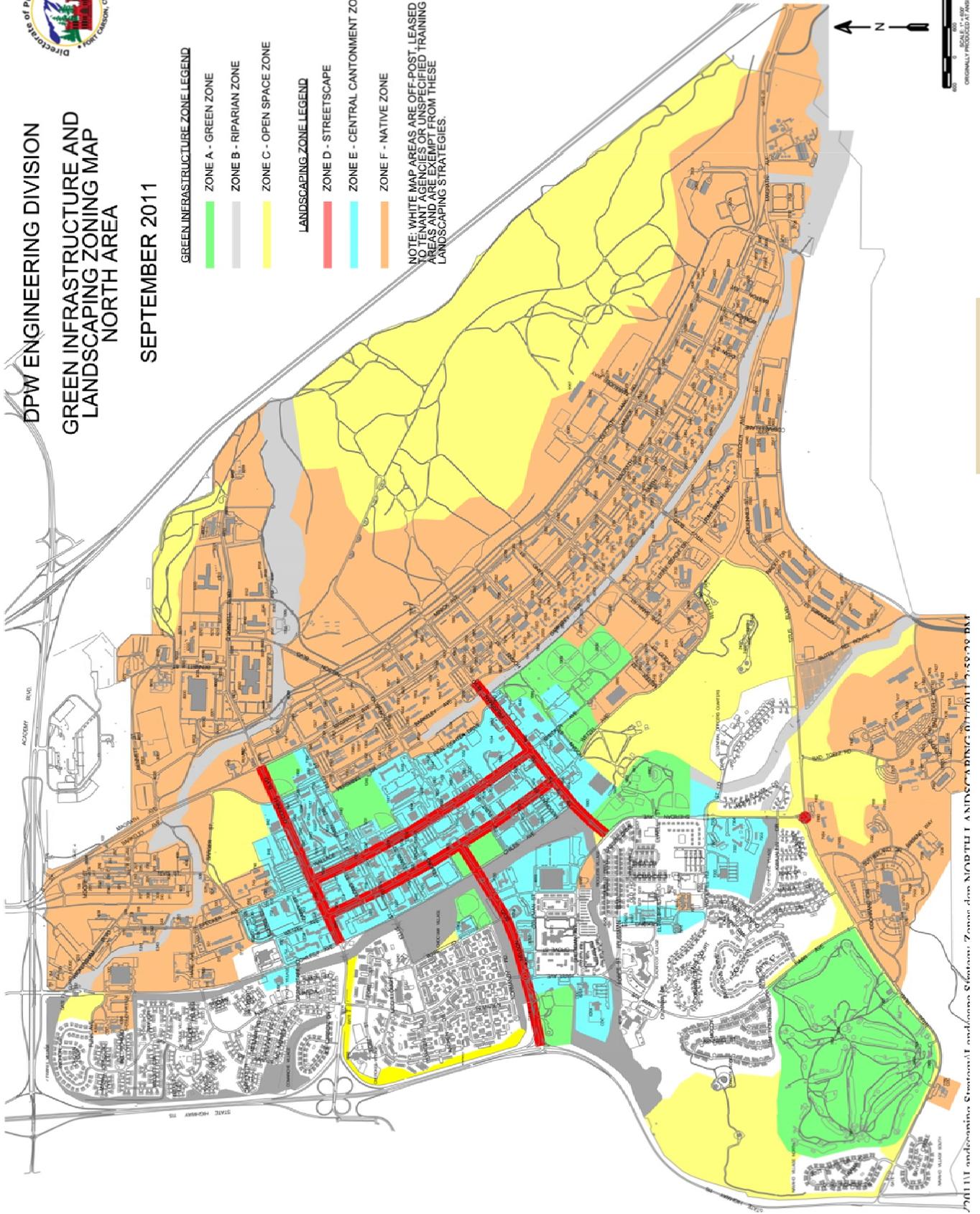
DPW ENGINEERING DIVISION
GREEN INFRASTRUCTURE AND
LANDSCAPING ZONING MAP
NORTH AREA

SEPTEMBER 2011

- GREEN INFRASTRUCTURE ZONE LEGEND**
- ZONE A - GREEN ZONE
 - ZONE B - RIPARIAN ZONE
 - ZONE C - OPEN SPACE ZONE

- LANDSCAPING ZONE LEGEND**
- ZONE D - STREETSCAPE
 - ZONE E - CENTRAL CANTONMENT ZONE
 - ZONE F - NATIVE ZONE

NOTE: WHITE MAP AREAS ARE OFF-POST, LEASED TO TENANT AGENCIES OR UNSPECIFIED TRAINING AREAS AND ARE EXEMPT FROM THESE LANDSCAPING STRATEGIES.



SECTION 3
SITE

Figure 3.4.b Green Infrastructure Plan North



DPW ENGINEERING DIVISION
GREEN INFRASTRUCTURE AND
LANDSCAPING ZONING MAP
NORTH AREA

SEPTEMBER 2011

GREEN INFRASTRUCTURE ZONE LEGEND

ZONE A - GREEN ZONE

ZONE B - RIPARIAN ZONE

ZONE C - OPEN SPACE ZONE

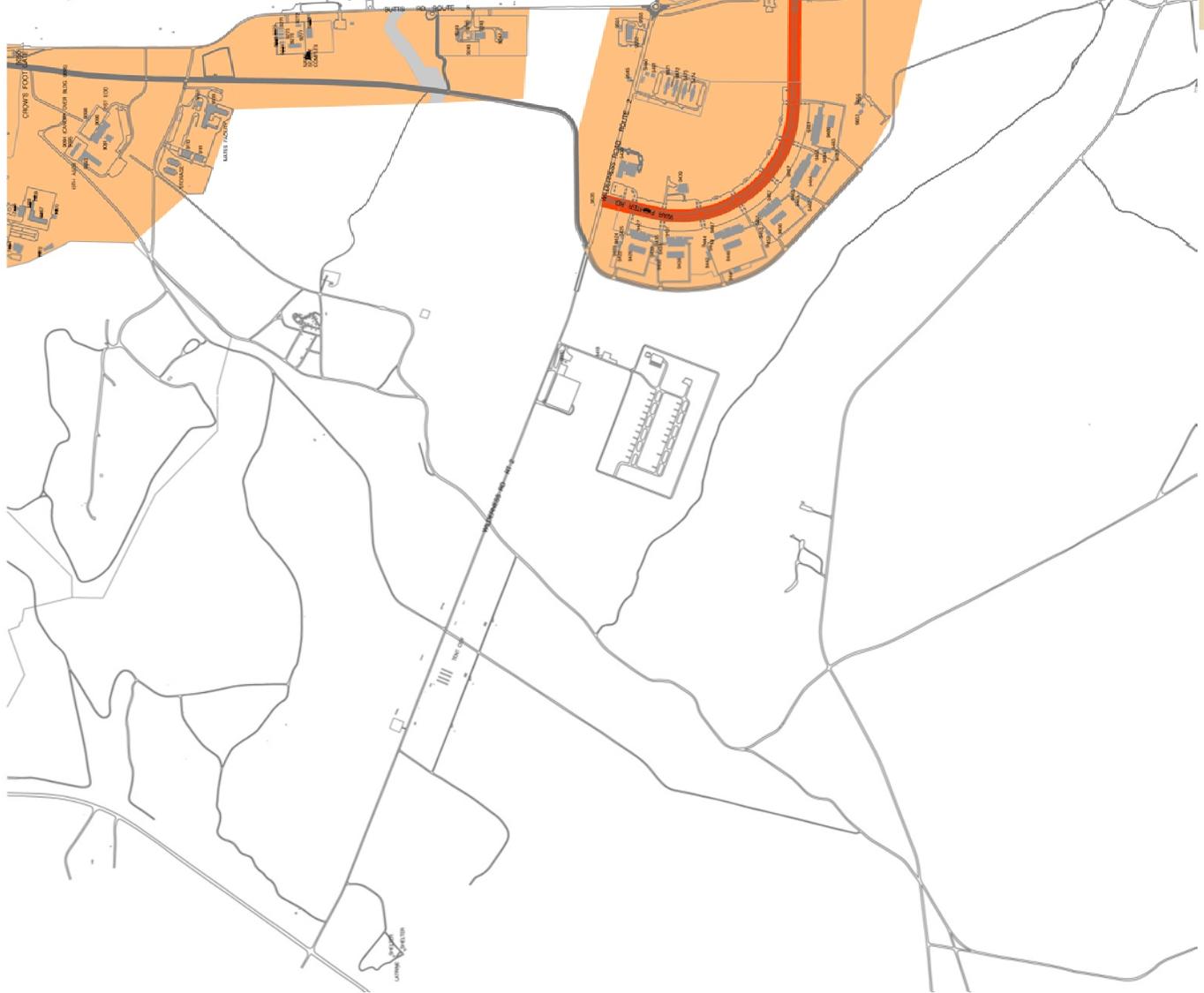
LANDSCAPING ZONE LEGEND

ZONE D - STREETSCAPE

ZONE E - CENTRAL CANTONMENT ZONE

ZONE F - NATIVE ZONE

NOTE: WHITE MAP AREAS ARE OFF-POST, LEASED
TO OTHER AGENCIES OR UNSPECIFIED TRAINING
AREAS AND ARE NOT COVERED BY THESE
LANDSCAPING STRATEGIES.



SECTION 3
SITE

Figure 3.4-c Green Infrastructure Plan South

1.1-A ACCEPTABLE PLANTS LIST

BOTANICAL NAME**COMMON NAME****LARGE DECIDUOUS TREES**

<i>Fraxinus pennsylvanica</i> 'Marshall Seedless'	<i>Celtis occidentalis</i>
<i>Fraxinus americana</i> 'Autumn Purple'	Hackberry
<i>Tilia americana</i> 'Redmond'	Redmond Linden
<i>Tilia americana</i> 'Littleleaf'	Littleleaf Linden
<i>Gleditsia triacanthos inermis</i> 'Shademaster'	Thornless Honeylocust or Sunburst
<i>Catalpa speciosa</i>	Western Catalpa
<i>Gymnocladus dioica</i>	Kentucky Coffee Tree
<i>Quercus macrocarpa</i>	Burr Oak

ORNAMENTAL DECIDUOUS TREES

<i>Malus hybrids</i>	Crabapples: Indian Magic, Spring Snow, Radiant, Dolgo
<i>Acer ginnala</i>	Amur Maple
<i>Acer grandidentatum</i>	Rocky Mtn. Glow Maple (Big Tooth Maple)
<i>Acer grandidentatum</i>	Wasatch maple
<i>Crataegus crusgalli</i>	Cockspur Hawthorne
<i>Crataegus phaenopyrum</i>	Washington Hawthorne
<i>Crataegus ambigua</i>	Russian Hawthorne
<i>Prunus virginiana</i> 'Shubert'	Canada Red Chokecherry
<i>Koelreuteria paniculata</i>	Golden Raintree
<i>Quercus gambelii</i>	Gambel Oak
<i>Pyrus calleryana</i>	Chanticleer Pear

EVERGREEN TREES

<i>Pinus ponderosa</i>	Ponderosa Pine
<i>Pinus edulis</i>	Pinyon Pine
<i>Pinus nigra</i>	Austrian Pine
<i>Pinus strobiformis</i>	Southwestern Pine
<i>Pinus flexilis</i>	Limber Pine
<i>Picea pungens glauca</i>	Colorado Blue Spruce
<i>Picea pungens</i>	Colorado Green Spruce
<i>Abies concolor</i>	White Fir
<i>Pinaceae pseudotsuga menziesii</i>	Douglas Fir

EVERGREEN SHRUBS

<i>Juniperus horizontalis</i>	'Blue Chip' Blue Chip Creeping Juniper
<i>Juniperus horizontalis</i>	'Bar Harbor' Bar Harbor Creeping Juniper
<i>Juniperus horizontalis</i>	'Wiltonii' Wiltoni Prostrate Juniper
<i>Juniperus sabina</i>	'Broadmoor' Broadmoor Juniper
<i>Juniperus chinensis</i>	Gold Coast
<i>Juniperus sabina</i>	'Tamariscifolia' Tammy Juniper
<i>Juniperus chinensis</i>	'Spartan' Spartan Pyramidal Chinese Juniper
<i>Juniperus scopulorum</i>	'Cologreen' Cologreen Rocky Mountain Juniper
<i>Juniperus monosperma</i>	One seed Juniper
<i>Cytisus purgans</i>	Spanish Gold Hardy Broom
<i>Ephedra equisetina</i>	Bluestem Joint Fir

BOTANICAL NAME

COMMON NAME

EVERGREEN SHRUBS (CONTINUED)

Cercocarpus montanus Mountain Mahogany

SMALL DECIDUOUS SHRUBS

Spiraea bumalda hybrids Anthony Waterer, Froebel, Daphne, Little Princess, Neon Flash
Holodiscus dumosus Rock Spirea
Potentilla fruticosa hybrids Dakota Sunrise, Prairie Snow, Jackmanii, McKay’s White, Mt. Everest Goldstart, Gold Drop
Philadelphus x Mockorange
Atriplex canescens Fourwing Saltbush
Amorpha canescens Leadplant
Prunus besseyi Western Sandcherry Pawnee Buttes
Chrysothamnus nauseosus Rabbitbrush Dwarf Blue

MEDIUM DECIDUOUS SHRUBS

Caryopteris sp x *clandonensis* Blue Mist Spirea, Dark Knight or Longwood Blue
Chamaebatiaria millifolium Fernbush
Viburnum trilobum ‘Compactum’ Compact European Cranberry Bush
Rhus trilobata Three-Leaf Sumac
Prunus besseyi Western Sand Cherry
Perovskia hybrids Russian Sage
Cotoneaster lucidus Hedge cotoneaster
Berberis sp. Barberry

LARGE DECIDUOUS SHRUBS

Forestiera neomexicana New Mexico Privet
Syringa vulgaris Common Lilac
Viburnum lantana Wayfaring Tree
Viburnum opulus European Cranberry Bush
Viburnum x *rhytidophylloides* ‘Alleghany’ Alleghany Viburnum
Viburnum trilobum American Cranberry Bush

ORNAMENTAL GRASSES, PERENNIALS, AND GROUND COVERS

Sporobolus wrightii Giant Sacaton Grass
Sorghastrum nutans Indiangrass
Schizachyrium scoparium Little Bluestem
Andropogon gerardii Big Bluestem
Festuca x ‘Elijah Blue’ Elijah Blue Fescue
Pennisetum alopecuroides ‘Hamelin’ Dwarf Fountain Grass ‘Hamelin’
Panicum virgatum Switchgrass
Hemerocallis sp ‘Stella D’Oro’ Stella D’Oro Daylily
Vinca minor Dwarf Periwinkle
Sedum spurium varieties Stonecrop
Calamagrostis x *acutifolia* ‘Karl Foerster’ Feather Reed Grass ‘Karl Foerster’
Pennisetum setaceum ‘Purple Fountain Grass’ Purple Fountain Grass

BIO-RETENTION AREA PLANTS

Salix amygdaloides Peach Leaf Willow

Populus angustifolia	Narrow Leaf Cottonwood
Populus deltoides ssp.monilitera	Plains Cottonwood
Salix fragilis	Crack Willow
Acer negundo	Boxelder
Betula occidentalis	Water Birch
Betula nana	Bog Birch
Physocarpus monogynus	Small Ninebark
Cornus sericea	Redosier Dogwood
Salix exigua	Coyote Willow
Prunus virginiana	Chokecherry
Ribes odoratum	Golden Currant
Sarcobatus vermiculatus	Greasewood
Rosa woodsii	Wood's Rose
Panicum virgatum	Switchgrass
Iris missouriensis	Rocky Mountain Iris
Carex bebbii	Bebb's Sedge
Elymus glaucus	Blue Wildrye
Elymus canadensis	Canada Wildrye
Andropogon gerardii	Big Bluestem
Agropyron trachycaulum	Slender Wheatgrass
Agropyron riparium	Streambank Wheatgrass
Agropyron smithii	Western Wheatgrass
Sporobolus airoides	Alkali Sacaton
Carex lanuginosa	Woolly Sedge
Asclepias incarnata	Marsh Milkweed
Helianthus nuttallii	Marsh Sunflower
Vicia americana	American Vetch
Carex nebrascensis	Nebraska Sedge
Eleocharis palustris	Creeping Spikerush
Sporobolus heterlepis	Prairie Dropseed
Schizachyrium scoparium	Little Bluestem
Distichlis stricta	Inland Saltgrass
Juncus torreyi	Torrey's Rush
Juncus balticus	Baltic Rush
Ribes montigenum	Gooseberry
Potentilla fruticosa	Bush Cinquefoil
Andropogon hallii	'Garden' Sand Bluestem
Bouteloua curtipendula	'Butte' Sideoats Grama
Calamovilfa longifolia	'Goshen' Prairie Sandreed
Oryzopsis hymenoides	Indian Ricegrass
Sporobolus cryptandrus	Sand Dropseed
Artemisia frigid	Pasture Sage
Aster laevis	Blue Aster
Gaillardia aristata	Blanket Flower
Ratibida columnifera	Prairie Coneflower
Dalea Petalostemum purpurea	Purple Prairieclover

Grass Seed Mixture "A" (Buffalo/Blue Grama Mixture)

Seed Type Variety lbs PLS/1,000 S.F.

Buffalograss Cody Primed w/ KNO3 2.5

Blue Grama Alma, Hachita 0.5

Total = 3.0 lbs/1,000 S.F.

Grass Seed Mixture “B” (Field Grass Mixture)

Seed Type Variety lbs PLS/Acre

Western Wheatgrass Arriba, Rosana 3.5
 Crested Wheatgrass Road Crest, Ephraim 2.6
 Streambank Wheatgrass Sodar 2.6
 Blue Grama Alma 3.5
 Sideoats Grama Pierre, El Reno, Vaughn 3.5
 Sheep Fescue Covar 1.3
 Total = 17.0 lbs PLS/Acre

Grass Seed Mixture “C” (Tall Fescue Grass Mixture)

Seed Type Variety lbs PLS / 1,000 S.F.

Turf Type Tall Fescue Blackwatch 2.0
 Turf Type Tall Fescue Avenger 2.0
 Turf Type Tall Fescue DaVinci 2.0
 Turf Type Tall Fescue inferno 2.0
 Perennial Ryegrass Monterey 3 0.5
 Kentucky Bluegrass Blue Chip 0.75
 Kentucky Bluegrass Everest 0.75
 Total = 10 lbs /1,000 S.F.

Grass Seed Mixture “D” (Bluegrass Mixture)

Seed Type Variety lbs PLS / 1,000 S.F.

Kentucky Bluegrass Nuglade 1.2
 Kentucky Bluegrass Liberty 1.2
 Kentucky Bluegrass Blue Chip 1.2
 Perennial Ryegrass APM 1.2
 Perennial Ryegrass SR-4200 1.2
 Total = 6.0 lbs /1,000 S.F.

Grass Seed Mixture “E” (Blue Grama Mixture)

Seed Type Variety lbs PLS / 1,000 S.F.

Blue Grama Alma, Hachita 3.0
 Total= 3.0 lbs /1,000 S.F.

CAB-Butts Airfield Mixture

Seed Type Variety lbs PLS / 1,000 S.F.

Slender Wheatgrass 4.0
 Pubescent Wheatgrass 2.50
 Hard Fescue 2.75
 Canada Bluegrass 1.25
 Sideoats Grama 4.0
 Blue Grama 1.25
 Sand Dropseed 0.40
 Western Wheatgrass 3.75
 Crested Wheatgrass 1.50
 Annual Ryegrass 1.25
 Appropriate annual grass (eg. cereal grain) for nurse crop 5.0
 Total = 27.65 lbs PLS/Acre

3.5 Furnishings

Currently, the only requirements are that site furnishings compliment the surroundings, both natural and man-made. They must also be of suitable material for heavy use and weather resistant.

3.6 Lighting

3.6-A Parking

Fort Carson highly encourages the use of solar powered exterior lighting whenever possible, the appropriate lighting levels can be achieved with this type of lighting.

3.6-B Walkways

Fort Carson highly encourages the use of solar powered exterior lighting whenever possible. Walkway lighting is currently being used at minimum levels to conserve energy use. This can be easily mitigated by the use of solar powered fixtures, and therefore this type of lighting is highly encouraged.

3.6-A Miscellaneous

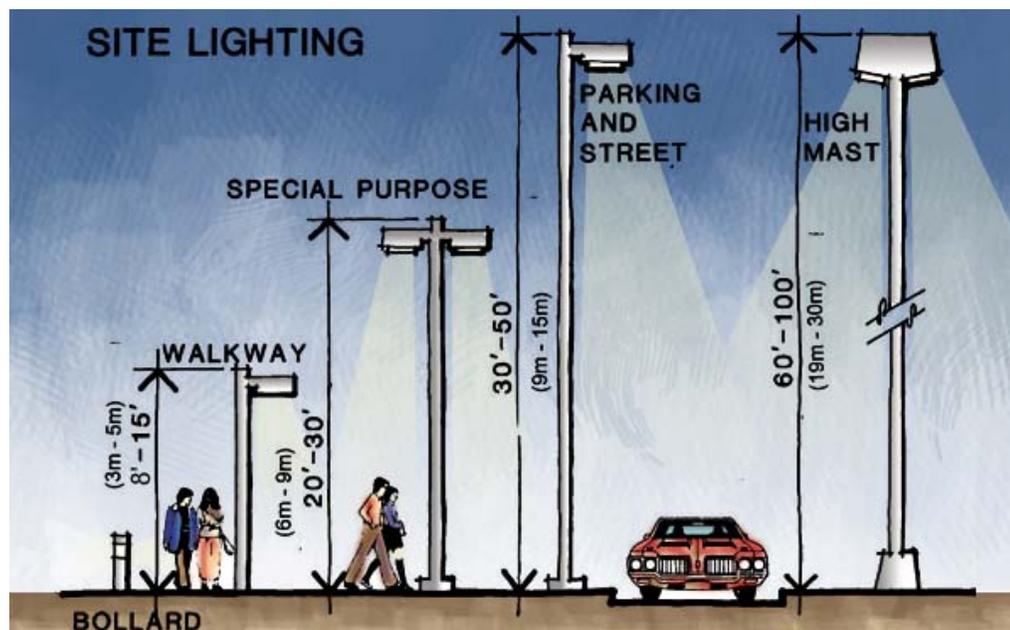


Figure 3.1-f Site Lighting Design Examples

3.7 Signs

All signage shall conform with the Installation Design Guide and Post Wide Paint Exterior Finish Standards and color charts. For building signage requirements, refer to Section 4. Traffic signage is covered by other standards and not contained within this publication. Also see **UFC 3-120-01 Design: Sign Standards**, with Change 2, October 2014.

3.7-A General

All signs will be manufactured from materials meeting or exceeding the EPA required minimum recycled content. Low quality and "homemade" signs are prohibited.

3.7-A.1 General Installation Signage

3.7-A.1(A) Color

All sign panels and posts will be brown (Federal Specification Color Number 20059) and all lettering will be white for installation identification and informational signage. All paint used on signs will be gloss.

3.7-A.1(B) Material

All panels will be made of double-face aluminum, .080" thick minimum.

3.7-A.1(C) Foundation

All sign foundations will be either concrete pier or direct burial.

3.7-A.1(D) Font

Signs will use either Helvetica medium or regular lettering. Helvetica medium should be used for major information on all signs. Helvetica regular has a slightly thinner stroke width, and should be used for secondary information on identification signs and on other miscellaneous signs. Helvetica medium should always be used when directional arrows are required in the sign message.



Figure 3.6-a Typical Identification Sign

3.7-A.1(E) Content

- Personal names are only authorized to be displayed on building identification signs for higher level military headquarters (battalion level and above). Requests for exceptions must be submitted first to DPW for subsequent review and approval by the Garrison

Commander. All authorized personal names will be placed on separate hanging signs below the primary facility sign. Intent is to easily replace the name as personnel are reassigned without having to re-make the facility sign.

- In all cases, no more than two names are authorized on an information/identification sign.
 - Senior ranking Officer of military unit, Battalion level and above.
 - Senior ranking NCO of military unit, Battalion level and above.

3.7-A.2 US Army Branding on Installation Signage

3.7-A.2(A) The Army logo is 9" tall by 7" wide.

3.7-A.2(B) BN HQs and above "may" place unit decals on their facility signs. The Unit will bear the cost of this modification.

3.7-A.2(C) Unit Logo Guidelines

- Decal will be no larger than 6" tall by 7" wide.
- Must be placed to the left of the Army Logo with 2" of clear spacing.
- Must be aligned with the bottom of the Army Logo.
- Must not overlap and sign lettering.



Figure 3.6-b Army Branding

3.7-A.3 Commercial Signs

3.7-A.3(A) Commercial symbols are allowed only on signs supporting commercial facilities. Contractor operated fast food establishments; AAFES facilities; private vendor banks and credit unions; and contractor operated car wash facilities are examples of such facilities. The post's bowling alley is an example of a non-commercial facility, since this is run by DFMWR.

3.7-A.3(B) Normally, DPW allows some flexibility on commercial signs, however appropriate size and lighting are major considerations when considering approval.

3.7-A.4 Animated Signs

Signs that are mechanically animated (i.e., revolve, rotate, or move in any way) are prohibited.

3.7-A.5 Special Signs Requests

The memorialization or naming of facilities is not allowed unless an approval request package is reviewed by DPW and approved by the Garrison Commander. Please contact Master Planning Division of DPW for further information.

3.7-B Parking Signs

The Garrison Commander is the final approving authority for reserved parking on Fort Carson.

3.7-B.1 Reserved Parking

3.7-B.1(A) Authorized Reserved Parking

All Authorized Reserve Parking will be the responsibility of DPW to identify and mark with applicable signs.

- Handicap
- Government vehicle parking
- Commander and Senior NCOIC at Company or Detachment level
- Motorcycle Parking
- Gold Star families
- Garrison Directors

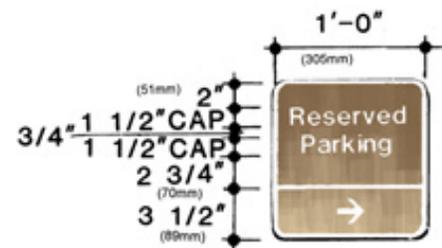


Figure 3.7-a
Reserved Parking Sign

3.7-B.1(B) Exceptions

Facility Managers may request reserved parking in addition to the authorized parking above based on unique and compelling needs for their mission. Proponents must submit an Exception To Policy Request (ETP), through DPW, to be approved by the Garrison Commander, using the Exception To Policy process defined in paragraph 3.7-E. DPW will install signage based on the approved exception.

3.7-B.1(C) Military HQs Parking Areas

Battalion or equivalent and higher military headquarters may control reserved parking within the parking lots immediately adjacent to their HQ buildings. Units are responsible to develop the reserved parking plan, fund and install curb markings, and enforce compliance. Signs are not permitted to identify reserved parking in these areas. Units are responsible to remove the curb markings when clearing the facility. These reserved parking areas must provide sufficient Handicapped parking as identified and installed by DPW.

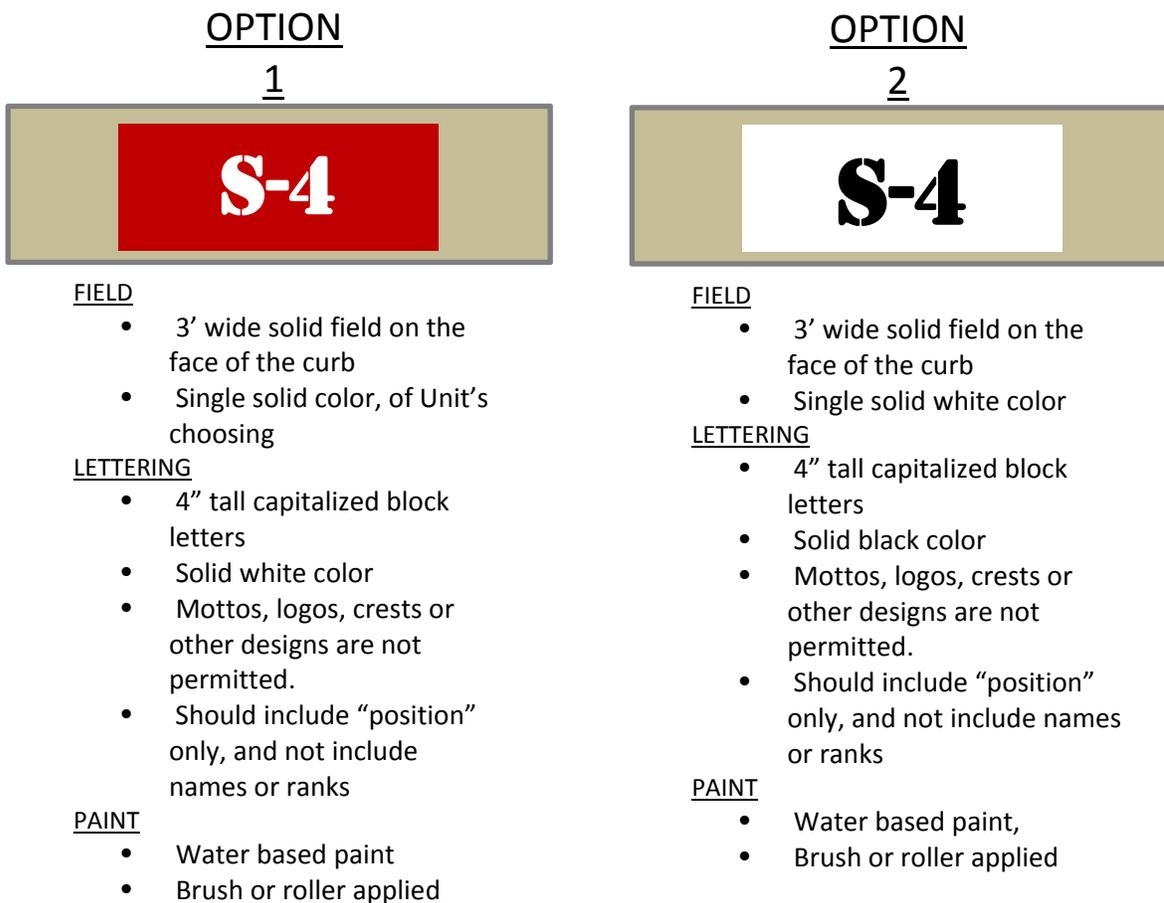


Figure 3.7-b Curb Marking Standards

3.7-B.1(D) Evans Army Community Hospital

MEDCOM may control reserved parking within the parking lots within the Hospital complex. MEDCOM is responsible to develop the reserved parking plan, fund and install signs and curb markings, and enforce compliance,

3.7-B.1(E) Restrictions

- Parking spaces may not be designated for "VIP" parking.
- Parking spaces may not be designated for Leadership in Energy and Environmental Design (LEED) credit points, such as Low Emission Vehicles, and Car-Pool parking

- Anything not covered by this reserved parking standard is considered an exception and will be approved by the Garrison Commander through the Exception To Policy as described in Paragraph 3.7-E.

3.7-C New Sign Requests

3.7-C.1 Public Works approval is required prior to installing, painting, revising, relocating, or expanding any sign. To request a new sign fill out a DA Form 4283 work request form and provide to the Customer Service Branch of the DPW. The Directorate of Public Works is the approving authority for all new signs. DPW will disapprove any request not consistent with this IDG. Proponents may request an Exception To Policy for any denied signs. Proponents must submit an Exception To Policy Request, through DPW, to be approved by the Garrison Commander, using the Exception To Policy process defined in paragraph 3.7-E.

3.7-C.2 No approval is required to perform normal maintenance and repair of a conforming sign or to change a message on a sign or marquee specifically designated for this purpose.

3.7-D Sign Change Requests

Requests to change existing signage can be done through the DPW Service Order Desk by calling 719-526-5345. DPW will disapprove any request not consistent with this IDG. Proponents may request an Exception To Policy for any denied changes. Proponents must submit an Exception To Policy Request, through DPW, to be approved by the Garrison Commander, using the Exception To Policy process defined in paragraph 3.7-E.

3.7-E Exceptions To Policy

Signage on Fort Carson (reserved parking, facility, commercial, special purpose) is governed by this Installation Design Guide (IDG). The strategy for signage is to minimize signs to the bare minimum for safety (traffic), legal requirements (Handicapped Parking) and facility identification. This intent of this strategy is to minimize costs associated with initial installation and the enduring costs for repair/replacement and updating with current information. It also minimizes sign clutter which detracts for the post's general appearance, and also creates "sign fatigue" by having too many signs that become irrelevant or overlooked. The IDG specifies authorized signs for parking and facility identification, and their standard appearance and wording. However, DPW understands that some units or agencies may have compelling and unique missions that may require signage exceeding the authorized standards. This ETP is a way to request authority for those cases.

3.7-F Exceptions To Policy Process

3.7-F.1 Requestor submits a new sign request via the Work Request (DA Form 4283) process or a sign modification through the Service Order Process.

3.7-F.2 Signs that do not comply with the IDG will be disapproved through staffing. The requestor will be notified.

3.7-F.3 Requestor submits an Exception to Policy Request Memo to DPW Operations and Maintenance Division Sign Coordinator.

3.7-F.4 The request shall:

- Contain a memorandum requesting the ETP signed by O-5 commander or GS-14 Director. The memorandum shall contain a compelling and unique justification for the sign as it pertains to the unit/organization mission.
- Contain specific information about the requested sign: detailed depiction of sign with colors, wording, size, etc. Include a drawing of the sign.
- Contain a site map of the proposed location and orientation.
- Contain copies of disapproved work request or service order if available.

3.7-F.5 DPW O&M Sign Coordinator will prepare ETP packet including the requestor's memo and documentation, DPW's recommendation and routing forms through DPW Director, Garrison Commander (GC).

3.7-F.6 DPW will route and track the ETP through approval/disapproval by GC. DPW will forward the ETP packet to the requestor, notifying the requestor of the GC's determination and the next steps if any.

IDG**SECTION 4****Buildings**

4.1 Architectural

Directorate of Public Works, Master Planning Division, manages the visual themes and colors for all facilities on Fort Carson and Pinion Canyon Maneuver Site. While a specific level of continuity and visual appearance is desired amongst the facilities on post, the intent is to allow for design professionals to use their talents and abilities, for which they have been hired, to exercise creative flexibility without deviating too far from commonly accepted architectural features and colors.

Architects and designers are encouraged to include narrative and direction when proposing a visual theme and/or appearance that would deviate from the norm. This will allow for DPW to more accurately review and approve or disapprove of colors and materials that deviate.

4.1-A Visual Themes

Fort Carson is comprised of six different visual themes that apply to facilities. These are classified as:

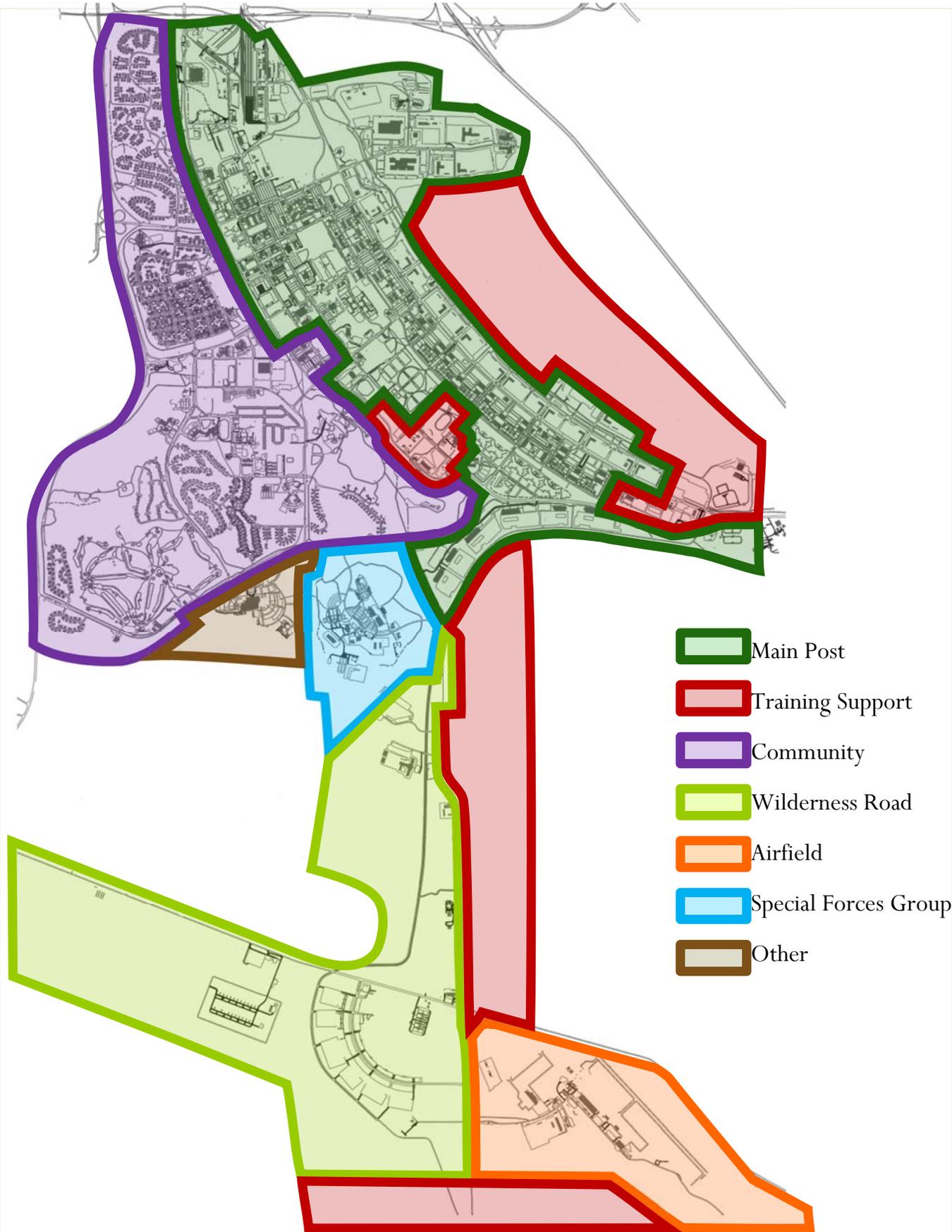
- Main Post
- Training Support
- Community
- Wilderness Road
- Airfield
- Special Forces Group
- Hospital

The following page shows a map of the boundaries typically identified with each visual theme. These boundaries are only meant as a guide and are not inflexible. As the Fort Carson Master Plan changes and is updated, these boundaries may shrink or grow as needed.

NOTE: These boundaries are not intended to accurately reflect the existing visual theme of the installation! This map depicts the intent of the visual theme for new buildings, or buildings that are remodeled in the future! Many facilities within each visual theme currently have different colors than those defined within this section. These color variations are to be phased out over time as these facilities are remodeled or demolished. This may cause some visual differences in these areas, but is necessary to achieve the preferred end state.

SPECIAL INSTRUCTIONS TO DESIGNERS/CONTRACTORS:

The intent within each visual theme is not to have all facilities look exactly alike. Rather, the intent is to have common architectural elements and colors within each area. Designers are encouraged to explore different designs with variations between adjacent facilities, while maintaining this common visual theme.



SECTION 4
BUILDINGS

Figure 4.1-a Fort Carson Visual Theme Boundaries

4.1-B Visual Theme boundaries

In most cases, boundaries between visual themes follow defined roadways. In some cases, boundaries are defined by existing land features such as hills, drainage streams, or unimproved vehicle or pedestrian paths.

4.1-B.1 Main Post

The Northern boundary is defined by the north end of the installation. The Southern boundary is defined by the tank trail. The Eastern boundary runs along Chiles Avenue from the north. The boundary then runs East along Flint Avenue, then proceeds south along Specker Avenue.

4.1-B.2 Training Support

These boundaries include any range area, including undeveloped areas East of Magrath Avenue, East of Butts Road, and south of Butts Army Airfield. There is also a specific area between Community and Main Post areas. These boundaries are not specific, and are dictated by facility use (ie. bldgs. 2020, 2130, 2135, and 2400 area).

4.1-B.3 Community

These areas include all of the family housing areas West of Chiles Avenue and Iron Horse Park. The southern boundary runs along Titus Boulevard until West of the Hospital area, then includes all areas West.

4.1-B.4 Wilderness Road

The Northern boundary is the 10th SFG area. It then includes areas West of Butts Road until reaching the range areas on the Southern end.

4.1-B.5 Airfield

These boundaries are East of Butts Road and South of Wilderness Road, ending with the range areas on the South

4.1-B.6 Special Forces Group

These areas are more specifically defined in the Fort Carson Master Plan, and mainly include all facilities specifically built under direction from US Army Special Forces Command.

4.1-B.7 Hospital

These boundaries are not specific, and encompass any facility associated with, and adjacent to, Evans Army Community Hospital. Other facilities on the installation that are occupied by medical personnel are not included in the Hospital visual theme, and are governed by the visual theme of the area they are located.

4.1-C VISUAL THEME CATEGORIES

4.1-C.1 Main Post

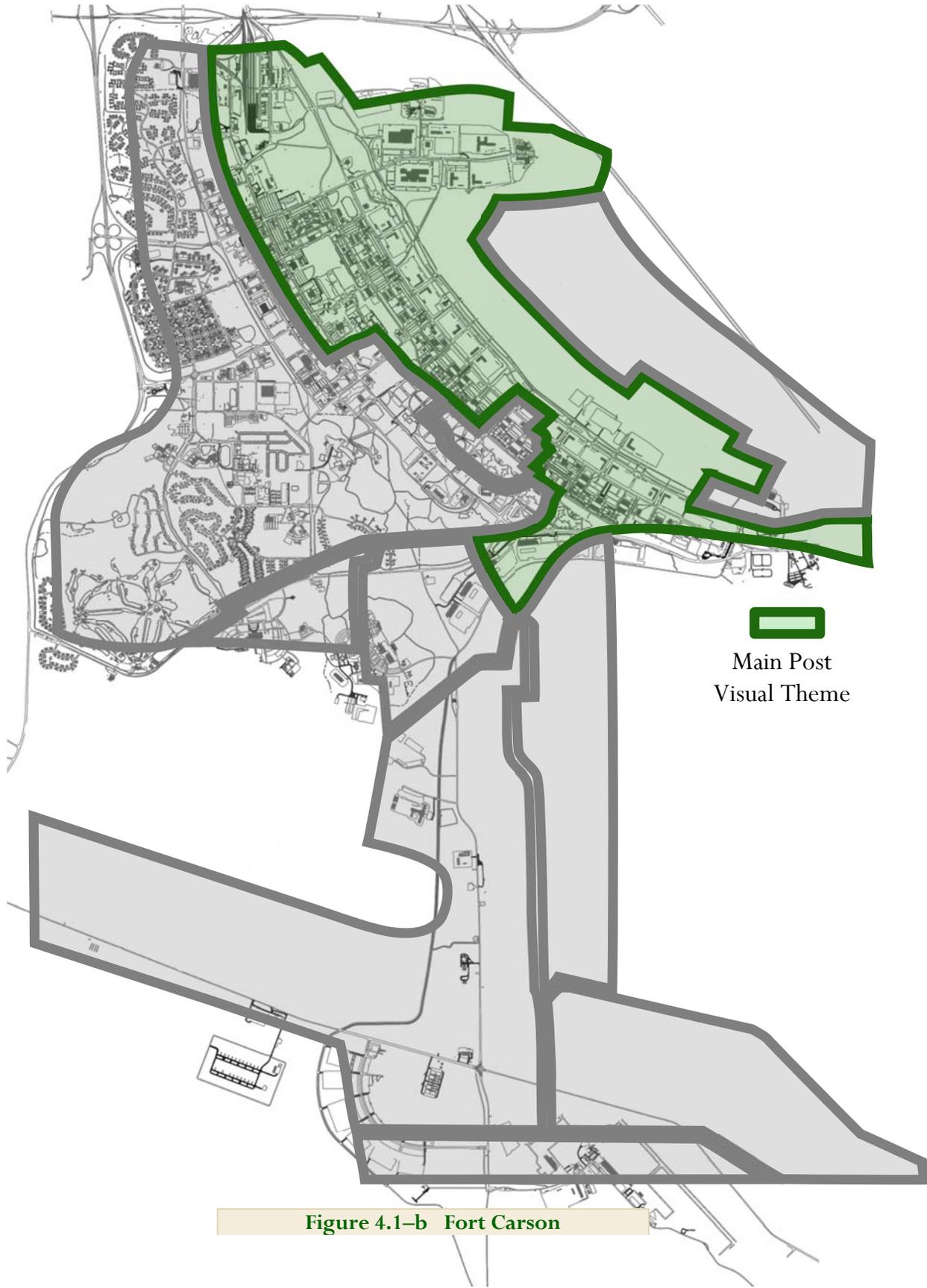


Figure 4.1-b Fort Carson

SECTION 4
BUILDINGS

4.1-C.1(A) Main Post Exterior Materials and colors

CATEGORY	DESIGN ELEMENT	PREFERRED MATERIAL*	ACCEPTABLE COLOR (MANUFACTURER)†
Roof	Sloped	Standing Seam Metal	American Buildings® Hemlock Green Berridge Manufacturing Company® Hemlock Green Ceco Building Systems® Spruce
	Flat	-	Light colored reflective membrane
Walls	Base	Split-Face or Course CMU	Best Block® Western Beige Robinson Block® Antique White
	Primary	Smooth Face Brick or Veneer	Robinson Block® Schoolhouse
	Secondary	Smooth Face Brick or Veneer	By Designer
Fenestration	Doors	Aluminum, Steel	To Match Medium or Dark Bronze, or Roof Color
	Door Frames	Aluminum, Steel	Medium or Dark Bronze
	Window	Glass	Clear or Smoke Tinted
	Window Frames	Aluminum, Steel	Medium or Dark Bronze
	Window Base and Header	Precast Concrete	Light Color to match Base, or color accent.
Other Items	Facia	Metal	To match roof color
	Soffit	Metal	To match roof color
	Gutter, Downspout	Metal	To match roof color
	Grills and Louvers	-	Match adjacent material color. When framed by design element, color determined by design.
	Roof Elements	-	To match roof color
	Site Elements	-	To match main building colors and materials

* Exterior building materials are not limited to a specific material. Any material listed above reflects Fort Carson’s preferred material to maintain a consistent visual appearance. Contractors bidding on contracts that require compliance with the Installation Design Guide will receive a more favorable rating when proposing use of preferred materials.

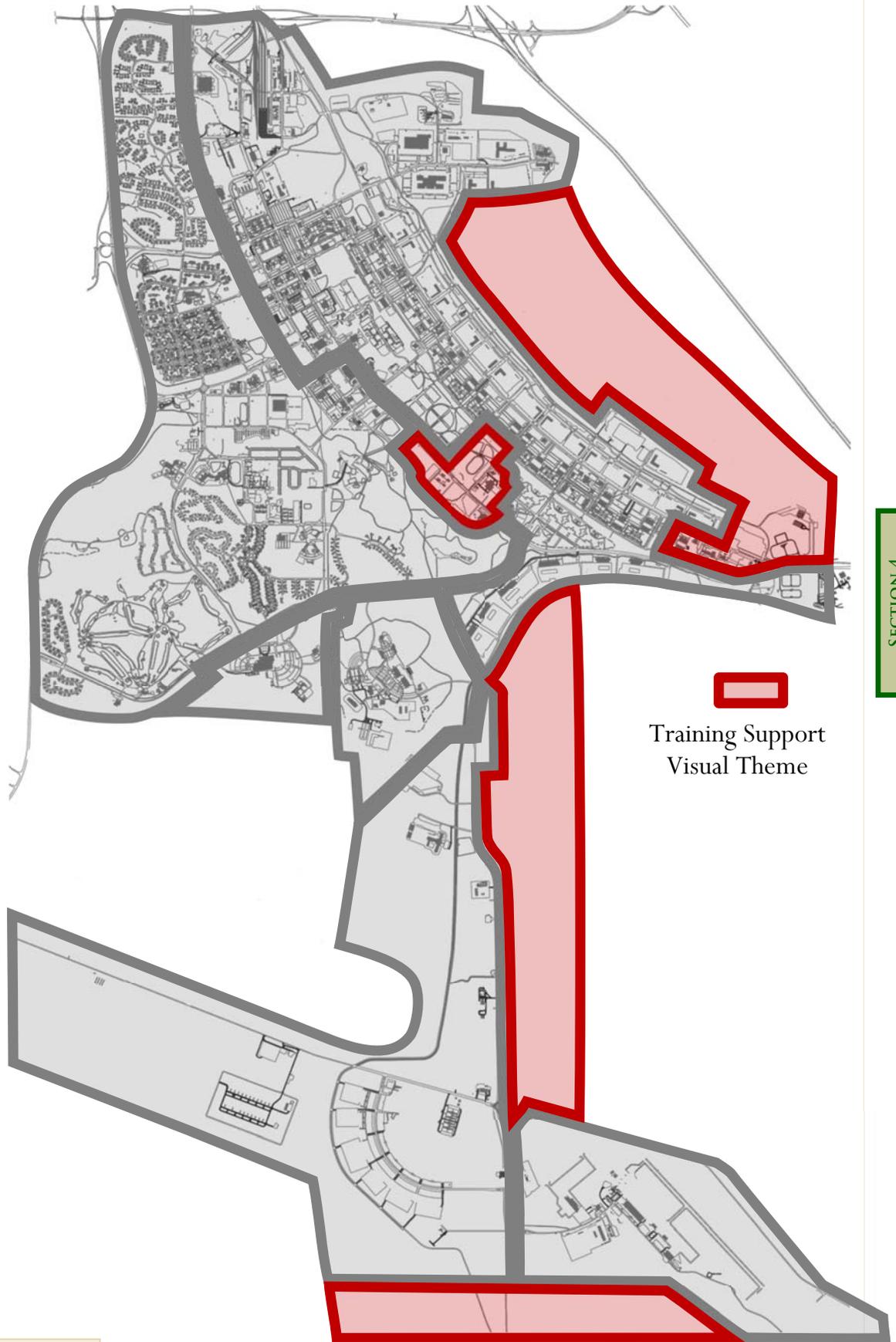
† Acceptable color and manufacturer does not imply any endorsement or preference by Fort Carson or the US Government. Manufacturer color and names are meant solely for reference in complying with the visual themes.

4.1-C.1(B) Example Images



SECTION 4
BUILDINGS

4.1-C.2 Training Support



SECTION 4
BUILDINGS

Figure 4.1-c Fort

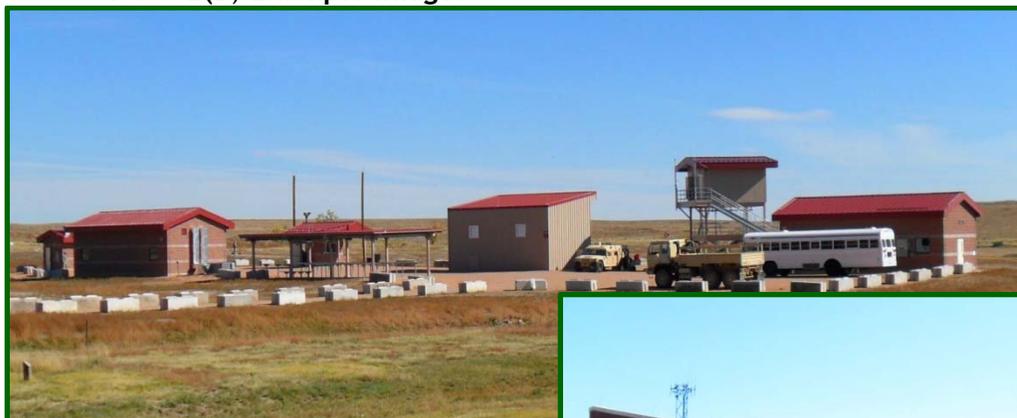
4.1-C.2(A) Training Support Exterior Materials and colors

CATEGORY	DESIGN ELEMENT	PREFERRED MATERIAL*	ACCEPTABLE COLOR (MANUFACTURER)†
Roof ¹	Sloped	Standing Seam Metal	American Buildings® Colonial Red Berridge Manufacturing Company® Colonial Red
	Flat	-	Light colored reflective membrane
Walls	Base	Split-Face or Course CMU	Best Block® Western Beige Robinson Block® Antique White
	Primary	Smooth Face Brick or Veneer	By Designer
	Secondary	Smooth Face Brick or Veneer	By Designer
Fenestration	Doors	Aluminum, Steel	Similar to Roof Color or other Light Color
	Door Frames	Aluminum, Steel	Same as Door
	Window	Glass	Clear or Smoke Tinted
	Window Frames	Aluminum, Steel	Clear / Aluminum
	Window Base and Header	Precast Concrete	By Designer
Other Items	Facia	Metal	To match roof color
	Soffit	Metal	To match roof color
	Gutter, Downspout	Metal	To match roof color
	Grills and Louvers	-	Match adjacent material color. When framed by design element, color determined by design.
	Roof Elements	-	To match roof color
	Site Elements	-	To match main building colors and materials

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4.1-C.2(B) Example Images



SECTION 4
BUILDINGS

4.1-C.3 Community

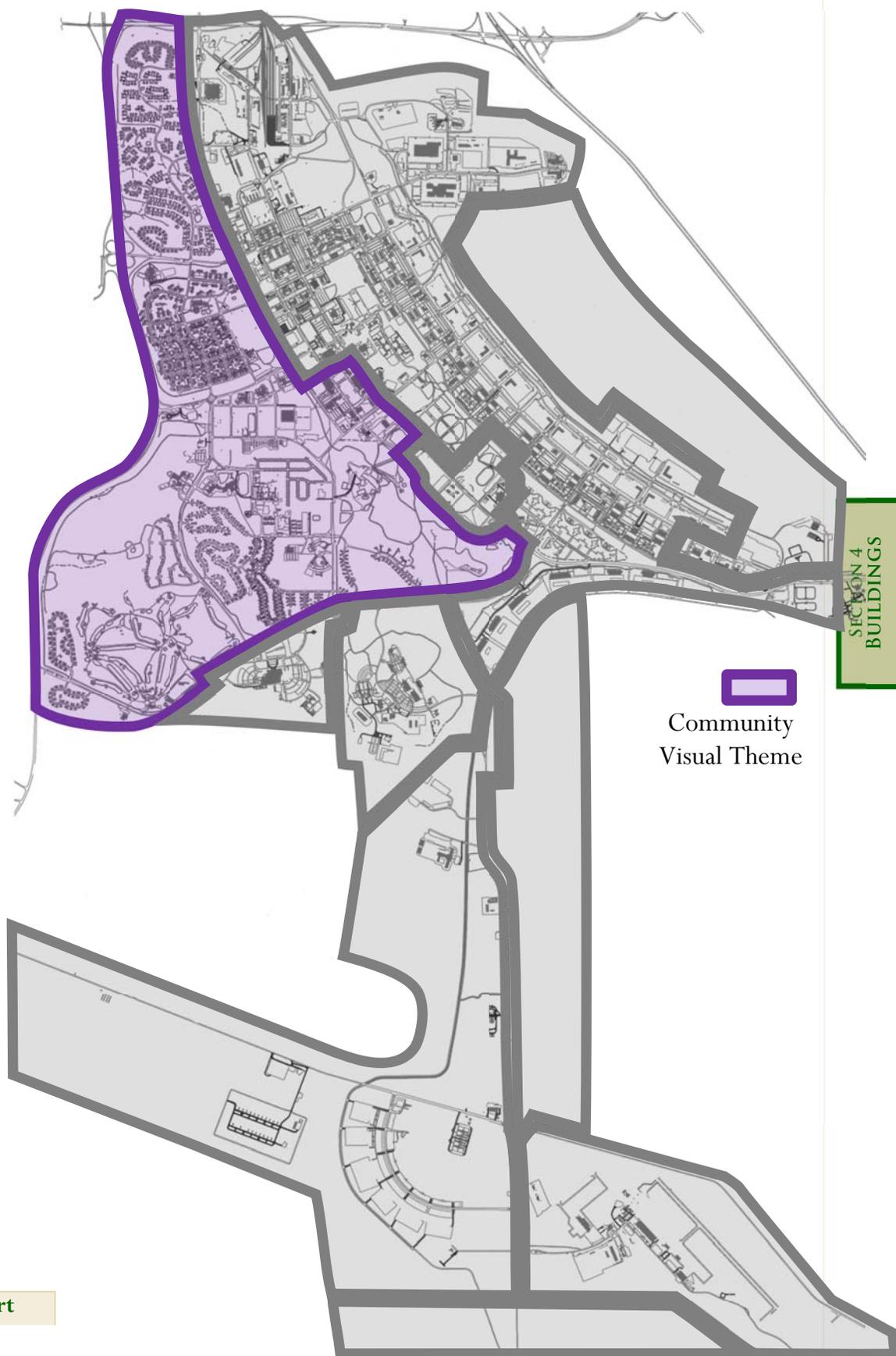


Figure 4.1-d Fort

4.1-C.3(A) Community Exterior Materials and colors

CATEGORY	DESIGN ELEMENT	PREFERRED MATERIAL*	ACCEPTABLE COLOR (MANUFACTURER)†
Roof	Sloped	Standing Seam Metal	American Buildings® Evergreen Berridge Manufacturing Company® Forest Green Ceco Building Systems® Spruce
	Flat	-	Light colored reflective membrane
Walls	Base	Split-Face or Course CMU	Best Block® Western Beige Robinson Block® Antique White
	Primary	Smooth Face Brick or Veneer	Robinson Block® Schoolhouse
	Secondary	Smooth Face Brick or Veneer	By Designer
Fenestration	Doors	Aluminum, Steel	To Match Medium or Dark Bronze, or Roof Color
	Door Frames	Aluminum, Steel	Medium or Dark Bronze
	Window	Glass	Clear or Smoke Tinted
	Window Frames	Aluminum, Steel	Medium or Dark Bronze or Match Roof Color
	Window Base and Header	Precast Concrete	Light Color to match Base, or color accent.
Other Items	Facia	Metal	To match roof color
	Soffit	Metal	To match roof color
	Gutter, Downspout	Metal	To match roof color
	Grills and Louvers	-	Match adjacent material color. When framed by design element, color determined by design.
	Roof Elements	-	To match roof color
	Site Elements	-	To match main building colors and materials

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4.1-C.3(B) Example Images



SECTION 4
BUILDINGS

4.1-C.4 Wilderness Road



Figure 4.1-e Fort Carson

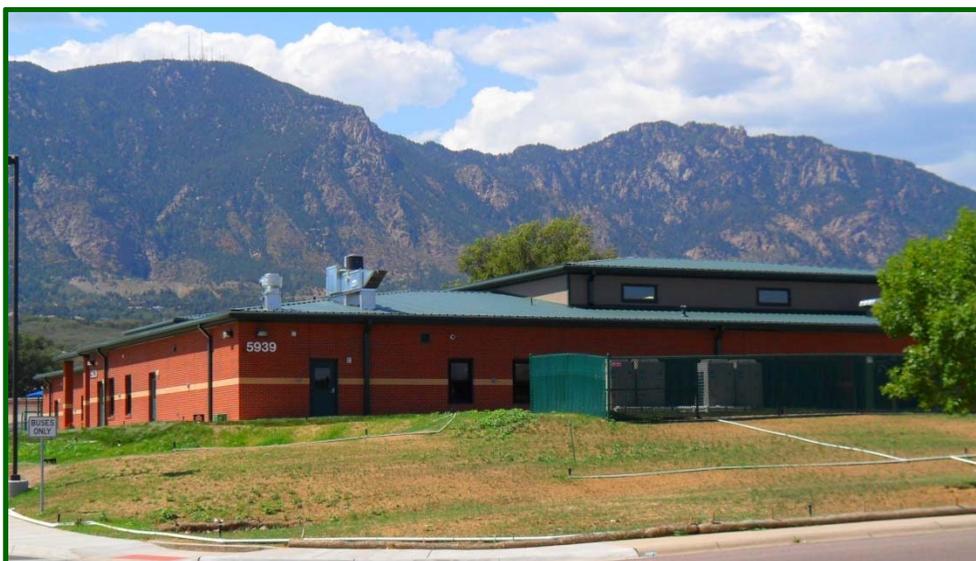
4.1-C.4(A) Wilderness Road Exterior Materials and colors

CATEGORY	DESIGN ELEMENT	PREFERRED MATERIAL*	ACCEPTABLE COLOR (MANUFACTURER)†
Roof	Sloped	Standing Seam Metal	American Buildings® Hemlock Green Berridge Manufacturing Company® Hemlock Green Ceco Building Systems® Spruce
	Flat	-	Light colored reflective membrane
Walls	Base	Split-Face or Course CMU	Best Block® Western Beige Robinson Block® Antique White
	Primary	Smooth Face Brick or Veneer	TBD
	Secondary	Smooth Face Brick or Veneer	TBD
Fenestration	Doors	Aluminum, Steel	To Match Medium or Dark Bronze, or Roof Color
	Door Frames	Aluminum, Steel	Medium or Dark Bronze
	Window	Glass	Clear or Smoke Tinted
	Window Frames	Aluminum, Steel	Medium or Dark Bronze
	Window Base and Header	Precast Concrete	Light Color to match Base, or color accent.
Other Items	Facia	Metal	To match roof color
	Soffit	Metal	To match roof color
	Gutter, Downspout	Metal	To match roof color
	Grills and Louvers	-	Match adjacent material color. When framed by design element, color determined by design.
	Roof Elements	-	To match roof color
	Site Elements	-	To match main building colors and materials

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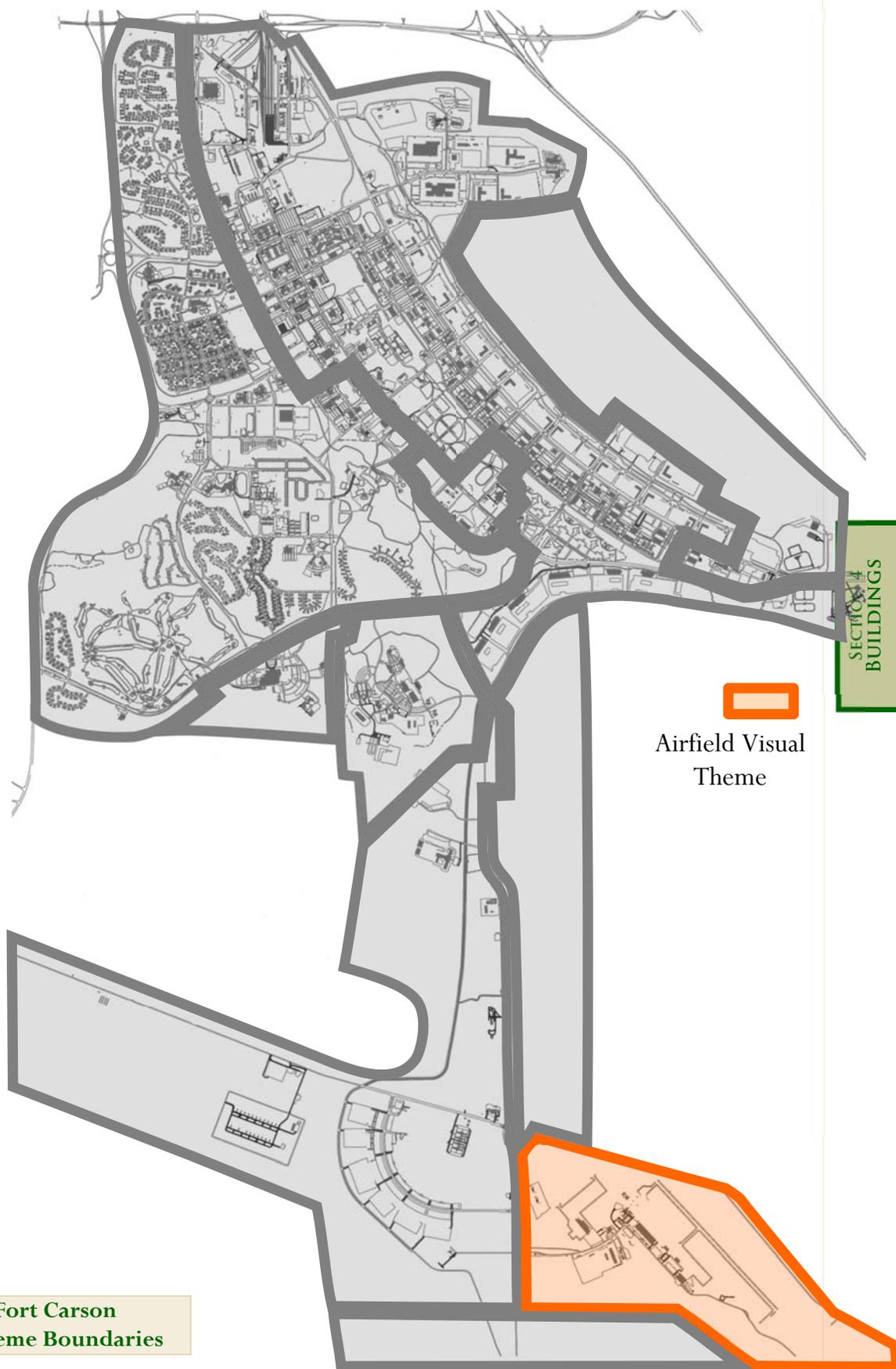
† Acceptable color and manufacturer does not imply any endorsement or preference by Fort Carson or the US Government. Manufacturer color and names are meant solely for reference in complying with the visual themes.

4.1-C.4(B) Example Image



SECTION 4
BUILDINGS

4.1-C.5 Airfield



**Figure 4.1-f Fort Carson
Airfield Visual Theme Boundaries**

4.1-C.5(A) AIRFIELD EXTERIOR MATERIALS AND COLORS

CATEGORY	DESIGN ELEMENT	PREFERRED MATERIAL*	ACCEPTABLE COLOR (MANUFACTURER)†
Roof	Sloped	Standing Seam Metal	Berridge Manufacturing Company® Copper-Cote™ Ceco Building Systems® Spruce
	Flat	-	Light colored reflective membrane
Walls	Base	Split-Face or Course CMU	Best Block® Western Beige
	Primary	Ledgestone Drystack	Owens Corning Cultured Stone® Chardonnay
	Secondary	Smooth Face Brick or Veneer	Best Block® Western Beige Robinson Block® Antique White
Fenestration	Doors	Aluminum, Steel	To Match Medium or Dark Bronze, or Roof Color
	Door Frames	Aluminum, Steel	Medium or Dark Bronze
	Window	Glass	Clear or Smoke Tinted
	Window Frames	Aluminum, Steel	Medium or Dark Bronze
	Window Base and Header	Precast Concrete	Light Color to match Base, or color accent.
Other Items	Facia	Metal	To match roof color
	Soffit	Metal	To match roof color
	Gutter, Downspout	Metal	To match roof color
	Grills and Louvers	-	Match adjacent material color. When framed by design element, color determined by design.
	Roof Elements	-	To match roof color
	Site Elements	-	To match main building colors and materials

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4.1-C.5(B) EXAMPLE IMAGE



SECTION 4
BUILDINGS

4.1-C.6 Special Forces Group

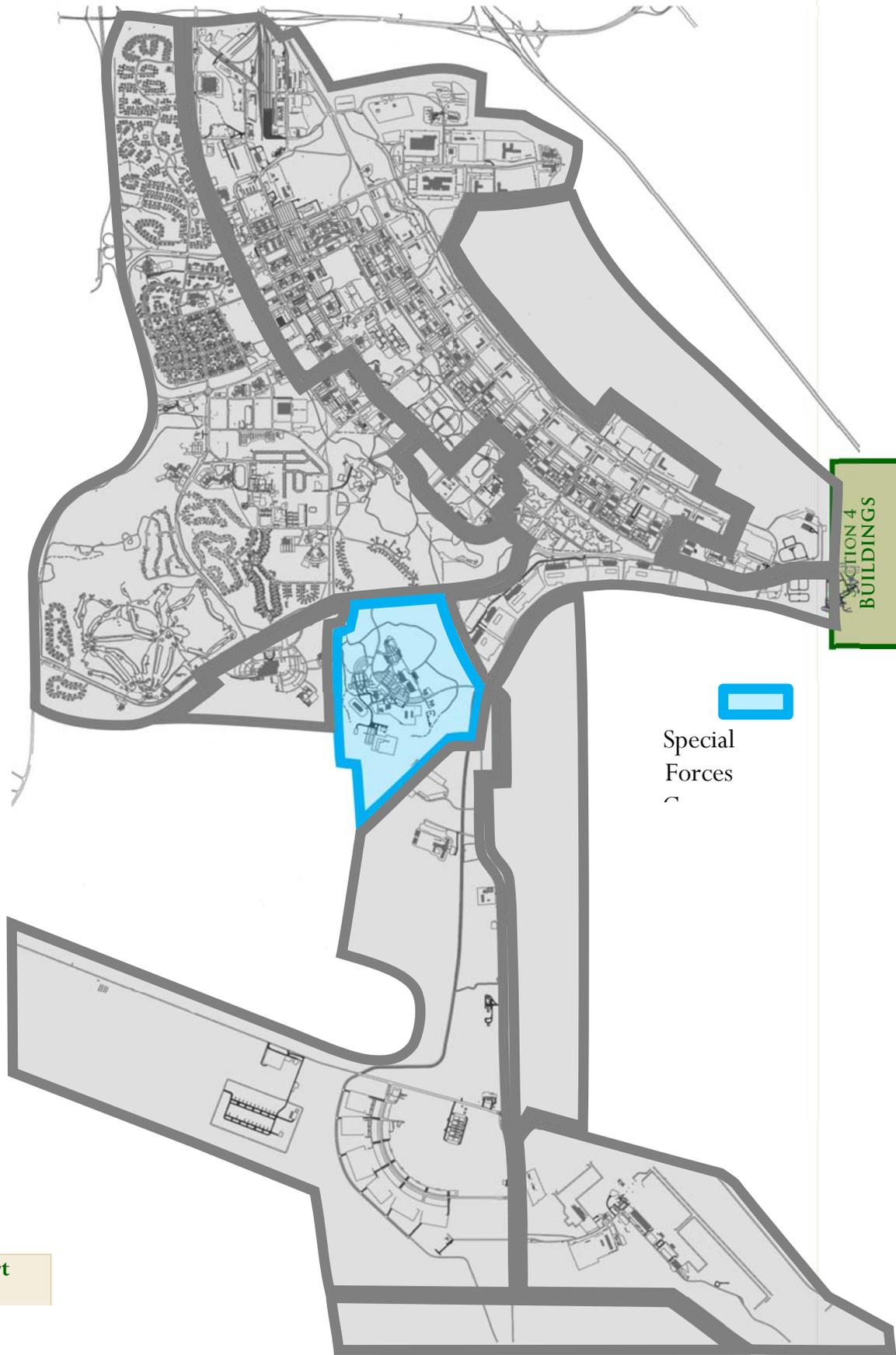


Figure 4.1-g Fort Carson

4.1-C.6(A) Special Forces Group Exterior Materials and colors

CATEGORY	DESIGN ELEMENT	PREFERRED MATERIAL*	ACCEPTABLE COLOR (MANUFACTURER)†
Roof	Sloped	Standing Seam Metal	Centria® #974 Teal Blue Berridge Manufacturing Company® Teal Green
	Flat	-	Light colored reflective membrane
Walls	Base	Split-Face or Course CMU	Best Block® Western Beige Robinson Block® Antique White
	Primary	Smooth Face Brick or Veneer	TBD
	Secondary	Smooth Face Brick or Veneer	TBD
Fenestration	Doors	Aluminum, Steel	To Match Medium or Dark Bronze, or Roof Color
	Door Frames	Aluminum, Steel	Medium or Dark Bronze
	Window	Glass	Clear or Smoke Tinted
	Window Frames	Aluminum, Steel	Medium or Dark Bronze
	Window Base and Header	Precast Concrete	Light Color to match Base, or color accent.
Other Items	Facia	Metal	To match roof color
	Soffit	Metal	To match roof color
	Gutter, Downspout	Metal	To match roof color
	Grills and Louvers	-	Match adjacent material color. When framed by design element, color determined by design.
	Roof Elements	-	To match roof color
	Site Elements	-	To match main building colors and materials

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4.1-C.6(B) Example Image

SECTION 4
BUILDINGS

4.1-C.7 HOSPITAL

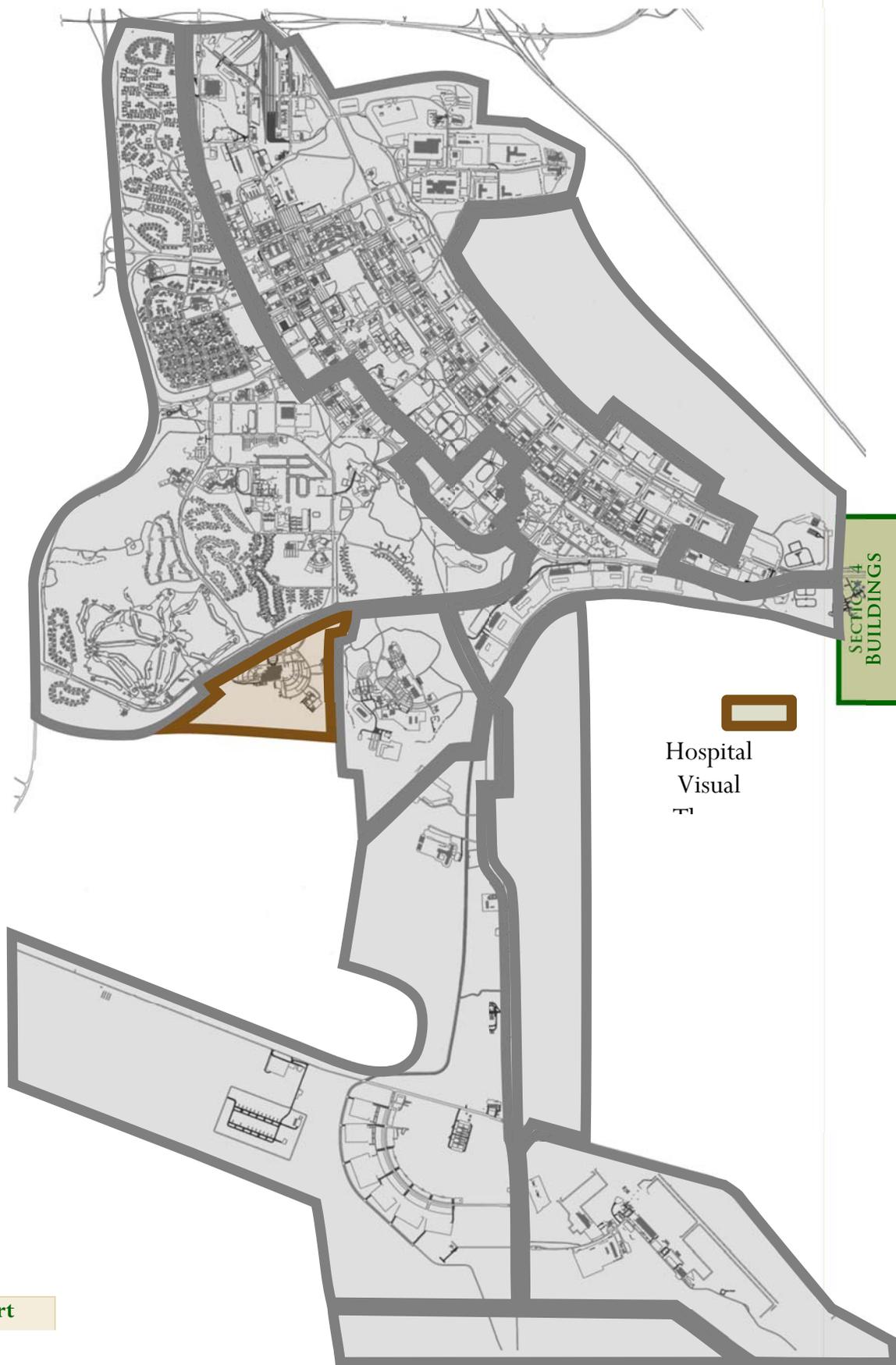


Figure 4.1-h Fort

4.1-C.7(A) Hospital Exterior Materials and colors

CATEGORY	DESIGN ELEMENT	PREFERRED MATERIAL*	ACCEPTABLE COLOR (MANUFACTURER)†
Roof	Sloped	Standing Seam Metal	By Designer
	Flat	-	Light colored reflective membrane
Walls	Base	Split-Face or Course CMU	Best Block® Western Beige Robinson Block® Antique White
	Primary	Smooth Face Brick or Veneer	By Designer
	Secondary	Smooth Face Brick or Veneer	By Designer
Fenestration	Doors	Aluminum, Steel	To Match Medium or Dark Bronze, or Roof Color
	Door Frames	Aluminum, Steel	Medium or Dark Bronze
	Window	Glass	Clear or Smoke Tinted
	Window Frames	Aluminum, Steel	Medium or Dark Bronze
	Window Base and Header	Precast Concrete	Light Color to match Base, or color accent.
Other Items	Facia	Metal	To match roof color
	Soffit	Metal	To match roof color
	Gutter, Downspout	Metal	To match roof color
	Grills and Louvers	-	Match adjacent material color. When framed by design element, color determined by design.
	Roof Elements	-	To match roof color
	Site Elements	-	To match main building colors and materials

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4.1-C.7(B) Example Image



SECTION 4
BUILDINGS

4.1-D Keyed Access Entry Control

4.1-D.1 General Requirements

Where required, the construction contractor shall be responsible for installation of all locksets and exit devices for their assigned project(s). This includes combination and installation of any required cores and key duplication. The core type and combination shall meet the requirements of the master key system on Fort Carson.

4.1-D.1(A) Lockset

To meet the Ft Carson master key plan, provide all keyed lockset devices with patented Best Lock Corporation or ASSA ABLOY Corporation cores. The type of core required will be dependent on the security requirement for the building and/or room. During the planning phase in coordination with the Contracting Office, DPW, the O&M contractor locksmith and Post Physical Security may assist in determining the core type. The point of contact for this coordination is DPW Business Operations Division, phone (719) 524-0786.

4.1-D.1(B) Lock Cores

The construction contractor shall be responsible for installation of all permanent lock cores. Any coordination required with Best Lock Corporation or ASSA ABLOY Corporation for installation of the cores shall be planned for and is the responsibility of the construction contractor. The contractor shall be responsible for the core schedule, installing all cores and validating functionality of all keys for the respective core including the master key(s).

4.1-D.1(C) Cylinders

Provide fully compatible cylinders with products of the Best Lock Corporation or ASSA ABLOY Corporation with Small Format Interchangeable Cores (SFIC), which are removable by a special control key. Factory set the cores with [seven] pin tumblers using the BEST or MEDECO Keymark x4 patented keyways (for use solely in the 18, 19, 24 or 25 series locksets as determined by design source). Submit a core code sheet with the cores. Provide master keyed cores in one system for this project. Provide construction interchangeable cores. Equipment spaces; electrical, communications and mechanical rooms shall be keyed independently from the building master system. The communication room door shall be on a different core than the DPW areas.

[For medical projects, pharmacy door locks shall be keyed separately from building master key system.]

4.1-D.1(D) Keys

All cores shall include four keys for interior doors and five keys for exterior doors and with two master keys for each KNOX box placed at the building location. Furnish a quantity of key blanks equal to 20-percent of the total number of file keys. All keys shall be stamped with "U.S. GOVERNMENT DO NOT DUPLICATE". In addition the keys and cores shall be stamped with the core number. Do not place room number on keys. All master keys provided shall be turned over to the O&M contractor locksmith for security control through the Government Project Engineer. All other keys shall be inventoried and turned

over to Facilities Utilization for issue to the building occupants through the government Project Engineer. Provide a key cabinet and control system for all facility keys, including a floor plan cross referenced to all key locations.

4.1-E Building Signage

The building signage addressed in this section apply only to signs that are attached to the exterior of the facility. For all other exterior signs, see Section 3.6 Signs.

4.1-E.1 Building Numbers

Building numbers of correct dimension, contrasting with the background and properly posted are required in accordance with the Fort Carson Installation Design Guide and NFPA 1.

4.1-E.1(A) General

For each facility constructed, a minimum of two building number signs will be funded by the respective project. The number of such signs will be determined by DPW-Master Planning during project design. The mounting location for each building number sign will be determined by DPW Master Planning. Number may be pin mounted or mounted on a backing material, which is then mounted to the facility.

4.1-E.1(B) Dimensions

- All buildings are required to have numbers a minimum of twelve inches high, with an appropriate corresponding width, and ½-inch stroke
- Assigned address numbers are to be posted, on construction sites in a highly visible location facing the address street, at all times during the construction period of any complex.

4.1-E.1(C) Lettering

Signs shall have contrasting color lettering.

4.1-E.1(D) Placement

Building numbers shall be located a minimum of 7'-0" above the finish exterior grade at the building. This height can be adjusted higher or lower as the building design dictates, to allow for greatest visibility from the roadways.

4.1-E.1(E) Location

The building numbers shall be located at the two corners most predominant by traffic flow. This may be opposite sides of the same corner, or opposite corners, whichever is most appropriate. Contractor/designer shall propose a location which shall be approved by DPW prior to placement on the building.

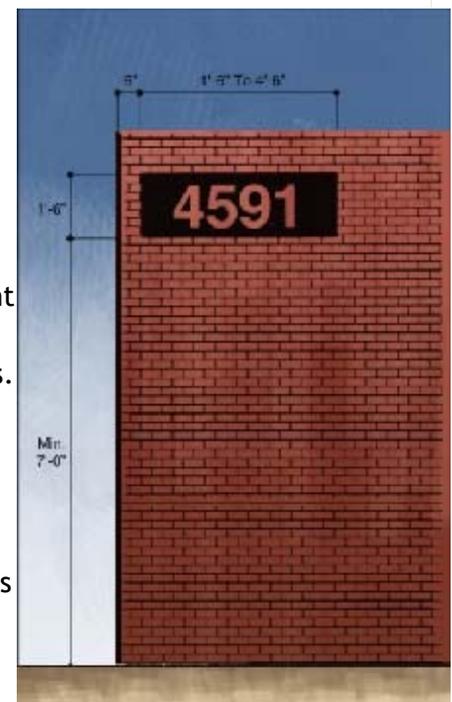


Figure 4.2-b Bldg # Placement

4.1-E.2 Information/Identification Signs

These are signs that identify entrances to the installation, areas within the installation, major tenants, buildings, and organizational or functional components. They identify a location, and guide or greet the visitor to that location. They should be compatible in scale and character with the architecture and also blend with the natural surroundings.

4.1-E.2(A) Insignia/mottoes are authorized on battalion level and above headquarters signs.

4.1-E.2(B) Directories or names of extra organizations in the facility will not be allowed on building identification signage. Utilize building directories inside the facility entrances for these purposes.

4.1-E.2(C) Specific room numbers of activities/services/individuals will not be placed on exterior signs, but will be provided on “directories” located inside primary entrances of applicable buildings.

4.1-E.2(D) No postal address signage will be placed on signs.

4.1-E.2(E) Hours of operation will not be placed on signs.

4.2 Interior Design

4.2-A Interior Finishes

4.2-A.1 Floor

4.2-A.1(A) Accent carpet and carpet borders are to be used in officer suites and command conference rooms. 24” square carpet tiles are preferred. 6’ or 12’ rolled goods are acceptable in low traffic areas. The accent carpet or a carpet border may be used in other areas if approved by the DPW.

4.2-A.1(B) VCT tiles are to be used in all areas except as noted above.

4.2-A.1(C) Polished concrete floors are an acceptable alternative floor finish.

4.2-A.2 Walls: Design professionals contracted to perform interior design are encouraged to use their expertise in deciding upon colors and materials. Traditional “military” colors may not always be appropriate.

4.2-A.3 Restrooms

4.2-A.3(A) All faucets are to be electronic, infrared or motion sensor operated and shall incorporate a turn off switch for cleaning. Sensors shall not be battery powered. Adjustable faucets shall have instant hot water capability.

4.2-A.3(B) All flush valves are to be electronic, infrared or motion sensor operated. They shall not be battery powered and shall be exposed, not concealed, within the walls. Flush valves shall have a manual option.

4.2-A.3(C) Solid plastic toilet partitions are the required material in all restrooms. Solid plastic urinal screens shall be provided at all urinal locations.

4.2-B Furnishings

4.2-B.1 General: Fort Carson does not have guidelines for furniture and furniture systems, however a common theme or color style that matches the interior of the facility is desirable. Design professionals are encouraged to use their expertise when deciding upon furniture colors, materials and style.

4.2-B.2 Task Lighting: All workstations and desks shall be provided with task lighting whenever possible.

4.3 Structural

4.3-A Foundations

4.3-A.1 Soils:

Area soils frequently exhibit a tendency for sulfate attack on concrete they are in contact with. As a result, all concrete that will be adjacent to or near the soil will be designed to be sulfate resistant (Type II or V) unless soil tests show there will not be a problem.

4.3-A.2 Frost Depth

4.3-A.2(A) Heated Structures: 3'-0" minimum below finished exterior grade.

4.3-A.2(B) Unheated Structures: 4'-0" minimum below finished exterior grade.

4.3-A.3 Grades: Grades shall slope a minimum of 2% from foundations within the first 10'-0".

4.4 Mechanical

4.4-A General

4.4-A.1 Design Conditions:

4.4-A.1(A) Indoor air: 68 F winter, 78 F summer (where cooling permitted)

4.4-A.1(A) Outdoor dry bulb: 0 F winter, 90 F summer;

4.4-A.1(A) Outdoor wet bulb: 58 F summer.

4.4-B Domestic Hot Water Heaters:

4.4-B.1 Water heaters shall be natural gas fired with electric pilots. Electric heaters shall be used only if natural gas service is not economically available.

4.4-B.2 Gas water heaters shall be no less than 85% efficient.

4.4-B.3 "On demand" (instantaneous) water heaters shall be utilized wherever load is limited (1-2 showers, 2-3 sinks, etc.). See below for information on water- conserving plumbing fixtures.

4.4-B.41 "On demand" booster heaters shall be used wherever point loads requiring higher temperatures exist (commercial dishwashers, etc.).

4.4-C Hot Water or Steam Boilers: Where possible, designers shall consider tapping into existing underground high-temperature hot water and/or chilled water distribution systems.

4.4-C.1 Boilers shall be natural gas fired with electric pilots. Electric boilers shall not be used.

4.4-C.2 Heating system capacities shall be based on no more than 125% of the calculated demand. No "rule of thumb" estimates for demand may be used.

4.4-C.3 Steam boilers for individual building systems shall operate at 15 psi. Distribution systems within buildings shall operate at 3-5 psi.

4.4-B.4 Boiler systems shall be designed around a "staged" concept: several smaller boilers in place of one large boiler, staged to come on as building load requires.

4.4-D Air Conditioning

4.4-D.1 Air conditioning for office space shall be evaporative cooling unless life-cycle cost analysis demonstrates mechanical cooling (MC) to be the preferred option.

4.4-D.2 MC equipment capacity shall be based on 100% of the calculated demand. No "rule of thumb" estimates for demand may be used.

4.4-D.3 MC equipment shall have at least two stages of unloading (100% and 50%), with outside air counted as a third stage. Unloading shall be controlled by HVAC control system, not suction temperature.

4.4-D.4 MC equipment shall use a non-CFC or Halogenated Chloro- Fluorocarbon (HCFC) refrigerant unless such is not economically available, in which case an HCFC refrigerant may be used.

4.4-E Air Distribution: Blower motors over 5 HP shall be equipped with variable frequency drives. Reset shall be duct static pressure, outside air temperature, or other as appropriate.

4.4-F Radiant Heat Systems:

4.4-F.1 High-bay space (hangers, warehouses, etc.) shall be heated with overhead, natural gas fired or in-floor, hot water tube radiant heaters unless space arrangement prohibits.

4.4-F.2 Overhead radiant heaters shall be electric ignition, direct fired, with outside exhaust. Preferred for large spaces is combustion tube type with powered direct vent combustion air. Small areas may be heated with single units using conditioned space air for combustion, provided adequate makeup is included.

4.4-F.3 Radiant floor heat shall be flexible rubberized tubing intended specifically for the application (embedding in concrete, attachment to subfloor, etc.).

4.4-G Ventilation:

4.4-G.1 Minimum outside air per ASHRAE 89-62 shall be provided during all occupied hours.

4.4-G.2 Facilities with large makeup air requirements (i.e., motorpools, locker rooms, kitchens) shall either utilize a heat-transfer technique to recover waste heat from exhaust stream, or shall include a Solar- Wall-type makeup air pre- heater.

4.4-H Control Systems:

4.4-H.1 Standard control signals shall be 4-20 milliamp at 24 V.

4.4-H.2 Single HVAC units shall have line-voltage electric thermostats with integral programmable night setback function.

4.4-H.3 Air-side economizer control shall be provided on all cooling systems.

4.4-H.4 Morning warm-up or cool-down periods shall use 100% re-circulated air.

4.5 Plumbing

4.5-A Interior Plumbing Systems

4.5-A.1 Design interior plumbing systems in accordance with the most current version of Unified Facilities Criteria (UFC) 3-420-01 and the International Plumbing Code (IPC) except for the following.

4.5-A.2 PVC and CPVC plastic piping shall not be installed inside or underneath a building.

4.5-A.3 Flush valves or flushometers shall be the piston type. Do not use diaphragm type flush valves or flushometers.

4.5-A.4 Use only 1.5 gallon per minute (GPM) shower heads.

4.5-A.5 Use only 1.28 gallon per flush (GPF) water closets or commodes.

4.5-A.6 Use only .125 gallon per flush (GPF) urinals.

4.5-A.7 Use only .5 GPM lavatory aerators

4.5-A.8 Trap primer water supply shall not be connected to a potable water pipe.

4.5-A.9 An approved backflow device shall be installed on the buildings water service supply (preferably in the mechanical room) to isolate the building from the water distribution system. Additional backflow devices will be installed within the building to isolate crossconnection and the building's potable plumbing system.

4.5-A.10 Air admittance valves (AAV) shall not be allowed on the building's drain venting systems.

4.6 Electrical

4.6-A Electric Meters: Meters are required on all new facilities. Meter standards are designated by the City of Colorado Springs and Fort Carson mirrors their standards.

4.6-B Conductors: All interior wiring shall be copper. ROMEX and MC cable are by permission only.

4.6-C Energy-Efficient Lighting Guidelines

4.6-C.1 Light levels:

- 30 fc in administrative areas; 10 fc in hallways.
- Lighting power densities shall not exceed 1.5 W/sf, with goal of less than 1 W/sf.
- Design lighting with separate on-off switching for each zone within a space.
- Install occupancy sensors in hallway, latrines, classrooms, and meeting rooms.
- Take advantage of daylighting potential. Where daylighting is used, provide photosensors for electric lighting control.

4.6-C.2 Electronic Ballast Specifications

- UL listed Class P
- Sound rated A
- Total harmonic distortion greater than or equal to 10%, third harmonic distortion less than 6%
- Power factor must be greater than or equal to 95%
- Ballast factor must be greater than or equal to 0.88
- Lamp current crest factor less than or equal to 1.7
- Flicker 5% or less with any lamp suitable for ballast
- Minimum 5 year warranty

4.6-C.3 Fluorescent Lamp Specifications:

4.6-C.3(A) General

lamps shall be 265 mA "t-8" rapid start type as follows:

- 2' lamps shall be 17 watt F17T8.
- 3' lamps shall be 25 watt F25T8.
- 4' lamps shall be 25 watt F25T8.
- 5' lamps shall be 40 watt F40T8.
- 1'MOL U-lamps shall be 16 watt FB16TS.
- 1.5'MOL U-lamps shall be 24 watt FB24T8.
- 2'MOL U-lamps shall be 31 watt FB31 TS.

4.6-C.3(B) Color:

- Lamps shall be 4100 Kelvin correlated temperature.
- Color rendering index: Lamps shall have a minimum CRI of 80 through the use of rare earth phosphor coatings.

4.6-C.4 Compact Fluorescent Lamp/Ballast Specifications:

4.6-C.4(A) General

- Lamp efficacy must be at least 50 lumens/watt.
- Ballast must be of High Power Factor (HPF) type, capable of increasing power factor to 90%.

4.6-C.4(A) Color:

- Lamps shall have a minimum CRI of 80 through the use of rare earth phosphor coatings. Lamps shall be of 2700, 3000, 3500, or 5000 Kelvin correlated temperature.

4.6-D Occupancy sensors

4.6-D.1 Ceiling mounted occupancy sensors.

- Under cover switch with delay of 30 seconds to 15 minutes.
- Detector must be of passive infrared (PIR), ultrasonic, or a combination of both.
- Ultrasonic and infrared devices must be equipped with a sensitivity adjustment.
- Sensor must have positive detection device, LED or equal.
- Minimum 5 year warranty

4.6-D.2 Wall mounted occupancy sensors.

- Under cover switch with delay of 30 seconds to 15 minutes.
- Detector must be of passive infrared (PIR), ultrasonic, or a combination of both.
- Ultrasonic and infrared devices must be equipped with a sensitivity adjustment.
- Sensor must have positive detection device, LED or equal.
- Minimum 5 year warranty

4.7 Fire Alarm Systems

4.7-A There is a post wide fire alarm system to which any new work must be compatible with. The fire alarm control panels are Thorn and the transmitter and antenna are Monaco BTXM (G.H. Harlow is being phased out).

4.7-A.1 Fire alarm and detection systems that will use 25 devices or more shall be an addressable system.

4.7-A.2 Exit signs shall be red LED type.

4.8 Energy Management Control System

All Contractors and Government employees are instructed to name and program new Smart meters and DDC controls according to the “Naming Conventions” set forth in this document. Likewise, all contractors are to allow for the use of “Relative Pathing” when setting up the system graphics.

4.8-A EMCS Scheduling Procedure

In order to ensure that the proper resources are available, Contractors are advised to contact the Fort Carson EMCS Department 3 business days prior to commencement of work requiring EMCS participation. EMCS will respond to confirm the scheduled date and time a minimum of 1 business before appointment.

To schedule an appointment or request support from the ECCS Department, please use the following contact numbers:

Office - 719-526-6093

Fax - 719-527-9781

4.8-B Naming Conventions

4.8-B.1 The following naming convention should be followed for all controls to be integrated into the EMCS monitoring system.

4.8-B.1(A) Analog Points: At the JACE level should read 0-100.

4.8-B.1(B) Digital Points: At the JACE level should read “On/Off” for a fan status, “Open/Close” for a damper position, “Enabled/Disabled” for cycling equipment.

4.8-B.2 Any control points not listed shall be coordinated with EMCS to be named and added to the “Naming Conventions Appendix”

4.8-B.3 The folder that the points reside in should be named “points”. This folder should reside in a controller or folder named for the unit. (Example AHU_2.) Similarly, the points should be named by the naming convention all ending in a point extension. The space temperature for AHU_2 would reside in the “points” folder under a folder or controller named AHU_2 and point would be named “SP_temp”.

4.8-B.4 See “Naming Conventions Appendix” for point naming

4.8-B.5 Command Overrides: It is imperative that the contractor must verify that the programmed override works in the following manner.

4.8-B.5(A) Command Override: From the JACE building controller

4.8-B.5(B) Analog Override: Command points should read “Override / Auto” and should be “Emergency Override” command.

4.8-B.5(C) Digital Override

- Command points should read “On / Off / Auto” for equipment that is either on or off.
- Command points should read “Enable / Disable / Auto” for equipment that cycles on and off.
- Command point should read “Set / Auto” should be “Emergency Override” command.
- Setpoint W/O Logic Controlling Point - Command point should read “Set” and should be the “Set” command

4.8-C History Extensions: All “points” shall have COV History logs configured

4.8-C.1 Analog points: Shall be set up as a COV (Change of Value) set to a limit reasonable for the point, see COV on “Naming Conventions” chart under the Naming Conventions section.

4.8-C.2 Digital Points: Shall be set up as a COV (Change of Value) set to COV.

4.8-C.3 All COV History extension names must be set to %parent.parent.parent.Name% %parent.displayName%. Contractor can put in any Interval History logs needed for LEED studies or other purposes, but it must be named differently.

4.8-D Metering: Install and configure meters according to the following requirements:

4.8-D.1 Smart Electric Meters

4.8-D.1(A) Meter shadow object should be named such that it identifies the meter make and model. IE shark200 Eaton IQ260.

4.8-D.1(B) Meter points specified by COE should be exposed and histories set up.

4.8-D.1(C) KWH received / KWH delivered /KWH net readings should be logged monthly/weekly/daily/15min delta.

4.8-D.1(D) Alarm set up for lower than last value or larger than maximum change of value (adjustable).

4.8-D.1(E) Meter shall read KWH received as energy to building and KWH delivered as energy back to the grid.

4.8-D.2 Pulse Meters (water/gas/dumb electric)

4.8-D.2(A) Pulse point should connect to a compatible controller IE NR-NPC or NDIO.

4.8-D.2(B) Pulse point should be logged.

4.8-D.2(C) Pulse program shall count pulses and account for pulse rollover and meter rollover to keep a reading that matches the meter at the building and a total count past the meter rollover.

4.8-D.2(D) Alarm shall be generated if pulse count is less than last reading or is greater than a maximum change of value (adjustable).

4.8-D.2(E) Meter reading shall be logged monthly. Total reading should be logged monthly/weekly/daily.

4.8-D.2(E) ***Note:** Contact EMCS for assistance with Modbus mapping and translation through equipment, and for programming to accomplish task 3. EMCS has extensive programming that can be shared to get meters functional ASAP. Phone: 719-526-6093

4.8-E System Graphics

4.8-E.1 The programmer must use “kitPxHvac” module for graphical images.

4.8-E.1(A) ScrollPane (Root)
Background = White

4.8-E.1(b) CanvasPane (Content)
Size = 1200x768
halign = Left
valign = Top
Background = DPWLOGO.gif (Top, Left)

4.8-E.2 “BorderPanels” are not be used as they are not compatible with the way that EMCS is displaying information. “BoundLabels” have been found to have the same functionality with better display properties. EMCS will provide any templates available to match the Naming Conventions listed.

4.8-E.3 Templates to be modified by contractor as needed. Template library to be updated as system grows.

IDG SECTION 5 ENVIRONMENTAL

5.1 General Information

5.1-A Environmental Compliance Assessment Team (ECAT)

The DPW Environmental Division ECAT mission is to provide support to units, Garrison directorates and tenants with needs as they relate to environmental compliance and management. The ECAT conducts assessments of all facilities on a regular basis in concert with unit Environmental Protection Officers in order to protect the Installation from unnecessary fines and environmental violations by assessing facilities on an annual, biannual, quarterly and monthly basis. ECAT is located in building 1219 and is available Monday through Friday, 7:30 a.m. to 3:30 p.m., 526-4446.

5.1-B National Environmental Policy Act (NEPA)

The DPW Environmental Division manages NEPA actions for Fort Carson. The NEPA requires all federal agencies analyze environmental impacts of their activities. Contact DPW Business Operations and Integration Division Work Management Branch at 526-2900 prior to any construction, demolition or renovation projects. For all other activities that may potentially impact the environment, such as training operations, contact the Installation NEPA coordinator at 526-4666 to find out what documentation and future coordination is necessary to go forward with the activity (Monday through Friday, 7 AM to 4:30 PM, 526-4666).

5.1-C Spill Control

The DPW Environmental Division Spill Coordinator is responsible for assisting with the management of all spills that occur on the Installation to ensure environmental compliance. As the first spill responder, the Fort Carson Fire Department relies on the expertise of the Environmental Division compliance team. The Environmental Division augments the Fort Carson Fire Department efforts. The team helps in mitigation and advising units and activities on cleanup procedures and reporting requirements for spills. Monday through Friday, 8 a.m. to 4:30 p.m., 526-1686.

5.2 Environmentally Sensitive Programs

5.2-A Wetlands and Surface Waters (Streams, Creeks and Ditches)

Fort Carson's and the Army's goal is to maintain and enhance water quality, and avoid loss of wetlands (no net loss of wetlands). To achieve this goal the Environmental Division of DPW manages and monitors surface waters within Fort Carson and Piñon Canyon Maneuver Site as well as wetlands. Environmental Division of DPW works to minimize impacts to wetlands, obtain permits and serves as a liaison with the USACE Regulatory office with regard to project planning, permitting and construction or when having to mitigate wetland loss.

5.2-A.1 Whenever possible, avoid impacting wetlands. If unavoidable, coordinate closely with the Environmental Division of DPW wetland staff with regard to permitting issues, project design and construction.

5.2-A.2 The Environmental Division of DPW will work with other DPW staff in preparing the appropriate documents required by the Corps of Engineers. State authorization and permitting applies.

For more information contact the Resource Compliance Branch at (719) 526-1693..

5.2-B Wildlife

5.2-B.1 The DPW Environmental Division Wildlife Program at Fort Carson and Pinon Canyon Maneuver Site work to maximize access to Army land, air and water resources for military training while ensuring wildlife is protected and biological diversity of natural resources entrusted to the Army maintained and sustained for training, scientific research, education, recreation and other compatible uses. The Wildlife Program seeks to improve wildlife recreational opportunities for Soldiers and their families. Monday through Friday, 7 a.m. to 3:30 p.m., 524-5393.

5.2-B.2 In areas where birds are not desired (BAAF, front of Commissary etc) including overhangs, archways, trees or the use detention ponds is not recommended as birds will likely nest or perch on the structures (i.e. mud swallows will build nests under an overhang on buildings at BAAF and may increase the BASH potential). Screen mesh is along the ceiling of hangars is also recommended if hangar doors are going to be kept open during the summer. Sheds or connexes should be placed on concrete pads to prevent rabbits from living underneath. In some cases bird spikes should be included in the design for exposed horizontal beams or supports to prevent birds from perching above entryways or on light fixtures.

5.2-C Cultural Resources

The DPW Environmental Division manages Installation cultural resources to ensures compliance with historic preservation laws, mandates and regulations while simultaneously facilitating the Garrison support missions. Monday through Friday, 7 a.m. to 4:30 p.m., (719) 526-4484.

5.2-D Forestry Program

5.2-D.1 The DPW Environmental Division Forestry Program manages both the urban trees within the Main Post and the downrange forest communities on Fort Carson and the Pinon Canyon Maneuver Site (PCMS).

5.2-D.2 The Installation Arborist ensures the Garrison greenways and individual trees are healthy and vibrant to continue to provide shade and esthetics. The Installation Forester uses eco-system management principles for the downrange forest communities providing a healthy and vibrant forest that are more responsive to troop training and wildland fires.

5.2-D.3 The Forestry Program sells firewood at highly competitive rates to local residents. Our hours of operation are Monday through Friday, 7 a.m. to 4:30 p.m. Arborist, 719-526-1692; Forester, 719-526-1667.

5.3 Air Quality

5.3-A Air Program

The DPW Environmental Division Air Program reviews processes and materials used to sustain Fort Carson's mission. The program strives to comply with Clean Air Act (CAA) laws and regulations and provide the leadership with the knowledge and alternatives necessary to implement decisions geared toward minimizing air quality impacts and maintain Title V permit compliance. Hours of operation are Monday through Thursday, 7 a.m. to 5 p.m., 526-6601.

5.4 Water Quality

5.4-A Water and Wastewater Program

5.4-A.1 The DPW Environmental Division manages the Drinking Water and Wastewater (Industrial and Sewage) Water Programs for the Installation. Fort Carson collects and treats its wastewater at the Sewage Treatment Plant on Post and disposes of its wastewater at PCMS via evaporative lagoons, DPW Environmental Division manages all aspects of compliance with the Clean water Act (CWA) and Safe Drinking Water Act (SDWA).

5.4-A.2 The Installation receives its drinking water from Colorado Springs Utilities (CSU). CSU maintains an extensive testing program that assures full compliance with the requirements of the Safe Drinking Water Act. In addition, the DPW operations and maintenance contractor performs routine supplementary testing for chlorine levels, coliform contamination and chlorination byproducts on the drinking water distribution system with the goal of providing water that is safe to drink for all Fort Carson consumers. The Water Programs Manager can be contacted Monday through Friday, 6 a.m. to 3:30 p.m., 526-1730.

5.4-B Water Rights

The DPW Operations and Maintenance Division manages both surface and subsurface water rights at Fort Carson and the Pinon Canyon Maneuver Site. Water management includes wells that provide downrange industrial use water, and surface water that provides military training, downrange fire protection, recreational waters, wildlife habitat and irrigation. Turkey Creek Recreation Area has a well that provides potable and non-potable, fire-fighting water to the Recreation Area, including the Fire Station. Monday through Friday, 6 a.m. to 3:30 p.m. 719.524.2124.

5.5 Petroleum and Soils Management

5.5-A Above Ground Storage Tanks (AST)

The DPW Environmental Division Above Ground Storage Tanks (AST) Program manages all convaults used to store used oil, diesel, used antifreeze and new oil on the Installation. Program responsibilities includes, but are not limited to, the inspection, records monitoring, maintenance training and operation of ASTs. Hours of operation are Monday through Friday, 7 a.m. to 2 p.m., 526-9411.

5.5-B Underground Storage Tanks (UST)

The DPW Environmental Division Underground Storage Tank (UST) Program manages all underground storage tanks, which supply Fort Carson with fuel at the AAFES service stations throughout the Installation. This process includes, but is not limited to, the paying of fees, compliance management, inspection and training on all aspects of UST management. Monday through Friday, 7 a.m. to 2 p.m., 526-9411.

5.5-C Installation Restoration Program (IRP)

The DPW Environmental Division Installation Restoration Program has an ongoing commitment to the cleanup and restoration of soil contaminated sites (Solid Waste Management Units or SWMUs) on Fort Carson and Pinon Canyon Maneuver Site. No project activities, or construction can occur

within or potentially impacting SWMUs without coordination and approval by IRP staff.. Monday through Thursday, 7 a.m. to 5 p.m., 526-8001.

5.5-D Pest Control and Management

The DPW Environmental Division provides oversight and technical support to the Installation Pest Management Program, and helps to ensure installation-wide compliance with federal, Army, state, and local pesticide storage, use, and disposal regulations and reporting requirements. Pesticide applications on Fort Carson or the Pinon Canyon Maneuver Site shall follow all Federal, State and Department of Defense rules and regulations. In addition, the contractor shall coordinate with the Fort Carson Pest Management Coordinator (PMC) at least 30 calendar days prior to the application of any pesticides. The PMC will ensure that the applicators are appropriately licensed and that the proposed pesticide is approved for use on the installation. Only Colorado State Certified Operators under the direct supervision of a Colorado State Qualified Supervisor are permitted to apply pesticides on Fort Carson and the Pinon Canyon Maneuver Site. Building 1219, 1626 Evans Street, Monday through Friday, 7:00 a.m. to 4:30 p.m., 719 526-5141 or 719 524-2124.

5.6 Contaminates

5.6-A Asbestos, Lead and Toxics Program

The DPW Environmental Division manages the Asbestos, Lead and Toxics Program. There are asbestos containing building materials throughout most of the older buildings on Fort Carson and Pinon Canyon Maneuver Site. Additionally, some facilities may have lead-based paint, naturally-occurring radon and polychlorinated biphenyls (PCBs) . The DPW protects the environment while ensuring that there are no exposures to Soldiers or civilians. Hours of operation are Monday through Friday, 7 a.m. to 3:30 p.m., 526-1725.

5.6-B Hazardous Waste Storage Facility

The DPW Environmental Division manages a Hazardous Waste Storage Facility, which collects, stores and manages hazardous waste for units and activities on the Installation. Building 9246, Butts Road, Monday through Friday, 7:30 a.m. to 3:30 p.m., 526-8003.

5.6-C Household Hazardous Waste Disposal Facility

Fort Carson residents can dispose of a variety of household hazardous waste at the El Paso County Household Hazardous Waste Facility. For information about which household hazardous waste products the county accepts and disposal dates and times, visit:

<http://adm.elpasoco.com/Environmental%20Division/Household%20Hazardous%20Waste/Pages/>

Household Hazardous Waste Disposal Facility (El Paso County)
3255 Akers Drive
Colorado Springs, Colo. 80922

Phone 520-7878.

IDG SECTION 6 FORCE PROTECTION

6.1 General

The Department of Defense Physical Security design and construction and standards are published in the **Unified Facilities Criteria (UFC) 4 Series design documents**. The UFCs cover a wide range of security planning, design and construction including antiterrorism design standards to Access Control Points. The UFCs are available at :

http://www.wbdg.org/ccb/browse_cat.php?o=29&c=4

6.1-A Guidance

Accommodating the need for security and antiterrorism is a significant concern for all military design. Security and antiterrorism requirements must be integrated into the total project. Design of protective elements should seek to visually enhance and complement the design of a facility. Site elements such as fences, courtyards, screen walls, swales, berms, planters, and retaining walls can be used effectively for facility protection. These design elements should be utilized to provide visual harmony with the main facility, producing architectural compatibility through consistent use and application of materials, forms, and colors.

6.1-B Coordination

All design decisions involving security and antiterrorism requirements will require coordination among the design disciplines including master planners, landscape architects, architects, intelligence personnel, security personnel, Force Protection Officer, facility users, and engineers. The designers must work to resolve conflicts and balance force protection requirements with all other requirements that impact design and development. These include the **Americans with Disabilities Act Accessibility Guidelines (ADAAG)**, the **Uniform Federal Accessibility Standards (UFAS)**, **National Fire Protection Codes (NFPA)**, and all applicable local building codes and ordinances. The design team will also consult security personnel to determine whether portions of the design documents are subject to access limitations.

6.2 Building Siting and Design

6.2-A A primary concern for Army installations throughout the world is the threat of terrorist attack. To minimize the likelihood of mass casualties from terrorist attacks against DoD personnel in the buildings in which they work and live, DoD has developed the Unified Facilities Criteria (UFC) 4-010-01, DoD Minimum Antiterrorism Standards for Buildings. This document establishes the minimum building antiterrorism standards for all DoD components.**6.2-B** Implementation of the mandatory standards is obligatory for all new construction regardless of the funding source. These standards apply to FY 2004, and all subsequent fiscal years, for projects involving new construction and major renovations for inhabited structures. The standards will be reviewed before any site planning or design is initiated.

6.2-C Minimum Standoff Distances and Building Separation

6.2-C.1 Standards

Incorporating appropriate standoff distances around facilities is the most effective and desirable tool in meeting force protection requirements in facility site design. The need for standoff distances varies with the type of facility, its location, and the asset contained within the structure. The DoD minimum standards, when applicable, may be supplemented by more stringent force protection building standards to meet specific threats inherent in the geographical area where the facility is to be constructed. Those additional requirements may be established by standards for specific Combatant Commanders or based on Risk and/or Threat Analysis.

6.2-C.2 Reference Material

- The minimum standoff distances and separation for new and existing buildings are found in Table B-1 of UFC 4-010-01.
- The minimum standoff distances and separation for expeditionary and temporary structures are found in Table D-1 of UFC 4-010-01.
- Additional guidance on applying the DoD Minimum Antiterrorism Standards for Buildings will be found in UFC 4-010-02, (FOUO) DoD Minimum Standoff Distances for Buildings.

6.2-C.3 Alternative to Standoff Distances

When the minimum standoff distances cannot be achieved due to limited land availability, the standards allow for building hardening to mitigate blast effects. Costs and requirements for building hardening are addressed in the DoD Security Engineering Manual.

6.2-D Building Orientation

The following force protection considerations will be given when determining the orientation of a building:

6.2-D.1 Line of Sight

Deny aggressors a clear "line of sight" to the facility from on or off the installation where possible. Protect the facility against surveillance by locating the protected facility out of range or out of view from vantage points.

6.2-D.2 Perimeter Barriers

Protect against attack by selecting perimeter barriers to block sightlines such as obstruction screens, trees, or shrubs. Non-critical structures or other natural or man-made features can be used to block sightlines. See UFC 4-010-01 for Setback Requirements

6.2-D.3 Defensible Space

Create defensible space by positioning facilities to permit building occupants and police to clearly monitor adjacent areas. Avoid locating the facility adjacent to high surrounding terrain, which provides easy viewing of the facility from nearby non-military locations.

6.2-D.4 Vehicular Flow

Design vehicular flow to minimize vehicle bomb threats; avoid high-speed approach into any critical or vulnerable area. If roads are nearby, orient building so that there are no sides parallel to vehicle approach routes.

6.2-D.5 Waste Dumpsters and Bins

Place trash containers as far away from the facility as possible. Antiterrorism/force protection requirements restrict the location of dumpsters to a minimum of 10 meters (33 feet) from inhabited buildings and 25 meters (82 feet) from billeting and primary gathering areas (Unified Facilities Criteria (UFC) 4-010-01, DoD Minimum Antiterrorism Standards for Buildings, Table B-1).

6.2-D.6 Balanced Design

Designers need to balance the need for signs that identify, locate, and direct residents and supported personnel to installation assets, versus the need to discourage and frustrate hostile intelligence gathering and access. One method of achieving this balance could be to direct people to a community support or information center to obtain directions to high security activities. Another could be signage like - "All incoming personnel and visitors report to building number ____."

6.3 Landscape Considerations

Landscaping guidelines for buildings should not be ignored because of standoff distances. The landscape design should enhance the overall attractiveness of the facility while still providing the objective level of security. Establish clear zones along both sides of security fencing.

6.3-A Vegetation

6.3-A.1 Clear Zone: Vegetation in the clear zone should not exceed four inches in height. (DoD 0-2000.12-H, Protection of DoD Personnel and Activities Against Acts of Terrorism and Political Turbulence, Appendix EE, Table EE-4)

6.3-A.2 Vehicle Access: Strategically locate trees and planters to prevent penetration of an attack vehicle into the secure area perimeter. Vegetative groupings and earth sheltering berms provide inherent blast effect reduction from external blast forces. Plant material that can provide concealment will not be used adjacent to high security structures or fence lines

6.3-A.3 Natural Barriers: Use dense, thorn-bearing plant material to create natural barriers that will deter aggressors. Screen playground and outdoor recreation areas from public (off the installation) view

6.3-A.4 Unobstructed Space: Ensure that vegetation and site features within 10 meters (33 feet) of inhabited buildings do not conceal from observation objects of 150mm (6 inches) in height. (UFC 4-010-01 , Appendix B, Para B-1.2) This does not preclude landscaping within the unobstructed space, but it will affect the design and may affect plant selection.

6.3-B Fences

6.3-B.1 Fences should be utilized to define boundaries and to deter penetration of a secure area. A fence will assist in controlling and screening authorized access to a secured area. Fences also serve the purposes listed below:

- As a platform for the Intrusion Detection System.
- As a screen against explosive projectiles.
- To stop moving vehicles (must be reinforced to do so).

6.3-B.2 Plants with tall growth habits and/or large mature growth will be located well away from security fences.

6.3-B.3 See **UFC 4-022-03 Security Fences and Gates** dated 1 October 2013 for design and construction of security fences and gates.

6.4 Physical Security

6.4-A Lighting

Lighting systems for security operations provide illumination for visual and closed-circuit television (CCTV) surveillance of boundaries, sensitive inner areas, and entry points. When CCTV is used as part of security operations, the lighting system will be coordinated with the CCTV system. The specific installation environment and the intended use determine lighting system requirements. Often two or more types of lighting systems are used within a single area. Guidance on the use of security lighting may be obtained from TM 5-811-1, Electrical Power Supply and Distribution.

6.4-B Berms

6.4-B.1 Use of berms for force protection can fulfill one or more of the following functions.

- Define boundaries of property or boundary limits. Provide a barrier to moving vehicles.
- Hinder pedestrian movement. Intercept projectiles.
- Obstruct lines of sight.



Figure 6.4-a Force Protection Berms

6.4-B.2 Berms used to block lines of sight or projectiles must be high enough to achieve those objectives or may be combined with landscaping or other construction elements. Detailed design guidance is contained in Army Technical Manual (TM) 5-853-3/ AFMAN 32-1071, Vol. 3, Security Engineering Final Design.

6.4-C Physical Security Equipment

The Product Manager, Physical Security Equipment (PM-PSE) under DoD Directive 3324.3 is assigned the mission of developing, fielding, and supporting Physical Security Equipment (PSE)

throughout its life cycle for the Army, Joint Services, and other government agencies. The DoD Directive assigns specific areas of responsibility which include: interior PSE, Command and Control Systems, security lighting, force protection systems, barrier and systems, and interior and exterior robotics.

6.4-D Area Specifications (Provost Marshal/Physical Security Requirements)

Information contained in the Provost Marshals Office (PMO) and Physical Security (PS) portion of this planning guide is directed primarily toward the construction requirements for arms, ammunition, and explosives storage facilities and the installation's Integrated Intrusion Detection System (ICIDS) and related requirements. For additional information contact Fort Carson Physical Security, DSN 691-2760 or Commercial 719-526-2760 or FAX 719-526-3961. New facilities requiring Secure Storage or a Controlled Substance storage vault please contact Physical Security to conduct a "Risk Analysis". Risk Analyses will be used to determine construction standards for these types of facilities.

6.4-E Arms Storage

6.4-E.1 Refer to AR 190-11 if Category II arms are to be stored in new facilities built for the principal purpose of storing arms.

6.4-E.2 See UFC 4-215-01 Armories and Arms Rooms, dated 1 December 2014 for planning and design of arms rooms.

6.5 Gates and Entrances (Access Control Points)

6.5-A Installation entry points are key components in the force protection security program. The most effective entrances accommodate the functions of observation, detection, inspection, access control, and disablement of hostile personnel and vehicles, while containing the vehicles and pedestrians until access is granted. These areas are among the most important installation features in the creation of a sense of arrival for both installation personnel and visitors. It is important that these areas present a positive public image.

6.5-B References

- Army Standard for Access Control Points, ACSIM Memorandum dated 13 April, 2012
- Army Access Control Points (ACPs) Standard Design, dated May 2013 (USACE COS)
- **UFC 4-022-01 Security Engineering Entry Control Facilities/Access Control Points** dated 25 May 2005.

IDG SECTION 7 FIRE PROTECTION**7.1 General Information**

7.1-A The requirements of all applicable Codes, Standards and Unified Facilities Criteria still apply and take priority over anything stated in these local standards. These local standards are intended to help prepare plans for submittal to the Fort Carson Fire and Emergency Services Fire Prevention Office for review. It addresses items which will be checked during the final inspection of projects, prior to acceptance. It also gives general guidance on general construction topics to aid contractors with fire prevention issues. These items are requirements derived from current Department of Defense (DoD) Directives/Regulations, Army Regulations (ARs), UFC 3-600-01, UFC 4-021-01, International Building Code (IBC), National Fire Protection Association (NFPA) Codes and local policies.

7.1-B In reviewing plans for remodeling or new construction projects, the Fire Department is concerned with several major items. These items will be checked utilizing the above mentioned codes and references. Which codes are used, of course, will depend upon the type of facility being constructed. Please prepare your plans with this thought in mind, that our objective is to insure life safety. While every effort is made to be very thorough in our review process, there is a possibility something may be overlooked at the plan review stage. If this occurs, it may be noted at the time of acceptance. Therefore, if you feel something will require our particular attention or you have specific questions, please bring this to our attention, as soon as possible. We would prefer to utilize the plan review process as a positive time to review important issues rather than try to correct major problems while your tenant is scheduled and waiting to move in to the new building.

7.1-C These standards are not all inclusive, refer to appropriate documents for total compliance i.e. UFC's, Regulations and NFPA Codes and Standards

7.1-D We encourage preplanning consultations to discuss projects before plans are finished. Please contact our office to request an appointment and feel free to call any time with any questions you have.

**FORT CARSON FIRE & EMERGENCY SERVICES
FIRE PREVENTION DIVISION
BUILDING 1805
FORT CARSON, CO 80913-5023**

Phone: (719-526-9355)

7.2 Fire Extinguishers: One extinguisher per 3,000 square feet per floor; 75 linear feet is the maximum travel distance for light hazard occupancies.

7.2-A One extinguisher per 1,500 square feet per floor; 50 linear feet maximum travel distance for extra hazard occupancies.

7.2-B Extinguisher size to be in accordance with NFPA 10.

7.2-C Extinguishers shall be mounted in visible and accessible location (in the path of egress, if possible).

7.2-D Fire extinguishers shall be placed in cabinets, (recessed/semi-recessed) in all finished areas.

7.2-E Mounted no closer than 4 inches to the finished floor and no higher than 5 feet above the finished floor to the top of the extinguisher.

7.3 General Project Guidelines

7.3-A SITE MAINTENANCE DURING CONSTRUCTION

7.3-A.1 Hydrants and access roads will be serviceable prior to and during construction.

7.3-A.2 Prior to construction: Access roadways shall be made serviceable and maintained for fire protection and emergency purposes. Required street and "on-site" fire hydrants and water mains must be installed and operable as soon as possible.

7.3-A.3 Exits and exit corridors are to be unobstructed prior to fire final.

7.3-A.4 Adequate removal of debris shall be maintained during construction.

7.3-A.5 Supply and maintenance lay down areas shall be neat and orderly.

7.3-A.6 Provide fire extinguishers at predetermined locations.

7.3-A.7 Smoking areas will be provided with adequate means of disposing smoking materials.

7.3-A.8 Compressed gas cylinders are to be secured.

7.3-A.9 Access roads and fire hydrants are to be maintained and unobstructed.

7.3-A.10 Workers shall be briefed on emergency procedures (medical, fire, hazmat and 9-1-1, etc.). Procedures shall be posted at the work site.

7.3-B SPECIAL SYSTEM PLANS: Most special systems require separate plans to be submitted by subcontractor. The Fire Prevention Division is required to review all plans:

7.3-B.1 Fire Alarm and/or detection.

7.3-B.2 Fixed fire protection.

7.3-B.3 Sprinkler and/or standpipe.

7.3-B.4 Compressed gases.

7.3-B.5 Spray booth/drying ovens (also needs to be submitted to Director, Environmental Compliance and Management.

7.3-B.6 Flammable liquid storage, handling, or mixing room.

7.3-B.7 Outside/inside ground/underground fuel and/or waste oil storage reviewed prior to installation.

7.3-B.8 Provisions for outside storage of hazardous materials or flammable/combustible liquids.

7.3-C SYSTEM TESTS:

7.3-C.1 System tests and written certification (if required) will be conducted for the following (minimum 72 – hour notification required unless otherwise noted).

7.3-C.2 Alarm systems.

7.3-C.3 Smoke detector systems.

7.3-C.4 Fire doors (magnetic hold open devices, smoke detectors, smoke seals, and self closures, (as applicable).

7.3-C.5 Emergency lighting and EXIT sign emergency lighting.

7.3-C.6 Smoke removal systems.

7.3-C.7 Sprinkler systems (200 lb. hydrostatic, final, visual, etc.).

7.3-C.8 Tank certification, pressurization, and line.

7.3-C.9 Above ceiling inspections.

7.3-D INSPECTION, TEST AND PERMIT REQUEST INFORMATION: Schedule these items with the appropriate Project Fire Inspector.

7.3-D.1 It is the responsibility of the contractor to appropriately conduct all testing in accordance with all applicable codes and standards. This includes all manpower and equipment necessary to properly conduct the test. The Fire Prevention Divisions role is that of a witness only.

7.3-D.2 Final acceptance tests of the fire alarm and mass notification systems will not be scheduled at a time when construction is still taking place. The facility may have final cleaning taking place, however, it shall halt whenever it conflicts with the testing. It will be at the discretion of the projects Fire Inspector whether a facility is ready or not for testing. If the Inspector deems the facility is not ready for testing, the final test will be cancelled until such a time that the facility is ready.

7.3-D.3 The facility and all rooms (dependent on test being conducted) are to be unlocked prior to the start of the scheduled time.

7.3-D.4 An approved set of construction plans/drawings are to be on-site for all tests and inspections.

7.3-D.5 For mass notification testing, the facility must be in a finished state and no work can be going on. It is preferred that the building be vacant for this testing. If ongoing work conflicts with the testing, the testing will be cancelled and rescheduled.

7.3-D.6 Sprinkler systems and Fire Alarm/Mass Notification Systems must be 100% completed and pre-tested prior to scheduling the final acceptance test. Pre-test documentation when required by NFPA will be onsite at the time of final testing.

7.3-D.7 Failure to comply with these requirements will result in the cancellation of testing until the requirements are met. Rescheduling will be required.

7.3-D.8 Hot work permits shall be issued for all hot work and kept current for the duration of the work. The expiration date of a permit is at the Fire Inspectors discretion. Request permit 72 hours prior to the work being conducted.

7.3-E PROJECTS WITH SPECIAL CONSIDERATIONS

7.3-E.1 Contact the Fort Carson Fire Department for assistance:

7.3-E.2 High-rise buildings.

7.3-E.3 Large malls or shopping centers.

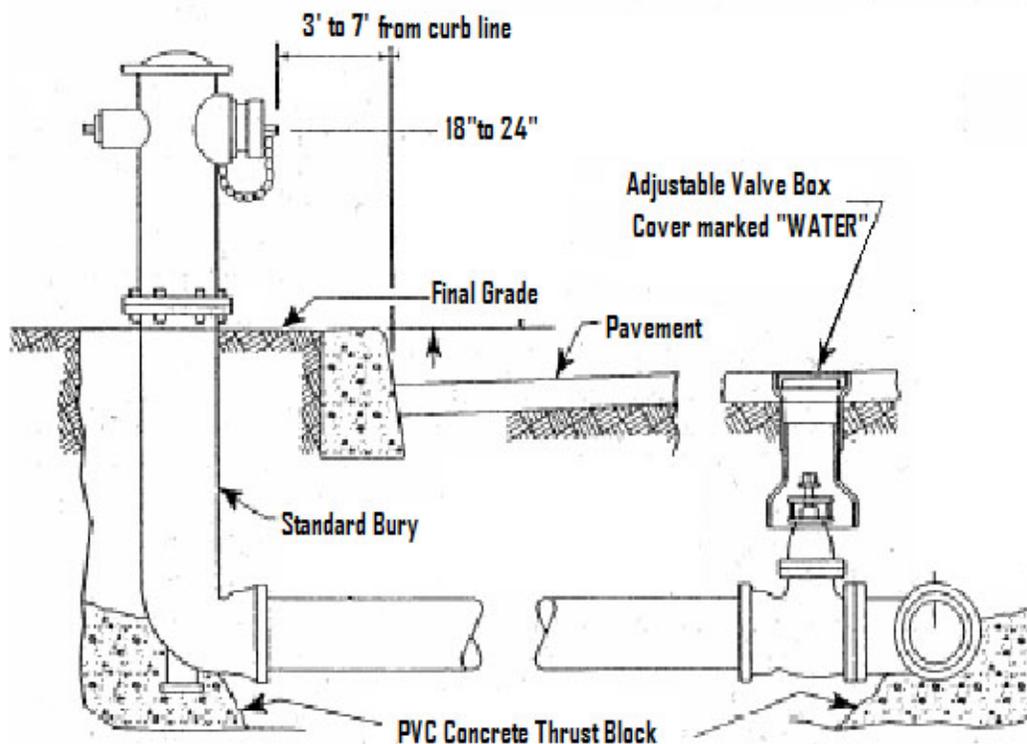
7.3-E.4 Large warehouse facilities with high - piled combustible stock requirements.

7.3-E.5 Major new developments and/or construction projects.

7.3-E.6 Projects involving large quantities of storage and/or use of hazardous materials and/or flammable liquids.

7.4 WATER SUPPLY

The regulations governing water supplies are found in UFC 3-600-01. This UFC is used as the guideline for establishing necessary fire flow, fire hydrant spacing and hydrant color coding within Fort Carson. The data included in this section will provide information for determining the needs for newly constructed or remodeled facilities. Some additional considerations and information needed to assist you are listed below.



7.5 FIRE HYDRANT CLEARANCES

7.5-A GENERAL NOTES

7.5-A.1 Hydrant nozzles shall be positioned at right angles to the curb. If no curb or sidewalk exists, nozzles shall be placed at right angles to the street or alley.

7.5-A.2 Hydrants shall be placed a minimum of 5 feet from any utility or drainage structure.

7.5-A.3 Hydrants shall open counter clockwise.

7.5-A.4 Fire hydrants must be UL listed, FM approved or listed or classified by an NRTL and must have two 2 1/2 inch and one 4 1/2 inch suction with National Standard Fire Hose Thread.

7.5-A.5 Typically, with proper fire flow requirements being met, one fire hydrant will be allowed on a dead-end 6-inch main. Two fire hydrants or one fire hydrant and one sprinkler system may be permitted on a dead-end 8-inch main.

7.5-B FIRE DEPARTMENT ACCESS:

7.5-B.1 Two points of access shall be provided to each development and every building. This is a safety consideration which helps the Fire Department avoid being blocked from reaching an emergency. It also provides the public emergency egress from an area.

7.5-B.2 Cul-de-sac or other single access situations can be addressed by keeping deadends to under 500 feet and/or by providing a wider than normal road mat. Other factors to consider include keeping road grades well within standards, installing fire suppression and detection systems, providing for intermediate turnarounds, looping water mains, and providing a secondary "emergency access only" roadway.

7.5-B.3 The emergency access provisions tend to be the least desirable solution as they tend to fall into disrepair, become obstructed with vegetation, and not be cleared of snow in winter. If an emergency access is being proposed for a development, please contact the Fire Prevention Division for an appointment to discuss your proposal.

7.5-B.4 Fire lanes are to be properly posted as required (see Sign Specifications).

7.5-B.5 Cul-de-sac to have a minimum diameter of 84 feet.

7.5-B.6 No grade greater than 10%; grade at intersections no greater than 4%.

7.5-B.7 Maximum backup distance, 150 feet; if greater than 150 feet, provide an approved turnaround (See attachment #2 for approved turnarounds).

7.5-B.8 Minimum of 20 feet of clear access throughout development posted "NO PARKING" - FIRE LANE.

7.5-B.9 Required minimum vertical access clearance, 13 feet 6 inches.

7.5-B.10 Interior streets - Inside radius of 33 feet on curves.

7.5-B.11 Vacating streets - Access to any adjoining property shall not be denied. Reach of available water for firefighting purposes not to be extended or denied.

7.5-B.12 Fire department access roadways shall: Be a minimum of 20'-0" wide; have 13'-6" vertical clearance; be maintained and unobstructed in all types of weather; be engineered and constructed to support the load of fire apparatus.

7.5-B.13 Dead-end access roads in excess of 200 feet shall be provided with an approved fire department turnaround.

7.5-C "NO PARKING FIRE LANE" SIGN SPECIFICATIONS

7.5-C.1 The "NO PARKING FIRE LANE" sign shall be 12 inches by 18 inches, red lettering on white background. There shall be a minimum clearance of one foot from the edge of the sign to the street face of the curb. The fire lane sign shall be placed at the beginning of the restriction, at the end of the restriction, and at least every 200 feet within the restricted area.

7.5-C.2 When mounted on posts, signs shall be mounted so that the bottom of the sign is 7 feet from the finished grade. Appropriate arrows will indicate the direction of the restrictions. Please contact the Fort Carson Fire Prevention Office for any alternate sign design/usage approval.

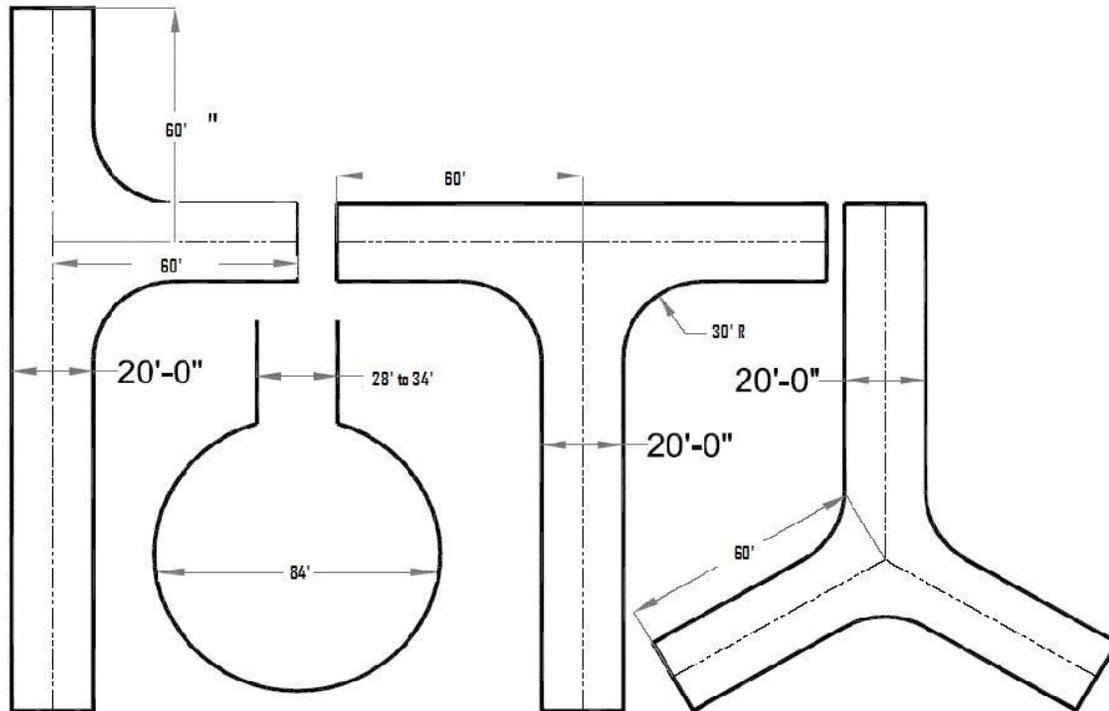
7.5-C.3 "NO PARKING FIRE LANE" signs must be posted on both sides of access roadways less than 28 feet wide and on one side of access roadways 28 feet wide but less than 34 feet wide. The signs shall be set at an angle of not less than 30 degrees and no more than 45 degrees with the lane of traffic flow, visible to approaching traffic.

7.5-D ADDRESSES, STREET NAMES, AND SIGNS

7.5-D.1 Building number signs will be of a type mandated by the Directorate of Public Works (DPW). Numbers on buildings are required to be plainly visible from the street. In Family Housing Units numbers shall be at least four inches high, 1/2" stroke; suite numbers in office and hotel-type occupancies, two inches high and 1/8" stroke.

7.5-C.2 If access to a premises is provided by a private drive or easement, or if a structure or portion of a structure is obscured by another structure or other feature, either man-made or natural, or a premises is located on the interior of a lot or block, the numeric address shall, in addition to being posted on the building, be posted in a permanent manner at a location in the nearby vicinity of the intersection of the private driveway with a public street.

7.6 APPROVED TURN-AROUNDS AND CUL-DE-SAC



7.6-A AERIAL FIRE TRUCK INFORMATION

- Wheel base: 22' 8"
- Total length: 40' 1"
- Total width: 10' Total width with jacks out: 16'
- Ladder overhang: 4"
- Minimum turning radius: 40'
- Distance from front of vehicle to center of front wheels: 7' 6"
- Distance from back of vehicle to rear wheels: 10' 6"

7.6-B APPROVED FIRE ACCESS SURFACES

7.6-B.1 1. The Fort Carson Fire Department requires all buildings be provided access, and that it be all-weather pavement of either concrete or asphalt construction.

7.6-B.2 Access roadways shall be finished by application of an all-weather driving surface of hot asphalt mix or concrete pavement over flexible base capable of supporting a design wheel load of 18,000 pounds (GVW 80,000 minimum) in conformance with the pavement design criteria manuals. The design is to be prepared and certified by a registered engineer.

7.6-B.3 Any fire department access, including decorative paving, within 100 feet of any building must meet the same vehicle wheel load criteria. These access roadways are to be properly maintained and kept clear for emergency use at all times throughout the year.

7.6-B.4 Any alternatives to these specification must be reviewed and approved by the Corps of Engineers and/or DPW Engineering prior to construction.

7.7 NFPA 704 PLACARDING

7.7-A The NFPA 704 Placarding System is a nationally recognized hazardous material labeling and identification system.

7.7-B NFPA 704 placards shall be placed at all entrances of buildings and locations where hazardous materials are stored, used, handled, or dispensed, and any other location deemed necessary to properly identify all hazardous materials that may be encountered by emergency response personnel in a fire or disaster situation.

7.7-C This requirement includes all stationary aboveground tanks containing flammable/combustible liquids and/or hazardous materials. These placards tell fire fighters what they must do to protect themselves from injury while fighting a fire in the area.

7.7-D For specific information regarding your hazardous materials, contact your supplier and request the applicable materials safety data.

7.7-E Example of Placard:



7.8 FIRE ALARM SYSTEM PLANS AND MINIMUM SUBMITTAL REQUIREMENTS

7.8-A General Guidance

7.8-A.1 When there are more than 25 input devices on a system, an "addressable" system shall be used.

7.8-A.2 When required, Fire Alarm Systems shall report to the Fire Department Emergency Communication Center, Located at the Fire Station, Bldg, 1805, via a Monaco Radio Transmitter (frequency 141.3625).

7.8-A.3 Plans shall be designed IAW UFC 3-600-01, UFC 4-021-01 and NFPA 72. Refer to Attachment #1 for Mass Notification requirements.

7.8-A.4 All fire alarm systems are to be properly labeled. A graphic map shall be provided showing the zones of coverage. Maps will be installed at the main fire alarm control panel and at any annunciator panel locations. Maps must be mounted in a professional manner. The map must be mounted in a fashion that is properly orientated to how the facility actually faces. Maps at a minimum will show the following items:

- Initiating devices with appropriate addresses.
- All panel locations, to include mass notification local operator consoles (LOC's).
- End of line resistor locations.

- Building number.
- “You are here” indicator.
- Room numbers.
- Power booster supply locations.
- **Accurate floor plan to include all doors and walls.**
- Duct detector remote test switches.
- North indicating marker.
- Isolation modules.

7.8-B DRAWINGS Shall be submitted as described:

7.8-B.1 Floor Plan Drawn to scale:

- Device locations.
- Type of device.
- Alarm panel locations and remote annunciator Panel location
- Conduit connections and size
- Type and size of wire or cable.
- Exterior mounted devices, weather proof.
- Transmitter and antenna Location

7.8-B.2 Point-to-Point System Wiring Diagram:

- Interconnection of identified devices and controls.
- Type of power feed to control panel.
- Exterior connection of modules.

7.8-B.3 Symbol List (legend) and Equipment Identification on Drawing:

- Symbols to be used on drawings.
- Symbol description.

7.8-C Attachments to Drawings

7.8-C-1 Manufacturing Data Sheets on all Equipment Used.

7.8-C-2 Battery Calculation Sheet.

- Standby power consumption of all current drawing devices times the hours required by minimum requirement by NFPA
- Alarm power consumption of all current drawing devices times the minutes required by minimum requirements by NFPA.
- Formula format for battery calculations.

7.9 Fire Alarm Notification Location Requirements

7.9-A This list is not all inclusive, areas not indicated on the list will be looked at on a case by case basis. The rooms requiring notification devices, both audio and visual unless otherwise indicated, include, but not limited to:

7.9-A.1 Reception lobbies

7.9-A.2 Waiting rooms, lobbies

7.9-A.3 Conference/meeting rooms

- 7.9-A.4** Corridors for public areas
- 7.9-A.5** Restrooms (visual only, unless showers are present)
- 7.9-A.6** Restrooms serving four or more stalls will have both audio and visual devices not to exceed 115db
- 7.9-A.7** Elevator lobbies
- 7.9-A.8** School office areas
- 7.9-A.9** School health/nurse rooms
- 7.9-A.10** Places of assembly: theater, auditorium, gymnasium etc.
- 7.9-A.11** Classrooms
- 7.9-A.12** Handicap & hearing impaired rooms etc.
- 7.9-A.13** Locker/shower rooms
- 7.9-A.14** Indoor pool areas
- 7.9-A.15** Public lodging laundry rooms
- 7.9-A.16** Break/lunch rooms
- 7.9-A.17** Dining/cafeteria rooms
- 7.9-A.18** Sales floors/customer areas
- 7.9-A.19** Music practice rooms
- 7.9-A.20** Single offices great than 200sq ft.
- 7.9-A.21** Open office spaces
- 7.9-A.22** Mechanical/electrical/data/phone/utility rooms greater than 400 sq ft.
- 7.9-A.23** Mechanical/electrical/data/phone/utility rooms less than 400 sq ft. when no exterior devices are in close proximity
- 7.9-A.24** Medical exam/treatment/patient care rooms
- 7.9-A.25** Copy/mail rooms greater than 100 sq ft.
- 7.9-A.26** Open work areas greater than 100 sq ft. This encompasses hangers, motor pools, woodshops etc.
- 7.9-A.27** Storage Rooms over 300 sq ft.

7.10 AUTOMATIC FIRE SPRINKLER SYSTEM REQUIREMENTS

7.10-A Fire sprinkler systems shall meet the criteria of UFC 3-600-0 1 and all applicable provisions of the most current versions of NFPA 13, NFPA 13-R and NFPA 13-0. Plan submittal with required approval, and associated inspections must be secured through the Fort Carson Fire Department, Fire Prevention Office.

7.10-B A set of drawings are required to be submitted to the Fort Carson Fire Department, Fire Prevention Branch and shall include, but are not limited to the following items:

- 7.10-B.1** Piping locations.
- 7.10-B.2** Pipe sizing.
- 7.10-B.3** Hanger locations and hanger details.
- 7.10-B.4** Head locations and details.
- 7.10-B.5** Existing system components (if applicable).
- 7.10-B.6** Riser specifics including valves and gauges.
- 7.10-B.7** Hydraulic calculations.
- 7.10-B.8** Other items of concern if deemed necessary by the Fire Protection Systems Specialist.

7.10-C Fire Department Connections (FDC) shall be immediately discernable. A minimum of three feet clear space shall be maintained from any FDC or any outside fire protection control valve. A

minimum of three feet clearance shall be maintained from the riser area, for the purpose of maintenance. The FDC shall be installed at locations approved by the Fort Carson Fire Department and on the side of the structure in which the building address numbers are placed and/or approach to the building is made. This shall be facing the street, which the building is addressed.

7.10-D A fire hydrant, capable of supplying the system, shall be within a maximum of 150 feet from the FDC and no closer than 40 feet to the building. If special building conditions and/or restrictions exist and the FDC cannot be located per these guidelines, approval by the Fort Carson Fire Department for an alternate location must be obtained.

7.10-E Sprinkler valves shall be secured and properly labeled per the provisions of NFPA 13. In buildings with automatic sprinkler systems, that are protected with fire alarm systems, valves shall be connected into the supervisory alarm circuit and shall be monitored through the fire alarm system.

7.10-F Sprinklers that require a 200-pound hydrostatic test procedure shall have the test witnessed and approved by the Fort Carson Fire Prevention Branch.

7.10-G Sprinkler piping and hangers shall not be covered and/or concealed by any means prior to being inspected and approved by the Fort Carson Fire Department. THIS INCLUDES DROP GRID STYLE CEILINGS.

7.10-H Automatic fire sprinkler systems shall be provided with flow switches zoned per floor in multi-story building. A minimum of one flow switch per floor is required. Additional flow switches may be required on individual floors as deemed necessary, due to special building characteristics, i.e. large floor areas, different occupancy types or uses, or special concern on the part of the Fire Department which would warrant their installation. All buildings with sprinkler systems shall be monitored by the Fort Carson Fire Department Emergency Communication Center via the Radio Alarm Reporting System.

7.10-I Any floor or area of the building, which is required to have flow switches, as outlined above shall have an isolation valve installed with a corresponding tamper switch. Tamper switches shall be wired so that it will send in a trouble signal on the same zone as the corresponding zone flow alarm.

7.10-J Tamper switches shall be provided on all automatic sprinkler systems, which have flow switches and isolation valves installed.

7.10-K On dry systems, a low air and high air indication shall be supplied that will send in a supervisory signal to the Communication Center.

7.10-L All standpipe, automatic fire sprinkler systems, fire department connections and valves shall be properly identified, so as to indicate clearly what each component or each piece of equipment serves.

7.10-M In buildings used for high-piled combustible storage, fire protection shall meet the criteria of the applicable provisions of NFPA 13.

7.10-N Buildings under construction shall have fire protection equipment installed and maintained in accordance with NFPA Standards.

7.10-O Shelving units and shelves shall be constructed as not to provide storage closer than two feet below any ceiling, nor closer than 18 inches below the horizontal plane of any sprinkler head deflector.

7.10-P Suitable signage shall be provided on the door of the enclosure in which any sprinkler system valves/controls are located, stating "Fire Sprinkler Control Valves" in two-inch high block letters with a stroke of not less than $\frac{1}{8}$ inch and of a color contrasting with its background. Valves or switches which are located within building elements must also be identified in an approved, suitable, and easily identifiable method or manner at the point/location giving access to said valve or component.

7.10-Q An exterior horn/strobe device to indicate water flow is to be properly placed within 20 feet of the fire department connection.

7.10-R On buildings where more than one outside horn/strobe device is being installed for fire alarm systems, each unit shall be properly identified, utilizing permanent signage with 2 -inch high letters minimum, indicating which horn/strobe device is for which type of system.

7.10-S Free standing post indicator valves will be installed for all fire sprinkler systems. These are to be supervised through the facilities fire alarm system.

7.11 POST INDICATOR VALVE CLEARANCE

7.11-A GENERAL NOTES

7.11-A.1 PIV's are to be electronically supervised through the facilities fire alarm system.

7.11-A.2 PIV installation must meet the manufacturers recommended installation instructions.

7.11-A.3 Post-indicator valves shall be located not less than 40 ft from buildings. If 40 ft cannot be achieved and the valve must be installed closer it must be done so with a written request and approval from the Fort Carson Fire Prevention Office.

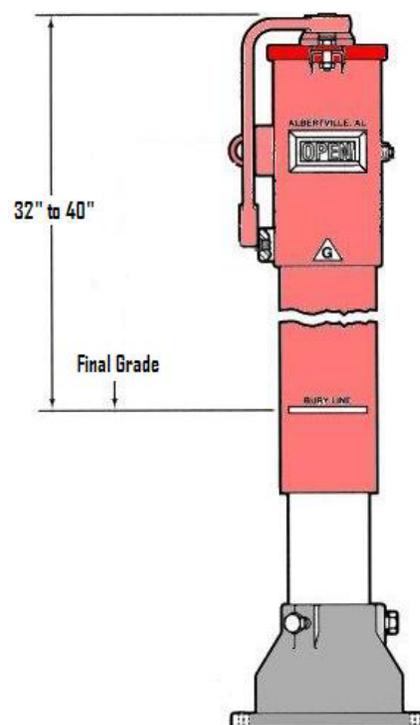
7.11-B STANDPIPE REQUIREMENTS

7.11-B.1 Standpipes shall be installed in accordance with NFPA Standard 14.

7.11-B.2 CLASS I wet standpipes shall be required within facilities that meet the following criteria:

- CLASS I wet standpipes shall be required within facilities that meet the following criteria: Buildings that are 4 stories in height or greater.
- When the distance between the closest exterior placement of fire apparatus to the furthest point within the facility is in excess of 300 feet.
- Exit travel distance from within the facility exceeds 150 feet in non-sprinkled buildings and 200 feet in sprinkled buildings.

7.11-C BOLLARDS: Bollards are required to protect fire hydrants and PIV's whenever they are subjected to mechanical damage.



7.12 COMMERCIAL COOKING FIRE EXTINGUISHING SYSTEMS

7.12-A Cooking hood extinguishing systems, provided for protection of kitchen grease hoods and ducts, will be reviewed at the time of submittal. For complete review to take place the following information shall be provided:

7.12-A.1 A set of drawings shall be submitted to the Fort Carson Fire Department, Fire Prevention Branch.

7.12-A.2 Description of extinguishing system type (automatic sprinkler, carbon dioxide, dry chemical, or liquid agent).

7.12-A.3 Type of system design - Either an engineered system or a pre – engineered system.

7.12-A.4 Cooking hood-extinguishing systems shall be designed and installed in accordance with the most current editions of UFC 3-600-01, NFPA 13, 17a, NFPA 96, and Uniform Mechanical Code.

7.12-A.5 Engineered and pre-engineered systems shall contain full details of system design.

7.12-A.6 Design shall specifically note interconnection for fuel supply shutoff, ventilation control, damper control, associated ducting system, alarm re-transmission, etc.

7.12-A.7 Alarm transmission – The system is required to be interfaced with the fire alarm control panel and a Monaco Transmitter through a dedicated zone. This shall be indicated on the plans. Alarm transmission will be verified at the time of field inspection.

7.13 HIGH-PILED STOCK

7.13-A High-piled combustible storage is combustible materials in closely packed piles more than 15 feet in height or combustible materials on pallets or in racks more than 12 feet in height. For certain special hazardous commodities such as rubber tires, plastics, some flammable liquids, idle pallets, etc., the critical pile height may be as low as 6 feet.

7.13-B If your organization is planning for any type of storage such as this, we highly recommend that you contact the Fort Carson Fire Department, Fire Prevention Branch in the initial stages of planning and design. Special consideration, as well as numerous options, may be available. Design engineers may be needed to properly assist you with all applicable details of this standard.

7.13-C It also may be necessary to provide details of several special aspects of design criteria critical to NFPA requirements. These areas may include:

- Special designed NFPA Series Sprinkler Systems.
- Special design fire alarm systems.
- Smoke and heat removal systems.
- Curtain boards.

7.13-D Please contact the Fort Carson Fire Prevention Office for assistance on this and any other questions regarding this article. Special forms and/or submittals may be required by the Division to satisfy requirements related to this article.

7.14 EXIT SIGN REQUIREMENTS

7.14-A Exit signs shall be installed as required by NFPA 101 and NFPA 70.

7.14-B Exit signs shall be installed when an exit serves an occupant load of 50 or more.

7.14-C Additional exit signs, lights, or markings may be required to assure that the exit path is easily identified regardless of the occupant load.

7.14-D Illumination of exit signs is required where occupant loads served by the exiting system exceeds 100.

7.14-F Where these signs are required to be illuminated, they SHALL be of the red lettering type.

7.14-G Exit signs shall be installed at all required exit doorways and where otherwise necessary to clearly indicate the available egress systems. If two or more exits are required, each of the respective exit ways must be indicated with signs to clearly indicate each individual exit egress system.

7-15 RAPID ENTRY EQUIPMENT (When Required)

Any building equipped with a monitored fire protection (suppression and/or detection) system, when access to or within a structure or area is unduly difficult because of secured openings, where large amounts of hazardous materials are stored, or where immediate access is necessary for life-saving or fire fighting (i.e. locked apartment buildings) shall have approved rapid entry equipment installed in an accessible area.

7.15-A Approved Type: Key lock boxes and similar products manufactured by the Knox™ Company are the only type approved by the Fort Carson Fire Department. All Knox™ products shall be ordered directly through the Fire Prevention Branch.

7.15-B Required Keys

7.15-B.1 The Knox™ Box shall contain no fewer than two (2) labeled sets of keys. The key sets shall include:

- Any key that will provide Fire Department emergency responders access to all areas of the building.
- Rooms with fire detection and/or fire suppression equipment.
- Those required to operate the fire protection equipment.
- In structures equipped with elevators, one (1) key for each elevator car.
- When electronic locks are employed in any portion of the building, two (2) copies of the appropriate codes and/or electronic key-cards shall be supplied.

7.15-C Placement of the Key Box: The key box shall be installed at a location approved by the Fort Carson Fire Department (normally adjacent to the main entrance). The box shall be clearly visible and mounted in accordance with the manufacturer's recommendations (6 feet above the finished grade but no higher than 8 feet to the top of the box).

7.15-D Marking the Building: Fire Prevention requires a window decal placed near the main entrance to alert fire fighters that a key box is provided. One (1) decal is included when the Knox™ Box is shipped.

7.15-E Override Switches: A Knox™ Key Switch is the only application that we allow on electronic gates. They operate similar to any other type of electronic switch. An advantage of this device is that it allows us to keep the gate in the open position to allow other responding emergency vehicles access thus reducing response times.

7.15-F Padlocks: In many situations it is critical to restrict access across a driveway or roadway, however, these areas must also remain accessible to the Fire Department in case of an emergency. A Fire Department provided padlock or Knox™ padlocks are required where a chain or manual gate is being utilized in this manner.

7.15-F.1 Coordinate with the Fire Department to verify the shackle size and that the links on the chain are large enough to allow the padlock shackle to pass through the chain or shackle.

7.15-F.2 Utilizing two padlocks - - A standard lock and one manufactured by the Knox™ Company can be hooked together as indicated on the diagram below. This will allow access to both the owner (by unlocking the standard lock) and the Fire Department personnel (by unlocking the Knox™ lock) through. NOTE: Model 3752 does not work well with this type of application.

7.15-F.3 APPROVED PADLOCK INSTALLATION

- Knox™ Padlock (Keyed for Fire Department access)
- Standard Padlock (Keyed for owner's access)

7.15-F.4 Lockup: When your Knox™ Equipment is ready to be locked, please contact the Fire Prevention Office at 526-2679 (main number). A Fort Carson Fire Inspector will be scheduled to perform the lockup. As such, 3 business days notice is necessary.

7.16 FORT CARSON MASS NOTIFICATION REQUIREMENTS

7.16-A Background: Mass notification provides real-time information and instructions to people in a building, area, site, or installation using intelligible voice communications along with visible signals, text, and graphics, and possibly including tactile or other communication methods. The purpose of mass notification is to protect life by indicating the existence of an emergency situation and instructing people of the necessary and appropriate response and action.

7.16-B Purpose: This section is for information only. It is to aide in the design, installation, inspection and final acceptance of the Mass Notification System (MNS). The requirements of all applicable Codes, Standards and Unified Facilities Criteria still apply and take priority over anything stated in this information sheet.

7.16-C Abbreviations

ACU Autonomous Control Unit
ADAAG Americans with Disabilities Act Accessibility Guidelines
ABAAG Architectural Barriers Act Accessibility Guidelines
CIS Common Intelligibility Scale
DOD Department of Defense
FACP Fire Alarm Control Panel
FAS Fire Alarm System
HVAC Heating, Ventilation, Air Conditioning
LOC Local Operators Console
MNS Mass Notification System

NFPA National Fire Protection Association
UFAS Uniform Federal Accessibility Standards
UFC Unified Facilities Criteria
UL Underwriters Laboratories, Inc.

7.16-D Review/Installation Process

7.16-D.1 Waivers and Exemptions: This is the requester's responsibility to accomplish in accordance with UFC 4-021-01. This cannot be accomplished at a local level.

7.16-D.2 The building MNS shall be designed in accordance with the most current UFC 4-021-01.

7.16-D.3 A combined system is required on Fort Carson.

7.16-D.4 The Fort Carson Fire & Emergency Services Fire Prevention Office is required to review all project drawings prior to installation.

7.16-D.5 All review comments made by the Fire Prevention Office must be answered, changes implemented and drawings updated prior to installation.

7.16-D.6 Any field changes required in the field during installation must be communicated to the appropriate Fire Inspector prior to the changes taking place.

7.16-E Mass Notification Components: Autonomous Control Unit (ACU): The ACU is used to monitor and control the MNS notification appliance network.

7.16-E.1 The ACU shall form a combined system with the FACP. These control panels may be co-located in the same enclosure or may be physically separated.

7.16-E.2 Actions taken at the ACU will take priority over actions taken at any other location.

7.16-E.3 The ACU shall be integrated with the building fire alarm control panel.

7.16-E.4 The ACU panel will be designed in a locked cabinet. This is typically installed in the same enclosure with the fire alarm system.

7.16-E.5 Removal of glass panels so occupants can utilize MNS functions is not acceptable.

7.16-E.6 For facilities where just one LOC is required. It may become necessary to install the LOC next to the ACU and FACP.

7.16-E.7 Integration with a public address system is typically not allowed on Fort Carson. This must be addressed and decided upon during the design phase.

7.16-E.8 Activation of the fire alarm system during a MNS event will immediately cancel out the MNS until MNS is reactivated.

7.16-E.9 MNS will override fire alarm audible messages and visual signals for no longer than one minute. At the end of one minute the fire alarm must reactivate.

7.16-E.10 Fire and MNS notification appliance network devices will not stay activated in conjunction with each other. When one is on the other is completely off.

7.16-E.11 Be a listed combination system with the fire alarm system as described in NFPA 72 and meeting UL Standard 864 and the specific requirements of UFC 4-021-01.

7.16-E.12 Have the ability to interrupt public announcements and silence building background music while delivering voice messages.

7.16-E.13 Be able to switch between MNS and fire alarm notification functions without generating trouble alarms in either system.

7.16-E.14 Have the capacity for multiple pre-recorded messages (at least eight). If not known, contact project representative for the required messages.

7.16-E.15 The system shall deliver messages quickly.

7.16-E.16 The termination of a message shall be automatic when the equipment can accommodate it. Messages will play no less than 3 minutes and no more than 10 minutes before automatically shutting off.

7.16-E.17 Provide a supervisory signal if the MNS is used to override fire alarm. The supervisory signal shall be annunciated at the FACP, any remote fire alarm annunciators and be transmitted to the fire department. This supervisory signal shall be separate from other fire alarm system supervisory signals.

7.16-E.18 Provide a complete set of self-diagnostics for the controller and appliance network.

7.16-E.19 Have a local diagnostic information display.

7.16-E.20 Provide a local system event log file.

7.16-E.21 All programming codes or passwords shall be provided to the DOD installation no later than the date of final system acceptance.

7.16-F Power Supply Features

7.16-F.1 Be capable of accepting 120/240 VAC, 50/60 Hz.

7.16-F.2 Be appropriate for a MNS/FACP system that meets at least the minimum NFPA 72 requirements.

7.16-F.3 A standby source of power shall provide a minimum of 60 minutes of mass notification at the maximum connected load.

7.16-F.4 Conform to applicable sections of NFPA 72.

7.16-F.5 Only use Commercial Off-the-Shelf Equipment in accordance with UFC 4-021-01

7.16-G Local Operator Console (LOC) A LOC is a unit designed to allow emergency response forces and building occupants to operate the individual building MNS, including initiating delivery of pre-recorded voice messages, providing live voice messages and instructions, initiating visual strobe and alphanumeric message notification appliances, overriding external voice announcements, and terminating mass notification functions. Not all functions that could be performed at the ACU are necessarily available at a LOC.

7.16-G.1 Provide a single switch or operating mechanism capable of shutting down all HVAC equipment in the facility in accordance with the requirements of UFC 4-010-01.

7.16-G.2 The HVAC switch can be located within a LOC.

7.16-G.3 Provide a LOC to allow emergency response forces and building occupants to access the MNS and originate messages in emergency situations from locations in the building other than from the ACU.

7.16-G.4 Do not place a LOC inside a locked room or area.

7.16-G.5 Be protected in a small, wall-mounted enclosure and also be protected from tampering by use of a finger turn latching device to hold the panel door closed. No other securing method may be used, such as, keys and magnets.

7.16-G.6 Make a LOC available for use by visitors in those facilities open to unescorted visitors or to the public.

7.16-G.7 Install a LOC at those facility entrances/exits that will be used when building access is limited because of elevated terrorism threat levels.

7.16-G.8 Provide a LOC so that occupants do not need to travel more than 200 ft. horizontally or to travel to other floors to access a LOC.

7.16-G.9 Have an easy method (such as individual manual activation push buttons) of activating the MNS pre-recorded messages.

7.16-G.10 Signage shall be provided to allow rapid recognition of the means of initiating the pre-recorded messages.

7.16-G.11 Have signage on the outside of the enclosure similar to "Mass Notification" and "HVAC Emergency Shutdown" (if applicable).

7.16-G.12 Regardless of what LOC button is pressed, another LOC or the ACU, must be able to cancel or override the current functions. The ACU, however, takes over-all priority.

7.16-G.13 Must be designed and installed to meet ADAAG/ABAAG requirements (This would be treated with the same height requirements as a fire alarm pull station).

7.16-H Audible Appliance Network

7.16-H.1 Provide appliances capable of satisfying all UFAS and ADAAG/ABAAG requirements.

7.16-H.2 Use speakers suitable for the intended climatic and environmental conditions.

7.16-H.3 Use speakers suitable for installation in commercial/industrial applications with consideration of electrically hazardous (classified) locations.

7.16-H.4 Speakers shall meet the listing requirements of UL Standard 1480.

7.16-H.5 System design shall comply with NFPA 72.

7.16-H.6 Provide speakers at all locations inside a building where the building fire alarm must be audible. MNS and FAS speakers can be shared.

7.16-H.7 Provide speakers mounted on the exterior of the building in areas commonly used by building occupants for a distance up to 16 ft from the building.

7.16-H.8 Use speakers with directional characteristics that transmit minimal backplane noise when mounted on the sides of the building.

7.16-H.9 The speakers shall be located near entrance/exit doors.

7.16-H.10 Install speakers with field-adjustable tap settings that allow for adjustments.

7.16-H.11 Do not use speakers exceeding 15 watts for indoor applications.

7.16-H.12 Wiring methods shall comply with NFPA 72.

7.16-H.13 Ensure that a CIS score greater than 0.8 is provided in each area where building occupants normally could be found. *Note: CIS values of 0.75 through 0.84 will be rounded to 0.8.*

7.16-H.14 Areas of the building provided with hard wall and ceiling surfaces that are found to cause excessive sound reflections may be permitted to have a CIS score less than the minimum required value if the building occupants in these areas can determine that a voice signal is being broadcast and they must walk no more than 33 ft to find a location with at least the minimum required CIS value within the same area.

7.16-H.15 Areas of the building where occupants are not expected to be normally present are permitted to have a CIS score less than the minimum required value if personnel can determine that a voice signal is being broadcast and they must walk no more than 50 ft to a location with a CIS score of at least the minimum required value within the same area.

7.16-H.16 For cavernous-type open areas, refer to the UFC.

7.16-H.17 Measurements should be taken near expected head levels

7.16-H.18 There must be no squeal/feed-back when operating the microphones.

7.16-H.19 Exterior speakers will sound both fire and MNS announcements as applicable.

7.16-I Visual Appliance Network

7.16-I.1 Provide visual appliances capable of satisfying all UFAS and ADAAG/ABAAG requirements.

7.16-I.2 Use visual appliances suitable for the intended climatic and environmental conditions.

7.16-I.3 Use visual appliances suitable for installation in commercial/industrial applications with consideration of electrically hazardous (classified) locations.

7.16-I.4 MNS strobes are not required outside the building.

7.16-I.5 Wiring methods shall comply with NFPA 72.

7.16-I.6 Provide amber-colored strobes with white housings that are factory marked with the word "ALERT" to alert the hearing impaired.

7.16-I.7 Amber strobes activated in conjunction with the delivery of a pre-recorded voice message shall operate continuously until message termination.

7.16-I.8 Amber strobes activated in conjunction with the delivery of a live voice message shall operate during the message and for not less than 15 seconds after the message ends.

7.16-I.9 MNS strobes will be co-located with fire alarm strobes inside the facility.

7.16-I.10 In corridors or long rooms, where both sets of strobes are mounted horizontally of each other, they will be staggered so that the lenses are at different heights of each other. Height requirements of NFPA 72 still apply with this application.

7.16-I.11 Combined visual and audio devices may be used.

7.16-J Fort Carson Monaco Transmitter Requirements: Fort Carson utilizes Monaco BT-XM communicator to combine the Fire Alarm and Mass Notification systems to communicate to the Base Monaco D21 central station.

General Transmitted zones for BT-XM:

Zone Number	Description
1	General Alarm
2	Water flow
3	Supervisory
4	Local Panel Trouble
17	Mass Notification Activation
18	Mass Notification Panel Trouble

Monaco Parts required for Mass Notification:

Part Number	Description
227-623-141.3625	BT-XM Communicator
176-212-00	Expansion backplane
176-206-00	Zone expansion card
176-214-00	Relay board

Building Indoor Prerecorded Messages

Message Number	Description
1	Severe thunderstorm (Severe thunderstorm warning. A severe thunderstorm warning has been issued)
2	National security (Attention... A national security warning has been issued. Please go inside and tune to your local television or radio station. Remain calm)
3	Emergency evacuation (Attention... This is an emergency evacuation order. Remain calm. Follow the emergency officials. Remain calm)
4	Gate closure (Attention... This is a gate closure advisory. Standby for a gate closure announcement)
5	Bomb Threat (A Bomb Threat has been issued for this facility please evacuate Remain calm)
6	Shelter In Place (Shelter In Place, wait for further instructions, Remain calm, listen for further instructions)
7	All Clear (Attention please..., Attention please..., An all clear to the previous alert has been issued..., An all clear to the previous alert has been issued)