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Section G – Sitework and Utilities

G0010 – General Site Requirements

Introduction

This section includes requirements for general site improvements at the University of Colorado-Boulder (UCB). UCB is the Authority Having Jurisdiction (AHJ) for all improvements on the campus with exception to certain regulated utilities such as gas and electrical mainlines where Xcel Energy is the AHJ. See **Facility Standard G3000** or individual **G30 Site Utilities** sections for more specific utility requirements.

The most recent City of Boulder Design and Construction Standards are incorporated by reference into the site portions of the Facility Standards. In some cases, UCB may refer design review to the City of Boulder, however, the UCB Civil Engineer must approve, in writing, any deviation from these standards, prior to construction.

UCB Requirements

1. Geotechnical Report/ Subsurface Exploration:
    a. Confirm with the UCB Civil Engineer if a Geotechnical Engineer will be required to conduct a geotechnical investigation and prepare report for the project.
    b. If there is conflict between the UCB Facility Standards, the recommendations of the geotechnical report or the City of Boulder Design and Construction Standards, the more stringent shall apply.

2. Standard Details:
    a. Refer to **Appendix G0000.1** for UCB Standard Details pertaining to site and civil installations.
    b. Provide designs in compliance with the UCB Standard Details.

3. Existing Conditions, Tree and Landscape Protection:
    a. Protect structures or other features designated to remain against accidental damage.
    b. Tree and plant protection requirements are identified in **Facility Standard G1040**.

4. Contractor Submittals:
    a. Pedestrian and traffic control plan.
    b. Photographs of existing conditions.
    c. Complete manufacturer's data for all site materials and chemicals used, including:
        1) Manufacturer's Safety Data Sheets (MSDS).
        2) Location and method of application.
    d. Confined space access plans and proposed work schedules.

G0011 – Site Storm Drainage Criteria

Introduction

In many areas of the campus, the existing storm infrastructure does not have capacity to convey runoff events exceeding the 5 or 10-year events event. The project drainage system design must incorporate an assessment of upstream and downstream capacity and include appropriate design to convey major (100-year) storm events without flooding the project or adjacent buildings.

UCB Requirements

1. Reference Standards:
    a. The City of Boulder Drainage Criteria and Urban Drainage and Flood Control District (UDFCD) Urban Storm Drainage Criteria Manual (USDCM), Volume 3, Best Management Practices, latest edition.
    b. Strict implementation of stormwater management techniques meeting the 2009 Edition of LEED Stormwater Design – Quantity Control SS Credit 6.1 and Stormwater Design – Quality Control SS Credit 6.2, or LEED v4 Sustainable Sites Credit for "Rainwater Management".
    c. UCB encourages creativity and innovative implementation of Low Impact Development (LID) stormwater water quality systems. Where proposed stormwater solutions are not specifically defined or technically supported in either the City of Boulder manual or USDCM, the designer may reference applicable technical research from the New Jersey Stormwater Best Management Practices Manual or State of Washington Stormwater Management Manual.
    d. Creative stormwater systems must conform with State of Colorado Water Law.

2. Reference Reports:
    a. Meet with UCB to review drainage conditions surrounding project and to obtain current version of relevant reference reports.

3. Stormwater Management and Performance Goals:
    a. All campus projects including new buildings, building renovations, utility projects, road improvements, or parking projects require evaluation and incorporation of appropriate stormwater improvements to correct existing unfavorable drainage conditions, or to mitigate adverse impacts caused by the project.
    b. All projects must facilitate passage of upstream runoff to a downstream location that will not cause flooding or otherwise adverse impacts.
    c. Where existing UCB storm sewer infrastructure is often at capacity, and where above-ground extended detention is discouraged, projects must incorporate strategies to reduce runoff from the project area to the maximum extent practicable using Low Impact Development (LID) techniques and by minimizing project net impervious area.
    d. Meet with the UCB Civil Engineer and UCB Landscape Architect to discuss opportunities for meeting the following Water Quality and Quantity goals:
        1) Provide stormwater water quality systems to capture and treat minimum of 90% of the project runoff from a 2-year 24-hour storm (the Water Quality Event).

2) Provide LID Best Management Practices (BMPs) capable of removing 80% of post-development Total Suspended Solids (TSS).
3) Manage peak flows to pre-project levels or better to the extent practical. Implement reduction in runoff volume when existing project sites have more than 50% imperviousness.
4) Specific BMP Performance Requirements:
    i. Appropriate for potential TSS pollutant source.
    ii. Minimize maintenance and include pretreatment where appropriate.
    iii. Retain and enhance existing natural infiltration zones, wherever possible.
    iv. Maximize natural water quality processes including biological uptake and evapotranspiration.
    v. Maximize flow attenuation, wherever possible.
    vi. Minimize concentrated flows and maximize disconnected impervious areas.
    vii. Minimize BMP disturbances by routing the Water Quality Events through BMPs while bypassing runoff exceeding the Water Quality Event directly to the storm sewer or road conveyance system.
    viii. Shall compliment adjacent drainage and water quality strategies.
    ix. Shall be protected from site construction activities.
    x. Mitigate mosquito growth by minimizing term of standing water.
5) Preferred techniques mimic natural systems and blend seamlessly with campus landscape architecture. Examples of preferred techniques include:
    i. Water Quality Swales
    ii. Rain Gardens
    iii. Bioretention
    iv. Porous Pavers in-lieu of asphalt or concrete, where appropriate.
    v. Sand Filters
    vi. Infiltration Systems:
        a. Geotechnical permeability tests are required.
        b. Consider and mitigate potential migration of infiltrated water through utility trenches or into adjacent buildings.
        c. Incorporate underdrains to avoid overloading and saturated conditions.
    vii. Underground Detention
    viii. General reduction of concentrated flows.
    ix. See USDCM, Volume 3, Chapter 4 for Treatment BMP Fact Sheets.

4. <u>Drainage Study:</u>
    a. Provide a drainage study for projects disturbing over 10,000 square feet, or as directed by the UCB Campus Civil Engineer.
    b. Follow the City of Boulder outline format, addressing the criteria listed below at a minimum:
        1) Prepare a Conceptual Drainage Study during the Program Plan Phase to assist with appropriate infrastructure budgeting, and:
            i. Identify intent, methodology, and conceptual layout for addressing:
                a. Offsite tributary flows
                b. Management of developed flows
                c. Effects on existing downstream campus projects and infrastructure

d. Demonstrate how the proposed design meets requirements of the campus' drainage goals.

2) Preliminary and Final Drainage Studies:
   i. Follow the outline for "Preliminary Storm Water Report and Plan" or "Final Storm Water Report and Plan," as noted in Chapter 7 of the City of Boulder Design and Construction Standards.

G0020 – General Landscape

Introduction

The campus intent is to provide a consistently beautiful environment in keeping with the commitment to providing a world-class education. A health and robust landscape plays an important role in the recruitment and retention of both students and faculty. The exterior spaces at UCB are an integral component to the campus architectural character and the design consultant is expected to treat the site design as equal to the architectural design.

Irrigation systems are considered a campus utility and the standards are found in **Facility Standard G3040**.

UCB Requirements

1. UCB Review:
   a. Pre-Design Meeting:
      1) Meet with UCB Landscape Architect, UCB Civil Engineer and designated UCB Landscaping, Irrigation and Grounds Staff to determine project goals and to identify strategies for maintaining and adding to the existing campus landscape.
   b. Construction Inspections:
      1) UCB Landscape Architect, UCB Lead Arborist and designated UCB Landscaping, Irrigation, and Grounds Staff need to be represented at any site construction inspections or punch-list walks. Confirm invite list with UCB PM.

2. General Landscape Requirements:
   a. Campus site design should be simple, reinforce the scale and context of the area in which they are located, and contribute to the quality of the campus experience.
   b. Provide positive drainage away from building.
      1) Consider settling of soils at the foundation wall when setting the slope percentage away from the building.
   c. Planting Window:
      1) In general, the planting window on campus is from April 1st to October 15th. Any planting outside of these dates requires approval from UCB.
   d. Trees:
      1) Existing trees are to be preserved wherever possible. Refer to **Facility Standard G1040** for requirements.

2) To avoid planting trees over existing or future utilities, coordinate planting locations with UCB Utilities group.

e. Plantings:
   1) Obtain list of non-preferred or restricted plantings from UCB prior to specification of plantings.
   2) Minimal and easy maintenance for all plantings.
   3) Provide specific information on planting depths in the construction documents, as plants are frequently planted at improper depths.
   4) Wherever possible and practical, plant material should be drought tolerant and require minimal irrigation.
   5) Consider seasonal changes and incorporate plant material with winter interest. Also consider salt tolerant species due to the campus use of salt-based ice abatement products during the winter months.
   6) Ability to resist disease and insect infestation should be considered.
   7) Select plant material appropriate for the region and the campus environment.
   8) Avoid non-native plant material known to be invasive in this region.

f. Warranty:
   1) Warranty period is one full calendar year plus a minimum of one full growing season after Final Acceptance of Landscape work.
   2) During the warranty period and at no additional cost to UCB:
      i. The contractor shall replace any trees, shrubs or ground cover that are dead, or that are, in the opinion of the UCB Landscape Architect or Lead Arborist, in un-healthy, or unsightly condition, or that have lost their natural shape due to dead branches or excessive pruning of dead branches.

3. <u>Soil Preparation:</u>
   a. Soil Analysis:
      1) Determine gradation, soil classification, pH, mineral content, organic content, and deleterious material of soil.
      2) Incorporate nutrients and amendments to the soil based on testing analysis to bring soil to optimum growing conditions.
   b. Soil Requirements:
      1) New topsoil shall be fertile, friable, natural loam surface soil reasonably free of subsoil, clay lumps, brush, weeds, roots, stumps, stones, litter, or other extraneous or toxic matter harmful to plant growth.
   c. Soil Source:
      1) Obtain topsoil from:
         i. Local sources or from areas having similar soil characteristics to that found at the project site.
         ii. Naturally well-drained sites where topsoil occurs.
      2) Do not obtain from bogs or marshes.
      3) Confirm replacement soil source with UCB Landscape Architect.
   d. Soil Depth:
      1) To alleviate construction compaction of campus soils, UCB requires the removal of the top 12” of topsoil in any area impacted by construction.

2) Provide 12” deep topsoil for planting beds, and 6” deep topsoil for areas receiving turf or native seed:
   i. For locations receiving 6” of topsoil, provide topsoil over scarified 6” of native soil. Scarified native soil should have no clumps larger than 2” before adding 6” of amended topsoil.
   ii. Place topsoil in (2) lifts of 3”.

e. Soil Compaction:
   i. Discuss compaction requirements with UCB, compaction requirements can change based on top-soil or plant soil mixture.
   ii. Provide soil compaction to minimize future settlement based on soil types.
   iii. Do not over-compact to limit plant growth.
   iv. Protect soils outside the scope of work from compaction.
   v. All soil and landscaping (including soil outside the scope of work) impacted by construction activities shall be removed and replaced at Contractor expense.

4. Natural Seeding:
   a. Clearly indicate limits of seeding work on drawings.
   b. List proposed blend of native grasses to provide optimum performance for this region.
   c. Indicate seasonal planting window for permanent lawn seeding.
   d. List temporary seeding if not covered in erosion control.
   e. List requirements for mulch and/or erosion control blanket used on seeded lawn areas.

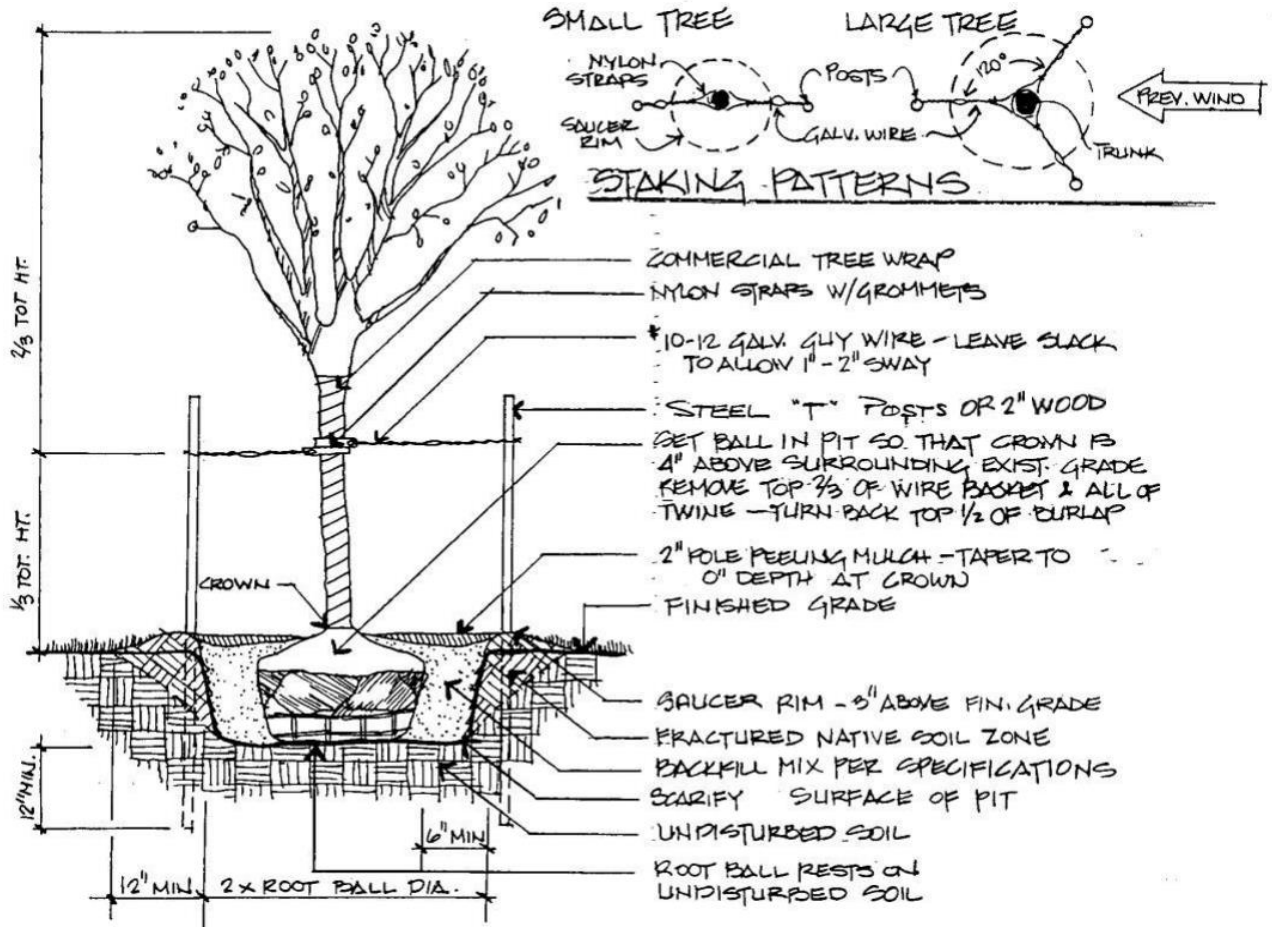
5. Bluegrass Sodding:
   a. Provide thick-cut sod with a minimum 1-1/4” depth to help reduce the establishment period.
   b. Provide sod from suppliers that are members of the Colorado Sod Growers Association.
   c. Clearly indicate limits of sodding work on drawings or site walk depending on size and scope of project.
      1) Scope of sodding work may increase based on pre-installation site walk with UCB Landscape Architect.
   d. List a blend of 3 varieties of improved Kentucky bluegrass shown to provide optimum performance for lawns in this region.
   e. Plant during UCB specified planting window.

6. Pest Management:
   a. UCB maintains all turf and grasses without use of pesticides in effort to create a healthy environment for campus occupants.
   b. Confirm current campus Pesticide Policy with UCB Integrated Pest Management prior to any pesticide specification or application. Direct all questions referring to pesticides to UCB Project Manager.

7. Construction Documents:
   a. Include a ‘Replacement Boundary’ in addition to the ‘Construction Limit Boundary’ on the construction drawings.
      1) The ‘Replacement Boundary’ is intended to identify areas outside of the construction limits that the contractor is responsible for damage to the landscape during the project.

b. Refer to diagram below for required details:

Diagram G0020.1 - Tree Planting Detail



G1010 – Erosion Control and Site Clearing

Introduction

The UCB Department of Environmental Health & Safety (EH&S) oversees and enforces Erosion Control efforts on campus, including administration of the campus-wide Municipal Separate Storm Sewer Systems (MS4) Permit.

A Stormwater Management Plan (SWMP) is required in accordance with the Colorado Department of Public Health and Environment

Periodic inspections may be performed by UCB. These inspections do not alleviate contractor's responsibility of performing inspections following the timetable outlined in the approved SWMP.

UCB Requirements

1. Erosion and Sediment Control:
   a. Erosion Control Best Management Practices (BMPs) and an Erosion Control Plan is required in all cases to mitigate discharge of pollutants or sediment to the storm sewer or streams.
   b. Selection and Installation of Erosion Control BMP selection and installation
      1) Type and location of BMP type and location shall maintain flow paths to ensure flooding of campus buildings and structures does not occur.
      2) It is imperative that existing and new storm inlets remain in service during construction activities.
      3) Any flooding or damage resulting from BMPs shall be the sole responsibility of the Contractor.
      4) Refer to the Campus Drainage Master Plan for critical conveyance paths.
   c. All temporary erosion and sediment control measures shall be removed after the site has achieved final stabilization and the SWMP permit has been inactivated.
   d. The contractor is responsible for mitigating erosion until final permanent stabilization is established, and through the end of the 1-year warranty period, whichever is longer.
   e. The contractor is not to discharge any construction water, waste or debris into the storm water or sanitary system.

G1020 – Earthwork and Grading

UCB Requirements

1. Grading Design:
   a. Grading design needs to be performed and certified by the project civil engineer. Grading design by the project Landscape Architect is limited to planting areas but must be reviewed by and approved by the project Civil Engineer to ensure proper drainage conditions are maintained.

2. Storm Runoff:
   a. Provide overland route for all storm runoff.
   b. Installation of erosion control BMPs shall not be installed as to cause storm water to backup and cause localized flooding. Contractor shall evaluate the type and placement of BMPs so that overland path of storm runoff is maintained during and post construction.

3. Earthwork Compaction:
   a. Meet recommendations identified in the project Geotechnical Report. At a minimum all fill (not including topsoil) shall be compacted to a minimum 95% standard proctor at optimum moisture content. Concentrated efforts shall be made for compaction around utilities and when backfilling against buildings.
   b. Warranty:
      1) Settling of fill after final grading shall be warranted for a period of 2 years.

4. Grading Adjacent to Buildings:
    a. Un-paved final grade adjacent to buildings should be a minimum of 6 inches below finished floor elevations or 6 inches below the top of an elevated foundation wall where finished floor elevations are below grade.
    b. Final grade shall slope away from the building at 10% grade for the first 10 feet to promote rapid positive drainage away from the building. Where compacted fill is placed adjacent to the building, proposed grading should consider increased slopes to account for potential consolidation of the compacted fill.
    c. Coordinate construction routes and stockpile staging areas with UCB Project Manager.

G1030 – Surveying and Utility Locates

Introduction

The intent of this section is to standardize surveys and to ensure surveys have adequate detail for their intended purpose. Provide surveys prepared by a Professional Land Surveyor licensed in the State of Colorado.

UCB Requirements

1. Utility Locates:
    a. Locate existing utilities, including irrigation mains, prior to construction.
        1) If needed, utilize potholing with the least invasive technique available.
    b. Contractor Submittals:
        1) Utility notification tickets
    c. All underground utility locate requests must be initiated by calling 811 or go to www.Colorado811.org. Utility locates in Colorado are governed under State Legislative Statutes that are provided on the Colorado811 website. All work shall be in accordance with the applicable State Statues.
        1) Prior to any excavation on the CU Boulder campuses, Construction Team (Managers and Contractors) shall refer to: www.colorado811.org and become familiar with and follow the procedures established by Colorado811 and applicable laws of the State of Colorado.
        2) CU Boulder is a Tier 1 Facility Owner that will comply with the statute and the Project Team is required to follow the process and procedures of the Colorado811 system (latest Revisions). No Exceptions. Utilizing the process and procedures of Colorado811 properly ensures the most efficient response from CU Boulder Utilities and any other Utility Company on the CU Boulder campuses.
            i. Utility and Energy Services (UES) is the management group for the CU Boulder campuses in regards to compliance and enforcement of the statute.
        3) Colorado811 Requests must include official building addresses, landmarks, building names and relative compass locations in the locate request description.
            i. All official building addresses for CU Boulder campuses can be found on the CU Boulder “Office of Space Optimization” website under “Resources - Master Building List” at:

www.colorado.edu/fm/divisions/planning-design-construction/office-space-optimization

4) CU Boulder Utility & Energy Services (UES) does not charge projects or events for locating CU Boulder Utility Infrastructure Refer to G3000 General Utilities for list of CU Boulder utility distribution systems located by UES.

d. Project or CU Approved Event Coordination Requirements
   1) Prior to initiating a Normal Request, contact CU Boulder through the Colorado811 for a "Meet Request".
      i. A Site Plan of the specific extents of the excavation areas (or event area) must be provided to CU Boulder Utility Services AND the excavation or area of impact (e.g. tent stakes) shall be pre-marked with white chalk paint and/or white flags.
      ii. The Contractor must make every effort possible to fully define and describe any area when the utility locate request is called into Colorado811.
      iii. Emergency Requests will follow Colorado811 process and procedures.
   2) Note: non-university utility owners that have utilities on university property are responsible for their own utility locates (e.g. Xcel Energy, Verizon, Sprint, City of Boulder Utilities). When locate requests are initiated thru Colorado811 these owners will also receive notice.
   3) Projects that require potholing for the purpose of locating utilities shall submit a pothole location map with restoration details for each type of disturbed surface for CU Boulder approval prior to the start of work. Submit information to CU Boulder Civil Engineer and Landscape Architect for approval.
   4) Project Submittals: All submittals shall be provided to the Utility through the Project Manager in accordance with the Contract Documents and Specifications of the Project. Locate Submittals are:
      i. Pothole Map Location and Restoration Details
      ii. Colorado811 Notification Ticket Summary Report
   5) The Project Team (CU Project Managers, Architects, Engineers, and Construction Managers) and the related Contractors (including Event Planners or Managers) need to ensure all work that can impact underground utility infrastructure is properly located in accordance with the statute.
      i. In the event of damage to an underground facility, the excavator shall comply with the statute and immediately give notice to Colorado811 and CU Boulder. UES will work the excavator to ensure cooperation to mitigate damages to the extent reasonably possible. CU Boulder does not directly fine excavators, but will report damages in accordance with the statute.
      ii. The Project is required to provide a complete and detailed Damage Report to UES for any damages to utility infrastructure that resulted in a service outage of any duration.

e. The Project Team must ensure that the locators representing the utility owners (CU Boulder, Xcel Energy, City of Boulder, etc) have completed their work in accordance with the process and procedures of Colorado811 before any type of excavation starts (e.g. emergency request, normal request, etc).
   1) Only CU Boulder authorized Utility Locators are approved to mark CU Boulder owned utility infrastructure.

f. Locate existing utilities, including irrigation mains, prior to during design to minimize construction change orders.
    1) If needed, utilize potholing with the least invasive technique available.
g. Contractor Submittals:
    1) Utility notification tickets

2. UCB Review/Coordination:
    a. After locating existing utilities (including existing irrigation mains), provide the location information to UCB for purposes of updating and reconciling campus utility mapping.

3. Survey Content:
    a. Provide Benchmark and Basis of Bearing per UCB Horizontal and Vertical Control Monuments.
    b. Surveys shall be based on State Plane or Modified State Plane Coordinates.
        1) Provide scale factor for Modified State Plane surveys.
    c. At a minimum, include level of detail matching a 2016 ALTA (or equivalent, from latest ALTA version) with Table A Options:
        1) 1 (when available), 3, 5 (contours at 1 ft intervals), 7a (including finished floor elevations at exterior doors), 8, 9, 11, 16, 17.
    d. Provide property lines only when the survey is adjacent to the Campus Boundary or Property Line.
    e. Campus GIS and CAD files are based on Colorado State Plane Coordinates.
        1) Include utilities not surveyed but known to exist based on Campus GIS and CAD files.
        2) Clearly denote items on the survey that were derived from the Campus GIS and CAD files.

4. CAD Submittal:
    a. Provide a 'dwg' file to UCB. Refer to **Facility Standard A0023** for additional information pertaining to CAD deliverables.

G1040 – Tree and Plant Protection

Introduction

This section includes requirements for protecting the existing trees and plantings on the University of Colorado-Boulder (UCB) campus.

UCB Requirements

1. General Requirements:
    a. Reference standard:
        1) Current edition of ANSI Z133 and ANSI A300
    b. City permits are necessary for pruning or removal of all trees in the right-of-way.

2. Pre-Design Meeting:
    a. The Consultant will visit the site with UCB to inspect all existing trees and plant material, and clearly identify all plant material to be removed, relocated, or to be protected.
    b. Confirm with UCB if the UCB Lead Arborist or a third-party ISA Certified Arborist will be engaged for project to determine the value of each tree or other plant materials within the limits of work line that are designated to remain.
    c. Based on project size and scope, contractor may be required to hire an ISA Certified Arborist to work with both the contractor and UCB Lead Arborist to maintain tree protection throughout the duration of the project.

3. Pre-Construction Conference:
    a. Conduct pre-construction conference with UCB Landscape Architect and Staff, Project Architect, Landscape Architect, UCB Lead Arborist, Contractor, Manufacturer/Supplier, and other parties who are involved.

4. UCB/Arborist Review:
    a. The consultant will submit a tree and planting protection plan to the UCB Landscape Architect and UCB Lead Arborist including:
        1) Existing trees and plantings identified to be removed, relocated, or protected.
        2) Means of tree protection.
        3) Scope and length of project.
    b. Prior to construction, the contractor will install tree protection for inspection by UCB Lead Arborist and/or contracted Licensed Arborist.
    c. Damage to any trees within tree protection boundaries due to contractor neglect or improper construction activities will result in financial damages for the assessed value of the tree or damage done as determined by a licensed arborist.

5. Tree and Planting Protection:
    a. All plant materials to remain or relocated will be tagged by the design consultant to assist the contractor in identifying the trees.
    b. Critical root zones shall be protected at a radial dimension taken from the trunk of the tree based on the following calculation:
        1) 12” per every 1” of Diameter at Breast Height (DBH) of tree to be protected.
    c. Confirm tree protection fencing system with UCB Landscape Architect and UCB Lead Arborist. Provide the following fence types at 6’ minimum height:
        1) Free standing temporary chain link fence panels with sandbags securing base.
        2) Tee-posts with snow fencing infill.
    d. Designated protection areas including critical root zones are to remain untouched and unharmed during but not limited to the following activities:
        1) Construction Activities
        2) Erosion Protection
        3) Silt Control Installation
        4) Stockpiling
        5) Irrigation
        6) Underground Utilities

6. Tree Demolition Regulatory Requirements:
    a. Refer to State of Colorado Department of Agriculture to determine any organisms that may have regulatory quarantines or restrictions and comply with associated regulation. For example, there is a current established quarantine in the Boulder County area related to the Emerald Ash Borer.
    b. The Contractor will provide certificate of transfer to approved mitigation entity.

7. Damage to Existing Landscape Outside of Construction Zone:
    a. The campus has had issues in the past with areas outside of the construction zone being cut off from irrigation service for long periods of time due to construction.
    b. The campus has had issues in the past of areas just outside of the construction zone being irreparably damaged during the construction phase.

8. Drainage:
    a. Maintain positive drainage from Tree Protection Areas. Divert runoff from site around Tree Protection Areas.

G2010 – Pavements

Introduction

This section includes requirements for asphalt and concrete at the University of Colorado-Boulder (UCB) for road, pedestrian and multi-use pavements. The overall intent of the University is to have stable, long-lasting pavements designed and constructed for the needs of the respective applications.

Colorado Department of Transportation (CDOT) standards, latest editions are applicable.

UCB Requirements

1. Asphaltic Concrete Paving:
    a. Follow recommendations identified in the Geotechnical Report for composite sections if greater than UCB standards.
    b. Minimum UCB standards:
        1) Scarify and recompact 12” below all new asphalt.
        2) Parking lots and service roads:
            i. Base Course per Section 703.3, Class 6, CDOT Specifications
            ii. Minimal Base Course Thickness: 12”
            iii. Minimum Asphalt Thickness: 5.5”
            iv. PG 64-22 Binder
        3) Main roads subject to heavy traffic loads, such as buses, trucks, emergency vehicles.
            i. Base Course per Section 703.3, Class 6, CDOT Specifications
            ii. Minimal Base Course Thickness: 12”
            iii. Minimum Asphalt Thickness: 7”
            iv. PG 64-22 Binder

c. Provide asphalt complying with CDOT Specifications for S and SX Asphalts.
    1) Bottom lift(s) shall be Type S.
    2) Top lift shall be Type SX with maximum thickness 3 inches.
d. Full-depth asphalt pavement sections are not permitted.
e. Portland Cement Concrete is to be used at loading docks, high turning areas (such as in front of trash enclosures), and bus stops. Asphalt pavements are **not** permitted in these areas.
f. Seal saw cuts and joints between pavement surfaces, including curb and gutter and sidewalks, a minimum of 2".

2. Portland Cement Concrete Paving:
    a. Follow recommendations identified in the Geotechnical Report for composite sections if greater than UCB standards.
    b. Minimum UCB standards:
        1) Scarify and recompact 8" below all new concrete.
        2) Provide minimum 6" depth aggregate base course based on CDOT Specifications.
        3) Provide CDOT Type P Concrete.
        4) Provide a compressive strength of 4,000 psi minimum.
        5) Fly Ash (up to 15% by weight) may be substituted for Portland cement, in accordance with CDOT Specifications.
    c. Reinforcing is required for all concrete paving as follows:
        6) Reinforcement shall adhere to all provisions of ACI 318 for maintaining proper clear cover.
        7) Reinforcing Bars: ASTM A615 and Supplement 1, Grade 60
        8) Reinforcing Bars: ASTM A615 and Supplement 1, Grade 60, epoxy coated. Required for entrance and exit points to parking facilities.
        9) Fibrous Reinforcement: Collated fibrillated, polypropylene fibers containing no reprocessed olefin materials and having a tensile strength of 70,000 psi. Use 1.5 lbs. per cubic yard of concrete minimum.
    d. Minimum thicknesses:
        10) Sidewalks not subject to vehicular traffic and less than 8-ft width: 6" thick with Fibrous Mesh Reinforcement.
        11) Sidewalks and Drives subject to vehicular traffic or sidewalks greater than or equal to 8-ft width: 6" with rebar reinforcement, #4 bars @ 18" OC EW.
        12) Loading docks and sidewalks or drives that serve as fire or emergency: 8" thick with rebar reinforcement, #5 bars @ 18" OC EW.
        13) Structurally supported slabs (such as over tunnels) shall be designed by a Colorado licensed structural engineer to meet loading requirements. At a minimum, HS20 loading.
    e. Joints:
        1) Replace concrete to the nearest existing concrete joint
        2) Concrete joints shall not exceed 10 feet apart.
        3) Square-off triangular panel shapes.
        4) The long side of a rectangular panel shall not be more than 1.5 times the shorter side.
        5) Use jointing details in accordance with CDOT standards as published in current M & S Standards.

6) Seal joints in accordance with current CDOT Standard Specifications for Road and Bridge Construction.

3. Pavement Testing Requirements:
    a. All testing and inspections will be performed by an independent testing and inspection agency employed by the University.
    b. Contractor is responsible for test scheduling and delays caused scheduling conflicts.
    c. Contractor will pay for any retesting required due to failed test.
    d. Contractor to ensure all documentation, including the Compaction Test Reports are provided, to the UCB Civil Engineer at the end of each working day. Location of tests shall be included.
    e. Contractor is not to perform work if testing and inspection agency is not onsite for testing services.
    f. Asphalt and Concrete testing:
        1) Shall be tested in accordance with the Colorado Department of Transportation's "Standard Specifications for Road and Bridge Construction", Latest Edition, and the current edition of CDOT Field Materials Manual.

4. Pavements Slopes:
    a. Provide a minimum net slope of 1.8% and comply with ADA grading constraints where part of an accessible route.
    b. Test all new pedestrian pavements for compliance with ADA criteria.
    c. All sidewalks are to be accessible, refer to **Facility Standard A0040** for additional information.

5. Paver Unit Pavements:
    a. Refer to **Facility Standard G2011** for additional information on paver unit pavement systems.

6. Pavement Marking:
    a. It is preferred that methyl methacrylate (MMA) markings be used. Confirm pavement markings with UCB Parking and Transportation Services.

7. Snowmelt:
    a. Meet with UCB Outdoor services to review proposed entry locations, site stairs, and loading docks and evaluate if snow melt is beneficial for entry location.
    b. Consider maintenance requirements and environmental impacts of the different system types.

G2011 – Decorative Paving

Introduction

This section includes requirements when specifying decorative unit pavers. The overall intent of the University is to provide durable and safe surfaces while maintaining a uniform aesthetic throughout the campus.

UCB Requirements

1. General Paver Design:
    a. Layout work to minimize cutting.
    b. UCB has had issues with porous pavers settling. Provide pavers and sub-base design based on intended use and traffic loads. Refer to **Facility Standard G2010** for sub-base design requirements and for general testing requirements of paving on the campus.
    c. UCB has had issues with loss of infill material over time. During design and material specification, identify to UCB the expectations for maintenance and routine re-sweeping of infill material.
    d. Warranty:
        1) Installation Contractor will return to site after 11 months from the completion of work and provide the following initial maintenance as required by the UCB:
            i. Fill paver joints with stones
            ii. Replace broken or cracked pavers
            iii. Re-level settled pavers to initial elevations using properly graded material.
            iv. Any warranty work shall be considered part of the original bid price with no additional compensation.

2. Paver Selection:
    a. Maintain a uniform aesthetic with existing campus for pavers specified for crosswalks.
    b. UCB has also had issues with paver spalling and deterioration due to snow melt strategies and snow removal methods.
        1) Provide a paver which is resistant to de-icing salts and with strength characteristics to resist damage from snow removal blades.
    c. Submit products for approval by UCB Landscape Architect.

3. Mock-Up:
    a. Provide 4’ x 3’ in-place mock-up for review by UCB. Refer to **Facility Standard A0020** for additional mock-up information.

4. Existing Pavers:
    a. Protect existing paver installations from construction activities. Following construction activities, perform a full sweeping of area, and clean and replace fill material as needed to bring existing pavers to pre-construction conditions.

G2020 – Site Furnishings

Introduction

This section includes requirements for selecting site and street furnishings for the University of Colorado-Boulder (UCB) campus. The overall intent of the University is to provide furnishings that are durable over long-term and maintain a uniform appearance across the campus.

UCB Requirements

1. General Site Furnishing Design:
    a. Provide each type of site furnishing from one source and from a single manufacturer unless directed otherwise.
    b. Specify black powder coating for all site furnishings unless otherwise noted or approved by UCB. Refer to **Facility Standard B3020** for information pertaining to paint specification.
    c. Show all items accurately located on drawings.
    d. The products listed below are provided to meet the intent of a uniform campus aesthetic, however, alternative products may be submitted for approval by the UCB Landscape Architect.
    e. Confirm sole source agreements pertaining to site furnishings with UCB.

2. Trash and Recycling Receptacles:
    a. Provide Victor Stanley, SD-42, 36-gallon, side opening and lockable.
    b. Provide in locations of high visibility and adjacent to main campus pedestrian circulation routes:
        1) Refer to **Facility Standard A0022** for additional information when interfacing with UCB Waste and Recycling entities.
        2) Confirm locations, quantities and labeling with UCB.
    c. Provide concrete base at all trash and recycling stations similar to adjacent sidewalk construction.
    d. Provide (2-3) receptacles within a few feet of each other and not separated:
        1) Receptacle labeled 'GLASS, PLASTIC, ALUMINUM' on horizontal banding.
            i. Lid Type and Color: Convex; Gold
        2) Receptacle labeled 'PAPERS' on horizontal banding.
            i. Lid Type and Color: Tapered Formed; Black
        3) Receptacle labeled 'LANDFILL' on horizontal banding.
            i. Lid Type and Color: Tapered Formed; Black
    e. Provide label based on specifications provided in **Table G2020.1** and **Diagram G2020.1**:

Table G2020.1

Vinyl Product:	3M ScotchCal 220 Film, High-Performance, Premium 2-Mil Cast Vinyl, Durability of 5 to 8 years.
Ink:	GCS-601 Champagne Gold (GerberColor Spot series, thermal transfer foils) [Note that white underpass done with gold color on top]
Printing Machine:	Gerber EDGE Digital or Thermal printing systems.
Font:	San-Serif = Helvetica Neue Bold
Text Layout:	All caps, consistent letter spacing across entire length of label. Text Height: "PAPERS" and "LANDFILL" = 1.607 inches tall; "GLASS, PLASTIC, ALUMINUM" = 1.329 inches tall. Text Color: "LANDFILL" = Gold Text over Clear Background;

	"PAPERS" and "GLASS, PLASTIC, ALUMINUM"= Gold Background with 'knock-out' Clear Text. Recycle Arrow Art: Used with "PAPERS" and "GLASS, PLASTIC, ALUMINUM", as indicated in **Diagram G2020.1**.
Label Size:	2.25" high x 37.5" long, 2 decals per can

Diagram G2020.1

3. Tree Grates:
    a. Provide grates from the Neenah Foundry Company Metropolitan Collection.

4. Bike Racks (Confirm selection with UCB Landscape Architect):
    a. Cora Bike Rack, Expo W7510, 7 Hanger Rack
    b. Urban Racks, Urban Rack 7510, 7 Hanger Rack (Custom)
        1) Single bolt attachment per leg
    c. Dero, Campus Rack, 7 Hanger Rack
    d. Confirm with UCB for preference of hardscape, permeable paving or softscape beneath bike racks.

5. Benches:
    a. Provide Victor Stanley RB-28, 6' long bench. UCB may require a combination of benches with and without backs, confirm locations with UCB.

6. Tables:
    a. Provide Landscape Forms, Carousel Table with 3, 4, 5, or 6 seats.
        1) Seat Configuration: Backed or backless, surface mounted
        2) Seat Material: Perforated metal
        3) Table Top: Steelhead Perforated with umbrella hole

7. Bollards:
    a. Provide Landscape Forms, Annapolis

8. Site Signage:
    a. Refer to **Facility Standard A0050** for information pertaining to exterior signage requirements.

G2021 – Site Structures

Introduction

This section includes requirements when designing and specifying accessory structures to be built on the University of Colorado-Boulder (UCB) campus. The overall intent is to provide aesthetic consistency across the campus for these types of structures.

UCB Requirements

1. Bus, Bike Parking, and Accessory Shade Shelter:
    a. Preferred Product: Classic Recreation Systems, Mesa Model
        1) Provide the modified single post, black structure (open on all four sides) with metal roofing.
    b. Structural Requirements: It is understood that accessory structures are often designed by the manufacturer. All final accessory structure construction drawings must be stamped by a Licensed Engineer.
        1) Note that wind speeds vary across the campus. Refer to **Facility Standard B1011** for information pertaining to 'special wind regions' identified on campus.

G3000 – General Utilities

Introduction

The intent of this section is to properly inform the project design team (planners, architects, engineers, construction managers, and contractors) of the coordination process and responsible parties for the installation of utility infrastructure (new or modified) on the CU Boulder campus.

This section includes requirements for requesting new, temporary, and/or modifications to utility distribution systems. Additionally, it includes the requirements for utility system separation, pipe crossings, typical compaction standards and use of flow fill at the University of Colorado Boulder (CU Boulder).

The CU Boulder Utility & Energy Services (UES) group functions as an auxiliary enterprise managing the operation of providing utilities (electric, water, sanitary, steam, and chilled water) to the campus facilities and charging for the services through utility rates (similar to the local utility companies).

Additionally, UES functions as the primary liaison with the local utility companies managing interconnection agreements and points of delivery with both the City of Boulder (water and sewer) and Xcel Energy (gas and electric).

Therefore, all utility work is either performed by UES or coordinated through UES personnel. Utility work is defined as any main, secondary, and/or service distribution infrastructure interconnected with the existing utility distribution systems to the Building(s) Point of Delivery (POD). The POD is the demarcation point between a building system and the utility system which is generally five feet (5ft) from the building wall. The utility distribution systems on the CU Boulder campuses and properties are:

1. *Domestic Water (WATER):* also known as Potable Water
2. *Sanitary Sewer (SEWER):* also known as Wastewater
3. *Steam (STM):* includes Condensate Return System
4. *Chilled Water (CHW):* Supply and Return
5. *Electric Distribution (EDS)*: 15kV systems operating at 3-PH 13.2kV
6. *Centralized Compressed Air (CCA) System*
7. *Utility Tunnels*

Note: *Storm Sewer (STORM):* also known as Flood is not part of the distribution systems managed by UES (see exception information under Utility Distribution Project Section). Storm sewer piping, BMPs, and drainage management

The CU Boulder Facilities Standards in conjunction with the "CU Boulder Utility Services Design Criteria" documents contain the requirements and uniform standards necessary to coordinate any utility distribution or metering system and ensures a safe, economical, and reliable service for the CU Boulder campus.

1. The Project Team is required to request the latest Utility Services Design Criteria information related to their work at the start of every project through the "Inquires and Information" portal located at the CU Boulder Utility Services website:

   https://www.colorado.edu/fm/divisions/utility-and-energy-services

2. UES is not responsible for delays or costs due to rejected submittals or failed inspections that result from the Project Team not requesting and using the latest design criteria.

The uniform administration of these standards will expedite service connections and treat each campus customer equally and fairly. Additionally, the standards are a valuable resource to capital program planners and construction managers by providing the necessary requirements for building systems to be connected to the universities utility distribution systems.

Utility Services is subject to all state, local, and federal regulations. As well as the local utility providers standards for electric, gas, and water services. Namely the following:

1. "Xcel Energy Standard for Electric Installation Use"
2. City of Boulder's Design and Construction Standards, Chapter 9, Utilities Standards
3. The National Electrical Safety Code
4. The National Electrical Code

UCB Requirements

1. General Utility Requirements:
    a. Utilities under buildings, structures, or landscaping features:
        1) Submit a detailed design of all utility distribution systems proposed to be installed under buildings, structures, or other instances for approval by UES and the CU Boulder Civil Engineer. CU Boulder prefers no utility infrastructure be installed under buildings, but will review on a case-by-case basis.
    b. Protection of Existing Utilities:
        1) Comply with CU Boulder Facility Standard G1030 "Utility Locates" prior to starting design and before starting any excavation.
        2) Submit shop drawings for review by UCB on support methods for protection of all affected existing utilities including, but not limited to: electrical duct-banks and steam tunnels expected to be encountered during construction. Submittal is intended to describe the anticipated support and protection measures to be employed at each utility crossing. UES and CU Boulder Civil Engineer will review this information and provide approval or direction to gain approval. Also, UES will forward and coordinate with 3rd party utility owners affected by the work for their review and approval (e.g. City of Boulder or local electric company). Review of submittal does not relieve the contractor's responsibility to maintain uninterrupted service of existing utilities including the Office of Information Technology (OIT).
        3) Use extreme caution when excavating under and around any utility distribution infrastructure.

2. Utility Tunnels:
    a. In general, the protection of existing utility tunnels during new building construction, building renovation, building maintenance, etc. is a major concern and projects shall coordinate work with UES to ensure the operating utilities within the tunnel systems are not impacted.
    b. Work with UES to determine if proposed construction will impact above or near any utility tunnels.
    c. Facility Standard B1013 provides information when penetrations are required to the existing tunnels. Any underground penetrations will be fully sealed to prevent any water penetration into the tunnel.
    d. Confirm if sidewalks, driveways, or roads will need to be 'bridged' over a section of utility tunnel to avoid damage to the tunnel.

3. Tree Protection and Utility Separation:
    a. Refer to **Facility Standard G1040** for requirements when trenching and backfilling near trees or landscaping designated to remain.

4. Separation of Utilities:
    a. Provide parallel (horizontal) separations between utility mains and services to provide for adequate trench excavations and maintenance operations in accordance with CU Boulder Utility and Energy Services EO-150 "Utilities Separation Design Criteria"
    b. Utility and Energy Services (UES) and the CU Boulder Campus Civil Engineer may approve a deviation from the minimum separation distances on the case-by-case basis. However, all attempts to comply with EO-150 shall be made prior to request for variance waiver.

5. Utility Trenching and Backfill Requirements:
    a. Refer to specific UES Utility Design Criteria for trenching and backfill materials of each utility. All trenching and backfilling shall comply with the published UES Utility Design Criteria or the City of Boulder's Design and Construction Standards, Chapter 9.
    b. Refer to EO-151 "Flow Fill Requirements for Utility Distribution".
    c. Repair pavements in accordance with City of Boulder Standards.

6. Request for New, Temporary, or Modification to Existing Utility Service:
    a. All application for utility services(s), or modifications to an existing service(s), should be submitted to the Utility and Energy Services (UES) department through the "Request for Utility Service Application" located at the CU Boulder UES department website: https://www.colorado.edu/fm/divisions/utility-and-energy-services

    b. UES is required to complete any utility distribution system project (see "instructions" on website) and remove existing metering infrastructure, however, the Project is responsible for protection of all existing utility infrastructure (see General Requirements) as well as any demolition and removal of abandoned equipment affecting the work. Meaning, UES will complete the permanent isolation of utility distribution systems (including meter infrastructure removal), but the project shall demolish and remove the abandoned equipment (e.g. pipe, valves, fittings, devices, etc.). Note: Any metering infrastructure damaged or demolished without authorization shall be replaced by the Project.
    c. Requestor is advised to review the process and timeline information sheet on the website and service request form thoroughly to ensure the requested information is submitted and expectations of service are acknowledged. Failure to complete all the information will delay the approval process and construction schedule.

7. Utility Distribution Projects:
    a. All utility distribution work is completed by UES with the exception of stormwater distribution infrastructure. The stormwater distribution infrastructure including, but not limited to: BMP, stormwater piping, and grading (site work) is to be completed by the Project. However, the Project is still required to coordinate the work with UES and CU Boulder Campus Civil Engineer under the CU Boulder building construction process and procedures. Stormwater distribution systems shall be designed and installed in accordance with the City of Boulder's Design and Construction Standards and CU Boulder's MS4 non-standard permit. Refer to Facility Standard G3030.
    b. The utility (upon approval of the service request for utility work) shall complete the design and installation of the system under the approved scope of work.
    c. UES is the only approved group to isolate utility systems for the CU Boulder campuses. Coordinate with UES to schedule utility distribution outages necessary to support building project work.

8. Utility Inspections:
    a. UES is the campus authority having jurisdiction for all utility infrastructure. The designated inspector(s) for each utility is authorized to accept or reject utility installations on the CU Boulder campuses. The utility inspectors ensure the installation was done in compliance with

the provision of all applicable codes, safety standards, and CU UES service rules. The utility inspector is not responsible for equipment past the point of delivery and does not inspect building infrastructure for adequacy, safety, or compliance with applicable codes on the building side; such responsibility remains with the CU building inspectors and Authorities Having Jurisdiction (AHJs).

b. The utility will not energize any new or modified building service interconnection that does not provide an approved [passed] inspection report for the related system for the building infrastructure.
c. All gravity flow utilities, including foundation drainage, shall be televised after backfill and compaction are completed.

9. Testing:
    a. Comply with the City of Boulder's Design and Construction Standards, Chapter 9, Utilities Standards.

G3001 – Utility Metering

Introduction

Unless otherwise instructed by UCB, all buildings will be metered for all utilities including electricity, gas, water, steam, or steam condensate as required, chilled water from central chiller, etc.

UCB Requirements

Utility meters are owned and operated by either UES or the local utility. If owned by the local utility, then all standards of the local utility shall apply. If owned by CU UES, then all information in this standard apply for interconnection and metering.

The Project Team shall become familiar with the metering installation requirements provided below and on the CU Boulder Utility and Energy Services website:

https://www.colorado.edu/fm/divisions/utility-and-energy-services

1. General Utility Metering:
    a. All UES metering infrastructure shall be in accordance with the latest revision of the following UES Design Criteria documents:
        1) EO-100 Utility Meter Panel
        2) EO-101 CHW Meter Details
        3) EO-102 Steam and Condensate Meter Details
        4) EO-111 Typical Meter OIT Interface
        5) EO-118 Domestic Water Meter Details
        6) EO-119 Metering 120-208V & 277-280V Circuits

b. UES does not permit a temporary unmetered account on any new building or construction related utility service.
c. All utility services to a building will be supplied by a single service (point of delivery) and only one (1) meter will be installed at an address.
d. Only authorized University employees or qualified individuals authorized by CU UES are permitted to commission, connect, disconnect, move or remove meters. All metering components including, but not limited to, service wires, instrumentation, devices, and piping installed by the University for measuring energy at the building shall be the property of CU UES.
e. Under no circumstances hall building controls or equipment:
    1) Be connected to, on in any way be served from, the secondary terminals of the voltage and/or current metering transformers or the Utility Metering Panel (UMP)
    2) Be installed within any metering enclosures including, but not limited to, metering transformer cabinets, transformer compartments, secondary connection cabinets, meter sockets, or UMPs.
    3) Be connected to an unmetered bus, conductor, or piping (steam, chilled water, domestic water) system.
    4) Split signal any metering system device including, but not limited to, flow meter or temperature sensors.
f. Before permission will be grated to energize a new service, all utility and building inspections shall be completed and passed by the AHJ.
g. The Project Team shall provide an easily accessible metering location. UES will locate an acceptable point of delivery and interconnection location. UES is not responsible for the relocation of the service connection, service entrance, or metering equipment resulting from an improper location chosen by the Project Team that does not meet the requirements of UES.

G3010 – Water Supply

Introduction

The City of Boulder provides water service to UCB. There are master meters at the perimeter of the campus for water mains serving the campus. UCB is the Authority Having Jurisdiction (AHJ) when water main design is planned inside campus boundaries, where it is inside water meters serving the campus. Water main projects near the perimeter of the campus may require review and approval by the City of Boulder.

Contact UCB to perform operation of any water valves, hydrants or other apparatuses; the contractor is not allowed to perform these duties. Contractors must obtain authorization to use a fire hydrant, in writing, from UCB.

Unless otherwise noted, follow the City of Boulder's Design and Construction Standards, Chapter 9, Utilities Standards and Specifications for design of distribution systems and interconnection details.

UCB Requirements

1. General Water Main and Service Lines:
    a. Follow City of Boulder Design standards, except where modified herein.

2. Identification:
    a. During backfilling and top-soiling of underground piping, install continuous underground line markers, located at two depths: 1' below grade and 2' above pipe.
        1) Provide permanent, bright-colored, continuous-printed detectable warning tape with metallic core, intended for direct-burial service; not less than 6" wide x 4 mils thick. Furnish blue tape with black printing reading "CAUTION WATER LINE BURIED BELOW".
        2) Provide test stations.
        3) Provide tracer wire on all water main piping greater than 2" in diameter.

3. Valves and Hydrants:
    a. Locate valves near pipe intersections along all branches of the potable water main and lateral network, resulting in three valves at the tee (including tees for fire hydrants) and four valves at a cross.
        1) The quantity of valves identified above are required at all tees and service line connections because UCB has insufficient valving to isolate many parts of the water main network.
    b. Locate a valve within 10' of a fire hydrant.
    c. Locate hydrants where they will be readily visible by fire department personnel, and with minimum 3' clear space on all sides.

4. Pipe Restraint:
    a. Comply with the City of Boulder's Design and Construction Standards, Chapter 9, Utilities Standards.
    b. Install thrust blocks at all changes of direction.
    c. Install pipe mechanical restraints for the required length of joint restraint shown on the City of Boulder Standard Details, in addition to thrust blocks.
    d. Restrain fire hydrants laterals for their full-length.

5. Hydraulic Study and Models:
    a. Determine if new water system mains, fire hydrants, or service lines may overload the network or create residual pressures below 20 psi.
    b. A hydraulic study or model may be required to confirm adequate system pressures and flow rates.

G3020 – Sanitary Sewer

Introduction

The City of Boulder provides sanitary sewer service to UCB. Unless otherwise noted, follow City of Boulder Standards and Specifications for design of sanitary sewer distribution systems and interconnection details. UCB is the Authority Having Jurisdiction (AHJ) when sanitary main design is planned inside campus boundaries, however, consult with UCB Utility Services for exact demarcation boundaries as City main lines route through the campus.

UCB Requirements

1. Sewer Pipes:
    a. Provide minimum 4" diameter gravity drain lines.
    b. Provide access points on gravity drain lines to facilitate maintenance and video inspection.

2. Cleanouts:
    a. Install cleanouts and rise extension from sewer pipes to cleanouts at grade. Install piping so cleanouts open in direction of flow in sewer pipe.
    b. Provide two-way cleanouts at building service connections.
    c. Set cleanout frames and covers in concrete pavement with tops ¼" below the pavement surface. Cover shall say "sewer".
    d. Provide cast-iron frame and cover in all areas.

3. Manholes:
    a. Minimize the number of service connections and manholes for new buildings.
    b. Make connection to existing manholes, where no pipe is stubbed out, in similar manner as new manhole. Core existing manhole as necessary to insert new pipe and attain watertight seal.
    c. Provide manholes at all connections to main lines. Service wye connections are not permitted at UCB.
    d. Where differences of 24" or less in invert elevations are called for, form the sloped flow channels so the flow does not undergo a vertical drop. Where differences exceed 24", an external drop manhole shall be used. Use of internal drop manholes is not allowed unless specifically approved by UCB in writing.
    e. Any time grade above a manhole is adjusted, raise or lower the manhole risers as necessary.
    f. The manhole must not have less than 8" or more than 18" of mud rings plus manhole risers.
        1) If the amount is over 18" or under 8", add or subtract barrel sections.
    g. Provide a concentric flat top for manholes with a depth of 3'-6" or less.
    h. Upstream pipe inverts shall be 0.2' above downstream pipe inverts when the deflections angle through the manhole is less than 60 degrees. When deflection angle is greater than 60 degrees upstream pipe inverts shall be 0.3' above downstream pipe inverts.

G3030 – Storm Sewer

Introduction

Unless otherwise noted, follow City of Boulder Standards and Specifications for design of distribution systems and interconnection details. Storm sewer projects near the perimeter of the campus may require review and approval by the City of Boulder. Colorado Department of Transportation details may be used when approved by UCB.

Escherichia coli (E.coli) are bacteria found often in storm water near animal habitats. Fit all storm inlets and pipe outfalls with "Animal Deterrent Screens" to prevent entry of animals.

UCB Requirements

1. Roof Drain Connections:
    a. Refer to **Facility Standards B2020** and **D2040** for additional information on roof drainage.
    b. Connect roof drains to storm drainage system. Refer to **Facility Standard G0011** for additional information.
    c. Minimize maintenance and disturbances to water quality BMPs by routing the Water Quality Events through BMPs while bypassing runoff exceeding the Water Quality Event directly to the storm sewer or road conveyance system.
    d. Discharging stormwater from the roof onto hardscapes is prohibited.
    e. Connecting roof drains to foundation drainage is not prohibited.

2. Gravity Drains:
    a. Utilize gravity systems to convey stormwater whenever possible.
    b. Provide minimum 4" diameter gravity drain lines.
    c. Identify access points that facilitate maintenance and video inspection.
    d. Design piping for minimum velocity of 2' per second.

3. Sump Pumps:
    a. Obtain UCB approval for use of stormwater sump pumps.
        1) Locate sumps and sump pumps within buildings.
        2) Sump pumps shall be duplex at a minimum.
        3) If used, provide access to sump pumps to avoid confined space procedures.

4. Cleanouts:
    a. Cleanouts may be used on pipe 4" in diameter. Provide one cleanout prior to each alignment change, unless a manhole is present.
    b. Provide cast-iron covers that are labeled "storm".

5. Concrete Catch Basins, Storm Inlets, and Pipe Outfalls:
    a. Provide "Animal Deterrent Screens" or grates on catch basins, storm inlets that prevent racoon or animal entry.
    b. Inlets with curb openings are discouraged but may be used with modifications approved by UCB.

c. Provide “Animal Deterrent Screens” or grates on pipe outlets to swales, grassy areas, grates, or ponds (e.g. flared end sections, head walls).

6. Manholes:
   a. Provide manholes at these locations:
      1) Connection point for two or more storm pipes.
      2) All changes in grade, slope, alignment, and pipe size.
   b. Where differences of 24” or less in invert elevations are identified, form the sloped flow channels so the water does not undergo a vertical drop.
   c. Manholes must not have less than 8” or more than 18” of mud rings plus manhole risers. Add or subtract barrel sections when needed to meet this requirement.
   d. Provide a concentric flat top for manholes with a depth of 3’-6” or less.
   e. Manholes with diameter less than 4’ cannot be deeper than 3’ so storm piping leading into or out of the manhole can be easily maintained and televised.
   f. Support precast elements using key-ways or doweling.
      1) Obtain approval from the UCB Civil Engineer for an alternate design.

7. Manhole Covers:
   a. Provide cast iron, ASTM A48 Class 35B, heavy duty type, cover machined to fit securely without rocking. Provide hot-dipped asphalt coated castings.
   b. Furnish with lettering cast into top reading “STORM SEWER – Drains to Creek” or approved equivalent wording.

8. Pipe Materials:
   a. Pipe materials shall comply with the City of Boulder’s Design and Construction Standards, Chapter 9, Utilities Standards, subject to review by UCB.
   b. High-density polyethylene (HDPE) is not acceptable, unless approved by UCB Civil Engineer.

9. Trees and Planter Drains:
   a. Utilize an indirect connection to the storm conveyance system, based on the following options:
      1) Daylight to a bio-swale or other surface drainage system.
      2) Daylight above a storm drainage inlet.
      3) Other methods of indirect connection need approval by the UCB Civil Engineer.

10. Abandoned Utilities:
    a. Close the ends of abandoned underground utilities which are indicated to remain in place.
    b. Provide closure to withstand any hydrostatic or earth pressure which may result after ends of abandoned utilities have been closed.
    c. Wood plugs are not acceptable.

11. Storm Water Quality and Quantity:
    a. Refer to **Facility Standard G0011**.

G3031 – Foundation Drainage Systems

UCB Requirements

1. Materials:
    a. Provide PVC pipe, perforated or plain (SDR-35).
    b. Furnish drainage pipe complete with bends, reducers, adapters, couplings, collars, and joint materials.
    c. HDPE slotted pipe is not acceptable for foundation drainage or landscaping underdrainage.
    d. Confirm specification of drainage fill material surrounding perforated foundation drains with the Geotechnical Report. Use of a filter fabric to prevent drainage fill from passing through pipe perforations is highly discouraged. Perforations and drainage fill shall be compatible, so the fill will not pass through pipe perforations.
    e. "All-in-one" foundation drainage systems are not acceptable.
    f. Provide drainage pattern pipe fittings to direct flow downstream.

2. Installation:
    a. Follow recommended installation procedures provided by project Geotechnical Engineer.
    b. Provide cleanout at every 180° in the direction of flow.
    c. It is preferred that two 45-degree bends be used instead of one 90-degree bend. The use of 90-degree bends must be approved by the UCB Civil Engineer.
    d. Do not connect storm conveyance systems to the foundation drainage system, including but not limited to: tree and planter drains, roof drains, curb inlets, catch basins unless authorized by the UCB Civil Engineer.
    e. Protect groundwater sumps residing in elevator shafts from any water generated in the elevator shaft. Groundwater sumps are not to be used or considered as elevator emergency drain pump.

G3040 – Irrigation Systems

Introduction

This section includes requirements for the design of landscape irrigation systems at the University of Colorado-Boulder (UCB). Landscape irrigation systems are a key component for maintaining the health of existing trees and plantings on campus.

Irrigation systems at UCB are not considered a 'secondary' utility but are considered a major utility. Design consultants and contractors are expected to treat irrigation systems in the same manner and level

of care that other site utilities (facility water supply, storm and sanitary sewers, central plant heat and energy distribution) are treated.

The campus irrigation system is supplied by a system of ditches, ponds and pump stations. Although the design consultant may not directly interact with the ditch, ponds or pump station systems, the consultant should understand that the success of the ditch system is just as critical to site and landscaping success as the pump stations.

UCB Requirements

1. Pre-Design Meeting:
    a. The campus runs a complex system containing fully networked weather stations, pump stations, moisture monitoring, and control systems, and to maintain a high-level of consistency and coordination across the campus, the consultant and irrigation system designer shall meet with UCB prior to commencing design to coordinate the irrigation system project scope.
    b. Pay attention to the impact to existing irrigation systems during the construction phase. The consultant will review existing system locations with the UCB to determine how maintain service to landscaped areas affected by building construction.

2. Pre-Construction Conference:
    a. Hold a pre-construction conference to review quality control and construction requirements for equipment, materials, and systems used to perform the work. Schedule the conference at least 10 days prior to commencement of work. Include the consultant, irrigation system designer, UCB PM, UCB Landscape Architect, contractor, installer and other UCB Staff as determined by UCB PM.
    b. During the construction phase, the contractor needs to identify strategies for maintaining existing landscaping up to 10’ outside of construction fencing. These strategies will need to be confirmed with UCB.

3. Protection of Existing Landscape Outside of Construction Zone:
    a. The campus has had issues in the past with areas outside of the construction zone being cut off from irrigation service for long periods of time due to construction.

4. Protection of Existing Irrigation Lines:
    a. The Contractor is responsible for:
        1) Coordination of work within irrigated areas with the UCB PM, UCB Landscape Architect and Grounds Maintenance Department.
        2) Temporary capping, sprinkler head removal and restoration of disturbed irrigation facilities within work areas at no additional expense to the University.
        3) Replacement of irrigation lines and sprinklers damaged during construction.
        4) Any landscaping restoration required due to damage during construction, as required by the UCB Landscape Architect and Grounds Maintenance Department.

5. Submittals:
    a. Provide record drawings indicating the following items:

1) Connection to existing water lines
2) Routing of sprinkler pressure lines (dimension maximum 100' along routing)
3) Sprinkler Control Valves
4) Quick Coupling Valves
5) Drain Valves
6) Control Wire Routing in not with Pressure Mainline
7) All Gate Valves
8) Other related equipment as directed by UCB.

6. Post-Construction Responsibilities:
    a. Include cost in bid for winterizing complete system at conclusion of sprinkling season (in which system received final acceptance). Reopen, operate, and adjust system malfunctions accordingly during Spring of following season as requested by UCB.
    b. Furnish the following maintenance items to UCB prior to final acceptance:
        1) Two sets of tools required for removing, disassembling and adjusting each type of sprinkler head and valve supplied on this project.
        2) One eight-foot valve key for operation of stop and waste valve.
        3) Two six-foot valve keys for operation of gate valves.
        4) Two keys for each automatic controller.
        5) Two quick coupler keys and two matching hose swivels for each type of quick coupling valve installed.
        6) Two aluminum drain valve keys of sufficient length for operation of drain valves.

7. General Irrigation System Design:
    a. Provide all lawn and planting area with a complete underground irrigation system.
    b. Design the irrigation system for maximum efficiency and water conservation.
        1) Provide separate zones for lawn and planting areas, due to different water requirements for each of these areas.
    c. Provide sprinklers, drip emitters, drip lines, valves, piping, fittings, wiring, pumps, and controllers of sizes and types as required to provide 100% coverage of the area.
    d. The irrigation system will be tapped from an existing campus water supply and will include a backflow device.
    e. Irrigation water will not be permitted to spray on sides of buildings, walks, paths, or roadways.

8. Tree and Plant Protection:
    a. Coordinate trenching and installation of irrigation systems with **Facility Standard G3000**.

9. Products:
    a. Refer to **Table G3040.1** for irrigation equipment products. Due to maintenance and operational concerns, no substitutions will be allowed for the products listed.

Table G3040.1

System Component	Manufacturer and Model Number
Pop-Up Spray Head	Rain Bird 1804
Pop-Up Spray Nozzle	Rain Bird MPR Series Nozzles or Rain Bird U-Series
Shrub Spray Head	Rain Bird 1812
Gear Driven Rotor	Hunter I-25 or Hunter I-20
Ball Valve	Asahi Sch. 80 Ball Valve
Control Valve	Irritrol 700 Series
Controller	Toro Network 8000 Satellite; Model 32-76-08
Quick Coupler Valve	Rain Bird 44NP
Control Valve Boxes	Carson #1419-12 / #1220-12
Gate Valve Boxes	Carson #910-12
Wire Splice Boxes	Carson #910-12
Drip Valve Boxes	Carson #1220-12
Pumping Station	Flowtronex Pumping Stations

G3050 – Steam & Condensate Distribution

Contact Utility and Energy Services for specific requirements.

G3060 – Chilled Water Distribution Systems

Contact Utility and Energy Services for specific requirements.

G3070 – Medium Voltage Distribution

1. General Information to Building Designers
    a. All electrical components, devices, terminations, and accessories installed in the MV DIST System are to be listed and labeled as defined in NFPA 70, Article 100, by Underwriters Laboratories and marked for intended use. Comply with all NFPA, NEC, OSHA, ANSI, and IEEE codes and standards including all ANSI/IEEE specialty standards regarding medium voltage equipment and installation.
    b. ANSI C57.12.22 Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers with High-Voltage Bushings; High Voltage, 34,500 GrdY/19,920 Volts and Below; 2500kVA and smaller. Though the standard references transformers up to 2500kVa, campus standard preference is to install 1500kVa and smaller, unless approval provided.
    c. The medium voltage system utilized on both the Main and East campus is 13,200/7,620 WYE connected. The neutral of this system serves as the ground for the system. It is grounded at

the engineering switchgear and carried via 600V 1/0 insulated GND cable to all medium voltage system equipment, raceways, and the phase conductor cable shield concentric neutral.

d. All UES MV DIST infrastructure is installed in accordance with the "Utility Services Design Criteria" Documents, contact UES for up-to-date documents.

1. EO-105 Medium Voltage Ductbank Details
2. EO-110 Medium Voltage Grounding System
3. EO-119 Metering Standards
4. EO-125 Electrical Manhole Details
5. EO-126 Electrical Transformer Location Guidelines
6. EO-127 Electrical Transformer and Secondary Connection Cabinet Details
7. EO-128 Electrical Manhole Entry Details
8. EO-129 Standard MV DIST Transformer
9. EO-130 Electrical Wiring and Termination Criteria

2. Point of Delivery (Demarcation)

a. The point of demarcation is the point where CU Utility Services owned electric facilities are connected to the [secondary] electric facilities of the building. The point of demarcation between CU Utility Services responsibility and CU Boulder campus buildings is at the secondary connection point of the UES owned transformers. It is the policy of the University for CU Utility Services to own, operate, and maintain the primary (over 601V) electric distribution facilities up to the point of demarcation. This policy is applicable to all CU buildings interconnected with the CU Boulder 15kV microgrid.

b. All services rendered by the local electric utility (e.g. Xcel Energy direct interconnection) shall be in accordance with the policies of the local utility.

c. All facilities will be installed in accordance with either the CU Utility Services Design & Installation Criteria or the local utilities "Standard for Electric Installation and Use".