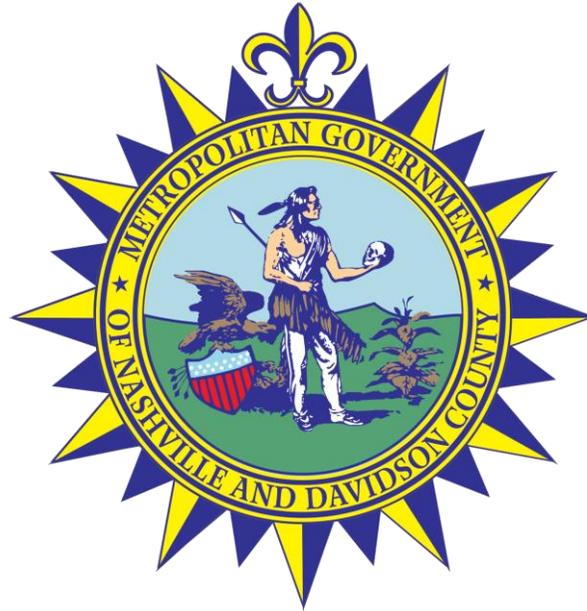


Metro Nashville Government of Nashville and Davidson County

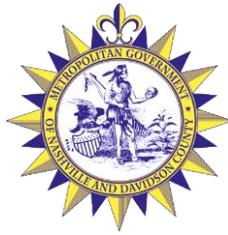


Department of General Services Design and Construction Guidelines

October 2018

Metropolitan Government
of Nashville and Davidson County

David Briley, Mayor
Nancy Whittemore, Director



Department of General Services

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October 12, 2018

Dear Metro Partners,

The Metro Department of General Services delivers an array of services to all departments and agencies of the Metropolitan Government of Nashville and Davidson County. These services include overseeing new construction; the modification, renovation, and major maintenance of Metro facilities; and design-related aspects of work space and furnishings renovations.

Throughout the work we do, our goal is to provide healthy, safe, comfortable, functional, and long-lasting public buildings and spaces. We also ensure that our buildings operate at the highest level of sustainability from the initial design to the functionality and technology provided to the end users.

We cannot achieve this mission without the help and dedication from our trusted partners. It is important to us that our partners understand General Services' involvement, commitment, and standards relating to all our capital projects which are outlined in the *Department of General Services Guidelines* manual. In this manual, we have identified specific expectations, guidelines, and standards throughout all phases of a project.

We value our partnership and look forward to working with you to actualize the contents of these *Guidelines*.

Sincerely,

A handwritten signature in blue ink that reads "Nancy Whittemore".

Nancy Whittemore

Director of General Services

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ORGANIZATIONAL GUIDELINES

The Department of General Services (DGS) is responsible for building, renovating and maintaining many Metro facilities. Building Operations & Supports Services (BOSS) and Sustainability (STS) are DGS Divisions that focus on design and construction projects. Construction, Design & Relocation, ADA and Safety Services (ADA), and Maintenance are all services in BOSS that are integral to the implementation of every project. The Sustainability Division ensures that high sustainability standards are integrated into every project.

There are many possible scenarios in which the DGS Design and Construction Guidelines apply; however, there may be cases of exception. The purpose of this document is to provide general guidance in the following areas:

1. Collaboration – Ongoing collaboration is critical to the success of a project. It’s important that DGS staff, other Metro agencies, and Metro contractors make a commitment to interface throughout the project to ensure that the Design and Construction Guidelines are followed.
2. Project Phases – Typically every project has ten phases beginning with the programming phase and ending with the closeout phase. The phases in between are described in detail in this document.
3. Project Specifications –The project specifications provide insight into what DGS considers as best practices.

Below is an organizational overview of the Department of General Services and supporting agencies:



Teams

Below are brief descriptions of roles involved in each project phase:

Department of General Services (DGS)

DGS is the project “Owner” and is responsible for all phases of the project.

Metro Department “End User”

The “End User” is the Metro agency(s) housed in the facility. The “End User” has the functional knowledge required to improve or design work spaces. The “End User” agency may have several individuals on their team attending meetings and providing feedback. An “End User” contact is identified to present final agency decisions/ requests.

Department of General Services Project Manager (DGS PM)

The DGS PM may be a DGS employee or a Metro Contractor. The DGS PM works on behalf of DGS to oversee quality, financials, schedules, and to act as a liaison with the design and construction team throughout the life of the project.

The following are additional team members who provide support roles on the project:

Department of General Services Program Manager (DGS PrM):

The DGS PrM may be a DGS employee, or a Contractor, who assists DGS and the End User to determine their needs for the project. The PrM is involved prior to establishing a budget. The PrM evaluates existing spaces and records a program that will be used in site selection and budget creation. Once these two items are complete the PrM assists DGS in establishing design criteria to be used as part of the procurement process, to provide enough information to the Design-Build (DB) Contractor.

Metro Information Technology Services (ITS)

ITS provides input on information technology on behalf of General Services for the building and connectivity to the Metro network. ITS' involvement begins at the Budget Phase to develop ITS needs and costs. ITS is heavily involved in the Design-Build Phase to provide input to the architects and engineers and oversee installation of the systems.

Audio Visual (AV)

The AV team provides input during the Design-Build Phase to ensure the proper connectivity for predetermined AV devices. The team is present during the Move-In Phase for installation.

Commissioning Agent (CA)

The CA is a third-party agent that verifies all (or, depending on scope, some) of the subsystems for mechanical, heating, ventilation and air conditioning (HVAC), plumbing, electrical, fire/ life safety, building envelopes, interior systems, co-generation, utility plants, sustainable systems, lighting, wastewater, controls, and building security to achieve the DGS project requirements designed by the building architects and engineers. The CA is involved during the Design-Build and Move-In Phases.

Other Metro Consultants/ Contractors

Depending on the project, other consultants or contractors may provide expertise. Examples include but are not limited to security, geotechnical, survey, materials testing, and experts in End User equipment.

GENERAL REQUIREMENTS

Communication and Meetings

Internal and external partners provide the essential insights and decisions required to build or renovate a building. Communication is extremely important to a successful project and meetings are an important venue to receive these insights and decisions.

Communication shall be ongoing and seamless with the DGS PM and other team members during all project phases. Information on key issues, design, submittals, inputs from third-party vendors, permits, codes issues, budget and scheduling issues, energy modeling and management, LEED, solar installations, etc. shall be continuously shared.

During each phase, the DGS PM or DGS PrM takes the lead on scheduling meetings at appropriate intervals to remain on schedule. At the beginning of the DB Contract, a project kickoff meeting will be initiated by the DGS PM and will include several representatives including Metro's LEED consultant, the Commissioning Agent, and Metro ITS. During construction, an Owner-Architect-Contractor (OAC) meeting will generally be held every other week to provide updates on progress. Many other partners may also be included.

Auxiliary teams, such as ADA, ITS, Security, and AV, are brought into the meetings when the project is at pivotal points that relate to their subject areas. To prevent unnecessary meetings, the following guidelines shall be considered:

- All planning & design meetings and communications shall include the designated DGS PM and the designated End User representatives.
- The DGS' BOSS and Sustainability teams shall be involved in all discussions on energy modeling, value engineering, energy efficiency, renewable design, and metering/sub-metering.

The DGS PrM provides meeting documentation to include: a list of those in attendance, their roles and contact information, meeting minutes and specific action items. Additional items such as submittals, RFI's, Contingency Tracker and Change Order Proposals are included with meeting documentation during the Design-Build Phase. Meeting minutes are distributed to the team within 48 hours of the meeting.

Sustainability (STS)

The STS team is responsible for ensuring that the building is designed to DGS sustainability standards. STS provides guidance during the Design Criteria Phase, the Design-Build Phase for the LEED certification process, and during the MoveIn Phase. Pursuant to Metro Ordinance BL2013-381, every new project shall attain a LEED Silver certification at a minimum. A LEED kickoff meeting is required for each project and will be guided by Metro's LEED contract facilitator and STS.

Sustainable DGS projects integrate the best use of energy reduction practices within the design of a building and focus landscape design on best stormwater management practices and appropriate species selection. In addition, projects will include the use of renewable technologies and other sustainability features as early as possible during the design phase.

Energy modeling is a tool to develop the most sustainable and energy efficient building design. Energy modeling is used throughout the project and requires close collaboration with the LEED consultant and the BOSS and Sustainability teams.

Metro Information Technology Services (ITS)

When working with the DB Contractor, ITS requires the following:

- Only the Metro Nashville approved contractors are authorized for bidding. (A list will be provided.)
- Metro ITS Wiring Standards shall be followed.
- DB Contractor is responsible for obtaining all permits and inspections to correspond with the project schedule.
- DB Contractor is required to attend scheduled meetings to report on progress of the project.
- DB Contractor and employees shall have passed the required security screening and have been issued a Vendor badge prior to working on any Metro site.
- DB Contractor is required to work with ITS regarding the project schedule and notify of any conflicts.
- Test reports and as-built drawings shall be provided prior to invoicing for all low voltage systems installed.
- Drawing formats shall be Adobe Acrobat (.pdf) or Visio (.vsd).

Plan Reviews

It is imperative that DGS team members, including the End Users, provide feedback regarding the project at various intervals of the project. More detail can be found in the “Phases of the Project” section below.

Project Management Software

Information on the project such as budget, meeting minutes, submittals, requests for information, and key communications is located on a project management software site designated by DGS. Contractor shall ensure that monthly field operations, and inspection logs and associated change requests are uploaded into designated software and DGS and other designees will have full access to these documents.

Background Checks

All Contractor personnel performing on-site work shall have successfully completed a Metro Nashville Police Department (MNPd) security background screening. The cost of these background checks is the Contractor’s/ Designer’s responsibility. Prior to any Contractor personnel access to Metro locations, Contractor shall provide Metro with documentation of compliance with this requirement for everyone (notwithstanding said documentation, Metro management shall receive MNPd confirmation of each individual’s security background screening “PASS” status before Contractor or Designer may assign personnel to such duties under the contract).

PHASES OF THE PROJECT

Programming

The Department of General Services becomes involved in a project when a Metro department(s) has received notice of funding to begin planning for a new facility, renovation, or relocation. DGS will work with the DGS PrM and the Metro department(s) to gather information, identify objectives for the project, determine an overall square footage, and parking requirements. This information is required for site selection and to receive funding in Metro's spending plan.

Site Selection

If a new site is required, DGS will work with the relevant departments, including Metro Finance, Metro Public Property Administration, the End User, and the DGS PrM, to select an appropriate site. This phase includes site plans that indicate the building footprint, ingress, egress, parking, and other requirements.

Preliminary Budgeting

Once a site is identified along with an overall square footage of the building, DGS, other department(s), Metro ITS, and the DGS PM will work together to develop and submit a project budget to the Capital Improvement Budget for approval by the Mayor's Office and by Metro Council.

Funding

The Capital Spending Plan is on an annual cycle and may be approved by Council as submitted or approved with modifications. Once approved, the funding will be released.

Design Criteria

Once the site has been selected and the funding has been approved, DGS will work with the approved overall square footage and parking requirements developed during the Programming Phase. The Design Criteria includes the final Program and a conceptual floor plan indicating adjacencies and square footage.

Request for Qualifications (RFQ) & Request for Proposal (RFP) Process

The Department of General Services and the DGS PM will work with the Metro Procurement Division to solicit proposals for the DB contract by means of a process called a Two-Step RFP. In Step 1, DB Contractors are required to provide a proposal indicating that their team is qualified to be selected. After responses are received, DGS will review and shortlist the qualified DB Contractors that will advance to Step 2.

Step 2 will include the Design Criteria, a site visit, and review of the DGS Construction Guidelines in order to provide enough information to bid on the project. Step 2 proposals will be reviewed, and a DB Contractor will be selected.

Design Build Phase

Once the DB contract is in place, there are several sub-phases to the Design Build phase of the project. These sub-phases are not consecutive, and several may overlap or occur simultaneously. Focused reviews will occur during the Schematic Design (SD), Design Development (DD), and Construction Documentation (CD) Phases. Partners involved in reviews include CA, STS, LEED Consultant, Roofing Consultant, HVAC lead, maintenance lead, Landscape Manager, ITS, security, ADA, and other key disciplines.

This will ensure timely identification of issues with equipment, specifications, or other elements of the design that require discussion.

Design

The DB Contractor's Architect/ Engineer (A/E) Team will lead a series of meetings with DGS, other Departments, the DGS PrM, and the DGS PM to develop construction documentation used to permit and build the project.

Value Engineering (VE)

Once the A/E Team receives enough detail, the DGS PrM will do additional budget calculations to be sure that the project is still on budget. VE takes place in this phase, which means reducing scope in order to reduce costs, as necessary. VE shall always be undertaken with input from the DGS team.

Permitting

Permits are obtained after construction documents have been submitted to and approved by the Authorities Having Jurisdiction.

Bidding

Even though the DB Contractor was selected by means of a competitive process, the DGS PrM shall also competitively select each subcontract (i.e., concrete, structural steel) package through a sealed bid process.

Construction

During this phase, the building is constructed or renovated.

Commissioning & LEED Facilitation

LEED Facilitation and Commissioning are two tasks that occur in several phases throughout the Design Build phase of the project. Third party consultants will provide review and direction during all phases, and soon after construction, the building will receive a LEED Certification.

Move In

Once the Design-Build phase of the project is complete and the building has received the occupancy permit, the End Users may begin the process of moving in. During this phase, DGS' Interior Design/ Move Management Team will manage furniture purchasing and delivery and relocation services.

Close Out

At the end of the project, the DGS PM and DB Contractor will provide a copy of the Project File to the End User (if required) and the Department of General Services for record keeping.

The Project File shall include:

- All drawings and plans, including As-Built/ Record Documents, in electronic format (both CAD and PDF versions).
- All maintenance documentation, including O&M equipment manuals, warranties, etc., valve and equipment tag list (with location, model, service date, barcoding), and owner equipment training session material.
- All photo documentation and time-lapse video.

- All communications documentation.
- Budget documentation including all copies of Pay Applications, Change Order Proposals, and Executed Change Orders, as well as the PM's Budget Tracker and other tools that show the overall cost allocations throughout the project.
- Substantial & Final Completion Punch Lists with approval/ acceptance documentation;
- Occupancy permit.
- Warranty and/or guarantee documentation.

GENERAL DESIGN REQUIREMENTS

General Design Overview

It is the goal of the DGS to provide buildings that meet the needs and functionality for the End Users and designed with a lifespan of 50+ years in mind to create buildings that are easy to maintain and durably constructed. This requires installing equipment that is appropriate to the needs of the building and that has a track record of low maintenance requirements.

The DGS seeks to provide functional, collaborative work spaces that will accommodate future growth needs as well as maximizing square footage with an efficient floor plan design. Additionally, to support maintenance and attic stock of materials, the DGS has established standardized design processes guiding material selection as described in the following section.

Rooms Required in All Projects

In addition to those required by program needs and for codes compliance, several rooms are required in new building construction (and renovations, if possible):

- Lactation Rooms
 - Per Civil Service Policy 4.13, lactation sites and break times require that lactation rooms shall be provided for the employees that work in the building.
 - Lactation rooms design shall follow the *American Institute of Architects'* best practice: "Lactation Room Design".
- The Department of General Services Maintenance Room
 - The DGS maintenance room will house a building automation system along with other instruments used to maintain the building. The base size of the maintenance room is a 10x14 or 100 SF office with maintenance room attached.
- ITS Rooms
 - In most cases there are MDF and IDF room layouts and will be discussed early in the design phase.
- Mechanical, Electrical, Fire Protection, and Other Infrastructure Rooms
 - All infrastructure rooms shall be located along an exterior wall with access from the exterior for servicing. If that is not possible, these rooms shall be in a non-secure area so that the equipment may be maintained without requiring access to secure spaces.
- Submetering
 - Submetering is required in all new buildings and shall be considered in all renovations.
- Recycle Room
 - Recycle room shall be located near dock with base size of 10x12'.

Equipment and Program Requirements

In every project there is a differentiation between costs that fall under the DGS project budget and under the End User program budget. These costs will be determined on a project-by-project basis and shall be discussed with the DGS PM.

DESIGN GUIDELINES – Specify the following:

A – SUBSTRUCTURE

1. FOUNDATIONS

- A. Waterproofing and drainage systems shall ensure watertight foundations.
- B. Proper water mitigation techniques shall be employed.
- C. Submit grading plans and proposed waterproofing products for the DGS review at the Schematic Design Phase.
- D. Locate subsurface drains to prevent subsurface drainage from entering the structure.

2. SLABS ON GRADE

- A. Slabs on grade shall be flat or level.
- B. Refer to Section 4.8 of ACI 117-10 *Specification for Tolerances for Concrete Construction and Material* for guidance about specifying realistic *Ff* and *Fl* values for the floor's intended use

3. WATER AND GAS MITIGATION

- A. Provide a radon mitigation plan for new construction (including standalone buildings and additions).
- B. Metro Water Services shall review Stormwater Plan for new construction or site work/ disturbance before the design development phase begins.

4. SUBSTRUCTURE RELATED ACTIVITIES

- A. Soil treatment shall protect against termites for new construction (including wood-framed, metal-framed, and predominately concrete and CMU construction).

5. METRO DEPARTMENT CONSULTATIONS

- A. If needed, the Designer shall coordinate with a DGS representative to consult with other departments of Metro.

END OF SUBSTRUCTURE

B - SHELL

1. SUPERSTRUCTURE

- A. All new buildings and building additions intended for solar or energy generation shall be designed to support such infrastructure with minimal future building modifications.
- B. Watertight testing shall be located at transitions between building envelope components as indicated on Design Checklists (see page 56).
- C. Roof edges shall be designed of low-sloped roofs to have parapets (24" min.) or gain approval from DGS at the schematic design phase for roof edge designs that are not parapets.

2. EXTERIOR VERTICAL ENCLOSURES

A. Exterior Doors

- 1. Refer to Section C-INTERIORS

3. EXTERIOR HORIZONTAL ENCLOSURES

A. Roofing

- 1. Submit roofing documents to be reviewed by DGS roofing consultant as indicated on Checklist.

END OF SHELL

C - INTERIORS

1. INTERIOR CONSTRUCTION

A. Interior Partitions

1. Locate thermostats, strobe lights, light switches, control panels, etc. together to keep walls as clean as possible.
2. Demountable walls shall only be used upon approval by DGS.
3. Soundproofed walls shall be included around restrooms, conference rooms and other rooms as requested by DGS on a per project basis.
4. Support details shall be provide for moveable partitions designed for room dividing.

B. Door Hardware (Interior and Exterior)

1. *BEST Hardware* or DGS approved equal shall be used that is compatible with existing hardware.
2. All building hardware schedules shall be prepared by an AHC certified hardware consultant.
3. All door hardware in new buildings shall have US26D finish.
4. Small format interchangeable core system shall be used for grandmaster keying. All lock-sets and lock cylinders shall accept small format cores. Hardware shall be shipped with temporary construction cores. Final cores will be shipped to the DGS Lock Shop. DGS will remove the construction cores upon final keying of the building prior to acceptance.
5. Panic hardware devices shall be rim or mullion type. Vertical rod type shall be non-concealed and shall be used in double doors where rim or mullion-type cannot be used. Device shall be through-bolted to door.
6. Locksets shall be heavy-duty, mortise type. Handles shall be lever type with lever return back to door surface.
7. Closers shall have adjustments for back check closing speed, latch speed, and spring power. Bracket types shall be specified. Closer shall be mounted on interior side of doors in parallel arm position or in regular arm position. Concealed or semi-concealed closers are unacceptable.
8. Electric Automatic Door Openers shall be *BEST Electric Auto-Equalizer*, or DGS approved equal. The following shall be included:

- a. Systems compatible with keypads or card readers and have built-in supply for actuators and peripherals, power actuators, and electric latch retraction or magnetic locks.
 - b. All units shall be covered by a two (2) year warranty. Warranty shall begin after installation and not upon delivery.
 - c. Wall plate actuators for exterior applications shall be hardwired low voltage and shall have a stainless steel 4 ½" round plate with engraved blue filled handicap symbol. Where applications require a surface-mounted actuator, the system shall include a surface mounting box made of heavy industrial-grade components providing weather-resistant installation. Specified models shall be *BEST 958* or *BEST 956* or DGS approved equal.
9. New door and/ or frames receiving automatic door operators shall be prepped for electrified hardware or hinge for future installation of a card reader. Selected products shall be *BEST*, or DGS approved equal.
10. All doors shall have minimum of three (3) hinges. Doors over 90 inches high shall have one additional hinge for each additional 30 inches in height. Exterior doors, corridor doors, doors over 36 inches wide, and all doors with closers shall have ball bearing hinges.
11. Push/ Pulls shall be through-bolted to each other.
12. Location of stops may not damage door skin or adjacent walls during door operation. Locate stops 2/3 the door width from the hinged edge of door. Wall bumper stops shall be reinforced with additional studs or intermediate blocking in the wall.
13. Specific Door Type Hardware Requirements:
- a. Entrance door closers shall not be exposed to weather. Hold-open or select-hold-open features on overhead stops are unacceptable. Heavy-duty mortised dead latches with a minimum throw of 3/4 inch shall be used.
 - b. Doors to roofs, penthouses, mechanical rooms, transformer vaults, elevator equipment rooms and custodial closets shall have closers and self-locking locks with a free lever handle on the inside and key access only.
 - c. Corridor doors acting as fire or smoke doors that sustain heavy use shall be equipped with magnetic hold-open devices and include a coordinator, a closer, and automatic flush bolts.

- d. Double doors shall be equipped with a coordinator, an astragal, and a pair of automatic flush bolts on one leaf. Dust-proof strikes for the floor bolt.
- e. Yard hydrant cabinet access doors shall be equipped with slot-type locks operable with a screwdriver. Key locks are not acceptable.

C. Interior Doors

- 1. Doors shall be consistent with the building architecture. For renovations, new interior doors and frames shall match existing doors and frames in adjacent areas.
- 2. Interior doors shall be flush face, solid lumber, per AWI Section 1300 specifications.
- 3. View lights shall be included on all doors except at building support rooms.
- 4. Welded frames shall be used. Knock-down frames are not acceptable.
- 5. Interior door frames shall be 16-gauge steel (min.).
- 6. A minimum of three anchors per jamb shall be used for doors up to and including 7'- 6" high. Four (4) anchors for doors from 7'- 6" high up to and including 8'-0" high. One (1) anchor per every two (2) feet for doors over 8'-0" high.

D. Exterior Doors

- 1. Doors shall be consistent with the building architecture. For renovations, new exterior doors and frames shall match existing doors and frames in adjacent areas.
- 2. Main and secondary building entrance doors shall be heavy-duty commercial with reinforcements for all hardware: closers, locks, exit devices, butt hinges, and power operators.
- 3. Exterior aluminum frames shall be steel reinforced for hardware: butt hinges, continuous hinges, and strikes.
- 4. Exterior service doors shall be hollow metal: 16-gauge steel (min.) face panel, 14-gauge (min.) frame.
- 5. The minimum clear opening size shall be 3'-0" wide x 7'-0" high.
- 6. Double door sized openings shall use a keyed removable center mullion.

7. Automatic door openers shall be used on all main entrance doors, including air lock doors. The automatic door opener's push-plate actuators shall be protected with an all-weather seal.
8. Floor mounted closers are not acceptable.

E. Ceiling Construction

1. Maximize ceiling heights.
2. Utilize 2x2 suspended ceilings systems.
3. 2x4's, specialty sizes or reveals are not acceptable without approval from DGS.
4. Locate access panels in hard ceilings in corridors for all valves and equipment for maintenance. Locations shall be coordinated with DGS.

F. Toilet Accessories

1. Owner provided and Contractor installed accessories shall be identified.
2. Whenever possible the Contractor will furnish and install all public toilet accessories for new construction and major renovations.
3. Provide coat hooks on backs of toilet partition doors.

G. Janitor closets – provide the following:

1. Three (3) slot mop hangers.
2. Stainless steel wall shelf.
3. Hose end holder.

H. Toilet Rooms

1. Locate unisex toilets in public locations unless DGS approves alternative.
2. Lactation Rooms shall be accessible from or within women's restrooms.
3. Lactation Rooms shall be accessible to employees only.
4. Toilet room partitions and stall doors shall be constructed from high density polyethylene resistant materials.
5. Two (2) coat hooks shall be centered horizontally on back of door.
6. Partitions shall be ceiling mounted.

7. Stall door privacy hinge shall be designed to completely eliminate sightline gaps around doors.
8. Baby changing stations shall be in all public restrooms.
9. Electric hand dryers shall be in toilet rooms unless directed otherwise by DGS.

I. Signage

1. Exterior

- a. Signage shall be directional in nature and include program, department, or agency.
- b. The naming of a building in honor of an individual shall be approved by Metro Council.

2. Interior

- a. All rooms shall have signage that corresponds to architectural room numbers.
- b. Architect shall establish room numbers at schematic design phase. DGS to identify rooms, doors, etc. for maintenance.
- c. Door frame tags shall be placed at all door frames within project.
- d. In renovation projects, door frames shall be tagged so the tag corresponds to architectural room number (i.e. outside surface, surface hinge, side top of frame).
- e. Any interior signage that includes an individual's name, such as the name of an elected official, shall be approved in advance by DGS.

2. INTERIOR FINISHES

A. General

1. LVT Flooring

- a. Luxury vinyl tile (LVT) shall be 20 mil thick minimum.
- b. Vinyl composition tile (VCT) or recycled vinyl (BVT – by product vinyl tile) shall not be acceptable.
- c. Rubber flooring shall be used in fitness areas and considered for use in other areas upon DGS approval. Rubber flooring shall

incorporate 30 to 95 percent EPDM color chips, nine (9) mil thick minimum, and use rolled goods instead of squares.

2. Carpet

- a. Walk off carpet tiles shall be used at entrances.
- b. Recessed walk off mats are not acceptable.
- c. Carpet fiber in heavy use areas (such as building corridors and large open office environments) shall be Antron nylon six (6), six (6), 20 oz. pile density carpet.
- d. Carpet fiber and weight for all other spaces shall be as approved by DGS.
- e. Adhesives shall be low VOC type as recommended by manufacturer for the product type.

3. Ceramic/ Porcelain Tile

- a. All floor tiles shall be non-slip and rated for heavy duty use.
- b. Low VOC adhesives recommended by manufacturer per product type shall be used.
- c. Designs where floor and wall tile indicate a pattern shall be detailed in the contract documents to clearly indicate the complexity of the pattern and tile sizes.
- d. All floor tile grout shall be sealed.
- e. Tiles on the slope to a floor drain shall not be larger than 6" x 6" in size.
- f. Hold grout joints to 1/8" or less.

4. Sealed Concrete

- a. Transparent sealer shall be low VOC.
- b. Building support rooms may use sealed concrete upon DGS approval.
- c. Flooring transition strips shall be installed at each transition between floor finishes that vary in thickness.
- d. Integral coves in wet areas for sheet goods and trowel applied flooring, 4 inch high, minimum.

5. Wall Finishes

- a. Level four (4) finish on gypsum board shall be used with surface primer.
- b. Only low VOC paint shall be accepted.
- c. Paper, vinyl or fabric wall coverings are unacceptable.
- d. Apply ceramic tile on wet walls at a min. of 48" above finish floor.
- e. Waterproofing tile shall be applied to cementitious backer board.
- f. Wet walls are defined as walls that have plumbing fixtures on them.

6. Coat Hooks

- a. Two (2) shall be mounted in toilets on the partition door.
- b. Office spaces, exam rooms and other locations requested by DGS shall include two (2) mounted on the walls (not doors) to include blocking at lower level (height as required by ADA) and higher level (60 inches above finished floor).

7. Interior Millwork and Casework

- a. AWI and AWMAC Premium Quality.
- b. Faces, bottoms, dovetailing, hinge capacities, etc. shall meet premium quality standards.

8. Ceiling Suspension System.

- a. A single manufacturer shall produce acoustical ceiling tiles and grid components.

9. Stair Finishes

- a. Non-slip surfaces shall be used.

10. Window Coverings

- a. *Mecho Shade* or DGS approved equal shall be used.
- b. 1% light control for majority of spaces shall be installed.
- c. Black-out shades shall be used in sleeping quarters and conference rooms.
- d. Dual-shades shall be used for conference areas.

END OF INTERIORS

D-SERVICES

1. PLUMBING

A. General Requirements

1. ASME expansion tank with manual air/ water bleed shall be used for all water heater tank systems.
2. If available, steam to hot water converters shall be used for domestic hot water.
3. Caulk wall-mounted fixtures with 100% white silicone sealer shall be used.
4. All fixtures shall be provided with maintenance accessible integral or separate I.P.S. stops.
5. Chrome-plated cast brass one-piece, p-trap with cleanout, ground joint, threaded 1 1/2" outlet shall be used for lavatories, sinks, and water coolers.
6. Chrome-plated cast brass escutcheons with setscrews shall be used for exposed flush valves, water supplies, and p-traps.
7. Chrome plated brass shall be used for exposed piping in restrooms and kitchens.
8. Hose bibs shall be used for all restrooms with floor drains, mechanical equipment rooms, cooling tower enclosures, packaged chillers, and roof top mounted AHU's. Loose key operated hose bibs for public locations.
9. Vandal-proof features shall be used for plumbing fixtures located in public areas and provide DGS a minimum of one (1) set of supporting vandal-proof tools.
10. The same manufacturer shall be used for each grouping of faucets, valves, flush valves, etc. for the entire building.
11. Shock absorbers with lockable access doors shall be used for domestic water systems with flush valves.
12. Interceptors and appropriate treatment shall be used for any waste that could be detrimental to the drainage system and/ or the Metro Nashville waste treatment plant.
13. Sump pumps and/ or sewage lift stations are not acceptable. Elevator sump pumps are acceptable.

14. Bottom side of roof drain pans shall be insulated. Insulate horizontal I roof leader piping. In addition, insulate under floor surfaces of floor drains, p-traps and piping receiving condensate from a cooling coil or ice machine to prevent condensation.
 15. Cold and hot water piping is not permitted in exterior walls.
 16. Freeze proof wall hydrants with extended stems shall be supplied from interior partitions perpendicular to exterior walls.
 17. Exterior hose bibs shall be spaced at a maximum of 200 feet apart.
 18. Isolation valves shall be placed in accessible valve boxes located in corridors or public space. Boxes shall be placed so they can be accessed without climbing into small or restrictive spaces such ceiling plenums.
 19. Primers shall be used for all floor drains.
 20. Floor drains shall be used for restrooms with two or more flushing fixtures.
 21. *ENERGY STAR* appliances and equipment shall be used.
 22. Under sink supply and waste piping shall be insulated.
 23. Toilets, urinals, private lavatory faucets, and showerheads shall be *WaterSense* labeled for all newly installed fixtures that are eligible for labeling.
- B. Fixtures – the following shall be provided:
1. ADA type throughout.
 2. TOTO or Zurn flush valves, or DGS approved equal.
 3. Electric water cooler only.
 4. Bottle fillers at all water coolers.
 5. Terrazzo mop sinks.
 6. Floor Drains
 - a. Mechanical Rooms: Galvanized cast iron parts with sediment bucket that supports round strainer. Strainer to suit application. Do not locate inside built-up air handling units. Specify primer connection. Use deep seal p-traps.
 - b. Other Locations: Cast iron body coated with chrome nickel alloy strainer to suit application. Use square tops where floor finish has

a straight grid pattern. Use funnel drains for indirect waste. Specify primer connection. Specify clamping collar in waterproof floors.

7. Electric water heaters shall only be considered if life cycle costs show electric is the best overall choice.
8. Low usage, such as hand washing in restrooms.
9. Shower valve – A single lever operated anti-scald pressure balance valve with integral stops tamperproof water saver head. Use thermostatic mixing valve in lockable enclosure for hot water supply to gang showers.
10. Wall Hydrant – Wall mounted concealed cast brass box type, non-freeze, automatic draining, and polished brass or stainless steel face with loose key lock.
11. Eye Wash Stations – Connect drain from free standing/ wall mounted eye wash to building drainage system.
12. Safety Showers – Safety showers shall be installed in areas where bodily exposure to hazardous chemicals could occur. (i.e. mechanical rooms, labs, etc.)

2. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

A. General Requirements

1. Warranties

- a. Chiller and refrigeration compressors, 5 years parts & labor.
- b. HVAC control two (2) years parts & labor.

2. HVAC Systems

- a. Hydronic systems consisting of chilled water and heating hot water with forced air ventilation. Electric resistance heating and DX cooling for building systems shall require permission from DGS.
- b. Unoccupied spaces that require continuous cooling such as telecom rooms and electrical rooms shall be on separate systems. Limit use of fan coil units to unoccupied spaces that have primarily sensible heat loads.
- c. Air handling unit configuration and layout to optimize the zone within the facility such that the same air handler to maximize

energy conservation through scheduling functions serves areas of similar operating schedule, exposure and function.

- d. Mechanical rooms that contain electronic control panels, to include Variable Frequency Drives, to be conditioned to provide temperature and humidity control to allow proper function of electronic equipment at <85°F and <60% RH.
 - e. Installed equipment not to exceed 80 dB A measure three (3) feet from the equipment.
 - f. Chiller alarms to be connected to alert DGS Center of Responsible Energy (CORE) management facility.
 - g. HVAC systems regardless of size to have the capability to dehumidify the space using an additional means (hot gas reheat, electric reheat, etc.).
 - h. Thermostats to display both room/ space temperature and humidity.
 - i. HVAC subsystem components such as FCU's, VAV boxes, etc. shall be located of the work zone, employee desks or cubicles. Locate subsystem components over hallways or over doorways in office spaces. Separate mechanical closets and floor mounting is preferred if space allows.
 - j. Newly installed systems to monitor building pressure at all outside doors.
3. Piping Information to be included through the BAS:
- a. Schedule 80 for chilled water piping that is less than or equal to $\frac{3}{4}$ " .
 - b. A dirt leg on all chilled water supply and returns at coils.
 - c. Weld-neck flanges only are allowed. Do not use slip-on flanges.
 - d. Follow ASTM A2078B for bolts when bolting to cast iron flanges, valves, or pumps.
 - e. Pump discharge check valves shall be sized so that the check valve is full open at design flow rate.
 - f. Expansion tanks shall be provided with a sight glass or other means of visually verifying level in tank.
 - g. Condensate return from equipment shall be gravity fed to the condensate receiver.

- h. Propress piping and fittings.
4. Air systems
- a. Ducted supply and return systems. Return plenums are not allowed unless approved by DGS.
 - b. Only exterior insulated supply ductwork.
 - c. For return air systems, the air handler shall include a preheat coil. Exceptions may include AHU's dedicated to core or interior zones. Heating coils in return air systems shall be hot water.
 - d. Fan rooms shall not be utilized as return or supply plenums.
 - e. HVAC systems shall include air-side economizer mode to reduce energy consumption.
 - f. Dampers and louvers shall be fully gasketed, opposed blade, face and bypass dampers at equipment coils where used.
 - g. Humidification shall be provided as required to maintain minimum humidity levels for comfort and/ or equipment functionality.
 - h. Mechanical rooms shall not be used as return air, outdoor air or mixing plenums.
 - i. All central multi-floor-type return air risers shall be ducted.
 - j. Flexible ducts: sheet metal collars and sleeves shall be beaded to hold draw bands.
 - k. Air filters shall be changed within one week of building acceptance by DGS.
 - l. Minimum efficiency reporting value (MERV) 13 or higher filtration on each ventilation system that supplies outdoor air to occupied spaces.
 - m. MERV 8 filters in the return air stream.
 - n. Access doors of sufficient size to access all fire dampers, smoke dampers, smoke detectors, volume dampers, motor operated dampers, humidifiers, coils (steam, hot water, chilled water, electric), and other items located in ductwork which require service and/or inspection.
 - o. VAV terminal units with reheat shall be supplied with access door between damper and reheat coil.

- p. Locate all terminal units with unobstructed access to unit access panels, controls and valves. Piping connections shall be on same side of unit as control box.
 - q. Terminal unit installation: group spaces/zones/rooms/areas of similar areas of similar occupancy, i.e.
 - i. Offices zoned with offices.
 - ii. Offices shall not be zoned with conference rooms or other dissimilar rooms.
 - iii. East offices shall not be zoned with south offices, etc. Corner offices/ spaces shall be zoned separately.
 - r. Duct drainage: Outside air intake chambers shall be furnished with water tight alarmed drain pans minimum two inches in depth. An indirect drain line shall be designed to carry rain or melting snow to a nearby floor drain.
 - s. When possible, smoke duct detectors shall be located between the humidifier and the fan.
 - t. For duct detectors and humidity sensors that shall be installed downstream of the humidifier, their location shall be 6" beyond the entrainment zone specified by the humidifier manufacturer.
 - u. Multiple exhaust fans shall not be designed as combination manifold unless backdraft protection is properly installed.
5. Valves
- a. Isolation valves for all main runs and all branch runs for ease of maintenance.
 - b. Pressure independent chilled water control valves will be utilized for all facilities connected to a central chilled water plant to minimize energy consumption and increase temperature differential back to the plant.
 - c. Use PICCV (Pressure Independent Characterized Control Valve) in lieu of standard 2-way control with a separate balancing valve in VAV reheat systems.
 - d. Isolation valves at all pieces of equipment for maintenance and service.
 - e. Chainwheel operator for all valves in equipment rooms mounted greater than 7'-0" above floor level, and chain shall extend to 5'-0" above floor level.

- f. All valves shall be furnished and installed so that the valve remains in service when equipment or piping on equipment side of valve is removed.
- g. On multi-floor buildings, each floor will have Isolation Valves installed to allow each floor to operate independently and without service interruption to other floors. Each piping branch off of the main supply piping shall have an isolation valve.
- h. Domestic water backflow preventers shall be located in mechanical rooms.

6. Gauges

- a. Thermometers shall be installed in both the supply and return piping to all water coils, chillers, boilers, heat exchangers, and other similar equipment.
- b. Thermometers and pressure gauges are required on the suction and discharge of all pumps, chillers, boilers, heat exchangers, cooling coils, heating coils and cooling towers.
- c. Duct static pressure gauges for the central air-handling air supply fan discharge, and at all duct locations at which static pressure readings are being monitored to control the operation of a VAV system.
- d. Differential static pressure gauges shall be placed across filters in air-handling units to measure building pressure relative to the outdoors.
- e. For critical areas, an airflow monitor is preferred in lieu of a pressure sensor.
- f. HEPA filters: Only HEPA filters and filters for critical areas are to have DP sensors tied into the DGS BAS System.
- g. Magnehelic or inclined manometer on all other filters.

7. Mechanical Insulation

- a. External ductwork insulation and soundproofing is the DGS requirement except on transitions. No exceptions.
- b. Roof deck underlay insulation is required in structures with attic space. No blown in insulation is permitted.
- c. Spray foam insulation on walls and decks is the preferred medium.

3. COOLING TOWERS

A. General Requirements

1. ANSI/AFBMA 9 - Load Rating and Fatigue Life for Ball Bearings.
2. ANSI/AFBMA 11 - Load Rating and Fatigue Life for Roller Bearings.
3. ASME PTC-23 - Atmospheric Water-Cooling Equipment.
4. Cooling Tower Institute (CTI) ATC-105 - Acceptance Test Code for Water Cooling Towers.
5. Cooling Tower Institute (CTI) - Certification Standard STD-201.
6. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
7. Closed loop type towers.
8. Fan drive to be right angle gear type.
9. Cooling tower manufacturers to be Marley, BAC, or Evapco.
10. Ladder and safety railing for towers.
11. Distribution, collection basins, and sump shall be 316 stainless steel.
12. One cooling tower per chiller having thermal capacity to cool the required flow (GPM) of condenser water from 95°F to 85° F at a design entering air wet-bulb temperature of 80° FWB.
13. Design structural system for a minimum of 50 psf live load and 21 psf wind load in addition to tower dead-loads and operating-loads.
14. Structural system, including assembly of collecting basin and steel casings, shall be fabricated via bolt connections with stainless steel fasteners. Joints shall be sealed to make watertight enclosure.

4. FIRE PROTECTION

A. General Requirements

1. Fire protection equipment shall fully comply with NFPA Standards. The latest edition of the "FIRE SPRINKLER SYSTEMS" shall be used as a guideline in the design of these systems.
2. The design water supply shown in the contract documents shall be the field-tested fire flow with the static and residual pressures. The fire flow test will only be valid for 12 months prior to the start

of construction. The installing sprinkler Contractor shall include a 10 psi cushion in the hydraulic design.

B. Materials and Standards

1. The same manufacturer shall be used for sprinkler heads, valves, etc. for entire project.
2. Flow control (on/off) sprinkler heads are unacceptable. Quick response heads shall be used where approved by NFPA.
3. Pendent heads shall be semi-recessed with a two-piece adjustable metal threaded escutcheon. Push-on escutcheons are not acceptable.
4. Only U.L. or F.M. listed sprinkler heads shall be acceptable for use.
5. Sprinkler system meet NFPA 13 requirements and shall include the following components.
6. An alarm check valve with outside water motor gong shall be used.
7. A Post Indicator Valve (PIV) shall be located a minimum of 40 feet from building walls.
8. A Fire Department Connection (FDC) shall be located on the building side of the backflow prevention device and on the street side of any alarm check valve. Where sprinkler and standpipe systems are separated, a separate FDC for the standpipe system labeled "STANDPIPE" shall be provided. Permanent signage indicating location of FDC shall be provided.
9. The FDC shall be located to provide unobstructed access for fire department apparatus.
10. The location of all tamper switches and flow switches shall be indicated on the drawings. A riser diagram showing major components shall be provided.

C. Fire Sprinkler Specialties

1. A PIV and tamper switch shall be provided for each system.
2. Fire Department hose valves shall be 2-1/2" without hose. 2-1/2" x 1-1/2" reducing coupling with cap and chain shall be provided at each fire department hose valve. Threads shall match National Standard.

3. Backflow preventers shall be installed with the highest portion no more than 48" above the floor and the lowest point no less than 12" above the floor. Devices shall be provided with three (3) foot clearances around the device for testing and maintenance and shall be provided with a method of discharging water out of building.
4. Fire hydrants and their installation shall meet AWWA standard requirements and NFPA 24. Fire hydrants shall be installed in a looped system around building perimeter outside the subject building's "fall zone" calculations. Hydrant control valves shall be located in valve boxes.
5. The fire pump assembly shall be located inside the building with direct exterior access. Room shall have permanent heat and emergency lighting. Fire pump shall be installed and located as to be tested per NFPA 20 Standard.

D. Installation

1. Exposed piping and heads shall be installed as high as possible. Sprinkler heads less than seven (7) feet above the floor shall be provided with guards. In other areas where there is the potential to damage the sprinkler heads (athletics, etc.) guards shall be provided for the heads.
2. All valves controlling water supplies for sprinkler systems or portions thereof, including floor control valves, shall be located for unobstructed access and within seven (7) feet above the floor level. All sprinkler valves and controls shall be provided with tamper switches and labeled. Valves located above ceilings shall receive prior approval by DGS if valves are concealed above a lay-in ceiling, color-coded ceiling markers shall be provided. If valves are located above a hard ceiling, access doors with markers shall be provided.

E. Fire Protection

1. DGS prefers extinguishers in recessed or semi-recessed boxes held close to corners, white fire extinguisher boxes with full glass fronts. Need to coordinate with signage (signage at top of wall to indicate locations of extinguisher boxes).

5. FIRE ALARM SYSTEMS

A. General Requirements

1. Engineer of Record shall design a complete fire detection system with total smoke detector coverage.

2. The Fire Alarm Control Panel (FACP) or annunciator, shall be mounted at the building's designated emergency entrance. Annunciation of all building alarms shall occur in one central location. This includes fire, ventilation failure, and gas monitor alarms.
3. Prior to final inspection, the Fire Alarm Contractor shall demonstrate 100% compliance with plans, submittals, specifications and NFPA 72 to DGS.

6. ELECTRICAL POWER/GENERATORS

A. General Requirements

1. Generators, transfer switches, and all electrical feeds shall be grouped separately from the HVAC equipment and viewable via their respective control systems using the BAS as a viewing medium.

B. Metering

1. All electrical installations are metered for KWH/KWD for utility billing purposes, on the secondary side of the building transformers.
2. DGS requires metering equipment, including meter, meter base, current transformers, potential transformers, wiring, and terminations.
3. The meter shall indicate a 15-minute integrated demand and reset. Graphic or chart type meters are not acceptable. For freestanding switchgear, include a test block to enable the use of plug-in recording current and voltage equipment.
4. Current transformers shall be of dual rating. Two (2) duplex grounded convenience receptacles, supplied from the emergency power system, shall be placed adjacent to the meter location. In freestanding switchgear, the meter shall be factory wired and flush-mounted with minimum 65KA fuse protection. Potential tap points shall be protected with High Interrupting Capacity (HIC) fuses.
5. Metering shall be suitable for connection to the DGS automation system. Meter shall accommodate remote read capabilities over the campus network. Panel installation is preferred.
6. Main Distribution switchboards shall be equipped with digital metering to measure the following:
 - a. Voltage: Phase to Neutral and Phase to Phase.
 - b. Current: True RMS amperage for each phase and neutral.
 - c. Demand: Kilowatts.

- d. Power Factor: Ratio KW/KVA.
 - e. Reactive Power: KVAR.
7. Each building or building complex shall have an exterior pad-mounted transformer.

C. Emergency Generators

1. The generator system shall be supplied by the factory-authorized distributor of the engine. The supplier shall have a parts and service facility located within 100 miles of the job site, with factory-trained technicians in full time employ and a stock of spare parts. Use one of the following products or DGS approved equal:
 - a. *Onan*
 - b. *Kohler*
 - c. *Caterpillar*
 - d. *Cummins*
 - e. *Katolight*
2. Engine Specifications:
 - a. The prime mover (engine) shall be diesel or natural gas.
 - b. The engine shall be liquid-cooled (radiator cooling system) with thermostatic temperature control and high coolant temperature shutdown.
 - c. The engine shall be a model that has been manufactured and successfully operated in similar service for a minimum of five (5) years to establish its reliability.
 - d. Noise generated by the generator shall not exceed 60 dBA at 50 feet.
 - e. Exhaust shall be located away from building at a distance to prevent air entrainment of the building air intake.
 - f. The alternator shall be 4-pole, brushless, with drip-proof construction, revolving field type with fully rectified exciter, protected and sized for maximum motor starting loads. Insulation shall be Class F per NEMA MG1-1.65. The rotor is dynamically balanced and permanently aligned to the engine by flexible disk coupling. Voltage regulation shall be solid state temperature

compensated with phase-controlled sensing. Provide heavy-duty permanently lubricated ball bearings.

3. Control Systems

a. Engine generator controls shall be contained in a shock-mounted cabinet. Digital controls and metering shall be used. The following controls and metering shall be provided at minimum:

- i. AC Ammeter 92% accuracy, 3.5"
- ii. AC Voltmeter 92% accuracy, 3.5"
- iii. Phase Selector Switch/Current Transformer for each Phase
- iv. Frequency Meter
- v. Running Time Meter
- vi. Oil Pressure Gauge
- vii. Water Temperature Gauge
- viii. Battery Charging Ammeter
- ix. Voltage Adjusting Rheostat

b. Safety Shutdown and Alarm Light for:

- i. High Water Temperature
- ii. Low Oil Pressure
- iii. Engine Over speed
- iv. Engine Over crank
- v. Auto-Off-Reset Switch
- vi. Panel Lighting
- vii. Molded Case Main Circuit Breaker

4. Fuel Tanks

a. Diesel fuel tanks shall be integral base mounted with secondary containment. All tanks shall be sized for a minimum 72 hour engine operation at 80% full rated generator output.

- b. The Contractor shall fill fuel tanks immediately following installation and refill tanks immediately prior to acceptance of the project.

5. Automatic Transfer Switches

- a. Three phase automatic transfer switch (ATS) shall be rated for continuous duty and shall be either three-pole type with overlapping neutral transfer contacts, or four-pole with full-size neutral contacts.
- b. ATS shall be Underwriter Laboratories (UL) listed.
- c. The ATS shall be a closed transition assembly (make before break).
- d. Automatic transfer switch, solid state controlled, rated for all classes of loads, both inductive and non-inductive, and mechanically held on normal and emergency shall be provided. The transfer switch solid state control system shall include the following minimum features:
 - i. Time delay on engine starting: adjustable from 0 to 6 seconds.
 - ii. Time delay on transfer from normal to emergency: adjustable from 0 to 120 seconds.
 - iii. Time delay on re-transfer from emergency to normal: adjustable from 1 to 30 minutes.
 - iv. Time delay on stop: adjustable from 0 to 8 minutes.
 - v. Under frequency/under voltage relay for emergency source to prevent transfer prior to generator output reaching pre-set levels.
 - vi. Test switch to simulate power outage.
 - vii. Main shaft auxiliary contacts, minimum one (1) NO and one (1) NC.
 - viii. Solid state battery charger with a three (3) ampere minimum charge rate and automatic adjustable float setting.

6. Transformers

- a. Three-phase transformers shall be pad-mounted.

- b. Transformers (single and three-phase) shall have four (4) spade-type terminals with matching connectors on the secondary side. All four secondary terminals shall connect secondary leads to the main switchgear.
- c. Transformers shall have two (2) 2.5% taps above and two (2) 2.5% taps below rated voltage. Transformers shall be oil filled with “less hazardous” oil types (i.e. silicon-based and R-Temp).
- d. Pad-mounted transformers shall have distribution-type lightning arrestors and include barriers to separate high and low-voltage compartments. Current-limiting fuses shall be used throughout. All transformers shall be fused to 150% of transformer rating.
- e. All transformers shall be equipped with a dial-type thermometer, liquid level gauge, pressure-vacuum gauge, filling and top filter press connection drain, bottom filter press (to completely drain), and oil sampling valve. All items shall be accessible without removing any covers.
- f. The nominal maximum KVA rating of any single transformer installation shall be as follows:
 - i. 500 KVA at 2/480 Volts, or at 480 Volts delta
 - ii. 1000 KVA or below at 120/208 Volts, or at 240 Volts delta
- g. Pad-mounted transformers, 500 KVA or less, shall contain three (3) 15 KV or 25 KV single-phase load-break switches, rated at 200 amps. Current-limiting fuses shall maintain protection and the switches shall be three individual units, separated by insulated plates.
- h. Pad-mounted transformers, 750 KVA or larger, shall have a built-in gang-operated primary disconnect switch, either oil or air type. Protection to be by dry HIC current-limiting fuses.
- i. Pad-mounted transformers shall be dead front, loop feed design.
- j. Transformers shall conform to the latest applicable standards of the National Electrical Manufacturers Association (NEMA) and the American National Standards Institute (ANSI).
- k. The electrical riser diagram for the power distribution systems for each building shall be mounted at the main switchgear in the mechanical/electrical room under clear protective material.

7. ENERGY MANAGEMENT

A. General Requirements

1. New installations shall include electrical, water, natural gas, and solar (where applicable) energy metering. BTU meters for steam and chilled water shall be included where applicable. These meters shall be interfaced either with their native automation software or through the building automation systems.
2. All subsystems as directed by DGS' Sustainability Division, shall be monitored and trended and capable of producing reports.
3. Meters shall have local display and a lightning surge protector. Each meter output shall be connected to DGS network V-LAN via Modbus RTU TCP/IP. Meter shall be provided and capable of measurement of both instantaneous and accumulated energy usage.
4. Design shall provide detail drawings indicating manufacturer requirements for proper installation, illustrating both upstream and downstream minimum straight pipe distance requirements for flow and thermal-energy meters.
5. Piped utility meters shall be installed with isolation valves and drain valves. A 20 mesh 316 stainless steel strainer shall be provided with select piped meters including positive displacement and turbine types used for city water and condensate.
6. Contractor shall validate the performance and accuracy of the meter.
7. When possible, meters shall be installed five (5) feet or lower above the finished floor.
8. Include a 12x12x8 System Security Interface (SSI) box for a secure connection between meter output and campus LAN. When distance between meter and telecommunications room exceeds 300 feet, copper to fiber converters shall be used.
9. Contractor shall provide one (1) four (4) hour training session by a representative from the energy meter supplier to cover the operation and maintenance of all components.

B. Materials & Standards

1. For building domestic cold and domestic hot water metering, meter shall be *Neptune Tru Flo Compound* for variable flow, 2" pipe and above, *Neptune Turbine* for constant flow, 2" pipe and above, *Neptune Positive Displacement* for smaller than 2" pipe.
2. The meters shall record water usage in units of gallons.

3. Meters shall be equipped with a pulse output and shall be wired into a flow computer or DGS approved input-output device. Meter shall include a cover on the register and minimum of 10 feet of wiring sealed within unit.
4. The use of magnetic flow meters for domestic water applications is subject to approval by DGS.
5. A make-up water meter shall be provided for domestic hot water systems.

C. Electricity Metering

1. Primary electrical meters shall be furnished by DGS. The meter will be a *Nexus 1262*, or DGS approved equal.
2. Sub meters shall be UL approved and be of the *Nexus, Electro Industries* family, or DGS approved equal.
3. Communications: 10/100BaseT, Rapid Response Ethernet.
4. Sub meters shall be capable of accepting up to one (1) input pulse and transmitting via *Modbus TCP/IP*.
5. If primary DGS provided electrical meter is located on building transformer, (1) one inch conduit with pull string shall be run to nearest mechanical or electrical room. Do not run the conduit to the telecom room, as DGS Energy Systems does not have access to those areas. Data ports shall be provided.

D. Building Chilled Water and Heating Hot Water Metering

1. Meter preference is as follows: *Siemens Ultrasonic, Magnetic Flow* or DGS approved equal.
2. Thermo-wells (316 SS) shall not be mounted closer than 10 pipe diameters upstream or five (5) pipe diameters downstream from flow element.
3. Gauge pressure transmitters on both supply and return lines. The flow computer will calculate the differential pressure from these inputs.
4. The flow computer shall be a *KEP*. See further detail in the "Flow Computer" Section F-8 below.
5. Ultrasonic (strap-on) Flow Meter application: Use for all pipe sizes in the supply or return lines. Straight pipe required is a minimum of 10 pipe diameters upstream and five (5) pipe diameters downstream.

6. Designer shall alert DGS when ultrasonic meters will not be suitable for 12" diameter and larger piping.
7. Transmitter signal: 0-20v, 4-20mA, or pulse output.

E. Full-bore Magnetic Flow Meter

1. Application shall be Straight pipe required with minimum of five (5) pipe diameters upstream and five (5) pipe diameters downstream.
2. Transmitter signal: 0-20v, 4-20mA, or pulse output.
3. Matched thermos-well transmitters with spring-loaded sensors shall be supplied by manufacturer of flow metering system.
4. All pressure and temperature transmitters and magnetic meters shall be provided with HART Communications Protocol compatibility.
5. All temperature transmitters shall provide linear output with temperature within accuracy of 0.15 deg. F, over the calibrated range.

F. Building Steam Metering

1. Steam Meters shall be *Veris Accelabar* differential pressure flow meter or DGS approved equal.
2. Meter shall be aggressively sized to permit capture of the entire steam flow range, from low to high, since this meter will be used for billing. The low to high flow range shall be correctly identified. DGS can assist the Designer by providing steam use data on existing comparable buildings. This same procedure applies where an existing meter is being repurposed for a revised steam load.
3. Accuracy: +/-0.5% of rate, transmitter signal: 0-20 or 4-20mA.
4. 316 stainless steel body.
5. For process pressures above 80 psi use ANSI B16.5 Cast Iron – Class 300 Flanges, for process pressures 80 psi and below use ANSI B16.5 Cast Iron – Class 150 Flanges.
6. The transmitter to measure differential pressure (DP) shall be direct mount integral to the *Veris Accelabar* meter with a 3-valve manifold. The transmitter shall be a *Foxboro IDP10S*, or DGS approved equal

7. A RTD mounted in the meter shall be used to send signals to the flow computer to register temperature. A puck style transmitter shall be used between the RTD and the flow computer.
8. The flow computer shall be a *KEP*. See further detail in the “Flow Computer” section “H” below.
9. When needed, ½” 316 stainless steel isolation valves at drain and fill points shall be provided to ensure tight shut off. Valves are to be designed with NPT threads and rated for 450F and 150 PSIG saturated steam. Drain points are to face horizontal or downward. Drain points are not to face upward.
10. All pressure/temperature transmitters shall be provided with HART Communications Protocol compatibility.
11. All temperature transmitters shall provide linear output with temperature within accuracy of 0.15 deg. F, over the calibrated range.
12. Stacked transmitters shall be used when the turn down of the steam meter is 10:1 or less or if the entire flow range cannot be covered with a single transmitter.
13. After start up the Designer/Contractor shall provide interval steam supply and condensate readings to EM.
14. The final adjustments on the flow computer and transmitters shall be vetted by an authorized technician representing the manufacture of the meter. This technician shall deliver a summary of findings to EM on the status of the settings on the flow computer and transmitters.
15. Final Acceptance shall be by DGS based upon the meter operating in the design range after the transmitters have been zeroed. Meters will not be accepted if it is determined the meter is not operating in the design range. DGS will only be able to complete this task after the communication wire/instruments are installed which transfers signals from the flow computer to the data historian via the campus LAN. The serial number(s) of the meter shall be provided to DGS.
16. When needed, impulse lines shall be 316 stainless steel and 0.049” wall providing a minimum rating of 2,000 psig.
17. When needed, supports at 12 inch to 16 inch intervals shall be added to support impulse lines at *Veris Accelabar* meters from walls or device mounting supports.

18. Each pressure sensing transmitter at *Veris Accelabar* meters shall be provided with a three (3)-valve manifold.

G. Building Steam Condensate Metering

1. Steam condensate metering is required in addition to building steam metering to quantify the total condensate being returned to the thermal plants.
2. High temperature *Niagara MTX/WPX* turbine flow meter suitable for steam condensate shall be provided.
3. Meter shall read in gallons.
4. Reed switch contact closure shall be included. Meter shall be integrated to the nearest available *KEP* flow computer or *DGS* approved input-output device.
5. *KEP* flow computer display shall indicate condensate flow total (gal).

H. Flow Computers

1. Basis-of-Design Product: Subject to compliance with requirements, package flow computer shall be provided, including NEMA 1 enclosure, computer, Modbus RTU to Ethernet converter, 24VDC power supply and UPS power supply. *Kessler-Ellis* products or approved equal.
2. Enclosure:
 - a. NEMA 1 Wall Mount Enclosure
 - b. Prewired raceway
 - c. Internal duplex for power connection complete with conduit entry
 - d. Panel cutout for *KEP ES762* flow computer
 - e. Quick release cover latch
 - f. Mounting provision for Modbus RTU to ethernet converter, power supply and UPS
3. Design Basis: MS810: Part # MS810NEMAST4X1-QR-PW-SP-AE-DP-PS-UPS.
4. Modbus RTU to Ethernet Converter: Design Basis: *B&B MESR901*.

5. Power Supply Design Basis: *PULS MiniLine ML30.100*.
6. 115VAC to 24VDC Power Supply for Modbus RTU to Ethernet Converter and Flow Computer.
7. UPS Power Supply Design Basis: *Tripp Lite Internet Office INTERNET550U*.

I. Installation

1. Assemble and install connections, tubing, and accessories between flow measuring elements and flow meters according to manufacturer's written instructions.
2. Install flow meter elements in accessible positions in piping systems.
3. Install differential-pressure-type flow meter elements, with at least minimum straight lengths of pipe, upstream and downstream from element according to manufacturer's written instructions.
4. Install permanent indicators on walls or brackets in accessible and readable positions.
5. Install connection fittings in accessible locations for attachment to portable indicators.

J. Connections

1. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.
2. Connect flow meter-system elements to meters.
3. Connect flow meter transmitters to meters.
4. Connect thermal-energy meter transmitters to meters.

8. MECHANICAL/ELECTRICAL ID

A. General Requirements

1. Paint or label all equipment and piping exposed to view in finished areas.
2. Electrical breaker panels shall be clearly labeled with panel name, voltage and source feed information. Label per ANSI 13.1.

3. Typed circuit directories shall be provided within each panel indicating the location and load name for each circuit.
4. Color code piping in mechanical rooms by covering surface with paint; and/ or corresponding labels or stencils indicating service type, i.e. chilled water supply, chilled water return, etc.
5. Directional flow arrows with corresponding labels or stencils on all pipes or pipe covering shall be displayed at 10 ft. intervals to signify the direction of flow and indication of service type, whether the piping is exposed or concealed above ceilings.
6. Steam lines shall indicate pressure, i.e. low pressure, high pressure, etc.
7. Brass valve tags on all valves and a schedule under rigid plastic cover and frame in the mechanical room.

B. Color Coding for Piping

1. Utilize the following color coding for various pipes, pipe banding, and pipe insulation. On Lines 2” or greater identifying direction of flow, all life safety conduit to be red in color or at a minimum the face plate of the J-Box be red in color:

Fire Protection	Red
Steam Supply	Orange
Condensate Return	Aluminum
Potable Cold Water	Dark Green
Potable Hot Water	Dark Yellow (gold)
Non-Potable Water	Bright Yellow
Deionized Water	Light Green
Chilled Water	Dark Blue
Condenser Water	Light Gray
Natural Gas	Light Yellow
Compressed Air	Dark Brown
Vacuum	Beige
Process Water	Light Blue

Drain, Waste, and Vent	Same as surrounding area
Heating Hot Water	Light Brown
Reclaimed Water	Purple

2. Mark location of valves above ceilings with identifying “adhesive buttons”; colors corresponding to the above color chart. Mark locations of VAV boxes, terminal units, etc. with labels, black lettering on clear tape. Labels on ceilings/grids to correspond to labels on thermostats or room temperature controllers.

9. WATER TREATMENT

A. This section includes water-treatment systems for the following: heating, hot water piping (closed-loop system), chilled-water piping (closed-loop system), heating, steam and condensate piping, condenser water piping (open system), domestic water piping.

B. General Requirements

1. Closed-Loop System shall include one bypass feeder on each system. Bypass feeder tanks to include one-piece filter socks inside tank Isolating and drain valves shall be installed at circulating pumps.
2. Closed-Loop Steam and Condensate Piping shall introduce the chemical to the boiler through a chemical feed system. Coordinate with the DGS HVAC water treatment Contractor.
3. Open-Loop Condenser Water Piping shall include chemical feed and bleed control systems with integrated chemical feed systems based upon the current water treatment program.
4. System performance requirements shall be subject to compliance with the DGS water treatment Contractor. Contractor shall provide products obtained from the Chemical Treatment Vendor for DGS for initial treatment.
5. Submittals shall include product data for shipping, installed, and operating weights, rated capacities, water-pressure drops, and furnished products listed below:
 - a. Chemical feed and bleed control systems with integrated inhibitor and dual biocide feed tank shall be provided.
 - b. Chemical Treatment Contractor shall inspect installation and initial water treatment. Contractor shall provide test of initial charge and a verification retest within five (5) days

prior to opening utility distribution valves or within five (5) prior to beneficial occupancy.

- c. Water softening treatments to be included in all humidifier applications that warrant. Water checks of site water shall be performed by building constructor.
- d. Newly installed chemical feeder systems shall communicate the water conditions back to the central building system (BAS) for remote monitoring by staff.

10. INTEGRATED AUTOMATION

A. General Requirements

1. The controls system shall be web based, capable of integrating multiple building functions including equipment supervision and control, alarm management, energy management and historical data collection.
2. HVAC controls system Contractor shall provide a fully integrated system, UL listed, incorporating direct digital control for energy management, equipment monitoring and control.
3. Building systems which require an emergency generator shall have a control system with UPS for all affected control panels.
4. The installer shall have at least 10 years of experience and be approved by the manufacturer for both installation and maintenance of building systems and equipment.
5. There shall be only one Ethernet connection per building to the DGS wide area network. The Ethernet connection shall not be located in DGS telecommunication rooms.
6. The sequence of operations for the building shall be available on the graphical webpage for the building systems, either through a link to a HTML page or a PDF.
7. In buildings and spaces requiring strict individual room humidity and/or air quality control, a multiple point air quality monitoring system shall be provided.
8. New BAS installations shall incorporate the ability to install software using a virtual machine server type.

9. Building Automation System main controllers shall have a touch screen monitor capable of viewing the system components from the main controller location.
10. No laptop or desktop PC is required with new BAS systems.
11. Controllers shall operate on the *Tridium/Niagara* platform (JACE) controllers, *JCI Metasys* platform, or similar platform and shall comply with ITS requirements (see page 5). ITS reserves the right to limit the controls vendors to three choices due to serviceability.
12. New applications shall be locally supported with documented local service companies who have (Metro Nashville Government) background checked service technicians.
13. Warranty and Service
 - a. Extended warranty that includes remote service and future software upgrades for five (5) years shall be included in all new projects.
 - b. The Contractor shall warrant the system to be free from defects in material and workmanship for a period of one (1) year from the date of completion and acceptance of the work by the owner.
 - c. The Contractor shall provide one (1) year of maintenance service for the Heating Ventilating and Air Conditioning (HVAC) controls system to begin concurrently with the first year of warranty. Service shall include inspection and adjustment of all operating controls and components during the alternate season commissioning effort. A service report shall be provided to DGS.

B. Materials & Standards

1. Direct Digital Control (DDC) System
2. All newly constructed buildings shall be controlled using stand-alone microprocessors, web based, BACNET compliant DDC computer systems. All hardware, software, and equipment required to insure that the DDC system can be managed from the DGS LAN shall be provided. Installer shall be responsible for all low voltage wiring installation and shall coordinate networking and server installation (including specifications) with DGS IT Department.
3. Schemes shall be submitted for connecting new facilities to the control center(s). All DDC systems shall be connected to the appropriate control center(s) using a fiber optic network, a hard-wired communication trunk,

or a telephone communications trunk. Site specific desktop or laptop hardware is not required.

4. A conduit system shall be installed between all DDC panels within a given building. Conduit system to extend to the appropriate building exit point. All cables that provide the communications link between the DDC controllers and the external communications network shall be installed as a part of the project. The remote communications link shall be established and remote capabilities shall be verified by the Contractor prior to final acceptance of the DDC system.
5. For systems with DDC of individual zone boxes reporting to the central control panel, static pressure setpoint shall be reset based on the zone requiring the most pressure; i.e., the setpoint is reset lower until one zone damper is nearly wide open.
6. All relevant DDC systems shall follow *ASHRAE Standard 135-2010 – BACnet a Data Communication Protocol for Building Automation and Control Networks* with any updated addendums.
7. The DDC's and/or Building Automation System (BAS) or HVAC will provide remote access for control and monitoring of both the systems and energy consumption. The BAS shall be BACNET compatible with web based access. No separate server or PC shall be required to access controls. All BAS systems shall be set up to allow alarms or faults to be emailed and/or texted to various DGS email recipients as set forth per DGS.
8. DDC Controllers (stand-alone) shall be microprocessor-based with a minimum word size of 16 bits. They shall be multi-tasking, multi-user, real-time digital control processors consisting of modular hardware with plug-in enclosed processors, communication controllers, power supplies and input/output point modules.
9. Control of the mechanical systems shall be performed by a field programmable microprocessor-based DDC, which incorporates closed loop control algorithms, all necessary energy management functions.
10. Each unit shall, at a minimum, be capable of performing the following energy management functions: Start/stop optimization, Time of day scheduling, Enthalpy economizer control, Supply air reset, Chilled water reset, Hot water reset, Event initiated programs, Night setbacks.

END OF SERVICES

G – SITEWORK

1. EXTERIOR SITE IMPROVEMENTS

A. General Requirements

1. DGS projects shall comply with [Metro Public Works Engineering Details and Specifications](#), [Metro Planning Department's NashvilleNext](#), and other applicable plans.

B. Materials & Standards

1. Electrical vehicle charging stations shall use *ChargePoint* or DGS approved equal. Model shall be current and not discontinued.
2. Chain link fences shall be vinyl coated. Color, black.
3. Fences and gates for screening shall be of metal.

2. PLANTS, TURF GRASS, AND SOIL PREPARATION

A. General Requirements

1. Native trees and shrubs appropriate for this region are preferred.
2. Submit a copy of the applicator's license and MSDS data sheets for chemical applications.
3. Annual planting beds shall not be used.
4. Plantings shall be designed so that at maturity, there is three (3) feet minimum between the building face and the shrub and tree canopy.
5. Plant material over three (3) feet in height at maturity shall be 10 feet back from the edge of walkways. Root barriers shall be used where trees are less than ten feet from paved areas, to protect pavement.
6. All large shade trees planted shall be coordinated with pedestrian and street lighting.
7. Each large tree shall have a six (6) foot diameter minimum mulch ring.
8. Locate trees in groupings within a continuous mulch bed where possible.
9. Landscape and site design shall preserve existing trees to the maximum extent possible.

10. Trees shall be offset a minimum of 10 feet from underground utility infrastructure. DGS shall approve any exceptions. Water and sewer easements are twenty feet wide unless specified otherwise.
11. For trees specified within 10 feet of utilities, and approved by DGS, root barriers shall be used to minimize impact to utilities.

B. Materials & Standards

1. All plants shall conform to the current *American Nursery Standards for Nursery Stock* published by the American Association of Nurserymen.
2. Mulched areas identified in the construction documents shall use triple shredded hardwood mulch. It shall be well-composted, shredded hardwood with a maximum particle size of three (3) inches, and free of waste materials.
3. All plants shall be sound, healthy, and vigorous, free from defects, disease, and all forms of infestation. All plants shall have a fully developed form without voids and open spaces. Plants held in storage will be rejected if they show signs of growth during storage.
4. Trees and shrubs shall not be pruned prior to delivery to the project site. After delivery is accepted, pruning is acceptable only to remove broken branches.
5. Pruning wounds exceeding a diameter of one (1) inch are unacceptable. Wounds shall show vigorous bark on all edges.
6. Ball and burlap plants with cracked and/or loosen or broken root balls shall be rejected.
7. Root bound container grown stock shall be rejected.
8. Staking shall be removed by the Contractor at the end of the warranty period.

C. Certification of Grass Seed

1. Packages shall state botanical and common name, percentage by weight of each species and variety, percentage purity, germination, and weed seed.
2. Seed shall be fresh, clean, dry, new crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances within inspection date no more than three months prior to application.

3. Seed shall be at minimum 85% germination, and 95% pure seed. Seed exceeding 0.5 percent weed seed is unacceptable.
4. Seeding new lawns: Seeding rate shall achieve 90% coverage prior to acceptance and will be determined on a per square yard basis.
5. When hydro-seeding is used, adjacent areas shall be protected from overspray.
6. Seeded areas that achieve less than 90% coverage shall be replaced.

D. Certification of Sod

1. The sod source shall be identified with name, address and telephone number of supplier. Sod shall comply with *Turfgrass Producers International (TPL)* "Specifications for Turf grass Sod Materials" in its "Guideline Specifications to Turf grass sodding".
2. Sod shall be viable, of uniform density, color, and texture and strongly rooted at a minimum of one-inch ($\frac{1}{2}$ "). It shall be capable of vigorous growth and development.

E. Soil Amendment and Fertilizers

1. Contractor shall submit manufacturer's product certificates.
2. Amendments shall be incorporated prior to installation of sod, sprigs or seed.
3. All areas with plant material shall follow the soil analysis report for recommendations on lime and fertilizer.

F. Tree Protection

1. All construction activities are prohibited in tree protection areas, unless approved by DGS.
2. In addition to required tree protection fencing, where construction equipment may impact trees, battens are required.
3. Tree protection shall be shown on demolition, grading, and erosion control plan sheets.
4. If construction occurs within the critical root zone of a protected tree, outside of the limits of the tree protection area, a 12" layer of mulch, or logging mats, or nylon protection shall be installed over the impacted area prior to construction activities, but not located within the limits of work where machinery maneuvering will compact soils.

G. Pruning

1. Contractor shall not remove or prune any landscape materials without prior approval from DGS.
2. All tree work above and below grade shall be approved by an arborist certified by the *International Society of Arboriculture*.

H. Watering and Irrigation

1. Irrigated areas shall include parking lot islands.
2. The irrigation design shall ensure that no paved surfaces get wet.
3. Turf irrigation shall be on separate zones from other plant irrigation.
4. Irrigation water use shall be submetered.
5. Irrigation system shall include an automated weather sensor.

I. Installation

1. Contractor shall field stake the position of trees and shrubs for the Designer to review prior to planting.
2. Trees and shrubs shall be delivered and planted within six (6) hours after planting preparations have been completed. If planting is delayed more than six (6) hours, set plants in the shade, protect from weather and mechanical damage, keep roots moist, prevent freezing of root ball, and remove ties from branches.

J. Planting

1. Planting pits for ball and burlap material shall be two times the width of the root ball, minimum.
2. Excavation depth shall allow the top of root flare to be two (2) to three (3) inches above final grade.
3. The excavation backfill shall use amended soil, tamped to remove air pockets. Ball and burlap plants shall have the upper third burlap, wire, rope and/or straps removed after the plant is partially backfilled and stable.
4. Any imported soil shall be approved by DGS.

K. Mulching

1. Mulch shall be three (3) inch in depth, after settling.

L. Lawns

1. On slopes exceeding 3:1, sod shall be laid across the angle of the slope Pin 50% of the area.
2. Sod shall be rolled as necessary to achieve contact with sub-grade.
3. Sod shall be watered as necessary until established.
4. Sod shall be laid within twenty-four (24) hours of delivery.
5. All newly planted areas shall be cordoned off from foot traffic until lawn is established.

M. Warranties

1. Maintenance and protection of the work is the responsibility of the Contractor after Final Acceptance and for the full warranty period.
2. Maintenance consists of mowing, watering, cultivation, weeding, mulching, resetting of plants to proper grades or upright positions, keeping the plants free of insects and disease and in thriving condition.
3. The warranty requires that plants be healthy, vigorous, and thriving for the full warranty period. Dead or dying plants will be documented and removed immediately by the Contractor.

3. EXTERIOR FURNISHINGS

- A. Exterior benches - Include skate stoppers on benches.
- B. Outdoor tables - Use dark or neutral color, metal tables and chairs.
- C. All exterior furniture shall be graffiti resistant and shall shed water.
- D. Exterior trash and recycling receptacles - recycling receptacles shall be paired with a trash receptacle.
- E. Ash urns shall be stand alone with an oxygen restricting design that extinguishes still burning butts, the opening shall be limited to discourage unwanted trash.
- F. Bicycle racks – In-ground mount option shall be used. Locate on pavement and under cover where possible. Use wired and finished joints.

4. EXTERIOR EQUIPMENT

- A. Flagpoles

1. Not more than one American Flag per open space.
2. Flagpoles shall be accessible.
3. Flag Poles shall not exceed 35' in height.
4. Flag poles shall have integrated lanyard with locking hoisting access.
5. Flag Pole color and materials: clear satin finish aluminum pole, gold truck on top. Include cleat lock box with halyard cover: satin finish.
6. Flag pole base shall be on pavement, contiguous with a walk or plaza surface.
7. Ensure proper flag display etiquette is accomplished with the pole siting and flag display according to United States Code Title 4, Chapter 1.
8. Use of bollards shall be minimized. Lighted bollards may be considered upon DGS approval.

5. EXTERIOR PLUMBING FIXTURES

- A. Outdoor Hydration Stations shall be Bi-level, outdoor, tubular bottle filling station with pet fountain, *Elkay Model LK4420BFDB* or DGS approved equal.

6. LIQUID AND GAS SITE UTILITIES

- A. DGS is responsible for the operation and maintenance of most site utilities associated with project development.
- B. A Storm Sewer System permit shall be obtained in compliance with the Tennessee Department of Environment and Conservation (TDEC) permit.
- C. Metro stormwater management is managed as an integrated systems approach. Stormwater management for each project site shall be studied in context with the entire watershed and subsequent impacts downstream.
- D. Each project shall incorporate a combination of methods to minimize the production of stormwater runoff and to slow and infiltrate water near the source rather than relying on one large device to control stormwater for the entire watershed.
- E. Stormwater devices shall be incorporated into the landscape plan. Maintenance access shall be provided to all stormwater management devices.
- F. Designs of stormwater control shall minimize erosive grades and large contiguous areas of impervious surface. Designer shall employ Best Management Practices (BMP's) that infiltrate or retain and filter the first inch of runoff on the site. BMP's shall be designed in accordance with the most recent

version of TDEC Division of Water Quality Stormwater Best Management Practices Manual.

- G. Domestic Water & Sewer - All property shall require individual metering and cross-connection protection for each individual building. Building meters may be inside the building but shall be accessible to maintenance personnel. Main backflow preventers shall be located inside the building.
- H. Designers shall contact DGS prior to beginning design for utilities available and connections.
- I. Buildings with separate lab waste systems shall include a sampling manhole outside of the building prior to combination with the normal building waste stream. Installation and design shall comply with DGS wastewater collection permit.
- J. All steam, condensate, and domestic water lines within the building envelope shall be insulated. Chases and stack areas carrying heating lines shall be ventilated.
- K. All connections to mains shall include valves, both at the connection to the main and in the mechanical room of the building.
- L. All new piping shall conform to the DGS color scheme for mechanical identification and be stenciled with type of service and direction of flow.
- M. Process steam generation shall be independent of the building heating system.
- N. All new buildings shall have steam flow meters with insulated removable jacket.
- O. Condensate meters shall be placed on the discharge side of the condensate pump and measure all condensate discharged. A three-valve bypass around steam and condensate meters shall be provided.
- P. Exterior steam and condensate lines shall be installed in semi-accessible precast concrete tunnels or fully accessible walkable concrete utility tunnels.
- Q. Triple-wall, pre-insulated piping systems will be reviewed on a project specific basis.
- R. Expansion loops shall be used.
- S. Steam pipe shall be schedule 40 black steel pipe with 300 pound rated fittings to the building's first pressure reducing station. Steam piping shall be all welded construction.
- T. Condensate pipe shall be schedule 80 black steel pipe with schedule 80 fittings. Condensate piping shall be all welded construction to the first valve in the drip leg. Threaded fittings are permitted for use on the drip leg after the first valve.
- U. Provide valves at each intersection of mains.

- V. Drip Legs - Inverted bucket traps shall be used.
 - W. High-pressure condensate from the drip legs shall not be introduced to the pumped wet condensate return system. A high-pressure drip line shall be used.
7. CHILLED WATER
- A. Ductile Iron Pipe shall conform to AWWA C151 minimum class 50 with a minimum four-inch diameter. Provide inside/outside coating and provide mechanically locked ball joints on D.I. Pipe.
 - B. Fittings shall be ductile iron mechanical joint type manufactured in accordance with C104/A21.10, rated for 250 psi working pressure.
 - C. System drains at low points and system vents at high points shall be provided.
8. NATURAL GAS
- A. Designer shall ascertain natural gas availability on a project specific basis. Metering and lateral piping shall be included in the project.
9. IDENTIFICATION OF UNDERGROUND UTILITIES AND PIPING
- A. All underground piping and utilities, except lawn irrigation lines, shall have two (2) stages of identification and/or warning by a combination of non-detectable and detectable warning tapes.
 - B. Warning Tape (detectable warning tape) shall be six inches (6") wide, installed directly on top of the pipeline and permanently secured to the pipeline at 10 foot intervals. The tape shall consist of aluminum foil core or stainless steel tracer wires laminated between multiple layers of polyethylene tape with an overall thickness of four to six (4-6) mils. Detectable core or tracer wire "circuit" shall be continuous from valve box to valve box or manhole to manhole. Tape manufacturers' approved splice kits shall be used for long runs. Warning tape shall terminate just inside of valve box cover or manhole ring cover and be accessible for "clip-on" type utility location meters. The black colored lettering on the warning tape shall be abrasion resistant and be imprinted on a color-coded background that conforms to APWA color code standards.
 - C. Trace Wire shall be installed on all non-metallic pipe, including lawn irrigation lines, and metallic pipe with compression gasket fittings installed underground shall have a tracer wire installed along the length of the pipe. The wire shall be taped to the bottom of the pipe at a maximum of 10 foot intervals. Tracer wire shall be single-conductor, 10 gauge minimum, copper single-conductor wire with type "UF" (Underground Feeder) insulation, and shall be continuous along the pipeline passing through the inside of each valve box.

10. IDENTIFICATION OF UNDERGROUND ELECTRIC UTILITIES

- A. All electrical utilities, shall have identification and/or warning via detectable warning tapes.

- B. Identification Tape shall be six inches (6") wide, and buried 18" to 30" above the electrical utility line, and a minimum of 10" below finished grade. It shall consist of multiple layers of polyethylene with an overall thickness of three to five (3-5) mils. It shall be installed continuous from junction box to junction box or manhole to manhole, and shall terminate a maximum of six (6) inches away from junction box or manhole. The black colored lettering on the warning tape shall be abrasion resistant and be imprinted on a color-coded background that conforms to the National Electric Safety Code (NESC) or the National Electric Code (NEC) color standards.

END OF SITEWORK