**GROUNDS MAINTENANCE:**

The Grounds Maintenance of MUSC the Facilities and Engineering Unit provides a planned program of grounds care on the main campus for the educational, general and housing areas. This program includes turf maintenance; care of shrubs, ornamental plantings, and shade trees; road and walk cleaning and maintenance: and on the rare occasion when it does snow, snow and ice removal and special event preparations. The Grounds Maintenance staff is responsible for all basic grounds construction and maintenance consisting of two areas including landscape and lawns.

**ROADWAYS, PARKING LOTS, SIDEWALKS**

*Daily:*
1. Pick up trash and debris, perform normal grounds maintenance tasks.
2. Survey entire site for recent unsafe conditions.
3. Transfer equipment/furniture per work requests.
4. Move/deliver paper goods (catalogs, schedules, restroom products) per work request.

*Weekly:*
1. Contact MUSC Maintenance Manager for repair or replacement of outside signs.
2. Clean on site roadways and parking lots.
3. Check placement of wheel stops; realign and secure.
4. Clean and inspect sidewalks and exterior steps.

*Monthly:*
1. Inspect paving for cracks or potholes.
   a. Contact MUSC Maintenance Manager for repair major defects immediately or barricade as appropriate.
   b. Schedule repair of remaining defects.

*Quarterly:*
1. Sweep and inspect all parking garages.
   a. Contact MUSC Maintenance Manager for repair of major defects immediately or barricade as appropriate.
   b. Schedule repair of remaining defects.

*Annually:*
1. Contact MUSC Maintenance Manager to repair and fill asphalts Cracks and potholes.
2. Inspect all parking lots for visual appearance. Contact Paint Shop to stripe parking lots, paint directional signs, fire lanes, and crosswalks.
3. Complete landscaping projects to enhance overall appearance of campus.
4. Power-wash all Garages annually or as required including stairwells. Insure that elevator cars are on the top floor to reduce chance of possible water damage to elevator associated equipment.

**IRRIGATION SYSTEMS**

1. Test all automated systems monthly. Make repairs and/or adjustments as necessary.
2. Test all quick connects areas as needed. Make repairs and/or adjustments as required.
3. Repair all breaks in lines, fittings, and spray heads as they occur.
4. Drain entire irrigation system including pumps annually.
5. Upgrade systems as time and funds permit.
6. Ensure irrigation systems to comply with City of Charleston Public utilities regulations.
   a. Check if there is backflow prevention on all systems and inspect as required.
   b. Check and inspect rain sensor over-ride on all irrigation systems.

LANDSCAPING GENERAL

1. Trim trees and shrubs as needed.
2. Cut grass and edge as needed.
3. Apply fertilizers in spring and fall.
5. Aerate high maintenance turf areas semi-annually.
6. Inspect all areas for undesirable insects weekly and treat with approved methods by a certified applicator.
7. Convert lawn areas to xeriscape where practical to minimize need for irrigation.
8. Add trees and shrubs as funds allow.
9. Remove dead or diseased trees, shrubs or plants as needed.
10. Schedule and complete two plantings of annuals each year.
11. Upgrade planted areas as funds and time allow.
12. Maintain strict inventory control of all chemicals in accordance with Governing regulations.

STORM DRAINS (including open and closed)

2. Keep open ditches clear of weeds and brush growth by using approved weed and brush control methods.
3. Repair erosion problems as they occur.

LANDSCAPING AND GROUNDS EQUIPMENT AND TOOLS

Daily:

1. At the end of the shift, each operator of power equipment is responsible for cleaning, servicing and inspecting the equipment to which he is assigned. He/She will follow the checklist prepared for that piece of equipment from the manufacturer’s operations handbook. Some of the more obvious items appearing on the checklist should include the following:
   a. Check all fluid levels adding proper amount of fluids as required.
   b. Add grease as required to all lubricated points.
   c. Check all blades for sharpness, nicks, cracks and attachments.
   d. Check all belts for tension wear and cracks.
   e. Check all attachment points for lubrication, excessive wear and proper locking pin or device.

2. The operator will certify his completion of the checklist by signing off on a sheet provided for that purpose.

3. Major repairs or adjustments will be referred to the designated mechanic for action.
GROUNDS DEPARTMENT VEHICLES (General Maintenance, Verify specific maintenance with Manufacturer's recommendations.)

1. Seasonal Servicing by MUSC Mechanic
   a. Check fluid levels.
   b. Check belts for wear and cracks; replace as needed.
   c. Check bearings for lubrication and excessive wear. Replace as required.
   d. Service vehicles every 4,000 miles
      a) Change oil, filters and grease.
      b) Check all fluid levels.
      c) Check tires for wear and change as needed.
      d) Inspect brakes and repair as required.
      e) Inspect belts and hoses for wear and cracks. Replace as required.

2. Daily Inspections (Grounds Maintenance Employees)
   a. Check all fluid levels. Add FLUIDS as necessary.
   b. Check all lights and turn signals.
   c. Check tires for proper inflation and wear.
   d. Check wipers
   e. Check exhaust systems
   f. Check brakes
   g. Check horn

3. Tune-up Vehicles at recommended service intervals as prescribed by the manufacturer.
   a. Change spark plugs.
   b. Change spark plug wires.
   c. Adjust carburetor
   d. Perform manufacturer's standard diagnostic
   e. Inspect and change worn equipment as recommended by vehicle manufacturer.

IRRIGATION SYSTEMS SPECIFICATIONS AND MAINTENANCE GUIDELINES

Irrigation: All preserved trees shall be provided with adequate supplemental irrigation if required, this includes use of water trucks, or temporary irrigation systems.

Irrigation Systems: These Irrigation System Design Guidelines have been prepared to establish standards of excellence for future design and construction of irrigation systems at Medical University of South Carolina. It is intended that these guidelines, along with the standard irrigation specifications and installation details, be made available to irrigation consultants working with MUSC. This will allow the consultants to be aware of considerations necessary when designing an irrigation system for MUSC and give MUSC a methodology for checking completeness of each design.
Design Review

Planning and Construction will review all irrigation plans, according to the guidelines set forth herein. Approval of system design must be obtained before beginning construction of any irrigation system. The irrigation designer bears the burden of proof that the irrigation system design meets the intent of these guidelines. The following information shall be submitted for review:

- A detailed irrigation plan. The recommended scales are:
  - 1 inch = 20 feet for small areas using primarily spray sprinklers.
  - 1 inch = 100 feet for large areas using only rotary sprinklers.
- Manufacturers’ catalog sheet information.
- Completed Irrigation Checklist. (Irrigation Checklist is in Appendix A.)
- Completed Irrigation Specifications.
- Completed Irrigation Installation Details.

Design Issues: General

The design of irrigation systems at MUSC shall address the following major issues:

1. **Demolition of Existing Irrigation System**: All existing sprinklers, valves and other equipment of value shall be removed in a manner that minimizes damage to the equipment, and then turned over to the Supervisor at the Grounds Maintenance Shop. Existing piping will be abandoned in place. When installing the new irrigation pipe, if existing irrigation pipe is crossed, it should be cut and removed so that no existing pipe is within two feet of the new pipe. This will minimize the possibility of maintenance personnel encountering the old pipe in the future, with resultant confusion. The removal and disposal of any asbestos-concrete (transite) pipe shall be in accordance with applicable Environmental Protection Agency rules and regulations.

2. **Irrigation System Laterals**: Whenever possible, areas of differing exposure to the sun are to be irrigated by separately valved irrigation laterals. In this way, south-facing turf or shrub areas near hot pavement areas can be irrigated longer than turf or shrub areas with a northern exposure. Additionally, areas with plant materials having significantly different water requirements shall be irrigated with separately valved laterals. Furthermore, the irrigation of landscaped slopes that are steep enough to result in runoff shall be irrigated with separately valved laterals. Only sprinklers with matched precipitation rates for various sprinkler arcs can be installed on a single irrigation lateral.

3. **Overspray onto Hard Surface Areas**: For reasons of safety and water conservation, it is important to minimize spray over walkways and roadways.

4. **Sprinkler Spacing**: Sprinklers are to be spaced at no more than 50% of the manufacturer’s rated diameter of throw to ensure efficient water application. This is due to potential winds at MUSC, which can reduce the effective radius of throw.

5. **Low Flow Irrigation**: Drip irrigation is MUSC’s choice for low flow irrigation and should be used to irrigate trees and shrubs in planting areas. However, MUSC may choose to use bubbler irrigation in selected installations.

6. **Lateral Pipe Routing**: In areas which are to be renovated, new lateral piping may need to run parallel with existing lateral piping. New piping should be offset 12-inches from the existing piping to minimize interference with installation and future maintenance operations.
7. **Remote Control Valve Sizing:** The landscape on the MUSC campus is constantly changing due to continual construction. To allow flexibility with the irrigation system, it is desirable to be able to add sprinklers to a lateral at a future date. Remote control valves should be sized conservatively. It is recommended that the remote control valves be sized to operate in the lower half of the manufacturer's rated flow range.

8. **Isolation Valves:** Isolation valves are to be provided for ease of maintenance. Portions of the irrigation system can be isolated to allow timely repair without affecting operation of the entire irrigation system.

9. **Irrigation Sleeves:** All irrigation mainline pipe, irrigation lateral pipe, and control wiring routed underneath roads, sidewalks, and other paved surfaces shall be contained in sleeves. Boring for sleeves shall be performed where these features are existing, and cannot be readily or economically cut and patched. Typically, one pipe shall be contained in a single sleeve. However, two lateral pipes or a lateral pipe and wiring may be installed in a single sleeve if it is more economical when boring is required. The sleeves shall be able to withstand earth and traffic loads. Nominal sleeve size shall be twice that of the contained pipe or wiring bundle.

10. **Backflow Prevention on Potable Water System:** Adequate backflow prevention measures are necessary for health reasons and must meet applicable local rules and regulations. Reduced Pressure Principle backflow prevention devices should be installed at all potable water points-of-connection. Applicable rules and regulations, and manufacturer's recommendations, shall govern the installation of all backflow devices.

11. **Booster Pumps:** Booster pumps may be needed on new points-of-connection. Special care must be taken when installing a new booster pump to prevent a hydraulic imbalance in the irrigation distribution system. Contact MUSC Engineering and Facilities personnel for specific instructions regarding the installation of booster pumps.

12. **Bedding for Mainline Pipe:** Mainline pipe shall be bedded and backfilled with washed plaster sand.

**Design Issues as Related To Location**

1. **Potable Water:** At present, the MUSC campus is irrigated using potable water. All irrigation design and installation shall be consistent with the use of potable water.

2. **Quick Coupling Valves:** Quick coupling valves should be installed at a spacing of approximately every 200 feet. Additionally, irrigation systems for baseball fields shall include one quick coupling valve on each side of the infield to facilitate the watering down of the dirt portions of that infield. The location of quick coupling valves shall be such that all areas included within the irrigation system can be reached with a 100 foot section of hose attached to a quick coupling valve. Allowances should be made for existing hose bibs on building walls.

3. **Water Emission Device Selection:** In general, the selection of the type of sprinkler and nozzle will be dependent upon the shape and dimensions of the area to be irrigated. This subject is clarified further in the Description of Recommended Equipment section that follows. An additional guideline is that all sprinklers installed within athletic fields shall have rubber covers to help minimize injuries. For shrub areas, low flow irrigation will be used.
Description of Recommended Equipment

Specific irrigation equipment recommendations will change as new improvements and technical advancements occur in the industry and are incorporated in various manufacturers' product lines. As certain products are discontinued by manufacturers and new products introduced, particular equipment recommendations will be continually updated by MUSC to reflect these changes. Close attention must be paid to proper installation of the equipment. It is important to design the placement and specify the installation of irrigation equipment according to manufacturers' recommendations, and in accordance with acceptable design standards.

1. **Pop-Up Spray Sprinklers**: Pop-up spray sprinklers are typically available with pop-up heights of 4-, 6-, and 12-inches. The 4 inch pop-ups will be used in turf areas with widths generally less than 25 feet. They are also useful in irrigating slightly larger turf areas that are not on ducivet or rotor sprinklers due to being more oddly shaped, such as with curvilinear boundaries. Spray nozzles are available in set arcs between 60 degrees and 360 degrees and the sprinklers have a radius of between 10 and 16 feet. Use of fixed risers is not recommended due to potential breakage problems.

2. **Pop-up Rotary Sprinklers**: These are sprinklers with a pop-up height of 2- to 4-inches, and are used to irrigate medium to large turf areas. These sprinklers typically have 30 to 60 foot radii of throw, depending upon the particular interchangeable nozzle that is selected. Dependent upon the manufacturer, these sprinklers either have infinitely adjustable arcs or they have fixed arcs in increments of 15 or 30 degrees. Other features include matched precipitation nozzles, adjustable radii of throw, small surface areas, check valves, rubber covers (sometimes as an option), and vandal resistance.

3. **Pressure-Compensating Emitters**: These emitters are used to irrigate individual shrubs and trees, and have the advantage of delivering a fairly uniform flow rate over a large operating pressure range.

4. **Pressure-Compensating Bubblers**: These bubblers are used to irrigate individual shrubs and trees, and have the advantage of delivering a fairly uniform flow rate over a large operating pressure range. Pressure-compensating stream bubblers and flood bubblers are available, with watering patterns as indicated by their names. Bubblers are to be used in place of emitters only at the direction of MUSC.

5. **Remote Control Valves**: Remote control valves are installed along the mainline pipe and wired to the irrigation controller. The purpose is to control the start time and duration of flow to an irrigation system lateral. Solenoid valves should be equipped with a flow regulating: Quick coupling valves are installed on the irrigation mainline for incidental watering purposes. Quick coupling valves are activated by inserting a special lug key into the valve. The key can be equipped with a hose swivel ell for manual watering or for use with a sprinkler. Quick coupling valves equipped very useful in the establishment of plant materials. Quick coupling valves should be 1-inch nominal diameter, one piece, bronze construction with locking caps.

6. **Isolation Gate Valves**: Isolation gate valves are installed on the irrigation system mainline, and are used to isolate certain sections of a mainline for ease of repair and maintenance. Isolation gate valves are usually sized to match the mainline pipe. The valves should be bronze, with threaded connections 2-inch 3-inch and body cast ends.

7. **Pressure Reducing Valves**: Pressure reducing valves (PRV's) are used to reduce irrigation system pressure downstream of the installed location. PRV's are typically used on bubbler, drip, and pop-up spray sprinkler systems. PRV's are used in conjunction with solenoid valves for each irrigation lateral. A separate PRV is not required on systems equipped with pressure regulating solenoid valves.
8. **Backflow Prevention Devices**: Local code requires that an acceptable device be installed to prevent water from flowing back through a municipal tap into the public water supply. There are several types of backflow prevention devices, with varying degrees of backflow prevention capability and corresponding cost. The most effective type of backflow preventer, and the type required by MUSC, is a reduced pressure principle backflow preventer.

9. **Central Irrigation Control**: The irrigation control system is the time clock for the irrigation system. The central controller allows operation of the entire system from a single location. The satellite controllers actuate the remote control valves for the specific time and duration. With the addition of a centralized control system the irrigation supervisor has the ability to reduce irrigation times on cool days, increase the time on warm days, and delete irrigation on rain or high wind days, all from a central position. The overall effect of using the central irrigation controller will be to reduce water waste, and still provide adequate irrigation water to properly maintain the landscape. All controller installations shall be compatible with the existing central control system. MUSC will provide specific instructions on the preferred type of field satellite controller and communication link between the central and the field satellites. If the communication link is hard wire, use signal wire and splices per the central control system manufacturer's recommendations. If the communication link is telephone, coordinate telephone requirements with MUSC Engineering and Facilities.

10. **Water Meter**: Water meters are used to measure the flow and volume of water used in an irrigation system. A water meter is an essential tool for proper management of the irrigation system. Water meters will be used at each point-of-connection. Water meter installation shall be per manufacturer's recommendations and must be compatible for remote readout from the central control system.

11. **Polyvinyl Chloride (PVC) Irrigation Pipe**: The mainline pipe is constantly pressurized, therefore, Schedule 40 PVC pipe is recommended. 4-inch and larger diameter pipe on the mainline should be casketed due to the cost and ease of installation compared to solvent-weld pipe. Gasketed pipe should use the Reiber Gasket system. Concrete thrust blocks at fittings should be used on all gasketed pipes. PVC Class 200 solvent weld pipe should be used for the irrigation laterals. PVC pipe should be extruded from material meeting the requirements of ASTM Standard D1784 for Cell Classification 12454-A or 12454-B. The pipe should conform to the dimensions and tolerances established by ASTM Standard D2241 and NSF approved.

12. **Fittings**: There are several types of fittings (solvent-weld, gasketed, and threaded) and several types of materials (PVC, ductile iron, epoxy-coated steel). Solvent weld and threaded PVC fittings should be Schedule 40, Type 1, PVC meeting the requirements of ASTM Standard D2466 and D1784. PVC threaded nipples, however, should be Schedule 80. Solvent-weld fittings are glued to PVC pipe. Gasketed fittings should be either PVC, ductile iron, epoxy-coated steel. Gasketed PVC fittings should be one piece injection molded from virgin PVC material with the same rating as the mainline pipe. Gasketed fittings are typically used on mainlines 3-inch and larger due to their ease of installation.

13. **Pre-fabricated Swing Joints**: Pre-fabricated swing joints may be utilized where swing joints are required, such as with quick coupling valves and rotary sprinklers. Pre-fabricated swing joints minimize the chance of improper swing joint assembly.

14. **Valve Boxes**: Valve boxes are typically made of inert plastic suitable for underground burial, and manufactured specifically for housing irrigation system components. Irrigation equipment housed in a valve box has a longer life, and ease of maintenance warrants the use of valve boxes. Various sizes of valve boxes may be required to provide adequate housing for different assemblies. Valve boxes should be sized to allow a 3-inch minimum clearance for the components.
15. **Remote Control Valve Wiring:** Control wiring from the satellite controllers to the remote control valves shall be American Wire Gauge (AWG) No. 14 solid copper, type UF cable, UL approved for direct underground burial. A common ground wire and one control wire should be installed for each remote control valve. Spare wires should be installed for future maintenance considerations. Typically two (2) spare wires should be rated from the satellite controller to the most distant remote control valve(s). Use multiple sets of spare wires as necessary to ensure that every remote control valve has two spare wires passing its location.