FACILITIES MANAGEMENT AND OPERATIONS CENTER

FMOC

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Change Log

Rev.	By	Date	Type	Change Description	ID
0	JC	11/10/11	Subst	Provided more direction to Landscape Architects about SNL landscaping goals and specific site objectives, such as water harvesting, landscapes in hardscapes (such as parking lots), protecting existing landscapes during construction, and new DOE and EPA WaterSense® requirements for irrigation systems.	

4.0 Landscape Design Standards

These design standards generally apply to the Landscape Design phase on all projects. For general requirements that apply to all project phases, see chapter 2, "General Design Standards and Procedures." For specific project requirements, refer to the design criteria. For standard product specifications, see the applicable sections in the Sandia National Laboratories (SNL) Standard Construction Specifications. The design criteria take precedence over this chapter of the *Design Standards Manual*.

4.1 Purpose

This chapter defines how to design and develop landscape requirements for the SNL New Mexico (SNL/NM) campus. The design must promote efficient water use through landscape design and irrigation concepts appropriate to Albuquerque's climate zone.

4.2 Landscape Construction Drawings and Specifications

Landscape drawings for construction must include quantitative information. Such information must be described in the project specifications and not be duplicated in the drawings, except as needed in the irrigation schedule.

4.3 Landscape Construction Drawings

See chapter 2, "General Design Standards and Procedures," for information on drawing organization and the arrangement of the overall Construction Drawing Set. Accurately prepare the drawings to scale with the various plans to the same orientation and scale. Refer to the *SNL CADD Standards Manual* for scale, sheet size, and other CADD requirements. Landscape drawings and the organization of those drawings within the Construction Drawing Set include, but are not limited to, those shown in Table 4.1.

Table 4.1 Landscape Construction Drawings

Drawing	Scale	Remarks
General Notes	No Scale	Includes General Notes, Construction Notes, Irrigation Notes, and any special planting notes.
Landscape Plan (Composite)	1" = 50'- 0"	Includes planting areas, mature plant location and size to scale, plant legend and schedule (with botanical names, common names, container size, and quantities), site furniture and legend, and keyed notes. date, revisions, plan scale, bar scale, north arrow, and any additional planting installation details and notes not in the specifications, and square footage of each hydrozone listed individually.
Landscape Enlargement Plan, when applicable	1" = 20'- 0"	Same as Landscape Plan, as needed, and adjacent sheet numbers on applicable plan sheets
Irrigation Plan (Composite)	1" = 50'- 0"	Includes all applicable components (Irrigation Legend, Irrigation Emitter Schedule, Pipe Sizing Chart, Valve Legend, and other items noted in Irrigation Design Drawings below.)
Irrigation Enlargement Plan	1"= 10'- 0"	All applicable components
Landscape Planting Details	Not to Scale	SNL Standard Drawing
Irrigation Details	Not to Scale	SNL Standard Drawing

All plans must be complete and show the entire building site with north arrow oriented in the same direction as the Civil Site Plan.

Present details on a separate detail drawing. Do not show details on plan or other types of system drawing sheets.

4.4 Landscape Design Requirement

This section describes general landscape design guidance. For project-specific requirements, refer to the design criteria or Concept Plan, if provided.

Refer to chapter 3 of this *Design Standards Manual*.

All areas indicated on the contract drawings must be prepared for the installation of a complete underground sprinkler system or an aboveground temporary sprinkler system, and the planting of trees, shrubs, groundcovers, and native warm- or cool-season grass seeding or sodding.

4.5 Review Process

Submit design packages in accordance with SNL Standard Specification Section 01300, *Submittal Procedures*, and the Contract Bid Documents.

4.6 Safety

Design all related landscape site conditions to promote the safety and welfare of the tenants and the public; the design must conform to SNL's security requirements. Consider path lights for safe passage along walks, stairs, and ramps. Refer to subsection 9.4.2, "Exterior Lighting Systems Design," and the *Campus Design Guidelines* (CDG) for SNL/NM for more information.

4.7 Accessibility Requirements

Design all new and remodeled landscape areas to be safe, readily accessible to, and usable by individuals with disabilities. Refer to the *ADA-ABA Accessibility Guidelines for Buildings and Facilities*.

4.8 Landscape Design Goals

Sandia National Laboratories understands the value of designing, installing, and maintaining comfortable, attractive surroundings. Use this information to permit the safe and efficient design of landscape and irrigation materials and systems in accordance with industry accepted practices.

The practice of landscape architecture and construction varies considerably depending on the geographic location, soil characteristics, and microclimate of a given area.

Sandia National Laboratories wants to create and maintain a campus-like atmosphere through the landscape surrounding its buildings and infrastructure. Landscape development should enhance the overall exterior appearance of buildings and related sites while serving as a link connecting buildings,

pathways, and the various outdoors spaces of the SNL/NM campus. To achieve this campus atmosphere SNL is providing these design guidelines. The SNL *Master Landscape Plan (Draft)* has more information on goals and principles for exterior design at SNL, which must be understood and followed. These design guidelines should be used with the latest version of the *Campus Design Guidelines*

Design landscape improvements in accordance with the design criteria or Concept Plan (if provided) and the *Campus Design Guidelines*.

Landscape irrigation and water conservation are long-term requirements at SNL and provide a positive measure of efficiency in their actual performance when measured over time. Emphasize xeriscape principles to minimize maintenance and promote low water usage. This effort can be effective by using a variety of native plant material and grasses. Do not simply avoid the use of canopy shade trees. Shade trees can cool environments and make pedestrian areas more usable. Similarly, certain entry courts and the north sides of multistory buildings lend themselves to an oasis or high-mountain type of design that might not be xeric.

Capture storm water from roofs in storage tanks and site water infiltrated into the ground as assets to reduce site drainage runoff and storm drain costs and liabilities.

Consider landscaping when designing energy-conservation solutions. Landscaping design should reduce solar radiation during the growing season (summer) and heat loss from winter winds.

4.9 Existing Condition

Evaluate the project site and prepare plans showing all landscape features, including plant material and irrigation heads. Have department 4843, Grounds & Road Services (G&RS), activate the irrigation system to determine its operability. As a minimum, the design team, the G&RS Supervisor, and the SNL Landscape Architect/Site Horticulturalist, must use the geographical information system (GIS) maps during a site visit to verify the accuracy of information. Collect critical measurements during site visits. Existing drawings may be obtained from the SNL CADD Department (4825). The SNL Landscape Architect/Site Horticulturalist also has some hard copies of existing drawings.

Identify affected areas and potential areas lying outside the limits of construction, such as laydown areas, that might be affected and might need to be restored or revegetated as part of the construction.

Provide additional utility-location methods, such as line spotting, potholing, and excavation, as required to design the project properly. Refer to chapter 3, "Civil Design," for more information.

Before designing any landscape or irrigation construction or renovation project, contact the SNL Staff Biologist for guidance about special provisions necessary to protect or minimize areas of expansion of wildlife, such as burrowing owls, migratory birds, and prairie dogs.

Contact the Staff Biologist at the following address:

Sandia National Laboratories Staff Biologist
Environmental Programs Department
Organization # 4143
P.O. Box 5800, MS 730
505-845-7711

4.10 Landscape Design Considerations

Plan and apply xeriscape design principles. These principles promote the use of native, well-adapted plant material and reduce maintenance and irrigation requirements. Consider landscape design concepts that incorporate functional water and energy conservation methods. Xeriscape installations can effectively address the valuable water resource proficiently and economically. In the larger design framework, use low-impact design and development principles. See the *Master Landscape Plan* for more information. Consider the following areas:

Develop a Plan: Plan the landscape with regard for function, image, and quality. Evaluation factors must include the following:

- Existing Conditions (preserve mature trees)
- Views (enhance positive views)
- Vehicular and Pedestrian Circulation (address safety and logical paths and clear visibility for pedestrians)
- Quality of user experience (improve shading, cooling effects of canopy trees, wind-reduction opportunities)
- Topography (stabilize steep slopes)
- Soils (test soil to confirm suitable pH, electrical conductivity or EC, texture, exchangeable sodium percentage or ECP, and calcium carbonate or $CaCO_3$. Also, recommend the addition of amendments to adjust for soil test deficiencies.)
- Utilities (avoid underground utility locations)
- Water Supply (employ existing piped or harvested and reclaimed water sources as part of the project)
- Drainage (integrate run-off patterns, locate potential ponding areas, and incorporate into planting plans where feasible)
- Security Requirements (observe line-of-sight and required setbacks)
- Wildlife (preserve existing habitat and limit the growth of habitat)

Minimize Cool Season Turf Areas: Cool season sodded turf is discouraged at SNL and must only be added or replaced in areas where cool season sodded turf is desirable. Consider the use of warm season sodding or seeding.

Improve Soils: Soils can vary greatly over an installation or even over a job site. A soils analysis determines exactly what improvements might be required. Soils at SNL tend to be very compacted after construction, and ripping and loosening the soil is a significant need and should be considered a requirement unless otherwise noted.

Test Soils: Collect samples of soil in planting and seeding areas. Mix and submit a **single composite sample** to a recognized testing laboratory for evaluation of fertility. Testing must evaluate pH, base saturation percentage, ECP, EC, texture, and free lime. Sample turf and planting beds separately.

Conserve Natural Resources: Conservation and protection of the natural resources at the site are important. Keep any disturbance of natural resources occurring during planting operations to a minimum. Consider harvesting existing plants and relocating them to other sites or containerizing and storing them for reuse on the site.

Select Water-Efficient Plants: Use water-efficient plants in appropriate settings. Less xeric plants may be used in oasis areas or in pedestrian or parking lot applications. Plants that require less water are readily available locally and in surrounding regions and states. Consider the use of rabbit- and prairie-dog resistant plant material.

Use Mulches Appropriately: Mulching with open voids (materials with no fines) provides protection and cover around plant material, reduces evaporation, reduces runoff, increases infiltration, cools soil temperatures, and reduces erosion. Crusher fines are not considered to provide these benefits. Trees not located within hardscape plantings (for example, within turf, dirt, or rock mulch areas) must be designed with wood mulch ring bases 4 times the diameter of the root ball to be planted.

Consider Storm Water Pollution Prevention Plans (SWPPPs): To allow SWPPPs to be closed by the end of a given project design, remnant dirt areas must be drill-seeded with native grasses, wildflowers, or both, and covered with a minimal layer of rock mulch. A temporary irrigation system must be installed to support the grasses and wildflowers until they are established with a minimal layer of rock mulch (not more than 2 inches).

Design for Maintenance: The design must aid in determining the required maintenance. Designing "smart" allows SNL to manage effectively and maintain its landscaping while using resources efficiently.

Consider Plant Placement Carefully: The placement of trees and shrubs in turf areas should be done with careful consideration of species, mature size, rooting habits and depths, and water requirements.

When trees are placed they must be mulched according to the guidelines provided above in "Use Mulches Appropriately." Do not locate shrubs in turf areas. Locate shrubs so the mature size footprint they produce does not extend into pedestrian or vehicle pathways or interfere with the site triangle/distance at roadway intersections or driveways.

Carefully consider the placement of trees in relation to facility structures and utilities. Underground utilities must be avoided by a minimum of 5 feet in any direction. In case of conflicts with utilities, contact the appropriate Systems Engineer to determine the correct setback of trees and shrubs from the utility in question. When considering planting trees in proximity to gas or sewer lines, plastic or herbicide impregnated root barriers must be considered and used where deemed necessary by the System Engineer.

Because of security issues and plant competition for water, shrub placement together with trees in parking lot islands is to be reviewed with the SNL Landscape Architect/Site Horticulturalist or the Grounds and Road Services Supervisor.

Canopy shade trees should be set back 5 feet from any paving, curb, or fixed object. Further, keep larger canopy trees 20 feet from any building edge. Smaller ornamental trees can be 10 to 15 feet from a structure and 5 feet from paving edges. Coordinate placement of canopy shade trees with roadway or pedestrian path lighting.

Design all landscapes so they do not impede visual assessment or allow bridging of any security fence. Specifically, no landscape plants or boulders must be installed within 10 feet of any security fence. See the *Campus Design Guidelines* for more information.

Use curbs or seat walls for shrub beds to reduce sand and trash from being blown into shrub beds.

4.11 Hardscape and Parking Lot Design

Plan and apply rooting volume principles that recognize and promote the relationship between a plant's above ground canopy size and the available rooting soil volume. To achieve near full plant maturity in age and size there must be enough soil volume for the plant to root into. This rooting soil volume can be achieved using one or a combination of several of the methods described in this section.

4.11.1 Hardscape Design

- Do not use structural soil in planting any SNL landscapes.
- Design raised planters so they do not contain large tree species (such as shade trees and large conifers) unless there is enough space for proper root growth over the life of the tree. Specifically, the planter limits must be at least two times the diameter of the mature tree canopy.

4.11.2 Parking Lot Design

Coordinate landscape designs for parking lots with the Civil Engineer on the project, and adhere to the following guidelines.

4.11.3 Tree Sizes

The size of trees planted in any parking lot must be a function of how much uncompacted soil is available in which the trees can root. This space is proportional to the availability of aboveground area not used for parking that can be dedicated to landscaping. Where there is enough space available, large shade trees from the approved plant palette must be used. In locations where space is limited, use medium-sized shade trees and small ornamental trees. Table 4.2 describes the cubic footage requirements to use to determine the sizes of trees that can be planted.

Table 4.2 Tree-Size Requirements for Parking Lots

Tree Size	Requirement
Small Trees	120 to 500 cubic feet of rooting space (maximum 2-foot depth) is required for mature tree canopy spread of between 10 and 20 feet
Medium Trees	500 to 1,000 cubic feet of rooting space (maximum 2-foot depth) is required for mature canopy spread of between 20 and 30 feet
Large Trees	1,000 cubic feet or greater of rooting space (maximum 2-foot depth) is required for mature canopy spread of 30 feet and larger

4.11.4 Design Methods for Achieving Soil Volume

The design method used to achieve adequate soil volume is dictated by the availability of aboveground space that can be left unpaved. The following design methods are listed in preferred order:

- Completely Open Soil Area
- Covered Soil Area using Soil Cells

4.11.5 Other Hardscape Tree Planting Designs

Coordinate landscape designs for pedestrian areas with the Civil Engineer on the project, and adhere to the guidelines listed below.

Designing tree and shrub plantings for pedestrian areas is dependent on the sidewalk width and the amount of space between permanent structures, such as buildings and utilities. Reference the Tree Space Design Matrix on page 9 of the Tree Space Design publication entitled "Growing the Trees Out of the Box," published by CaseyTrees@www.caseytrees.org. With this matrix use the following design methods:

- Completely Open Soil Area
- Covered Soil Area using Soil Cells
- Covered Soil Area Connected to Green Space
- Open Soil Connected to Green Space

4.11.6 Rain Water Harvesting

Use rainwater harvesting and retention. When possible, incorporate rainwater harvesting into parking lot design. Both passive and active systems may be designed. Promote a design that manages and integrates the use of storm water into the landscape. Sandia National Laboratories encourages the capture of roof water, which is typically comparatively clean and disposed of at a single or few locations in a cistern. All rainwater harvesting designs must be done in accordance with the Grading and Drainage Plan and in accordance with SNL policy for the retention and detention of developed storm water flows.

Note that swales are used and function to evacuate and drain water. They can also lower adjacent water moisture. Swales are not a water conservation element by design. Providing small check dams, unpaved areas with minimum acceptable slopes or gradients, and shallow water ponding areas with flat bottoms coordinated with tree locations is encouraged. Reduce or eliminate site runoff, and use the rainfall for trees and shrubs.

Include a grading plan design indicating finished configurations and elevations of the landscape areas, including the height of graded slopes, impoundment areas, ponds, water-recharge zones, percent of slopes, general drainage patterns, pad elevations, and finished grade. Design grading and drainage to create onsite water harvesting wherever possible.

Any rainwater harvesting system that captures and stores water for release under pressure must be designed so that it is integrated into the Centralized Irrigation Control System (CICS) and uses a CICS-compatible flow meter.

4.12 Damage Control and Mitigation

Effective tree and landscape feature preservation must be integrated with the project design and site development. Formulate a plan to identify, limit, and remediate damage to the landscape relative to the proposed project site and its adjacencies by addressing the following Table 4.3 requirements:

Table 4.3 Requirements for Landscape Damage Mitigation

Requirement	Description
Erosion Control	Include mitigation methods for protecting Tree Protection Zones (TPZs) from anticipated erosion matter and storm water runoff.
Excavation	Where encroachment into a TPZ is determined to be unavoidable, include proposed excavation methods.
Irrigation System and Outages	Evaluate effects on systems and plants.
Fencing	Where necessary, temporary fencing (rigid in nature) may be used to protect TPZs and tree canopies from accidental encroachment and damage.
Tree and Shrub Pruning	Prior approval is required. Coordinate with the SNL Landscape Architect/Site Horticulturalist.
Landscape Demolition	Propose a Feasibility Plan for the transplanting or relocation of trees, shrubs, and other landscape features, such as boulders, furniture, and sculptures.
Plant Material Value	Appraise all plant material to be demolished. Suggested guidelines: *Guide for Plant Appraisal* by the Council of Tree and Landscape Appraisers (CTLA), current edition. Predamaged conditions must be documented and recorded (that is, photographed). Plant material damaged or demolished during construction must be replaced and the cost borne by the project. The SNL Landscape Architect/Site Horticulturalist must select locations for the replacement plants and the funding Project Manager must release funding to the General Contractor to subcontract an approved landscape contractor to purchase and install the replacement plants. The SNL Landscape Architect/Site Horticulturalist must approve any plant material used as replacement plants.

4.13 Design Personnel

Landscape design must only be performed by a New Mexico Board of Landscape Architects licensed Landscape Architect who possesses a current LA stamp or a Council of Landscape Architectural Registration Boards (CLARB) certified individual. Only Irrigation Association (IA) Certified Irrigation Designers that are Environmental Protection Agency (EPA) WaterSense® partners can be approved and permitted to design landscape irrigation systems.

4.14 Irrigation Design Drawings and Review Process

At the beginning of the design process, the SNL Project Lead must contact the SNL Systems Landscape Architect about the upcoming project. Thereafter the SNL Landscape Architect/Site Horticulturalist may contact the SNL Landscape Maintenance department to present 30% or 90% design drawings for its review and markup. All comments and markups must be returned to the project Landscape Architect within 5 working days.

Irrigation design drawings submitted for review must label and show the location for the following:

1. Point of connection
2. Flow meter location and size
3. Master valve, control valves, and pressure regulators (each valve must be labeled numerically)
4. Backflow prevention devices and sizes
5. Mainline and lateral piping sizes

6. Isolation valves and quick coupler valves
7. Manual drain valves
8. Hose bibs and hydrants
9. Sprinklers, bubblers, drip emitters, filters, control wire routing and sizes, and controller
10. Power supply/electrical access
11. Date, revisions, legend, and scale
12. Irrigation installation details, notes, and specifications
13. Designer's name, address, telephone number, and certification or license number

In addition to the information listed above, Irrigation Plans must have a System Performance Information Chart in Microsoft® Excel® that gives the following information for each control valve:

1. Control valve number
2. Valve manufacturer, model number, and size
3. Irrigation head manufacturer and model number
4. Irrigation head nozzle size
5. Irrigation head radius and spacing
6. Irrigation head gallons per minute and per hour
7. Total gallons per minute/valve
8. Design operating pressure through the valve and at the head
9. Precipitation rate at the design operating pressure
10. Length of time required to operate the valve to apply .25 inches of water

On Leadership in Energy and Environmental Design (LEED®)-rated projects, submit a water budget showing required reductions in water use from the baseline. Use the Blaney-Criddle formula for evapotranspiration (Et) rates.

All irrigation plans must state the existing static pressure at the meter or point of connection.

The following statement must appear on the face of each irrigation plan: *At the time of final acceptance, the Contractor must demonstrate to the SNL Landscape Architect/Site Horticulturalist that the operating pressure at the head has been adjusted to match the specified design operating pressure for each valve.*

4.15 Distribution Uniformity

Design and install each system such that its performance enhances distribution and emission uniformity and promotes the efficient use and protection of SNL water resources.

Conduct a distribution uniformity (DU) test using established IA landscape water-auditing guidelines using catch can tests that measure the actual amount of water applied to the target landscape on all irrigation system installations.

4.16 Design Criteria

This section describes factors and requirements that must be considered and included when designing irrigation systems at SNL.

4.16.1 Water Supply

Review all potential water supply sources as part of the irrigation system design process, and advise SNL about the cost and suitability of each. The water supply, if it is other than a potable water system, is tested to identify materials or chemicals that could damage system components, plant material, or cause an environmental or public safety problem.

The water source must be adequate from the standpoints of volume, flow rate, pressure, and quality to the irrigation requirements of the irrigated area, as well as other demands, if any, both at the time the system is designed and for the expected life of the system.

Available Pressure and Capacity:

Potable water systems: If not available from the water provider, determine the available pressure and flow rate from a water supply meter connection by conducting a flow test to measure the pressure downstream of the meter at various flow rates. Consider daily, seasonal, and long-term fluctuations in the supply pressure and available flow when developing a safety factor to derate the flow and pressure measured by the field test.

Design flow rate through the meter must be no greater than 75% of the maximum safe flow capacity as stated by the meter manufacturer or use the American Waterworks Association standards. Where possible, develop a water supply from roof runoff into a cistern or other sources and deliver water using a pump.

4.16.2 Application Rates

Use application rates, scheduling practices, or both, that avoid runoff and permit uniform water application. Consider land slope, soil hydraulic properties, vegetative ground cover, peak use demand, and prevailing winds when specifying application rates.

4.16.3 Application Uniformity

Table 4.4 lists the minimum accepted distribution uniformity ratings for SNL irrigation systems.

Table 4.4 Minimum DU Ratings for SNL Irrigation Systems

System Type	Rating
Rotary systems	75%
Fixed spray systems	65%
Point source systems	85%
Line source systems	90%

The SNL Landscape Architect/Site Horticulturalist must commission the irrigation system as a whole. The commissioning must include an irrigation system audit with at least one representative valve (as recognized by IA nomenclature) from each zone type installed (drip, bubbler, fixed spray, or rotor) being audited and passing the minimum DU requirements listed above. Any zone not meeting the minimum target values must be redesigned, reconstructed, or both, until it meets the minimum target values. All zones of the same type that use the same emission devices (drip, bubbler, fixed spray, or rotor) as the failed zone must be audited and be required to meet the minimum DU values in Table 4.4.

4.16.4 Peak Water Use Requirements

The irrigation system must be capable of meeting the peak water use demand of turf and landscape areas. Estimate the peak water use requirement based on the plant species and local climate conditions. If using a cistern, estimate year-round flows. Any overhead spray irrigation system must have the capacity to apply water at a rate that satisfies the peak water demand of the fully mature landscape within 12 hours. If line size is a limiting factor, it must be addressed during the design phase.

4.16.5 System Zoning

Divide the irrigation system into zones based on the following considerations:

- Available flow rate, water velocity, and pressure
- Consistency with hydrozone concepts
- Sprinkler heads with matched precipitation rates
- Type of vegetation irrigated (such as turf, trees, or shrubs)
- Consistency with microclimates (such as buildings, shaded areas, and reflective heat)
- Elimination of mixed head types (such as bubblers and rotaries on the same zone)
- Cultural use of the area (such as pedestrian walks and seating areas)

4.17 Irrigation System Source

The preferred source for landscape irrigation water is from building potable water systems. Coordinate with the Mechanical Designer for location and correct pressure of irrigation water needed for landscaping. Evaluation of alternate sources (harvested rainfall, cisterns, and so on) is encouraged. If alternate sources are used, include in the water budget if a LEED-rated project.

4.18 Irrigation Equipment Selection – General

Select equipment consistent with SNL's landscape requirements and central irrigation control system (CICS). Adjustments to manufacturer's altitude rating are required for SNL/NM altitude at 5,000 feet.

Select equipment, when available, that is labeled WaterSense by the EPA. The project Landscape Architect must consult the EPA WaterSense web site to look for products that are labeled WaterSense.

Design sprinkler and bubbler irrigation systems to meet water requirements for individual plants at maturity.

4.18.1 Controller

Select a controller capable of handling the required zones with a minimum of two additional spare zones. See the SNL Standard Specification 02812, *Landscape Irrigation Systems*.

Design as recommended in the *Calsense® Designers Guide* available from Calsense, Inc. at (800) 573-8608 or locally from Ewing Irrigation at (505) 821-4441.

Ensure the irrigation system design incorporates CICS either with a new controller and flow meter installation or by using an existing controller and "tying" the new system into the existing one.

Projects that include construction of a new building must specify that the Calsense controller communicate using internal Ethernet modem back to central. The Calsense controller must be specified in the following manner: ET2000E - # of stations desired – EN – RRe - F

4.18.2 Controller Enclosure

The preferred enclosure for the Calsense controller is the pedestal-mount heavy-duty stainless steel enclosure. When this option is not possible, installing the standard wall mount enclosure is acceptable.

4.18.3 Wiring

- Refer to Standard Drawing LP5002, "Irrigation Details."
- Show wire route and size on plan.
- Install one extra wire to each valve in the same trench as the other zone wires.

4.18.4 Backflow Preventers

Backflow-preventers (BFPs) must be approved by SNL. Refer to section 7.3, "Fire Protection Backflow Preventers," in this *Design Standards Manual*. Apply the devices in accordance with the City of Albuquerque Cross Connection Control Ordinance, section 8.6.6 of this manual, and the following guidelines:

- Double-check assemblies are **not** permitted for use on irrigation systems.
- Wilkins backflow preventers must be specified. Pressure gauges with isolation valves should be installed in the inlet and outlet piping to the backflow preventer.
- Backflow preventers may be installed in building's mechanical room.

4.18.5 Backflow Prevention Assembly Freeze Protection

The approved backflow prevention assembly enclosure must be a positively heated insulated enclosure.

If positive heat is not available, an approved Lexan® enclosure may be used. Submittals must be provided through the usual channels for use of a Lexan enclosure.

4.18.6 Pressure Regulating Valves

Provide an adjustable brass pressure-regulating valve (PRV) on all projects downstream of the point of connection and upstream of the backflow preventer. The PRV can be located in any position (for example, horizontal or vertical). Individual pressure regulators must be used on zones requiring low pressure (drip or low-flow bubblers).

4.18.7 Flow Meter

Flow meters must be used in all irrigation applications using the CICS. Consult with the SNL Landscape Architect/Site Horticulturalist about the use of a flow meter on any given irrigation system. This consultation must occur regardless of the water source—potable or nonpotable.

4.18.8 Master Valves

Normally closed master valves must be used on all irrigation systems.

4.18.9 Quick Coupler Valves

Quick-coupler valves must be installed as needed or a minimum of every 100 feet of mainline as per SNL Detail Drawing LP5002STD.DGN #14.

4.18.10 Drain Valves

Automatic drain valves are not acceptable. Use one manual drain valve in the low point of each lateral and mainline piping.

4.18.11 Piping

Construction Standard Specification 02812, *Irrigation Systems*, specifies materials, processes, and installation requirements for subgrade irrigation systems that apply as designated on the contract drawings.

All pipelines must be sized and routed to limit pressure variations, so the operating pressure at all points in the irrigation system is in the range required by the manufacturer for uniform water application.

As a safety factor against surge or water hammer, the working pressure must not exceed 72% of the pressure rating of the pipe with the pipeline water velocity limited to 5 feet per second.

Design the system with the appropriate size pipe to limit variations in operating pressure between the first and last emission devices (sprinklers, bubblers, drip) on a given zone to 20% or less.

4.18.12 Fittings

Male adapters must not be used to connect valves; use toe nipples instead.

4.18.13 Multioutlet, Point Source, and Line Emitters, and Bubblers

As a general rule, all plant material must be designed using a multioutlet point source (MOED) emitter system. Only dense planting beds must be designed using a line source emitter system.

All trees and shrubs must be designed with drip/micro irrigation systems unless specified otherwise. The drip system for trees must use two ball valves to divide the system into sections—one for the first 1 to 5 years of establishment and the second for 6 years and older of maturity. Reference Irrigation Detail Drawing LP5002STD.DGN #13.

Use pressure-compensating emission devices only in instances where elevation changes warrant them.

The location of drip emitters or bubblers is important in proper water distribution and in allowing the plant to mature fully. Evenly distribute emitters around the root ball at least 12 inches from the outside edge of the root ball.

Account for differences in plant Et rates by using different nozzle size emitters or using greater or fewer emitter numbers.

Group plants on a given zone according to type, size, and Et rates, for example, trees and shrubs should not be placed on the same valve.

4.18.14 Spray Heads

Design all spray head irrigation systems using Matched Precipitation Rate principles.

In turf areas, use a triangular-spaced spray head system when possible.

All fixed-spray sprinkler systems must be designed using in-head check valves and in-head pressure regulators.

All fixed-spray and bubbler irrigation systems must be designed with pressure-compensating devices.

Do not use spray irrigation heads when designing for areas less than 10 feet in any direction.

Space sprinklers to prevent overspray onto adjacent property, nonirrigated areas, walks, roadways, or structures. Heads must be located 8 inches from any hard surface.

Use a minimum 4-inch pop-up fixed spray head in all cool season turf areas. Use a minimum 6-inch pop-up fixed-spray head in all native or warm season turf areas.

Specify fixed-spray heads that have fixed-arc nozzles whenever possible. Adjustable-arc nozzles must be used only when odd arcs are required.

Provide fixed-spray heads connected to the same control valve with matched precipitation rates to guarantee application of water at the same rate.

Provide fixed spray heads with automatic flow shut-off devices in areas where damage from pedestrians or vehicles might occur.

4.18.15 Rotary Sprinklers

Design all rotary spray head irrigation systems using Matched Precipitation Rate principles ensuring that the radius of throw is constant regardless of the arc.

Provide rotors that have the smallest practical radius to reduce wind drift.

Impact rotary heads are not acceptable for use.

A triangular-spaced spray head system is preferred for use in turf areas when possible.

All rotary-head sprinkler systems must be designed using in-head pressure regulators. In locations of changing elevations, the system must be designed using check valves at the base of each head to eliminate or reduce low-head drainage.

Locate rotor sprinklers 8 inches away from sidewalks, edges of paved areas, and adjacent walls, buildings or fences.

Use a minimum 4-inch pop-up rotary head in all cool season turf areas.

Use a minimum 12-inch pop-up rotary head in all warm season turf areas.

Provide rotors with automatic flow shut-off devices in areas where damage from pedestrians or vehicles may occur.

A triangular-spaced rotary head design must be applied to large turf areas where overthrow of the sprinklers is not a concern (no buildings or hard surfaces).

4.18.16 Miscellaneous Parts and Components

Refer to SNL Standard Specification Section 02812, *Landscape Irrigation System*, and Facilities Standard Drawings LP5001001STD and LP5001002STD for listing and additional irrigation equipment requirements. These requirements include the following:

- Ball Valve
- Electric Valve
- Manual Drain Valve

4.19 Reclaimed Water Guidelines

When a project has reclaimed water available or is in an area that will have reclaimed water available as irrigation water, install the irrigation system using the industry standard purple color, pipes marked "Reclaimed Water – Do Not Drink," or both, valves boxes, and sprinkler heads.

Meter the backup potable water supply.

The backup supply water is only to be used in emergencies when reclaimed water is unavailable. Protect the backup water supply with the appropriate backflow prevention device. If a project is to be LEED-certified, include reclaimed water in the water budget.

Control valves using effluent water must not have an external manual bleed.

4.20 Irrigation Scheduling

Proper irrigation scheduling applies the correct amount of water at the correct intervals for optimum growing conditions for plant material. A schedule must define the time of day, days of the week, and length of time a zone is operated to apply water.

Develop an irrigation schedule that accounts for the effects of temperature, plant species, soil types, precipitation rates, and microclimates. (Either the project Landscape Architect or Irrigation Designer develops this schedule.)

Base schedules must be developed for each zone/station/month for the first 12 months after installation. Use the following criteria to develop base schedules:

- Runtimes per zone/station
- Cycles per day
- Days per week or frequency

Changes in irrigation frequency in response to changes in Et must be reflected by increasing or decreasing the frequencies rather than changing the length of the run time. These changes must be reflected on monthly schedules for an entire year.

When water application rates exceed soil infiltration rates, determine the run time before run-off occurs and incorporate this variable into the schedule.

The schedule must use the principles approved and used by the Irrigation Association in its Landscape Irrigation Auditor Program, and the LEED system, if applicable.

4.21 Schedules, Charts, and Legend

Schedules of equipment or plant material must be complete, well-organized, and representative of industry standards.

- End of Chapter -