

TABLE OF CONTENTS

B-C GEN	GENERAL ARCHITECTURAL REQUIREMENTS	3
1.0	APPLICATION OF THIS CHAPTER.....	3
2.0	ACRONYMS AND DEFINITIONS.....	4
3.0	GENERAL.....	4
4.0	DESIGN PRINCIPLES.....	4
5.0	SITING & SITE DEVELOPMENT.....	5
6.0	CODES AND STANDARDS.....	5
7.0	DESIGN DOCUMENTATION.....	6
8.0	PROPERTY AND MISSION CONTINUITY PROTECTION REQUIREMENTS.....	8
9.0	TEMPORARY AND RELOCATABLE STRUCTURES.....	8
D10	CONVEYING EQUIPMENT	8
D1010	ELEVATORS	8
E20	FURNISHINGS	9
1.0	GENERAL.....	9
G2040	EXTERIOR SCREENS AND SIGNS	9
1.0	EXTERIOR SCREENS.....	9
2.0	EXTERIOR SIGNS.....	9
G2050	LANDSCAPING	11
1.0	GENERAL.....	11
2.0	LANDSCAPE SITE FACTORS.....	11
3.0	LANDSCAPE DESIGN ELEMENTS (REQUIREMENTS).....	12
4.0	CONSIDERATIONS FOR INSTALLATION.....	12
5.0	DESIGN CONSIDERATIONS FOR MAINTENANCE.....	13
6.0	SEEDING.....	14
7.0	SODDING.....	16
8.0	PLANTING.....	17
9.0	IRRIGATION.....	18

RECORD OF REVISIONS

Rev	Date	Description	POC	OIC
0	06/28/99	Document rewritten to support LIR 220-03-01. Superseded Architectural Facilities Engineering Standards, Vol. 4, Manual Rev. 6, 2/17/98.	Miles Brittelle, <i>PM-DS</i>	Dennis McLain, <i>FWO-FE</i>
1	11/18/02	General revision and addition of endnotes. Replaces subsections 100, 102, 200, 209, 211. New siting article.	Scott Richardson, <i>PM-1</i>	Kurt Beckman, <i>FWO-SEM</i>
2	8/16/04	General requirements now in ESM Chapter 1 Sect Z10. Added ADA, visual screening, firestopping, and sitework requirements. Landscaping expanded. LEM became ESM.	Scott Richardson, <i>PM-DS</i>	Gurinder Grewal, <i>FWO-DO</i>
3	10/27/06	Administrative changes only. Organization and contract reference updates from LANS transition. IMP and ISD number changes based on new Conduct of Engineering IMP 341. Master Spec number/title updates. Other administrative changes.	Scott Richardson, <i>F&ME-DES</i>	Kirk Christensen, <i>CENG</i>
4	02/07/19	Reorganization to increase clarity and logic of order. Expanded design documentation section and deleted non-passenger/freight conveying equipment section. Deleted handling material now in Mechanical Ch 6. General update of information, references, URL links, codes and standards throughout.	Scott Richardson, <i>ES-EPD</i>	Larry Goen, <i>ES-DO</i>

CONTACT THE ARCHITECTURAL STANDARDS POC
for upkeep, interpretation, and variance issues

Ch. 4, B-C-GEN	Architectural POC/Committee
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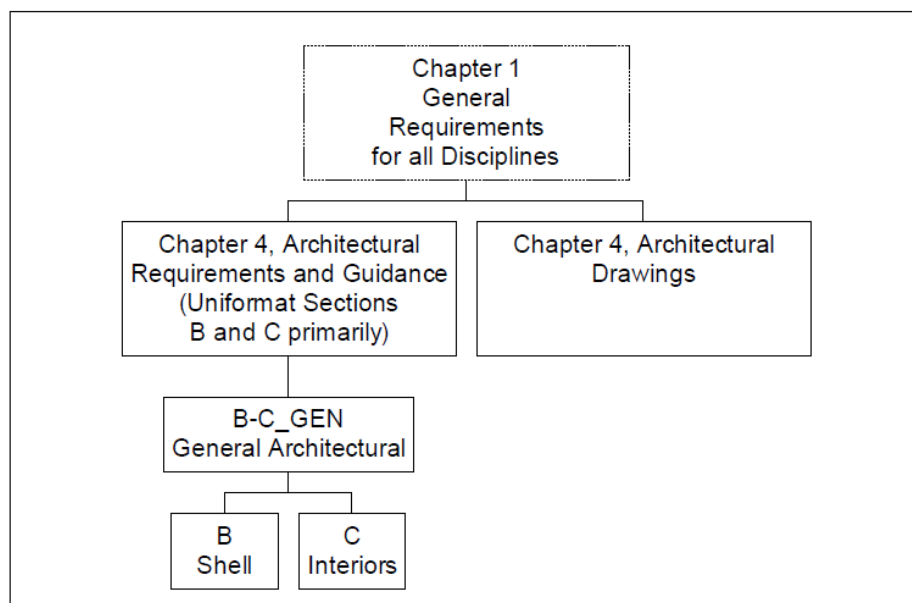
B-C GEN GENERAL ARCHITECTURAL REQUIREMENTS

1.0 APPLICATION OF THIS CHAPTER

1.1 General

- A. The purpose of this chapter of the LANL Engineering Standards Manual (ESM) is to meet the Site and Architectural Design Principles¹ while providing architectural systems, materials and finishes that:
 1. Develop a unique architectural character that is based on LANL’s regional context, history, function and vision for the future;
 2. Reflect a science and technology image;
 3. Provide designs of buildings and structures that are flexible for long-term changes in use;
 4. Provide designs that incorporate energy conservation, durability, efficiency of maintenance, and meet safety and security requirements, and
 5. Implement a unifying design palette for architectural design.

- B. All architectural design, materials, equipment, and installations shall comply with site-specific requirements in this Chapter and Chapter 1, *General* of the ESM.



This hierarchy and the organization of this chapter are depicted below:

¹ See discussion at 4.1.A of this section B-C-GEN.

- C. In addition to new architectural installations, this Chapter applies to all renovation, replacement, modification, maintenance, or rehabilitation projects. See ESM Chapter 16, IBC Program.

2.0 ACRONYMS AND DEFINITIONS

- A. See ESM Chapter 1 for all acronyms and definitions.

3.0 GENERAL

- A. For general standards and requirements for all project phases see Chapter 1, Section Z10, *General Requirements for all Disciplines/Chapters*.

4.0 DESIGN PRINCIPLES

4.1 General (*Guidance*)

- A. The vision for the physical development of the Laboratory is to create an exceptional work environment that supports its mission, and attracts and retains the quality personnel needed to meet that mission. Using the standard of a world-class working environment the Laboratory sets out to revitalize and develop its facilities and infrastructure in a manner that improves and upholds the functionality, safety, security, appearance and life cycle effectiveness of the built environment. To that end, the *Site and Architectural Design Principles* document, LA-UR-01-5383, January 2002 was published to provide, early in a project's life, end-result direction towards meeting those goals.² The document is intended to provide maximum latitude in design decisions while maintaining consistency in the final product at the institutional level by implementing the principles therein on every project regardless of project size.

1. The *Site and Architectural Design Principles* document can be found as a reference to this chapter at:
http://engstandards.lanl.gov/ESM_Chapters.shtml#esm4

Additionally, bound hardcopies may be requested from the Operations & Infrastructure–Infrastructure Planning (OI-IP) Group.

4.2 Sustainable Design

Guidance: Large Projects (GPP and larger) should implement the whole building, or integrated design, approach in all disciplines including Architecture and Architectural Programming; for further guidance see <http://www.wbdg.org/design-disciplines>.

- A. Sustainable or green-building design minimizes site disturbance, optimizes energy and water use, provides good indoor and outdoor environmental quality, implements the use of environmentally preferable building products, processes construction and demolition waste in a resource-conserving manner and improves operations and maintenance.

² The Site Planning and Construction Committee (SPCC) members endorsed the *Site and Architectural Design Principles* original 2001 version (LA-UR 01-5383) document for Laboratory use per the Comprehensive Site Planning LPR and LIR requirement on October 10, 2001(EMRef-16).

Section B-C GEN General Architectural Requirements

Rev. 4, 02/07/19

- B. All new buildings and certain renovation projects must meet the sustainable design requirements of ESM Chapter 14, *Sustainable Design*.
- C. In addition, LANL has developed the *Sustainable Design Guide* which can be found at <http://engstandards.lanl.gov/esm/architectural/Sustainable.pdf>
- D. When specifying architectural products and materials refer to the CPG website at <https://www.epa.gov/smm/comprehensive-procurement-guideline-cpg-program> for designated products and recycled-content recommendations. See ESM Chapter 14, *Sustainable Design* for more information. Also see Chapter 14 for information regarding the United States Department of Agriculture Bio-Preferred Program required for Federal purchasing.

5.0 SITING & SITE DEVELOPMENT

- A. Coordinate siting of all structures with Operations and Infrastructure–Infrastructure Planning (OI-IP) group.
- B. Appropriate levels of site development such as sidewalks, parking lots, lot and walkway lighting, provision for parking of maintenance and delivery vehicles close to the building, and site improvements shall be provided by and for each project as determined by the associated LANL master plans, area development plans, comprehensive site plans and the *Site and Architectural Design Principles* document. Contact OI-IP for assistance.
- C. Primary building entries, whenever feasible, should have southern orientation for winter solar exposure to minimize problems due to snow and ice whenever possible. Similarly, major pedestrian ways (sidewalks, plazas, building approaches, etc.) shall be oriented—and solar access to them protected—to maximize winter solar exposure. Artificially heated walkways are not to be utilized without a variance obtained.³
- D. For fire-related building separations and wildland fire-based clearance zones, follow ESM Chapter 2 Fire Protection, *Exposure and Natural Phenomenon Hazards Protection* article (7.0).
- E. For Right-of-Way requirements follow ESM Civil Chapter 3, Section G30 Site Civil/Mechanical Utilities, Utility Line Clearances Above Ground.
 - 1. Contact Utilities and Institutional Facilities for ROW distances and underground utility locations and verification.

6.0 CODES AND STANDARDS

6.1 General: See Chapter 1, Z10 – *General Requirements for all Disciplines/Chapters* for codes and standards applicable to architectural design.

6.2 Accessibility⁴

- A. Design of new facilities and modifications to existing facilities shall meet the latest accessibility requirements of Americans with Disabilities Act (ADA) and Architectural

³ E-mails on SCC Problems from Maez and Ojeda to Oruch June/July-04 (EMRef-29).

⁴ If direction on accessibility is added to ESM Ch 1 Z10, that direction supersedes.

Section B-C GEN General Architectural Requirements

Rev. 4, 02/07/19

Barriers Act (ABA) *Accessibility Guidelines* (July 23, 2004/adopted July 23, 2010) and the International Building Code. Where discrepancies occur, the most stringent shall apply.

- B. When existing conditions of existing facilities being modified do not permit full compliance, the modification shall be made accessible to the extent technically feasible and in no way shall make an existing facility less accessible than it is currently.
- C. Federal law provides for exclusion of disabled personnel from buildings, or portions thereof, where hazardous materials or activities exist and the presence of such disabled personnel could represent a hazard to themselves or to others during an emergency. The affected disability(ies) must be specific and documented (an Alternate Method Form 2137 approved in advance of design commencing is the preferred form of documentation). In such buildings, specific disabilities NOT excluded shall be accommodated (to the extent technically feasible for existing buildings).⁵

7.0 DESIGN DOCUMENTATION

7.1 General

- A. Architectural Construction Drawings: See the ESM CAD Standards Manual for information on types of drawings, drawing organization and arrangement of overall construction drawing set.

7.2 Emergency Evacuation Diagrams (EEDs) and Life Safety Plans

- A. LANL shall produce floor plans of record for all new buildings and modify existing plans when existing buildings are altered. When required, Emergency Evacuation Diagrams (EEDs) and Life Safety Plans are produced from these floor plans of record. EEDs are required for⁶:
 1. Assembly Occupancy Types
 2. High Rise Buildings – (the highest occupied story greater than 75 ft above the lowest level of fire department access)
 3. Business, Factory and Industrial Occupancy Types with more than 500 occupants or more than 100 occupants above or below the level of exit discharge
 4. Hazardous Occupancy Types
 5. Customer-requested and funded applications.
- B. EEDs shall be wall-mounted at locations prescribed by Security and Emergency Operations based on ASTM E-2238, 48–60 inches above finished floor to the center of the sign.

See the [ESM CAD Standards Manual](#) for detailed requirements for producing EEDs.

⁵ 29 CFR 1630, *Equal Opportunity for Individuals with Disabilities*, Section 1630.2(r) *Direct Threat*.

⁶ For EEDs: These criteria were developed during a working meeting held 8/30/18. SEO, FP-DO, ES-DO, ES-EPD, and UI-DO attended. The agreed-to decisions were based on national consensus codes and standards as they apply to EEDs. Deviation requires written approval from SEO and this chapter's POC.

7.3 Project Design Data

Include detailed project design information for all designs. See the [ESM CAD Standards Manual](#) for information that is placed on drawings. If necessary, use a small plan of the building to identify various conditions.

- A. Consider including the following information:⁷
1. **Code of Record:** Identify building and life safety codes the new construction work is designed to meet. Provide IBC, IEBC, NFPA and additional DOE/LANL regulations specifically applicable to the building use. For modifications to existing buildings provide original code of record (if available) as well as the new code of record, the IEBC Alteration Level, and, on a small plan show the “Area of Work” as defined by IEBC along with associated square foot calculations.
 2. **Occupancy Classification:** Identify the IBC and the NFPA 101 occupancy classification(s) including accessory occupancies, and mixed use occupancies (with and/or without separation).
 3. **Occupant Load:** Identify IBC and NFPA 101 occupant load by individual occupancy and total occupant load.
 4. **Type of Construction:** Identify type of construction as defined by the IBC. Identify areas that may have different types of construction, and state whether an automatic fire sprinkler system is included in the building’s life safety systems.
 5. **Building Areas and Number of Stories** (as defined by IBC): Identify total area of structure, area of each floor if applicable, number of stories, and the allowable areas and stories per IBC. Also note if allowable building area was increased based upon use of an automatic fire sprinkler system.
 6. **Corridors, Occupancy and Area Separations:** Identify the fire rating of corridor walls and note if a credit based upon use of an automatic fire sprinkler system was taken. Identify any area separation walls/fire rated barriers and reason for their use.
 7. **Floor and Roof Loadings:** Identify the floor and roof live loads used in the design of the structure.
 8. **Hazard Classifications:** List the hazard classifications and IBC Risk Categories used in the design of the structure.
 9. **Egress Requirements:** Identify required exits, means of egress, total travel distances, paths of common travel distances and lengths of dead end corridors.
 10. **Fire Safety Features:** Identify fire safety features including sprinklers, standpipes, fire alarms, fire extinguishers, smoke detectors, emergency lighting, exit lights and emergency power generators.

⁷ The intent of this information is to determine the code and design basis upon which the project was developed.

Section B-C GEN General Architectural Requirements

Rev. 4, 02/07/19

11. **Special Systems:** Identify Hood-Suppression Systems (Fume and Kitchen), other special systems, and disconnect switches.
12. **Plumbing Fixtures:** Identify required plumbing fixture type and quantity by occupancy type, gender, total number of fixtures required and total number of fixtures provided. For existing facilities, identify existing number of available fixtures and number of fixtures required under the new code of record.

7.4 Floor Plan of Record (FPR)

- A. LANL produces and maintains floor plans of record for all new and existing buildings as detailed in the ESM CAD Standards Manual. The floor plans of record in DWG format are available from OI-IP.
- B. Refer to the Architectural Standard Drawings Example A-1000 and A-1001 for example floor plans of record.

7.5 Roof Plan of Record (RPR)

- A. LANL is developing roof plans of record for all new and existing buildings as detailed in the ESM CAD Standards Manual. Roof plans of record in DWG format are available from OI-IP.
- B. Refer to the Architectural Standard Drawings Example A-1010 and A-1011 for roof plans of record.

8.0 PROPERTY AND MISSION CONTINUITY PROTECTION REQUIREMENTS

- A. Refer to ESM Chapter 2, *Fire*, and references in same.

9.0 TEMPORARY AND RELOCATABLE STRUCTURES

- A. Facilities (including manufactured structures, mobile homes, trailers, semi-trailers, modular type structures, factory assembled structures, cargo containers, hazardous materials or flammable liquid storage containers, air-supported/inflated structures, tent/membrane and cloth/rib structures) shall comply with requirements of PD1220 Fire Protection Program and DOE Standard 1066-2016, Appendix C in addition to the IBC and Life Safety codes.
- B. Refer to ESM Chapter 16 IBC Program for temporary facilities, structures, and building systems and components requirements (*IBC-GEN Prefab heading*).

D10 CONVEYING EQUIPMENT**D1010 ELEVATORS**

Section B-C GEN General Architectural Requirements

Rev. 4, 02/07/19

- A. Structures of two or more stories, regardless of occupancy type, shall have at least one elevator serving every floor level. At least one such elevator shall accommodate a 24"x84" ambulance stretcher in its open, horizontal position.⁸

Guidance: Consider the use of machine-room-less, gearless, traction, and/or regenerative-drive elevators for low and mid-rise structures.

E20 FURNISHINGS**1.0 GENERAL**

- A. System or "modular" furniture of any kind being attached to building partitions or walls shall have engineered anchorage for the expected gravity and lateral loads involved.⁹
- B. Refer to the following LANL Master Specifications:
1. Section 06 2000, *Finish Carpentry*
 2. Section 06 4100, *Architectural Wood Casework*
 3. Section 12 3100, *Manufactured Metal Casework*

G2040 EXTERIOR SCREENS AND SIGNS**1.0 EXTERIOR SCREENS**

- A. Permanent visual screening shall be provided for unsightly areas such as refuse containers, HVAC and electrical equipment (whether roof-mounted or pad-mounted), delivery areas, etc. *Dumpster screens should not have gates. Locating such areas on the least-visible side of predominant viewpoints can minimize or eliminate the need for additional screening. See Site & Architectural Design Principles.*
- B. The preferred method of screening is louvered materials and assemblies with louvers oriented in such a way as to allow passage of winter sun to aid the melting of snow and ice.

2.0 EXTERIOR SIGNS**2.1 General**

- A. Provide General Road Signs in accordance with the *Manual on Uniform Traffic Control Devices* (MUTCD) <http://mutcd.fhwa.dot.gov/>. Refer to LANL ESM Chapter 3, *Civil* for detailed requirements.
- B. See LANL Master Specification 10 1405, *Exterior Signage* and Architectural [Standard Drawings](#) ST-G2040-4, *Exterior Wayfinding*.¹⁰

⁸ Expands upon IBC 2015, Section 3002.4 regarding this for structures of 4 stories and greater.

⁹ Incorporates concerns that resulted in VAR-2012-092, *Labwide Anchoring Overhead Storage Flipper Units*.

Section B-C GEN General Architectural Requirements

Rev. 4, 02/07/19

- C. See *Site & Architectural Design Principles*, Section IV.C, *Landscape Elements*.

2.2 Technical Area Signs

- A. Locate technical area freestanding signs at the entrances to a technical area and all locations within the technical area where designation of the area is important.
- B. When sited at an entrance road to an area, the face of the sign shall be perpendicular to the major road.
- C. For details, comply with the Architectural Standard Drawing(s) ST-G2040-4, *Exterior Wayfinding*.

2.3 Structure Signs

- A. Building-mounted building identification signs are required on all buildings, transportables, trailers and transportainers. Other large outdoor structures (transformers, tanks, switchgear, antenna, etc.) require structure number signs which are less elaborate than building identification signs.
- B. Numbers: Obtain structure numbers from the OI-IP group as part of the siting process.
Guidance: A structure identified as 55-0004 is Building 4 in Tech Area 55.
1. Format: Comply with Standard Drawing ST-G2040-4, *Exterior Signs*.
 2. Proposed facility identification signs (freestanding and building mounted) are to be approved by the Architectural design review SME prior to project design completion.
- C. Building Signs
1. *Guidance: Adjustments to the following will often be needed for best placement based on the requirements of the individual project. The primary considerations are visibility of structure identification for emergency and wayfinding purposes and appearance of the location of the signs in context with the structure's shape and other features. Contact the ESM Architectural Point of Contact for assistance if needed.*
 2. Location: Locate building mounted identification signs on the right-hand end of the building face first seen from the street and/or parking area. Use more than one structure sign when appropriate to enhance wayfinding.
 3. Provide additional sign(s) on buildings near building entrance where appropriate.
- D. Transportainer Signs
1. Locate signs as high as possible in the upper right or left-hand corner of the structure. Place the number on the side or end that has the access doors.

¹⁰ The Site Planning and Construction Committee (SPCC) members endorsed the *Site and Architectural Design Principles* 2001 version (LA-UR 01-5383) document for Laboratory use per the Comprehensive Site Planning LPR and LIR requirement on October 10, 2001. Also endorsed during that meeting was the new metal wayfinding (signs) with teardrop cross-section uprights (EMRef-16).

G2050 LANDSCAPING

Much of the following appears in the *Site and Architectural Design Principles* document and use of either or both is acceptable. If discrepancies arise, either may be considered acceptable practice. The scope is generally building landscaping, not civil/roadside work described by ESM Ch 3, Civil.

1.0 GENERAL

This section sets forth minimum design criteria for planting, seeding, sodding, and irrigation for the landscaping of new facilities or re-vegetation of disturbed sites due to construction activities. The objectives of landscaping are as follows:

- A. Use landscaping and re-vegetation to prevent erosion, runoff and soil damage to new and existing facilities.
- B. Use plants to modify environmental problems such as temperature fluctuations, snow accumulation, wind, noise, glare and light reflection, and energy and water conservation.
- C. Landscaping can be used to control visual clutter for security, safety, and aesthetic reasons.
 - 1. Planting designs must support the security and safety requirements of each project while improving the visual appearance of the area.
- D. Planting design and installation should minimize long term maintenance requirements while maximizing functional and aesthetic uses.
- E. Because LANL is made up of scattered research areas rather than being a unified complex, landscaping can be used to create a cohesive look for the Laboratory and enhance the work environment.

2.0 LANDSCAPE SITE FACTORS

- A. Site factors for planting, seeding, and sodding may exist separately or in various combinations. Consider the following factors for landscaping or re-vegetation of construction areas:
 - 1. Drainage
 - 2. Topography
 - 3. Soils
 - 4. Climatic data
 - 5. Existing Vegetation
 - 6. Security Requirements
 - 7. Pedestrian Circulation

8. Maintenance Requirements.

3.0 LANDSCAPE DESIGN ELEMENTS (REQUIREMENTS)

- A. Planting Plan: Show exact locations of proposed and existing plant materials, seeding, and sodding within the project area in the planting plan. Follow the ESM CAD Standards Manual. Draw plant materials at approximately two-thirds their mature spread, unless they are exceptionally slow growing, then the plant should be drawn at half their mature spread.
- B. Plant List Schedule: Include a plant list on the drawings. The plant list shall contain the following: The symbol or abbreviation for the plant used on the plan, the common and botanical names of the plant, installation size, spacing, and any special notations. Group the plant list by trees, shrubs, vines and ground covers. Indicate trees as containerized or balled and burlap (B&B) material, and single or multi-trunk as appropriate per species.
- C. Planting Details: Include planting details in the Drawings.
- D. Specifications: Use LANL Master Specifications. Carefully examine and edit the section as needed for each project. Sections cover planting irrigation (32 8400), seeding (32 9219), sodding (32 9223), and plants (32 9300).
- E. Seeding Schedule: Include a seeding schedule in the Drawings, which includes lawn or native grasses to be seeded. The seeding schedule shall list: common and botanical names of the grasses and application rate for each grass type. Native grass seed rates shall be in pure live seed pounds (lb/P.L.S.) per acre, or in lb/P.L.S. per thousand square feet for areas of a quarter acre or less. Refer to the Grass Characteristics and Adaptations Matrix (Table 1) below.
- F. To reinforce a sense of unity, use plants and design themes that complement existing landscape on adjacent sites. If a change in a material or design theme is desired, a transition area should be designed rather than abruptly changing materials or design. Use landscape materials that reinforce the high mountain pine setting. Avoid formal planting arrangements except in highly public locations such as administrative buildings and visitor areas.

4.0 CONSIDERATIONS FOR INSTALLATION

- A. Coordinate landscaping with stormwater management requirements in ESM Civil Chapter 3 Section G10-G1030 (*article 6.0*), and the LANL Sustainable Design Guide Section 3.
- B. Protection of Existing Trees: Require a temporary construction fence or barrier 2 feet beyond the drip line to protect the roots. Save pine trees larger than 10 inches in a trunk diameter, and others of similar maturity, whenever possible. *Guidance: Grades within the drip line of the tree should not be altered.*
- C. Use of Native and Drought Tolerant Plants: Whenever practical, to reduce maintenance, use native and drought tolerant plants that, after establishment, can survive on available rainfall and are adapted in local growing conditions. Plan for native and drought tolerant plants to be irrigated during the first growing season with water being reduced after the first growing season gradually acclimate the plants to the natural water regimen.

- D. Soil Preparation: Examine the job site to determine the extent and quality of the existing subgrade material and whether top soil is available as part of the grading operation. Determine if top soil or top dressing should be imported to the site and the extent of scarification required. If material quality is in doubt, arrange soil tests to determine the soil type and the required soil mix and soil amendments to be used to enhance the growth characteristics. Consider soil amendments including commercial fertilizers, top soil, sand, and mulch.
- E. Fertilizer Guidance: *The use of fertilizer in landscaping design depends on highly variable circumstances. These include location, schedule, desired short-term results, soil type, and installation methods. In the case of plantings, fertilizer tablets may be considered, depending on time of year, size, and condition of the plants involved. In general, it is Laboratory policy to keep fertilizing to the minimum that will assure growth and desired results over a reasonable period of time. Instant results are not necessarily desirable, at the expense of plant health, maintenance requirements, or environmental concerns.*
- F. Unapproved Materials: Do not include the following for the reasons stated:
1. Kentucky bluegrass is not well adapted to the Los Alamos climate, requires excessive water, and can be expensive to cultivate and maintain.
 2. Manure as a fertilizer or soil amendment. Manure that is not properly aged can introduce harmful chemicals. In addition, quality is difficult to control and manure can contain seeds of unwanted or noxious weeds.
 3. Herbicide may contain materials that are harmful to the environment. They are not considered necessary or desirable for initial installations.

5.0 DESIGN CONSIDERATIONS FOR MAINTENANCE

- A. Maintenance (e.g., watering, fertilizing, weeding) of a seeded or sodded area after initial installation will directly affect the results of the project. The seeded areas shall receive a regular watering, weeding, and fertilizing program to produce a higher germination rate and a healthier, stronger grass stand. Native grass seed mixtures will not germinate at the same time, protecting the species from total elimination if adverse conditions are present. When optimum conditions exist over a period of time (at least 60 days), more seed will germinate. It is recommended to have a watering program for a minimum of 60 days, unless planting is near fall frost. However, if this is not possible, time of seeding is important to guarantee optimum results.
- B. High Maintenance Zone: Areas immediately adjacent to buildings or pedestrian plazas. Maintenance in this zone will usually be weekly to semi-monthly and include mowing. Plants requiring frequent maintenance such as sodded lawn, ornamental shrubs and flowers shall be limited in use to high maintenance zones, and should be clustered in easily maintained areas.
- In general, limit high maintenance zones to areas of visual prominence or intensive use by employees and visitors. Not all technical areas or buildings will have high maintenance zones. Irrigation is normally utilized in high maintenance zones.
- C. Medium Maintenance Zone: Areas visually important areas where pedestrian use is moderate. In general, medium maintenance zones are transition zones between the

intensive landscaping of the high maintenance zone, and the low maintenance zones. Plants in medium maintenance zones should require only monthly or seasonal maintenance. The plant selection shall emphasize plant species, which have a proven history of low maintenance and drought tolerance. Irrigation may or may not be utilized.

- D. Low Maintenance Zones: The remaining portions of the project site that are not in the high or medium maintenance zones, or which were covered with native vegetation. Re-vegetate low maintenance zones or landscape for erosion and drainage control. Landscape low maintenance zones in a manner that allows them to be treated as native vegetation requiring little or no maintenance. Limit plants to natives and drought tolerant ornamentals that are acclimated to existing environmental conditions. Irrigation normally will not be provided.
- E. Consider scope, location, and time of year in developing maintenance requirements on the Drawings or in the Specifications. Evaluate if a medium or high maintenance zone design is warranted and whether irrigation will be used. Tailor the maintenance requirements of the Standard Specifications to reflect the above factors and to account for the growing seasons within the scope of the project. This will also affect the warranty provisions.

6.0 SEEDING

- A. Reestablish native grasses in all areas disturbed by construction activities. Objectives for seeding include providing erosion control and re-vegetation. Seeding requirements are defined by the following factors:
1. Site conditions: Slopes will require higher seed rates than level grades. Small areas will require higher seed rates than large, open areas. Broadcast seeding will require higher seed rates than drilling. Type of soil may inhibit or enhance growth of seed. Seed types shall be compatible. Refer to the Grass Characteristics and Adaptations matrix (Table 1).
 2. Optimum seeding times: Optimum seeding time is in the spring, after the last frost of the season, especially for warm season varieties. It is possible to seed in the late summer, but do not seed with warm season grasses any later than 6 weeks before the first frost; this will normally be around September 15th.
 - a. If absolutely necessary to seed after September 15, use a blend with cool season grasses. Any warm season grasses which germinate will most likely die if frosts occur earlier than 6 weeks from time planted. The success rate of a project seeded late in the year (late September through October) is greatly diminished compared to waiting for the following spring.
 - b. For projects that are seeded after late September, it is advisable to withhold water to prevent seed germination immediately after installation. Seeds that do not germinate in the fall will germinate in the spring, provided they are not washed away by snow melt. There is still a risk that seeds will germinate during a warm period in the winter and then be killed by winter frosts.
- B. Seeding mixtures and rates: In order to maximize the success of seeding and sodding projects, standard seeding mixtures have been developed for the high, medium and low

maintenance applications. These standards take into account local availability, maintenance experience, previous project results, seed supplier input, seeding contractor recommendations, and in-house landscaping expertise.

For most projects, the use of the standard mixtures will be appropriate. For unusual situations, a special mix should be designed using the Grass Characteristics and Adaptation matrix (Table1). All factors related to the project should be given due consideration. The twelve grasses listed are the recommended species for the Los Alamos area.

1. High Maintenance Zones: All areas under this category shall be solid-sodded with a tall fescue blend sod (Triathalon) composed as follows:

33%	Monarch Tall Fescue
33%	Olympic Tall Fescue
6%-10%	Alkali Sacaton

In cases where initial cost is the overriding factor, a seeding mix using the above blend can be used for lawns. This will increase later maintenance costs. Arizona Fescue (Redondo variety) may be substituted in the above mix. Seeding rates for the mix is 10 bulk pounds per 1000 square feet.

2. Medium Maintenance Zones: The areas under this category can be irrigated or non- irrigated. The standard seed mix is as follows:

3%-7%	Sand Dropped
8%-12%	Galleta Grass
6%-10%	Alkali Sacaton
10%-14%	Sideoats Grama
13%-17%	Indian Ricegrass
18%-22%	Sheep Fescue
8%-12%	Blue Grama
18%-22%	Western Wheatgrass

This blend shall be planted at a rate of 25 pure live seed pounds per acre.

3. Low Maintenance Zones: The areas under this category are normally not irrigated. The standard seed mix is as follows:

3%-7%	Alkali Sacaton
8%-10%	Blue Grama
6%-10%	Buffalograss
8%-12%	Galleta Grass

Section B-C GEN General Architectural Requirements

Rev. 4, 02/07/19

10%-14%	Indian Ricegrass
5%-9%	Little Bluestem
1%-5%	Sand Dropped
13%-17%	Sheep Fescue
8%-10%	Sideoats Grama
18%-22%	Western Wheatgrass

This blend shall be planted at a rate of 15 pure live seed pounds per acre.

- C. Wildflowers: On occasion, it will be desirable to add wildflowers to the medium or low maintenance zone mixes to create a meadow effect for a non-formal appearance. These should be areas where mowing will not be required. Supplemental watering will be required for heavy wildflower meadow growth. A wildflower blend should contain most or all of the following:

Coreopsis Prairie	Coneflower Purple	Blanket Flower Blue Flax
California Poppy Flanders Poppy	Plains Aster Plains	Mexican Hat Oxeye Daisy
Lemop Mint	Prairie Scarlet Flax	Lance-leafed Coreopsis Clover

This blend should be mixed with the grass blend at the rate of 20% wildflowers and 80% grasses. Plans should include a note that wildflowers that are considered “noxious weeds” by the local county extension office literature are not permitted.

- D. Mulches: Mulch shall consist of clean cereal grain straw, grass hay, long-fiber wood cellulose gravel, or commercial materials developed for this purpose. Anchor the mulch as required with crimping equipment, soil-anchored mulch, tackifiers, or netting materials.
- E. Seeding Methods:
 1. The most common seeding methods are seed drilling and hydro-seeding. Broadcast seeding by machine or hand may be appropriate for small or confined areas.
 2. The seeding method will depend on the size and shape of the area, cost, subcontractor in-house or outside contractor work, kind of seed, and available equipment, among others. Drilling introduces seed directly into the prepared seed bed by machine. Hydro-seeding uses a slurry composed of water and some or all of the following: seed, fertilizer, mulch and tackifier; the slurry is then sprayed onto the prepared seed bed.

7.0 SODDING

Sodding is recommended under most lawn conditions, because the long-term cost, considering maintenance, is similar to seeding. Sodding is especially appropriate under

Section B-C GEN General Architectural Requirements

Rev. 4, 02/07/19

the following conditions: the need to establish a lawn quickly for high visibility areas, aesthetic purposes, scheduling or program needs; initial high traffic areas with initial low maintenance needs; smaller areas adjacent to buildings, plantings, flower beds or physical features; and slopes or terraces where seeding may be difficult to start and maintain.

- A. Show sodding details on plans, consistent with the Standard Specifications. Include a typical cross section showing elements of subgrade, topsoil, top dressing, and soil amendments, to include thicknesses and/or rates of application. Verify that the type of grass sod in the standard specification is suitable for this specific application.
- B. When sodding on a slope, include anchorage details in the plans.
- C. Consider whether temporary, permanent, or no irrigation will be available to establish and maintain desired growth.

8.0 PLANTING

Planting as defined in this section includes trees, shrubs, ground covers, vines, and native plants. Planting objectives include but are not limited to:

- A. Use landscaping to prevent erosion, runoff, and soil damage to new and existing facilities.
 - 1. Landscape construction sites that have been denuded of natural vegetation to their natural state.
 - 2. Planting shall support the security and safety requirements.
 - 3. Use plants to modify environmental problems such as temperature fluctuations, snow accumulation, noise abatement, light reflection, and energy and water conservation.

- B. Verify Plant Availability

- 1. When a plant list has been established, verify local or regional availability of the specified plant materials. When a plant is not readily available in the nursery trade, note on the Drawings suggested sources for that plant.
- 2. When native plants are specified for a project, verify with local or regional suppliers that the native plant materials will be available during the period of installation. Verification of availability shall be done prior to specifying native plant materials.

- C. Minimum Plant Sizes

Specify plant materials in the following minimum sizes. These standards may or may not be applied to re-vegetation projects; determination for re-vegetation projects will be by experienced in-house LANL or Subcontractor professional operations personnel.

- 1. Deciduous Trees: 2 inch caliper or 24 inch container sizes.

Section B-C GEN General Architectural Requirements

Rev. 4, 02/07/19

2. Evergreen Trees: 6 to 10 foot heights except native pinon pines and junipers (shall be 6 to 8 foot heights).
 3. Shrubs: Height or spread 3 feet or more: 5 gallon sizes.
 4. Height or spread less than 3 feet: 1 or 3 gallon size.
 5. Ground Covers: Woody stock, 1 gallon size.
 6. Herbaceous stock: 4 inch pot sizes.
 7. Vines: 5 gallon sizes.
 8. Native Shrubs: Use largest practical size.
 9. Use the American Association of Nurserymen standards as the minimum plant specification.
- D. Planting/Backfill Mix
1. Refer to LANL Master Specifications, Section 32 9300 *Plants*.
- E. Maintenance
1. Refer to LANL Master Specifications, Section 32 9300 *Plants*.

9.0 IRRIGATION

- A. General
1. Provide permanent or temporary irrigation systems for new planting or re-vegetated sites as defined by:
 - a. Permanent irrigation system shall incorporate rigid PVC pipe.
 - b. Temporary irrigation systems shall be considered to be above ground aluminum pipe or PVC system, truck or sprayer system, and shallow burial drip irrigation system.
 2. Limit temporary systems to areas where water is required for plant establishment, but not for long-term maintenance. Temporary irrigation shall be supplied to native grass and wildflower seeding at minimum of 6 weeks.
 3. Temporary drip systems may be relied upon for a maximum of 2 years. If possible, temporary drip systems will be on an automatic remote control valve.
- B. Irrigation Site Analysis
1. During site analysis, consider drainage, topography, and soil factors that affect irrigation design.
 2. Consider environmental conditions such as aspect of slope orientation and precipitation.

Section B-C GEN General Architectural Requirements

Rev. 4, 02/07/19

3. Account for existing utilities including underground, aboveground, manholes, valve boxes, cleanouts, etc. and supply flow capacity factors.
4. Consider existing landscaping and maintenance availability.

C. Irrigation Design Elements

1. Draw the irrigation plan to scale and show or note the locations of all irrigation equipment including: controllers, backflow preventers, valves, heads, and pipes. All irrigation drawings shall be submitted for approval to LANL FWO Utilities and Infrastructure Grounds representative.
2. List irrigation equipment on an equipment schedule. The equipment schedule shall show each equipment symbol, list the manufacturer and the model number (when applicable) the size and the installation detail number.
3. Include in the Drawings installation details for each irrigation head and equipment type used in the irrigation design.
4. Show the point of connection (PtOC) for the irrigation system to the existing or proposed water line. Coordinate the PtOC with the utility plan. Connections to water mains should be avoided – use a PtOC within the structure's mechanical equipment room. The system shall be comprised of the interior backflow preventer with a valve in a control box at the exterior wall. The valve will be a control/stop/waste valve with a fitting for the blowdown of the sprinkler system at the start of winter.
5. Show the location of the controller and electrical connections on the irrigation plan.
6. Provide design calculation in accordance with standard engineering hydraulic principles.
7. Calculations shall be reviewed by a Professional Engineer.
8. The standard bury depth for pressurized mainlines shall be 48 inches, and 12 inches for non-pressurized lines. Designate the primary distribution lines from the master valve to zone valves as non-pressurized lines.
9. Electrical Connections
 - a. When practical, provide a dedicated electrical breaker for the irrigation controller.
 - b. When possible, controllers for irrigation systems in secure areas shall not be located in buildings requiring special access.

D. Irrigation Equipment Standards

The standard for irrigation equipment follows. In designing irrigation projects, calculations shall be based on the equipment standards or ESM POC approved-equal equipment.

Section B-C GEN General Architectural Requirements

Rev. 4, 02/07/19

1. Irrigation heads with parts that are interchangeable with the following irrigation heads without the need for adapters:
 - a. Large Radius Heads 50 Foot Radius: Toro 640
 - b. Medium Radius Heads 30 Foot Radius: Toro Super 700
 - c. Lawn Pop-ups: Toro 570-4P
 - d. Shrub Spray Pop-ups: Toro 570-6P or Toro 570-HP
 - e. Bubblers-Flood or Stream: Toro 500 series
 - f. Bubblers-Adjustable Flood: Toro 514-20
 - g. Electric Remote Control Valves: Toro 216 series brass body.
2. Adjustable pressure regulators with pressure gages.
3. Gate Valves: Brass body type up to 2-inch sizes or an iron body type more than 2-inch sizes, and include valve boxes. If an irrigation connection has to be made to a water main, the material from the main to the backflow preventer shall be in conformance with LANL Master Spec Section 33 1000.
4. Piping: Irrigation mainlines downstream from the master valve shall be Schedule 40 PVC pipe. Irrigation laterals shall be Class 200 PVC pipe. If an irrigation connection has to be made to a water main, the material from the main to the backflow preventer shall be in conformance with LANL Master Spec Section 33 1000.
5. Government Furnished Equipment (GFE): Installation of connection to supply and piping to control manhole.
6. Reduced pressure backflow preventer. See LANL Master Specification Sections 33 1000 and 22 1100.
7. Control manhole and appurtenances for the above.

TABLE 1

GRASS CHARACTERISTICS AND ADAPTATIONS

For information purposes and special applications only; standard mixes shall prevail.

COMMON NAME	BOTANICAL NAME	(1) HGT.	COOL/ WARM SEASON	BUNCHGRASS, SODFORMER, OR BOTH	NATIVE OR INTRODUCED	MIN. AMT. OF PRECIP. (INCHES)	BEST SOIL TEXTURE	(2) SEEDING RATE	(3) PLANTING TIME
Alkali Sacaton	Sporobolus Airoides	M	W	B	N	6	MED-FINE	2-3	LATE SUM
Arizona Fescue	Festuca Arizonica	M-T	C	B	N	14	MED	3-6	F
Blue Gram	Bouteloua Gracilis	S-M	W	B-S	N	12-14	MED	2-3	SUM
Buffalograss	Buchloe Dactyloides	S	W	S	N	12	MED	4-8	SP
Galleta Grass	Hilaria Jamesii	S	W-	B-S	N	8	FINE	6	SP
Indian Ricegrass	Oryzopsis Hymenoides	M	C	B	N	9	COARSE	6-B	F
Little Bluestem	Schizachyrium Scoparium	M	W	B	N	14	MED	3-4	SP/SUM
Sand Dropseed	Sporobolus Cryptandrus	M	W	B	N	10	COARSE	1	LATE SUM
Sheep Fescue	Festuca Ovina	M	C	B	N	10-12	MED	10	F/SP
Sideoats Gram	Bouteloua Curtipendula	M	W	B-S	N	8	MED	4-10	SUM
Tall Fescue	Festuca Arundinacea	T	C	B	I	16-20	MED-FINE	8	SP
Western Wheatgrass	Agropyron Smithii	M	C	S	N	10	MED-FINE	10	F/SP

Notes

(1) Height: Short (S) 1- to 12"; Medium (M) 13- to 24"; Tall (T) 25"+

(2) Seeding Rate: Pure Live Seed (PLS) Pounds Per Acre; PLS = % Purity X % Germination X Bulk Pounds; (1 Acre = 43,560 Sq. FT.) (3) Planting

Time: F = Fall, Sp = Spring, Sum = Summer

Note: Seeding rate ranges shown are for drilled seed or hydro-seeding large areas. Lower range is for level areas and higher for slopes. Also, increase rates 50% to 100% for mechanical broadcast seeding. For small or confined areas, increase rates shown to ensure heavy coverage.

All high-maintenance lawn areas shall be solid-sodded using a tall fescue sod blend (Triathalon) which is locally available.