Chapter 3: **Building Siting**

- *Site Issues at LANL*
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- *Site Design*
- *Transportation and Parking*

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Chapter 3

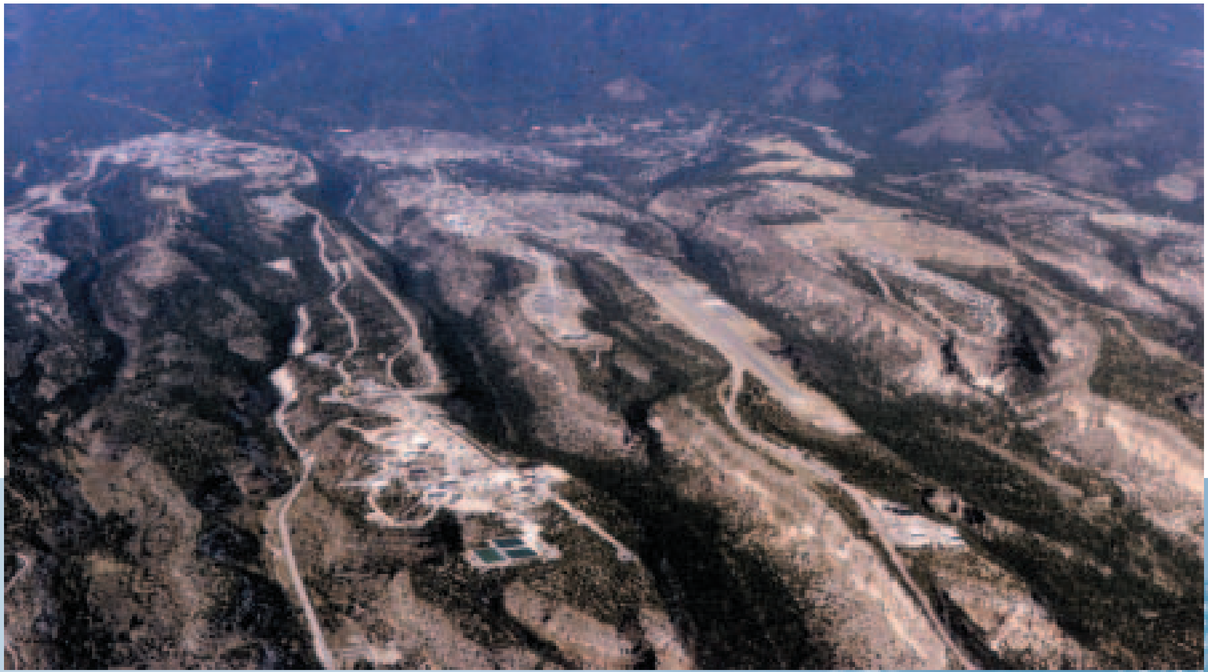
Building Siting

Site Issues at LANL

Laboratory site-wide issues include transportation and travel distances for building occupants, impacts on wildlife corridors and hydrology, and energy supply and distribution limitations. Decisions made during site selection and planning impact the surrounding natural habitat, architectural design integration, building energy consumption, occupant comfort, and occupant productivity.

Significant opportunities for creating greener facilities arise during the site selection and site planning stages of design. Because LANL development zones are predetermined, identify the various factors affecting development within the selected property and design the site to harmonize with adjacent development and the surrounding environment. Address site planning and building siting as part of the whole-building design process.

Site selection refers to the choice of a site, and is covered by Laboratory master planning activities in the *10-Year Comprehensive Site Plan, Area Development Plans, Area Master Plans,* and *Facility Strategic Plans.* ***Site planning*** refers to laying out proposed uses within property boundaries and is the responsibility of LANL Project Management (PM) Division and the Site and Project Planning Group (PM-1). The ***siting*** of structures on a particular property is the focus of this section. Site design guidelines are presented in the *Design Principles,* a publication referred to throughout this chapter.



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This aerial photo of portions of LANL, the Los Alamos town site, and the surrounding areas shows the diverse topography with the canyon and mesa erosion patterns of geological formations created 1.1 million years ago.

To promote sustainable land use, it is better to build on previously developed sites while improving or restoring natural site features, rather than develop natural undisturbed land. The Laboratory campus has both undisturbed (undeveloped) and disturbed (previously developed) sites that are targeted for new building projects. Approximately 2.5 percent of the 43 square miles that comprise the Laboratory campus has been developed. The remainder is preserved in its natural vegetative form: forest, prairie, and numerous streams. However, due to human traffic and barriers, much of the undeveloped land is not truly left alone.

When planning site design for a previously disturbed site, consider allocating funds saved from reuse of existing infrastructure to restore natural landscapes and historic features.

Sustainable and whole-building design practices assess both the site and the building program to determine a site's capacity to support the project without degrading vital systems or requiring extraordinary development expenditures. To enhance the sustainability of the environment while meeting the mission of the Laboratory, an integrated team approach is required throughout all aspects of Laboratory operations.


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The existing site of the Admin/Badge building...


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...and the proposed new building on the same site in TA-03.

Good siting practices should:

- Integrate the building architecturally into the natural context of the site, which minimizes the appearance
- Minimize site-clearing to reduce costs
- Take advantage of natural site features, such as topography, sunlight, shade, and prevailing breezes, to promote energy conservation
- Preserve existing vegetation, which can reduce landscape maintenance costs
- Mitigate erosion to reduce topsoil loss and protect surface water quality
- Avoid the need for supplemental irrigation and fertilizer, to minimize groundwater and surface water pollution
- Manage for snow and snow melt run-off to reduce maintenance costs

Preserving mature stands of native vegetation can:

- Add character to the site
- Provide energy-conserving shade and wind protection
- Eliminate the waiting period for expensive new plantings to mature to provide the poten tial benefits of preserved vegetation

Carefully planned building placement should:

- Maximize benefits for site occupants
- Minimize stormwater runoff
- Minimize natural habitat disturbance
- Protect open space
- Reduce the risk of fire and erosion
- Save energy by providing for solar energy utilization, daylighting, shading, and natural ventilation

Maximize factors that contribute to the health and productivity of employees, such as:

- Thermal comfort
- Access to fresh air
- Acoustic privacy
- Aesthetic views
- Functional outdoor space

In the end, our society will be defined not only by what we create, but by what we refuse to destroy.

– John Sawhill, President
The Nature Conservancy 1990-2000

In spite of its significant size, no undeveloped land was broken for construction of the Nicholas C. Metropolis Modeling and Simulation Center at the Strategic Computing Complex (SCC). It was built at TA-3 on a site that previously held a gas station and parking lot. Removal of those struc tures and site remediation was completed in 1999. During deconstruction, some materials were stockpiled for reuse through the Waste Minimization/Pollution Prevention Program of LANL's support services subcontractor.

Given the prior history of development on the site, there were no new concerns with regard to ecological disturbance caused by construction of the new SCC building. In fact, the vegetative cover of today's site is better than that of the previous site. Where there had been less than 10% vegetative cover, native vegetation now covers 25 to 30%.

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The site of an old gas station and parking lot in TA-03 was deconstructed...

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...and redeveloped for the Nicholas C. Metropolis Modeling and Simulation Center.

Site Inventory and Analysis

The site inventory and analysis process takes the form of drawings and written documentation. This assessment is used to identify existing features and constraints of a site, including drainage patterns, infrastructure, notable topography, vegetation, existing structures, and microclimates. The natural and existing characteristics of a site influence the feasibility and cost of site and building design elements, including:

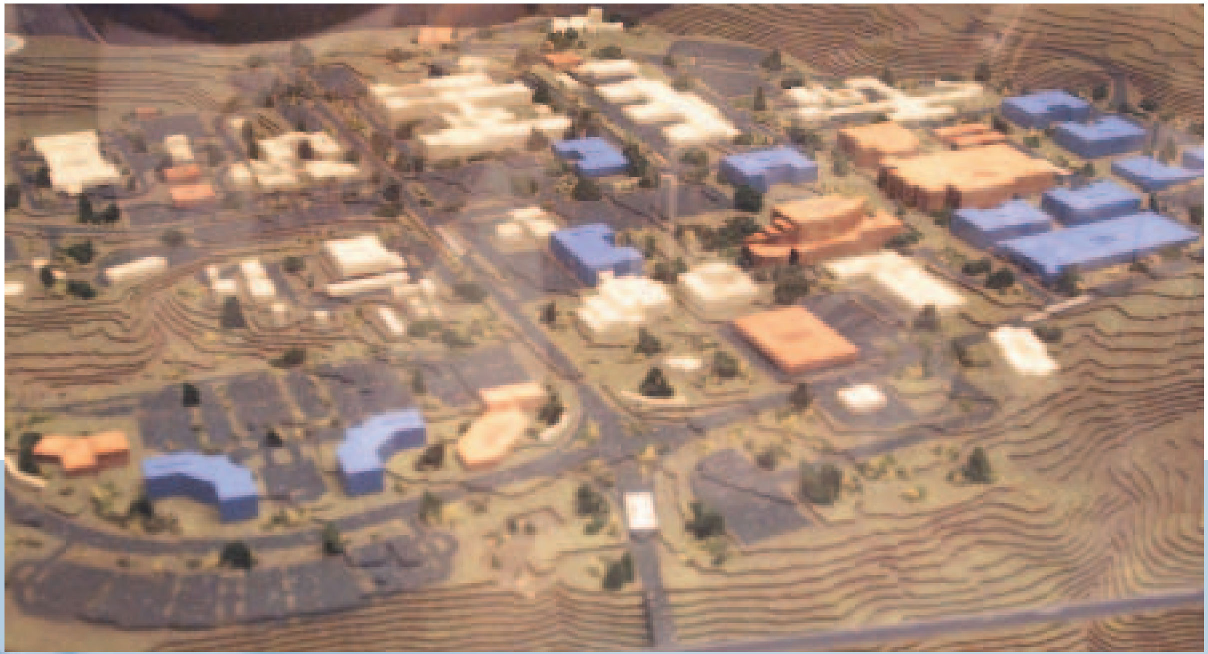
- Building shape
- Architectural massing
- Building materials
- Surface-to-volume ratio and building footprint size
- Structural systems

- Mechanical systems
- Site/building access and service
- Solar orientation
- Provisions for security and fire safety
- Wildfire protection
- Stormwater management

Use the Site Inventory and Design Impacts table on the next page to optimize sustainability opportunities as part of the pre-design phase. This table references site analysis issues from the *Design Principles* (p. 21) and identifies design elements affected by specific site characteristics. Inventory the existing boundaries and site features of both disturbed and undisturbed portions of a previously developed site. These features include existing vegetation, drainage patterns, topography, views, adjacent land uses, existing and proposed infrastructure, and easements.

Once the site inventory is complete, it will be much easier to integrate development with the physical and ecological site and any specific site constraints. Follow the site analysis mapping approach described in the *Design Principles* to carry out this process. Although the project team performs most of the site inventory and analysis, it is important for the design team to understand the specific results of the site analysis before developing the building design.

Wind is a microclimate-specific element of site analysis. Each LANL building site experiences unique prevailing winds because of the varied terrain on the campus (see* Design Principles, *p. 17). Become familiar with the wind patterns on the building site. Situate building entrances on the protected side of the building, and position berms and landscaping to block winter winds and prevent snow build-up near the building. Also, locate outdoor meeting spaces, proximity of parking to operable windows, and placement of air inlets and exhaust ports to take advantage of prevailing winds.



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Site planning for the TA-03 area of LANL. The cream color denotes existing buildings, tan represents building projects in progress, and purple identifies buildings in the 10-year plan.

This table lists building and site design elements that are affected by specific findings of the site inventory and analysis. These impacts can be complex. Individual site characteristics may point to certain design solutions that, taken as a group, result in conflicts. For example, minimizing excavation costs and stormwater runoff for the given topography of a site may require a building to have an elongated north-south axis. Maximum energy efficiency is achieved with an elongated east-west axis. A building configuration that fits with this site topography and provides energy-efficient design opportunities may be an L-shape. A full understanding of the site characteristics will be necessary to find synergies and select trade-offs that result in a design with optimized cost-effectiveness and minimized environmental impact.


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Site Inventory and Design Impacts

Site Inventory Characteristic	*Building Design Elements*	*Site Design Elements*
Topography, Slope, and Adjacent Landforms	Building proportions Structural wind loading Architectural elevations Drainage away from structure	Natural features for diverting and detaining stormwater runoff Gravity-fed sewer-line corridors Fire risk-reduction strategies
Soil Types, Textures, and Load-Bearing Capacity	Foundation location and engineering	Site-grading procedures that minimize erosion or damage by machinery Plant selections appropriate to soil type
Vegetative Cover and Existing Native Plant Populations	Solar load access and avoidance Maintenance and operation strategies Construction boundaries and site drainage	Vegetation susceptible to damage during construction Long-term maintenance requirements Clearing for fire management setback zone Erosion mitigation and biofiltration through existing vegetation
Wildlife Migration and Nesting Patterns	Footprint location and proximity to wildlife	Location of game trails and established nesting sites
Geologic and Seismic Data	Foundation type Structural specifications Location relative to faults	Structural requirements for constructed landscape features (e.g., retaining walls)
Parcel Shape and Access with Adjacent Land Uses, Buildings, and Structures	Capacity to accommodate a proposed building size	Access points (should not burden lower-density or less compatible adjacent land use)

Site Inventory and Design Impacts

Site Inventory Characteristic	*Building Design Elements*	*Site Design Elements*
Utility Easements or Corridors	Footprint location options	Integration with site layout options
Utility Lines and Sizes	Location of building tie-in	Vegetation disturbance (ground cover and tree root systems)
Road System and Networks for Parking, Pedestrians, Bicycles, and Transit	Walking distance and orientation to other pedestrian destinations	Parking capacity for all vehicle types
		Total impervious area
		Pedestrian interface with alternative modes of transportation
		Access to natural areas
Legacy Contamination	Footprint location	Location of potential release sites (PRS) and site drainage patterns
Security and Safety Improvements	Building access points for people, utilities, and fresh air	Location of barriers, gates, fences, walkways, roads, parking areas, and exterior lighting
	Fire protection	Fire control measures and management strategies
Microclimate Factors (e.g., solar and wind loads)	Layout for solar orientation	Paved area location and snow/ice removal strategy
	Location of entrances, windows, and loading docks	Vegetation strategy for aesthetics and biofiltration
	Location of air inlets and exhaust	Landscape elements as windbreaks
Proposed Future Development	Design changes for efficiency of campus interconnectivity	Design changes for efficiency of the campus infrastructure

Maximize sustainability opportunities as early as possible in the site selection and site planning process – even before pre-design – to integrate site issues into the design process. Some opportunities continue through design development and, to a more limited extent, through facility and landscape construction. The earlier site issues are addressed, the better.

Site Design

After completing the site inventory and analysis, evaluate the overall project compatibility with the site. Identify alternative site design concepts to minimize resource costs and site disruption. Refine and adjust the proposed building footprint to optimize site opportunities. Follow these guidelines when developing the schematic design:

Natural Site Features

- ***Preserve natural drainage systems.*** Locate buildings, roadways, and parking areas so that water flowing off the developed site during extreme storm events will not cause environmental damage and result in excessive contamination of the watershed from silt, oils, automobile fluids, and other pollutants. Also, consider how site development and construction will affect on-site and off-site drainage systems. Avoid sites where impacts will be excessive.
- ***Locate driveways, parking, entrances, and loading docks on the south side of buildings.*** Desirable locations of driveways and parking are generally on the south-facing slopes or the south sides of buildings. This helps avoid snow and ice build-up. Balance these needs with other priorities for infrastructure and landscaping.
- ***Orient the building with the long side on the east-west axis.*** This orientation allows for the greatest winter solar gains and least summer solar gains. Mitigate excessive summer solar heat gain and minimize cooling loads through optimal orientation. It is possible to efficiently manage solar gains on buildings oriented up to 15 degrees off true south.
- ***Minimize ground-level wind loads.*** Snow build-up, especially at doors and loading docks, requires significant effort and energy for snow removal. Control ground-level wind with vegetation, walls, and fences acting as windbreaks. An area exposed to wind can also be protected through berming and earth sheltering. Optimize wind patterns for dispersal of stack-released aerosols and other chemicals.

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Examples of techniques to manage and direct stormwater without soil erosion.

Vegetation

- ***Minimize native vegetation disruption.*** Locate and size facilities to avoid cutting mature vegetation and minimize disruption to, or disassociation with, other natural features. Balance this strategy with the fire risk-reduction guidelines described in the *Design Principles.*

- ***Minimize visual impacts.*** Use natural vegetation and adjust the building plan and elevation to diminish the visual impact of facilities and minimize impacts on the cultural and natural viewshed.

Hydrology

- ***Minimize erosion.*** Locate and design facilities to minimize erosion and impacts on natural hydrological systems.

- ***Avoid hydrological system contamination.*** Safeguard the hydrological system from contamination by construction activities and building operation.

- ***Minimize runoff.*** Avoid large, impervious surfaces and building footprints that concentrate stormwater runoff into channels, which can carry soil away from the site (see Chapter 7). Manage the stormwater so that it irrigates site vegetation.

- ***Allow precipitation to naturally recharge groundwater.*** Use swales and dry retention ponds to maximize infiltration and minimize runoff.

Geology/Soils

- ***Minimize excavation.*** Site the long axis of a building or a parking lot with the natural topography to minimize site disturbance and excavation.

- ***Minimize disturbance to groundcover.*** Protect and plant groundcover that prevents soil loss to wind and stormwater erosion.

- ***Avoid soil compression.*** Locate construction vehicle parking and materials storage in proposed development areas such as future parking lots. Avoid locations designated as future landscaped or natural areas.

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A burned area undergoing restoration with soil erosion prevention strategies.

Transportation and Parking

It is estimated that LANL employees commute an average of 20 miles one-way to work. This commuting adds up to a total of 98 million miles each year. Also, employees must often drive to meetings within the LANL campus. In fiscal year 2001, there were 10,000 employees working at the Laboratory, and, according to the LANL report, "The Laboratory's Footprint: Our Environmental Impacts," an employee traveled an average of 10 miles per day within the facility for 225 workdays per year. This distance equals 22.5 million miles, or 900 trips around the world.

Reducing the use of single-occupancy vehicles driving to and from the Laboratory and circulating within the campus will:

- Save energy
- Reduce pollution
- Improve employee health (to the extent that walking or bicycling is encouraged)

Parking is often a significant user of land. Reducing the area devoted to parking results in:

- Reduction of polluted surface runoff (stormwater)
- Greater groundwater recharge
- Reduced heat island effect and glare
- Opportunities for creating more natural landscaping and pedestrian-friendly environments
- Improved air quality

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Note in this aerial photo of the Core Area of LANL the amount of land used for automobile parking and circulation.

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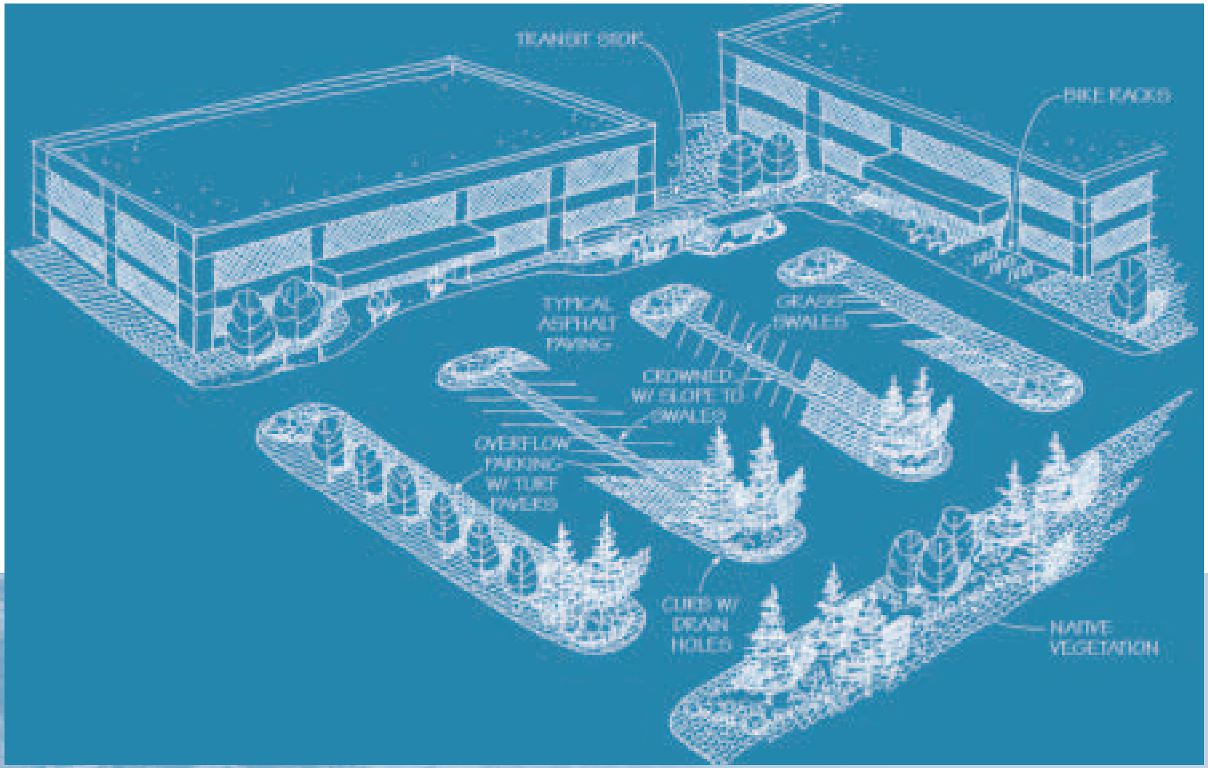
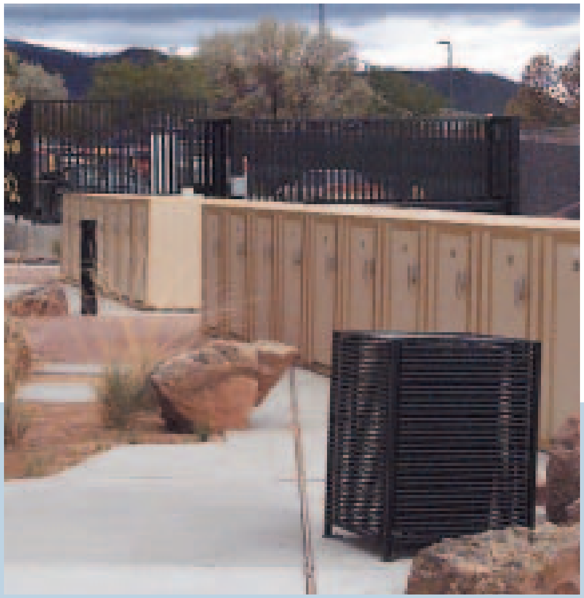
An example of a large impervious parking surface near the MSL building...

Strive to decrease land area devoted to automobiles and increase land area devoted to natural ecosystems and pedestrians. However, to successfully reduce the demand for parking spaces, alternative transportation options and incentives must be available to Laboratory employees.

- Encourage the use of bicycles by providing safe bicycle paths throughout the LANL site.
- Provide secure and protected bicycle storage near building entrances. Bicycle parking spaces for at least 5 percent of the building population is a reasonable initial guideline for sizing the bicycle parking area.
- Provide places to change clothes and shower for those interested in biking, walking, or jogging to work or exercising mid-day.
- Provide a safe and convenient commuter waiting area to serve those using public transit or the on-site shuttle service.
- Provide visible and safe pedestrian access from commuter waiting areas to primary building access points.
- Provide preferential parking for carpool vehicles. Consider incentives for carpooling and reducing the need for paved parking.
- Provide only the minimum required number of paved parking stalls as dictated by design standards. If a significant parking area must be included on the building site, then design bioretention swales into the parking lot landscaping as part of the exterior water management and shading strategies (see Chapter 7).
- Use landscaping materials and appropriate signage to create comfortable and safe pedestrian environments. (Refer to *Design Principles* for more detailed guidelines.)



...and several solutions for reducing parking lot impervious surface area.



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Secure and weather-protected bicycle storage lockers.

	Standard Practice/	*Better*	*High Performance*
Site Disturbance – undisturbed sites	◯ Federal and local codes	◯ Identify native plant populations and document preservation strategy (see also Chapter 8)	*PLUS:* ◯ Limit earthwork site disturbance to the Zone 1 fire management boundary and to 5 ft. beyond infrastructure requirements. Clearly delineate construction and disturbance boundaries with laydown, recycling, and disposal areas and contractual penalties for violation
Site Disturbance – previously developed sites	◯ Federal and local codes	◯ Do not exceed existing development boundaries for building footprint, parking, and construction	◯ Restore open area within Zone 2 and 3 fire management boundaries by planting native or adapted vegetation
Parking Area	◯ Federal and local codes (note: consider referencing the Institute of Transportation Engineers or City of Albuquerque)	◯ The *Design Principles:* Parking system principles (p. 44)	◯ Multiple alternative transportation choices and incentives
	◯ Typical office buildings: *minimum* of 1 standard car space per 200 gross square feet (gsf) of floor area	◯ *Maximum* of 1 space per 375 ft^2 of building area dedicated to office/administration purposes and 1 space per 1,000 ft^2 of building area dedicated to laboratory purposes	◯ Convenient parking spaces only for mass transit, carpools, bicycles, accessibility, delivery, maintenance, security, and emergency vehicles (maximum 2 spaces per 100 gsf)
Site Impact Analysis	◯ No site impact study completed	◯ Independent site assessment completed with no design solutions	◯ Develop a site impact study that can be used to guide the design process

Systems Integration Issues

- ☐ Select building siting, configuration, and massing to optimize sustainable low-energy building design relative to the anticipated space needs.
- ☐ Evaluate building siting options for solar access and effective use of landscaping elements, especially for harvesting daylight, avoiding glare, reducing summer cooling loads, and gaining passive solar heat in the winter months.
- ☐ Select building site, orientation, and form simultaneously with defining functional requirements of the building and before integrating load-reduction strategies into the building mechanical and lighting designs.
- ☐ Minimize earthwork by aligning long buildings and parking lots with land contours.
- ☐ Reduce paved areas to lessen heat buildup around the building that will add to cooling loads in the building.

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