STATE OF NEW MEXICO

SOUTH CAPITOL CAMPUS

2040 Master Plan

OCTOBER 1, 2010

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The South Capitol Campus in Santa Fe is home to primarily administrative and administrative support functions of state government. This campus serves nine executive departments in six major state office buildings, over 1,800 employees and thousands of visitors annually. The General Services Department is the property owner of the buildings on campus, and is responsible for providing clean, safe, accessible energy-efficient environments for employees and agency customers.

To accomplish mission and ensure we are prepared to respond in the future, GSD depends not only on our people, but also on our limited resources. This plan is designed to provide guidance to ensure that our facilities, infrastructure, and natural resources are managed in support of state agency employees and their mission. It is our responsibility to assist in this effort and to help protect and enhance these valuable resources with which GSD has been charged.

The South Capitol Campus Master Plan provides a blueprint for future development at this site for some of the executive branch agencies. It is the basis for programming and planning for some of the facilities and infrastructure that will meet current requirements and provide future growth. Its planning concepts have been developed to upgrade facilities and to ensure that mission needs are balanced and integrated with those of the Capitol Buildings Master Plan and the statewide planning process, and to provide flexibility to accommodate the changing needs of state government over time.

As occupants of South Capitol Campus, we all have an obligation to use state resources as efficiently as possible. Accordingly, when making decisions regarding the development of South Capitol Campus, we need to have the right information available. This Master Plan provides that information, and includes the guidance necessary to make sound planning decisions.

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Our task then is threefold. First, all department secretaries, their division directors, and functional managers on South Capitol Campus should understand the content and intent of, and comply with, this Master Plan. Second, future programs should be reviewed for compliance with the plan. Finally, the plan should be reviewed regularly and updated to keep it relevant and accurate. The result will be an integrated, organized approach to development on the South Capitol Campus. The payoff will be better management of every dollar entrusted to us by New Mexico citizens.

I am proud to present the South Capitol Campus Master Plan. This is the principal document to guide Executives and Legislators as they make decisions concerning the future growth of our campus. The South Capitol Campus has the potential to take on new missions and agency consolidations on state-owned properties as state government develops and realigns new operations and requirements. This Master Plan will guide us through facility planning and development to ensure South Capitol Campus maintains the campus role model status that is enjoyed today.

Sincerely,

Arturo L. Jaramillo, Cabinet Secretary
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ACRONYMS + ABBREVIATIONS

AC	Alternating current
AHU	Air handling unit
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
CBMP	Capitol Buildings Master Plan
CBPC	Capitol Buildings Planning Commission
CCTV	Closed circuit TV
CHP	Combined heat and power
CMU	Concrete masonry block
CYFD	Children, Youth and Families Department
DC	Direct current
DES	District energy system
DGSF	Departmental gross square footage (NASF plus corridors and walls within a suite)
DOAS	Dedicated outdoor air system ventilation
DOH	Department of Health
DoIT	Department of Information Technology
Efficiency	Ratio of NASF/GSF
EOB	Executive office building
EPMD	Ethylene propylene diene terpolymer [roofing]
FT	Feet
GHG	Greenhouse gas
GSD	General Services Department
GSD/BSD	General Services Department/Building Services Division
GSD/PCD	General Services Department/Property Control Division
GSF	Gross square footage (the total square footage in a building)
HHS	Health and Human Services
HOV	High occupancy vehicles
HRV	Heat recovery ventilator
HT	Height
HVAC	Heating, ventilating and air conditioning
LED	Light-emitting diode
LEED	Leadership in Energy and Environmental Design
LOS	Level of service
LSF	Leased square feet
MEP	Mechanical, electrical, plumbing
MIN	Minimum
MWH	Megawatts per hour
NASF	Net assignable square feet (square footage used)
NMDOT	New Mexico Department of Transportation
NMED	New Mexico Environment Department
NSF	Net square feet
PCD	Property Control Division
PED	Public Education Department
PNM	Public Service Company of New Mexico
PV	Photovoltaic
SCC	South Capitol Campus
SF	Square feet
SHGC	Solar heat gain coefficient
TARE	The difference between NASF and GSF (e.g., restrooms, mechanical areas, custodial spaces, corridors and exterior walls)
TPO	Thermoplastic polyolefin [roofing]
VAV	Variable air volume
VRF	Variable refrigerant flow
VSD	Variable speed drive

FIGURES

EXECUTIVE SUMMARY

Figure ES-1 South Capital Campus Conceptual Development Plan

Legend

- Existing buildings
- Proposed building locations
- Proposed parking structure locations
- Existing surface parking areas
- NMDOT Potential Train/Multi-Modal Depot and Parking Deck
- CP Campus parks
- PS Primary pedestrian spine
- RR Rail Runner Transit Mall
- Other State Owned Land
- Potential Pedestian Bridge

Development Capacity

Existing Buildings	Montoya Building	136,000 GSF
	Runnels Building	184,000 GSF
	Simms Building	60,000 GSF
	Lujan Building	80,000 GSF
	Chino Building	80,000 GSF
	Vital Records Building	10,000 GSF
Subtotal Existing Buildings		550,000 GSF
Proposed Buildings	Building A	107,000 GSF
	Building B	235,000 GSF
	Building C1	60,000 GSF
	Building C2	86,000 GSF
Subtotal Proposed Buildings		488,000 GSF
Total Development Potential /Offices		1,038,000 GSF

Note: Vital Records Building and Parking as a disconnected, stand alone site is not included in the above totals.

Parking Provided

Existing surface parking	111 stalls
Parking Structure P-A	410 stalls
Parking Structure P-B	1030 stalls
Parking Structure P-C	500 stalls
Total Potential /Parking	2051 stalls

EXECUTIVE SUMMARY

The South Capitol Campus is an office complex housing primarily administrative functions of the government of the State of New Mexico. This South Capitol Campus Master Plan documents existing conditions and proposes a long-term development strategy that achieves an optimal development capacity for the campus.

The South Capitol Campus Master Plan has been developed within the framework of the State of New Mexico's Capitol Buildings Master Plan. The Capitol Buildings Master Plan encourages the state to continue to meet its needs within designated "campuses," colocate agencies and functions according to adopted criteria, create more state-owned space as needed, and gradually relocate state agencies from leased space to owned space.

The Capitol Buildings Master Plan makes site-specific recommendations for the South Capitol Campus. Specifically, it encourages redevelopment of the campus at a higher density and investment in facility renewal. The Capitol Buildings Master Plan also identifies the potential need for increased pedestrian linkages between the facilities and multi-modal transportation uses on site, and the need for integrated, structured parking to accommodate long-range development.

In addition to the general goals established by the Capitol Buildings Master Plan, the South Capitol Campus Master Plan project team identified campus-specific goals in collaboration with representatives of the participating state agencies. Among these goals are:

- Establish a cohesive campus-like image
- Colocate agencies as appropriate
- Provide flexibility and adaptability to change
- Provide safe pedestrian access
- Seek opportunities for common uses
- Promote sharing and collaboration among site users
- Make the campus an exemplary model for sustainable development
- Make efficient use of existing space
- Develop a strategy for renewing existing buildings
- Create a plan that can be implemented in logical and incremental steps

A. Existing Campus

The South Capitol Campus is one of five state-owned campuses in Santa Fe. It occupies approximately 30.0 acres in the heart of Santa Fe, generally bordered on the north by Cordova Rd., on the east by St. Francis Dr., on the south by private residences along Columbia St., and on the west by Pacheco St. and the New Mexico Rail Runner railroad tracks. Alta Vista St. bisects the campus into northern and southern halves.

The campus currently consists of six buildings: Joseph Montoya, Harold Runnels, John F. Simms, Manuel Lujan, Wendell Chino, and the Vital Records Building (located across St. Francis Dr.). These buildings amount to approximately 540,000 gross square feet of administrative office space (not including Vital Records), currently occupied by the administrative offices of a wide range of state agencies.

An additional 22.7 acres of state-owned land controlled by the NMDOT is located directly adjacent to the South Capitol Campus. This land is considered part of the SCC in the Capitol Buildings Master Plan, but has in recent years been part of independent development planning efforts by the NMDOT. This land is not part of the study area for the South Capitol Campus Master Plan.

B. Owned vs. Leased

The State of New Mexico currently pays over $15 million annually in lease payments in the City of Santa Fe alone. These leases accommodate state agencies for which there is not an adequate supply of state-owned buildings. Many of these leased buildings are in inappropriate locations for the agency, are old and in need of significant up-grades, and no longer meet the needs of the tenant agencies.

By developing the South Capitol Campus for additional capacity, the state intends to meet the goal established by the Capitol Buildings Master Plan of moving agencies from leased space into state-owned facilities on this or other campuses. This change will allow the state to reduce its recurring expenditures for long-term leases and leverage those funds to offset the cost of new state-owned facilities.

C. Potential Site Capacity

In developing the South Capitol Campus Master Plan, it was determined that appropriate future development should respect and not exceed existing building heights. This limitation directly impacts the maximum potential site capacity. With this constraint in mind, the plan identifies a potential for between 200,000 to 488,000 additional gross square feet, for a possible total capacity of 725,000 to 1,038,000 GSF that could potentially accommodate up to 4,000 employees. Future efforts to encourage use of alternate transit modes may provide further opportunities to increase site capacity.

Including the 22.7 acres of land on the NMDOT side of the railroad tracks, the South Capitol Campus has considerable capacity and opportunity to adapt to the long-range facility needs of New Mexico state government. Future site planning for both the GSD and NMDOT portions of the SCC should explore opportunities to collaborate for the benefit of all of the state government's long-range needs.

D. Sustainability Plan

In accordance with mandates for sustainable development for state facilities and programs, the South Capitol Campus Master Plan sets a target at full build-out of "no-net" increase of water and energy use over existing 2010 demand. It is crucial to begin, as soon as possible, advanced detailed infrastructure systems planning to achieve this goal. New infrastructure planning must be in place prior to any future development, as the detailed implementation plan sets specific targets for future development components. These targets cannot be met if the infrastructure is not in place. *See Section III Sustainability Plan for discussion.*

E. Transition to Multi-Modal-Accessed Site

A crucial concept underlying the master plan is a recommendation to maximize site carrying capacity through better use over time of multi-modal transit opportunities. To achieve this objective, the plan assumes several paradigm shifts, including changes in how the site is accessed by employees and other users, and in the expectation that parking will be provided at the current ratio. The plan assumes that over time, employees will use alternate transportation modes to access the campus, thereby reducing required on-site parking.

With direct access to the Rail Runner commuter train and the City of Santa Fe's multi-modal transportation hub, as well as an adjacent multi-use path for bicyclists and pedestrians, the South Capitol Campus is uniquely positioned to capitalize on available on-site alternate transportation options. Additionally, with a sole-employer campus, there are opportunities to incentivize the use of alternate transportation to achieve the transition to a primarily multi-modal-accessed site.

F. Key Features of the Master Plan Document

The South Capitol Master Plan Document is comprised of six major sections.

I. *Introduction (page 5)* describes the planning intent and context for the South Capitol Campus Master Plan, its relationship to other state planning efforts, and the process used to develop the document.

II. *Master Plan (page 13)* describes the South Capitol Campus Master Plan and the major conceptual strategies that are embodied in the plan.

III. *Sustainability (page 27) Plan* proposes a framework for developing long-term sustainability targets and possible methodologies to evaluate for use in the future development of the South Capitol Campus.

IV. *Design Guidelines (page 49)* provides future project administrators and designers with specific guidance on design and planning goals, and issues for future buildings and site improvements at the South Capitol Campus.

V. *Implementation/Phasing (page 65)* describes options and strategic first steps to begin development and implementation of the plan.

Appendix (page 69) contains in-depth analysis of the existing users programs, buildings, site and environmental conditions of the campus and master-plan-level cost analysis.

G. Implementation Strategies

The South Capitol Campus Master Plan is designed to allow development flexibility.

The primary development strategy pairs buildings with structured parking. This pairing concept allows development to occur in any order, depending on demand and colocation requirements of the agencies. The plan proposes development options A, B and C, and a "no-build" option based on renovation of existing buildings. *See Section V. Implementation /Phasing for maps.*

An additional development component is a neighborhood park at Pacheco and Alta Vista Streets.

Some Initial implementation recommendations are listed below. *(See Section V Implementation / Phasing for additional recommendations.)*

- Implement opportunities to transition to open office systems and reduce hard wall offices.
- Set state policy for long-range goals for transit use by employees to commute to the site and conduct research on current employee travel patterns.
- Prepare a multi-modal incentive and reduction plan for vehicle-mile travel with both short- and long-term needs which identifies ways to implement short-term opportunities as soon as possible.
- Establish the baseline current energy use data that will be the future target for a "no-net" energy and water use strategy.
- Conduct an in-depth audit of energy and water use in existing buildings and on campus to be incorporated into a detailed sustainability plan.
- Prepare a detailed sustainability plan for the South Capitol Campus which will set the 2040 targets for future energy and water by use and building-by-building.

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I. INTRODUCTION

A. Document Intent

B. Project Process

C. Project Goal

D. Relationship to CBMP and Other State Planning

E. Planning Focus

F. Vision Session

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A. DOCUMENT INTENT

The intent of this Master Plan is to record the guiding principles for future development of the South Capitol Campus. The plan describes a potential maximum build-out of the campus.

The plan illustrates a range of development scenarios, identifies targets for sustainable development of the site, and recommends guidelines for the development of the site, its buildings, infrastructure and circulation.

B. PROJECT PROCESS

The process for developing the South Capitol Master Plan was interactive and collaborative with the General Services Department/Property Control Division (GSD/PCD), General Services Department/Building Services Division (GSD/BSD) and State Agencies currently located at the South Capitol Campus.

The process included:

- Site and building analysis
- Current user space inventory
- Review of current and proposed plans and work on the campus
- Regularly scheduled update meetings with GSD/PCD and GSD/BSD
- Interviews with key stakeholders and subject-matter experts (security, IT, etc.)
- Vision session with stakeholders
- Draft master plan and design guidelines
- Draft review with stakeholders
- Final master plan and design guidelines

C. PROJECT GOAL

The goal of the South Capitol Master Plan is to create a hallmark administrative campus for the State of New Mexico that is a model for sustainable development and creates an exemplary environment for state employees and visitors alike.

In achieving this goal, the South Capitol Campus Master Plan not only reflects the vision of campus agency stakeholders, but is consistent with the guiding principles for planning and the long-range vision of the Capitol Buildings Master Plan (CBMP) as adopted by the Capitol Buildings Planning Commission (CBPC).

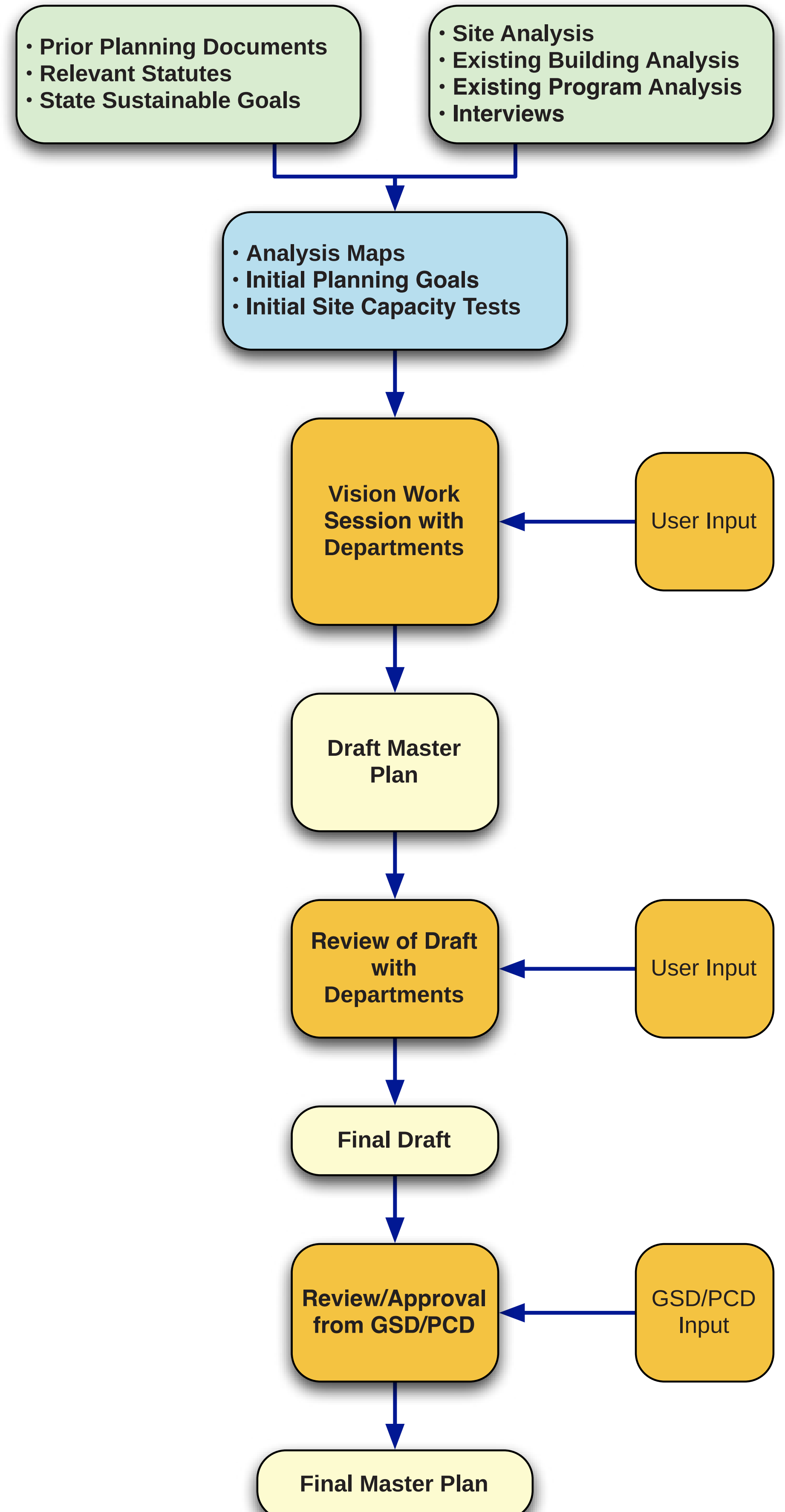


Figure 1-1 Document Intent Diagram

D. RELATIONSHIP TO CBMP AND OTHER STATE PLANNING

Capitol Buildings Master Plan (CBMP)

The South Capitol Campus Master Plan has been developed within the framework established by of the State of New Mexico's Capitol Buildings Master Plan (CBMP), first adopted in December 1999. The intent is to ensure that the South Capitol Master plan not only reflects the South Capitol Campus agency stakeholders' vision for the campus, but is consistent with the guiding principles of planning and long-range vision of the plan as adopted by the Capitol Buildings Planning Commission.

The CBMP established the following general future development policies:

- Continue to meet state needs within designated "campuses"
- Colocate agencies or functions according to adopted criteria
- Create more state-owned space
- Gradually relocate agencies from leased space to state-owned space

The CBMP encourages the state to own rather than lease buildings where the life cycle cost analysis demonstrates it is in the state's long-term interest. The plan states that there is not an adequate supply of state-owned buildings to meet the demand.

- Many agencies are in leased space (approximately 775,000 equivalent GSF, $15+ million yearly lease costs)
- Agencies in state-owned buildings may be crowded, located in multiple locations, or in facilities that do not conform to adopted location principles
- Many state-owned buildings require renewal

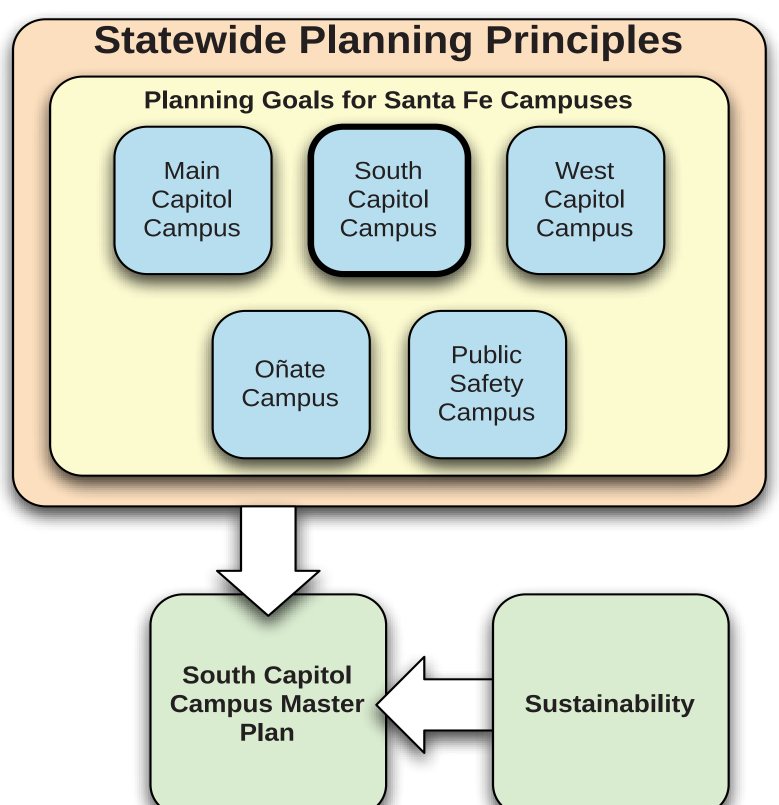


Figure 1-2 Stateside Planning Principles

South Capitol Campus

The CBMP identifies the South Capitol Campus as one of five state-owned campuses in the Santa Fe area. The adopted master plan established campus location principles that designate the use for the South Capitol Campus primarily as administrative and administrative support functions, and secondarily as field offices (depending upon development plans).

Current CBMP planning efforts continue to recommend the following site-specific development principles for South Capitol campus:

- Place priority on moving agencies from leased space
- Redevelop existing low-density uses
- Use integrated and structured parking to support tenants of GSD-managed buildings
- Increase pedestrian linkages between the facilities and the intermodal transportation uses
  (The state has constructed the Rail Runner commuter rail, which has a stop at the South Capitol Campus, enabling access to the site)
- Invest in renewing existing facilities

Other State Planning

New Mexico Department of Transportation (NMDOT)

The 1999 adopted plan recommended relocating the New Mexico Department of Transportation Headquarters to the NMDOT District 05 site and consolidating state administrative functions to the South Capitol Campus on NMDOT's part of the campus. However, rather than relocating per the initial master plan, the NMDOT initiated efforts to develop its state property as a "Transit Oriented Development" that would combine retail, office and residential use on the site.

In 2005, an RFP was first issued seeking developers interested in developing the headquarters site. This RFP was eventually withdrawn. A second RFP was issued in December of 2008 which requested services in two steps: 1) a feasibility study to determine what type of development might be viable for the property, and 2) a development plan for the property. However, in April, 2010, the NMDOT announced that the second RFP was on indefinite hold due to funding constraints within the department. The Capitol Buildings Planning Commission had been waiting for the results of this study before changing the adopted master plan. As a result, it has not yet addressed future integration of the NMDOT headquarters with the South Capitol Campus.

It is clear to all parties that any future development on either side of the railroad tracks will require coordination and cooperation between the GSD and NMDOT.

Health and Human Services (HHS)

The South Capitol Master Plan also takes into consideration the current planning for a Health and Human Services complex, which impacts some current tenants of the campus, and planned strategic moves at the main Capitol Campus that can potentially impact future development at the South Capitol Campus.

New Mexico Environment Department (NMED)

Other state agency planning efforts that are a consideration for the South Capitol Master Plan include a proposal by the New Mexico Environment Department to develop a new green-certified headquarters facility, and long-range planning currently in development by the New Mexico Department of Information Technology (DoIT).

Executive Order

The South Capitol Master Plan takes into account the following executive orders issued by Governor Bill Richardson:

MANDATE	PERFORMANCE REQUIREMENT
EO-2009-047	Establishing New Mexico as a Leader in Addressing Climate Change
EO 2008-028	Establishing a Strong Telework and Flexible Work Hours Program to Help Reduce Fuel Use and Taxpayer's Costs
EO 2007-053	Increasing Energy Efficiency in State Government by 2015 and Statewide by 2012 and 2020. • Use 20% below 2005 levels • State buildings 20% reduction by 2015 • Per capita 10% reduction by 2012
EO 2006-069	New Mexico Climate Change Action • Green Power Purchasing
EO 2006-001	State of New Mexico Energy Efficient Green Standards for State Buildings • LEED® Green Building Rating System™ - national benchmark for design, construction, and operations of high-performance green buildings. • LEED Silver or higher if > 15,000 SF • 50% energy reduction from national average if > 5,000 SF
EO 2005-049	Requiring the Increased Use of Renewable Fuels in New Mexico State Government • 15% alternative fuels by 2010
EO 2005-033	Climate Change and Greenhouse Gas Reduction
EO 2004-019	Declaring New Mexico the "Clean Energy State"

E. PLANNING FRAMEWORK

The Capitol Buildings Master Plan provides an established framework for all State of New Mexico long-range strategic planning. Key components of the CBMP framework that were used to guide the South Capitol Master Plan include both general development principles and site planning principles.

GENERAL DEVELOPMENT PRINCIPLES

- Locate state agencies to achieve functional, operational, and logistical efficiency
- Promote convenient public access to government services
- Provide equitable and adequate space
- Provide efficient/effective space organization (e.g., maximize required adjacencies)
- Provide a quality environment in order to attract and retain personnel
- Meet functional needs
  - Centralized administrative uses
  - Distributed or centralized field offices
  - Specialized functions with special location needs
- Realize economic efficiencies
  - Reduce recurring state expenditures for long-term leases
  - Promote economies of scale and asset sharing (e.g., parking, lobbies, receiving, meeting areas, teleconferencing, etc.)
  - Promote sustainable environments (high performance, energy-efficient green building practices)
  - Reduce operational expenses
- Protect long-term asset value
  - Provide sufficient resources to maintain and periodically renew facilities
  - Dispose of property only when expected benefits exceed long-term value
- Establish framework for campus development / redevelopment
  - Land use and density
  - Infrastructure development
    - » Circulation / parking
    - » Utilities
    - » Drainage
    - » Landscaping
- Plan for future growth and change through flexibility to meet changing needs

SITE PLANNING PRINCIPLES

- Land use and site planning
  - Establish uses appropriate for each site, based on surrounding context, function, site availability, and requirements for public access
  - Establish a framework for future circulation, parking, building sites and landscape planning
  - Provide guidelines for density, building coverage and building height
- Property development strategies
  - Adopt incremental development strategies that:
    - » Consider the long-term development vision
    - » Make most efficient use of site area (density, land coverage and parking)
    - » Promote integrated and structured parking
    - » Avoid dependence on long-term land acquisitions for implementation
    - » Allow, as appropriate, establish temporary “holding-zones” (portable metal structures) pending more permanent development
- Vehicle and pedestrian movement
  - Separate vehicular and pedestrian movement systems
  - Establish clear entry and exit points to each campus
  - Identify areas for drop-off/delivery and service as appropriate to the site and function
  - Provide for safe pedestrian routes between buildings
    - » Promote a pedestrian-oriented interior with pathways composed of a series of sidewalks, malls and plazas and connections to the open space system
    - » Allow for safe (well-lit and visible) destination travel (building-to-building) by walking or bicycling
- Visual and architectural character
  - Establish a consistent visual and architectural character unique for each site that capitalizes upon the development history, function and vision for the future
  - Establish common landscaping features linking campus zones and identifying areas of open space

F. PLANNING GOALS FOR THE SOUTH CAPITOL CAMPUS MASTER PLAN

To guide the development of the South Capitol Campus Master Plan, the consulting team developed the following specific planning goals according to Capitol Buildings Master Plan Development Principles.

FORM

- Establish consistent campus-like image for the South Capitol Campus site and facilities
- Establish a long-range building capacity that considers site density, surrounding uses, access, parking, circulation, and exterior quality

FUNCTION

- Identify a framework for future development that includes new building sites and potential expansion/redevelopment of existing buildings
- Provide administrative facilities that are flexible and adaptable to changing use
- Provide safe and convenient pedestrian access between facilities, the Rail Runner station, and surrounding uses
- Seek opportunities for common uses, sharing and collaboration among site users

ECONOMY

- Seek to make the South Capitol Campus a leader in demonstrating sustainable solutions that reduce long-term operating costs
- Make efficient use of existing space
- Develop a strategy for renewing existing buildings

TIME

- Create a plan that can be implemented in logical, incremental steps based on the long-range development vision for the site

These planning goals set the stage for the visioning session described in Section G. Vision Session.

G. VISION SESSION

A visioning session/workshop was conducted on March 17, 2010 and was attended by state agency directors and key staff representing most stakeholders.

Attendees reviewed the CBMP goals, the project goals based on the CBMP, and the analysis maps and information shown in the Appendix of this document: Existing Users, Existing Buildings, and Existing Site Analyses. The participants discussed their perceptions, ideas and questions regarding the opportunities and constraints for future development of the South Capitol Campus.

The results of the visioning session are summarized below.

CAMPUS DEVELOPMENT QUALITY

- Building height and massing shall be harmonious with the scale and character of the existing campus streetscape
- Discourage construction of a parking structure at the south end of the site adjacent to residential development
- Improve Rail Runner access and integration with the campus
- Activity centers and major entry points of buildings should be located on an interior spine and pedestrian corridor
- Office buildings should be arranged along the perimeter of the campus and parking structures toward the interior of the site
- The campus should have a high ratio of open space to development footprint

INTEGRATE SUSTAINABLE GOALS

- Plan for net-zero energy for buildings
- No net increase in campuswide energy use
- Reduce metered potable water use
- Promote/facilitate alternate commuting transportation modes
- Promote/facilitate strategies for reducing operations and maintenance costs

CAMPUS BUILDINGS DESIGN

- Architecture should reinforce the impression of permanence and dignity appropriate to the seat of government of the State of New Mexico
- Maximize flexibility to accommodate changes (highly flexible spaces)
- Renovate current office spaces to increase efficiency
- Use materials with long life-cycle characteristics and without extensive or expensive maintenance requirements
- Locate high density file storage systems in low quality, non-daylighted space whenever possible
- Conference room sharing/scheduling across agencies
- Optimize orientation and maximize benefits for site occupants
  - Daylighting
  - Solar access
- Consolidate support functions, such as storage, copy, and mail services where possible
- Building structures should be high mass to enhance passive energy capacity
- Design parking structures to allow conversion to other uses in the future

CAMPUS INFRASTRUCTURE

- Install utility systems in designated utility corridors
- Properly size infrastructure systems to support occupancy
- Design and locate utility systems for ease of maintenance and to minimize disruption of landscape features during installation and maintenance

CAMPUS SAFETY AND SECURITY

- Locate open space and community spaces on the interior of the campus to increase safety through more observation of activities
- Locate pedestrian crossings at safe locations and add traffic-calming features to enhance pedestrian safety
- Locate vehicular access/egress at safe locations
- Design ease of access/secure access for delivering materials and supplies to buildings
- Consider a pedestrian overpass over St. Francis Dr.

CAMPUS LANDSCAPE

- Minimize the impact of the heat island effect
- Minimize storm-water runoff and promote reuse where possible
- Develop signage for gateways to the campus
- Apply xeriscape principles in the site design and use native or adapted low-water use vegetation
- Reduce light pollution and follow night-skies policies

CAMPUS LEISURE AND SOCIAL ACTIVITIES

- Design open spaces to offer ample shade, seating and wind protection
- Designate smoking areas that meet distance requirements away from pedestrian traffic and protect those areas from inclement weather

DEVELOPMENT STRATEGY

- Plan for phased implementation to accommodate varying and incremental state funding
- Consider the relationship of the GSD site to future NMDOT parcel activities and the potential for interface
- Discourage additions to the Simms Building and strongly consider relocating DoIT to a more secure site

THREE CAMPUS DEVELOPMENT CONCEPTS

Three development opportunity concepts were presented as “idea generators” during the visioning session/workshop. These concepts explored a broad range of development densities, building and parking arrangements, and organization of open space.

CONCEPT A

This concept creates open spaces and public gardens along St. Francis Dr.

CONCEPT B

The concept incorporates a major outdoor open space or park in the north and south portions of the campus. A pedestrian/utility spine links the parks.

CONCEPT C

This concept develops a series of small plazas at building entry points. Some plazas are shared by multiple buildings.

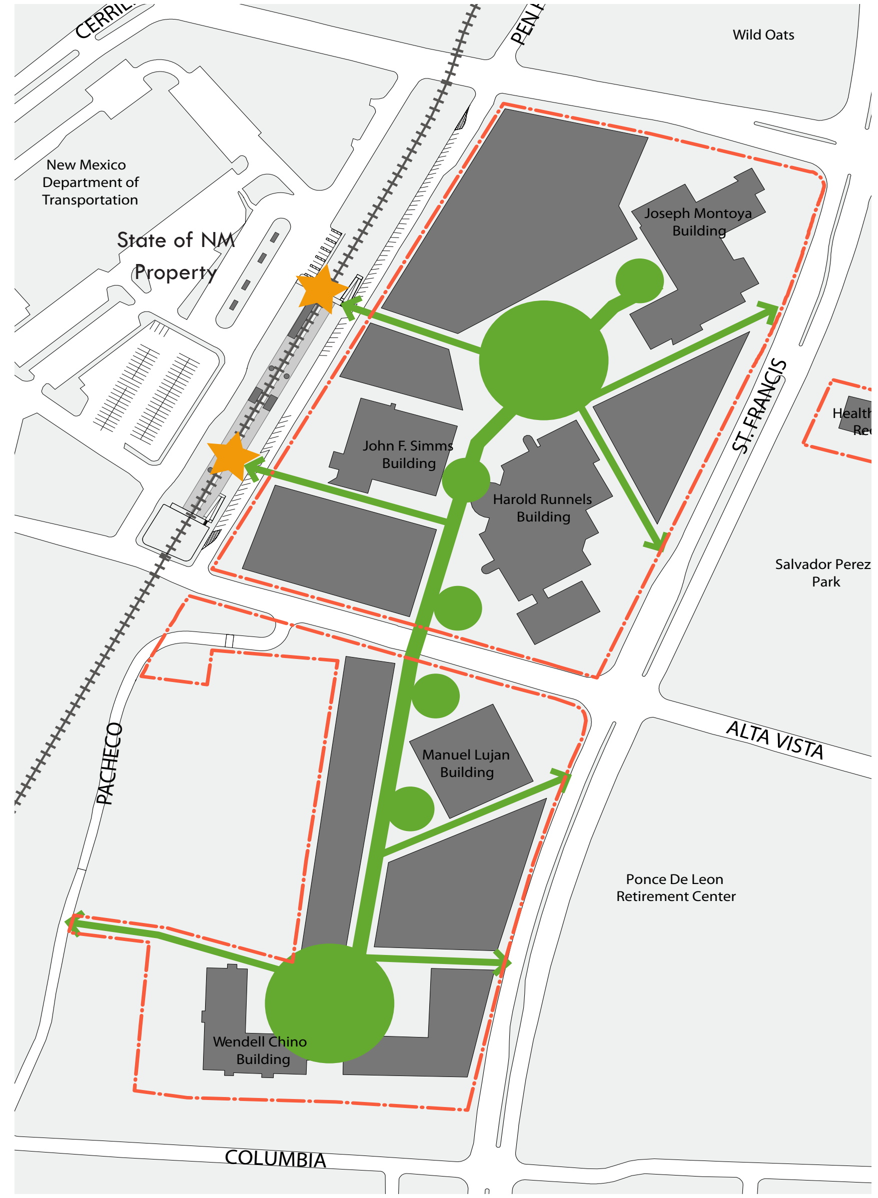
After discussion and review, the recommendation from attendees was for a campus master plan based on Concept B and including refinements from the other two options. Please see Executive Summary, page 2 and Master Plan Section II, page 15.

CAMPUS FORM DIAGRAM

BUILDING AREA
PEDESTRIAN OPEN SPACE NETWORK

DEVELOPMENT OPTIONS : CONCEPT A - PARK EDGES

Figure 1-3 Concept A - Vision Session Alternative Concepts



CAMPUS FORM DIAGRAM

BUILDING AREA
PEDESTRIAN OPEN SPACE NETWORK

DEVELOPMENT OPTIONS : CONCEPT B - INTERNAL PARKS

Figure 1-4 Concept B - Preferred - Vision Session Alternative Concepts

CAMPUS FORM DIAGRAM

BUILDING AREA
PEDESTRIAN OPEN SPACE NETWORK

DEVELOPMENT OPTIONS : CONCEPT C - PLAZAS

Figure 1-5 Concept C - Vision Session Alternative Concepts

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II. MASTER PLAN

A. Campus Site Concept

B. Land Use Strategy

C. Buildings Strategy

D. Circulation

E. Parking Strategy

F. Multi-Modal Strategy

G. Neighborhood Strategy

H. Infrastructure Strategy

I. Security and Safety Strategy

J. Landscape Strategy

A. CAMPUS SITE CONCEPT

The South Capitol Campus is the primary administrative campus for the State of New Mexico. It houses one of the largest concentrations of state departments and employees. Its location on St. Francis Dr. in Santa Fe makes it one of the most visible to the public. The State of New Mexico has set goals to move toward a more energy-efficient and sustainable future for state operations. The South Capitol Campus Master Plan therefore envisions that future development of the site will create a campus of state office buildings that is a model of sustainability and transit efficiency.

The campus organizational concept is to maintain offices at the public face of the site along St. Francis Dr. and Cordova Rd., with the main pedestrian systems internal to the site. Parking structures would also be placed internally.

The campus is organized along a pedestrian corridor and around two parks. This organization accomplishes several important objectives. First, it creates a practical way to accommodate a centralized utility corridor and emergency access routes. Second, it provides space needed to accommodate sustainable energy and water systems such as earth-based energy exchange systems, wetlands-based water treatment, and rainwater harvesting and storage. Third, it creates a pedestrian-friendly environment for people to safely walk and congregate as they navigate through the campus.

Increasing use of the multiple modes of transportation currently available at the site is a key component of the plan. The intent is to make the use of transit, bike and pedestrian modes of travel efficient, easy and accessible. Walkway systems are arranged to provide strong connections to the existing Rail Runner Station and multi-modal center on the west edge of the site. Walkways would also link to bus stops along the perimeter.

Tree-lined streets and landscaped park spaces will complete the image of the campus. The landscape will be environmentally appropriate and demonstrate the effects of water conservation, water reuse and water harvesting.

Figure 2-1: Campus Site Concept

B. LAND USE AND DENSITY CONCEPTS

The foundations used to develop the land use and proposed densities for the South Capitol Campus are:

- The state needs to develop greater density at the South Capitol Campus to better leverage the available land.
- The South Capitol Campus will primarily house administrative functions of the state government.
- Based on surface parking only, current land use is at full capacity. Future development will require structured parking.
- Current development orientations, massings and heights should be maintained to support current city zoning and development patterns in the area.
- Leadership in Environmental and Energy Design standards of 50% open space to development should be met.

Based on those basic goals, the land use and density concepts for the South Capitol Campus are:

- Only three major categories of land use are anticipated for the future South Capitol Campus: office buildings, parking and open space. It is recommended that office land use be located along St. Francis Dr. and Cordova Rd., with parking structures interior to the site. Locating office buildings at the public face maintains the current arrangement of most of the major office buildings on the campus.
- Building within the height limits created by the existing buildings on the north campus is a self-imposed development constraint by this Master Plan. See *Section IV Design Guidelines, B. Setbacks/Orientation/Height* for specific information about proposed height limits. Using current development height maintains a better relationship with City of Santa Fe development standards for commercially zoned land.
- The 45-degree orientation and stepped massing for new buildings that front St. Francis and Cordova should be maintained. This orientation and massing creates an interesting view of the buildings and reduces the visual impact of their mass.
- Meeting a target of 50% open space creates the opportunity for user-friendly landscapes and allows space for renewable energy, water harvesting and other functions that need land area. Other land use considerations that should be examined in more detail are:
  - The relationship to the state-owned property currently managed by the New Mexico Department of Transportation: this approximately 22-acre site is large. Its development could dramatically affect potential opportunities on the South Capitol Campus. Coordination between the two sites potentially could maximize infrastructure, parking and site efficiencies.
  - The Bureau of Vital Records and Health Statistics is located in an old facility east of St. Francis Dr. on a parcel of potentially high retail value. A future divestment strategy should be explored to trade or sell this site as a retail property and relocate the Bureau to the main South Capitol Campus or other state property. A cost/benefit analysis should be completed to weigh this option against proposed future renovations or upgrade costs.

C. BUILDING DEVELOPMENT CONCEPTS

The development strategy for the South Capitol Campus pairs new administrative office buildings with companion parking structures. The potential pairs are designated as A, B, and C on the Master Plan (see the parking scenarios on page 19). Since new buildings will eliminate surface parking, parking structures will be constructed to serve new building parking needs and replace the eliminated surface parking.

- Building entries will be oriented to the central pedestrian spine of the campus. Entries and lobbies should incorporate natural lighting.
- Building construction should be "high mass" to enhance passive heating, ventilating, and cooling. Natural ventilation should be incorporated in building design.
- High performance glazing should be utilized to maximize daylight and minimize heat gain, especially on west exposures.
- Windows should be recessed or shaded.
- Structural grids should be sized for flexibility and economy. Typical grids are 30' to 35' bays.
- Interior daylighting should be introduced when possible.
- Rooftop rainwater catchment structures with above-ground "silos," below-ground cisterns or other below-ground storage systems should be incorporated.
- Parking structures should be "flat decks" to accommodate future uses if current parking practices change significantly. These decks could be converted to storage or other support spaces that serve the administrative office buildings.
- Due to cost considerations, parking structures in the Master Plan are above-ground, open-air rather than below-grade structures.

OPTIONS FOR REDUCING THE NEED FOR NEW GROWTH SPACE

In today's changing workplace, employers and employees seek flexible, efficient workspaces that accommodate a variety of working styles. There is a paradigm shift away from traditional hard-wall offices, dedicated or assigned workstations and standard office hours. Strategies such as flexible scheduling, telecommuting and "hotseat" office space allow employees to maximize their productivity and reduce facility demands for office space and parking.

Office spaces in several existing buildings are predominantly hard-wall, private or semi-private spaces featuring minimal use of open office systems. The efficiency of existing office space is considerably lower than industry standards. Increasing the overall efficiency of existing buildings on the South Capitol Campus to align with changing trends in modern space planning could increase capacity within the existing buildings and reduce the need for additional new construction.

Most of the buildings on the South Capitol Campus are approaching the age at which major renewal efforts will be required, for which this study recommends using open-office concepts to the fullest extent possible. Preliminary analysis of the Runnels and Wendell Chino Buildings indicates that if they are renovated using these concepts, their efficiency could conservatively increase by 10%. (*See Section V. Implementation / Phasing, A Development Option* and the reconfiguration concepts for Chino and Runnels in the *Appendix*.)

Figure 2-2: Proposed Drop-Off at Lujan Building / "Flat Deck" Above Ground Parking and Recessed or Shaded Windows

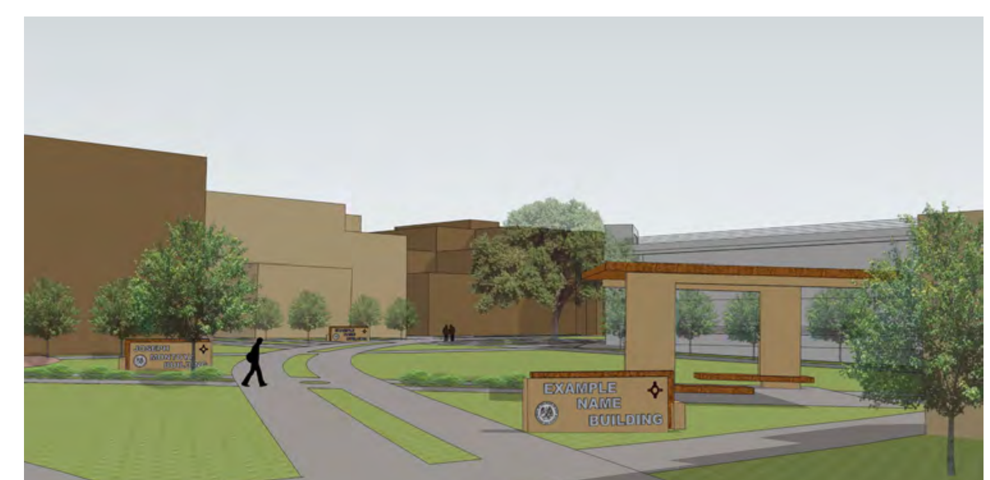


Figure 2-3: North Park View Looking South with Entrances of Existing and Proposed Buildings Organized Along Pedestrian Spine.

D. CIRCULATION CONCEPTS

The South Capitol Campus Master Plan focuses on creating a highly interconnected, safe and pleasant circulation system that prioritizes pedestrians first and leverages the exceptional existing multi-modal facilities that serve the campus.

The master plan is organized along a main pedestrian spine that extends from the north to the south ends of the campus. This pedestrian spine connects the main entrances/plazas of almost all existing and proposed buildings. It would be designed to encourage public use through gathering spaces, benches and small picnic tables. The spine would be designed to allow comfortable shared use by both bicyclists and pedestrians. Where there is an intersection of pedestrian and vehicular uses, pedestrian safety would be emphasized by using raised pedestrian tables and other traffic-calming means to clearly denote the priority of pedestrian needs. The pedestrian spine also serves as the easement area for the proposed primary underground utility corridor and as emergency vehicle access.

Around the perimeter of the site, pedestrian walks would be designed to encourage the existing walking/exercise uses of that walkway. The meandering perimeter walkway design along St. Francis Dr. would be extended southward on the south portion of the campus and along Cordova Rd. as those areas are developed. The Alta Vista streetscape would be improved to create a more formal urban streetscape as the main walking and road connector between the South Capitol Campus and the NMDOT sites.

The circulation master plan design for the South Capitol Campus maximizes and enhances connections to the existing multi-modal center along its western property edge. Wide and well-landscaped walkways and streetscapes would be designed to easily and directly lead to the multi-modal center from the buildings. The existing multi-modal center would be upgraded with high quality paving, lighting, signage and landscaping to become a destination feature of the site. Creating a pleasant and beautiful walking environment is crucial to encouraging more use of the multi-modal facilities, which support New Mexico's statewide energy use reduction and conservation goals. The multi-modal aspect of the master plan is discussed further in following sections of this document.

The main spine walkway is recommended to be a minimum of 10' wide to safely accommodate both pedestrian and bike uses. The plan supports the use of the existing Rail Trail, which is designed as a bike and hike trail, and the designated bike route along Alta Vista. Secure bicycle storage and bike commuter needs such as shower facilities within the buildings would become components of basic programming for new facilities at this site.

In the master plan, future automotive circulation will be restricted to parking structures and service areas. The primary vehicle accesses are recommended to remain mostly from Alta Vista and Cordova Streets. Secondary access via the shared Pacheco St. access drive west of the Wendell Chino Building and the existing driveways from St. Francis Dr. would still be used, but internal site circulation would be designed to continue limiting their use. Limiting increased vehicular use of Columbia and Pacheco Streets is critical to reducing traffic conflicts with the residents there.

PROPOSED CIRCULATION IMPROVEMENTS - OFFSITE IMPACT ANALYSIS

The master plan proposes substantive increases in density, which will increase traffic to the site. However, with the excellent existing transit service to the site, it would be possible to transfer a substantial amount of this traffic to transit. It is also likely that automobiles will continue to be one of the primary travel modes.

The effects of traffic increases on St. Francis Dr. and Cerrillos Rd., as well as at the Alta Vista St. and Cordova Rd. intersections will therefore need to be planned for. Analysis of the roadway cross sections of Cordova Rd. and Alta Vista St. will be needed to determine whether their present configuration can accommodate the anticipated traffic at the main entrances, particularly those that serve the proposed parking garages. Analysis should include evaluation of left-turn movements from Cordova Rd. or Alta Vista St. to reach garage locations, queue distances, and delay times. Any expansion plan for the Alta Vista St. cross section should evaluate the potential to locate most of the expansion on the south edge. The area north of Alta Vista St. and the Simms Building is planned for a future parking structure. Loss of space in that area will severely affect the ability to build an efficient and practical structure.

Working with NMDOT to evaluate the potential to realign Alta Vista west of the rail line is an important off-site circulation issue. Access to Cerrillos Rd. is limited from Alta Vista St. Currently, Alta Vista St. is a stop-controlled, right-in/right-out-only intersection at Cerrillos Rd. When or as the NMDOT General Office site redevelops, redesigning access to the NMDOT site by realigning Alta Vista St. to create a four-way intersection with Railfan Ave. at Cerrillos Rd. as a signalized intersection could improve vehicular access to both the NMDOT and South Capitol Campus sites.

Figure 2-4: View Looking North at Alta Vista with Improved Streetscape, Pedestrian Spine and Raised Pedestrian Table that Connect Plazas.

Figure 2-5: View From Montoya Building / Access to Rail Runner Looking West

Figure 2-6: View of Rail Runner from Alta Vista Looking North

E. PARKING STRATEGY

Parking is always a factor of great concern for clients and the surrounding affected communities. From a land use perspective, parking is enormously land-consuming and costly. Long-term development at the South Capitol Campus will require an appropriate balance between additional office square footage and associated parking. As the South Capitol Campus Master Plan has determined that future development should respect and not exceed existing building heights, a change in the ratio used to calculate parking requirements will need to be considered to maximize site development.

Existing parking is entirely surface parking, and parking on the site is at capacity. Existing parking lots are the only available locations on the campus for significant future development. In order to accommodate future development, the state will have to migrate away from surface parking to structured parking. Moving to structured parking would allow sustainable infrastructure opportunities, development of storm water control features, and other key site components.

Currently, existing parking at the South Capitol Campus meets a parking ratio of approximately one parking space per 350 GSF of building. If the state were to maintain this parking ratio, developed capacity on the South Capitol Campus would be maximized at 725,000 GSF of buildings with the construction of 2,051 stalls in multiple parking structures. Adjustment of the parking ratio toward a more urban parking standard can increase development capacity substantially. For example, at a ratio of one stall per 500 GSF, which is the current parking ratio used in downtown Santa Fe, the same 2,051 parking stalls could potentially serve 1,028,000 GSF of buildings (not including Vital Records). This is an additional 303,000 GSF of building served. If the current parking ratio of one space per 350 GSF were applied to the 1,028,000 GSF, the state would be required to build 865 additional spaces at a cost of $15-$20 million.

Toward this end, the master plan assumes several paradigm shifts, including changes in how the site is accessed by employees and other users, and in the expectation that parking will be provided at the current ratio. The plan assumes that over time, employees will use alternate transportation modes to access the campus, resulting in a decrease in required parking and conversely allowing an increase in the potential office space provided on the campus. Reducing parking demand by increasing the use of the available alternate transportation modes is a critical component for optimizing investments and reducing development costs for the South Capitol Campus.

The master plan proposes three parking structures with a capacity of up to 1,940 spaces and 111 spaces of surface parking for a total parking capacity of 2,051 spaces. The plan provides development flexibility by pairing buildings with companion parking structures, as described in *IV. Design Guidelines, A. Land Use*. Those pairings allow development of the pairs in any sequence determined to best fit the needs of the state.

F. MULTI-MODAL STRATEGY

The capacity of the South Capitol Campus to accommodate additional administrative office buildings can be greatly extended if state employees and visitors increase their use of the Rail Runner and the multi-modal facility.

With direct access to the Rail Runner commuter train, the existing regional multi-modal transportation hub, and adjacent regional trail for bicyclists and pedestrians, the South Capitol Campus is uniquely positioned to capitalize on alternate transportation options. The state is in a good position to encourage or require employees to use alternate modes of transportation. The State of New Mexico currently has strong mandates that encourage energy conservation and the use of public transit.

As a single employer with its own campus, the State of New Mexico has opportunities to incentivize the use of alternate transportation, and to influence the travel modes and timing of all the employees who work at this site. Corporations and governmental entities that have large campus facilities and limited parking availability, such as Sprint, Google, Microsoft, Apple, the Los Alamos National Laboratories, and Arizona State University, already manage the way employees and visitors arrive at their sites. They use a variety of ways to incentivize the use of multi-modal travel options to avoid the high cost of parking. *See box to right for a discussion of multi-modal planning.*

An education program which informs employees of the benefits of alternate modes of transportation such as gas savings, traffic reduction/traffic congestion, improvement of air quality, health benefits of walking, tax benefits, reduction of wear and tear on cars, reduction of taxpayer cost of structured parking, etc. is fundamental to this strategy.

The following page contains three scenarios that demonstrate possible increases in development capacity through progressively improving use of the variety of alternate transportation modes that currently serve the campus.

RIDE TO THE FUTURE

Measures to increase use of the variety of multi-modal transportation would be phased as development density increases over time. This phasing will ease the transition from reliance on singly occupied vehicles to other modes. A coordinated, campuswide approach to encouraging use of alternate transportation will result in a manageable transition.

Some potential incentives and mandates used in communities across the country include:

- Require all employees to “take the train,” “ride the bus” or carpool one day per week.
- Each agency could have a central location where employees “share” passes on a daily basis.
- Schedule a four-day work week with staggered days off. (This strategy will reduce day-to-day parking demand.)
- Encourage or support a “vanpool” service with discounted rates.
- Negotiate with transit providers for weekly/ monthly/annual passes at discounted rates. The cost of the passes to the employees qualifies as a tax-deductible business expense, unless it is part of a pretax benefit program.
- Work with transit providers to develop a voucher plan administered by the state. Providers would consign vouchers or passes to the state which would sell them at a discount. Consignment allows the state to pay for only the passes sold, thereby eliminating risk.
- Institute a carpool program.
- Provide:
  - Flexible employee work days
  - Reduced-cost rail and transit passes
  - High-occupancy vehicle parking and carpool programs
  - Home-based digital work flexibility
  - A centralized fleet car pool

Link to the General Services Department, “Commuting to Work at New Mexico State Government.”

http://www.generalservices.state.nm.us/energy/Commute.html

Figure 2-7: Parking Scenario One

Figure 2-8: Parking Scenario Two

Figure 2-9: Parking Scenario Three

PARKING SCENARIO ONE

Scenario One demonstrates the capacity for total development if a ratio of 1 stall for every 350 GSF of building is used for providing parking. Currently, at least 30 percent of employees arrive by other means than a single-occupancy automobile. *

NORTH OF ALTA VISTA

- Would allow building a total of 125,000 GSF of new building.
- Requires two parking structures totaling 1,440 spaces.

SOUTH OF ALTA VISTA

- Would allow building a total of 60,000 GSF new building south of the Lujan Building.
- Requires a 500 space parking structure + 111 surface stalls

Total square feet in Scenario One, including existing buildings (540,000 GSF) + new (185,000 GSF) is 725,000 GSF.

* *Vital Records Building was not included in these totals.*

*Note: This percentage is determined by totalling all surface parking, subtracting fleet parking and deviding by total current employees.

PARKING SCENARIO TWO

Scenario Two demonstrates the development capacity if a ratio of 1 stall for every 425 GSF of building for parking is used in conjunction with a targeted increase in multi-modal use to 39 percent of site employees.

NORTH OF ALTA VISTA

- Would allow building a total of 232,000 GSF of new building.
- Uses the same 1440 spaces in two parking structures.

SOUTH OF ALTA VISTA

- Would allow building a total of 100,000 GSF of new building.
- Uses the same 500 spaces in one parking structure + 111 surface stalls

Total square feet in Scenario Two, including existing buildings (540,000 GSF) + new (332,000 GSF) is 872,000 GSF.

PARKING SCENARIO THREE

Scenario Three demonstrates development capacity if a ratio of 1 stall for every 500 GSF of building for parking is used in conjunction with a targeted increase in multi-modal use to 50 percent of site employees.

NORTH OF ALTA VISTA

- Would allow building a total of 342,000 GSF of new building.
- Uses the same 1440 spaces in two parking structures.

SOUTH OF ALTA VISTA

- Would allow building a total 146,000 GSF of new building
- Uses the same 500 spaces in one parking structure + 111 surface stalls

Total square feet in Scenario Three, including existing buildings (540,000 GSF) + new (488,000 GSF) is 1,028,000 GSF.

Scenario Three is the optimum level of development and density possible on the site given the limitations of buildable area, compatible building heights, multi-modal use goals, and parking capacity.

SETTING THE TARGET / MULTI-MODAL USE

Setting a target is the first step to increasing multi-modal use by employees. An initial cursory analysis of current parking availability vs. number of employees provides some surprising information about how many employees currently may use other forms of transportation for commuting to work other than in a single-occupant automobile.

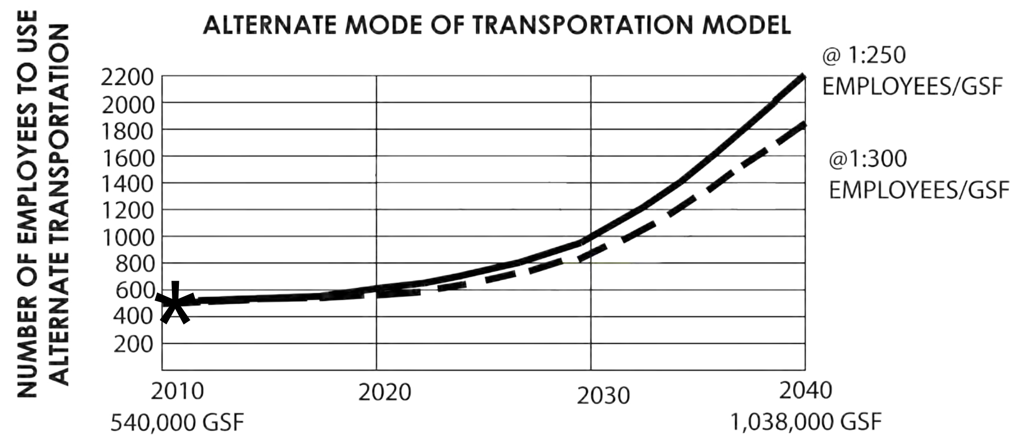
The current number of parking spaces on campus for general employee use is 1,168. The current number of existing employees on site is approximately 1,800. These totals mean that at least 30% of existing employees arrive at work by other means than driving in a single-occupancy automobile. The variety of ways likely includes: walking, biking, carpooling, van pooling, park and ride, local bus, regional bus, and the Rail Runner train system.

For this particular campus, the transition over 40 years to a multi-modal target of 50% employee arrival by modes other than single-occupancy automobile is an achievable target. This target is feasible because of the exceptional existing systems for alternate travel modes and off-site infrastructure for alternative transportation currently serving the site. However, continued coordination to support expansion and improvement of the alternate systems with the relevant entities that manage the off-site systems will be a continuing need, i.e. the City and County of Santa Fe, NMDOT, the Rail Runner management authority.

The matrix to the right is a generalized graphic of possible multi-modal targets over time.

In order to achieve these targets, a first phase activity recommended is to conduct a survey of employee travel modes and prepare a plan for setting and achieving long-term targets.

Figure 2-10: Alternate Mode of Transportation Model



The graph at the left indicates that approximately 500 employees are currently using alternate modes of transportation (the asterisk). The dashed line indicates the targets for increasing use of alternate modes of transportation to the site.

The solid line indicates the potential for increased use of alternate modes of transportation by improving the space efficiency of the building from the current ration of 1 employee/300 gsf to 1 employee/250 gsf.

Figure 2-11: Rail Runner Station - View 1

Figure 2-12: Rail Runner Station - View 2

Figure 2-13: Rail Runner Station - View 3

G. NEIGHBORHOOD AND CITY STRATEGY

The surrounding neighborhoods will be concerned and affected by the development of the South Capitol Campus. It will be important to prepare the community for the potential changes and to address concerns. There are also improvements that the State should consider to provide actual benefits for the impacted community. Recommendations for improvements specific for the community are:

First, look for strategies to limit increase of traffic on Columbia and Pacheco Streets. Both these streets are limited in rights-of-way and both have single-family and multi-family residences fronting on them. That means that increased traffic is of direct personal concern to those residents. Strategies to consider to reduce impacts to these two streets are:

- Limit daily entry and exiting traffic to the proposed parking structure west of the Lujan Building to be only from Alta Vista. The second southern exit from the structure would be an emergency only exit.
- Direct service traffic in the campus area south of the Alta Vista to use routes that avoid Pacheco and Columbia Streets. Part of site management would be to give explicit written instructions to use alternate routes to regular delivery and service providers.
- Consider limiting traffic in and out on the driveway west of the Chino Building. This existing driveway is shared with residential condominiums that abut the west property line of the south of Alta Vista campus area. Limiting conflicts on this drive would be useful.
- Work with the City of Santa Fe to continue development of traffic calming features on Pacheco Street between Columbia and Alta Vista Streets.

Second, consider improvements that add to the public amenities of the Pacheco neighborhood. Recommendations for improvements are:

- Work with the City of Santa Fe and the neighborhood to improve sidewalks and walking access to the South Capitol Rail Runner Multi-Modal Station
- Design a small neighborhood park-open space on the parcels held by the State adjacent to the north end of Pacheco as it intersects with Alta Vista.

Third, develop a pro-active process with the community as decisions to develop South Capitol Campus move toward budgeting and funding. Addressing as early as practical, the concerns of the adjacent neighborhood will not remove all objections to the project, but, can make sure that the proposed designs address to the greatest extent possible their concerns and are included in the initial design and budgeting of the project.

The development of the South Capitol Campus has important and potentially highly beneficial impacts for the surrounding commercial and retail activities in the Cordova Rd., Pacheco Street and Baca Street areas. Holding discussions with the local business in the area about how this development can support the economic vitality of this sector of the City of Santa Fe would be a positive step in building a community context for development of the South Capitol Campus.

Citywide, the impact of development of the South Capitol Campus will be felt in increased density and traffic changes on St. Francis Dr., Cordova Rd., and Cerrillos Rd. These streets are three of the most heavily trafficked on the city. Thus, engagement of the wider community beyond the immediately adjacent neighborhoods and enterprises will be needed. Developing a strategic plan for engaging that discussion should be planned for well in advance of general public release of the Master Plan.

The City of Santa Fe has made it a priority to establish a means to have input on State development projects that are within the City of Santa Fe. To smooth the natural tension between the local need to know and the State's needs to efficiently develop its properties, it is recommended that a discussion with the City and the State begin to proscribe the process by which City input will be solicited and formally responded to by the state. Building a sense of collaboration in how the process is described and acted upon with a clear acknowledgement that final control is by the State would be a valuable outcome.

H. INFRASTRUCTURE STRATEGY

The infrastructure strategy for the South Capitol Campus is to establish a new model for comprehensive and integrated infrastructure planning. The strategic change in methods of infrastructure planning begins with setting a target for energy and resource use and then designing all components of that system to meet the target.

For the South Capitol Campus, the target is "no-net" increase in energy and water demand over current 2010 usage when all future development is completed. This standard requires the following priorities:

1. Set and describe the "no-net" increase targets for the campus
2. Prioritize energy and water reductions and savings in existing uses
3. Design new structures and improvements to emphasize passive energy strategies to use less water and energy
4. Incorporate opportunities to harvest, reuse and recycle water
5. Capture energy and resource waste streams on site to support energy balancing
6. Lastly, generate renewable energy sources on site

This infrastructure strategy requires that each individual building and improvement design be evaluated and adjusted according to its contribution to a "no-net" increase. In a "no-net" increase strategy, the capacity of the existing utility systems shall meet all the future demands. Additions in utility lines and routes are therefore for efficiency of service, not increase in capacity.

Specific concepts for energy and water use reduction for buildings and the site for the South Capitol Campus are in:

- Section III - Sustainability Plan
- Section II.B – Building Strategy
- Section II.I – Landscape Strategy
- Appendix B – Existing Building Analysis

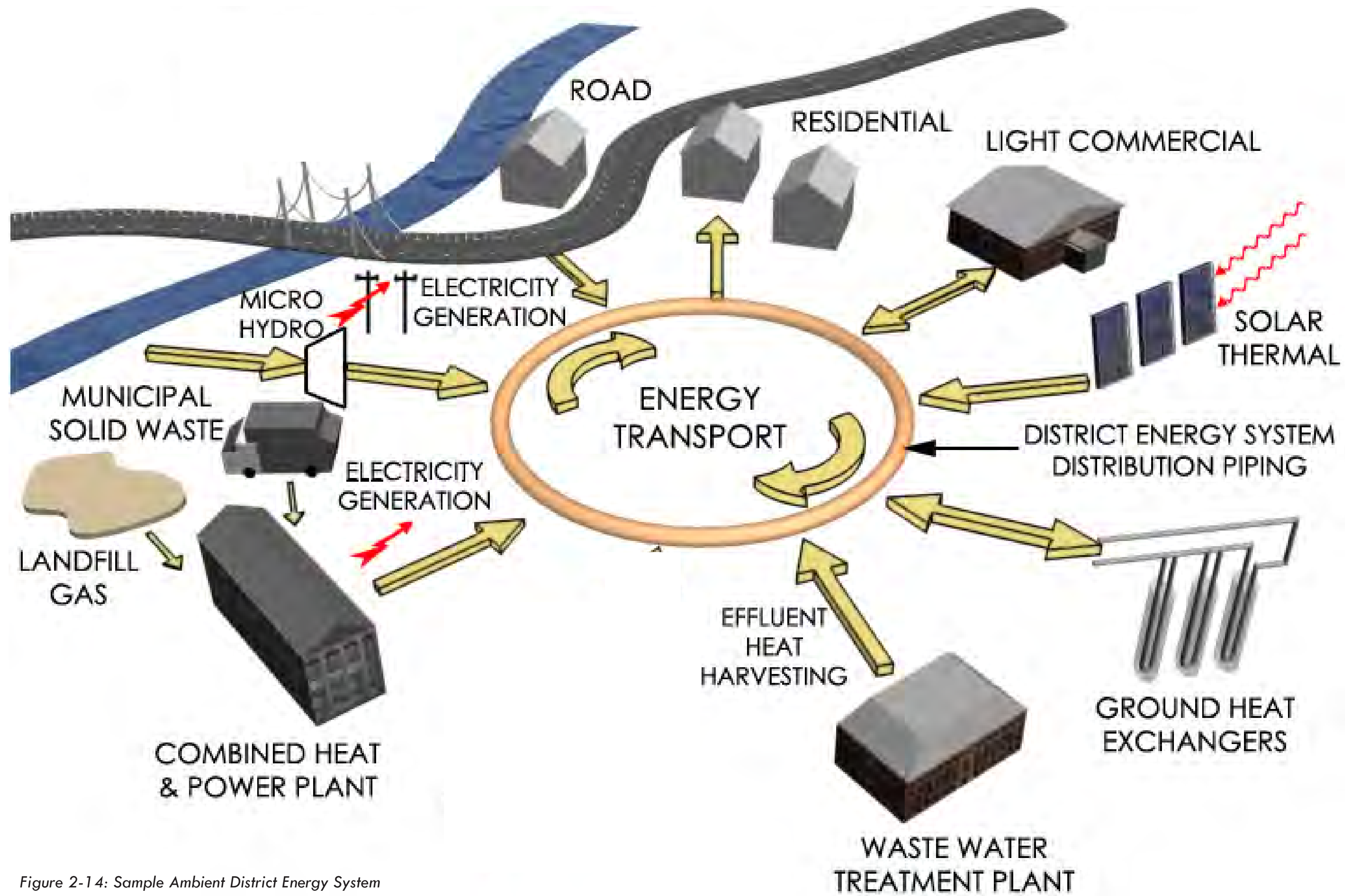


Figure 2-14: Sample Ambient District Energy System

I. SECURITY AND SAFETY STRATEGY

The security and safety strategy for the South Capitol Campus is focused on developing a process to set security standards and to coordinate security systems campus wide. Currently, security provision is done by the following groups.

- Property Control Division deals with programming of security for building occupants and interior spaces
- Building Services Division deals with securing the campus site and building perimeters
- DoIT deals with security for the Simms Building and information technology functions
- Homeland Security is involved with federal related security issues.

The multiplicity of agencies dealing with different levels and scales of security needs makes the necessity of development review and coordination of security improvements the most important step for security on the site. *See box to top right.* Security and safety components and recommendations included in the campus master plan are:

1) Designated major fire and evacuation routes
2) Designate the north, south and Pacheco campus parks as emergency refuge areas
3) Recommend coordination with City of Santa Fe to use Salvador Perez Park across St. Francis Dr. as a potential triage area for a major emergency.
4) Central security office for campus located in the Simms Building
5) Secure utility meters and equipment behind barriers or locate in access controlled service yards or areas.
6) Coordinated site-wide signage system that incorporates emergency needs for location and readability. *See Section IV. G, Landscape Design Guidelines.*
7) Set site-wide lighting standards for pedestrian personal security and safety. *See Section IV. G, Landscape Design Guidelines.*
8) Building and parking structure security needs are described in Section IV. E.
9) Snow melt on all main entries to buildings with emphasis on north and shady entries, but only if snow melt systems is part of an integrated sustainable infrastructure system.
10) Recommend formal security review process and committee for standards. *See box to top right.*
11) Recommend campus fire review is by State Fire Marshall with input from City of Santa Fe Fire Marshall.

SECURITY COORDINATION

Strategic coordination is the most important step to future security development at the South Capitol Complex. To achieve the optimum security for this site and its functions are two essential recommendations.

- Establish a formal review process between PCD / BSD/ DoIT / Homeland Security and other agencies that have regulatory review of this issue. As the complexity of the individual agencies perspectives about security increases, coordination is critically important to achieve a comprehensive, coordinated, efficient security system.
- Support development of a committee or development review group to set security systems standards for capabilities, compatibility, and most importantly operational maintainability. Setting standards would avoid ad-hoc system additions and support a more cohesive system.

SECURITY AND THE SIMMS BUILDING

Security is an increasing concern for critical State functions. The Simms Building houses critical Department of Information Technology functions. Security considerations for the DoIT functions have substantive affects on the capabilities and design of the South Capitol Campus.

The master plan examines two development strategies related to the DoIT functions, the Simms Building, and the effects on the Campus master plan.

DoIT FUNCTIONS STAY - Strategy #1

Should DoIT functions remain as the primary use of the Simms Building, the following are security consideration to accommodate it remaining in place.

- Increased required standoff distances.
- Hardening of structures in close proximity
- Increased perimeter security controls

These security considerations could have substantial impacts on the developable footprints of the adjacent new structures and add exceptional costs for hardening exterior perimeter walls.

A larger State evaluation is whether this location can accommodate the security level of perimeter control desired for the DoIT functions, or if a more secure site would be better suited for these functions. This evaluation should also examine the lack of redundancy for critical functions within the DoIT system state-wide and adequacy as a state-of-the-art IT facility. These issues should be resolved before any further renovations or plans for Simms are conducted.

Other non-security considerations related to DoIT remaining in the Simms Building are:

- The limited capacity for expansion of the Simms Building. Evaluation of original building plans shows that vertical expansion by adding a third story to Simms would be a major venture equivalent to building a new building, and would be difficult to accomplish while maintaining continued operations.
- The cost of a replacement facility.

DoIT FUNCTIONS MOVE - Strategy #2

Should a determination be made to move DoIT functions out of the Simms Building, a number of beneficial opportunities arise.

- By renovating the Simms to an open office concept, the campus gains temporary backfill space that can be use to move people from other buildings on site that need renovation.
- Costs of construction of adjacent structures become more average as exceptional structural hardening would not be needed.
- Stand off distances can be reduced making development more efficient.
- Property perimeter control issues are not elevated above that needed for general administrative uses.

Campus-wide safety and security offices and systems are anticipated to remain in the Simms Building regardless of the status of DoIT.

J. LANDSCAPE STRATEGY

In the South Capitol Campus Master Plan, future landscape and open spaces play a crucial role in the sustainable development of the campus. Open space is intended to meet the sustainable target of being 50% of site land use. In addition to adding beauty and comfort to the exterior environment, the landscape and open space supports multiple critical site functions.

The main overlapping functions for landscape and open space are listed below. A primary design activity will be to carefully integrate and coordinate these multiple functions for each future development phase of the landscape.

1) Main Walking Spine:	Main utility corridor Emergency vehicle access
2) North and South Parks:	Safety and security gathering zones Potential earth-based energy exchange systems Water harvesting zone Water quality treatment features
3) Gateway Corners:	Campus signage locations
4) Perimeter Parkways:	Security stand-off buffer from major streets Health and wellness walking loop

PARKS AS THE CORE

Two campus parks, one anchoring the north area and one in the south area, are the heart of the landscape and open space plan. The campus parks are to be the outdoor living space for employees and visitors. They are intended to be the hallmark destination open spaces of the campus. As such, amenities and site furnishings should be emphasized in these areas to encourage sitting, outdoor eating, wellness activities and appropriate sheltered outdoor smoking areas. The parks should be designed to accommodate large gatherings and include shade structures. Large shade trees and limited areas of cool season turf create a sheltered, green garden sense.

WALKWAY FOR CONNECTIVITY + WELLNESS

The main pedestrian walking spine connects the north and south campus parks. Wide and welcoming, the walking spine is designed to safely accommodate use by both pedestrians and low-speed bicyclists. Safe passage during the day and night is improved by raised tables at road intersections and ambient lighting for personal security. Tall shade trees help create the dappled shade along this spine that encourages people to walk in the warm summer season and provides some wind mitigation in the cool season.

Streetscapes along St. Francis Dr. and Cordova Rd. would be designed to encourage and maintain the existing wellness walking route and would be extended to the south campus as it develops. The Alta Vista streetscape is intended to be more urban in design. Its amenities are intended to support its function as a main walking route between the south area of the campus and the Rail Runner multi-modal center. The streetscapes are to convey to the public the State's commitment to creating liveable communities and a sense of public welcome. The campus streetscapes are therefore designed to encourage public use, demonstrate wise water use, and appropriate public landscapes for Santa Fe. A specific signage recommendation for the wellness route is to add interpretive signage for the public and employees describing the sustainable landscape strategies on the campus.

BUILDING ENTRY COURTS

Building entry courts would be oriented to the main walking spine and create areas of refuge and orientation along the spine. Directional and informational signage would be placed in these areas. The arrangement of distinctive paving materials, evergreen and flowering plants, and bicycle parking facilities would welcome employees and visitors to buildings. In conjunction with sustainable infrastructure development, these entry areas should be considered for sub-surface heated pavement. These systems would only be allowed if coordinated as part of a sitewide, balanced heating and cooling loop system. Heated pavement would greatly reduce winter maintenance problems and improve pedestrian safety around buildings.

PACHECO PARK

In the master plan, a small park is recommended at the intersection of Pacheco and Alta Vista Streets. As development and uses increase at the South Capitol Campus, the Pacheco neighborhood will be increasingly impacted. By providing this small park, the State would contribute to the community by improving the visibility at the Pacheco St. intersection, creating a new entry for the neighborhood, and improving access to the regional transit center and the regional bike and pedestrian trail adjacent to the rail tracks.

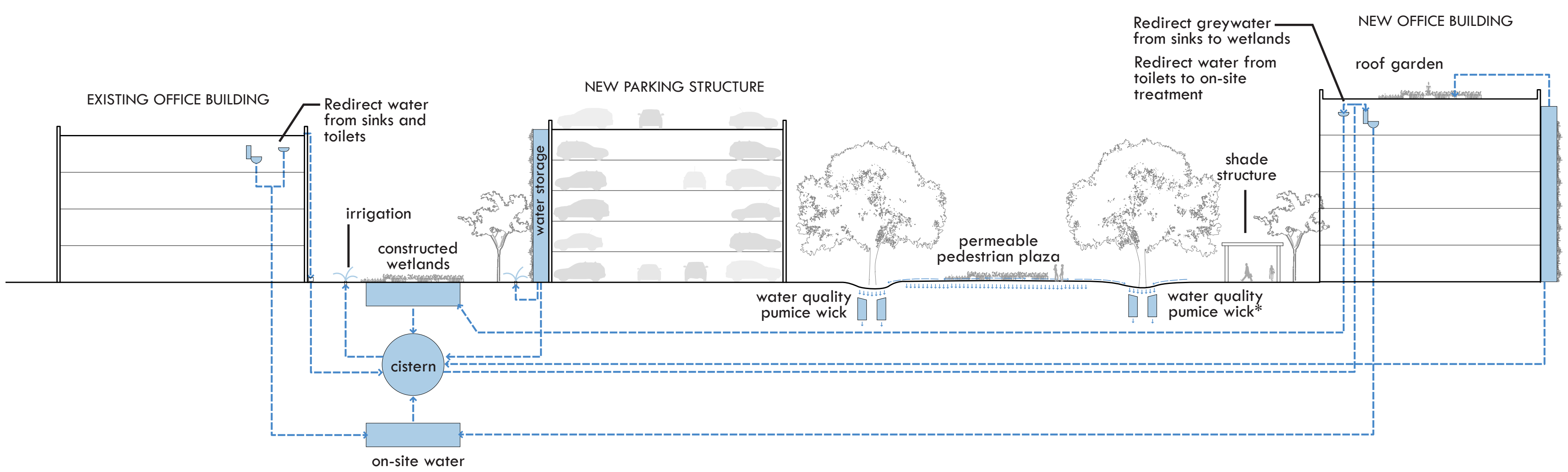


Figure 2-15: Water Harvesting Conceptual Diagram

** A Septic System Alternative*

PLANTING + IRRIGATION STRATEGY

A goal for the landscape at the South Capitol Campus is to create a healthy, beautiful landscape that demonstrates the richness of plants that can be maintained by the water harvesting, treating and recycling wastewater and rain water that is harvested on this campus.

The South Capitol Campus landscape will be a demonstration of an environmentally appropriate landscape that is specific to the site's water harvesting opportunities and the Santa Fe environment. This approach differs from the notion that a water-conserving site should be totally graveled. Large expanses of gravel in Santa Fe add to heat-island affects. Naturalized areas In Santa Fe that are left unirrigated for long periods actually begin to grow native grasses, native shrubs and flowering weeds. In Santa Fe, artificially creating a desert through graveling creates the need to use chemical weed killers and suppressants, triggering many environmental concerns such as water quality effects and long-term environmental migration.

A strategic goal is to allow the general landscape that is beyond the main pedestrian spine, main parks and building plazas to be rougher and more diverse in look, mimicking the natural landscape of undeveloped natural locations in Santa Fe. The initial landscape renovation would, for the first three years, require more staff to manage it and some supplemental irrigation for establishment. In the long-run, however, the operation and management of these areas should be limited and seasonal, as opposed to daily and weekly. It will be important to include educational interpretive signage during the transition so that employees and visitors understand and recognize this more sustainable change.

Plantings in the main pedestrian spine, parks and building entry plazas will be matched to the water capacity available from water harvesting, water treatment and water recycling. Trees and drought-tolerant flowering shrubs would be the main types of plants in these areas. Turf, if any, would be very limited. Water quality wetlands that clean roof runoff and greywater from the building would also increase the sense of green and coolness in the pedestrian areas.

Figure 2-16: Naturalized Native Grasses and Wildflower Landscape including Blue Grama Grass in Santa Fe at the Northeast Corner of Don Gaspar Ave. and Cordova Rd.

Figure 2-17: White-Flowered Ox-Eye Daisy and Yellow-Flowered California Poppy

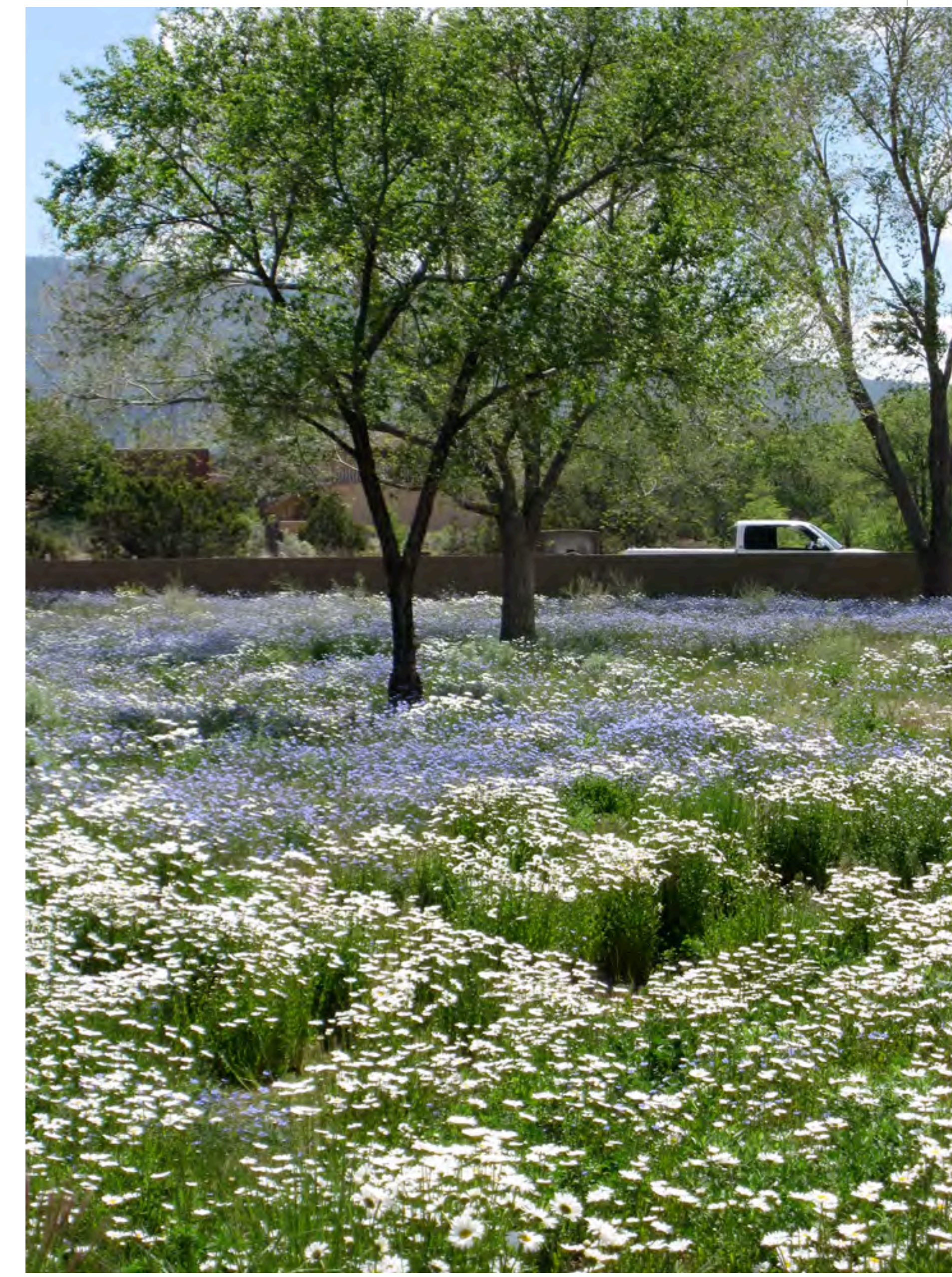


Figure 2-18: Field of Blue Flax and Daisies

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III. SUSTAINABILITY PLAN

A. Sustainability Summary

B. Introduction

C. Project Background

D. Passive Design

E. Primary Energy Source Options

F. Mechanical Systems

G. Plumbing Systems

H. Electrical Systems

A. SUSTAINABILITY SUMMARY

This section describes an approach to energy targets for new and existing buildings on the South Capitol Campus. It also provides design guidance for options for passive optimization and mechanical, electrical and plumbing systems in order to achieve the proposed energy targets.

The first section of the sustainability plan analyzes energy use by existing buildings and sets energy targets for both existing and new buildings on the site as options to achieve the energy targets set by the user. The second and third sections analyze passive design strategies and mechanical, electrical and plumbing (MEP) solutions for achieving the set energy targets.

No dynamic thermal modeling has been conducted as part of this plan and all proposed options are based on good engineering practice rules of thumb. Further analysis and modeling will be required to fully analyze the proposed passive and MEP advised solutions to accurately determine energy savings.

The master plan report for the South Capitol Campus identifies and evaluates sustainable opportunities for four major areas of design:

1. Passive design
2. Primary energy sources
3. Active mechanical systems
4. Water use systems

For this report, a summary description of each area has been included to introduce the sustainable approach and methodology for the project.

1. PASSIVE DESIGN

Passive building design encompasses the architectural, structural and envelope features that affect a building's response to the local microclimate. Though these features fall under architectural and structural disciplines, the envelope components affect the demands on the mechanical system and as such perform as elements of it.

Building envelopes designed for optimum energy performance reduce a building's peak heating and cooling loads, and annual energy requirements. This effect reduces the size, capital cost, and ongoing operating cost of the mechanical system. At the same time, high performance envelopes and other passive elements work with active mechanical systems to provide comfortable indoor environments. The intent is to reduce the energy demand in the building even before active systems are applied.

Energy-efficient buildings are best achieved in the early stages of design through an integrated, interdisciplinary approach. Advanced building energy modeling can aid passive feature design. Applicable features can be identified and then tested using annual building simulations that draw on local climate data and project parameters.

PASSIVE DESIGN ELEMENTS

BUILDING SHAPE AND MASSING

Building shape and massing affects energy performance and occupant comfort because the envelope surface area affects the amount of heat lost or gained through the envelope. The ratio of the envelope area to the useable floor space or volume is the compactness of the building. In climates with extreme hot and cold conditions, a more compact building will have lower rates of heat loss and gain in winter and summer, respectively, than a building which is less compact. The result is lower annual energy consumption for heating and cooling.

PROGRAMMING

Every building has various spaces with differing occupancy patterns, uses and temperature control requirements. The placement and location of these spaces with respect to the building orientation is referred to as programming, and can greatly impact the building's overall energy consumption.

GLAZING-TO-WALL-AREA RATIO

The glazing-to-wall ratio is the proportion of transparent glazing to the total wall area of the envelope.

THERMAL MASS

All matter has thermal mass, however, when referring to a building; thermal "mass" generally means materials capable of absorbing, holding and gradually releasing heat (i.e. thermal energy).

SOLAR SHADING

External solar shading includes overhangs, blinds, louvers, trellises, or anything that blocks the sun's rays from heating the building envelope and entering the building through glazing. Interior solar shading features, typically internal blinds, are any material inside the building that is used to block the sun's rays at the perimeter. Internal shading is significantly less effective at reducing solar heat gain and thus cooling energy requirements inside the building.

GLAZING ASSEMBLY PARAMETERS

Glazing assemblies consist of glass, and with more than one pane of glass a void, mounted in a frame. The thermal properties of glazing assemblies vary based on the number of glass panes, as well as the properties of the void, surface coatings and frame.

THERMAL INSULATION

Effective thermal insulation is the most critical design parameter of the building envelope. It reduces the rate of heat loss and gain to and from the outside, expressed in terms of R-value and U-value. Minimum R-values and maximum U-values are prescribed by the ASHRAE 90.1 energy standard for buildings.

ROOF DESIGN FOR SOLAR COLLECTION

Solar energy collectors (thermal to generate heated water or photovoltaic to generate electricity) have optimal orientation and angles of inclination for maximum solar energy capture over the year. The optimum orientation in the northern hemisphere is south to southwest facing.

INTEGRATED PASSIVE DESIGN STRATEGIES

Integrated passive design strategies combine the elements above to maximize the effectiveness of passive design in offsetting the energy requirements of heating and cooling systems by reducing energy losses and taking advantage of the naturally occurring thermal processes of the building structure and its surroundings.

PASSIVE HEATING STRATEGIES

The consistent availability of solar energy in Santa Fe provides an opportunity for integrating passive solar heating strategies in buildings there. The passive strategies take advantage of the combined effect of several passive elements. If applied properly, passive heating strategies could significantly reduce the heating energy requirements for this heating-dominant development.

The elements affecting passive solar performance were discussed in the preceding sections and have been studied with energy simulations, as discussed in the following sections. The strategies for this project include the optimization of the following passive design elements in various integrated combinations:

1. Programming and orientation
2. Solar control with external shading
3. Glazing-to-wall-area ratio
4. Thermal mass
5. Glazing assembly parameters

Thermally massive construction stores thermal energy from solar gain as well as thermal energy generated by mechanical systems, resulting in more stable internal temperatures and reduced heating energy consumption. The mass will be most effective with optimized building orientation and without the opposing radiant effect of large areas of cold glazing surface, which requires high performance glazing to provide adequate insulation. The glazing-to-wall-area ratio must balance between the benefit of allowing solar gain to enter the space while limiting the amount of heat loss through this weak link of the assembly. The combination of these features will enhance the comfort and heating performance of the buildings.

PASSIVE COOLING STRATEGIES

Passive cooling strategies reduce the amount of solar energy entering the space during summer and the amount of heat entering the space through ventilation air. These strategies remove heat from the building without using mechanical energy.

Passive cooling strategies include:

1. Passive evaporative cooling
2. Nocturnal cooling by natural ventilation
3. Thermal mass
4. Solar control with external shades and/or blinds

PASSIVE EVAPORATIVE COOLING

In the building, evaporative cooling uses heat from the spaces to convert water from a liquid to a vapor which converts the air in the space from warm and dry to cool and moist.

To cool a space by evaporative cooling, moisture must be added to an airstream. This can be achieved by drawing air across or through existing water (e.g., a water feature located within the building, a natural exterior body of water, a hydroponic living wall, etc.), providing a cooling effect to the space.

NOCTURNAL COOLING BY NATURAL VENTILATION

Natural ventilation overnight is encouraged to remove heat accumulated in the building mass during the day. Cooler night-time air flushes and cools the warm building structure/mass.

PASSIVE VENTILATION STRATEGIES /

EARTH-TEMPERED VENTILATION

The relatively constant temperature of the ground at depths exceeding 5' can be harnessed to temper building ventilation air. This strategy requires burying an air intake path, also called an earth tube.

2. PRIMARY ENERGY SOURCES

OVERVIEW OF ENERGY TYPES

For building system energy sources, provide either electrical power to perform mechanical work, such as running chillers, fans, or pumps, or thermal energy to provide heating. All forms of energy, with the exception of nuclear, are derived directly or indirectly from solar energy.

The important distinction between resources is the time frame of renewal. Sustainable resource use requires energy use at a rate equal to or less than the rate at which the resource can be renewed, and only those which renew within this time frame qualify as renewable.

The following are primary energy resources:

1. Fossil fuels – fossilized biomass, hydrocarbons such as oil, gas, and coal
    - Renewal time = millions of years
2. Biomass – organic matter which developed with solar radiation
    - Renewal time = 10s to 100s of years
3. Hydro – gravitational potential energy of water evaporated by the sun and precipitated at elevations higher than sea level
    - Renewal time = months to years
4. Earth source – solar radiation absorbed and stored in the earth: quick renewal time
    - Renewal time = days to months
5. Wind – air masses in motion due to convection, air heated by warm earth and water: quick renewal time, though intermittently available
    - Renewal time = intermittently available

Sustainable building designs should consider the primary energy resource that is impacted by the building operation, and not end these considerations at the property line. For example, electric resistance heating is often considered to be a 100% efficient conversion of electricity to heat. However, , when a fossil fuel thermal power plant generates this electricity at a remote site, the overall fuel-to-heat conversion efficiency is much lower, and can be less than 30%.

Sustainability designs must reduce dependence on fossil fuels for obvious reasons, and can do so by using renewable energy sources either on site or through the local utility.

3. ACTIVE MECHANICAL SYSTEMS

Buildings use energy to operate systems which provide space heating and cooling, ventilation air tempering, domestic hot water heating and lighting, as well as to run various types of electrical equipment from computers to refrigerators. The best way to reduce the overall amount of energy consumed is to first reduce the demand and amount of energy required before installing energy-efficient equipment.

Low energy-use building designs are best achieved by these design steps.

1. First, reduce the building's energy demand by applying passive energy saving features to the building, such as solar heating and shading strategies
2. Second, assess the available renewable energy sources and target prudent use of fossil fuel and electricity
3. Third, apply appropriate energy-efficient heating and cooling systems that are well matched with the identified renewable energy sources
4. Finally, design controls for the system and other primary energy uses to operate efficiently

Reducing energy demand with passive measures is the first and most important step because once the energy demand is reduced passively, active system components can be smaller and more efficient. High efficiency systems and plant equipment yield the lowest ongoing operating costs in a building with low energy demand.

4. WATER USE SYSTEMS

In an integrated water strategy, elements that are the most cost-effective, low maintenance, and easy to incorporate are high performance, low-flow fixtures. These fixtures include dual-flush toilets, low-flow faucets and high-performance, low-flow shower heads. High efficiency HVAC designs will also be assessed.

Once water conservation features are fully optimized, the next step is to identify nonpotable water sources to serve end-uses such as toilets, HVAC systems, etc. The availability and suitability of nonpotable sources will be evaluated.

B. INTRODUCTION

The intent of this report is to provide energy targets for new and existing buildings on the South Capitol campus and design guidance for passive optimization and MEP system options in order to achieve the proposed targets. Essentially, this sustainability plan will provide a vision for the South Capitol Campus concept designs and identify opportunities for enhanced sustainability to add value to the project.

No dynamic thermal modeling has been conducted as part of this report and all proposed options are based on the master plan past sustainable master planning projects and good engineering practice rules of thumb. Further analysis and modeling will be required to fully analyze the proposed passive and MEP solutions advised in order to accurately determine energy savings.

1. Passive design
2. Energy sources
3. Active systems
4. Water use

B.1 METHODOLOGY

Environmentally sustainable and energy-efficient design starts with an understanding of the local climate, since a building's passive response to changing environmental factors determines the amount of work required of a mechanical system and plant to maintain comfortable indoor conditions.

A building's active mechanical systems have the highest energy consumption, but they do not have the highest impact on building performance. The passive behavior of a building has the highest impact on its energy performance. The process begins with a move to eliminate heating and cooling loads by first considering passive behavior before active mechanical and electrical systems. For this reason, analysis focuses first on the climate and passive behavior of the architecture before considering any active mechanical features.

Energy sources and distribution are then explored, identifying opportunities for renewable sources on site and prioritizing these options over natural gas and electricity.

Mechanical system features are then considered, focusing on low-grade thermal energy sources and efficient systems, and identifying opportunities to use as many on-site renewable energy resources as possible.

The approach to water efficiency is similar to that of energy efficiency, focusing first on demand management, and then exploring alternative supply-side options. Waste management strategies focus on the reduction and recovery of waste streams by providing adequate facilities and potential waste recovery strategies. Opportunities to convert waste to resources on site are limited by the space constraints of the site. To maintain the delicate balance between the impacts of community-scale infrastructure and development-scale infrastructure, the process then considers the real benefits of water supply options based upon economic and environmental gains over use of existing municipal infrastructure.

Electrical services and communications system infrastructures options are then considered, including the way these options would serve various building operational needs. Low-voltage systems and communications options are reviewed, highlighting low energy devices that provide flexible and efficient energy systems.

C. PROJECT INFORMATION

The first section of the sustainability plan analyzes the energy used by the existing buildings and sets energy targets for both existing and new buildings on the site. The following sections analyze passive design strategies and mechanical, electrical and plumbing (MEP) solutions that could be used in order to achieve the set energy targets.

C.1 CONCEPT DESIGN ENERGY GOALS

1. State of New Mexico Sustainability: Imperatives for Change

The Office of the Governor has mandated change of environmental performance. The Office of the Governor has implemented a plan for change that is enacted by a series of Executive Orders. These Executive Orders, which apply to the executive branch under the Governor's control, will shape the energy performance goals of the project. The plan includes the following specific orders regarding environmental concerns:

1. EO-2009-047: Establishing New Mexico as a Leader in Addressing Climate Change
2. EO-2007-053: Increasing Energy Efficiency in State Government by 2015 and Statewide by 2012 and 2020
3. EO-2006-069: New Mexico Climate Change Action Plan
4. EO-2006-001: State of New Mexico Energy Efficient Green Standards for State Buildings
5. EO-2005-049: Requiring the Increased Use of Renewable Fuels in New Mexico State Government
6. EO-2005-033: Climate Change and Greenhouse Gas Reduction
7. EO-2004-019: Declaring New Mexico the "Clean Energy State"

2. Energy Goals

The initial goals proposed for a sustainability-oriented integrated energy strategy for South Capitol include:

1. Maintain the current annual energy performance of the campus as the new expansion is developed
2. Reduce existing building energy intensity by 23%, in line with the 2030 Challenge from AIA (kBtu/ft2•yr)
3. Achieve Net-Zero energy on new building construction
4. Reduce the footprint of CO_2 emissions from fossil fuel by 22% over the U.S. national average (Tons of CO_2/ft2•yr)
5. Develop local expertise and experience with high-efficiency construction and renewable energy systems

Establishing sustainability-oriented project performance targets in a clear and measurable manner is a fundamental prerequisite of successful sustainable design.

Often, as seen above, these performance targets are expressed as a percentage reduction (improvement) over a typical reference case. Since the performance of the reference case is seldom expressed in clear and measurable terms, the targeted performance will also lack the clarity required to effectively guide the project design and implementation process.

Therefore, in order to establish clear and measurable targets for energy efficiency and CO_2 emission footprint were analyzed and quantified the energy intensity and CO_2 benchmark values for conventional building performance in the Santa Fe climate. The result is energy and CO_2 targets for the South Capitol Campus as follows:

Energy Use	Existing		Target	
	Energy Intensity ($kBTU/ft^2$)	Emissions ($lbs\ CO_2/ft^2$)	Energy Intensity ($kBTU/ft^2$)	Emissions ($lbs\ CO_2/ft^2$)
Existing Buildings – 540,000 ft^2				
Heating	32.76	11.6	25.2	10.08
Cooling	33.93	4.4	26.1	10.44
Lighting	12.87	12.8	9.9	3.96
Equipment	37.44	40	28.8	11.52
Overall	117	11.2	90	36
New Buildings – 488,000 ft^2				
Heating			9.8	5.6
Cooling			10.15	5.8
Lighting			3.85	2.2
Equipment			11.2	6.4
Overall			35	20

Figure 3-1: Energy and Carbon Emission Goals

3. Water Goals

Residential water use per capita in Santa Fe is measured at about 100 USG/day, compared to about 75 USG/day in Boston, Massachusetts or 45 USG/day in the United Kingdom.

The goals for a sustainability-oriented integrated water strategy for the South Capitol Campus include the following:

1. Reduce municipal potable water use by 30-50%
2. Use non-potable water sources for process water and fixtures such as toilets, fluid coolers, and irrigation

4. LEED Certification Goals

The campus will be required to meet, at minimum, a LEED Silver standing per the Executive Orders from the Office of the Governor of New Mexico. With the aggressive energy targets proposed, the campus will easily attain this LEED target. All projects should be designed to achieve a minimum of eight LEED Energy Points.

C.2 INDOOR COMFORT DESIGN CONDITIONS

Proper understanding and definition of thermal comfort parameters is a key requirement for optimal building and system design. It is especially important for passive building design where the main objective is a building that maintains thermal comfort and optimizes energy performance.

D. PASSIVE DESIGN

Passive building design encompasses the architectural, structural and envelope features that affect a building's response to the local microclimate. Though these features fall under architectural and structural disciplines, the envelope components affect the demands on the mechanical system and as such, perform as elements of the mechanical system.

Building envelopes designed for optimum energy performance reduce a building's peak heating and cooling loads, and annual energy requirements. This effect reduces the size, capital cost, and ongoing operating cost of the mechanical system. At the same time, high performance envelopes and other passive elements work in synergy with active mechanical systems to provide comfortable indoor environments. The intent is to reduce the energy demand in the building even before active systems are applied.

Energy-efficient buildings are best achieved in the early stages of design through an integrated, interdisciplinary approach. Advanced building energy modeling can aid passive feature design. Applicable features can be identified and then tested using annual building simulations that draw on local climate data and project parameters.

D.1 BUILDING SHAPE AND MASSING

The building shape plays a significant role in overall energy performance and occupant comfort because the envelope surface area affects the amount of heat that is lost or gained through the envelope. The ratio of the envelope area to the useable floor space or volume is the compactness of the building.

In the Santa Fe climate, with fluctuation between hot and cold conditions, a more compact building with a deep floor plan will have lower rates of heat loss and gain in winter and summer respectively, than a building which is less compact. The result is lower annual energy consumption for both space heating and cooling.

However, as with many passive features, there is a tradeoff. In this case, a compact building limits the use of other passive strategies such as daylighting and natural ventilation. A building form with a shallow floor plate would permit daylighting of more office space and provide the opportunity to use natural ventilation strategies such as cross ventilation and night cooling. These opportunities are discussed later in this section.

Designing a more compact building shape but incorporating features such as skylights and atriums will combine the benefits of the two building forms.

Another consideration is that solar energy collectors (thermal to generate heated water or photovoltaic to generate electricity) have optimal orientation and angles of inclination for maximum solar energy capture over the year.

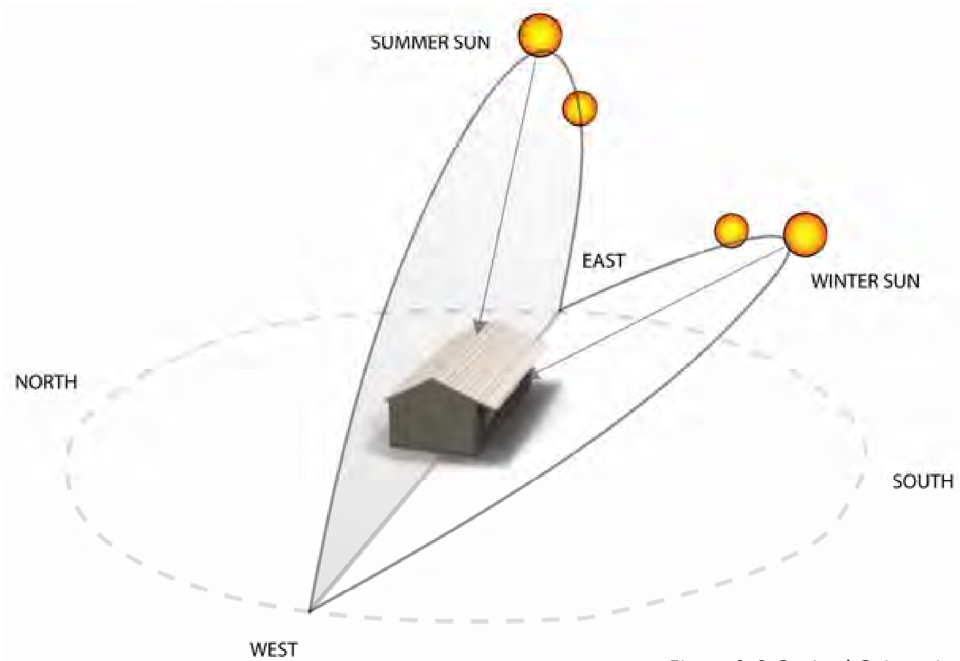


Figure 3-2 Optimal Orientation

Benefits

1. Deep plan geometries reduce heat gain and loss, and in turn annual energy consumption for heating and cooling compared with shallow floor plan geometries
2. Shallow floor plans present the opportunity for natural ventilation and daylighting strategies
3. A roof pitch designed for solar collection negates the requirement for pitched mounting frames, which reduces the complexities of snow removal and improves aesthetics

Limitations

1. Compact geometries negatively affect daylighting and natural ventilation strategies
2. Shallow floor plans increase the ratio of external walls to floor area

Application Potential for South Capitol Campus

The climate in Santa Fe induces both heating and cooling demands on all the considered space types, and new building construction would benefit greatly from a compact building shape with low envelope-to-volume ratios. However, the Santa Fe climate, with its wide diurnal temperature fluctuations, is ideal for night cooling and cross ventilation strategies. In this respect, the preferable building form has a shallow floor plate.

The trade-offs between both approaches to building form should be explored through dynamic building energy simulations using local weather data. Energy modeling should include a study of passive features such as skylights and atriums to maximize building energy performance and capitalize on passive ventilation opportunities.

The optimal building orientation is along an east-west axis, however, most buildings on the South Capitol Campus are at an angle to this axis. This orientation is demonstrated in Figure 3-2 Optimal Orientation. If future buildings continue with this architectural theme, passive features involving the building envelope could mitigate the building orientation. It will be difficult to implement any significant change to the shape and massing of the existing buildings.

When incorporating solar energy harvesting devices, pitched roofs are ideal, but they are not consistent the with pueblo-revival architecture style of Santa Fe. The roofs of the buildings on the South Capitol Campus are flat and would need to be capable of supporting pitched mounting frames and maintenance access for the panels. South-facing orientation is optimal at angles between 35° and 45° from the horizontal. Design must consider and deal with shading by adjacent buildings and even other parts of the same building. The roof-pitch design must consider snow accumulation.

D.2 PROGRAMMING

This feature, similar to shape and massing, is most appropriately implemented as part of new construction projects on the campus. All buildings have various spaces with differing occupancy patterns, uses and temperature control requirements. Programming addresses the placement and location of these spaces with respect to the building orientation, and it can greatly impact the building's overall energy consumption.

Benefits

1. Lower peak cooling loads can be met with smaller capacity equipment, reducing capital costs
2. Lower annual energy consumption for both space heating and cooling

Limitations

1. Cannot always be achieved, due to other programming requirements and constraints
2. If the space use changes in the future, additional capacity may be required from the equipment

Application Potential for South Capitol Campus

Wherever possible, the architectural team should ensure buildings are programmed consistently with the recommendations, as follows:

1. Spaces with consistently lower cooling demands, such as corridors or staff lounges, should be located on the south and southwest exposures
2. Spaces with consistent daytime cooling demands, such as meeting rooms or server rooms, should be located on north exposures
3. Spaces that require constant and steady temperature control should be located in the core of the buildings, with no exterior envelope exposure

For example, constant cooling zones, such as data rooms, should be located centrally in the building, to reduce solar heat gain into the space, thus maintaining minimized overall cooling. Corridors and offices with low cooling requirements should be located at the perimeter on the south and west sides of the building and meeting rooms, with high internal heat gains, should be located along the north building façades.

D.3 THERMAL MASS

All matter has thermal mass, however, for buildings, thermal mass generally means materials capable of absorbing, holding, and gradually releasing heat (i.e., thermal energy). The Santa Fe Pueblo Revival architecture exemplifies the realization of thermally massive construction strategies. Adobe, or alternatively used concrete, brick or stone, are examples of heavy, dense building materials that result in buildings with a high thermal mass.

Thermally massive materials absorb heat and slowly release it when there is a temperature difference between the mass and the surrounding space. In the winter, the mass absorbs heat and aids to maintain space temperatures by releasing this absorbed heat through radiation when space temperatures drop below the temperature of the mass. In the summer, the thermal mass absorbs heat from the occupied space, reducing the load on the mechanical system as shown in Figure 3-3 Thermal Lag of a Heavy Mass Building. See further benefits of thermal massing in regards to pre-cooling the mass in D.8 Natural Ventilation. Insulation should always be located on the exterior of the massing to capitalize on these benefits.

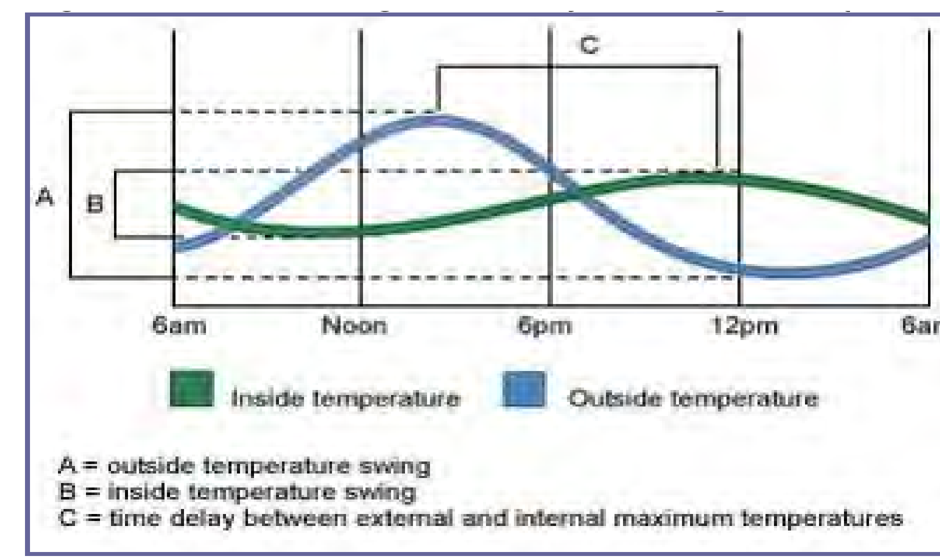


Figure 3-3 Thermal Lag of a Heavy Building Mass

Opportunities to increase the massing of the building are to add mass to the interior structures as well, including walls and floors.

When compared with lightweight construction, the interior surface temperatures of the heavy mass wall are closer to the desired space temperature set points in both winter and summer conditions. The result is more comfortable conditions for occupants and a reduction in the rate of heat loss (and gain in summer) through the envelope, which in turn reduces the annual energy consumption of the building.

Benefits

1. Reduced annual energy use and peak demand due to the radiant effect of a thermally massive structure
2. Increased acoustic insulation of assemblies
3. Improved fire ratings of assemblies
4. Complements existing architecture using adobe as a building material
5. Improves perception of thermal comfort inside the building

Limitations

1. Without adequate direct solar radiation in the winter or exposure to the interior conditioned space, thermal mass can consume increased heating energy from the mechanical system
2. Greater cost of construction of a thermally massive structure vs. a lightweight structure

Application Potential for South Capitol Campus

Santa Fe architecture was founded in the tradition of thermally massive construction. Prior to the widespread use of active heating and cooling systems, a heavy massed structure was used to mitigate the effects of the harsh mountainous climate. Thermal massing is an ideal solution for keeping warm in the winter and cool in the summer while reducing energy consumption. A reduction of heating and cooling loads in the building provides the opportunity to pursue proposed low-grade energy systems.

As mentioned previously, thermal mass is an existing feature of the buildings on the South Capitol Campus, and is typical of Santa Fe's ubiquitous Pueblo-revival architectural style. Use of this passive feature has not been optimized, specifically with complementary low-energy active mechanical systems. The considerations listed for new buildings in the following paragraph can enhance use of thermal mass in existing buildings.

New buildings should incorporate thermal mass in two places: in the floors, which receive direct sun through the windows during winter, and in the wall assembly on the interior side of the insulation to buffer the conditioned interior from the dynamic exterior temperatures.

Thermal mass placed closer to the core of the building, for example, deeper within a floor plate, will be beneficial during the cooling season, especially if nocturnal ventilation is implemented, and in heating season to stabilize internal temperatures.

Floor coverings such as carpet will reduce the thermal storage effect, but not eliminate it.

D.4 GLAZING PARAMETERS

<u>1. Glazing-to-Wall Ratio</u>

Both the ratio of glazing assembly to opaque assembly and the assembly's insulating quality affect the amount of heat that escapes from, or is trapped inside, the structure.

Large glazing areas trend toward high energy consumption and greater heating and cooling loads. An increased load causes a building to rely more on forced mechanical systems to maintain comfort. In Santa Fe, where buildings are subject to a heating-dominant environment, substantial glazing in the façades conflicts with reducing energy consumption and maintaining comfortable interiors. High glass percentages increase the cooling load and localized discomfort due to the sun's radiant effect as heat flows through glass. See Figure 3-4. Glazing to Wall Ratio, for a schematic representation of glazing to wall ratios.

As the glazing-to-wall ratio decreases, minimizing energy entering the building, summer cooling loads are lowered. However, decreased ratios limit the opportunity for passive heating in the winter, spring and fall. Consequently, the impact is a lowered cooling load but a greater heating one.

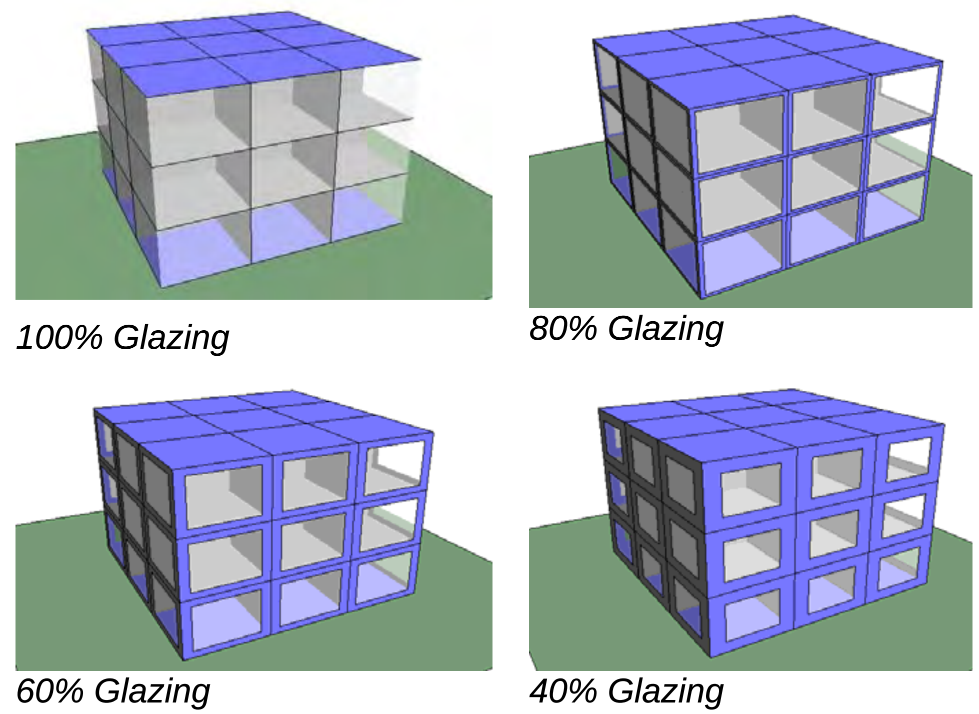


Figure 3-4 Glazing-to-Wall Ratio

<u>2. Glazing Assembly Parameters</u>

Glazing assemblies have poor thermal properties and are typically the weakest link in the building envelope. The thermal quality of the overall assembly — not necessarily the glazing alone — significantly determines the amount of energy loss through the building skin. Glazing systems consist of glass panes, and where there is more than one pane, a void between panes and a mounting frame. Properties that affect thermal performance are U-values of the glazing and frame, the void's spacer materials, and the solar heat gain coefficient (SHGC). Figure 3-5. Glazing Assembly shows a section of a thermally broken frame.

The frame acts as a thermal bridge, facilitating the unwanted transfer of heat across the building shell. Determining the overall performance of the glazing assembly should include the effect of this thermal bridging. The solar heat gain or shading coefficient is a fixed property of the glazing assembly, meaning it equally mitigates solar gain in both the summer and winter. Therefore, while improving energy savings in the cooling season, it achieves the inverse in winter when building heating demand and energy use increases. Low-shading coefficient glazing is not ideal for solar control; instead, implementation of effective shading devices allows seasonal control of solar gain and optimizes year-round energy consumption. See the following section for details on shading.

In a climate that experiences distinct heating and cooling seasons, it is important that the overall glazing performance and area be optimized for annual performance.

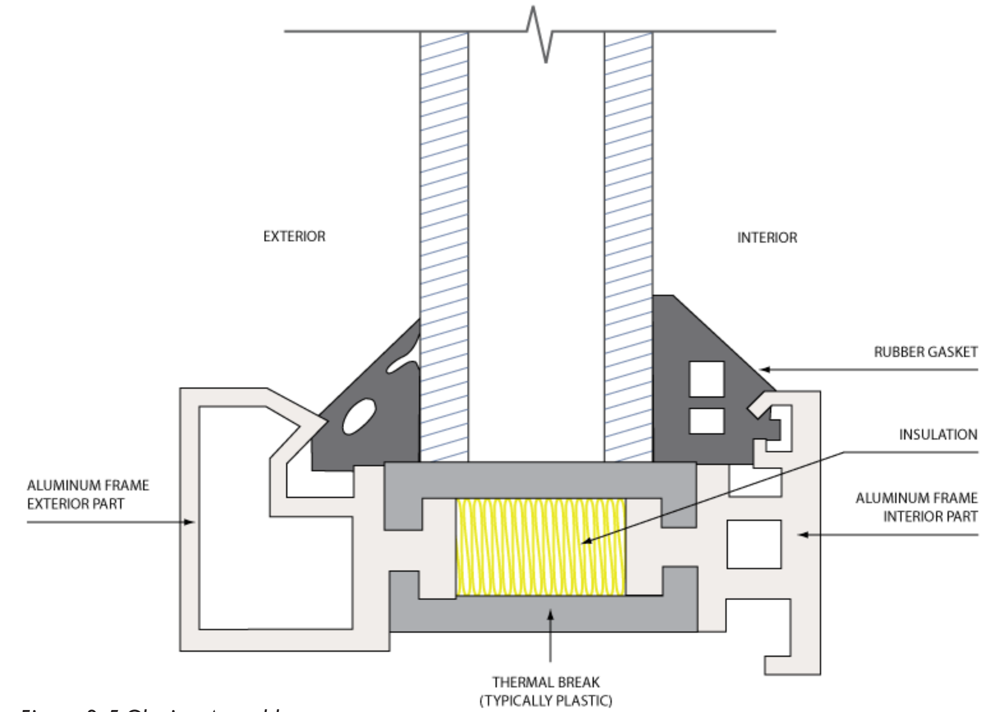


Figure 3-5 Glazing Assembly

Benefits

1. High performance glazing reduces heating and cooling energy demands
2. More stable interior surface temperatures increase thermal stability in the conditioned spaces, leading to improved thermal comfort
3. Reduced glare

Limitations

1. Capital cost

Application Potential for South Capitol Campus

Extreme climate conditions such as those in Santa Fe require careful consideration of the glazing assembly specification. Recommended minimum R-values and shading coefficients are listed below in Figure 3-6.

Glazing assemblies with higher levels of insulation will be beneficial in Santa Fe's cold mountainous climate. At minimum, assemblies should be clear double-pane assemblies with low-e coatings and have thermally broken or wooden frames. The clear glass will allow for passive heating in the winter, thus reducing building system energy loads. The winter climate can reach lows of -17°F: Consider triple-pane assemblies for facades with no solar gain or any facades with high glazing-to-wall area ratios.

Conversely, in the summer, Santa Fe has a sunny climate, which means tint and the resulting SHGC of windows and overall window area should be assessed. External shading is not typical of Santa Fe architecture. Consider specification of an appropriate SHGC that takes into account local architecture. This parameter, similar to shading, affects the amount of solar heating available to the space. While most spaces on the campus will be offices with expected high internal heat gains and a greater demand for cooling, the cooling load reductions achieved with tinted glass may impact energy use more effectively than the passive heating strategy.

Overall Glazing Performance *	ASHRAE 90.1-2004, Zone 5B	Recommended
Units	($ft^2 \cdot {}^\circ F \cdot h/Btu$)	
Overall U-value †	2.17	3.5
Overall SHGC †	0.26	16

* Overall performance to include the effects of thermal bridging across the frame

† Values are based on a maximum of 50% wall glazing

Figure 3-6 Glazing Assembly Performance

Detailed energy modeling will determine the optimized glazing-to-wall ratio, as well as the optimized thermal performance of both the glazed and opaque envelope assemblies. Life-cycle cost analysis will provide an economic understanding of this passive design strategy.

D.5 SOLAR SHADING

External solar shading is overhangs, blinds, louvers, trellises, or anything else that blocks the sun's rays from heating the building envelope and entering the building through glazing during the summer.

Interior solar shading features, typically internal blinds, are any material that is used to block the sun's rays at the perimeter but inside the building. Internal shading is significantly less effective at reducing solar heat gains, and therefore cooling energy requirements, inside the building.

Give careful consideration to shading design to reduce summer solar heat gains but maximize winter solar heating.

Benefits

1. Reduced demands on mechanical cooling system
2. Reduced glare
3. More stable interior surface temperatures increase thermal stability in the conditioned spaces leading to improved thermal comfort

Limitations

1. Must be balanced with the benefit of solar heat gains in winter
2. Implementation with the Pueblo Revival architecture

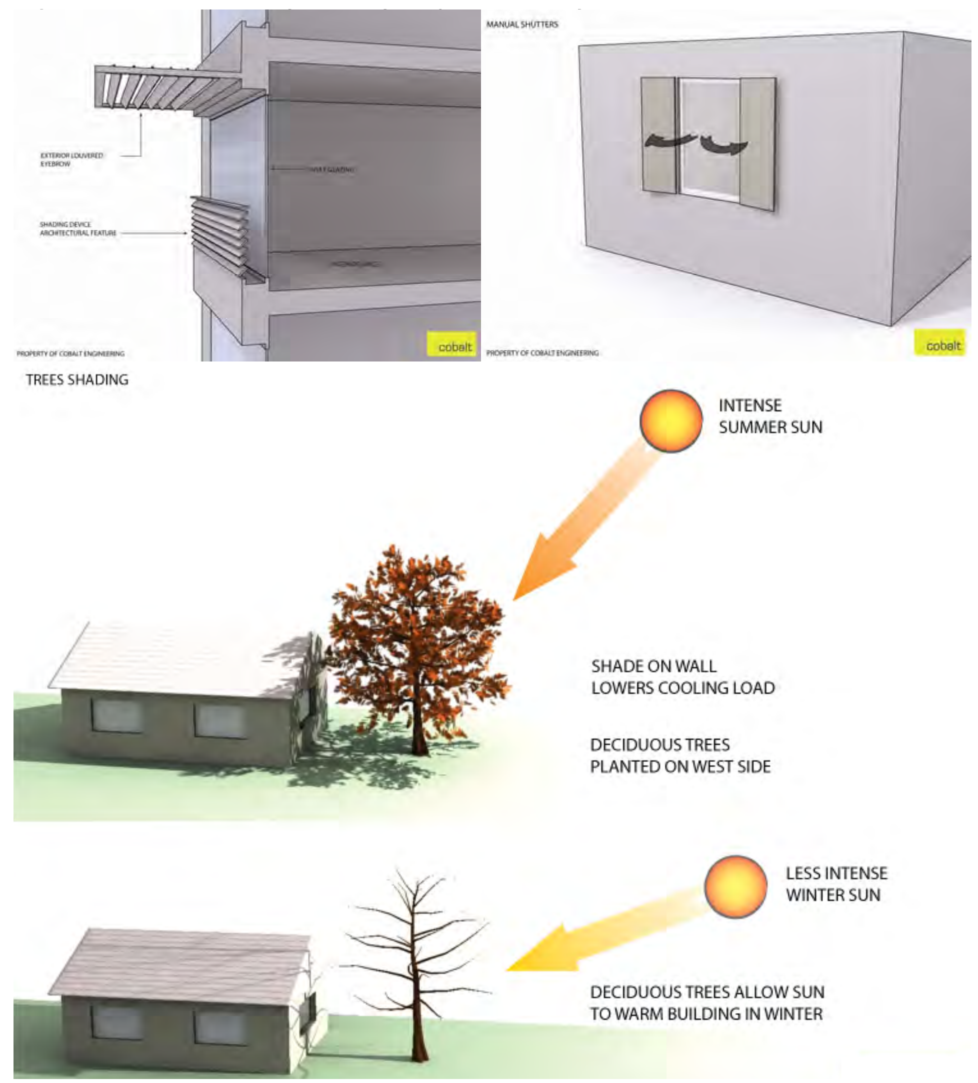


Figure 3-7 Solar Shading Strategies

Application Potential for South Capitol Campus

Considering that the Santa Fe climate varies seasonally, design of the solar shading strategies will need to respond to these variances. As discussed in the previous section; external shading devices are a more effective solution to seasonal solar gain control than reliance on the solar heat gain coefficient of glazing.

Design fixed shading features to balance, on an annual basis, the comfort benefit and reduce cooling energy requirements during summer with the reciprocal negative impact on heating energy requirements during winter. Ideally, shading devices should adapt seasonally as required, allowing passive solar heating in the winter and full mitigation of solar heat gain into the buildings in the summer. Seasonally adaptable shading strategies might include:

1. Operable blinds or shutters
2. Overhangs optimized for local sun angles
3. Deciduous trees located outside south and west facades

Another consideration will be the challenge of implementing shading strategies that complement the local Pueblo Revival architecture. An existing strategy for reducing solar gain is the use of recessed windows. Similar strategies as well as new innovative approaches should be explored further.

As mentioned previously, external shading is the most effective means of reducing building cooling loads. A detailed review should be done of the energy, comfort and economical benefits of external shading devices to control solar heat gain compared to improved coefficient of shading of the glazing itself.

D.6 THERMAL INSULATION

Effective thermal insulation is the most critical design parameter of the building envelope, as it reduces the rate of heat loss and gain to and from the outside. This reduction is expressed in terms of R-value and U-value. Minimum R-values and maximum U-values are prescribed by the ASHRAE 90.1 energy standard for buildings and noted in Figure 3-8.

Good thermal insulation provides comfortable indoor environments without using excessive amounts of energy for the mechanical heating system. Controlling the surface temperature on the envelope interior directly impacts thermal comfort by both radiant and convective heat transfer. Interior envelope surface temperatures must remain high enough during winter to avoid condensation and maintain the integrity of the assembly and materials over time. Critical consideration to the placement of the insulation within the assembly accomplishes this control.

Thermal bridging is a critical envelope performance issue, previously discussed in the glazing subsection. If present, thermal bridging will de-rate the performance of well-insulated building envelopes. Avoid the effects of thermal bridging by using continuous insulation on wall and roof assemblies.

Benefits

1. Reduces heating energy consumption
2. More stable interior surface temperatures increase thermal stability in the conditioned spaces

Limitations

1. Capital cost
2. Rate of diminishing returns, best investigated with building simulations

Application Potential for South Capitol Campus

The design of the building insulation plays a critical role in the overall building performance because of Santa Fe's cold mountainous climate.

The minimum prescriptive insulation requirements of ASHRAE Standard 90.1 should be exceeded, as expressed in Figure 3-8. Insulation, however, has a rate of diminishing returns at the point where added insulation thickness does not improve the energy performance significantly. Design of the envelope assembly should avoid thermal bridging. Use annual building energy simulations to explore in depth this overall assembly performance, including effects of any thermal bridging.

Thermally massive assemblies should have insulation on the exterior side of the mass. The design stage should pay further specific attention to the wall assembly construction.

D.7 PASSIVE EVAPORATIVE COOLING

Assembly Description	ASHRAE 90.1-2004, Overall Performance	Recommended Overall Performance
Units	(ft²·°F·h/Btu)	
Roof	29	37
External Walls	12	16
Exposed Floors	30	30
Glazing	2.17	3.5

NOTE: Overall assembly performance will need to be confirmed as part of a detailed thermal analysis performed by a third party building envelope specialist.

Figure 3-8: Recommended Minimum R-Values for Santa Fe from ASHRAE 90.1-2004 Climate Zone 5B

In the building, evaporative cooling uses heat from the spaces to convert water from a liquid to a vapor which converts the air in the space from warm and dry to cool and moist.

In order to cool a space by evaporative cooling, moisture must be added to an airstream. This addition can be achieved by drawing air across or through existing water (e.g., a water feature located within the building, a natural exterior body of water, a hydroponic living wall, etc.), providing a cooling effect to the space.

Benefits

1. Reduced energy consumption of high grade energy (electricity)
2. Potential to impact comfort by increasing humidity

Limitations

1. Increases water consumption

Application Potential for South Capitol Campus

Depending on the quantity of moisture evaporated and absorbed by air, this method is a very effective passive cooling strategy, especially in the hot and dry conditions Santa Fe experiences during summer.

However, the water required for operation is a consideration. This system would be able to supplement cooling for a building using an all-air cooling system or a dedicated outdoor air system with central air handling units.

D.8 NATURAL VENTILATION

Harnessing naturally available forces to supply, move and remove air through a building achieves natural ventilation. Two principal types of natural ventilation used in buildings are wind driven ventilation (e.g., operable windows, trickle vents, etc.) and stack ventilation (e.g., wind towers, atriums, etc.). Figure 3-9. Example of Natural Ventilation with an Atrium uses a library to demonstrate the flow of air when an atrium is used to drive natural ventilation in a building.

Natural ventilation can reduce building energy by minimizing the need to rely on forced air or fan-powered systems. Free cooling options are also available from natural ventilation strategies such as night cooling or free cooling during the day. Both strategies can positively impact the cooling energy consumption of the building.

Benefits

1. Night cooling will contribute to reducing cooling energy consumption
2. Night cooling used with thermal mass will contribute to the thermal comfort of occupants
3. Additional capital costs are minimal for a building using natural ventilation

Limitations

1. Concern for building security with nighttime openings in the building envelope for air movement
2. The natural ventilation air distribution patterns need to be carefully designed and implemented to be effective

Application Potential for South Capitol Campus

Natural ventilation is an encouraged strategy for this site, especially if implemented in conjunction with thermal massing. This approach capitalizes on the cool external temperatures typical of the local Santa Fe climate to pre-cool the building mass. Essentially, the cool air removes the heat accumulated in the building mass during the day. This strategy leads to significant cooling energy savings when implemented effectively with appropriate control strategies.

Implementing this strategy on the existing buildings will require using existing atriums and providing operable windows and/or trickle vents. New buildings will require shallow floor plans or use of atriums in conjunction with trickle vents and operable windows. Detailed thermal modeling and Computational Fluid Dynamics analysis will determine the effectiveness and appropriate implementation of this strategy on the South Capitol Campus.

D.9 SUMMARY

The envelope and the passive behavior of the building are the first and most

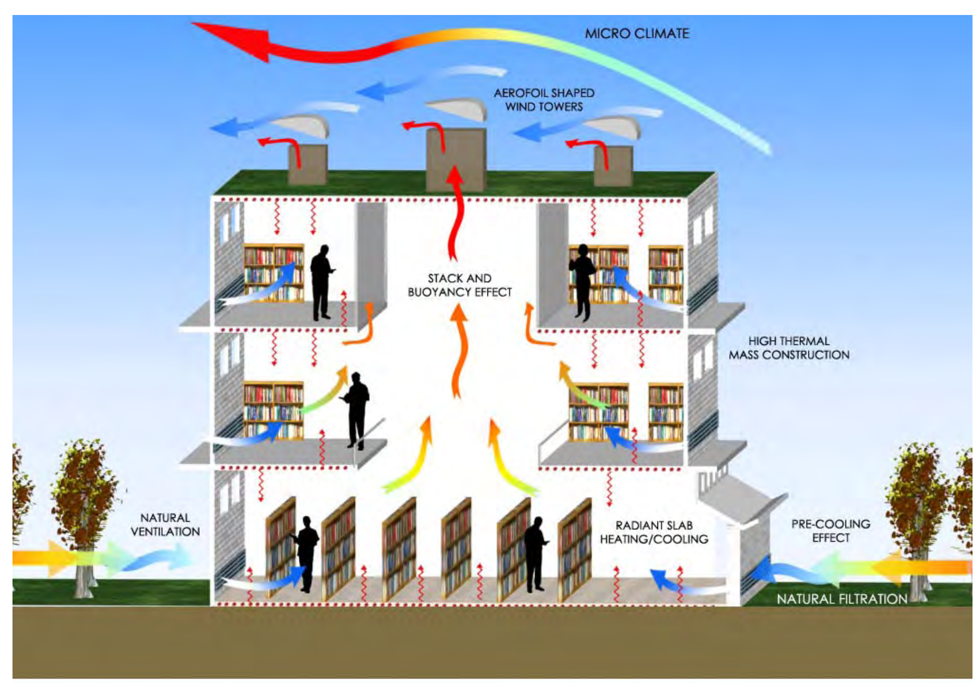


Figure 3-9: Example of Natural Ventilation with an Atrium (Potential for Runnels and Montoya Buildings)

critical elements in defining the thermal and energy performance of the building. While active systems consume the most energy, the strategies discussed above have the most significant impact on energy performance.

Opportunities

The strategies listed below are identified as having the greatest impact in realizing the energy goals of the project and are appropriately suited for the local conditions of the South Capitol Campus:

1. Night cooling
2. Shallow building plan and use of atriums
3. High performance glazing and opaque surfaces
4. Heavy mass

Next Steps

Further exploration of all strategies through extensive energy modeling and building simulations will determine the balance or extent of implementation. Specific features that will require a more detailed review include:

1. Thermal properties of the envelope
2. Passive evaporative cooling
3. External solar shading

E. PRIMARY ENERGY SOURCE OPTIONS

E.1 OVERVIEW OF ENERGY TYPES

After minimizing the energy consumption of the site, the focus is strategizing efficient ways to generate or harness energy for the site. Consideration of energy sources directly relates to the selection of active mechanical systems and thus both should be evaluated congruently. Identification of suitable energy sources for building systems energy involves two required forms of energy to address:

1. Electrical energy: Used for lighting, plug loads and to provide power to perform mechanical work, such as for compressors, fans, or pumps
2. Thermal energy: Transfer of thermal energy for space heating, domestic hot water heating, space cooling, etc.

Since both forms of energy are used, it is important to identify both electrical power sources and thermal energy sources. Two main fuel sources, fossil fuels and renewable energy can generate thermal energy.

The important distinction for the sustainability or renewability of resources is the time frame of renewal. Sustainable resource use requires energy use at a rate equal to or less than the rate at which the resource can be renewed, and only those which renew within this time frame are renewable.

The following lists primary energy resources:

1. Fossil fuels – fossilized organic matter formed by anaerobic decomposition of buried dead organisms. These fuels are combustible, consisting of hydrocarbons. Examples are oil, gas, and coal.
    a. Renewal time = millions of years

2. Biomass – Living plant matter and organic wastes derived from plants, animals, marine life and humans.
   a. Renewal time = 10s to 100s of years
3. Hydro – gravitational potential energy of water. The water cycle is renewed through the evaporation of water by the sun and precipitation of this water at elevations higher than sea level. The potential energy of water drives the rotation of electricity-generating turbines.
   a. Renewal time = months to years
4. Earth source – solar radiation absorbed and stored in the earth – quick renewal time
   a. Renewal time = days to months
5. Wind – air masses in motion due to convection, air heated by warm earth and water; quick renewal time, though intermittently available
   a. Renewal time = intermittently available

Sustainable building designs should consider the primary energy resource that is impacted by the building operation, and not limit these considerations at the property line. For example, electric resistance heating is often considered to be 100% efficient conversion of electricity to heat. However, when a fossil fuel thermal power plant generates this electricity, such as the coal plants in remote locations that provide electricity to the State of New Mexico, the overall fuel-to-heat conversion efficiency is much lower, and can be less than 30%. In other words, the electric baseboard heater is less than 30% efficient.

Sustainability designs must reduce dependence on fossil fuels for obvious reasons, and can do so by using renewable energy sources either on site or though local utility providers. The following report sections discuss options to consider for the South Capitol Campus, categorized as follows.

1. Electrical power sources
   a. Grid
   b. Photovoltaic
   c. Auxiliary wind
2. Thermal energy sources
   a. Natural gas
   b. Earth exchange (high and low temperature)
   c. Solar thermal
   d. Sewer heat recovery
   e. Alternative fuels including biomass
3. Combined heat and electrical power
   a. Fossil fuel
   b. Biomass
   c. Refuse derived fuel
   d. Purchased biofuel

E.2 CONSIDERATIONS FOR RENEWABLE ENERGY SOURCES

Integrating renewable technologies on site requires consideration of the following:

1. Availability: The availability of the energy source depending on the season, time of day, local microclimate and size of the site; and environmental factors
2. Timing: Designs must buffer the time difference between the source's availability and building demand. For example, solar water heating systems must have adequate storage to provide hot water early in the morning
3. Electricity: Many renewable low-grade thermal energy sources require heat pump technology which, though highly efficient, depends on electricity to operate
4. Back-up systems: Social expectations require that back-up systems always be available, in some cases resulting in redundant equipment or system components
5. Energy (grade or quality of energy): High-grade thermal energy sources produce very high temperatures that are usable in various systems. Low-grade thermal energy sources provide moderate temperatures that can be combined with only a limited number of compatible heating and cooling systems

E.3 ELECTRICAL POWER SOURCE OPTIONS

Electricity is not an energy source but rather the most versatile form of energy, a "carrier" suitable for transmitting and distributing energy for an almost unlimited range of uses.

At the South Capitol Campus, electricity is required in all buildings to run HVAC equipment, lighting, plug loads, etc. as well as to operate several of the renewable thermal energy sources listed in further sections.

A sustainable approach would consider the source of the derived electrical energy as well as the efficiency of electricity production. While the provision of electricity to buildings is unavoidable, the use of this high-grade energy form should be minimal.

Power plants, especially plants that produce electricity by coal or other fossil fuels, are the primary contributors to carbon gas emissions.

<u>1. Grid Electricity</u>

Utility providers generate grid electricity, typically at large-scale power plants, and distribute it via large capacity, high-voltage transmission lines to consumers who purchase the electricity.

Coal is the basis of the most prevalent method of electricity generation in the State of New Mexico. PNM, the electricity utility serving Santa Fe, generates power at plants that are fueled by coal (41% of total), nuclear power (16%, natural gas (22%) and wind (8%). The remainder of PNM's power comes from power purchases.

The Four Corners coal power plant that provides the electricity to the Santa Fe region and the South Capitol Campus is just west of Farmington, NM. The plant is located approximately 180 miles northwest of Santa Fe. This plant produces over 2,000 lbs. of carbon emissions for every MWH of energy.

Realizing a sustainable vision with a low carbon footprint for the campus will prioritize the use of alternate power sources over coal-sourced grid electricity.

Benefits

1. Always available
2. Easy to implement
3. Opportunity to purchase renewable electricity with the PNM SkyBlue program
4. Opportunity to generate on-site electricity and sell back to the utility

Limitations

1. Low efficiency energy use with high greenhouse gas emissions
2. Efficiency lost through long transmission distances
3. Inefficient use of high-grade energy when used for thermal heating where low-grade local energy sources could be used

Application Potential for South Capitol Campus

Electricity is a reliable, readily available and relatively inexpensive source of energy. Because of these benefits, more sustainable alternatives generally have very poor payback periods. However, electricity, especially the electricity available to the Santa Fe region, is inefficiently produced and produces large amounts of CO_2 electricity. The production of electricity therefore is inefficient (30%) and produces carbon emissions. PNM produces nearly 10 million tons of carbon emissions each year, which is 1,418 lbs. of CO_2 per MWH of energy.

While it is unreasonable to consider the elimination of grid electricity as an energy source, it is important to incorporate electricity produced from alternate sources. PNM currently provides optional purchasing of "green power" through its SkyBlue program. The "green power" is generated from wind farms consisting of 136 wind turbines located in House, NM.

PNM also offers a program to support customer-owned electricity generation systems. These systems can be interconnected to the PNM distribution system and are net-metered, providing an economic incentive for localized generation plants. With "net metering," any excess electricity that is generated on site via renewable sources is essentially sold back to the utility for distribution in the grid. This system helps offset the challenges of intermittent supply and variations between supply and demand timing, and provides an added financial incentive to explore on-site electricity generation.

<u>2. Photovoltaic</u>

Photovoltaic (PV) electricity is generated using solar radiation incident on PV collector panels. Figure 3-10 Photovoltaic Panels shows this technology.

PV panels, made of a precise combination of crystalline materials, convert photons from the sun to generate direct current (DC). An inverter converts the DC to alternating current (AC) and feeds it to the local electrical grid (net metering), where it is stored in batteries on site and used by AC devices in the buildings.

Benefits

1. On-site electricity generation offsets grid power consumption with clean, renewable source

2. Reduced GHG emissions
3. The net metering program from PNM provides financial incentives once the photovoltaic panels are operational
4. The net metering program also reduces the required storage capacity on site
5. Santa Fe has many hours of sun annually, offering an ideal climate for solar collectors
6. Minimal maintenance
7. Local incentives are available to offset capital costs
8. State, federal tax credits are available

Limitations

1. Cost per unit of electricity generated is very high, due to low efficiency. As a result, payback can be long when compared to other renewable options.
2. Panels currently do not have a long lifespan and their efficiency degrades significantly within the first 20 years
3. Panels have high embodied energy and are made of heavy metals, which must be disposed of safely at the end of their service life
4. Storage of electricity is required (batteries, etc.)
5. A large area is required for installation of the panels

Figure 3-10: Photovoltaic Panels

Application Potential for South Capitol Campus

As the equipment, plug loads and lighting for the campus require high-grade electrical energy, photovoltaic panels are best suited for producing electrical energy on site. Solar photovoltaic panels can be integrated with the building envelope of the new or existing buildings, or mounted in arrays independent from the buildings. For example, mount the panels on a structure installed in the parking areas. The panels will provide shade to the cars and reduce heat-island effect by capturing solar energy that would otherwise be absorbed by the paved parking surfaces. The solar electricity would charge batteries on site or could be sold back to PNM through its net metering program. The realistic capacity that can be generated on site, would determine the applications for Santa Fe. Capacity is a function of how much space is available for collectors outside and batteries inside the building.

The installation of photovoltaic panels must be balanced with the number of solar collectors on the roof. Depending on the solar collector area available, the percentage of collectors used to generate hot water should be balanced with the number of collectors used to generate electricity. (Refer to the solar thermal collector discussion for details.) A feasibility study will determine the area and combination of solar collection devices that would be of the greatest benefit to the campus, both financially and in terms of energy performance.

The State of New Mexico currently has incentives to bring solar panel manufacturers into the state. Use of this technology on the South Capitol Campus aligns with existing government initiatives.

Determination of the most energy-efficient, low-carbon solution requires a detailed energy summary comparing detailed microclimate renewable opportunities.

<u>3. Auxiliary Wind Power Generation</u>

Wind turbine technology has advanced in recent years to be an efficient producer of electricity. Turbines come in all sizes and are typically mounted on an independent tower, on or off site. Wind generation is generally only economical in large-scale installations in areas with consistently high wind speeds.

Benefits

1. On-site electricity generation offsets grid power consumption with clean, renewable source
2. Reduced GHG emissions
3. The net metering program provides financial incentive once the turbine(s) are operational
4. The net metering program also reduces the required storage capacity on site
5. Visual demonstration of sustainability

Limitations

1. Inconsistent source of energy dependent on wind patterns
2. High initial capital cost
3. Ongoing maintenance and maintenance worker hazard
4. Incorporation into the local architecture and aesthetic vision for the campus will require coordination
5. Wind generators are noisy

Application Potential for South Capitol Campus

The generation of electricity through harvesting kinetic energy from wind is another opportunity to reduce dependence on grid electricity. Micro-wind generators, shown in Figure 3-11, are recommended as the wind-driven technology for the South Capitol Campus. Because the campus is within the city limits, traditional wind turbine towers are not feasible due to the noise generated

Figure 3-11: Micro-Wind Generators

by the rotating turbines. Micro-wind generators can produce power with wind speeds as low as 2 mph.

A weather station is recommended to be installed on the South Capitol Campus to record wind data prior to estimating energy production and the feasible size of the micro-wind generator array. Long-term trends (preferably a full-year cycle) of parameters such as wind speed, direction, air temperature and humidity should be recorded.

If wind conditions prove favorable, micro-wind generators could be installed on site, producing electricity for the site when the production and demand occur simultaneously, and to charge on-site batteries. Any excess electricity could be sold back to PNM through their net metering program.

The location of the micro-wind generator arrays would be a function of aesthetics and wind patterns.

Determination of the most energy-efficient low-carbon solution requires a detailed energy summary comparing detailed micro-climate renewable opportunities.

E.4 THERMAL ENERGY SOURCES

<u>1. Natural Gas</u>

Natural gas is a fossil-fuel-based energy source, consisting mostly of methane which burns cleaner, with fewer emissions than other fossil fuels. While one of the cleanest fossil fuel options, the CO_2 emissions rate is still considerable at 459 lbs CO_2/MWh.

Natural gas is typically used in buildings as a thermal energy source; burned in boilers to generate hot water for domestic and space heating applications. It is a high grade energy source, which means that through combustion, high temperatures are generated for heating water and air used for a wide variety of system types and applications.

Benefits

1. Conventional and reliable
2. High-grade thermal energy with the greatest flexibility in HVAC system options

3. Effectively and efficiently partnered with improved boiler technology (condensing boilers)
4. More efficient in terms of carbon emissions at local level than grid electricity (459 lbs/MWH versus 2000 lbs/MWH)

Limitations

1. Contributes greenhouse gases to the atmosphere
2. Non-renewable fossil fuel

Application Potential for South Capitol Campus

Natural gas is available in Santa Fe through the New Mexico Gas Co. Due to the carbon emissions rate of natural gas, it is important to put in measures to reduce dependence and consumption of this fuel.

Natural gas will be required on site to provide back-up or supplemental heating to the renewable energy source used for domestic hot water heating and the building heating plant. However, by applying passive and active technologies as discussed in this report, the dependence on and overall consumption of natural gas can be reduced.

Determination of the most energy-efficient low-carbon solution requires a detailed energy summary comparing thermal energy sources.

2. Earth Source Exchange Systems (Ambient Temperature)

Solar energy is absorbed by the earth and below a certain depth (between 5' to 10'), the ground is a constant, site-specific temperature year round. Earth-source energy systems make use of this constant temperature as a source or sink for low-grade thermal energy. These systems use heat pumps and a circulating fluid (water or a water-glycol mixture) to extract heat from the ground in winter and reject heat to the ground in summer. The heat pumps form part of the building mechanical plant and supplement the transfer of energy between the ground and the building's mechanical system though a vapor-compression cycle to produce temperatures appropriate for the building systems.

Four primary types of earth source exchange systems, as shown in Figure 3-12 Earth Source Exchange Systems, can supplement the mechanical plant: vertical closed loop, horizontal closed loop, open loop groundwater and surface water. The local geology and hydrology determines which system is most appropriate for the site.

Benefits

1. Reduces the facility dependence on fossil fuel-based thermal energy, and reduces the amount of primary energy consumed overall
2. Reduces GHG emissions
3. Once installed, requires very little maintenance
4. Robust systems with reliable source
5. Low-grade energy matches well with low-grade and passive systems
6. Less mechanical/equipment space required in the building because chiller and cooling tower/fluid cooler are not required
7. Ideally coupled with a centralized ambient temperature loop

Limitations

1. Dependent on electricity, most likely from the local grid, for heat pump compressor operation
2. High construction costs associated with testing, drilling, and monitoring the installation
3. Requires a back-up heat source, in this case a boiler system

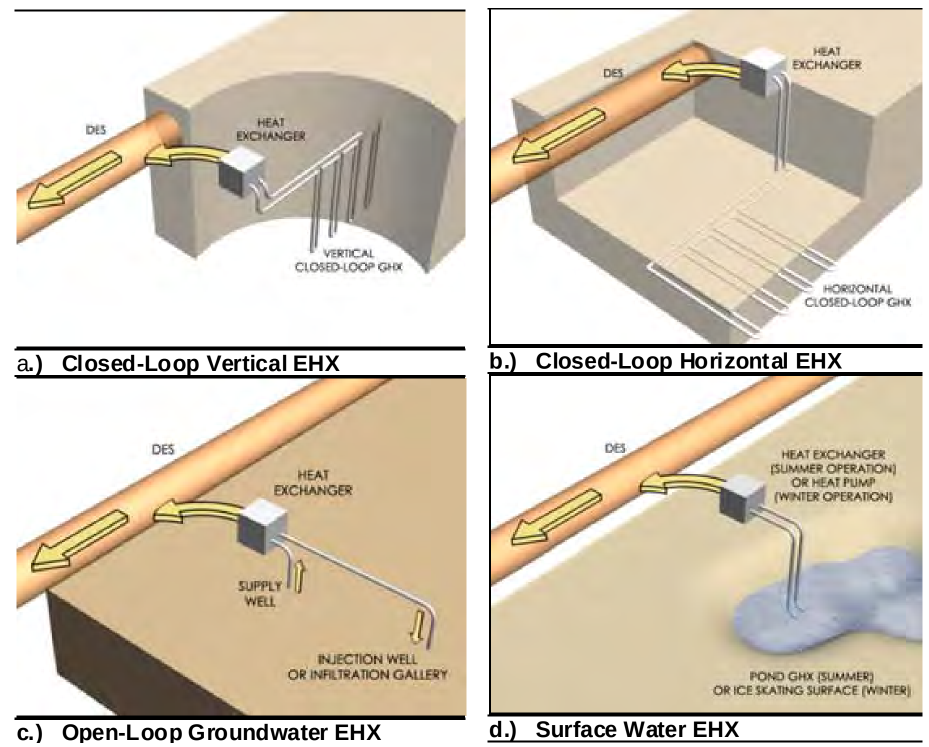


Figure 3-12: Earth Source Exchange Systems

Application Potential for South Capitol Campus

Since the type and size of heat exchange system applied depends on the site geology, site testing should be conducted to confirm if earth source exchange is a feasible approach for South Capitol campus. If site geology is favorable, this system would provide free heating energy for the building as well as a heat rejection sink for space cooling. The geo-exchange field(s) can be installed below open green spaces, parkades, new buildings and/or existing buildings. Refer to the sustainability plan in Section IV Design Guidelines for proposed locations for an Earth Source exchange system.

This thermal energy source provides water and air tempering at more moderate temperatures than conventional boiler or chiller plant equipment and requires mechanical heating and cooling systems that operate at these moderate temperatures. When well-integrated in the overall system, earth source exchange systems consume small amounts of electricity, using highly efficient heat pumps in lieu of high amounts of energy to run gas boilers and chiller cooling tower packages.

Determination of the most energy-efficient low-carbon solution requires a detailed energy summary comparing thermal energy sources.

3. Solar Thermal Energy

In a solar thermal system, solar collectors heat water (or a water-glycol mixture) by the sun, and building systems use this thermal energy for either domestic water or space heating. This system is more efficient for harvesting solar energy than the use of photovoltaic panels because the grade of energy is not changed. Low-grade thermal energy is harvested as low-grade thermal energy, using photovoltaic panels' low-grade thermal energy to produce high-grade electrical energy, which is inherently inefficient.

Benefits

1. The most reliable primary renewable energy source available on the South Capitol Campus
2. Free thermal energy source with very low electrical energy use only for circulating pumps
3. Relatively low maintenance
4. Can be integrated as part of the roofing system (if flat plate panels are used)
5. Reduced GHG emissions
6. Reduced dependence on fossil fuels
7. Low-grade energy matches well with low-grade and passive systems
8. Solar-to-thermal conversion efficiency is ~50-60%, significantly greater than the solar-to-electricity efficiency of ~10%

Limitations

1. High capital cost
2. Intermittently available source requires adequate storage capacity for hot water in the morning hours, as well as a back-up system

Application Potential for South Capitol Campus

Santa Fe receives high levels of direct solar radiation year round. Even with low outdoor air temperatures, certain types of solar collectors, such as the one shown in Figure 3-13. Evacuated Tube Solar Collector, can generate high temperatures. The circulating fluid would likely be a mixture of glycol and water, and heat exchangers between the solar system and the central hot water heating system would prevent cross-contamination. The heated water would be first available to the respective building system, and any excess could be transferred to an ambient-temperature campus loop and ultimately be stored in the earth source exchange system. Selecting the type of collector, flat plate

Figure 3-13: Evacuated Tube Solar Collector

or vacuum tube, will be a function of annual energy yield, capital cost, and any limitations on the collector installation. A back-up boiler system would also be installed. For information regarding location and installation of these panels, refer to E.3 Electrical Power Source Options.

Determination of the most energy-efficient low-carbon solution requires a detailed energy summary comparing thermal energy sources.

4. Sewer Heat-Recovery and Rejection

A sewer heat recovery system extracts low-grade heat contained in the greywater and wastewater flowing down the sewer system. Heat exchange can be at the individual building or on a campuswide scale. Figure 3-14. shows an example of a sewer heat recovery system.

Benefits

1. Harnesses otherwise wasted thermal energy, offsetting thermal energy consumption from fossil fuels
2. Heat sink for cooling
3. Reduced GHG emissions
4. Reduced dependence on fossil fuels
5. Low grade energy matches well with low-grade and passive systems

Limitations

1. Campuswide system requires added coordination between disciplines
2. Capital costs and long payback period

Application Potential for South Capitol Campus

The campus could use either or both sewer heat recovery system options. Each building could be equipped with the building-level heat exchanger on the building sanitary outflow pipe. The main sewers could be equipped with heat exchangers and heat pumps could transfer heat between the sewer line and the closest building. The low-grade energy would preheat domestic hot water or be part of a low-grade energy space heating system.

This strategy is a means to harvest existing biomass energy on the site. Determination of the life cycle costing and energy payback of this option will require a feasibility assessment.

5. Biomass Energy

A wide range of biomass fuels can heat and generate electrical power to reduce utility costs and GHG emissions, and to improve energy security. Biomass fuels require careful consideration of their availability and characteristics, and the viable energy technologies that can reliably use these fuels.

The most prevalent biomass fuel source is wood pellets. Wood chips come from waste timber or fallen trees from the forestry industry. While burning wood pellets produces CO_2 as a product of combustion, the actual combustion process is considered to be net-zero carbon emissions. This is because as the trees grow they absorb CO_2, thus negating the release of carbon when burned. However, biomass fuels are not net-zero carbon emissions, due to the energy required to process the fuels.

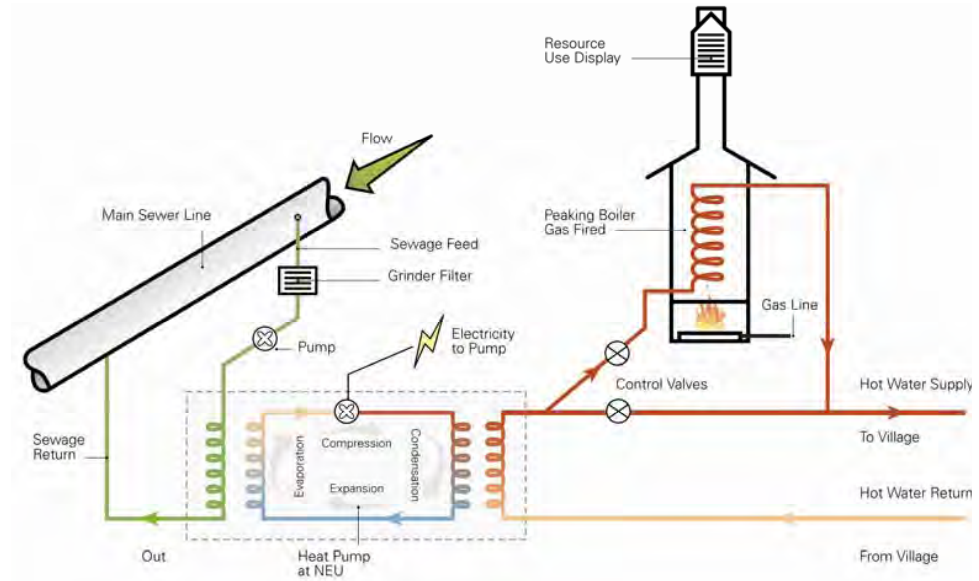


Figure 3-14: Example of Sewer Heat Recovery

Application Potential for South Capitol Campus

The ability to use biomass at the South Capitol Campus depends largely upon the type of fuel and the scalability of the applicable energy conversion technology. The most appropriate biomass fuel is wood pellets.

From a cost perspective, typically local sources of waste wood material are the most affordable options. The South Capitol Campus has an opportunity to use the local harvest of pine beetle wood or wood cleared as part of fire protection initiatives. The combination of consistent quality and low-cost sources for wood pellets supports the positive business case for an alternative fuel energy plant. Figure 3-15 Scale of Feedstock Hopper to Boiler shows the feeding method of wood pellets to the heating system.

Determination of the most energy-efficient, low-carbon solution requires a detailed energy summary comparing thermal energy sources.

E.5 COMBINED HEAT AND ELECTRICAL POWER

1. Natural Gas Combined Heat and Electrical Power

A combined heat and electrical power system uses an on-site facility that burns natural gas, or another combustible fuel source, to turn turbines which generate electricity while allowing the heat byproduct to be recovered.

When fuel combustion moves a turbine, only 35% of the fuel energy is converted to electricity and 65% is converted to heat. Typically, the heat is simply rejected to the atmosphere. This low-grade heat can be reclaimed for space heating, domestic water heating, or to run an absorption chiller cycle. When both electricity and heat are usable, the process is called Combined Heat and Power (CHP).

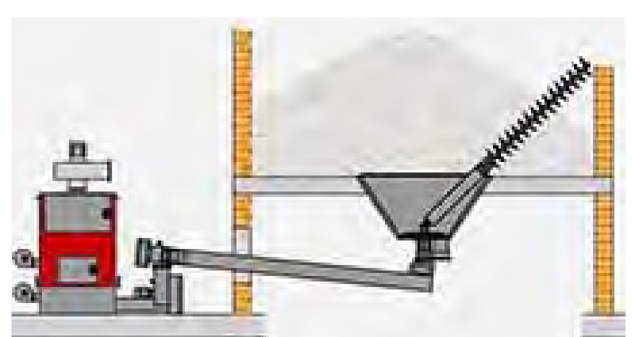


Figure 3-15: Scale of Feedstock Hopper to Boiler

Benefits

1. Lower purchased electricity at facility
2. Potential overall efficiency of 70%
3. Generation of low-grade energy matches well with low-grade and passive building systems
4. Reduction of GHG emissions when compared to grid electricity

Limitations

1. Increased dependence on depleting fossil fuel source
2. Space requirements
3. Turbine size, noise and vibration
4. Aesthetics

Application Potential for South Capitol Campus

This strategy is ideal because it meets the demands of both types of energy, thermal and electrical, identified as requirements for this site. A combined heat and power plant could be easily located on the campus and would provide electricity for the building equipment and thermal energy for space heating or domestic water heating. The CHP equipment would require space within one of the buildings and a sufficient exhaust route, similar to that of an emergency generator.

Determination of the most energy-efficient, low-carbon solution requires a detailed energy summary comparing thermal energy sources.

E.6 ENERGY DISTRIBUTION OPTIONS

After energy sources have been identified, the next step in the design is to identify the most effective means of distributing energy to the site. The means of distributing energy depends on the type of energy. The South Capitol Campus has two forms of energy; thermal and electrical.

1. Thermal Energy Distribution Options

Three broad categories of thermal energy distribution systems are relevant to South Capitol Campus:

1. Conventional localized energy: Heating and cooling systems are located within every building and buildings have no interconnection to each other or any district heating or cooling infrastructure outside of the building, other than connection to local electricity and natural gas supplies.
2. Centralized district energy: A single central heating or cooling plant provides heating or cooling to all buildings through a common distribution system.
3. Decentralized energy: Multiple decentralized heating or cooling sources provide heating or cooling to a common distribution system for delivery to multiple buildings.

Benefits

1. Promotes reuse of existing building systems and infrastructure without the added construction costs of a new central plant. In this case, the existing tunnels between buildings can be used to house the distribution mains without substantial costs.

2. Flexibility and diversity of sources: Potential to allow for the integration of several energy sources and sinks to be tied into the common energy distribution loops, as well as the connection to new and existing buildings on the campus
3. Expandability: once the common distribution loop is constructed, the addition of multiple energy sources and sinks can be phased as project financing is available

Application Potential for South Capitol Campus

The existing distribution system on the South Capitol Campus is a hybrid of the above described above. A conventional, localized energy system heats space and domestic water. A hybrid of the decentralized and conventional localized energy distribution system distributes chilled water. The Montoya, Runnels and Simms Buildings use a common distribution system to provide chilled water to the building mechanical systems. Cooling capacity for these buildings is generated locally in each building and can be transferred between buildings. This distribution loop currently has extra capacity.

Both the centralized and decentralized approach to energy distribution would be appropriate for the South Capitol Campus. Each has benefits and limitations.

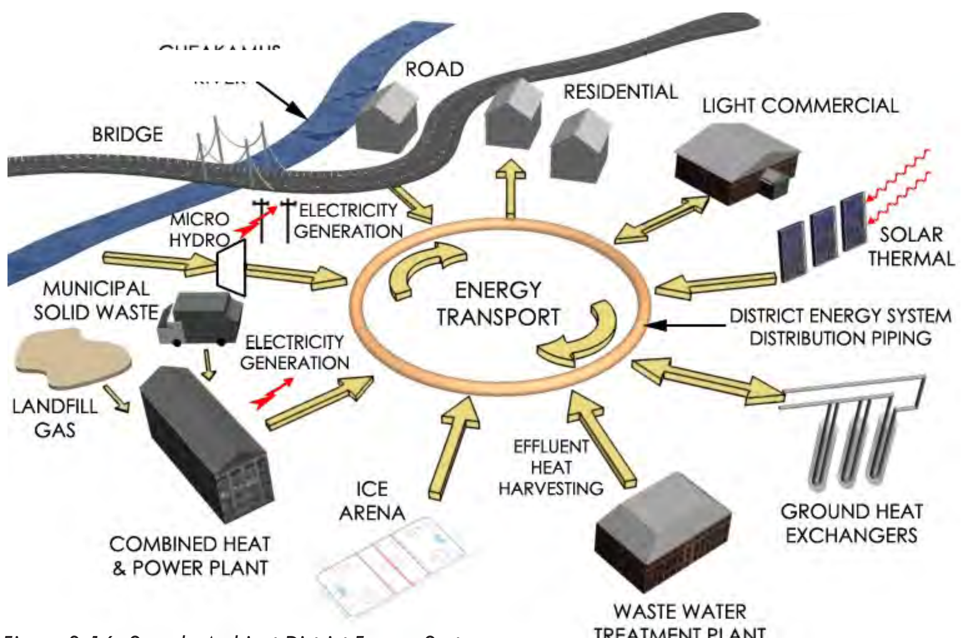


Figure 3-16: Sample Ambient District Energy System

A decentralized district energy distribution would allow for modular growth of the system. For example, as the campus expands and individual building upgrades proceed, the infrastructure of a decentralized system should be developed concurrently with construction phasing. This strategy would also permit the use of various active systems within each building. This type of distribution is illustrated in the Figure 3-16. Sample Ambient District Energy System.

The benefits of a centralized district energy distribution are economies of scale whereby an increase in the quantity of energy produced increases efficiency. A limitation of the system is that its one central location for the plant on site would require the infrastructure to both locate the plant and collect energy from the on-site sources, as well as distribute the energy produced to each building.

Overall, a detailed analysis of the construction phasing, feasibility of centrally located plant and energy sources should be explored.

<u>2. Thermal Energy Distribution System Temperatures</u>

There are two primary approaches to thermal energy distribution infrastructure from a temperature perspective:

1. Supply energy at temperatures that are directly usable by building energy delivery building systems, typically at more extreme temperatures.
2. Deliver ambient temperature fluid which has low energy (low ability to do work). Additional systems (i.e. heat pumps) at each building will complement this loop to deliver energy at temperatures useable by building mechanical systems.

Application Potential for South Capitol Campus

<u>3. Dual Temperature District Energy System (DES)</u>

These systems can be integrated with either a centralized or decentralized distribution strategy. This system is well suited because there is an existing low temperature chilled water loop that reduces the infrastructure required to interface with each building system. A notable disadvantage is that the potential of energy loss from the distribution piping is substantial. In order to use low-grade energy sources, mechanical equipment must elevate/reduce water temperatures before tying into the loop.

<u>4. Single Temperature DES</u>

Similar to the dual temperature DES, these systems can integrate with either a centralized or decentralized distribution strategy. This system is well suited because it facilitates the integration of multiple low-grade energy sources anywhere on the loop. The piping in this system does not require insulation, as it is not subject to energy losses. The single ambient-temperature DES system is much simpler, more flexible, readily expandable, more reliable and more robust than the conventional dual-temperature DES. The limitations of this system are that existing infrastructure on site is more consistent with the dual temperature strategy. The limitation of an ambient loop will also depend on the energy sources selected to be pursued as part of the campus development.

E.7 SUMMARY

Achieving the targets set for carbon emission reduction will require implementing a comprehensive plan for the site for use of renewable resources. Favor low-grade energy sources for thermal energy and pursue renewable means of electricity generation.

Opportunities

While the project will invariably use local utility services for electricity and natural gas, their use should be minimized. In all instances, the carbon emission rate of all fuels and the energy efficiency of the sources should be considered. The key opportunities for renewable sources, both electrical and thermal energy, are listed below:

<u>1. Electrical</u>

1. Solar Photovoltaic Panels
2. Combined Heat and Power

<u>2. Thermal</u>

1. Solar Thermal Panels
2. Earth Source Exchange System

<u>3. Biomass</u>

Next Steps

Analyze in detail the economic payback vs. energy efficiency and carbon emissions reduction. This study should balance renewable energy with minimized energy demands to determine the most appropriate strategies for on-site energy production and the percentage of energy derived from off-site sources.

F. MECHANICAL SYSTEMS

F.1 OVERVIEW OF BUILDING SYSTEM SELECTION

Buildings use energy to operate systems which provide space heating and cooling, ventilation, domestic hot water heating, lighting, and also to run various other types of electrical equipment from computers to refrigerators. The best way to reduce the overall amount of energy consumed is to first reduce the demand and amount of energy required before installing energy-efficient equipment.

Low-energy building designs are best achieved by the following design steps.

1. First, reduce the building energy demand by applying passive energy saving features to the building, such as solar heating and shading strategies (discussed in a previous section)
2. Second, assess the available renewable energy sources and target using fossil fuel and electricity prudently
3. Third, apply appropriate energy-efficient heating and cooling systems which are well matched with the identified renewable energy sources
4. Finally, design controls for the system and other primary energy uses to operate efficiently

Energy demand reduction with passive measures is the first and most important step, because once the energy demand is reduced passively, the applied active system components can be smaller and more efficient. (See the discussion in D. Passive Design.) With the reduction in building energy, the selection and identification of high efficiency systems and plant equipment can proceed. The assessment and selection of these systems must be congruent with the identification of energy sources available to the site. Without considering the other, neither phase will be optimized.

This section summarizes the available options for the mechanical heating, cooling, and ventilation systems.

F.2 OVERVIEW OF DELIVERY SYSTEM TYPES

Active building systems are the in-building systems whose primary role is maintaining space conditioning requirements and comfort conditions for occupants. The following sections provide a summary of the delivery systems applicable for the South Capitol Campus and analysis of their advantages and disadvantages in different applications.

F.3 HUMIDIFICATION

Review of the climate data revealed that during some outdoor conditions, the ventilation air introduced in the building has low relative humidity levels once it is heated. Humidification of the incoming heated air may be required to maintain occupant comfort. Reconcile the client's humidification captial needs with the capital costs. Humidification of air will increase energy and water use.

F.4 4-PIPE FAN COIL UNITS

A fan coil unit is a terminal forced-air heating and cooling unit that consists of a fan, air filter, and two coils (air-to-water heat exchangers. One coil is for cooling, one for heating. See Figure 3-17. Four-Pipe Fan Coil System.

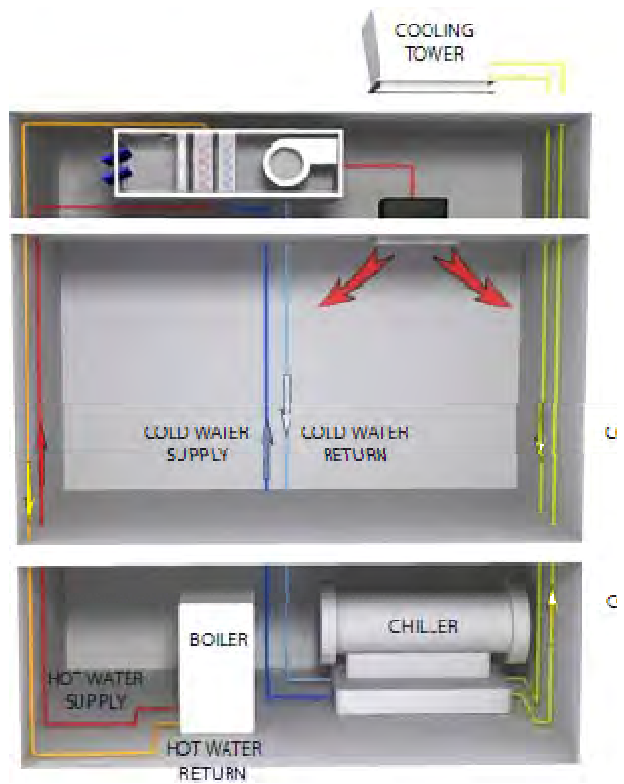


Figure 3-17: Four-Pipe Fan Coil System

Benefits

1. Very flexible cost-effective system
2. Can be tied into a variety of systems
3. Well-suited to use in offices
4. Conventional technology
5. Superior space controllability of thermal comfort to existing VAV system
6. Space conditioning and ventilation air conditioning can be achieved independently
7. Can provide different zones with simultaneous heating and cooling

Limitations

1. Use of air to heat and cool the space is a less efficient for transferring energy.
2. Is not easily coupled with a system that uses outdoor air for free cooling
3. Maintenance of filter within the space requires access to fan coil every three to six months
4. Fossil fuels are relatively high grade energy. Sustainable practices recommend a lower grade of energy for heating and cooling.

Application Potential for South Capitol Campus

Four-pipe fan coils could be used in any existing and new building on the South Capitol Campus. Because the thermal energy is transferred by water, the water could be tempered by either a dual or ambient temperature district energy system. Because the water required for this technology is relatively high-grade energy, water-to-water heat pumps and a back-up boiler would facilitate the tie into an ambient loop DES. Conversely, the system can use dual temperature sources, whether through a common loop or from existing and more conventional building equipment such as a boiler and chiller. Outdoor ventilation air supplied to the space could be pre-tempered by earth tubes or heat recovery units to reduce the load on the fan coils.

F.5 RADIANT SLAB HEATING AND COOLING

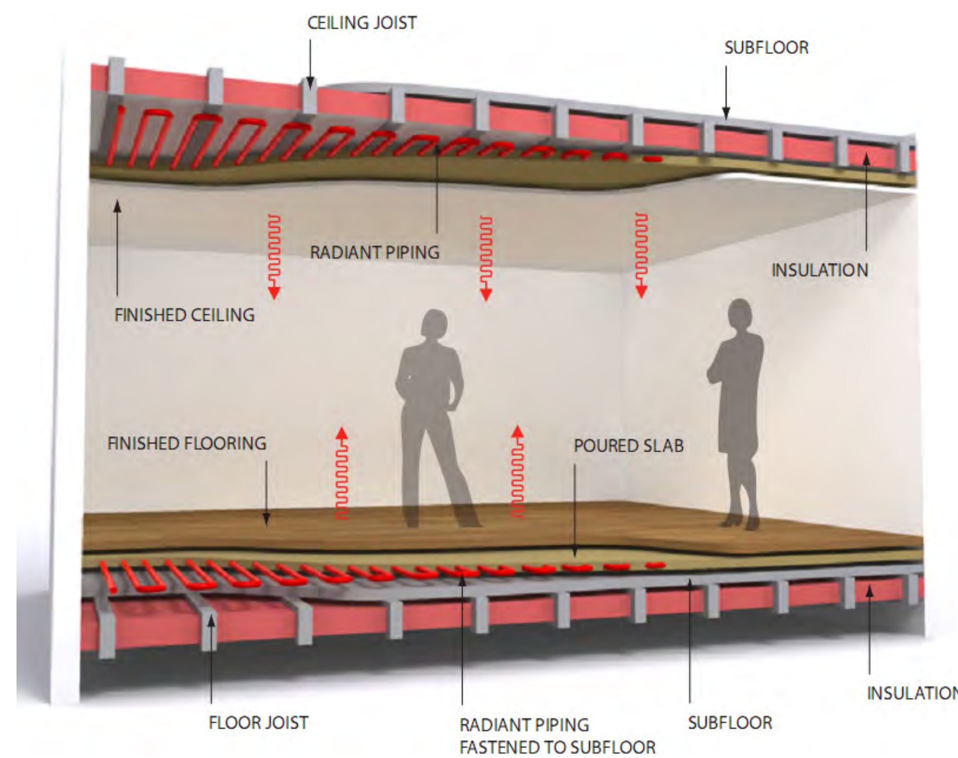


Figure 3-18: Radiant Heating and Cooling

A radiant system uses surfaces to heat and cool the space. The system consists of pipes embedded in the floor or ceiling which contain circulating hot or cold water that heats or cools the floor or ceiling surface. Refer to Figure 3-18. Radiant Heating and Cooling.

Benefits

1. Even distribution of temperature and superior comfort levels throughout the space and over time
2. The radiant effect contributes to the energy efficiency of the system, wider temperature ranges enable maintaining desired comfort levels
3. Easily coupled with thermally massive strategies
4. Potentially improved indoor air quality when matched with a system such as displacement ventilation because there is no need to recirculate the air and less dust is stirred up by the high velocity air movement of a conventional, forced-air system
5. Passive ventilation, such as via operable windows, can be implemented without affecting the perception of comfort in the space, since the air does not have enough energy-carrying capacity to overpower the heated or cooled surfaces
6. The pump energy required to circulate heating or cooling energy in a water-based system is much lower than for the fan energy in an air-based system, saving energy
7. Lower operating temperature facilitates the use of low-grade renewable energy

Limitations

1. Good performance depends on a well-designed envelope with sufficient levels of insulation and limited glazing, as discussed in the D. Passive Design
2. Affected by floor coverings such as carpet pads, which are thermal insulators and reduce the cooling capacity of the floor
3. While a commonly used system, the system installer must be experienced with water-based systems
4. System is slow to respond, but maintains a set temperature for a long period
5. Radiant systems have limited flexibility since tubes are generally imbedded in concrete
6. Individual space temperature control is limited

Application Potential for South Capitol Campus

Radiant slab heating and cooling is ideal for spaces such as offices that have a consistent and relatively predictable occupancy schedule and do not require rapid changes in space temperature settings. The system complements the existing trend for thermally massive construction associated with Pueblo Revival architecture. This system can work well in any of the buildings on the South Capitol Campus, but its effectiveness depends on a high degree of integrated design to coordinate the thermal mass and the envelope and glazing performance. The operating temperatures of the system also allow the use of low-grade renewable energy from an earth source exchange loop or an ambient temperature district energy system.

F.6 ACTIVE EVAPORATIVE COOLING

See D. Passive Design, Evaporative Cooling for system explanation, potential applications, benefits, and limitations.

Active evaporative cooling is based on the same physical principle as passive evaporative cooling. When applied with an active system, evaporative cooling operates by spraying water into the airstream or by placing a special porous paper in the airstream fabric with the end dipped in water.

F.7 ABSORPTION CHILLERS

Absorption chillers use a chemical absorption process driven by heat (instead of by electricity, as with most commonly used refrigeration processes) to produce chilled water for air or space conditioning. The heat can be produced through renewable sources such as solar energy, waste heat from other processes, or combined heat and power plants. Renewable energy sources can generate considerable cost savings in electrical energy use. See a graphical representation of the absorption chiller concept in Figure 3-19.

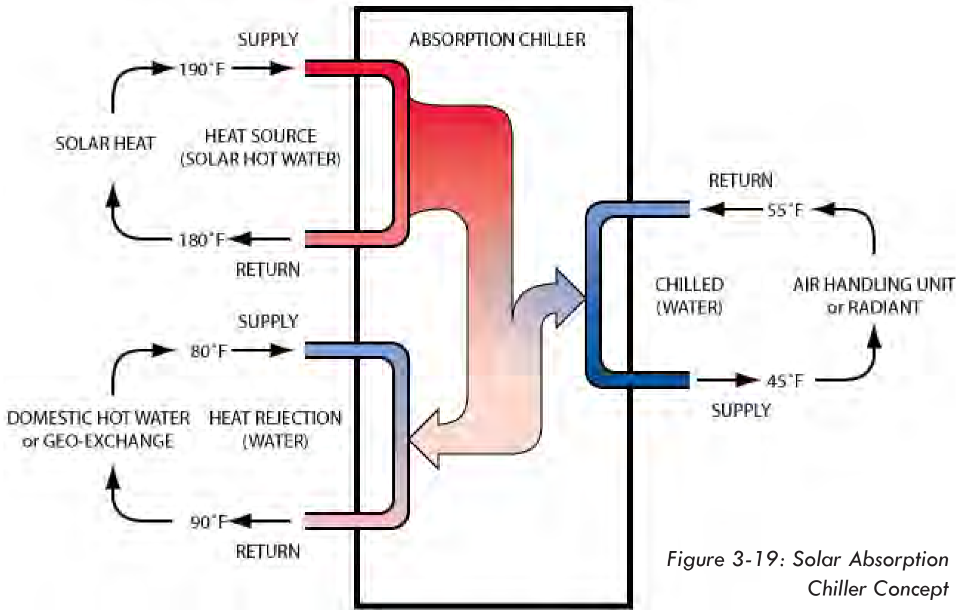


Figure 3-19: Solar Absorption Chiller Concept

Benefits

1. Reduced operating costs by minimizing electricity consumption, but requires other fuel sources
2. High reliability and low maintenance
3. Harvest solar energy or capture waste energy (i.e. CHP) for cooling

Limitations

1. Requires back-up cooling system
2. Best suited for dual temperature energy distribution or with localized energy plants
3. Requires greater capacity in the energy sink, for example, in the cooling tower or ground heat exchange system
4. Lack of widespread use of absorption chillers in the service industry
5. Initial capital cost

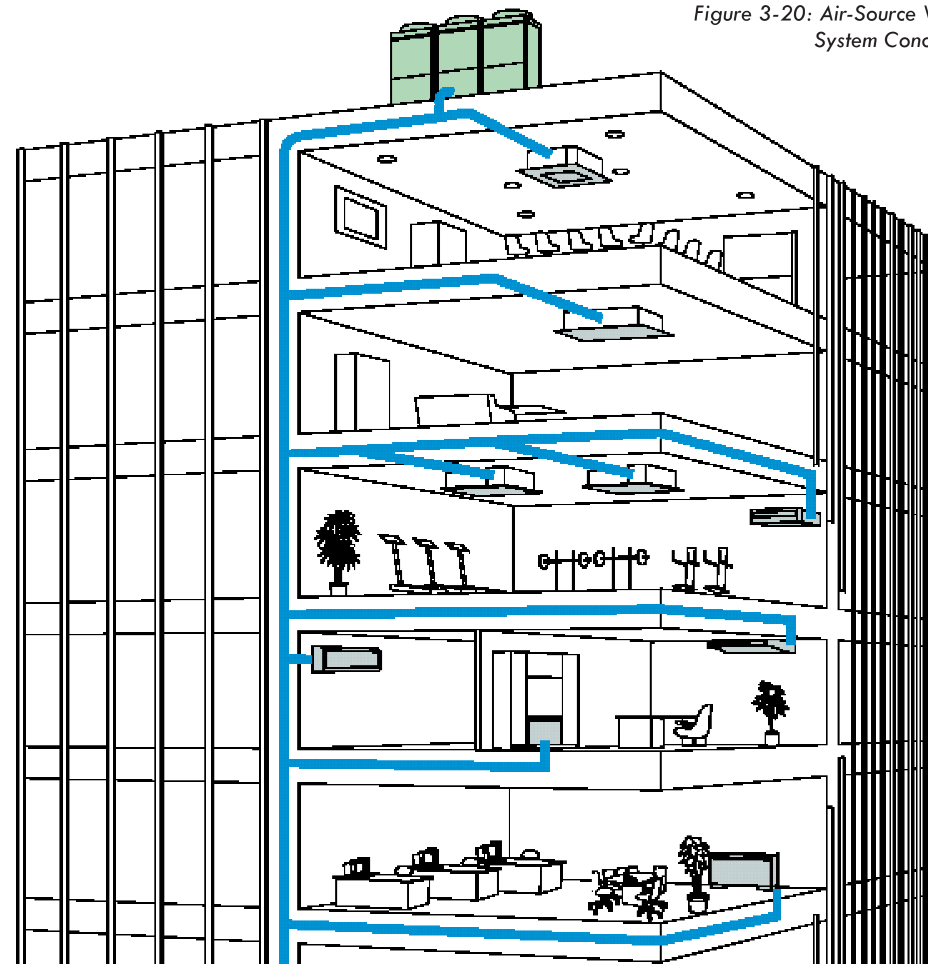
Application Potential for South Capitol Campus

Because the Santa Fe climate has high levels of solar radiation, solar absorption is ideal for generating chilled water for the campus. Cooling loads in office spaces are constant in terms of internal gain, but are also a function of solar gains,. Thus, when solar energy peaks, the space cooling load peaks as a result of increased solar radiation into the space. Typically, solar energy systems require an alternate system for times when solar energy is not available; a back-up system is likely required due to the consistent internal gains. However, perform building energy simulations to determine the reliability of solar energy compared to space cooling requirements. The use of solar absorption chillers has the potential to reduce electrical energy to meet cooling requirements for the site. Using solar panels to supplement the heating load in the winter and the cooling load in the summer would increase payback.

F.8 VARIABLE REFRIGERANT FLOW

Variable refrigerant flow (VRF) is a direct expansion, refrigerant-based heating and cooling system. The system operates under the same principles as a refrigerator, using the evaporation of a liquid refrigerant to absorb heat and create cooler temperatures. The system can easily reverse the cooling process to release heat into a space as the refrigerant liquefies. The ability of the system to provide both heating and cooling without any additional equipment distinguishes a VRF system from a more "typical" HVAC system. Inherent to the system's ability to switch between heating and cooling is that it can deliver both processes simultaneously to different zones in a building. In other words, the system is capable of efficiently recovering heat from one zone and transferring it to another zone. Refer to Figure 3-20 for an example of a VRF system.

Figure 3-20: Air-Source VRF System Concept



Benefits

1. Energy transfer between zones (total heat recovery) saves energy
2. Design flexibility with a variety of indoor units of different capacity and design
3. Superior controllability of systems with dedicated controls that can be operated through wall-mounted controls or a Web interface on the user's desktop
4. System easily adapts to changes in room layouts
5. Reduced temperature variations in the space made possible by the inverter speed compressor. Temperature variations can be held to +/- 2°F, superior to conventional systems
6. Very low noise levels (in general and relative to other systems)
7. The use of R-410A conforms to LEED standards
8. High energy efficiency since system capacity is produced on a demand basis
9. Water-based system can tie into an ambient temperature loop

Limitations

1. Forced-air systems are inherently less efficient than water-based systems
2. For air-cooled VRF systems, system performance is limited by Santa Fe's winter outdoor air temperatures
3. Contractor and service experience may be limited since the system is relatively new system in North America
4. Limit to vertical distance between condensing units and indoor units
5. System operates as a standalone system and interface with building automation systems will require coordination

Application Potential for South Capitol Campus

Forced air, overhead systems are typical in North American and are relatively inefficient compared to radiant systems. This system is ideal for the offices of South Capitol Campus, as it offers superior energy performance while maintaining the traditional approach of a forced-air overhead system. The system can easily and efficiently provide modular control, which may be of benefit depending on building programming. The Santa Fe climate is heating-dominant and therefore requires perimeter zones to be in heating mode, however, the data centers and other zones in the interior of the building will require to be in cooling mode year-round. This condition is optimal for the implementation of the VRF system which is capable of providing total heat recovery without any additional system equipment. VRF systems are very effective in office buildings because there are often simultaneous heating and cooling demands, especially in cold climates such as the mountainous region of Santa Fe. The only limitation of the air-cooled VRF system is performance during cold winter days, however, this can be avoided by adding more air cooled condensing modules or by opting for a water-cooled VRF system which can tie into an ambient temperature loop.

F.9 WATER-TO-AIR HEAT PUMPS

Heat pumps are refrigerant-based and use electricity to extract heat from one low temperature energy source and reject it to an energy sink. A water-to-air heat pump absorbs or rejects heat from a water supply source and transfers that heat through air to heat or cool the space it serves.

Benefits

1. Less mechanical room space required
2. Can use a renewable low-grade energy source

Limitations

1. Noise considerations because compressors are often located within occupied spaces
2. Maintenance and equipment failures require servicing, typically within the occupied spaces
3. More ceiling space required for equipment in occupied spaces

Application Potential for South Capitol Campus

The heat pump can be used in any of the buildings on the site. It would be ideal in an application with earth source exchange or ambient temperature district energy source. The heat pumps would be located throughout the buildings in a similar way as four-pipe fan coils. However, locations may need to be reviewed for noise concerns since the compressor is located within the heat pump.

F.10 WATER-TO-WATER HEAT PUMPS

Heat pumps are refrigerant-based and use electricity to extract heat from one low temperature energy source and reject it to an energy sink. A water-to-water heat pump operates between two water streams and either absorbs or rejects heat from one stream to control the temperature of the other. These pumps are typically located in the mechanical room.

Benefits

1. Can use low-grade energy sources
2. High efficiency with proper design
3. Can provide both heating and cooling
4. Heat pumps are conventional technology
5. Can decentralize heating/cooling plants

Limitations

1. Uses high grade energy (electricity)
2. Refrigerant-based
3. Higher capital cost than conventional boiler/chiller plant

Application Potential for South Capitol Campus

Water-to-water heat pumps are ideally matched with an ambient temperature loop or an earth source exchange as an interface to the building mechanical systems. On the building side, this system is best coupled with a radiant heating and cooling system with moderate water temperature requirements, increasing efficiency. Water-to-water heat pumps can also be used with four-pipe fan coil units if the envelope is efficient enough to allow the fan coils to use the moderate temperature hot water for heating.

F.11 HEAT RECOVERY VENTILATORS (HRV)

An HRV is an air handling unit (typically 100% outdoor air) that contains two fans and a heat exchanger. The supply and exhaust airstreams pass through the heat exchanger to reclaim heat from the exhaust air and use it to pre-heat the supply air, saving energy. The exhaust air stream remains entirely isolated from the supply air stream, as only heat is transferred. This type of system can recover a large percentage of heat from the exhaust air and transfer it to the incoming air, dramatically reducing the energy required to heat the outdoor air. Two types of heat recovery technology are shown in Figure 3-21.

Benefits

1. Recovers heat from the exhaust air and reduces energy consumption
2. Able to act as an air handling unit when the air is being conditioned in the space
3. Reduces peak heating load and can reduce the size of the heating plant
4. Common technology

Limitations

1. Increased capital cost
2. Bypass required during summer conditions so air is not heated when it is not desirable

Application Potential for South Capitol Campus

This system will be effective in reducing ventilation air heating requirements within the cold Santa Fe climate. It can be easily incorporated into most air systems and could easily be implemented in any of the buildings on the South Capitol Campus. HRV systems tend to have the best payback when applied to 100% outdoor air and dedicated outdoor air systems.

F.12 DEDICATED OUTDOOR AIR SYSTEM VENTILATION (DOAS)

A dedicated outdoor air system supplies only ventilation air and does not recirculate air. The system typically only supplies a relatively small volume of 100% outdoor air to meet building ventilation requirements. A DOAS does not provide space heating. If cooling is required, a it can provide limited capacity, or be upsized to provide higher air volumes sufficient to provide the required cooling. Refer to Figure 3-22. Displacement Ventilation for details.

Benefits

1. Smaller footprint within the building
2. Well suited to heat recovery
3. With proper design, a DOAS uses less energy for ventilation than a traditional system
4. Compatible with low-grade energy such as earth-tempered ventilation, as well as low-grade energy sources such as earth source exchange

Limitations

1. Limited ability to provide "free cooling"

Application Potential for South Capitol Campus

A DOAS is used when the heating/cooling of the building is provided by another system (i.e., VRF, fan coils or radiant). The DOAS can save energy by turning off the supply fan during unoccupied periods or if a natural ventilation strategy is used. Using heat recovery for a DOAS system typically provides quicker payback, since the capital cost is typically lower due to the smaller AHU size. Because the DOAS does not provide space heating, nor usually space cooling, it can supply more moderate air temperatures, achieved through lower-grade energy sources.

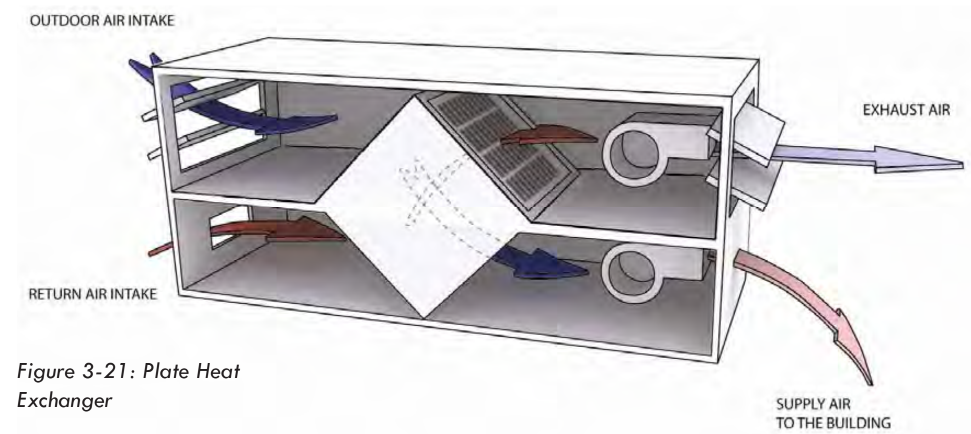


Figure 3-21: Plate Heat Exchanger

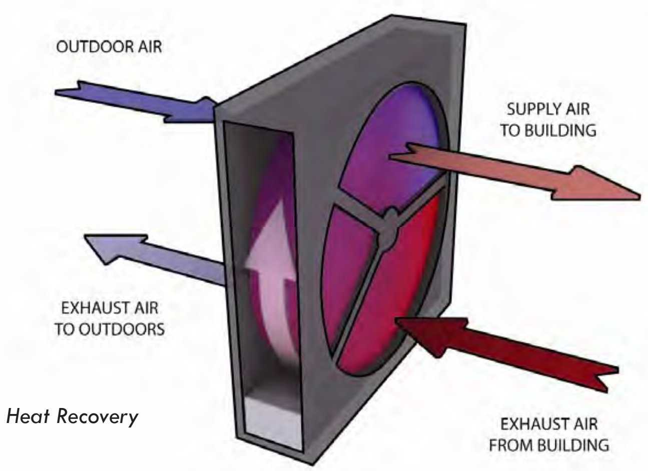


Figure 3-21: Heat Recovery Wheel

The system could potentially reuse existing VAV system infrastructure to implement a DOAS during building upgrades.

Humidification could be provided at the central air handling unit of the DOAS. This is an ideal location because the humidification equipment requires consistent maintenance and distributed equipment would increase the maintenance time. A DOAS would be included as part of many of the above listed system options, and therefore most of the considered systems could provide humidity control.

F.13 DISPLACEMENT VENTILATION/COOLING

Displacement ventilation is a type of DOAS system which delivers 100% outdoor air at a low level in a room. Air moves by means of a once-through system, resulting in superior air quality. Displacement cooling delivers air the same way, however, air flow rates and temperatures are sized to meet the space cooling load. With cooling, some of the air may be recirculated at the air handling unit.

Benefits

1. Increased air quality and perceived comfort throughout the space
2. Physical requirements for displacement ventilation systems and distribution duct work are about 20% of a typical system
3. Low airflows result in lower fan energy consumption than forced air systems

4. Lower capital costs with smaller fan and less ductwork
5. Quiet operation
6. Separation of ventilation from heating system, and where displacement ventilation is used, separation from the cooling system as well
7. Air movement works with the laws of physics and not counter (i.e., buoyancy)

Limitations

1. When used for cooling, the capacity of the system is limited
2. Locating supply air grilles at low level requires additional coordination
3. Cannot provide space heating

Application Potential for South Capitol Campus

Displacement ventilation system are best coupled with water-based heating and cooling systems. For the South Capitol Campus, the system could be coupled with a radiant slab heating/cooling system or a chilled beam system. Distribution ductwork to low-level grilles can be incorporated through the raised floor available in some of the existing buildings.

An earth tube system or heat recovery ventilator can temper ventilation air and, depending on the installed heating and cooling system, can be applied in any of the buildings on the South Capitol Campus.

F.14 EARTH TEMPERED VENTILATION

Earth tubes, a form of earth-tempering ventilation, are a passive heating and cooling strategy for ventilation air whereby the incoming outdoor air is preconditioned prior to entering the building. The technique uses the thermal mass of the earth (which stays at relatively constant temperatures year-round) to temper incoming air brought into the building through a series of buried tubes. Constant ground temperatures can be harnessed at depths starting at 5'.

Benefits

1. Safe and secure means of bringing air into the building
2. Constant earth temperatures create a reliable source of pre-conditioned air which would reduce energy consumption, operating costs and decrease the capacity of the mechanical plant
3. Can be combined with multiple ventilation system options

Limitations

1. Buried tube lengths should be long in order to provide benefit
2. Long developed tube lengths will require fans with higher energy consumption
3. Design, construction and maintenance to ensure pipe remains dry and clean, thus ensuring indoor air quality
4. Review duct-type construction to prevent possible ground water seepage or moisture ingress
5. Increased capital costs

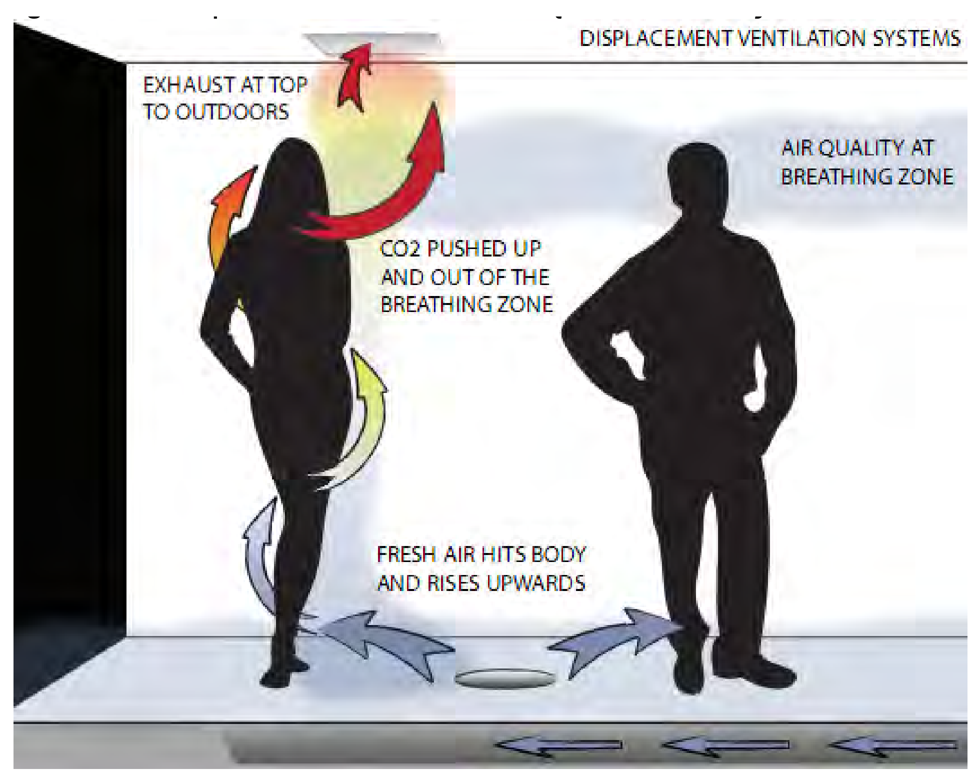


Figure 3-22: Displacement Ventilation

Application Potential for South Capitol Campus

The earth tube strategy is ideally suited for climates with warm and cold temperatures such as in Santa Fe. This strategy will contribute to a reduction in energy through the passive heating and cooling of ventilation air. The tubes can be integrated on the site by running adjacent to existing service tunnels. Air handling equipment could be downsized to depend on and work with this constant source of preconditioning energy. This system could also be combined with nocturnal ventilation cooling.

F.15 SUMMARY

The selection of the building mechanical system should be based on the following parameters:

1. Ability to maintain comfort in the building
2. Ability to realize project goals and priorities
3. Ability to use and optimize passive features and available on-site renewable energy sources
4. Cost of construction
5. Ability to deliver the environment, control and uses required by the building occupants

Each system discussed in this section has its advantages and limitations. The selection of the most appropriate solution is directly related to other decisions made as part of the integrated design.

Opportunities

The strategies recommended in D. Passive Design and E. Primary Energy Source Options are ideally coupled with these systems:

1. Radiant in-slab heating and cooling
2. Displacement ventilation
3. Evaporative cooling (passive and active)
4. Water source heat pumps (air and water)
5. Heat recovery ventilators
6. Earth tempered ventilation

The identified systems above are consistent with the fulfillment of the project's energy and carbon emission target.

Next Steps

The next steps in identifying appropriate active mechanical systems are as follows:

1. Perform annual building energy simulations
2. Clarity of user needs and desires
3. Clarity of passive features to be implemented
4. Weighted system comparison analysis identifying project priorities (see Appendix, page 97 "Next Steps")

G. PLUMBING SYSTEM STRATEGIES

This section summarizes demand-side and supply-side strategies to optimize water systems at South Capitol Campus. Optimization is based upon a desire to mitigate typical water-related sustainability issues, as follows:

1. Costs, energy, emissions, and ecological impacts associated with municipal water and wastewater treatment and needs to expand system capacities
2. Costs, energy, and emissions of water pumping and heating within South Capitol Campus

G.1 METHODOLOGY

An integrated water strategy involves several key steps. In order of priority, these steps are critical to the realization of a sustainable campus:

1. Water demand-side management
    a. Low-flow fixtures
    b. Low-water use HVAC design
    c. Water metering, monitoring, and maintenance
    d. Ongoing education and awareness
    e. Eliminate or reduce water use for irrigation
2. On-site water recycling
    a. Light gray-water recycling
    b. Park greywater recycling

c. Yellow water recycling
d. Black water recycling

3. Water Sources
    a. Roof rainwater and ground rain/snowmelt harvesting
    b. Stormwater harvesting
    c. Drainage dewatering water harvesting
    d. Municipal potable water

G.2 WATER DEMAND-SIDE MANAGEMENT STRATEGIES

1. General

The following section proposes a series of water demand-side management strategies to reduce total demand for and consumption of water at South Capitol Campus.

Demand-side management strategies include:

1. High-performance, low-flow fixtures
2. Low water-use HVAC design
3. Water metering, monitoring, and maintenance
4. Ongoing education and awareness
5. Elimination or reduction of water use for irrigation

2. Demand-Side Management Benefits

The benefits to water conservation through demand-side management are lengthy. For South Capitol Campus in particular, these benefits include:

1. Municipal energy and cost savings
2. Cost savings from reduced water and sewer bills, and reduced energy bills from lower domestic hot water heating and pumping requirements
3. Reduced costs associated with chemical, water, and energy use in poorly operating equipment such as pools or cooling towers
4. Potentially reduced costs to upgrade connections to municipal infrastructure as the campus expands
5. Ability to meet LEED rating system credit requirements
6. Good corporate social responsibility and public relations opportunities

3. Demand-Side Management Limitations

A major component of successful demand-side management is the ongoing education, awareness, and "buy-in" from water users and building system operators and maintenance personnel. A process to continuously engage and educate occupants and employees of water conservation initiatives will be necessary.

The dry climate of Santa Fe will require watering of plants and vegetation in order to maintain the proposed landscape strategy. Refer to Landscape Strategy in the master plan section for details.

4. Low-Flow Plumbing Fixtures

The first step in implementing a sustainable approach to water use is to reduce the rate of water consumption. Reduction is most effectively achieved through use of low-flow plumbing fixtures. The following list proposes fixture types best suited to realize reduced water consumption for the site.

1. Low-flush toilets – less water usage, reduced wastewater
2. Infrared sensors – limit water usage and reduce wastewater, as shown in Figure 3-23
3. Waterless urinals – eliminate water use, but have more specific maintenance requirements. Low-flush urinals are an alternative at 0.5 gpf, as shown in Figure 3-24
4. Low-flow showerheads – reduce use by replacing standard 4.5 gpm shower heads with 2.5 gpm heads in existing buildings and using the low flow heads in new buildings
5. Faucet aerators – easy to install and can reduce the water usage by as much as 60% while still maintaining a strong flow
6. Dishwasher and washing machine appliances (if applicable) – Shall be equivalent to upper-tier, water efficient models as specified by Energy Star®

5. Exterior Water Use for Irrigation or General Maintenance

In order of priority, exterior water uses for irrigation and general maintenance practices for water conservation should be as follows:

1. Use should be tightly restricted to operation by a few dedicated personnel, if possible. This restriction will ensure continuous monitoring of the system, enable proper training of operators, and build ability of operators to problem-solve and identify any system deficiencies or leaks.
2. Landscaping designs should not require ongoing irrigation after the first few years of plant establishment.
3. Any permanent irrigation systems should use non-potable water.
4. Permanent irrigation systems should be high-efficiency, with integrated advanced control and monitoring systems.
5. General maintenance should not include pressure washing or hosing off of patios to remove debris. The preference for water conservation is for manual or vacuum clearing of leaves, garbage, or dirt.
6. Pressure washers, rather than garden hoses, should be used for any necessary cleaning since they use less water and speed cleaning processes, for water savings up to 75%.
7. On-site washing of vehicles should be prohibited, with directives to use local carwash facilities that have water recycling systems.

Application Potential for South Capitol Campus

It is not clear yet where or how much water the South Capitol Campus will require for irrigation. Typical landscaping strategies have a preference for drought-tolerant native species. These species should be included in the design of all landscape plantings and decorative planters. However, there is an indication that

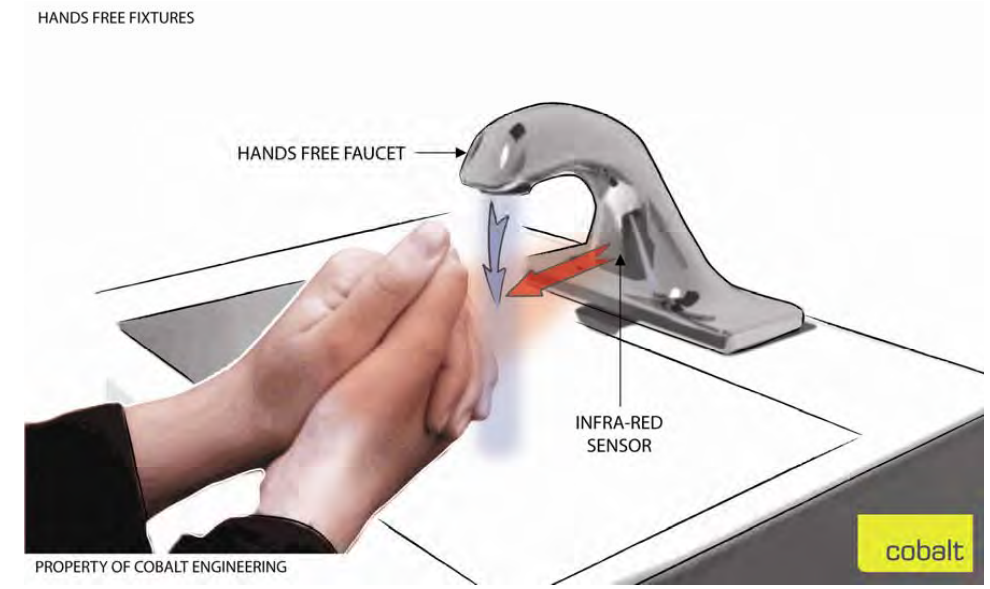


Figure 3-23: Infrared Sensor on Faucets

the South Capitol Campus will have some verdant green spaces that will require continual irrigation. Irrigation system design for these areas should offset the maximum water consumed for irrigation by available non-potable water sources. The permanent irrigation systems should use non-potable water or reused water and have high efficiency, buried drip irrigation lines with an advanced control system using soil moisture sensors to control irrigation use.

Figure 3-24: Waterless Urinal

It is expected that hose bibs will be provided throughout South Capitol Campus for both short term irrigation during periods of plant establishment and for maintenance requirements. To minimize potable water use, it is recommended that non-potable water be distributed to all exterior hose-bibs. Coupled with clear labeling, non-potable water at exterior fixtures will help educate occupants about the sustainable features and water-efficient design considerations of South Capitol Campus.

As is often the case, local codes and by-laws are not current to the newest sustainable design strategies. Consult local authorities prior to design of the system. If existing codes are limiting, it is an opportunity to work with local authorities on a strategy to "green" their codes and by-laws.

6. Billing, Monitoring, Reporting and Maintenance Program

In order to identify the overall quantity of water used on site, it is recommended to install meters at critical locations on site and take regular readings. In North America, despite the low customer charges for water consumption, billing building owners for their water use can result in a 30% reduction in water consumption.

Application Potential for South Capitol Campus

As part of an overall water management strategy at South Capitol Campus the following features are strongly recommended:

1. Installation of individual water meters for all tenants, offices or major use areas
2. Installation of sub-meters on all process equipment (cooling towers, commercial kitchens, etc.)
3. Installation of sub-meters on all irrigation lines
4. Installation of water meters on all rainwater distribution or on make-up to any rainwater system.
5. Implementation of a monthly consumption monitoring program integrated with routine facility maintenance activities in order to associate performance measurements with operations and maintenance employees and tenants.
6. Report to tenants and offices semi-annually on trends, conservation opportunities, conservation achievements, etc.

An energy metering and billing system could simplify and streamline implementation of a water metering and monitoring program at South Capitol Campus to improve economies of scale. In terms of maintenance, records of consumption trends and changes will help identify conservation opportunities, leaks, and poorly operating equipment. Similarly, building occupants should be engaged in a continuous monitoring program to identify water waste and conservation options.

G.3 WATER SUPPLY OPTIONS

On-site water sources are limited to capturing precipitation, including rain and snowmelt, and from wastewater treatment.

<u>1. Rainwater and Snowmelt Water Collection and Reuse</u>

The availability of water from precipitation depends on the effectiveness of the capture systems and the decisions surrounding snow melting on both roof and ground surfaces. This is demonstrated in Figure 3-25. Rainwater Harvesting Systems.

Consideration of the type of surfaces from which rainwater will be harvested will maximize the opportunity for rainwater harvesting. Consider the following design items:

1. First flush diversion – the system diverts the first few minutes of rainfall away from the collection reservoirs, since this water is typically concentrated with dirt, debris and contaminants which affect the quality of water
2. Roof construction – A rainwater system is not ideally coupled with a “green” roof since the soil affects the coloring of water trained from the roof
3. Ground level drainage – Paved surfaces can be used to harvest rainwater, however an assessment is needed of the degree of risk that contaminants from these surfaces will have on the non-potable system. For example, draining water from a loading dock is not recommended, but draining from a paved courtyard may be acceptable.
4. Storage reservoir – Identify an efficient location for the storage of harvested water
5. Filtration and treatment – Several filtration methods are available. Implementation of an effective strategy may require several simultaneous strategies:
   - Sediment interceptors: First level of control for suspended solids
   - Biosand filters: Gravity-fed filters impacting turbidity, suspended solids, water color and quality
   - Autoclean sediment filters: Self-cleaning filters impacting turbidity, water color and suspended solids
   - Ultraviolet: UV light eliminates micro-organisms such as bacteria and viruses
   - Water features: Circulate water through an on-site water feature to maintain water quality (through movement) and to treat quality with exposure to outdoor UV light
6. Test ports – Part of a maintenance procedure to verify water quality
7. Labeling and Identification – requires clear means of indicating non-potable piping and fixtures

Benefits

1. Supplementation of non-potable water sources
2. Lower contamination and filtration requirements compared to light and dark greywater
3. Best nonpotable water source for irrigation (absence of salts or detergents found in greywater)
4. Good public image and corporate social responsibility benefits associated with water conservation
5. Eligibility for credits under LEED rating systems

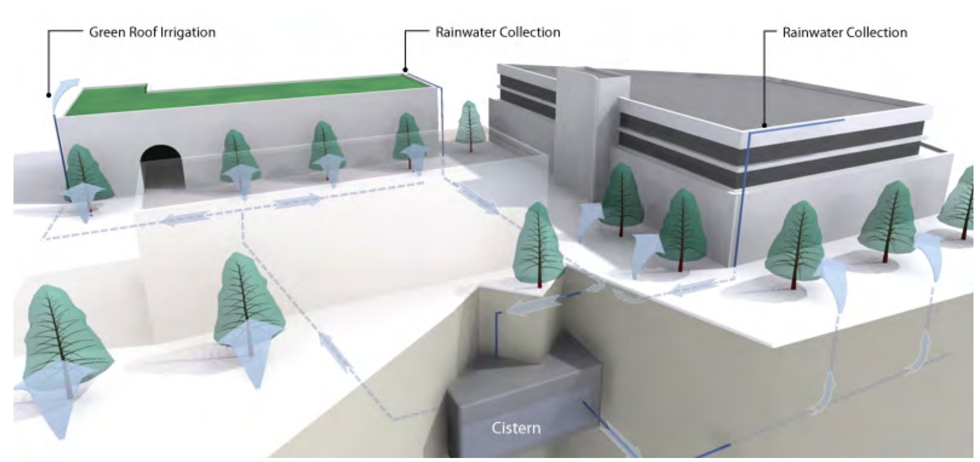


Figure 3-25: Rainwater Harvesting

Limitations

1. Successful code and by-law approvals
2. Availability of space on site for storage reservoirs
3. Capital cost associated with this secondary system

Application Potential for South Capitol Campus

In Santa Fe, the most prevalent form of precipitation is snow, providing an opportunity to take advantage of water harvested from snow melt. Harvesting is often done through active heating systems to encourage snow melting, however, this strategy is not consistent with the overall energy goals and should not be considered. The primary opportunity is to collect snow from all paved surfaces and collect it as a snow pack. This snow will melt over the course of the first few weeks of warm weather and the run-off can be collected and harvested for non-potable water use.

Due to the limited amount of precipitation, annually harvested rainwater and snowmelt should be limited for use on permanent irrigation systems and where possible to serve maintenance hose bibs. While a thorough water analysis is necessary, it is unlikely that these water sources will be able to supplement more than irrigation and maintenance requirements.

<u>2. Blackwater Collection and Reuse</u>

There are many options for blackwater treatment and reuse. However, the energy and economic benefits of these systems at a small scale should be assessed. Figure 3-27 provides a summary of the main types of blackwater treatment systems that may be considered for the South Capitol Campus.

Application Potential for South Capitol Campus

The incentive to implement on-site blackwater treatment is limited due to the availability of municipal sanitary and sewage utilities. The embodied energy that

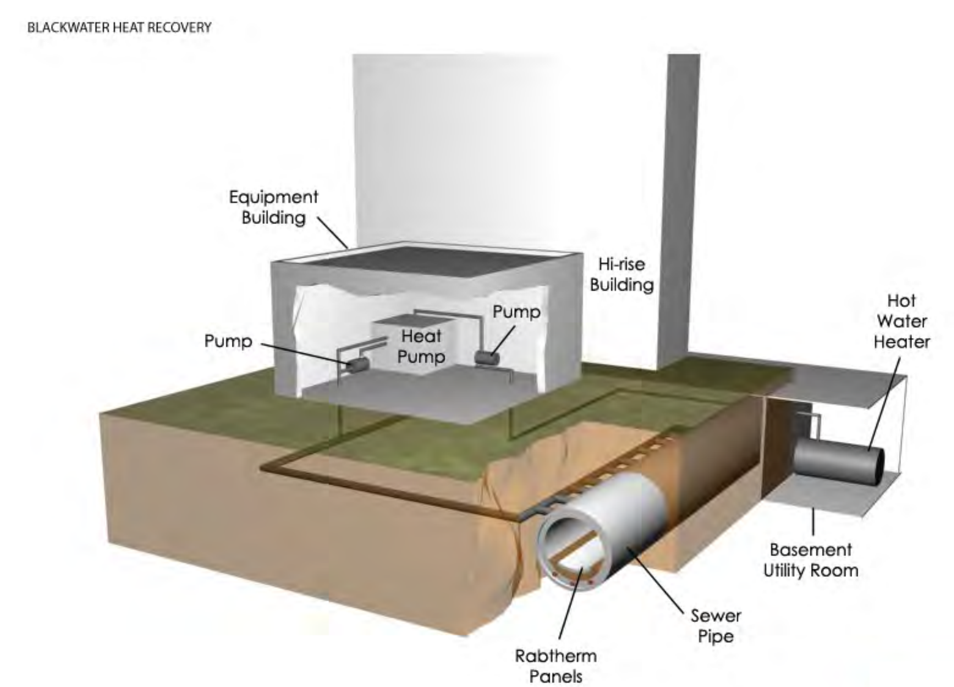


Figure 3-26: Blackwater Reuse

would go into such a system, when the municipal treatment plant has capacity, is not consistent with the sustainable vision of the project. The benefit of blackwater collection would be that it demonstrates possible technologies and could be a case study for the state. Using the Solar Aquatic systems would further this vision as the green houses could be open to the public for education.

Treatment Option	Performance	Capital Cost	Space Requirement	Energy Use	Benefits
Solar Aquatic Systems (Living Machines)	Tertiary-level treatment (pathogen and nutrient removal)	Typically more affordable than conventional mechanical and chemical treatment plants	500 sq.ft./1000 USG/day	Energy intensive pumping and aeration of system	Green house can be used as a demonstration of sustainability and opportunity to educate the public
Membrane Filtration System with disinfection	Tertiary-level treatment (pathogen and nutrient removal)	Variable	Low space requirements	Most energy intensive pumping systems	Small space requirements

Figure 3-27: Comparison of Blackwater Treatment Systems

3. Greywater Collection and Reuse

Greywater can be defined as the water discharged from lavatories and showers. A greywater system collects used water and redirects it for another use, most often for irrigation or toilet flushing. Collection of greywater flows requires a secondary set of plumbing drains to separate from blackwater. It also requires a secondary set of plumbing risers to separate distribution of treated, non-potable water to toilets and other end uses from the municipal potable water supplied to lavatories, sinks and drinking water fountains.

Greywater requires treatment depending upon the desired end-use and the requirements of local code authorities and public health departments. Greywater can be treated through relatively simple filtration and disinfection systems which are more affordable to purchase and operate than conventional chemical and physical wastewater treatment systems.

Benefits

1. Significant reduction in potable water demand from and sewage flows to water or wastewater treatment facilities, further reducing municipal costs
2. Good public image and corporate social responsibility benefits associated with water conservation
3. Eligibility for credits under LEED rating system
4. Possible reduction in sewerage fees due to reduced sewage flows

Limitations

1. Social acceptance of non-potable water (dyed green or blue in accordance with International Plumbing Code requirements)
2. Availability of space on site for storage reservoirs
3. Capital cost associated with this secondary system
4. If used for irrigation, there will most likely be a build-up of salts in the soil, given the low annual rainfall in Santa Fe. A build-up of salts will damage the soil structure and kill most species of plants over time.

Application Potential for South Capitol Campus

Similar to blackwater treatment, it is difficult to justify installing greywater treatment infrastructure when municipal sewer and sanitary services are readily available. However, greywater collection is a significant and reliable source of water for non-potable systems. The treatment process is less energy-intensive and relatively easy to implement. Furthermore, a greywater capture system could be married with a rainwater harvesting collection system.

Diversion and reuse of greywater will require the alignment and approval of local and state authorities and the New Mexico Department of Health and compliance with the International Plumbing Code.

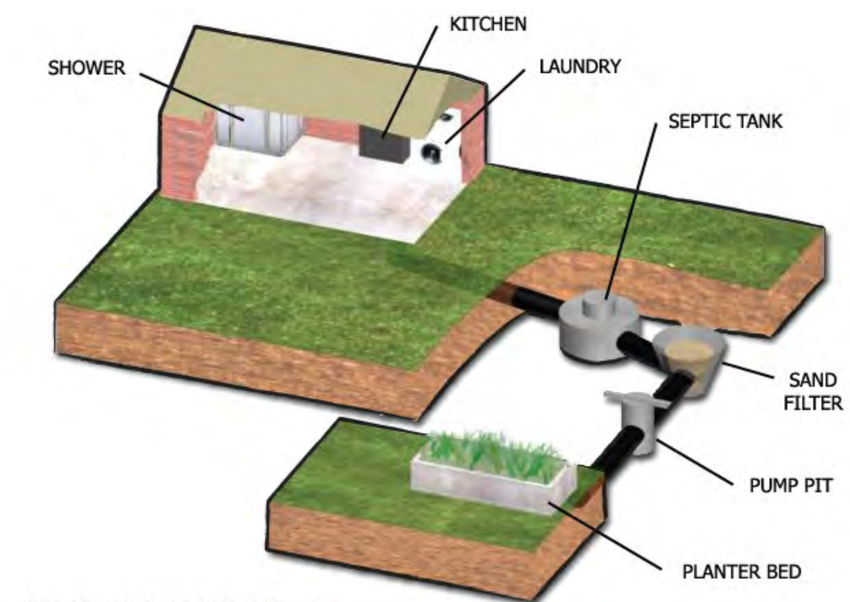


Figure 3-28: Greywater Reuse

4. Yellow Water Collection and Reuse

Yellow water is defined as urine waste that flows from urine diversion toilets or urinals. Yellow water can be used as a water source for irrigation systems, delivering required fertilizers to landscaped areas.

Yellow water is responsible for approximately 87%, 50%, and 60% of N:P:K nutrient and mineral loadings to municipal water treatment plants. Tertiary level treatment plants spend significant financial, chemical, and energy resources to remove these excess nutrients before discharge to surface waters.

The high nitrogen content in urine makes it an excellent natural fertilizer to promote leafy green growth in plants. The nitrogen, phosphorus, potassium (NPK) ratio in urine is on average 12 - 1.1 - 3.3. These ratios are extremely well suited for reuse as a fertilizer as follows:

- N – green, leafy growth for foliage plants
- P – root, flower, and fruit growth
- K – root development and disease resistance

Studies on yellow water use indicate that best use is through a subsurface irrigation system and diluted with irrigation water. Limited exposure to air prevents nitrification and loss of nutrients, while exposure to soil enables soil microorganisms to deactivate any pathogens. Any non-agricultural use of untreated yellow water should be through the subsurface irrigation system to avoid any human contact with urine.

Benefits

1. Reduced nutrient loading to wastewater treatment plant: yellow water (urine) is responsible for the majority of nutrient loadings to municipal water treatment plants. Wastewater treatment plants spend significant financial, chemical, and energy resources to remove these excess nutrients before discharge to surface waters.
2. Possible reduction in sewerage fees due to reduced sewage flows
3. Good public image and corporate social responsibility benefits associated with water conservation and reuse

Limitations

1. Capital costs are not justified with availability of local sanitary and sewage utilities
2. To the best of our knowledge, no yellow water collection systems have been implemented in New Mexico. For this reason, regulatory and permitting hurdles will need to be overcome.

It is currently not clear if the project design will include any significant landscaped areas which might use additional fertilizers. If there are these areas, it may be possible to provide short-term storage cisterns for yellow water on site. The high cost of infrastructure to implement this system is likely not justifiable with the system payback. However, implementation of this strategy could be a case study to promote innovative water conservation strategies.

G.4 SUMMARY

The critical action required to impact water consumption on the South Capitol Campus is to reduce the total load in the building. Reusing water will also contribute to water reduction, but the energy intensity of these solutions should be considered.

Opportunity

The greatest opportunity is in implementing the following strategies:

1. Installation of low-flow strategies for plumbing fixtures
2. Minimize water consumed by irrigation system
3. Impact water-consuming behavior through monitoring, billing and effective maintenance

The most effective means of reducing water consumption through the reuse of water which would otherwise be diverted is:

1. Greywater reuse
2. Rainwater reuse

Next Steps

Analyze in detail rainfall and snowfall to explore the economic feasibility of precipitation harvesting options.

H. ELECTRICAL SYSTEM STRATEGIES

Buildings, specifically office spaces, use electrical energy to operate systems which provide space heating and cooling, ventilation air tempering, lighting, and to run various types of electrical equipment from computers, to servers, to refrigerators. Consistent with the methodology echoed throughout this report, the implementation of energy efficiency is most effective through reduction in load.

In terms of electrical systems, there are a few areas to examine to improve efficiency:

1. Efficiency of equipment including motors on pumps and fans, computers, lighting, etc.
2. Reduced energy demand

Low-energy building designs are best achieved by the following design steps, listed in priority order:

1. Reduce the building energy demand by applying passive energy-saving features to the building, such as daylighting strategies
2. Assess the available renewable energy sources and target using electricity prudently. This strategy is discussed in E. Primary Energy Source Options
3. Use appropriate energy-efficient equipment and appliances
4. Finally, design controls for the system and other primary energy uses to operate efficiently

The primary sources of electrical energy consumption within an office building are identified below:

1. Lighting
2. Space heating and cooling
3. Equipment and appliances

H.1 LIGHTING

In regards to lighting, over 10% of building energy is used for lighting.

Energy-efficient lights reduce the cooling load within the building. The following energy-efficient lighting solutions apply throughout the campus:

1. Compact fluorescent lights
2. High frequency electronic control gear
3. T5 fluorescent lights
4. High-efficiency lighting fixtures that reject heat from fixture to plenum or return air systems rather than to occupied space
5. Light emitting diodes (LEDs) luminaires produce very low heat and come in an array of colors for various applications. Life expectancy is rated at 100,000 hours, which allows lower maintenance costs.
6. Outdoor lighting on the South Capitol Campus powered by photovoltaic panels

H.2 ALTERNATIVE LIGHTING OPTIONS

1. Daylighting with Solar Tubes

Solar tubes capture natural daylight and funnel it through high-reflective duct work to openings in the area requiring illumination. Solar tubes may also come complete with artificial lighting for night time. See Figure 3-29.

Application Potential for South Capitol Campus

New buildings on site can easily incorporate these tubes. Use for existing buildings will be more limiting since it will require modification to the building envelope. Solar tubes can be installed on buildings where no solar panels are being installed.

2. Fiber-Optics Hybrid Lights

Fiber optics supply light from rooftop-mounted dishes to fiber optic tubes to supplement fluorescent lamps in a single linear fluorescent fixture. However, distance is limited to approximately 30' from the light fixture to collector dish.

Application Potential for South Capitol Campus

Hybrid fiber optics luminaires are a unique solution to lighting. However, fluctuations in the intensity of collected solar light, due to changing cloud cover or solar collector movement requires that the associated lamp rapidly compensate to maintain constant room illumination. Currently, the advances with this technology are not sufficient to render it an applicable solution for this project.

H.3 EQUIPMENT AND APPLIANCES

Electricity is not an energy source but rather the most versatile form of energy, a "carrier" suitable for transmitting and distributing energy for an almost unlimited range of uses. In buildings, it is the energy type used to power HVAC equipment, lighting, plug loads, etc. It is important to address the efficiency of this HVAC and office equipment.

Select all pumps, fans and other mechanical equipment based on efficiency and seasonal performance. Similarly, select all office computers, servers, and appliances based on their efficiency.

H.4 CONTROLS

Control systems offer several ways to impact energy performance. Lighting control systems are an effective way of reducing electricity use and impacting the cooling load of the building. Examples include:

1. Daylighting sensors
2. Occupancy sensors
3. Dimmers

Encelium Energy Control System™ manages lighting energy consumption. It offers individual control to each individual lighting fixture within the management of the system. Incorporating control strategies that use daylighting sensors, occupancy sensors, dimmers and direct occupant control allows the system to reduce lighting energy cost in the range of 50% to 75%. The system provides individuals with the capability to have complete control from their computers of light levels in their workspace.

Figure 3-29: Solar Tube Section

An effective control strategy for the mechanical equipment is through the use of variable speed drives on all large motors in the building. The variable speed drive (VSD) optimizes the performance of the equipment by having the equipment operate as demanded. This control is critical in systems that have inherent diversity and fluctuation.

***LIMITING CONDITIONS*

This report has been prepared for Studio Southwest Architects on the South Capitol Master Plan project. It is based on a continuing integrated design process with the design team representatives from the client and professional consultants. The recommendations included in this report represent the professional opinions at Cobalt Engineering in light of the terms of reference, scope of work, and any limiting conditions noted herein. Any use that a third party makes of this report, any reliance on the report, or any decisions based upon the report, are the responsibility of those third parties unless authorized in writing by Cobalt Engineering. Cobalt Engineering accepts no responsibility for damages suffered by any unauthorized third party as a result of the decisions made or actions taken based on this report.

IV. DESIGN GUIDELINES

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INTRODUCTION

INTENT OF DESIGN GUIDELINES

The South Capitol Campus Master Plan is a long-term development plan for a 30-year horizon. Achievement of such an extended strategic development will be incremental and sequentially unpredictable. Design guidelines are a tool to organize and align, over time, the many separate individual projects and improvements as they occur in the process of achieving the vision of the South Capitol Campus Master Plan.

As a master plan-level design guide, this Design Guidelines section is broad in scope and general in overview. As each project or improvement for the South Capitol Campus undergoes detailed design, the Design Guidelines should be used to guide the project goals and evaluate the design.

USING THE DESIGN GUIDELINES

Design guidelines are most effective if used consistently and early in the planning of new projects or improvements for the South Capitol Campus. As a project begins budgeting and conceptual scoping, it is recommended that the master plan and these Design Guidelines be reviewed to help define project goals and requirements.

The Design Guidelines are in addition to the State of New Mexico's sustainability goals mandated and listed in the Introduction, D. Relationship to CBPM and Other State Planning of this document.

SCOPE OF DESIGN GUIDELINES

The Design Guidelines provide guidance in the following areas.

A. Land use

B. Building setbacks / orientation / heights

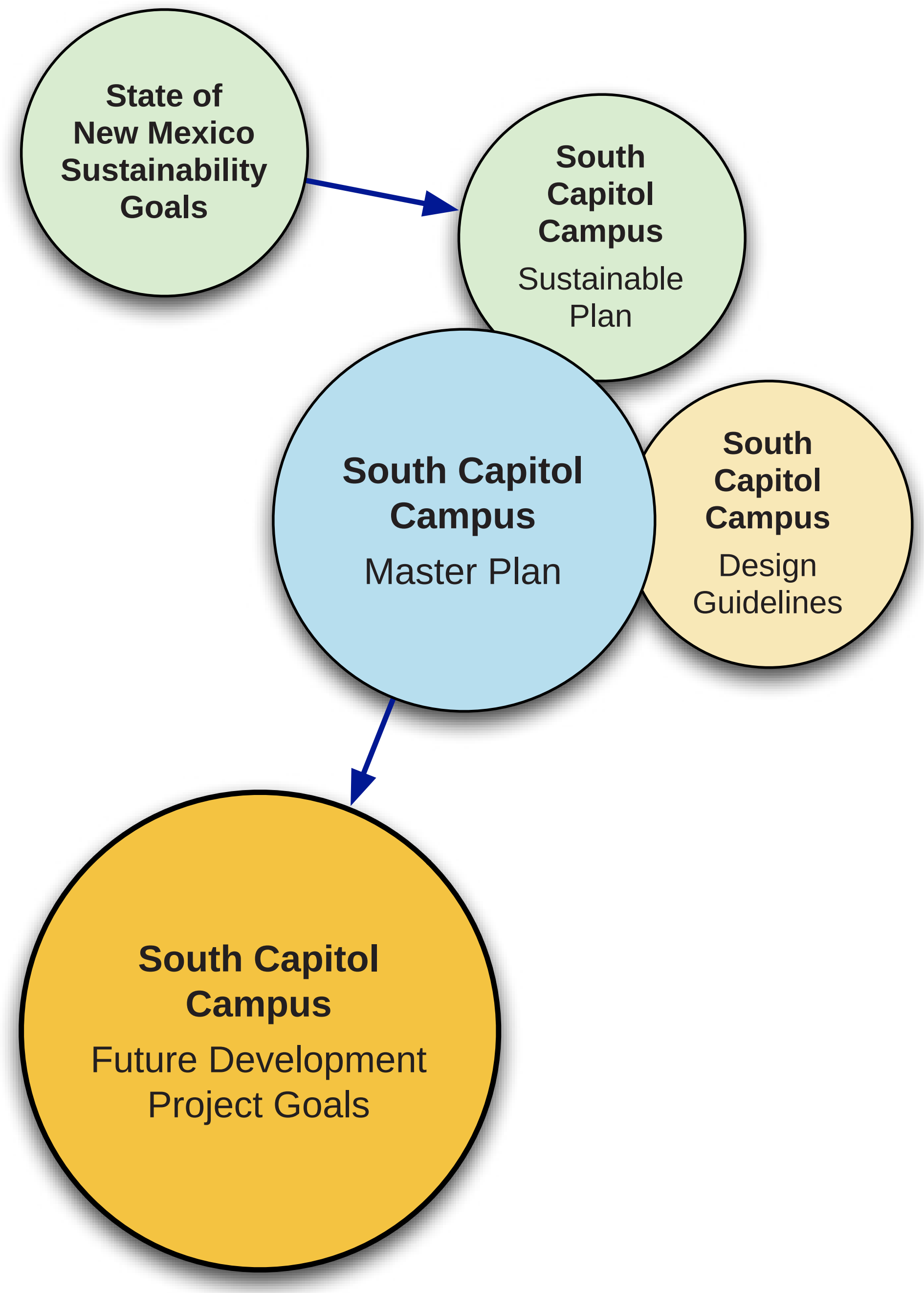
C. Utility infrastructure

D. Circulation

E. Architecture

F. Landscape

Figure 4-1: Design Guidelines Diagram



CHANGING THE WAY WE DESIGN

Achieving the goals of this master plan will require a fundamental change in the way planners, architects, engineers, landscape architects and other designers think about future projects for this campus. Most markedly, there must be a change in how they set and meet energy and water targets for each future building and site improvement.

The sustainability goal for the South Capitol Campus is a "no-net" increase, at complete build-out, in water and energy demand over current 2010 consumption. This means that as each future building and site improvement is developed, a comprehensive and verifiable planning and design process sets the energy and water goals specific for the project that support the overall objective of "no-net" increase.

A beginning point for design teams is to build upon current Leadership in Energy and Environmental Design (LEED) processes which require a coordinated, collaborative and comprehensive goal-setting at the start of each project between the Owner and the full design team. The value and importance of this step is to help assure alignment of client needs, design objectives, and the South Capitol Campus Master Plan goals.

To support the ability of future design teams to achieve the "no-net" increase standards, the State must do the following.

- Build the benchmark. Compile data on current 2010 energy and water uses sitewide and if possible, by each building or site use.
- Prepare a detailed sustainability plan for the campus. The plan would include a full energy audit of existing structures, specific conceptual infrastructure, and specific conceptual targets for existing buildings and for proposed future improvements based on this master plan.
- Build the consistent, comprehensive planning process within the state organizational structure to capture in depth and proactively the needs and input from leadership, departments, project management and operations. The process of the development of the South Capitol Campus Master Plan is a model.

A. LAND USE

The South Capitol Campus has three major categories of land use:

- Office buildings
- Parking
- Open space

1. OFFICE BUILDINGS

To reinforce the image as a state administrative campus, office buildings shall be the primary land use along St. Francis Dr. and Cordova Rd.

2. PARKING

Parking lots and parking structures shall be placed to the interior of the site.

Architecture requirements for parking structures, see Section E - Architecture

The target for the optimum parking ratio on the campus shall be:

1 Stall per 500 gross square feet = Total site parking

This ratio includes the gross square footage of all existing and proposed buildings on the campus. The interim step to meet this overall parking ratio is to build parking structures paired with specific building development. See Section V - Implementation for detailed pairings.

The parking strategy also requires that the state commit to incentivize use of the multi-modal transportation systems by approximately 50% of South Capitol Campus employees by 2040

3. OPEN SPACE

The plan calls for the creation of two major plazas: one on the north and one on the south of the campus. Each shall be major organizers for surrounding buildings.

Developed and landscaped open space shall be a minimum of 50% of the site. The open space excludes buildings, parking structures, parking lots from the overall site square footage calculations.

Dimension and landscape requirements for plazas and open space are described in *Section G - Landscape.*

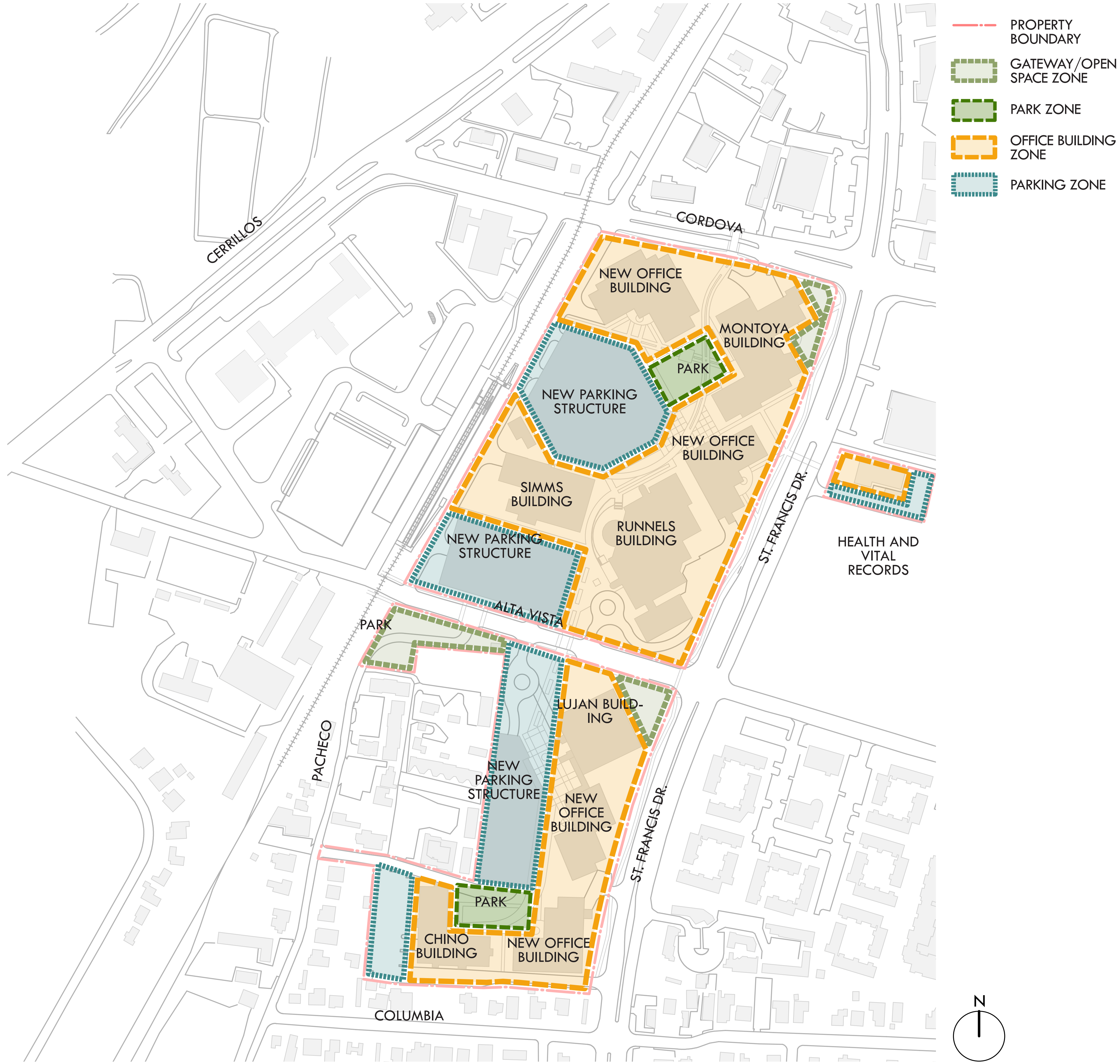


Figure 4-2: Land Use Concept Diagram

B. SETBACKS / ORIENTATION / HEIGHT

New buildings and parking structures at the South Capitol Campus shall reinforce the setbacks, building orientations and heights that exist on the campus.

1. SETBACK / PROPERTY LINES

Buildings and structures shall use the following setbacks. Setbacks are measured from the relevant property line.

- a) St. Francis Dr. frontage: maintain same setback as existing buildings
- b) Cordova Rd. frontage: maintain same setback as existing buildings
- c) Alta Vista St. frontage: minimum 20'
- d) Rail easement: maintain same setback as west face of Simms Building
- e) Residential edge: minimum 15'
- f) Residential edge/only south end: maintain same setback as Wendell Chino Building

2. SETBACK / SIMMS BUILDING

The Simms Building has a specific setback for adjacent new buildings or structures, unless the current departmental use of the building changes.

- a) Simms Building setback: minimum 30' or as required by security levels

3. BUILDING ORIENTATION

The South Capitol Campus is distinguished by the existing skewed orientation of buildings in relation to adjacent streets. New buildings and structures shall reinforce orientation patterns as noted below.

- a) St. Francis Dr. frontage / north parcel: maintain 45-degree orientation
- b) St. Francis Dr. frontage / south parcel: parallel or 45-degree orientation
- c) Cordova Rd. frontage: maintain 45-degree orientation
- d) Alta Vista St. frontage: parallel to street

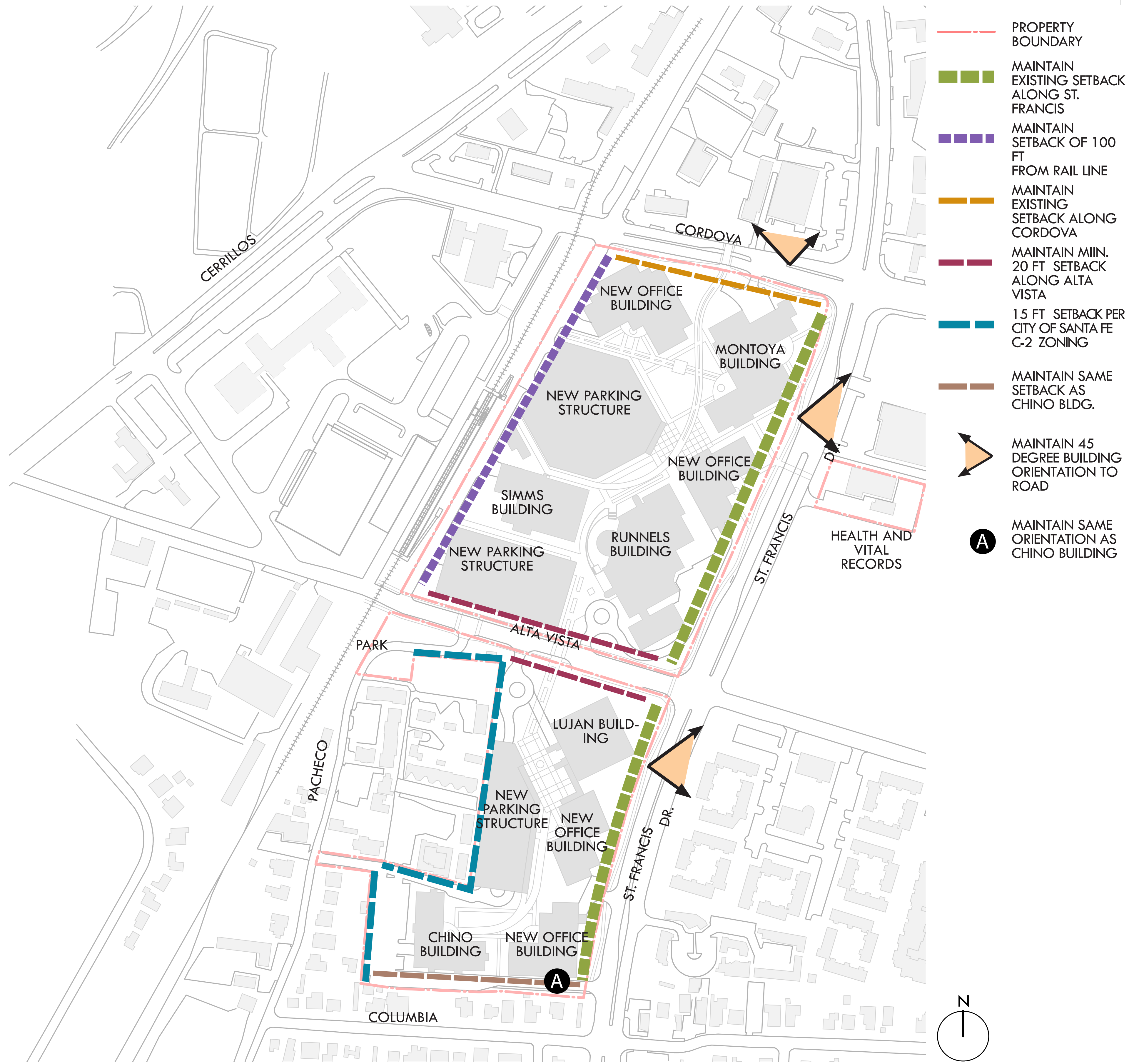


Figure 4-3: Setback & Orientation Concept Diagram

4. HEIGHT

In the initial development phases, the following elevations are the maximum height for buildings and structures.

a) North of Alta Vista St.: Highest parapet elevation on the Montoya Building

b) South of Alta Vista St.: 45 ft maximum similar to City of Santa Fe Zoning Code for C-2 zoning

5. UNIQUE REQUIREMENT

A specific unique requirement is for the structure that aligns in the middle of the area south of the Alta Vista. The structure is required to have a deep portal between 8' to 10' wide all along the east face of the building. This requirement will create an all-weather pedestrian walkway to serve this area of the campus.

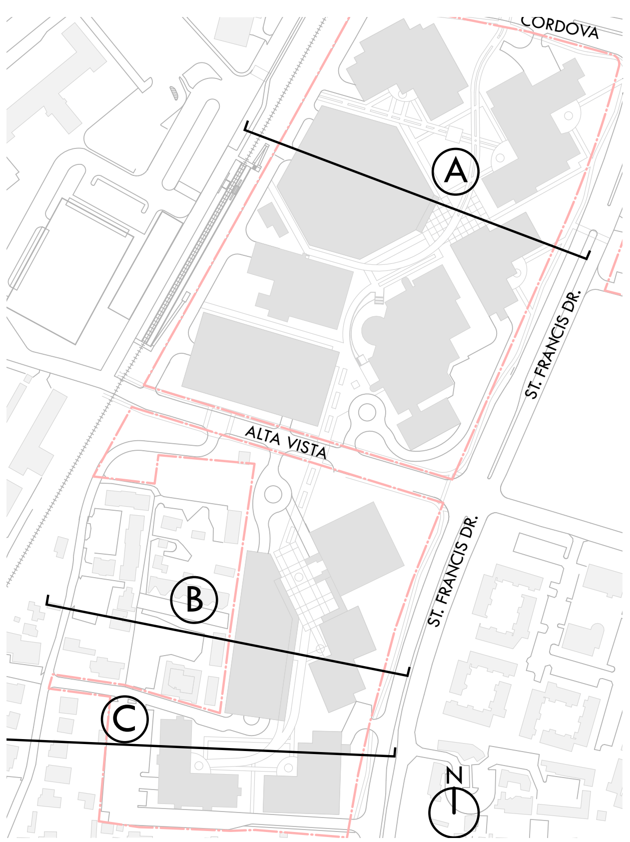


Figure 4-4: Sections Location Map

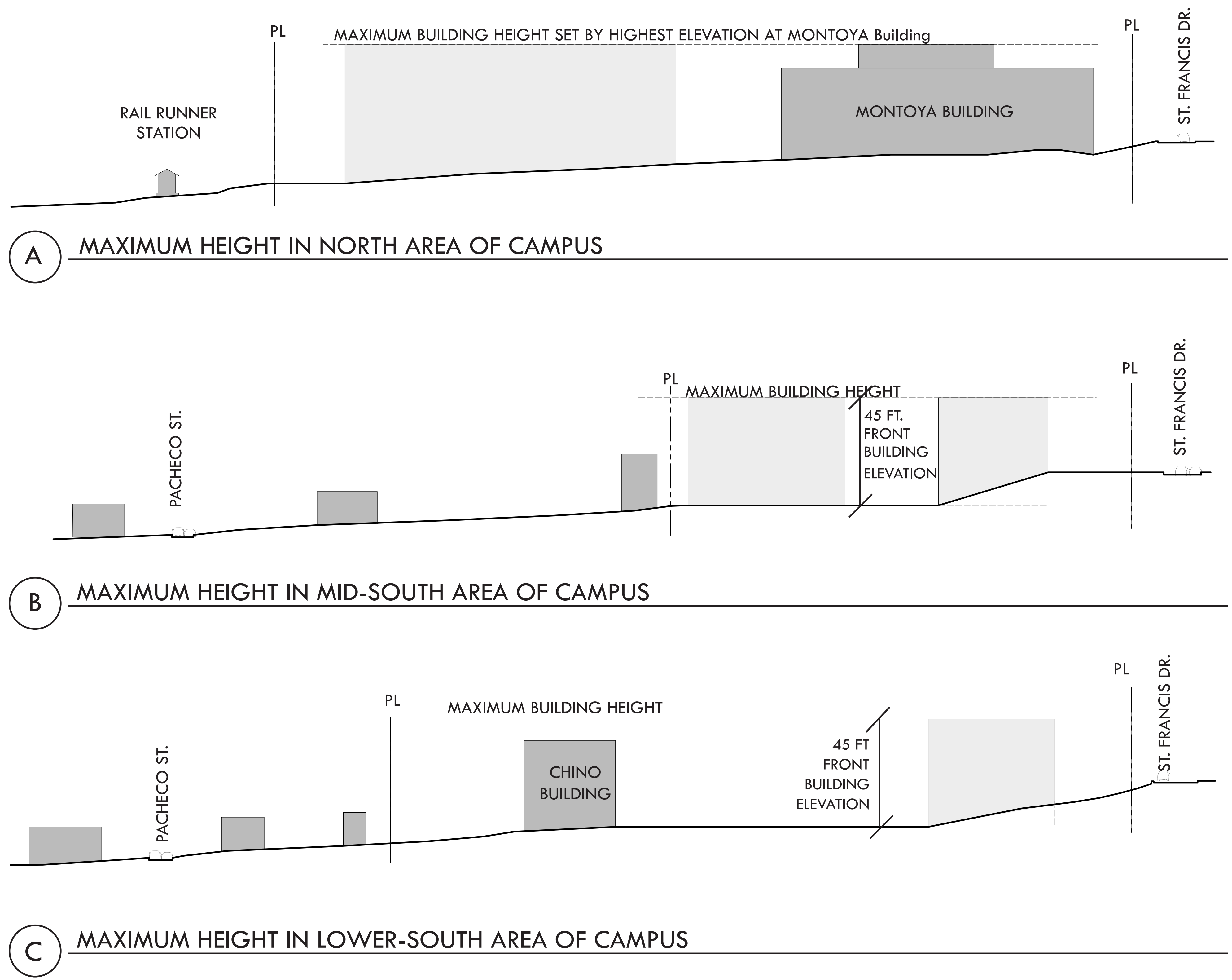


Figure 4-5: Maximum Heights

C. UTILITY INFRASTRUCTURE

A primary goal for utility infrastructure is to establish primary utility corridors that link all buildings on the campus and to implement long-term planning for a sustainable infrastructure.

1. UTILITY CORRIDOR / MAIN TUNNEL SYSTEM

Utilities, as they are improved, extended and added shall be coordinated by placing primary utility lines in defined utility corridor or underground utility tunnel. The arrangement of that system shall be as shown on the adjacent plan.

a) North Parcel: Use and extend the existing utility tunnel system that connects the Montoya, Runnels and Simms Buildings.

b) South Parcel: Use the existing utility system that connects the Runnels and Lujan Buildings. Extend the system to the south end of the property and align with the proposed main pedestrian spine through the south parcel.

2. UTILITY EQUIPMENT YARDS

Future above-ground utility equipment shall be placed in walled service yards that provide security for the equipment and are screened from public view.

3. UTILITY UPGRADES FOR EVALUATIONS

Information on existing on-site utilities is out of date. Each project should perform a complete evaluation of systems that the project will affect. Make adjustments in accordance with the primary goals of this project for sustainability and coordinated sitewide utility corridors.

4. SUSTAINABLE GOALS FOR INFRASTRUCTURE

See Section III - Sustainability Plan for master plan goals for a sustainable infrastructure for the South Capitol Campus.

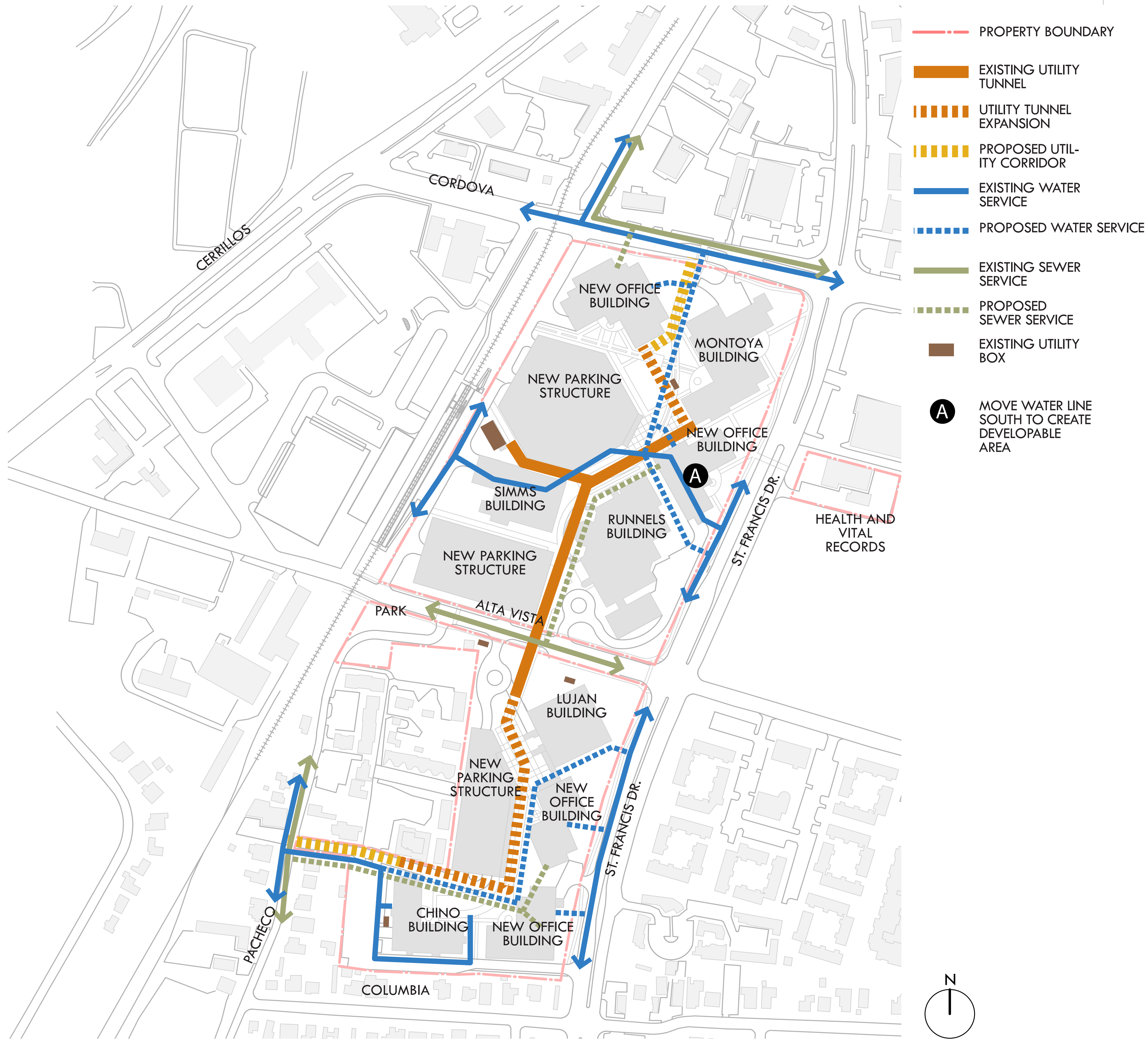


Figure 4-6: Utility Concept Diagram

D. CIRCULATION

The goal for the South Capitol Campus is a systematic, connected, multi-modal circulation system. To achieve that goal, the priority of circulation planning is:

1. Pedestrian systems
2. Transit systems
3. Bicycle systems
4. Automotive systems

This prioritization sets pedestrian needs and reduction of automotive vehicle miles as the main organizers for circulation design on this campus.

1. PEDESTRIAN SYSTEM

A connected, safe pedestrian system is fundamental to achieving a people-friendly site. There are different categories of walkways:

a) Primary walkways: The main connectors across the campus. They also align with, and in most cases are, the primary utility tunnel corridor for the project. See C. Utility Infrastriucture, 1. Utility Corridor-Main Tunnel System to coordinate primary walkways and utility corridor alignment.

b) Secondary walkways: Recommended to connect the primary walkway to the doorways and entrances to individual buildings.

c) Streetscape walkways: Related to improvements along streets. There are two recommended streetscapes:

- St. Francis Dr. / Cordova Rd. streetscape
- Alta Vista St. streetscape

d) Overhead pedestrian crossing of St. Francis Dr.

See G. Landscape for planting, lighting and amenities for each walkway type.

2. TRANSIT SYSTEM

The New Mexico Rail Runner station at the South Capitol Campus and the supporting bus, shuttles and park-and-ride routes that connect at these locations provide exceptional transit opportunities. Optimizing this asset is important to achieving the targeted parking ratio for the new development. The target is to achieve a 45% to 50% employee transit use rate for daily commutes by 2040.

Part of optimizing transit is the creation of strong walking and bicycling connections to the transit station. The South Capitol Multi-Modal Station is managed by NMDOT and the Mid-Rio Grand Council of Governments. By working collaboratively with those groups, the development goals for the transit system are:

a) Create a well-designed transit mall along the west edge of the north area of campus.

b) Design the transit mall to accommodate future longer lengths of the Rail Runner as commuter use increases.

c) Expand the transit center to connect both the GSD sites and the NMDOT sites. Parking for Rail Runner commuters is anticipated to be accommodated in a dedicated parking structure on the NMDOT site.

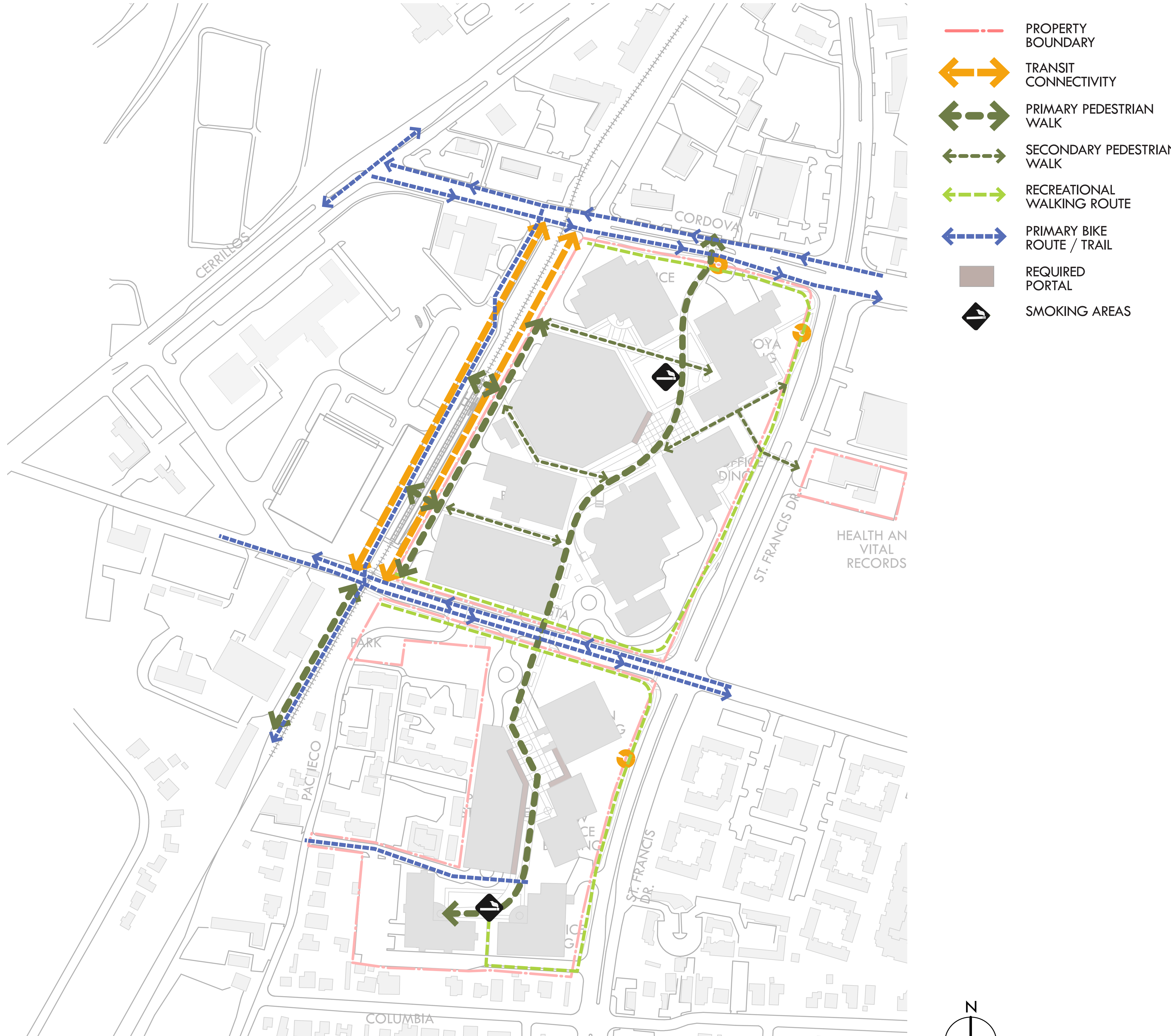


Figure 4-7: Pedestrian and Bicycle Concept Diagram

3. BICYCLE SYSTEM

Bicycles are the most energy-efficient transportation mode currently available. The City and County of Santa Fe have both invested in an extensive bikeway system and on-street biking routes that serve or connect to the South Capitol Campus site. Important development goals for the bicycle system on this campus are:

a) Reinforce connections to the City of Santa Fe Rail Trail as part of the Transit Mall located along west edge of the campus.

b) Develop the main pedestrian walking spine to accommodate mixed pedestrian and bicycle use, assuming low bicycle speeds on campus.

c) Provide bicycle racks at each building's main entry plaza.

d) Provide bicyclist support facilities to obtain LEED point in this category.

4. AUTO SYSTEM

Design of future roads on the South Capitol Campus will support pedestrian safety and provide ingress and egress to parking structures. The three anticipated levels of auto access are: parking access, service access, and emergency-safety access. Guidance recommendations for each are:

a) Drop-off locations shall be provided to serve the north and south ends of both portions of the South Capitol Campus.

b) Parking access shall be directed to parking structures and shall be from Cordova Rd. or Alta Vista St. Parking access from Pacheco St. shall be controlled and limited to avoid increased traffic impact to that road.

b) Service access shall be maintained to existing loading areas, but in some cases it may be controlled for access and managed as part of primary walkways. When possible, service access to new buildings shall be clustered, incorporating both utility and trash facilities.

c) Primary emergency access routes shall be as shown on the Security/ Simms Building map on page 58. These routes should be incorporated into the site walkway patterns so that their locations are indicated permanently in the landscape.

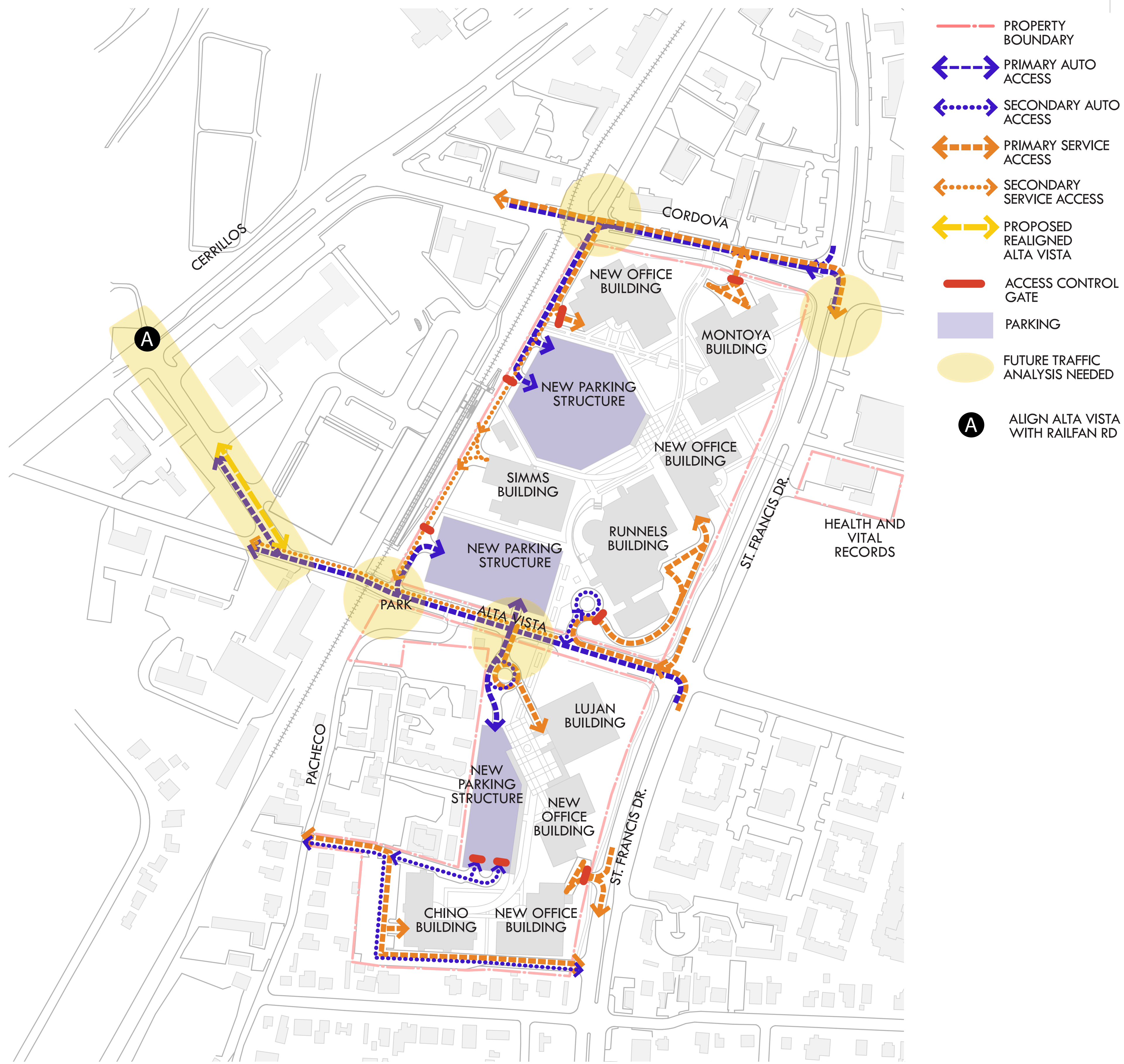


Figure 4-8: Auto and Service Concept Diagram

E. SECURITY/ SAFETY /SIMMS BUILDING

The South Capitol Campus currently does not have state-of-the-art security consistent with the level of state government administrative office functions on the campus. A campuswide security system should be part of the near-term and long-range planning for the campus. Specifically, the Simms Building, which serves as the state's information technology center, should have extensive improvements and "hardening" to secure this vital activity if it remains at this campus. Alternatively, relocate this highly sensitive function to a site with a secure perimeter.

The following improvements are recommended to address campuswide security issues:

- Provide CCTV system with pan-tilt-zoom cameras at sensitive areas such as building entries, parking structure entries and elevator lobbies, service yards, and sensitive/interior building areas
- Provide card reader or other access control to sensitive building areas
- Develop campuswide exterior lighting system with good coverage on the pedestrian spine, at building entrances and exits, and other sensitive areas
- Close and secure parking structures after work hours, providing access control by authorized personnel
- At new buildings and existing buildings with high security requirements, develop a single point of entry for both visitors and employees with CCTV
- Where possible, maintain a minimum parking standoff of 50'
- Security gates and access control at all service yards
- Secure all emergency generators
- Provide access control at all pedestrian/vehicle intersections

The following improvements are recommended to address campuswide safety issues:

- Provide pedestrian "tables" at crossings on Alta Vista St. and Cordova Rd.
- Provide pedestrian crossing warning lights at Alta Vista St. and Cordova Rd.
- Provide a minimum two foot-candle lighting level in all parking structures and even .5 foot-candle in pedestrian areas
- Plan for a pedestrian overpass to span St. Francis Dr.

Specific recommendations for hardening the Simms Building should the DoIT functions remain in this building:

- Provide blast-resistant mylar film on existing windows and verify window frame blast resistance capability
- Provide an enhanced card reader access control system
- Provide blast-resistant wall parking decks and extended parapets at any future parking structures adjacent to Simms Building
- Verify existing masonry exterior wall blast resistance and modify as required to withstand appropriate threat level
- Provide a full coverage CCTV system

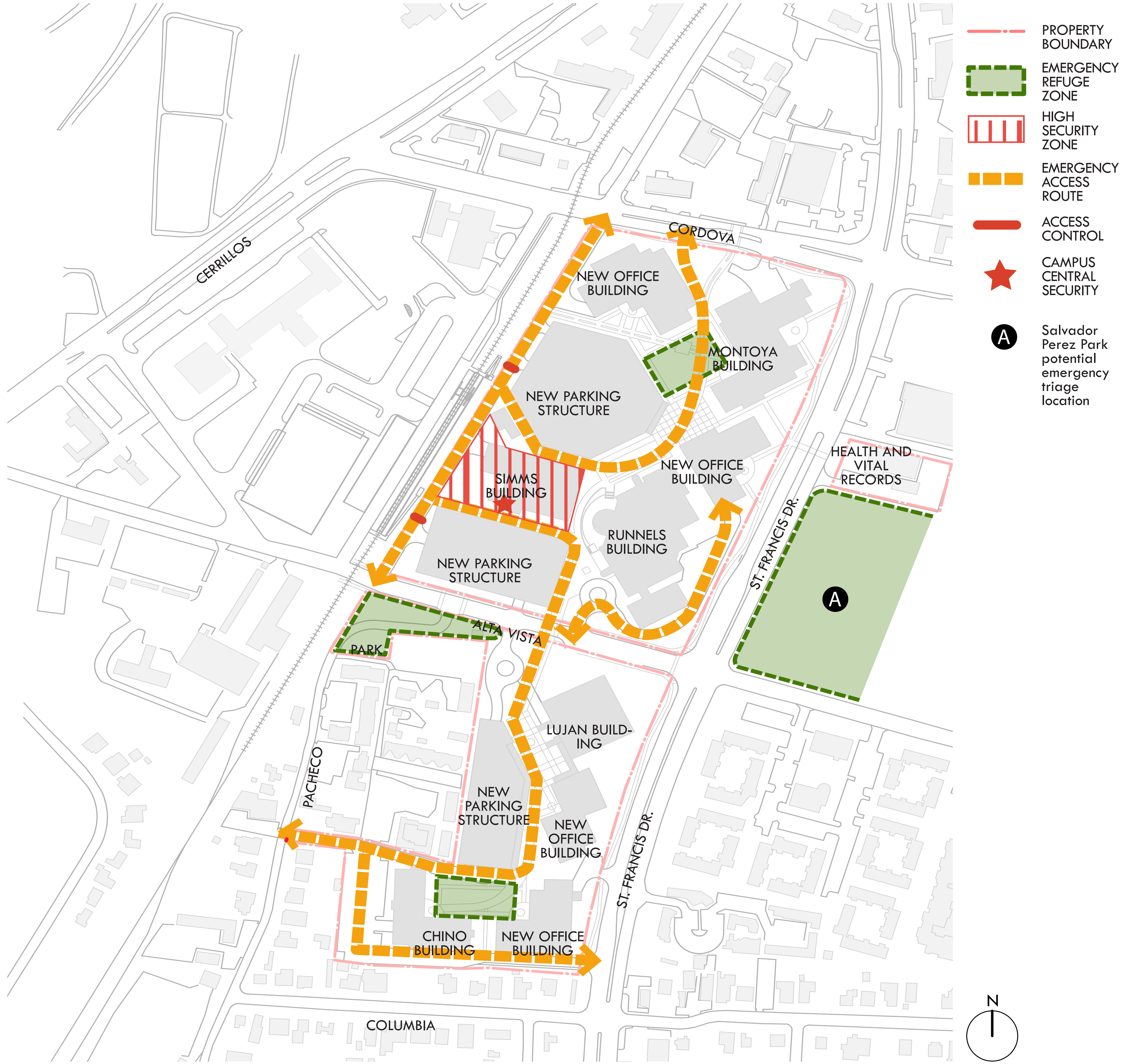


Figure 4-9: Security Concept Diagram

F. ARCHITECTURAL DESIGN

EXISTING BUILDINGS

The existing buildings are each somewhat unique and share some regional architectural expression. The stepped massing evident in the Runnels Building and, to a lesser extent, the Montoya Building, are consistent with Pueblo Revival style. The Chino Building is somewhat similar. The Lujan and Simms Buildings are not consistent with the Pueblo Revival style. The Lujan Building is a unique form and would be difficult to modify.

NEW BUILDINGS

New buildings should contribute to the generally established style of the existing campus and incorporate appropriate sustainability features. Buildings should include:

- Stepped massing of floors
- Wall plane change of a minimum 3' every 150' horizontal
- Color consistent with most existing buildings
- Utilize a plaster exterior, cast-in-place concrete, or precast concrete
- Control/shade solar exposures on the west, east and south elevations
- Orient buildings on an east/west axis if possible
- Building heights should be consistent with the balance of the campus and in no case exceed five stories. Five-story buildings shall not front St. Francis Dr.
- Windows should provide controlled daylighting to a majority of office spaces. Glazing shall be high-performance solar control glass with thermally broken frames.
- Vestibules shall be incorporated at all new building entries
- Service areas shall be screened from view by 6' high walls
- Any rooftop equipment shall be screened with an architecturally compatible material

Figure 4-10: View north from St. Francis & Columbia - Example of Stepped Massing

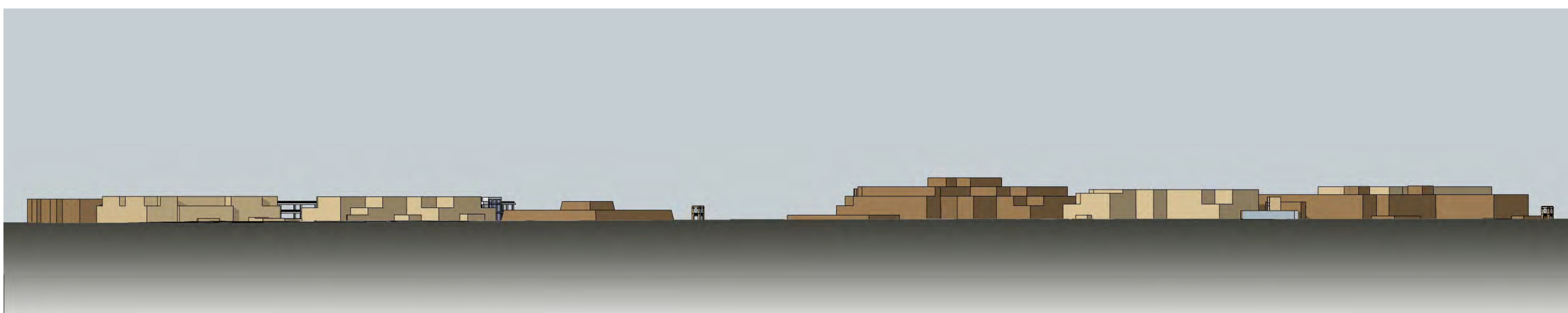


Figure 4-11: Section from St. Francis Looking West - Example of Building Height from St. Francis

G. LANDSCAPE

1. WATER GOALS FOR LANDSCAPE

The water use goal for the landscape is to create a lush New Mexico landscape that uses no potable water. Harvested rainwater, treated greywater, and if possible treated blackwater would irrigate plants. Plant selection for low water use will be important.

2. LANDSCAPE IMAGE

The native landscape of Santa Fe is high plains Piñon Juniper. Human intervention has, over the centuries, added a rich palette of drought-tolerant plants that have shown the durability to withstand the area's periodic droughts. The concept of the landscape is natural and human-influenced diversity allowing for a more natural, unmanicured, seasonal approach to maintenance.

3. LANDSCAPE - MULTI PURPOSE USES

Landscape areas will serve multiple purposes. Some of the multiple purposes anticipated in this master plan are:

a. Plaza / underground heat-pump well locations, water harvesting, water quality treatment zones, emergency routes
b. Primary walkways / utility corridors, emergency routes
c. Open space / water harvesting, water quality treatment zones
d. Parking / storm water detention, water harvesting

The multi-purpose nature of the landscape areas, mean that specific detailed programming that integrates utility, emergency access and other uses must be done prior to design of the landscape.

4. CAMPUS PARKS DESIGN

Campus parks are to be the hallmark landscape spaces for the South Capitol Campus. Three parks are recommended for the campus, one each on the north and south portions and one as a neighborhood park at the corner of Pacheco and Alta Vista Streets.

a. Design intent: Primary "people activity" zone, urban feeling, large gathering area, and multiple purposes noted above in paragraph G.3
b. Location: Generally as noted on South Capitol Campus Master Plan
c. Minimum square footage: North and South Plazas should have a minimum square footage of 35,000 sq. ft. The measured area shall be generally rectangular or square. The square footage shall be measured from bounding building faces and exclude roads, parking areas, parking structures and buildings. The calculation may include: walkways and stand-alone open structures whose primary purpose to shade pedestrians.
d. Paving materials: Gray concrete with limited specialty paving
e. Required amenities: Benches, picnic tables, trash cans, informational kiosks, flag poles, shade shelters, sheltered outdoor smoking zone
f. Lighting concept: Design for even ambient lighting of .5 foot candles, mix of pedestrian scale lights maximum 14' ht., pathway bollards, and limited facade lighting on faces of buildings immediately adjacent to the campus parks.
g. Landscape: Shade trees, flowering trees, evergreen and flowering shrubs. Limited cool season turf and specialty plants. Target area to be irrigated by greywater and water harvesting.

Figure 4-12: Landscape Zones Concept Diagram

5. BUILDING ENTRY PLAZA DESIGN

a. Design intent: Primary people activity zone, urban feeling, orienting visitors
b. Location: Main public entry to building
c. Minimum square footage: Size-appropriate to building, minimum recommended 4,000 - 5000 s.f.
d. Paving materials: Specialty paving. If sustainable infrastructure is in place, consider subsurface heated paving
e. Required amenities: Building name and building occupants signage, trash cans, bicycle parking facilities in close proximity
f. Lighting concept: Design for even ambient lighting of 1 foot candle., mix of pathway bollards pedestrian scale lights maximum 14' ht. and 2 foot candles lighting at primary entry alcove
g. Landscape: Shade trees, flowering trees, evergreen and flowering shrubs

6. TRANSIT MALL DESIGN

a. Design intent: Major regional transit hub
b. Location: West edge of north campus area
c. Minimum Square Footage: NA
d. Paving materials: Specialty paving
e. Required amenities: Benches, trash cans, bicycle parking racks, transit-related signage, site orientation kiosk, bollards, specialty site furnishings related to small-scale retail and food opportunities
f. Lighting concept: Design for even ambient lighting of 1 foot candle, pedestrian-scale lights maximum 14 ft. ht., specialty lighting related to transit center
g. Landscape: Shade trees, flowering trees, evergreen and flowering shrubs.

7. MAIN PEDESTRIAN WALKWAY SPINE DESIGN

a. Design intent: Main pedestrian walking spine
b. Location: Center of site connecting main building entries and campus parks
c. Minimum square footage: NA
d. Paving materials: Minimum 10' wide walkway, gray concrete
e. Required amenities: Benches, trash cans, bollards
f. Lighting concept: Design for even ambient lighting of 1 foot candle, mix of pedestrian-scale lights maximum 14' ht., limited pathway bollards
g. Landscape: Shade trees, must achieve 50% coverage of walkway

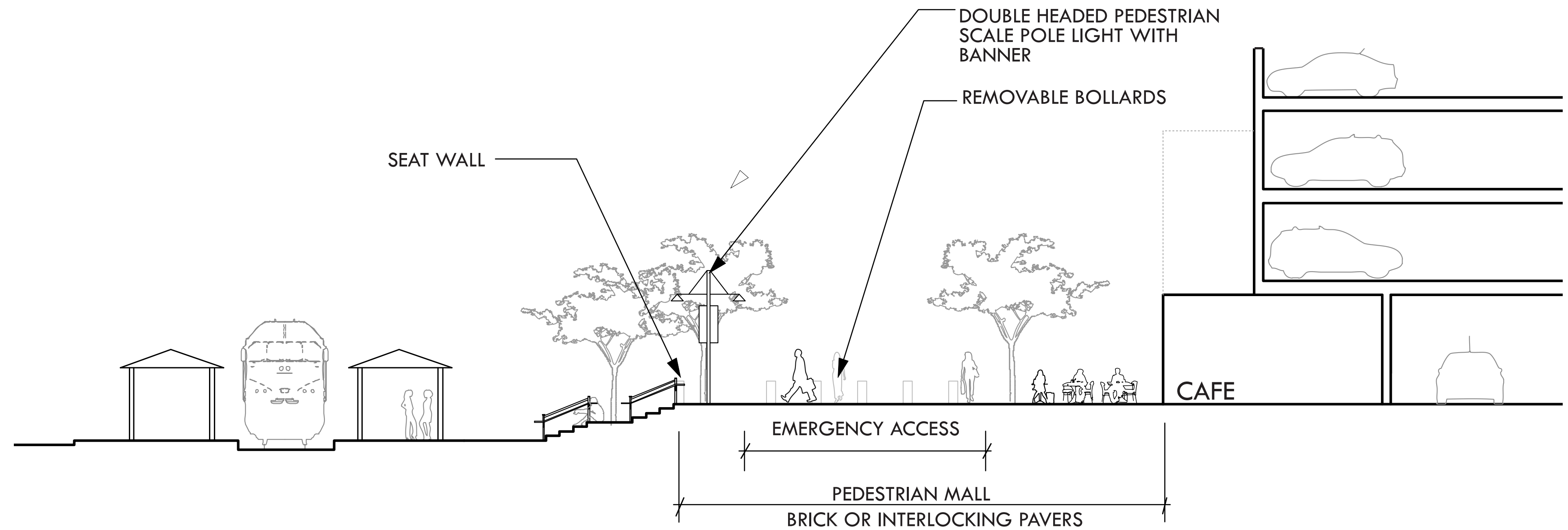


Figure 4-13: Transit Mall - Cross Section

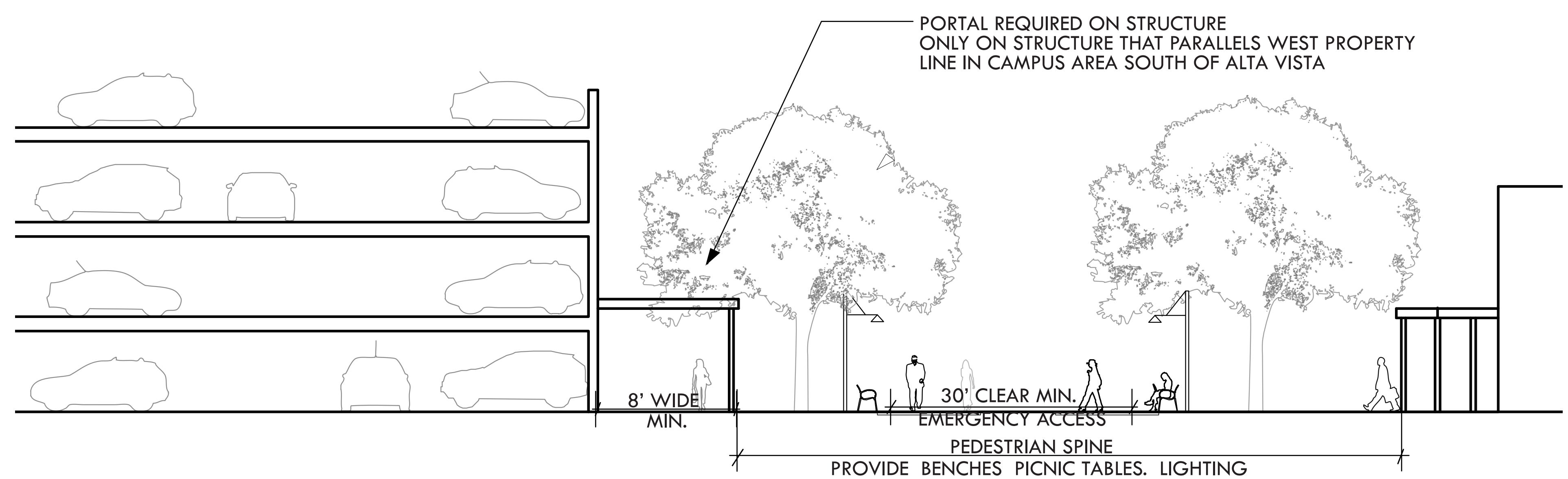


Figure 4-14: Campus Pedestrian Spine - Cross Section near Manuel Lujan Building

8. STREETSCAPE DESIGN

a. St. Francis Dr. and Cordova Rd.

1. Design intent: Public parkway and wellness route
2. Location: Perimeter of campus on St. Francis Dr. and Cordova Rd.
3. Minimum square footage: NA
4. Paving materials: Minimum 6' wide walkway, gray concrete. Consider pervious or permeable paving materials.
5. Required amenities: Walking mileage markers, benches sparsely spaced
6. Lighting concept: Limited pathway bollards
7. Landscape: Shade trees must achieve 50% coverage of walkway, very drought-tolerant, native and high salt-tolerant shrubs in parkway

b. Alta Vista

1. Design intent: Public parkway and main connective to South Capitol Rail Runner multi-modal center.
2. Location: Alta Vista St.
3. Minimum square footage: NA
4. Paving materials: Minimum 6' wide walkway, gray concrete
5. Required amenities: Benches evenly spaced
6. Lighting concept: Pedestrian-scale light poles maximum 14 ft. ht.
7. Landscape: Shade trees must achieve 50% coverage of walkway, evergreen shrubs and flowering drought-tolerant and high salt-tolerant shrubs in parkway planter. Shrubs to be less than 3' at maturity.

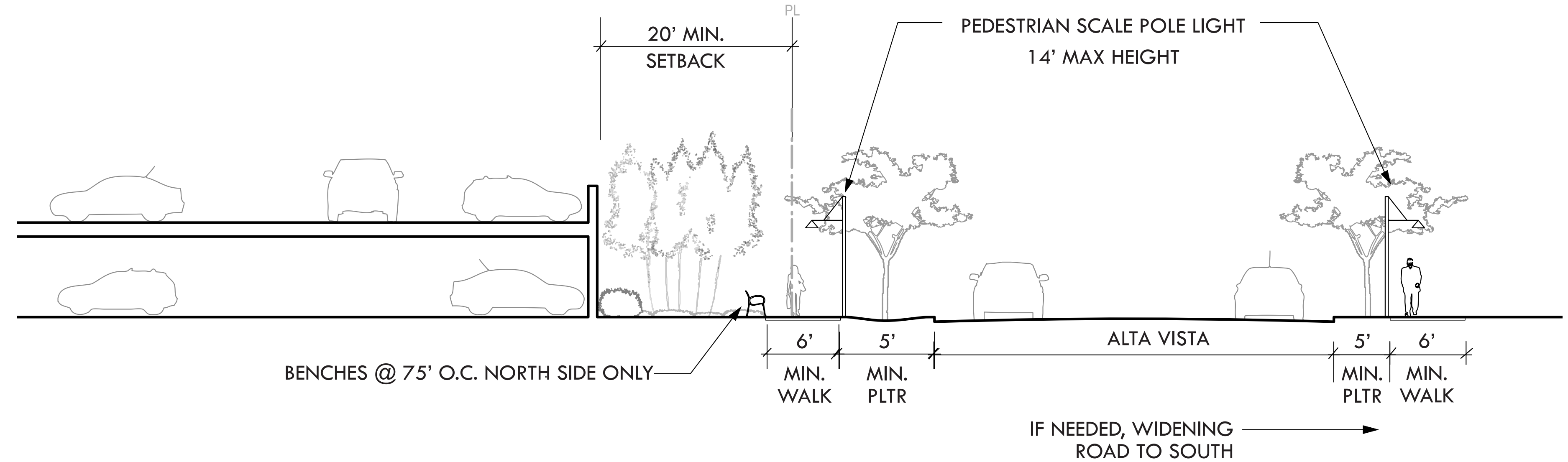


Figure 4-15: Alta Vista St./ Streetscape Section

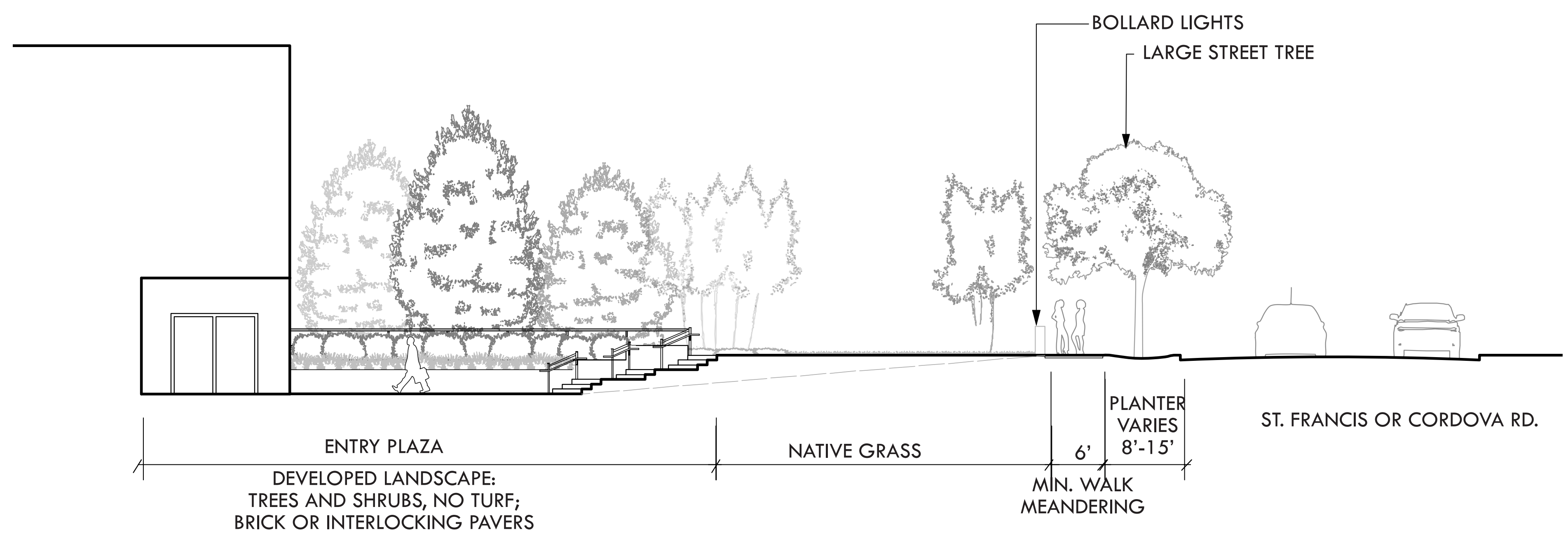


Figure 4-16: St. Francis Dr. - Cordova Rd. / Streetscape Section

9. SITE FURNISHINGS STANDARDS

a. Design intent: Establish a style and quality standard for furnishings

b. Style: Modern contemporary

c. Materials: Aluminium or brushed stainless for high recycled content, recyclable material, and permanent finish. No wood.

10. LIGHTING STANDARDS

a. Design intent: Establish general guidance for hierarchy for lighting fixtures, style and quality standard for lighting

b. Style: Modern contemporary

c. Materials: Aluminium or brushed stainless for high recycled content, recyclable material, and permanent finish

d. Performance standard: Preference is for lowest wattage fixtures, highest Energy Star® rating for type of fixture, designed to meet Night Skies requirements, photovoltaic powered

e. Lighting hierarchy: An exterior lighting fixtures standards and materials plan should be prepared. Consider the following as exterior lighting fixture categories:

- Parking pole lights: 30' ht.
- Pedestrian pole lights: 14' ht. maximum
- Pathway bollards: 30" to 36" ht.
- Ground-mounted wall washer
- Wall-mounted area lights. Must be shielded, very limited use.

10. SIGNAGE STANDARDS

a. Design intent: Establish general guidance on hierarchy, style and quality standard for signage

b. Materials: Compliment architectural materials used on campus

c. Performance standard: Lighting to be photovoltaic-powered, if possible

d. Signage hierarchy: An exterior signage standards and materials plan should be prepared. The following are exterior signage categories that should be considered.

- South Capitol Campus site identification lighted
- Informational kiosk /site map, temporary event signs, lighted
- Building identifier / ground mounted, roster for agencies in building, internally lit for night visibility
- Building name / building mounted, incorporate emergency locator considerations.
- Directional signs / Light reflective lettering
    - Vehicular
    - Pedestrian

Figure 4-17: Example park bench

Figure 4-18: Example bike rack

Figure 4-19: Example trash receptacle

Figure 4-20: Example picnic tables/benches

H. SUSTAINABILITY

1. PASSIVE DESIGN FEATURES

The envelope and passive behavior of the building is the first and most critical step in impacting the thermal and energy performance of the buildings on the site. Extensive energy modeling should be performed to optimize passive performance through the implementation of various features and strategies discussed in Section D of the Sustainability Plan.

2. PRIMARY ENERGY SOURCE OPTIONS

In order to achieve the targets for reduction of carbon emissions the incorporation of on-site renewable resources is essential. Location of the energy harvesting technology, such as solar collectors, Ground Source Energy Exchange Systems and Sewer Heat Recovery systems need to be coordinated early in the design in order to optimize energy collection and distribution efficiency. Similarly, the distribution strategy should be evaluated and decided upon. Refer to Section E in the Sustainability Plan.

3. BUILDING SYSTEMS

While the passive features of the building have the greatest potential to impact energy consumption it is the active mechanical and electrical systems that consume the most energy. Similarly, the building plumbing systems and strategies dictate the level of water consumption for the site. Sections F, G and H in the Sustainability Plan discuss various options and strategies for the active building systems.

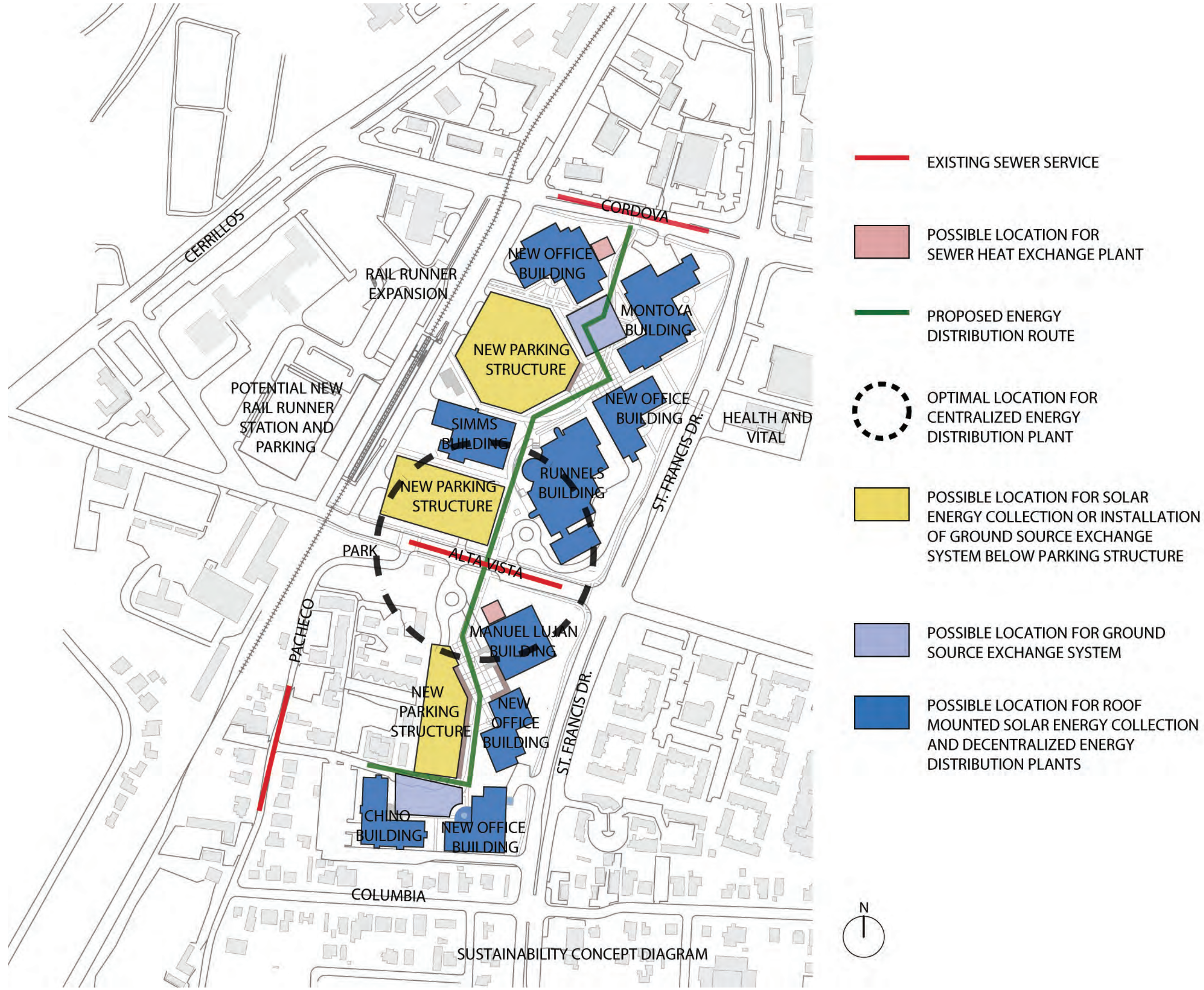


Figure 4-21: Sustainability Concept Diagram

V. IMPLEMENTATION / PHASING

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IMPLEMENTATION

The South Capitol Master Plan is developed as a flexible and adaptable document in order to give the State scenarios as new space demands are identified at the campus. The density of development is limited by the number of cars the site can accommodate in structured parking, and by observance of building heights consistent with the existing campus. Conversely, the density can be increased in direct proportion to the number of employees using alternate modes of transportation to access the site, in lieu of single-occupant vehicles.

As noted in Section II. Master Plan, the South Capitol Campus is uniquely situated to take advantage of the Rail Runner and the bus/multi-modal center. The degree of use of alternate modes to access the campus directly impacts the amount of space and employees the campus can accommodate. Opportunities to increase multi-modal ridership are discussed in B. Multi-Modal Strategies of this Implementation section.

A. DEVELOPMENT SCENARIOS

The master plan is based on the development of pairings of buildings with structured parking. This simple pairing concept allows development to occur in any order, depending on demand and colocation of agencies. The pairs are shown as Scenario A, B or C on the plan to the right. In addition, there is an opportunity to increase existing building use by renovating to more open office designs. The three scenarios and the no-build option are described below.

NO BUILD OPTION

The no-build option for the project is to renovate existing buildings and improve space utilization within the buildings by implementing open office concepts. Renovation of existing space will require one of two actions:

1. An agency vacates space on the site, which frees up backfill space to accommodate temporary relocation of employees during renovations. Possibilities could be DoIT or Department of Health.
2. Temporary leasing of off-campus space to relocate agencies during renovation activities

It is anticipated that renovation of existing space could accommodate, conservatively, an increase of employee capacity by 10%. Because no new building square footage is increased, the existing parking on site would meet the current standards for 1 parking space per 350 GSF. These additional employees would increase the use of the existing parking. This increase creates an opportunity to transition employees to use alternate modes of transportation in order to maintain effective and optimum use of the existing parking.

See *Appendix-Existing Building Analysis* for examples of open office floor plans for existing buildings.

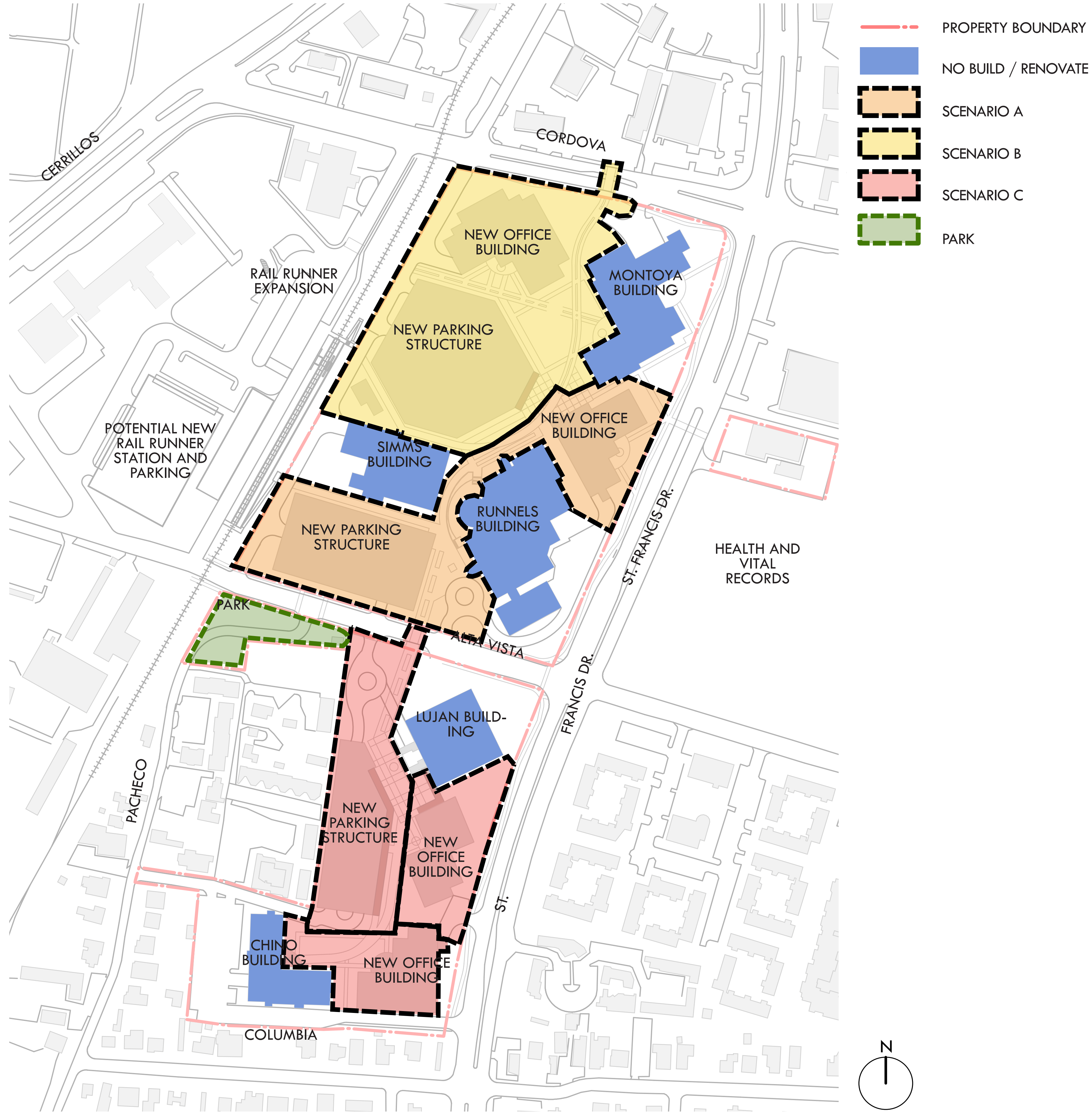

Figure 5-1: Development Scenarios Diagram

SCENARIO A

Build a two-story building of approximately 107,000 GSF between the Montoya and Runnels Buildings and a parking structure for approximately 408 cars south of the Simms Building. Major site improvements associated with this phase include:

1. A pedestrian crossing table on Alta Vista St.
2. Pedestrian connections north and south of the new parking structure to the Rail Runner/multi-modal center.
3. Pedestrian /site improvements from Alta Vista St. north to the new building and around the Runnels Building.

SCENARIO B

Build a four-story building of approximately 235,000 GSF at the northwest corner and a multi-story parking structure for approximately 1,030 cars. Major site improvements for this phase include:

1. The pedestrian connections north and south of the new parking structure.
2. The north campus park.
3. Extension of the pedestrian spine and utility corridor north to Cordova Rd.

SCENARIO C

Build two new buildings, one south (Option C1) of the Lujan Building with up to 60,000 GSF, and a one east of the Chino Building (Option C2) with up to 86,000 GSF and an approximately 500-stall parking structure south of Alta Vista St. The major site improvements associated with this phase include:

1. Extension of the pedestrian spine and utility corridor south of Alta Vista St.
2. The south campus park.

NEIGHBORHOOD AMENITIES

Build a small park as part of amenities for neighborhood.

B. MULTI-MODAL STRATEGIES - INITIAL STEPS

Planning for transportation change will require strategic short- and long-range planning to change travel habits, improve multi-modal capacity and quality, and parking expectations.

Initial planning steps recommended are:

1. Establish state policy on targets for long-range transit use for the South Capitol Campus.
2. Conduct research on current employee travel patterns, including: origin and destination study, transit utilization study which includes Rail Runner, regional bus systems, park-and-ride, local city bus system, bike, and walking. Examples of survey model:
    a) South Coast Air Quality Management District; Rule 2202 - On-Road Motor Vehicle Mitigation Options; Employee Commute Reduction Program Guidelines, dated Feb. 2004.
3. Prepare a multi-modal incentivization and vehicle mile travel reduction plan with both short- and long-term needs, methods and budget implications. Prioritize and find ways to implement the short-term opportunities as soon as possible.
4. Develop an education process and program about the goal for the South Capitol Campus to be a model multi-modal transportation site now and in the future.

C. SUSTAINABILITY STRATEGIES - INITIAL STEPS

1. Establish the baseline current energy use data that will be the future target for a “no-net” energy and water use strategy.
2. Conduct an in-depth energy and water audit of existing buildings and uses on campus to be incorporated into a detailed sustainability plan.
3. Prepare a detailed sustainability plan for the South Capitol Campus which will set the 2040 targets for future energy and water by use and building-by-building.

D. NEIGHBORHOOD STRATEGIES - INITIAL STEPS

Begin planning for the input process with the City of Santa Fe and the community. Recommended first steps are:

1. Establish dialogue with City to outline and agree on review and input process for the South Capitol Campus.
2. Begin to plan for a public input process that is diverse, proactive and includes both immediately adjacent stakeholders and other concerned citizens.

E. BUILDING STRATEGIES - INITIAL STEPS

1. Evaluate and begin planning to renovate existing buildings to increase capacity.
2. Implement program to transition to open office systems and reduce hard wall offices.

CHANGING OUR MINDS / “WHAT WE CAN IMAGINE, WE CAN DO”

In today’s world of ever changing technologies, engineering, and inventions, the greatest challenge is not our ability to design for change--it is our collective ability to change our minds toward a more sustainable future.

Change is always incremental and achieving a more energy efficient and sustainable campus will take the long-term interest and efforts of State legislators, departmental, project development, operations and management staffs, and the public. Education and training is fundamental to achieve a more energy and water conserving campus for the long-term economy and health of the State of New Mexico and its citizens.

The following are groups that are important to provide education, training and information to achieve the goals of this master plan.

PROVIDING DATA FOR LEADERS

For leaders to be able to support the changes proposed in this master plan, research and information on the benefits and evolving lessons-learned about multi-modal transportation, sustainable water and energy strategies should be monitored, compiled and documented for this site and sustainable projects throughout New Mexico and the nation. An example is the Building Services Division data on paper and solid waste recycling programs at the South Capitol Campus.

EDUCATING CAMPUS EMPLOYEES

Changing the way employees commute to and work in a more sustainable work environment will need employees who are continually involved and educated in the goals, reasons, research and programs to become more energy and water sustainable. Giving a context of how their individual actions help the State to achieve sustainable goals is fundamental.

TRAINING OPERATIONS AND MAINTENANCE STAFF

Operations and maintenance staff will need training to manage a campus that has an integrated sustainable infrastructure system and new building prototypes. Individual components may be easier to manage, and yet, the expertise to balance the inter-related nature of the various component systems will require a different perspective and new skills. Training time and dollars is a priority need to support Building Services staff in their critical role.

INFORMING THE PUBLIC

Public support of sustainable changes is important as it is public tax dollars that will fund and support most of the improvements. As the transition to a multi-modal, energy and water conserving site occurs, a creative information strategy to inform the public about Campus efforts to reduce operational costs and create healthier environments for the State and its citizens is an important part of changing our minds.

APPENDIX

- Existing Users Analysis / Program Analysis
- Existing Building Analysis
- Existing Site Analysis
- Cost Analysis and Assumptions
- Climate Data

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EXISTING USERS ANALYSIS / PROGRAM ANALYSIS

SUPPLY

Supply is comprised of available space in existing buildings and in additional potential buildings in the future as described in the master plan. Supply is the total carrying capacity of the campus.

The South Capitol Campus (SSC) is a state administrative complex that houses over 1,800 employees in approximately 540,000 GSF within six buildings.

Located at the southeast corner of St. Francis Dr. and Cordova Rd. in Santa Fe, the South Capitol Campus is home to over 1,800 state employees within nine different state executive agencies. The campus consists of five major office buildings on the central campus, and one standalone building on the east side of St. Francis Dr., the Public Health Nurses (Bureau of Vital Records and Health Statistics) Building.

The Capitol Buildings Master Plan has designated the SCC as primarily an administrative office complex, and the majority of existing occupants meet this designation. Of current occupants, only the Vital Records function and the Environment Department's laboratory functions do not fully meet the definition of administrative space.

The average GSF per person at the South Capitol Campus is over 300 GSF per person (see Figure A-1). Toward meeting this report's stated goal of increasing efficiency, the state should consider options to increase the use of existing space. Research on current building trends (see Figure A-2) indicates that a target range for current office buildings is between 225 and 250 GSF per person. Providing the most efficient office space is a goal of the CBMP. Section II Master Plan, "Strategies for High Space Efficiency" and "Accommodation for Potential Future Growth of State Agencies Located at South Capitol Campus" in the Appendix explore in greater detail options such as major renovations, open office workstations, and flexible scheduling.

The South Capitol Campus has the potential to add 200,000 to 488,000 GSF, for a total capacity of 1,028,000 GSF on the site. See Section II Master Plan for detail.

The New Mexico Department of Transportation (NMDOT) lands directly adjacent to the South Capitol Campus add even more potential building capacity.

Adjacent to the South Capitol Campus are 22.7 acres of state-owned property controlled by the NMDOT that are considered part of the campus in the State of New Mexico's Capitol Buildings Master Plan (CBMP). This property is generally referred to as the NMDOT General Office complex, and houses a mix of NMDOT functions.

In recent years, NMDOT has explored redevelopment options for this site independent of the CBMP. Those efforts have not yielded any viable development options to date, and as of May 2010, the NMDOT is no longer actively seeking redevelopment opportunities for this portion of the SCC.

South Capitol Campus: Existing Space and Staffing Analysis

		Harold Runnels	John F. Simms	Joseph Montoya	Manuel Lujan	Vital Records	Wendell Chino	Total
Department of Health	DGSF	85,827				6,560		92,387
	Staffing	425				15		440
Department of Information Technology	DGSF		37,470					37,470
	Staffing		163					163
Economic Development Department	DGSF			13,344				13,344
	Staffing			62				62
Energy Minerals and Natural Resources Department	DGSF						44,715	44,715
	Staffing						188	188
Environment Department	DGSF	43,785						43,785
	Staffing	236						236
General Services Department	DGSF	1,393	5,484	25,809				32,686
	Staffing		19	165				184
Indian Affairs Department	DGSF						3,121	3,121
	Staffing						15	15
Public Education Department	DGSF			2,143				2,143
	Staffing			12				12
Taxation and Revenue Department	DGSF			55,611	52,393		6,644	114,648
	Staffing			230	257		43	530
Total DGSF	DGSF	131,005	42,954	96,907	52,393	6,560	54,480	384,299
Building GSF (Rounded to the nearest 1,000 GSF)	GSF	184,000	60,000	136,000	80,000	10,000	80,000	550,000
Total Staffing	Staffing	661	182	469	257	15	246	1,830
GSF/Person	GSF	278	330	290	311	667	325	301

DGSF: Departmental Gross Square Footage (NASF plus corridors and walls within a suite)

**For planning purposes, the Vital Records Building was not included in these calculations.*

Figure A-1: Existing Space and Staffing Analysis

Gross Square Feet per Person: Recent Building Trends	GSF Per Person
"Anonymous" High-Tech Firm	225
AT&T	225
IBM	250
Lucent Technologies	200
Sydney, Australia - Private Sector Office	257
US GSA Standard Planning Metric	250
Average	**235**

Sources:
US GSA Office Space Use Review, 1997
and 2002 Space Use Update
US GSA Real Property Performance Results, 2005
US GSA Workplace Evaluation Study, 1999
Public Works and Government Services Canada, Fit-Up Standards
Technical Reference Manual, 2004 / 2009

Gross Square Feet per Person: South Capitol Campus	GSF Per Person
Harold Runnels	278
John F. Simms	330
Joseph Montoya	290
Manuel Lujan	311
Wendell Chino	325
Average	**307**
Overall Site GSF per Person	**301**

Note: Does not include Vital Records (Public Health Nurse's Memorial Building)

Figure A-2: Gross Square Feet per Person: Recent Building Trends

By including the NMDOT lands, the South Capitol Campus has considerable capacity and opportunity to adapt to the changing needs of the New Mexico state government, particularly in light of the Rail Runner station located on the NMDOT side of the campus. Future site planning for both the GSD and NMDOT portions of the South Capitol Campus should explore opportunities to collaborate for the benefit of all the state government's long-range needs.

DEMAND

Demand for space consists of existing agencies to remain at SCC, agencies that could be moved onto the campus from leased or owned space, and long-term growth of all potential occupants at the campus.

Potential total demand at the South Capitol Campus is between 47,800 GSF and 416,300 GSF of additional administrative space, depending on several variables. They include: success in moving agencies from leased and owned space to the SCC, completion of proposed building initiatives, availability of backfill space generated by those building initiatives, and the rate of growth of state government.

APPROXIMATELY 54,800 GSF COULD BE MOVED FROM AGENCIES CURRENTLY OCCUPYING STATE-OWNED SPACE TO SCC.

One agency, the Office of the State Engineer, currently occupying approximately 54,800 GSF of state-owned space at the Main Capitol Campus, has been identified as appropriate for a potential future move to the South Capitol Campus. This agency also has some leased space that could be consolidated, as identified below.

ABOUT 141,000 GSF OF ADMINISTRATIVE SPACE COULD BE NEEDED AT SCC FOR AGENCIES THAT CURRENTLY OCCUPY LEASED SPACE, NOT COUNTING CURRENT BUILDING INITIATIVES.

The Capitol Buildings Master Plan has established a key long-range planning objective of moving agencies from leased space to state-owned space, thereby reducing annual operational expenditures for leases. Analysis of current leases identifies agencies occupying approximately 120,000 leased square feet (LSF) of space, equivalent to 141,000 GSF, that house administrative functions appropriate for a potential move to the South Capitol Campus.

IF CURRENT BUILDING INITIATIVES ARE NOT COMPLETED AS CURRENTLY CONCEIVED, AN ADDITIONAL 350,000 GSF OF EXISTING LEASED SPACE COULD POTENTIALLY RELOCATE TO THE SOUTH CAPITOL CAMPUS.

Furthermore, the intent of several building initiatives already underway, namely the Health and Human Services Complex and the Executive Office Building, is to reduce the state's dependency on leased space in Santa Fe. However, if these projects are not completed as currently conceived, an additional potential demand could result in up to 297,000 LSF, or approximately 350,000 GSF, of leased administrative office space that would be appropriate for location at the South Capitol Campus. In all likelihood, actual demand would be less than 350,000 GSF, since the project scope would be reevaluated to include only agencies appropriate for SCC, and some agencies would remain in their existing locations.

LEASE ANALYSIS

An analysis of existing leases in Santa Fe is summarized in Figures A-3 and A-4. Currently, the State of New Mexico leases approximately 658,000 LSF in Santa Fe at a total lease cost of approximately $14.5 million annually (based on 2010 lease payments).

Agencies occupying approximately 120,000 LSF of space were identified as appropriate candidates for relocation to the South Capitol Complex, based on the location principles established by the Capitol Buildings Master Plan. These leases house primarily administrative functions, and include several agencies, boards, and commissions.

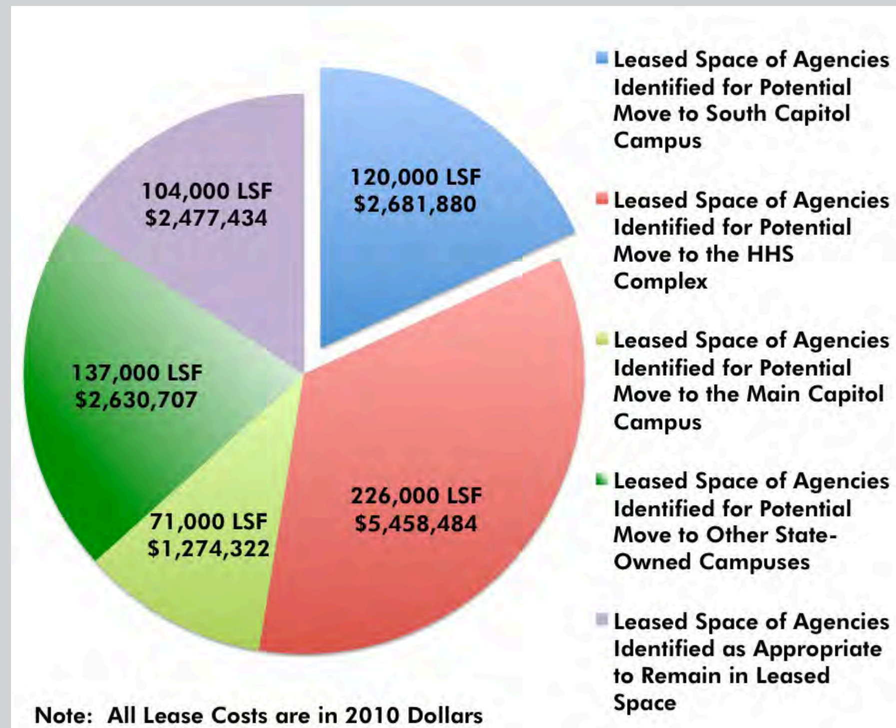


Figure A-3: State Agencies in Leased Space in Santa Fe

The proposed Health and Human Services (HHS) Complex, when fully realized, will house agencies currently occupying 226,000 LSF of leased space. The planned Executive Office Building (EOB), which will be located at the Main Capitol Campus, will also accommodate several agencies currently occupying approximately 71,000 LSF of leased space.

Agencies occupying approximately 137,000 LSF have been identified as appropriate for relocation from leased to state-owned space at other state-owned campuses. These agencies do not meet the CBMP site location criteria for the South Capitol Campus.

Additionally, it is considered appropriate for a number of agencies with special location requirements to remain in leased space rather than move to a state-owned campus. These agencies occupy approximately 104,000 LSF.

Analysis of Potential for Relocation of State Agencies Currently in Leased Space in Santa Fe to State-Owned Space	Leased Space (LSF)	Lease Cost (In 2010 Dollars)	GSF Equivalent* (LSF / 0.85)	Cost per Square Foot ($/LSF)
Leased Space of Agencies Identified for Potential Move to South Capitol Campus				
Environment Department	55,429	$1,116,997	65,211	$20.15
Commission for the Blind	4,687	$118,068	5,514	$25.19
Commission for the Deaf and Hard of Hearing	1,196	$22,856	1,407	$19.11
Developmental Disabilities Planning Council	3,892	$94,770	4,579	$24.35
Medical Examiner's Board	5,301	$121,449	6,236	$22.91
Public School Finance Authority	4,000	$74,889	4,706	$18.72
PED: Division of Vocational Rehabilitation	24,750	$614,422	29,118	$24.83
Office of the State Engineer	15,008	$400,136	17,656	$26.66
Engineer and Surveyor's Board	5,511	$118,294	6,484	$21.46
Subtotal	**119,774**	**$2,681,880**	**140,911**	**$22.39**
Leased Space of Agencies Identified for Potential Move to the HHS Complex				
Aging and Long-Term Services Department	2,710	$54,090	3,188	$19.96
Department of Health	58,519	$1,166,930	68,846	$19.94
Human Services Department	165,270	$4,237,463	194,435	$25.64
Subtotal	**226,499**	**$5,458,484**	**266,469**	**$24.10**
Leased Space of Agencies Identified for Potential Move to the Executive Office Building at Main Capitol Campus				
Department of Finance Authority	3,153	$68,947	3,709	$21.87
Higher Education Department	12,519	$267,956	14,728	$21.40
Office of the State Auditor	9,362	$192,682	11,014	$20.58
Public Education Department	19,440	$70,487	22,871	$3.63
State Investment Council	12,912	$267,183	15,190	$20.69
State Treasurer	13,620	$407,067	16,024	$29.89
Subtotal	**71,006**	**$1,274,322**	**83,536**	**$17.95**
Leased Space of Agencies Identified for Potential Move to Other State-Owned Campuses				
Department of Corrections	7,448	$121,835	8,762	$16.36
Department of Health	26,374	$590,876	31,028	$22.40
Department of Transportation	31,509	$670,765	37,069	$21.29
Department of Workforce Solutions	15,891	$362,122	18,695	$22.79
New Mexico Retirement Healthcare Authority	1,546	$31,894	1,819	$20.63
Tax and Revenue Department	9,620	$304,494	11,318	$31.65
Workers' Compensation Administration	2,341	$52,392	2,754	$22.38
Storage, Warehouse, and Non-Office Leases	42,174	$496,329	49,616	$11.77
Subtotal	**136,903**	**$2,630,707**	**161,062**	**$19.22**
Leased Space of Agencies Identified as Appropriate to Remain in Leased Space				
Children, Youth and Families Department	29,269	$605,900	34,434	$20.70
Department of Cultural Affairs	7,153	$170,914	8,415	$23.89
Department of Workforce Solutions	9,456	$165,156	11,125	$17.47
Human Services Department	37,406	$966,154	44,007	$25.83
PED: Division of Vocational Rehabilitation	5,024	$147,977	5,910	$29.46
Public Defender Department	16,088	$421,334	18,927	$26.19
Subtotal	**104,395**	**$2,477,434**	**122,818**	**$23.73**
Total	**658,577**	**$14,522,827**	**774,797**	**$22.05**
	Leased Space (LSF)	Lease Cost (In 2010 Dollars)	GSF Equivalent* (LSF / 0.85)	Cost per Square Foot ($/LSF)

* GSF Equivalent is calculated based on existing leased space and may not accurately reflect demand. Actual space needs may change once facility programming is completed.

Figure A-4: Analysis of Potential for Relocation of State Agencies Currently in Leased Space in Santa Fe to State-Owned Space

A NUMBER OF VARIABLES MAY IMPACT THE SUPPLY AND DEMAND OF SPACE AT THE SOUTH CAPITOL CAMPUS. AMONG THEM IS THE AVAILABILITY OF BACKFILL SPACE.

Several building proposals at the different levels of development and acceptance could move some agencies currently located at South Capitol Campus off site and would make available about 148,000 GSF for backfill by others (see Figure A-5).

Planned and Potential Moves of South Capitol Campus Occupants (Backfill Opportunities)	Existing Space (DGSF)	GSF Equivalent (DGSF / 0.85)
Move DOH from Runnels to the HHS Complex in Phase 2	85,827	100,973
Move PED from Montoya to other PED Offices	2,143	2,521
Move DoIT from Simms to a more secure location	37,470	44,082
Totals	125,440	147,576

Figure A-5: Planned and Potential Moves of South Capitol Campus Occupants (Backfill Opportunities)

The proposed Health and Human Services (HHS) complex includes plans to move the Department of Health (DOH) off site in the second of three phases. This project, which has funding for only the first phase, would accommodate all of the space currently occupied by the DOH in the Harold Runnels Building (approximately 86,000 DGSF, or an equivalent 101,000 GSF). This space would then be available for renovation and "backfill" use by other state agencies.

The existing occupancy of the Public Education Department (PED) at the Montoya Building is the result of a temporary move to accommodate growth within the PED that could not be accommodated in the agency's other locations. Ideally, the PED divisions housed at the Montoya Building will eventually be colocated with the rest of the PED administrative offices at the Main Capitol Campus. This move would open up approximately 2,100 DGSF (3,000 GSF) for backfill by other agencies.

Due to the sensitive and critical nature of the data processed by the Department of Information Technology (DoIT) and DoIT's security requirements, the functions located at the Simms Building may best be suited for a location that can better meet stand-off requirements for a highly secured and hardened computing center. Although no official study suggesting or recommending this move has been completed, Capitol Buildings Master Plan discussions have suggested considering a move of the state's computing center to a more secure location such as the Oñate Campus (the National Guard/Old State Penitentiary site).

This move would open up approximately 37,000 DGSF (44,000 GSF) of space on the SCC, which could provide turnaround space and backfill space that would facilitate much-needed facility renewal efforts at the remaining campus buildings. However, determination of whether this move is a viable and appropriate move for the state to consider requires further discussions and study.

If all of these various initiatives that may impact South Capitol Campus are realized, approximately 125,500 DGSF (148,000 GSF) would potentially be made available for backfill at the SCC. If DoIT does not vacate the Simms Building, the potential amount space made available for backfill is less: approximately 88,000 DGSF (104,000 GSF).

Additionally, two proposed building initiatives under consideration impact the South Capitol Campus. A proposed move of the General Services Department Secretary and associated GSD offices from the Simms Building to the Montoya Building and a proposed headquarters building for the Environment Department would result in the shifting of assigned space within the existing campus, but would not impact overall site capacity.

THERE WILL LIKELY BE ADDITIONAL DEMAND FOR STATE OFFICE ADMINISTRATIVE SPACE DUE TO GENERAL GROWTH OF THE STATE POPULATION AND ASSOCIATED GROWTH OF THE STATE WORKFORCE. THE MAGNITUDE OF FUTURE ADMINISTRATIVE OFFICE NEED DUE TO GENERAL GROWTH IS DIFFICULT TO QUANTIFY AT THIS TIME.

This report assumes the current downturn in the number of state personnel is a temporary shift or slowing of a growth trend that will likely return to normal in time. A prudent long-range planning strategy should assume that a growing population would demand more government services, which in turn translates to growth in state government staffing levels. The Bureau of Business and Economic Research (BBER) at the University of New Mexico projects that New Mexico population will continue to trend upwards at an average of 1.42% per year (see Figure A-6).

Population Growth Projections for New Mexico, 2000-2035

Year	Estimated/ Projected Population	Annual Population Growth
2000	1,810,046	1.20%
2009	2,009,671	2.50%
2005	1,969,292	1.87%
2010	2,162,331	1.72%
2015	2,356,236	1.50%
2020	2,540,145	1.28%
2025	2,707,757	1.13%
2030	2,864,796	1.04%
2035	3,018,289	
Average Annual Projected Growth:		1.42%

Sources:
UNM Bureau of Business and Economic Research, US Census Bureau
Year 2000 - US Census Count
Year 2009 - US Census Estimate Update
Years 2005-2035 - BBER Projections

Figure A-6: Population Growth Projections for New Mexico, 2000-2035

The State of New Mexico's Capitol Buildings Master Plan for the Santa Fe area, first completed in 2000, assumes that state government space requirements will increase to keep pace with general population and government growth. The CBMP identifies as reasonable an assumed staffing growth rate of between 1% - 3% per year. Assuming a 1.5% growth of just the 1,800 personnel currently on-site, the entire new capacity of the site would be needed within 50 years.

FINDINGS

Figure A-7 summarizes the supply and demand characteristics of the space need analysis. Site planning has demonstrated the potential to add 488,000 new GSF, essentially doubling the number of people who work on the site.

The demand for space is highly variable and dependent upon the successful implementation of two current building initiatives, the HHS and EOB. Four scenarios were developed making different assumptions about the future potential makeup of the campus. At the low end (most optimistic), there is immediate demand for about 50,000 GSF of new space. At the high end (most pessimistic), most of the site capacity would be consumed. This report assumes the mid-scenario is most reasonable and justifies about 100,000 GSF additional space that allows appropriate agencies to relocate from leased and state-owned space, and does not assume any immediate relocation of state agencies currently located on the campus. This scenario closely aligns with Development Option A in Section V Implementation / Phasing of this study proposing a 107,000 GSF building.

Figure A-7: Potential Moves Scenarios

Potential Moves Scenarios	High	High-Mid	Mid	Low
Potential New Demand from Agencies in Leased Space	141,000	141,000	141,000	141,000
Potential New Demand from Agencies in Owned Space	54,800	54,800	54,800	54,800
Potential Additional Demand if HHS is not built	220,500*			
Potential Backfill available if DOH moves out of Runnels			-101,000	-101,000
Potential Backfill available if PED moves out of Montoya			-3,000	-3,000
Potential Backfill available if DoIT moves out of Simms				-44,000
Net Additional Space Demand	416,300	195,800	91,800	47,800
Additional staff accommodated assuming 250 GSF / Person**	1,665	783	367	191
Proposed Additional Site Capacity	488,000	488,000	488,000	488,000
Remaining Capacity (GSF)	71,700	292,200	396,200	440,200
Additional Staff Capacity	287	1,169	1,585	1,761
% capacity used	85.3%	40.1%	18.8%	9.8%

* Represents programmed space for Phase I of HHS
All other numbers are based on existing GSF
** As recommended by GSA. See *Figure A-2*

All four scenarios assume that all agencies in leased and owned space identified as appropriate for South Capitol Campus move to SCC.

"Low" scenario – assumes all proposed building initiatives (including HHS and EOB) are completed as conceived, and that DoIT and PED move offsite, allowing for backfill space.

"Mid" scenario – assumes that HHS and EOB are constructed and that PED moves offsite, yielding a modest amount of backfill space. DoIT remains onsite.

"High-Mid" scenario – assumes no available backfill space. Agencies identified for other building initiatives (HHS) remain on campus, as do DoIT and PED.

"High" scenario – also assumes no backfill space is available. Accommodates all agencies in leased and owned space identified as appropriate for South Capitol Campus move to SCC. Also accommodates space programmed for Phase I of HHS to house the Children, Youth and Families Department (CYFD) and the Human Services Department (HSD).

EXISTING BUILDINGS ASSESSMENT

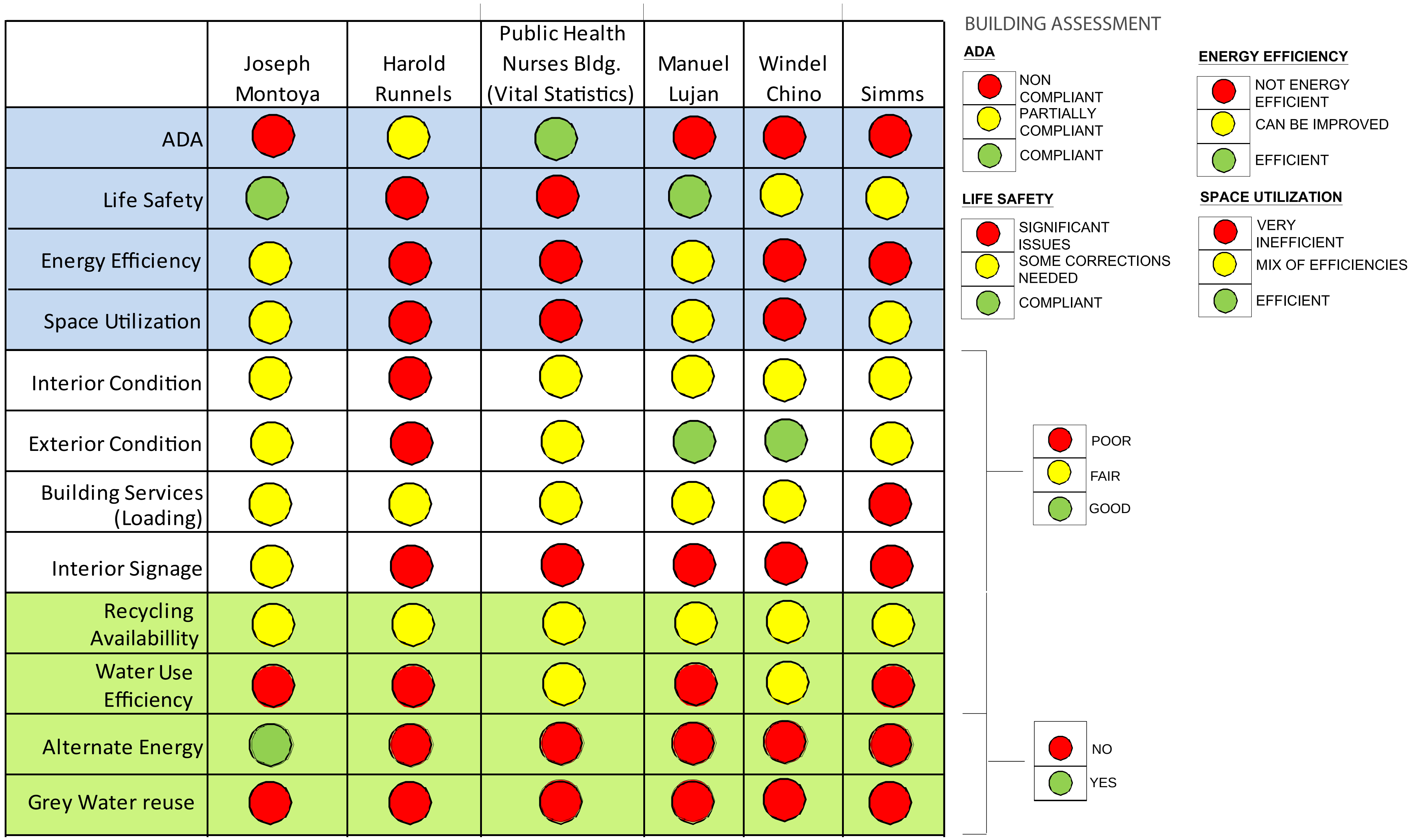


Figure A-8: Building Assessment Chart

Existing building assessments were compiled from walk-through reviews with PCD/BSD Staff, and review of the facility condition analysis of the Montoya, Runnels, Simms and Chino Buildings prepared by ISIS in 2009.

The following section addresses code and life safety deficiencies shown in red in the chart at the left. Further, several improvements can be made to the existing buildings.

STRATEGIES FOR HIGH SPACE EFFICIENCY

The Montoya, Runnels, Simms, and Chino Buildings all have the potential to achieve a higher efficiency in the use of existing space through greater use of open office concepts. This practice will increase the occupancy capacity of the buildings by 10%, conservatively. See Figures A-28 and A-29. Recommendations are ranked in order of priority: Low (**L**), Medium (**M**) and High (**H**).

MONTOYA BUILDING

The Montoya building appears to be structurally sound. The building is a steel frame with a concrete plank floor system. The atrium space is an attractive feature, however, it contributes to a large cooling load, especially in the summer. The atrium finishes are generally in good condition. The atrium does not comply with current codes which require a smoke removal system for atria over two stories. This issue should be evaluated with the State Construction Industries Division to ensure additional requirements are not triggered by a building renovation program. The mechanical systems are currently adequate for the building and the electrical systems appear adequate. Separate rooftop HVAC units serve the Taxation and Revenue data center IT on the 3rd floor, the only area of the building not served by the central HVAC system. The HVAC system is nearing the end of its life cycle and will need replacement in the near future. Electrical panels need some updating. The building is connected by a utility tunnel to the central mechanical plant in the Simms Building, facilitating a connection to a central plant should one ever be desired. The toilet rooms have some issues with the toilet carriers and there are some accessibility issues in the first floor toilets with the showers. The exterior loading area serves as a rear exit for employees. It is not secure because lighting is inadequate and it shows some damage to the building from unloading the dumpster. Following are general recommendations, ranked Low (**L**), Medium (**M**) and High (**H**), as determined by the General Services Department and the Property Control Division:

- **H** • The skylight system is insulated glazing and leaks. The system is very energy inefficient. We recommend replacement of the glazing with an insulating translucent panel system. This system will eliminate glare, reduce cooling loads in the summer, and significantly improve energy performance. Install a smoke removal system. Evaluate potential for atrium modifications to achieve passive cooling.
- **M** • The interior of the spaces are showing their age. A renovation program to update the finishes is recommended. When possible, elimination of hard wall offices can result in more efficient work spaces, increased daylighting, and, through the use of systems furniture, additional capacity. Toilet rooms should be renovated to contemporary standards. Replace toilet carriers and showers for full accessibility. Install low water-use toilets, sinks and showers.
- **H** • Building Services staff lack space to store janitorial and maintenance supplies. Some space should be provided. Currently, the staff is housed in mechanical rooms, which is undesirable.
- **M** • The building has a black EPDM roofing system. A white TPO or equal would have a significant impact on energy performance.
- **L** • The building has a solar hot water array which supplements the heating system hot water requirements. It is not clear if the system is operating correctly. This issue should be evaluated.
- **L** • Depending on the structural capacity of the roof, additional solar arrays for both hot water and photovoltaic panels should be evaluated.
- **M** • There is an existing diesel-fired emergency electrical generator in good working condition. Evaluate existing underground diesel fuel storage tanks for compliance with current environmental standards.
- **L** • Institute an organized recycling program which includes standardized recycling container systems in the building. Currently, recycling bins are stored in the hallways and may create exiting issues.
- **L** • Standardize and renovate atrium window treatments. In the case of spaces needing privacy, use translucent glazing.
- **L** • Implement a contemporary signage program and building directory that is fully ADA compliant.
- **L** • Outdoor areas are generally functional and accessible. The courtyard on the east could provide some tables for outdoor dining in good weather. The loading dock has some issues with trash pickup and lighting. Install additional protective bollards. A new loading dock along the north wall (90 degrees to the existing) will allow delivery trucks to turn and back into the dock completely on site.
- **L** • Install ADA-compliant handrails at all exterior ramp and stair locations.
- **L** • Install ADA-compliant drinking fountains.
- **H** • Install LED-type exit signs connected to an emergency power network at all locations.
- **M** • Use open office concepts in lieu of hard wall offices to the greatest extent possible. A mix of hard wall offices adjacent to the atrium with open office concepts throughout the perimeter, and/or hard wall offices at the perimeter with open office systems surrounding the atria will result in increased capacity of 10% to 15% of work stations.
- **L** • Replace all carpet.
- **L** • Repaint all interior spaces.
- **L** • Replace existing ceiling tile.
- **M/L** • Renovate/modernize toilet room finishes.
- **L** • Replace fluorescent light fixtures with more energy-efficient, modern fixtures
- **H** • Install motion detection light switches in appropriate rooms.

Figure A-9: Service Area

Figure A-10: Loading Dock

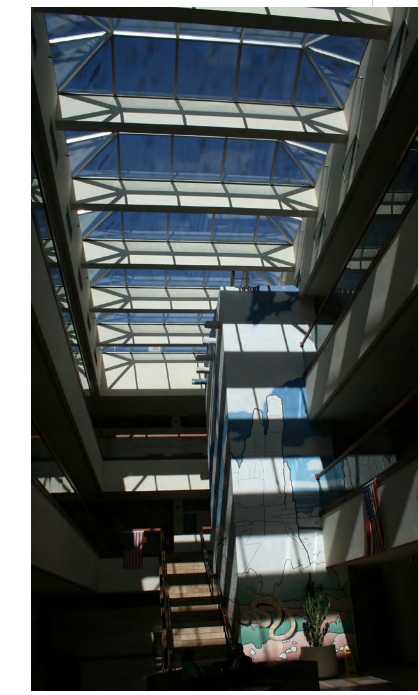


Figure A-11: Atrium

Figure A-12: Roof Solar Array

RUNNELS BUILDING

The Runnels Building appears structurally sound, but is showing its age both on the exterior and the interior. The structural system is steel frame. The EIFS is showing signs of failure and ultimately needs to be redone. The building is designed around two four-story atria which are intended to provide daylighting into the interior offices. Unfortunately, most of the windows have window treatments which are closed for privacy. The skylight systems are dated, energy-inefficient, and allow little light through, partly due to the color of the “waffle” grid. The mechanical system is connected to the Simms Building central plant through a tunnel. Electrical systems are adequate, but need some upgrading. A new fire alarm system was installed in 2009. Exterior entrances are controlled for security by a maglock system with card readers. The interior space is mostly hard wall offices which add to the lack of daylighting. Further, the hard walls are inflexible and inefficient.

Following are general recommendations, ranked Low (**L**), Medium (**M**) and High (**H**) priority, as determined by the General Services Department and the Property Control Divisions:

- **H** • The building entry is understated and rather dark. Replace tinted skylights with a more energy-efficient system that allows more light. An additional skylight at the intersection of the entries will brighten up the entry experience.
- **L** • There is an existing diesel fired emergency electrical generator in good working condition. The existing above-ground diesel fuel storage tank needs to be evaluated regarding current environmental standards.
- **M** • The auditorium includes an obsolete control room. By removing this booth, additional seating could be accommodated and the removal would open up the room for a greater visual connection with most occupants in the space.
- **H** • Replace the atria skylights with a more energy-efficient system and paint the “waffle” grid bright white. This improvement will result in greatly improved daylighting quality. Further, the lack of artificial lighting in the atria exacerbates the low quantity of light on overcast days and short days in the winter months. Incorporate additional lighting. The exit signs were not operational and need to be replaced with LED-type exit signs connected to an emergency power network.
- **H** • The glazing in the atria should be replaced with translucent glass to enhance uniformity and daylighting into the office areas.
- **H** • Incorporate a smoke removal system with nighttime cooling and passive atrium cooling.
- **H** • A separate consultant is currently completing an HVAC redesign.
- **H** • Install ADA-compliant drinking fountains.
- **H** • Implement a contemporary signage program and building directory that is fully ADA compliant.
- **M** • Renovation of existing interiors is recommended to address space utilization and exiting requirements.
- **L** • Remove all individualized window treatments on atria glazing and install a translucent film to 6 ft above floor for light transmission and privacy.

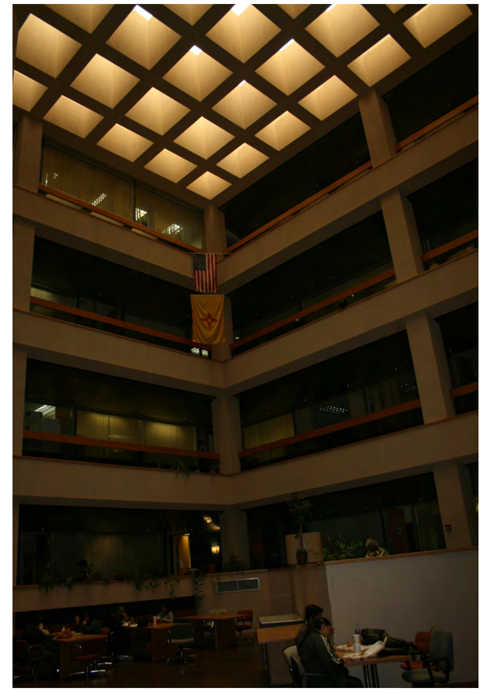


Figure A-13: Runnels Atrium

Figure A-14: Runnels Building

Figure A-15: Exterior EFIS

- **M** • Use open office concepts in lieu of hard wall offices to the greatest extent possible. A mix of hard wall offices adjacent to the atria with open office concepts throughout the perimeter, and/or hard wall offices at the perimeter with open office systems surrounding the atria will result in increased capacity of 10% to 15% of work stations.
- **L** • Replace all carpet.
- **L** • Repaint all interior spaces.
- **L** • Replace existing ceiling tile.
- **M** • Renovate/modernize toilet room finishes and reduced water use fixtures.
- **L** • Develop building legends and improved, consistent signage and way finding.
- **L** • Standardize recycling containers throughout the building.
- **L** • Replace fluorescent light fixtures with more energy-efficient, modern fixtures.
- **L** • Consider lowering window sills in some areas to increase daylight and views. Evaluate potential of operable windows for improved air quality.
- **L** • Insulate window frames to mitigate thermal bridging.
- **L** • Refinish exterior insulation finish system and consider adding an inch or two of rigid insulation to improve thermal performance.
- **M/L** • Install motion detection light switches in appropriate rooms.

Figure A-16: Runnels Building

PUBLIC HEALTH NURSES BUILDING (VITAL RECORDS)

This building comprises an older one-story structure and a 1996 addition (vault) for the records storage. Both buildings are block and brick construction and appear to be in good condition. The roof structure on the older building is bar joists with wood plank decking. The newer vault addition roof structure is bar joists with plywood decking. Interior walls are hard block and frame walls with some open office areas. A pneumatic tube system sends retrieved records from the vault to the public request area. There is no basement area. Some public toilets are fully ADA accessible and some private toilets are not ADA accessible.Following are general recommendations, ranked Low (**L**), Medium (**M**) and High (**H**) priority, as determined by the General Services Department and the Property Control Division:

- **L** • The mechanical systems are a series of older and newer split units, floor-mounted, with rooftop compressors. Supply ducts are under slab in the older building. Two mechanical rooms have sprinklers. There are no sprinklers in the remaining office areas. The building has three separate water heaters. Only in the lobby/public waiting room and records request area are heated. This area gets very warm during the summer because a large glass block wall there faces west. Replace HVAC system with new rooftop units. Abandon under-slab duct system.
- **L** • The entire building has a recently added fire alarm system.
- **M** • The vault has a wet sprinkler system, putting all documents stored there in jeopardy of being damaged and/or lost in the event of a sprinkler discharge. Install an emergency gas-type fire suppression system in this area.
- **L** • The vault has only one entrance/exit. If this exit is blocked, employees are instructed to take portable escape ladders to the roof exit. Install a new second exit on east side through new addition.
- **L** • The vault lacks adequate storage space for Safety Paper (paper records are printed on it). Add new storage area in new east side addition.
- **L** • The roof on the lower older building is a white (EPMD or TPO) that is patched in many places. Replace with new white EPDM roof.
- **L** • The roof on the vault is a black EPDM that appears to be in good shape. The HVAC system for the vault is adequate and in good condition.
- **L** • Create a new recycling/trash area in new addition to the east side of the existing vault.
- **L** • Add skylights to the open office areas.
- **L** • Renovate/modernize existing employee toilet room finishes and use reduced water use fixtures.
- **L** • Provide connection to south campus across St. Francis with pedestrian bridge.
- **L** • Renovate and secure public lobby.
- **L** • Replace all carpet.
- **M** • Repaint all interior spaces.
- **L** • Replace existing ceiling tiles.
- **M** • Replace fluorescent light fixtures with more energy efficient, modern fixtures.
- **M** • Install motion detector light switches in appropriate rooms.

Figure A-17: Vital Records Roof

Figure A-18: Vital Records Record Storage

Figure A-19: Vital Records Exterior

Figure A-20: Public Health Nurses Building Exterior

LUJAN BUILDING

This building is in good structural and exterior condition. The structure appears to be cast-in-place concrete with post-tensioned waffle slab. The resulting mass in the building reduces energy loads. This building is scheduled for a complete renovation. The basement is currently being used for Tax and Revenue mailing and temporary help for mailings. Head room is an issue in the basement and should be considered in the renovation plans. The first and second floors both have a raised floor system throughout which will be helpful in the renovation and redistribution of power and data.

This building is currently under complete redesign/remodel of all program and HVAC requirements under separate contract

WENDELL CHINO BUILDING

This building appears to be in good structural condition. The exterior is precast concrete panels. The floor structure is precast double tees with a topping slab. The building is an "L" shape floor plan with a central corridor which leads to the exit stairs. Three elevators serve the three-story structure. Two toilet cores are on each floor. The building entry is understated and minimally efficient. Ceilings are typically 8' high. The building is mostly hard wall offices. Following are general recommendations, ranked Low (**L**), Medium (**M**) and High (**H**) priority, as determined by the General Services Department and the Property Control Division:

- **L** • The use of hard wall offices limits the flexibility and efficiency of the building. The hard wall corridors also limit the possible configuration of office spaces. Since the building houses multiple agencies, some separation is required. If a single agency were to occupy building "wings," it would be possible to eliminate corridors, limit hard wall offices and achieve great efficiency.
- **L** • A mix of hard wall offices adjacent to the glazed corridor with open office concepts throughout the perimeter, and/or hard wall offices at the perimeter with open office systems surrounding the glazed corridor will imrpove employees' access to natural light.
- **M** • The mechanical system is "all-electric" and the air handling units are showing signs of age. There are new cooling towers on the roof.
- **H** • The toilet rooms need new finishes and are not accessible, except for one pair of toilets on the third floor. Renovate existing non-accessible toilet room for full ADA compliance and reduced water-use fixtures.
- **L** • The interiors finishes are not uniform and are showing signs of age.
- **M** • The building is not very efficient and, since the state occupies the entire building, portions of the corridor system could be eliminated which would greatly improve the efficiency of the floor plates.
- **L** • The lobby has very low ceilings and is not inviting or attractive. New finishes should be incorporated and, if possible, the ceiling height should be increased. Construct a new entry lobby with skylight.
- **H** • A dead-end corridor on the third floor is a code issue to be addressed with reconfigured office space.
- • IT connections to the Simms Building run underground through 5"-6" diameter conduits.

Figure A-21: Chino Cooling Towers

Figure A-22: Chino Building

Figure A-23: Chino Building

- • The roof is white EPDM with stone ballast and is in good shape with minimal roof penetrations.
- **H** • Install ADA compliant drinking fountains.
- **M** • Reconfigure the office corridor system by placing circulation corridor on the east and north exterior wall of the inside of the "L" shaped plan. Use a glazed corridor wall to allow daylight into office interiors.
- **L** • Replace all carpet.
- **L** • Repaint all interior spaces.
- **L** • Replace existing ceiling tile.
- **M** • Renovate/modernize toilet room finishes and use reduced water-use fixtures.
- **L** • Develop building legends and improved, consistent signage and way finding.
- **L** • Standardize recycling containers throughout the building.
- **L** • Replace fluorescent light fixtures with more energy-efficient, modern fixtures.
- **L** • Install motion detection light switches in appropriate rooms.

Figure A-24: Exterior Chino Building

SIMMS BUILDING

Simms Building structural systems appear to be sound. The building is concrete masonry and steel frame. The exterior of the building is split face block in good condition.

An upgrade of the electrical systems (primarily the UPS-uninterrupted power system, and some general fire alarm system upgrades) was completed in 2009. An existing diesel-fired emergency electrical generator is in good operating condition. Existing underground diesel fuel storage tanks need to be evaluated for compliance with current environmental standards. The Simms Building serves as the main data storage system/servers and IT system management for the state. The building is generally off limits to the public, with a high level of security systems in place. Other general electrical power panels and lighting upgrades are needed.

- **M** • The HVAC system has the original pneumatic controls. They need to be upgraded since they are a continuous part of an overall plan tol augment the Montoya and Runnels Building HVAC systems.
- **H** • The main water supply to the building possibly leaks. Maintenance staff has been working with the City of Santa Fe to determine the location of the leak.
- **L** • Except for the areas housing the servers, the general office areas are open cubicle systems that lend to easy reconfiguration. Classroom #1 is currently used for storage and can be reclaimed for office or training classroom use.
- **L** • Interior finishes are showing their age. Institute a renovation program for finishes. Modernize restrooms and address accessibility issues.
- **L** • Evaluate the training function in the building. One training room is full of stored items and an analysis of the frequency of use of other training rooms could result in more office space available for internal expansion.
- **L** • The roof has two air handler penthouses and a black EPDM roof in good condition. Increased energy efficiency could be achieved with a white TPO roof. The roof area is generally uncluttered with a slope of 1/8” per foot.
- **M** • Scenarios for the Simms Building are discussed in the master plan section and follow strategies for higher space efficiency. DoIT use will remain or be relocated.

Following are general recommendations, ranked Low (**L**), Medium (**M**) and High (**H**) priority, as determined by the General Services Department and the Property Control Division

SCENARIO ONE - DOIT REMAINS

- **L** • Renovate and secure lobby.
- **L** • Update all finishes and use lobby space more effectively.
- **M** • Renovate and modernize restrooms. Incorporate water-conserving fixtures.
- **M** • Increase use of open office concepts.
- **L** • Replace ceiling tiles.
- **L** • Replace fluorescent lights with energy-efficient modern lighting. Use motion detection light switches where appropriate.
- **L** • Repaint all interior wall surfaces.
- **L** • Provide new carpet throughout.
- **M** • Harden building exterior by adding Mylar blast-resistant film to windows.

Figure A-25: Simms Exterior

- **L** • Verify Masonry exterior walls blast resistant capacity and improve as required.
- **L** • Secure loading area and generator. (See security section.)
- **L** • Add CCTV system throughout the building and full surveillance capability at exterior. (See security section.)

SCENARIO TWO - REUSE BUILDING FOR OTHER AGENCIES

- **L** • Renovate lobby, update all finishes and use lobby space more effectively.
- **M** • Renovate and modernize restrooms. Incorporate water conserving fixtures.
- **M** • Increase use of open office concepts.
- • Replace ceiling tiles.
- **M** • Replace fluorescent lights with energy-efficient modern lighting.
- **M** • Install motion detection light switches in appropriate rooms.
- **L** • Repaint all interior wall surfaces.
- **L** • Provide new carpet throughout.
- **L** • Add exterior stucco system to existing CMU exterior to achieve an exterior more compatible with the campus.
- **L** • Standardize recycling containers throughout the building.
- **L** • Develop building legends and improved consistent signage and way finding.

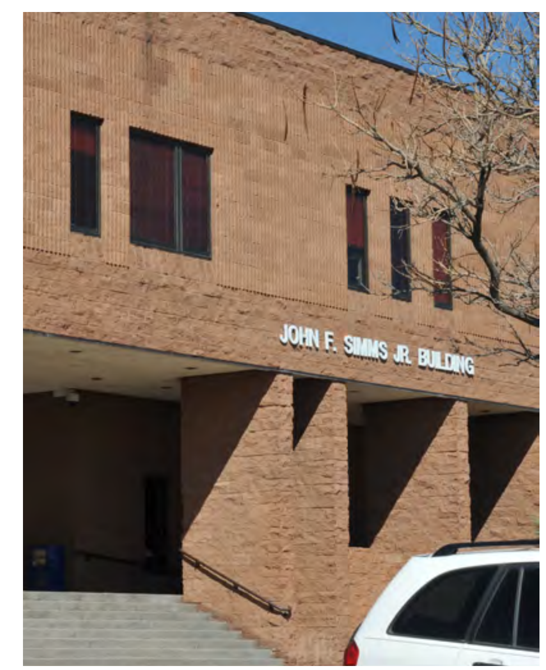


Figure A-26: Simms Entrance

Figure A-27: Simms Entrance

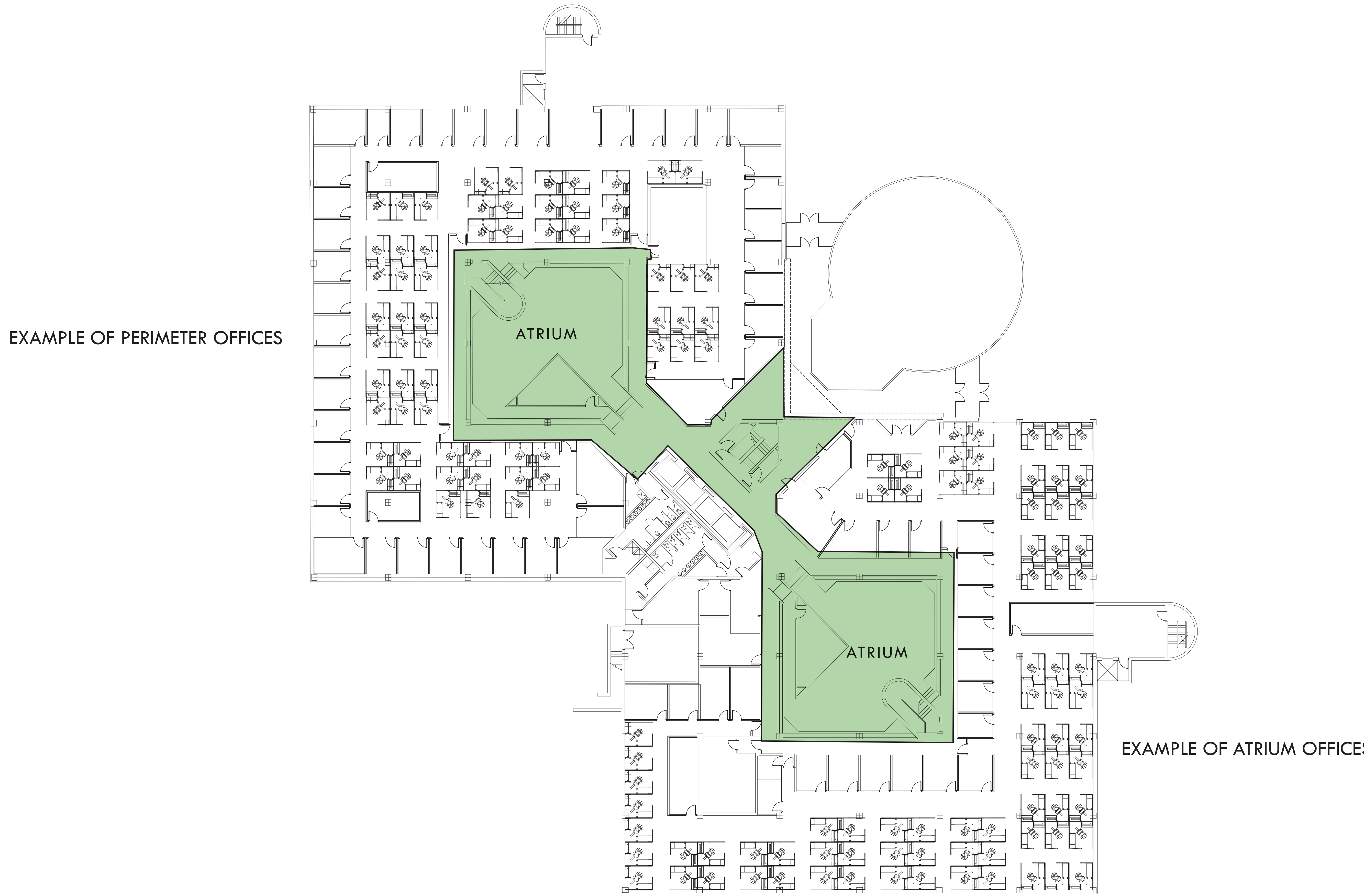


Figure A-28: Runnels Building Open Office System Reconfiguration Concepts

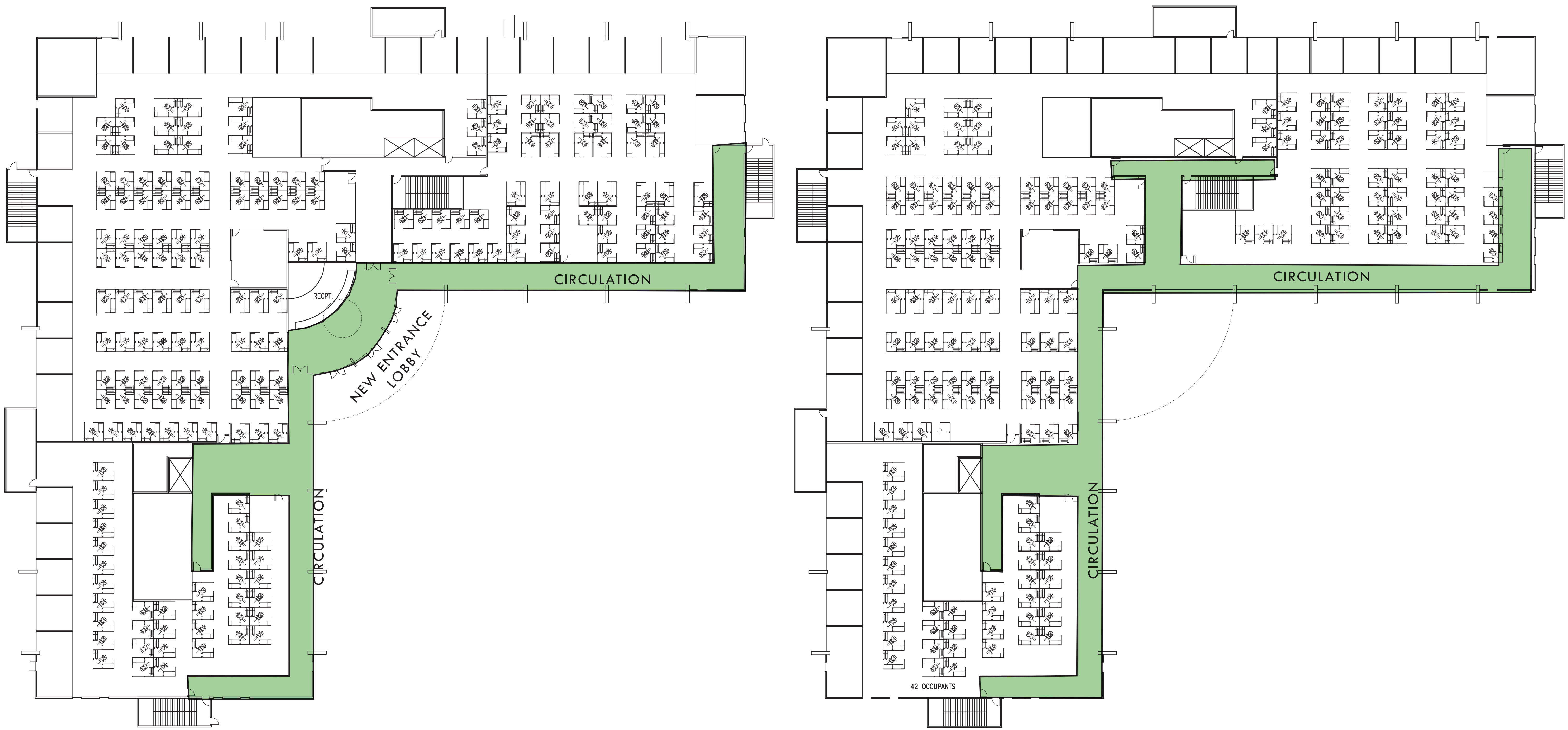


Figure A-29: Chino Building Open Office System Reconfiguration Concepts

Figure A-30: Examples of Open Office Systems

OPEN OFFICE SYSTEMS

EXISTING SITE ANALYSIS

The initiation of the planning process included an analysis of existing site conditions. The following information was documented and analyzed.

- Context
    - Aerial immediate adjacent context
- Land Use
    - Existing adjacent land use
- Circulation
    - Regional transit
    - City transit
    - Existing service and auto circulation
    - Existing pedestrian circulation and related improvements
- Utilities / infrastructure
    - Existing utility availability
- Drainage
    - Existing drainage patterns
- Landscape
    - Existing landscape
    - Views of site
- Summary suitability for development
    - Areas suitable for development

CONTEXT

The South Capitol Campus is comprised of three distinct areas.

- Campus area north of Alta Vista St.
- Campus area south of Alta Vista St.
- Vital Records east of St. Francis Dr.

Located along the heavily trafficked St. Francis Dr., the South Capitol Campus is a highly visible location in Santa Fe.

South Capitol Rail Runner Station is west of the north campus area and the main N.M. Department of Transportation site is just beyond. Important retail centers are north and northeast of the site: Wild Oats Market Center and the Cordova Rd. Shopping Center which houses Trader Joe's, Party City, Santa Fe Baking Co., and several other heavily used retail businesses. Salvador Perez, a regional park facility for the City of Santa Fe, is immediately east of the north campus area. Ponce de Leon, a thriving affordable housing complex for seniors, is across St. Francis Dr. from the south campus area. The Pacheco Street mixed-use neighborhood is south and west of the south campus area, and is comprised of small scale businesses, multi-family and single-family residential.

Figure A-31: Aerial - Adjacent Context

LAND USE

The land use context for the South Capitol Campus is highly varied. It ranges from single and multi-family residences to regional park facilities, light industrial to high intensity retail sales to large scale institutional uses. This range of adjacencies creates opportunities and challenges.

1. Opportunities: Increasing campus development at the South Capitol Campus brings the following opportunities related to surrounding land uses.
   - Increased commuter use of the Rail Runner and related transit services which could help support increased ridership and revenues
   - Increased market for retail and services in the local area
   - Increased use of fitness and exercise facilities at Salvador Perez Park, resulting in additional revenues to parks department
   - Potential of increased demand for multi-family development in adjacent neighborhoods, which could increase land values
2. Challenges: Increasing campus development at the South Capitol Campus has the following challenges related to surrounding land uses.
   - Perception of too high a density of state facilities in one location
   - Pacheco Neighborhood concerns about negative impact on views and increased traffic on Pacheco St.
   - Ponce de Leon concerns about increased traffic on streets surrounding it
   - City of Santa Fe concerns about density of development and traffic increase
3. NMDOT opportunities: The site's relationship to the New Mexico Department of Transportation (NMDOT) main complex to the west is a unique land use consideration for the South Capitol Campus. The NMDOT has for several years been examining opportunities to develop its property. A range of ideas has been advanced from dense mixed-use development to expansion of state facilities on that site. How the NMDOT site develops could have a marked influence on how the South Capitol Campus can develop. Coordinating the development of both sites would benefit both in approaching the surrounding neighborhoods and the City of Santa Fe with proposed future development.
4. City of Santa Fe development review: The State of New Mexico is not required to adhere to local statutes, but it generally strives to cooperate in accommodating review and coordination with local entities.

The following are possible considerations related to city land use and zoning review.

Current city land use	Institutional
Current city zoning	Multi-family (this current site meets zoning development requirements for height and setback, except that the use is institutional)

Land Use Recommendations:

A	Prioritize ways to mitigate land use affects on Pacheco Neighborhood.
B	Build connections with adjacent retail to support local businesses.
C	Consider collaboration with Salvador Perez Park to increase wellness activities for employees
D	Develop coordinated plan process for NMDOT and South Capitol Campus

Source: City of Santa Fe - GIS Services

Figure A-32: Existing Adjacent land Use

CIRCULATION

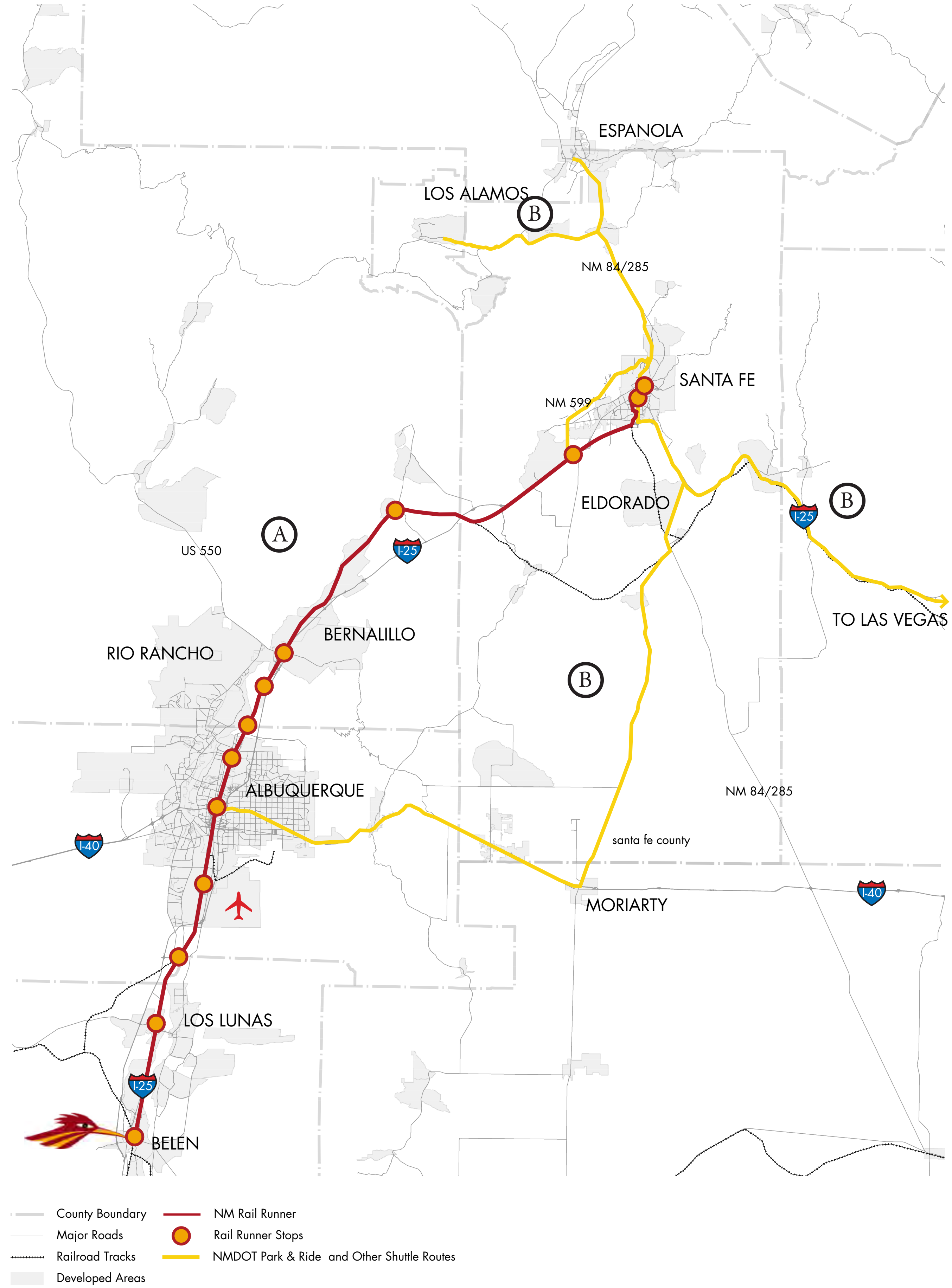
The South Capitol Campus houses approximately 1,800 employees, making it one of the largest employee destinations in the City of Santa Fe and in northern New Mexico. It is adjacent to the regional hub for transit in Santa Fe, so that all modes of transportation (rail, bus, bike, pedestrian and automobile) are available to the campus. The South Capitol Campus is therefore unique in its capability of providing a full range of transportation modes to employees and reducing traffic impacts in the future.

The circulation analysis reviews regional, city and local circulation opportunities.

1. Regional transit. Regional transit services provides access for employees to take rail, bus or shuttle from all larger communities between Belen, Española, Los Alamos and Las Vegas. All regional park and ride lines and the Rail Runner Train all have their major Santa Fe stop at the South Capitol Station.

   Supplemental to these more formal transit services, State of New Mexico policies encourage reduction in the number of individual employees driving to the campus. Important existing policies are:

   - HOV parking: Sets aside parking for automobiles that meet criteria for high occupancy vehicles that bring more than one employee to the site.
   - Van pools: Subsidizes operation of vans for state employee carpooling.
   - Fleet carpools: The state owns fleets of cars for use by state employees when conducting state business. This policy provides employees who do not bring individual automobiles to the site with vehicles for work-related travel.



Regional Transit Recommendations

(A) Identify ways to encourage the Rail Runner as the primary means for employees commuting from the Albuquerque area.

(B) Identify ways to encourage Park and Ride and regional shuttles as the primary means for employees commuting from Los Alamos, Española, Las Vegas and East Mountain- Moriarty areas.

Source: Regional Rapid Rides • NM Rail Runner

Figure A-33: Regional Transit

2. City multi-modal networks: The City of Santa Fe has focused over the last decade on planning a comprehensive network of city bus transit, bicycle routes and pedestrian trails. All of those systems have identified the South Capitol Campus as a major destination. Thus, the campus is well connected for many alternate travel modes.

    a. City bus transit: The South Capitol Station is a main transfer hub for the city bus system. All main loop routes connect there, and there local bus stops along the perimeter of the site along St. Francis Dr.

    b. Bicycle network: Primary bike trails and routes that currently serve the South Capitol campus are:

        1) Rail trail: The City and the County of Santa Fe jointly developed the Rail Trail that parallels the train line. It connects from south of I-25 to the South Capitol Campus and is in the process of being extended to Eldorado community southeast of Santa Fe. Most east-west bike trails in the city system intersect with the Rail Trail as the main connector spine.

        2) Baca St.- Railyard Trail: This trail connects the campus to the downtown area of Santa Fe through a connection that runs to Baca St., behind the west side of the School for the Deaf and through the Railyard Park and Railyard District to Downtown.

        3) Alta Vista St. - Don Diego Bike Route: A second bike route connecting the campus to downtown runs along Alta Vista St. and goes east to Don Diego Ave. which then connects to the downtown area.

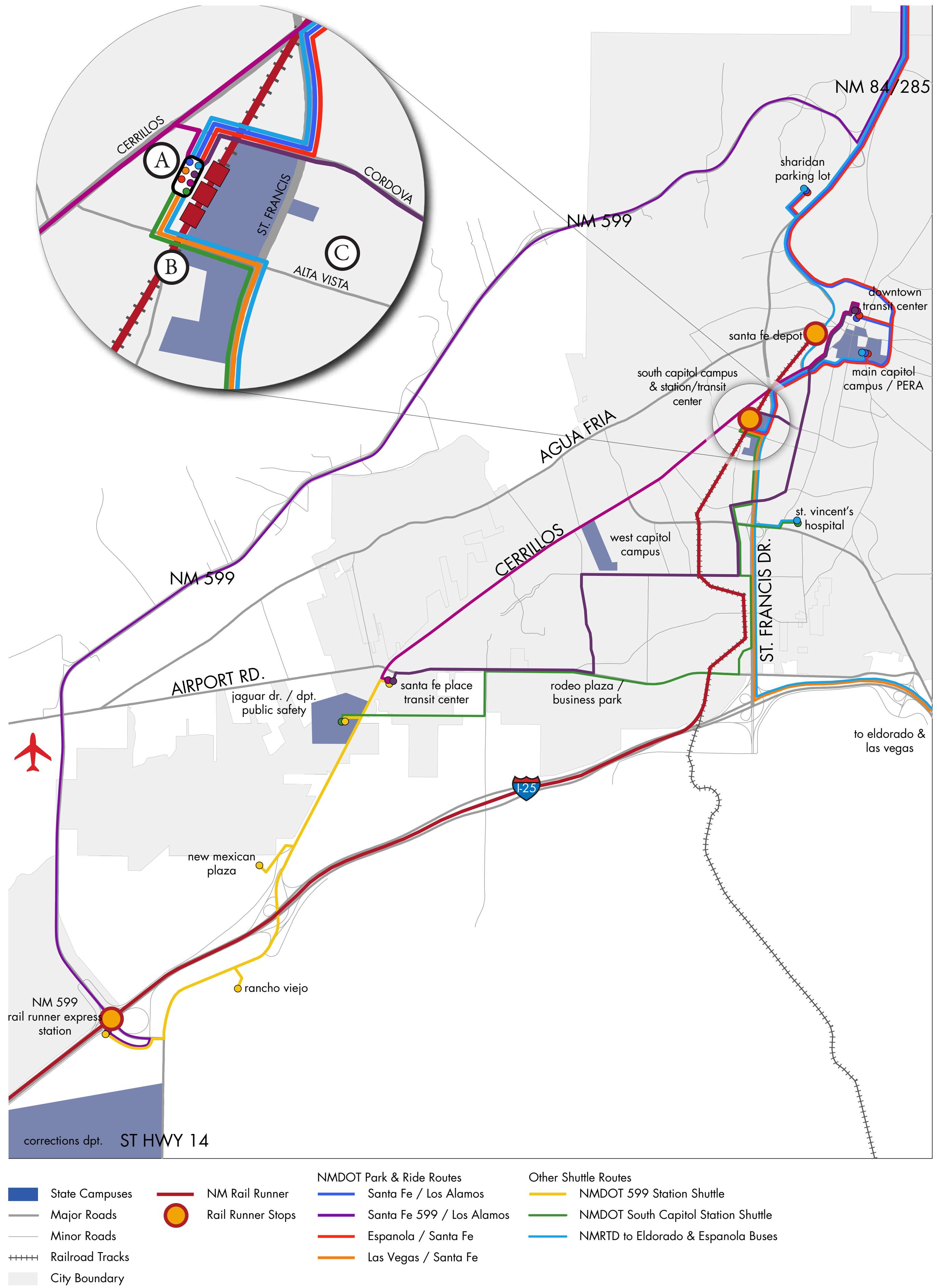
    c. Off-site pedestrian trail connections: The prominent pedestrian trails serving the campus also usually serve as the bike trails in this area, since they have been designed as mixed bike and pedestrian trails, approximately 10’ wide. They are:

        1) Rail Trail

        2) Baca St.-Railyard Trail

        3) Baca-Camino Sierra Vista St.: This pedestrian-only trail connects the site via the beginning of the Baca Street-Rail Trail, then connects over to Felipe St. and the Hickox-Camino Sierra Vista Neighborhoods.

        4) Street sidewalks: All the connecting roads in the area have minimum 5’ wide sidewalks which provide connectivity, although they would be measurably enhanced by landscaping and parkway plantings.



City Multi-Modal Recommendations

(A) Identify ways to encourage use of local bus system as the primary means travel mode for employees that are within the City and County bus service areas.

(B) Meet LEED criteria for bicycle facilities to support employees that use bicycles to commute to work.

(C) Collaborate with City and County of Santa Fe to continue to improve the walking connections to the Campus.

Source: City of Santa Fe Transit • Park and Ride Services • NM Rail Runner

Figure A-34: City Transit

3. Existing service and auto circulation. For any community, circulation and traffic effects are the most difficult issues for site development. Understanding existing circulation patterns can identify opportunities to mitigate possible future traffic impacts.

   The recently completed St. Francis Corridor Study found that the intersections of St. Francis Dr., Alta Vista St. and Cordova Rd. are currently operating at acceptable levels of service (LOS) in the peak hours, however, the concentration of pedestrian activity and the high volume of traffic has led to safety concerns for pedestrians. The study also found that in the horizon year of 2030, the Cordova Rd. intersection would require a second westbound left-turn lane in order for movement to operate at acceptable LOS. The study also recommended that pedestrian improvements be prioritized based on pedestrian volumes and crash history, proximity to employment centers and Rail Runner stations. Both the Alta Vista St. and Cordova Rd. intersections with St. Francis Dr. meet this criteria.

   Due to the proximity of the New Mexico Rail Runner Express and the multi-modal transit center adjacent to the South Capitol Rail Station, the South Capitol Campus, along with the NMDOT General Office, has a significant opportunity to leverage the transit availability to promote transit usage and avoid use of single occupancy vehicles.

   The latest data on New Mexico Rail Runner ridership provided in the *Proposed Rail Runner Station at Las Soleras Analysis of Ridership Potential* shows that 200 to 250 commuters disembark from the AM peak trains at the South Capitol Station, with approximately 30 to 40 commuters using the South Capitol Station in the AM peak to travel to Albuquerque. Extensive incentives would likely increase these numbers.

   Due to historically high traffic volumes on St. Francis Dr. and Cerrillos Rd., the South Capitol Campus has adopted a flex-time schedule that assists in dispersing traffic throughout the morning and afternoon peaks. These efforts, combined with the New Mexico Rail Runner Express, have limited the traffic impacts at the driveways to the site.

   a. Auto circulation patterns

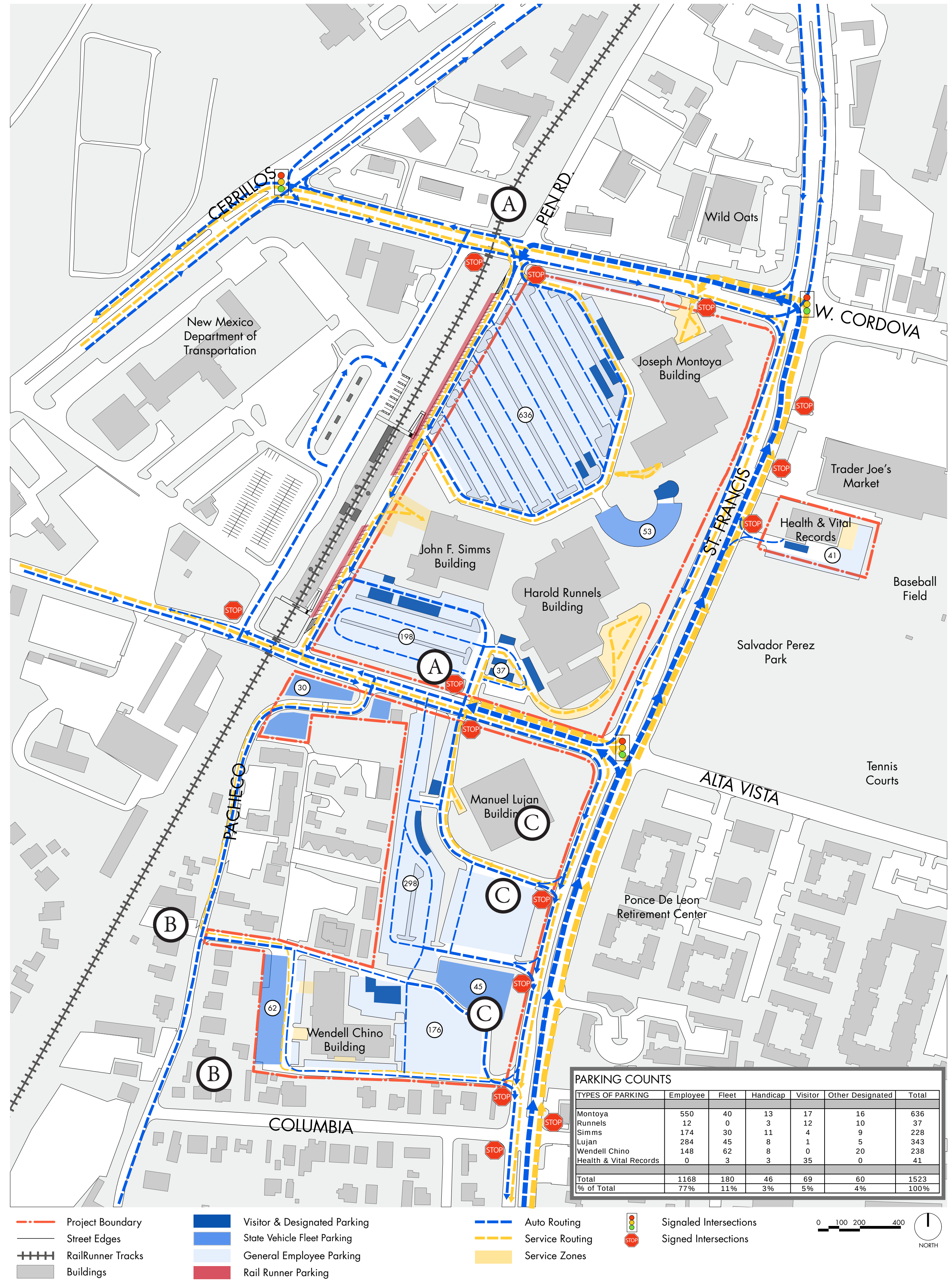
      1) The main vehicle routes into the north and south campuses are from Cordova Rd. and Alta Vista St., which carry the heaviest traffic into and out of the campus.

      2) St. Francis Dr. provides no direct access to the north campus.

      3) The south portion of the campus has three existing drives from St. Francis Dr. Since no left-turning median cuts exist for these drives, all three drives are right-in/right-out only.

      4) The limited access to the three south campus drives causes excess traffic on Columbia St. to the south. Northbound employee vehicles turn off St. Francis Dr. onto Columbia St., travel west on Columbia St. to Pacheco St., then turn north to the secondary entry to the west behind the Wendell Chino Building.

      5) Lack of automotive connections between the Wendell Chino and Manuel Lujan sites, and no left-turn access off St. Francis Dr. adds to traffic on Columbia St.



PARKING COUNTS

TYPES OF PARKING	Employee	Fleet	Handicap	Visitor	Other Designated	Total
Montoya	550	40	13	17	16	636
Runnels	12	0	3	12	10	37
Simms	174	30	11	4	9	228
Lujan	284	45	8	1	5	343
Wendell Chino	148	62	8	0	20	238
Health & Vital Records	0	3	3	35	0	41
Total	1168	180	46	69	60	1523
% of Total	77%	11%	3%	5%	4%	100%

Service/Auto Recommendations

(A) Maintain primary vehicle accesses to north and south campus areas should remain focused on Cordova and Alta Vista.

(B) Explore possibilities to reduce or limit excess traffic impacts on Columbia and Pacheco Street of future development.

(C) Maintain access to three existing driveways from St. Francis Dr. for future development flexibility.

Parking Recommendations

(A) Campus parking capacity can only be increased by building parking structures.

(B) Explore possibilities to reduce or limit fleet parking needs.

(C) Explore ways to use the existing rail, bus, park and ride opportunities to reduce parking demand..

Figure A-35: Existing Service, Auto Circulation and Parking

b. Service Circulation Patterns

1) The main service routes into the north and south campus are from Cordova Rd. and Alta Vista St., similar to the primary automobile patterns, but with different entry drives.

2) The service drive to the Montoya Building is undersized and does not allow adequate turning space for semi-truck deliveries.

3) The service docking area at the Runnels Building is generous and well designed. The drive leading to the service area does require a full 180-degree turn from Alta Vista St.

4) The loading dock at the Manuel Lujan Building is in a prominent front door location which is not conducive to deliveries or to entry of the building. Relocation of the dock would be optimum, and would require readjustment of the interior functions of the building.

5) Services to Wendell Chino Building are to the west and delivery vehicles often use Pacheco St. to arrive and depart.

4. Existing Parking

a) Current parking is all surface parking.

b) The site is at maximum capacity for surface-only parking using a ratio of one stall per 350 GSF of existing buildings on site.

c) Any future development of the site will require either structured parking, change in fleet parking needs, development of revised parking ratios that accommodate the effects of multi-modal options, or a combination of all three.

d) Fleet parking currently uses 11% of the parking stalls on campus. See the matrix on Figure A-35.

5. Existing Pedestrian Circulation

a) Pedestrian walkways are most developed north of Alta Vista St.

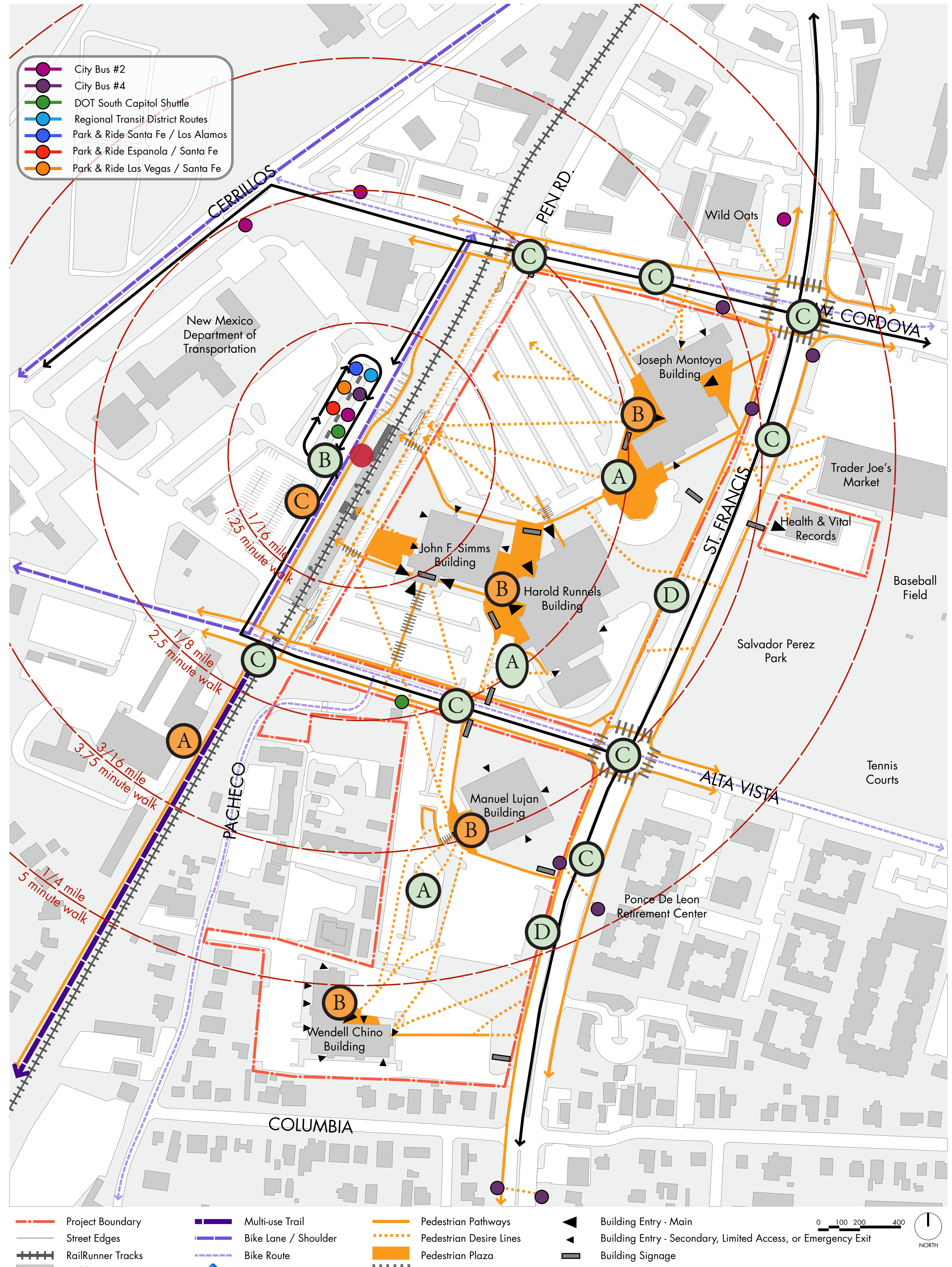
b) South of Alta Vista St., pedestrian sidewalks are adequate immediately around the buildings, but lack any paved or well-defined connections between the Lujan and Chino sites.

c) The development of the South Capitol multi-modal station on the adjacent NMDOT site has increased pedestrian and vehicle conflicts in the parking lots between the station and the main buildings. Recently, pedestrian table crossings have been installed on the main north-south drive along the west side of the campus in an effort to provide greater pedestrian safety.

d) Employees daily use the perimeter walkways as wellness-fitness routes. The routes lack mileage or route markings.

e) St. Francis Dr., Cordova Rd. and Alta Vista St. need safe pedestrian street crossings because of the volume of mid-block jaywalking.

f) Continuing to support the development of the surrounding trails system and other walking connections to the campus would help increase walking as a viable travel mode to commute to work from adjacent neighborhoods within a one-mile walk.



Pedestrian Recommendations

A. Create defined, safe pedestrian connections between all buildings on campus.

B. Explore possibilities to create well-defined system of paths to strengthen walk-ability to the South Capitol Multi-Modal Station on the NMDOT site.

C. Explore options for safe pedestrian crossings and reducing unsafe mid-block jaywalking on St. Francis, Cordova, and Alta Vista streets.

D. Continue to develop wellness-fitness routes on the perimeter of the site.

Bike Circulation Recommendations

A. Continue to support development of the regional bike trails in the City and County of Santa Fe. I

B. Improve bike parking and storage to meet LEED criteria for biking facilities.

C. Support addition of bike transport areas or devices on rail cars and transit buses. This allows greater flexibility to ride and bike for commuters.

Figure A-36: Existing Pedestrian Circulation And Related Improvements

6. Existing Bike Circulation

   a) The main bike trail that serves the campus is the city-county Rail Trail that runs alongside the Rail Runner tracks. Bike trail connections going north to the Railyard Park downtown and west to Felipe St. in the Baca St. neighborhood need funding to build.

   b) Designated on-street bike routes exist on Pacheco and Alta Vista Streets. Connections to on-site routes are not clearly designated.

   c) Several buildings need bike racks are nearby. The campus does not provide secure bike storage areas.

Figure A-38: Need a 5' Wide Sidewalk to Comfortably Accommodate Two People Walking

Figure A-39: Existing Wellness Route Mileage Markers

Figure A-40: North Campus Parkway with Landscaping Between Street and Walkway

Figure A-41: Need for Adequate Bike Parking May Lead to Inappropriate Bike Parking

Figure A-42: Dangerous Mid-Block Jaywalking on St. Francis Dr., Cordova Rd. and Alta Vista St.

Figure A-43: Sidewalks Along High-Traffic Streets Can be Uncomfortable Areas for Walking

Figure A-44: Bike Route on Pacheco St.

Figure A-45: West Drive to Chino Building from Pacheco St.

Figure A-46: Fleet Car Parking Lot at Pacheco and Alta Vista Street Intersection

UTILITIES / INFRASTRUCTURE

The City of Santa Fe provides water and sanitary sewer service to the site. Public Service Company of New Mexico (PNM) will provide electrical service. New Mexico Gas Co. will provide gas service. Qwest will provide communication and Comcast will provide cable television service. Utility service is available adjacent to or within the site. We were not able to obtain information about the Qwest or Comcast utility services availability at this time. Generally in areas that have service provided by PNM, communication and cable television services are also available.

Water service: The city's water system appears to have adequate pressure and available fire flow to serve the current buildings and future buildings planned on the site. Sangre de Cristo records show that there is a 20" water line along the west property line. There is also an 8" water line in St. Francis Dr., a 6" water line in Cordova Rd. and an 8" line that crosses the site, north of Alta Vista St. The 8" water line that crossed the site connects the 20" line west of the site and the 8" line in St Francis Dr. The locations of the water lines are based on information obtained from the City of Santa Fe Geographic Information System (GIS). The information shows that the water line crossing the site passes below the Simms Building. This location is probably not accurate, but the existing water lines are presented based on the city's GIS data. A section of the existing water line crossing will need to be relocated with the development of the new building located between the Runnels and Montoya Buildings. Further development of the site will most likely require extension of the public water system. The city will probably require that the water line extension loop through the site.

The design team made the request of the city to provide us with available fire flow. As policy the city assumes that the maximum fire flow is 3500 gpm. They provide the residual pressure at 3500 gpm. In order to acquire an available fire flow would be to hire a fire protection contractor to perform a flow test. This is commonly done in Albuquerque.

Sanitary sewer service: City wastewater division records show that there is a sanitary sewer line in Alta Vista St., Cordova Rd. and Pacheco St. The city did not indicate any capacity issues with the public sanitary sewer lines in the area of the project. We do not anticipate any issues with providing gravity sewer service for this project.

It is not known how the existing buildings on the site are served. Based on the site topography, it is assumed that the Montoya Building connects to the line in Cordova Rd. It appears that the Simms, Runnels and Lujan Buildings connect to the line in Alta Vista St. Sewer service for the Chino Building is most likely served by the public sewer line in Pacheco St. The capacity of this service is unknown at this time. Verification of this service line is needed for further evaluation as this southern area is designed and developed.

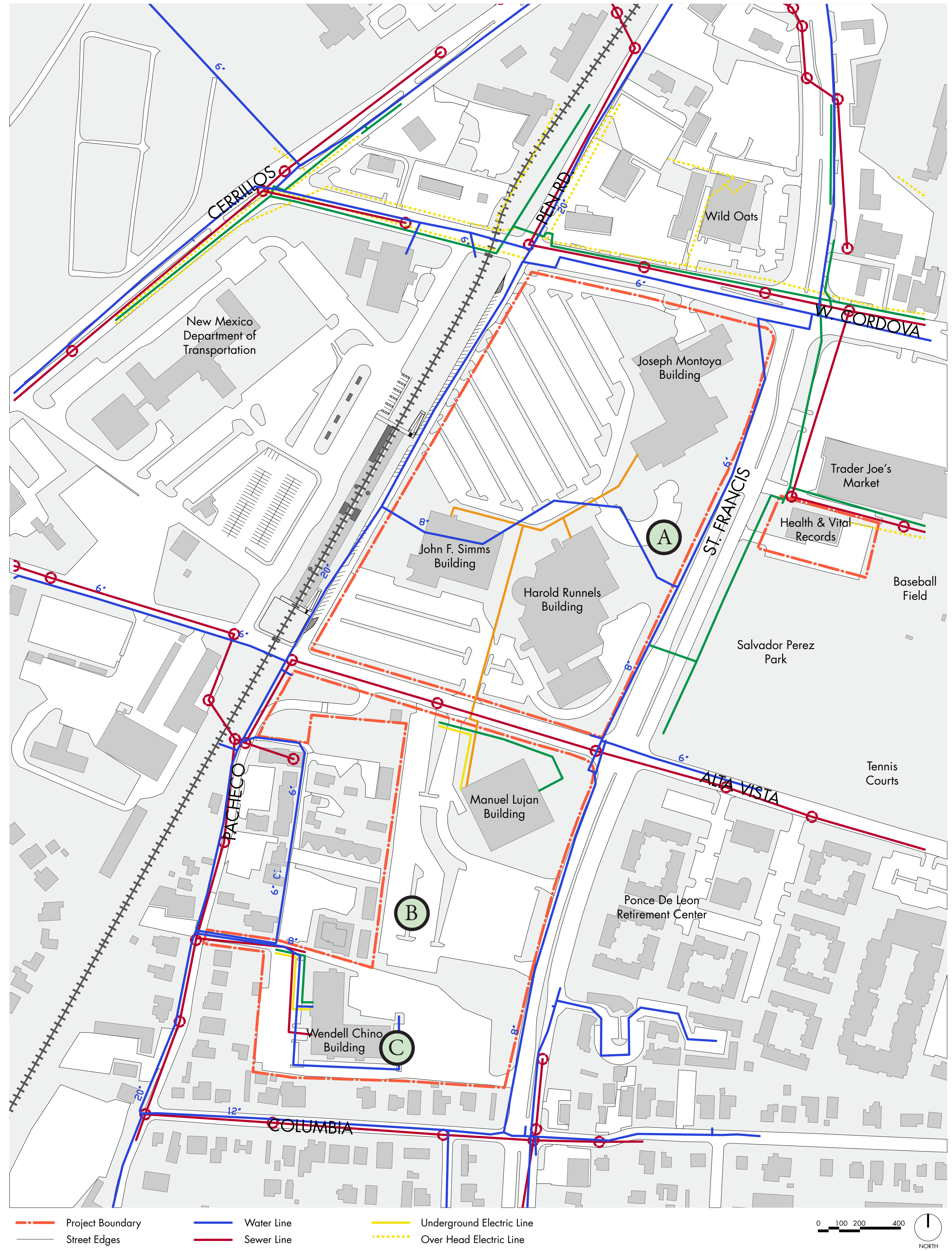


Figure A-47- Existing Utility Availability

Utilities Recommendations

- (A) Water main line in center of campus north of Alta Vista is likely to have to moved southward to create space for future development.
- (B) A looped water system is likely needed to allow future development of the campus south of Alta Vista.
- (C) Sanitary on-site sewer connection serving Chino Building will need further evaluation, if additional connections are made for future development.

<u>Electric and gas service:</u> PNM records show that there is an underground three-phase distribution line in Alta Vista St. and a three-phase overhead distribution line in Cordova Rd. Service to the project can be provided from either distribution line.

There is a 6" gas line in Cordova Rd., a 2" gas line in St. Francis Dr. and a 2" gas line along the west property line north of Alta Vista St. The 2" gas lines serve the existing buildings. Depending on the gas demand for the complex, service could be provided from these lines. If there is not adequate capacity from the 2" gas lines, then a gas line extension from Cordova Rd. will likely be required to serve the project.

DRAINAGE

The South Capitol Campus encompasses approximately 20 acres and generally slopes to the west. The average slope across the site is approximately 2%. St. Francis Dr. is east of the site and intercepts off-site drainage. The entire site is currently developed with buildings, surface parking and landscape areas. Several small detention ponds are located on the east side of the site between the existing buildings and St. Francis Dr. The ponds appear to intercept drainage from the landscape areas and some roof drainage. In the area north of Alta Vista St., a portion of roof runoff from the Montoya and Runnels Buildings was originally piped to the deep gravel medians in the large west parking lot. In the area north of Alta Vista St., a majority of the site sheet flows west to a drainage channel that parallels the railroad tracks.

The majority of the area south of Alta Vista St. has no identifiable detention areas. Surface drainage around the Manuel Lujan site flows north along the west edge of the area. Around the Wendell Chino Building, surface drainage flows to Pacheco St. using the west shared driveway access.

Since the South Capitol Campus site is fully developed, it is anticipated that the addition of future buildings will not require site detentions. However, future development should develop storm water quality features, meet LEED site development criteria and seek other allowed methods to manage site runoff to support landscape and other site infrastructure needs.

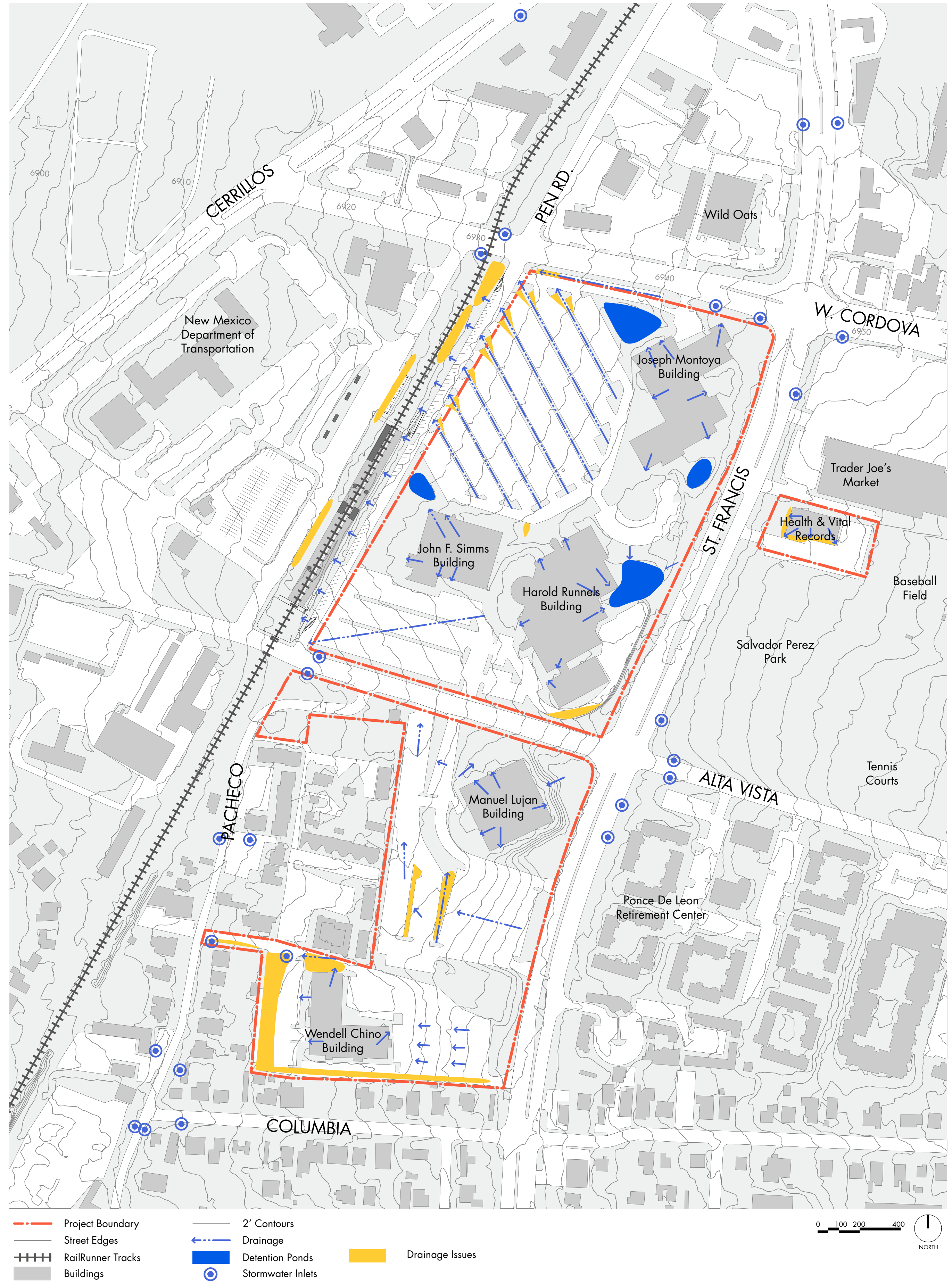


Figure A-48: Existing Drainage Patterns

Drainage Recommendations

(A) Redirect site and roof runoff to an integrated water quality and water detention system.

(B) Where possible consider reuse of site runoff to support landscape and other infrastructure needs, such as soil cooling for ground source heat pump loops.

LANDSCAPE

Most of the existing landscape at the South Capitol Campus is approximately 35 years old. This age is often the natural period when public landscape needs substantial rejuvenation of plants and the site furnishing. Current landscape is widely divergent in appearance and management because of modification to the landscape design in large and small ways over the years.

The perimeter landscape design is informal in style with large, mature trees clustered within the landscape. Interior and next to the existing buildings, paved hardscape and built planters create more shady urban entries. The following is landscape analysis by existing landscaped areas or types.

1. Existing turf areas / Irrigated and non-irrigated

   Turf areas show evidence of lack of irrigation either in coverage or quantity. These areas are the highest water use landscape and should be evaluated for conversion to either lower water use varieties, warm-season native grasses, or other landscape materials.

2. St. Francis Parkway-north area / Plantings in either crusher fines or cobble

   Newly installed, the crusher fines areas require chemical spraying to maintain weed-free condition. It is recommended to find a more chemical-free management method or change the crusher fines cover to more maintenance free material. Adjacent to streetscapes, street gravel build-up is an issue. These areas are low-water use, but require higher maintenance levels to maintain the crusher fines surface.

3. Building entries / Tree and shrubs in raised beds

   Existing shade trees are reaching a size and scale which provides good shade for the building entries. Maintenance to enlarge tree holes in metal grates is needed to prevent damage to the grates. Either heavy pruning by a professional arborist or replanting can revive somewhat overgrown shrub beds.

4. Existing parking planting / Large shade trees

   Until recent years, harvested site water and some drip irrigation supported trees in the two large parking lots in the north campus area and in the Manuel Lujan lots. Drought cycles in the early 2000s stressed the trees in the Lujan and Simms Building parking lots and most have died or are in poor health. Trees in the large parking lot west of the Montoya Building have survived better. We believe this may be due to the deep 30" cobble detention bed that was originally designed into each median.

5. Unlandscaped areas

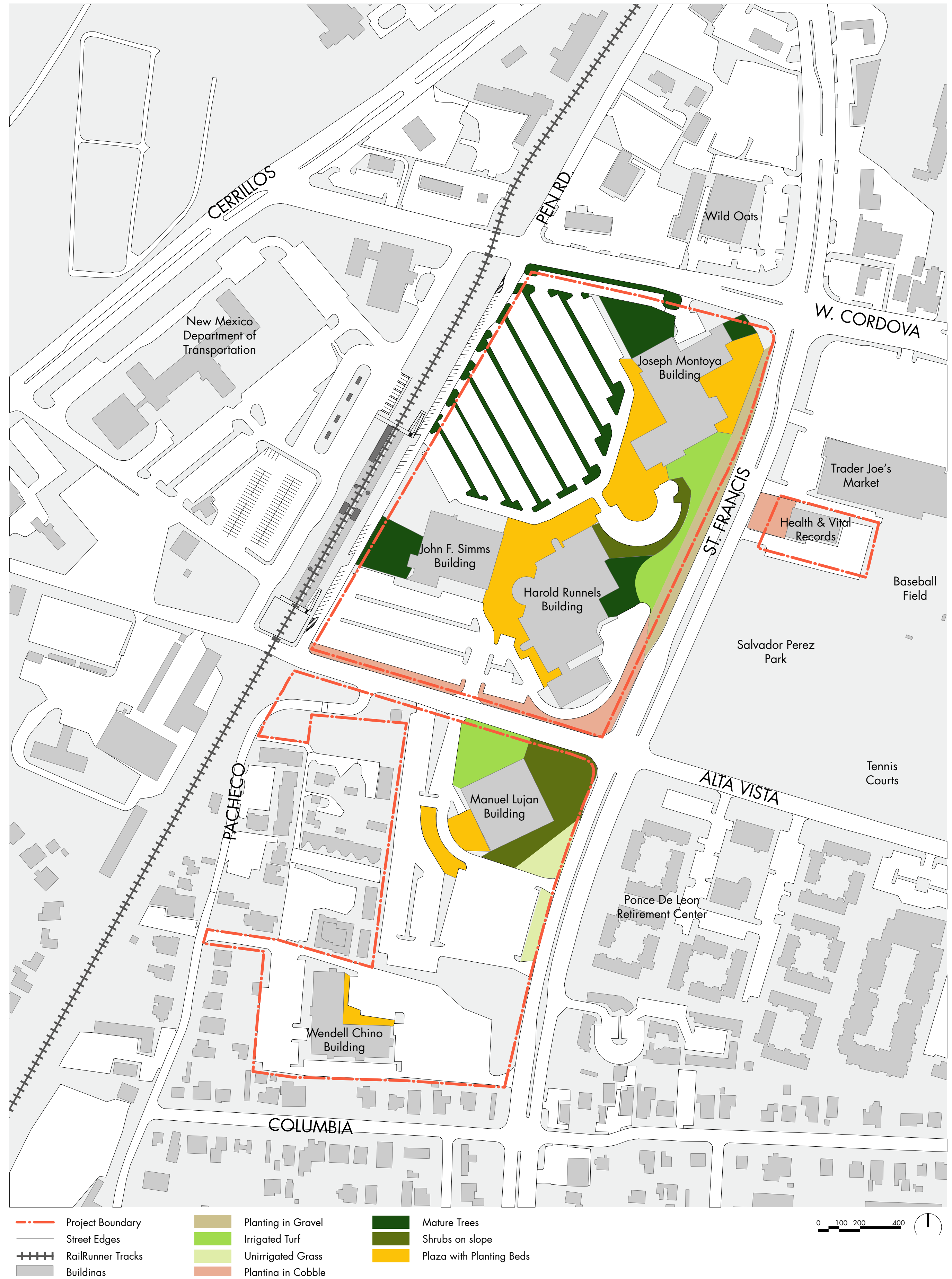
   These areas are mostly around the Chino Building site and the fleet parking area on Pacheco St. Both are visually unattractive areas and contribute to the heat-island effect.

6. Existing site amenities

   a) The brick and concrete paving materials have in general withstood the intended uses. Site maintenance prefers concrete surfaces because snow removal from brick is more difficult. LEED criteria is better met with permeable paving such as brick.

   b) The existing site furnishings do not match. The diversity creates additional maintenance work.

   c) Outdoor seating, picnic and smoking areas are widely scattered in parking lots and other areas not conducive to these uses.



Landscape Recommendations

(A) Develop more water conserving strategy for turf areas of the site.

(B) Explore possibilities for landscape ground covers that do not require the chemical management that crusher fines require.

(C) Rejuvenate existing planter beds as needed

(D) Develop site furnishings standards that do not require maintenance and that are more recycled and recyclable materials.

(E) Develop an exterior signage program and standards to improve wayfinding for first-time visitors to the campus/

Figure A-49: Existing Landscape

SUMMARY SUITABILITY FOR DEVELOPMENT

The summary suitability map at right is the compilation of lands that are best suited for new building and structure locations. These areas are noted in yellow on the map.

Removed from suitable areas are:

- Required setbacks from property edges
- Existing main utility corridors
- Recommended standoff distances from existing building for fire and life safety

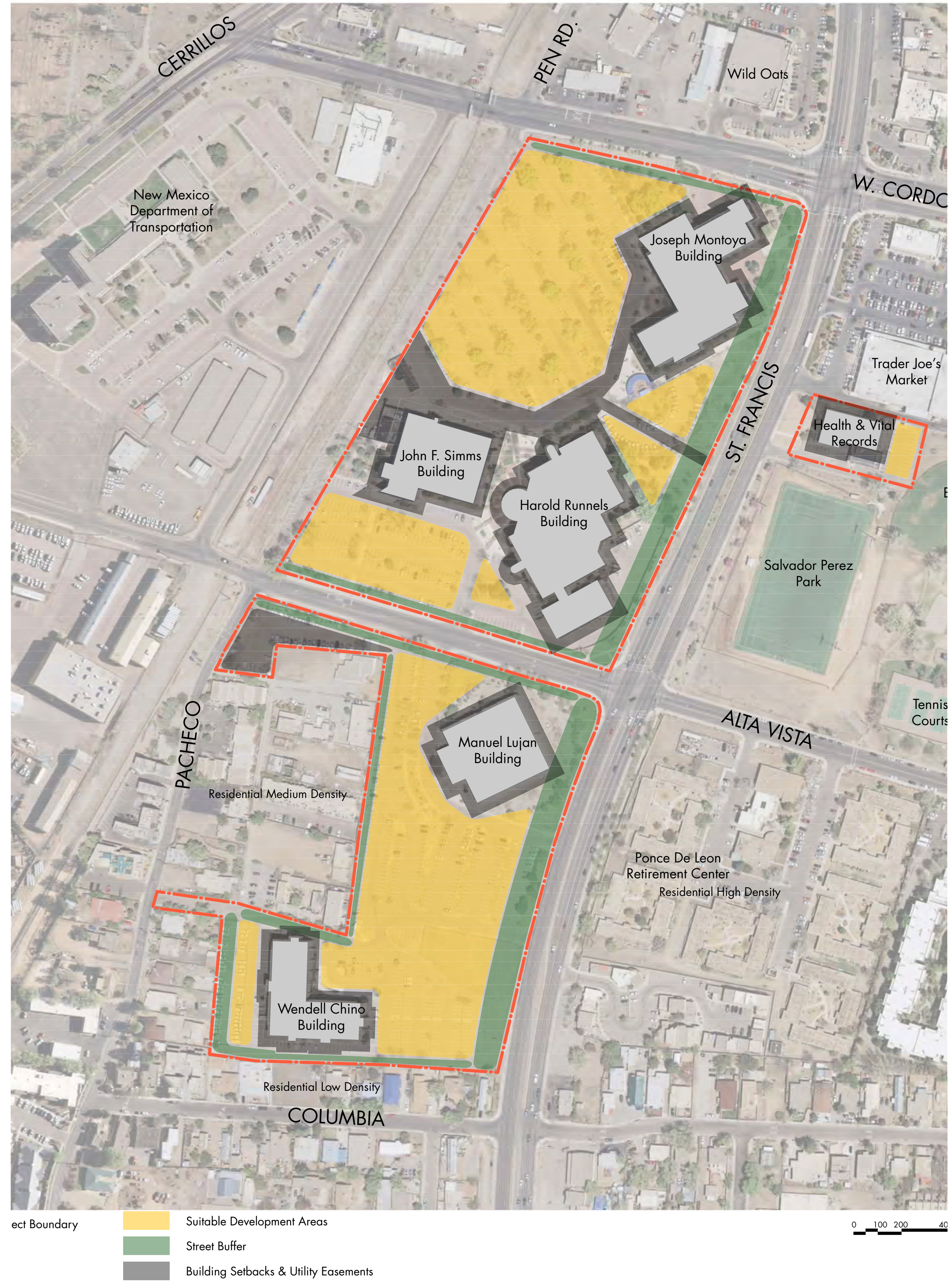


Figure A-50: Areas Suitable For Development

Figure A-51: Cost Estimates

SOUTH CAPITOL COMPLEX	ESTIMATE: CONCEPTUAL				
RECAP BY COMPONENTS	DATE: 8-10-10 Edit Version				
	Direct Cost Totals			Multiplier *	Total
UTILITIES/INFRASTRUCTURE					
NORTH SITE UTILITIES/INFRASTRUCTURE	$957,255			X 1.39	$1,329,407
SOUTH SITE UTILITIES/INFRASTRUCTURE	$988,902			X 1.39	$1,373,357
OFF-SITE IMPROVEMENTS	$1,225,000			X 1.39	$1,701,243
	UTILITIES/INFRASTRUCTURE TOTAL				$4,404,006
PHASE A					
107,000 SF OFFICE BUILDING	107000	X	$125	In Unit Price	$13,375,000
410 SPACE PARKING STRUCTURE	410	X	$18,500	In Unit Price	$7,585,000
SUSTAINABLE SYSTEMS (COBALT)	TBD				
WATER STRATEGY	$200,000			X 1.39	$277,754
				PHASE A TOTAL	$21,237,754
PHASE B					
235,000 SF OFFICE BUILDING	235000	X	$132	In Unit Price	$31,020,000
1030 SPACE PARKING STRUCTURE	1,030	X	$18,500	In Unit Price	$19,055,000
SUSTAINABLE SYSTEMS (COBALT)	TBD				
WATER STRATEGY	$200,000			X 1.39	$277,754
				PHASE B TOTAL	$50,352,754
PHASE C					
60,000 SF OFFICE BUILDING C1	60000	X	$125	In Unit Price	$7,500,000
86,000 SF OFFICE BUILDING C2	86000	X	$125	In Unit Price	$10,750,000
500 SPACE PARKING STRUCTURE	500	X	$18,500	In Unit Price	$9,250,000
SUSTAINABLE SYSTEMS (COBALT)	TBD				
WATER STRATEGY	$400,000			X 1.39	$555,508
				PHASE C TOTAL	$28,055,508
RENOVATIONS					
MONTOYA BUILDING	$5,771,777			X 1.39	$8,015,668
RUNNELS BUILDING	$4,399,586			X 1.39	$6,110,011
SIMMS BUILDING--SCENARIO #2	$6,122,272			X 1.39	$8,502,425
CHINO BUILDING	$5,070,073			X 1.39	$7,041,163
BUREAU OF VITAL RECORDS BUILDING	$715,384			X 1.39	$993,504
	RENOVATIONS TOTAL				$30,662,772
NOTE: TBD = to be determined. Costs depend on range of sustainable systems to be implemented.					

SOUTH CAPITOL COMPLEX	ESTIMATE: CONCEPTUAL		
RECAP BY COMPONENTS	DATE: 8-10-10 Edit Version		
LANDSCAPING			
NORTH CAMPUS PARK	$448,000	X 1.39	$622,169
SOUTH CAMPUS PARK	$448,000	X 1.39	$622,169
PACHECO PARK	$192,000	X 1.39	$266,644
MAIN PEDESTRIAN SPINE	$2,203,200	X 1.39	$3,059,737
ST. FRANCIS/CORDOVA STREETSCAPE	$976,140	X 1.39	$1,355,634
ALTA VISTA STREETSCAPE	$595,400	X 1.39	$826,873
	LANDSCAPING TOTAL		$6,753,225
MISCELLANEOUS			
PEDESTRIAN OVERPASS	$1,742,500	X 1.39	$2,419,931
	MISCELLANEOUS TOTAL		$2,419,931
	CONSTRUCTION TOTAL		$143,885,950
	9% ARCHITECTURE/ENGINEERING TOTAL		$12,949,736
	2.5% CAPITAL ADMINISTRATION TOTAL		$3,597,149
	CONST./A&E/CAPITAL ADMIN. TOTAL		$160,432,835
	8.1875% NMGRT		$13,135,438
	GRAND TOTAL		$173,568,273
* THE EXAMPLE BELOW SHOWS HOW THE MULTIPLIER IS CALCULATED:			
DIRECT COST SUBTOTAL	$100.00		
6% GENERAL CONDITIONS	$6.00		
SUBTOTAL	$106.00		
6% CONTRACTOR FEE	$6.36		
SUBTOTAL	$112.36		
3% BOND/INSURANCE	$3.37		
SUBTOTAL	$115.73		
20% ESTIMATE/TIME CONTINGENCY	$23.15		
ESTIMATE TOTAL	$138.88		

CLIMATE DATA - SANTA FE CLIMATE OVERVIEW

The City of Santa Fe (35°40'2" N, 105°57'52" W) is located in the northern Rio Grande Valley on the southern end of the Rocky Mountains. The unique topography of the city classifies it as both a mountainous and desert city. The elevation of Santa Fe is approximately 7,000' above sea level.

In general, the climate is warm in the summer and cool in the winter with high levels of solar radiation intensity year round. The city sees 300 days of sunshine annually. The climate is semi-arid, with only 14" of precipitation and 32" of snow per year. This weather pattern is due to the combination of high elevation and interior continent geography.

The concept analysis of shading, envelope, passive solar, active solar, building system energy and plant capacities requires thorough evaluation of weather data.

A complete, hourly weather data file is key to all energy simulations, including envelope, building system energy, and plant capacity analysis. This report is based on the U.S. Department of Energy's weather file.

The following sections present the climate parameters considered for the passive and active elements of the concept design.

DRY-BULB TEMPERATURE PROFILE

The following chart shows typical (average) daily weather profiles for each month from the Santa Fe weather data file. The data indicates a wide diurnal air temperature swing from day to night throughout the year and consistent solar radiation. The pink band represents thermal neutrality, the air temperature at which, on average, a large sample of people would feel comfortable, neither hot nor cold.

This data is relevant to system selection and sizing, understanding the local climate and occupancy trends, and building massing.

The following table shows the average minimum and maximum temperatures for Santa Fe during the coldest and hottest months. The main observation is the wide diurnal temperature range.

Location	January		July	
	Minimum, °F	Maximum, °F	Minimum, °F	Maximum, °F
Santa Fe	18.8	40.1	56.8	81.9

Source: *www.wrcc.dri.edu*

Figure A-53: Minimum and Maximum Temperatures

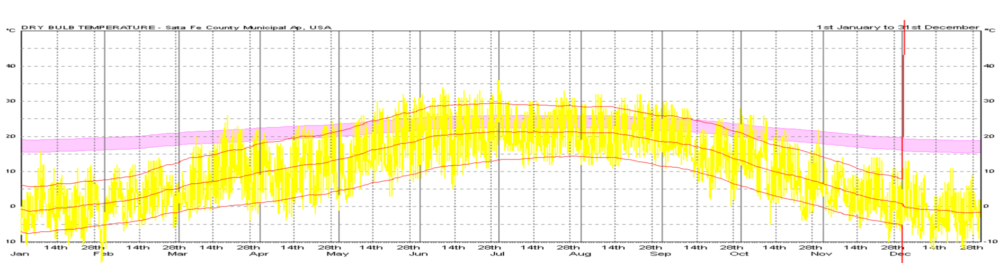


Figure A-54: Monthly Diurnal Averages

HUMIDITY

There are several ways to express the moisture properties of air. However, a psychometric chart is the best method. This chart will provide both the air temperature, humidity and water content of air. Psychometric charts as in Figures A-57 through A-61 show the dry bulb temperature, humidity ratio, relative humidity, wet-bulb temperature and dew point.

The relative humidity, expressed as a percentage, is commonly used when discussing the moisture content of air. However, this parameter can be misinterpreted, especially during colder weather conditions. High relative humidity is often mistaken for high humidity at any temperature, but that is not the case. For example, 80% relative humidity in 50°F air corresponds to significantly lower air moisture content than 80% relative humidity with 85°F air.

Also, cold outdoor air with high relative humidity becomes dry indoor air once heated, because the amount of moisture does not change, but the volume of the air increases and therefore the relative humidity percentage drops. Because of this difference, analyzing the relative humidity of the ambient outdoor air is not necessarily ideal for this climate analysis.

With the relative humidity and dry bulb temperature data in the weather file, other moist air properties can be calculated using the psychometric relationships. The South Capitol project analysis will use the dew point temperature to help guide the passive design process rather than expressing the ambient moist air properties in terms of relative humidity. Dew point temperature represents the temperature at which condensation will occur.

The annual dew point temperature profile was generated from the Santa Fe weather data file. The annual maximum dew point temperature is 63°F. Trend data shows that the daily peak dew point occurs at night, indicating that at peak daytime dry bulb temperatures, the dew point is low and therefore Santa Fe is relatively mild and dry.

This data is relevant when assessing building envelope construction, internal surface temperatures and ventilation air humidification/ dehumidification, and when considering radiant cooling systems.

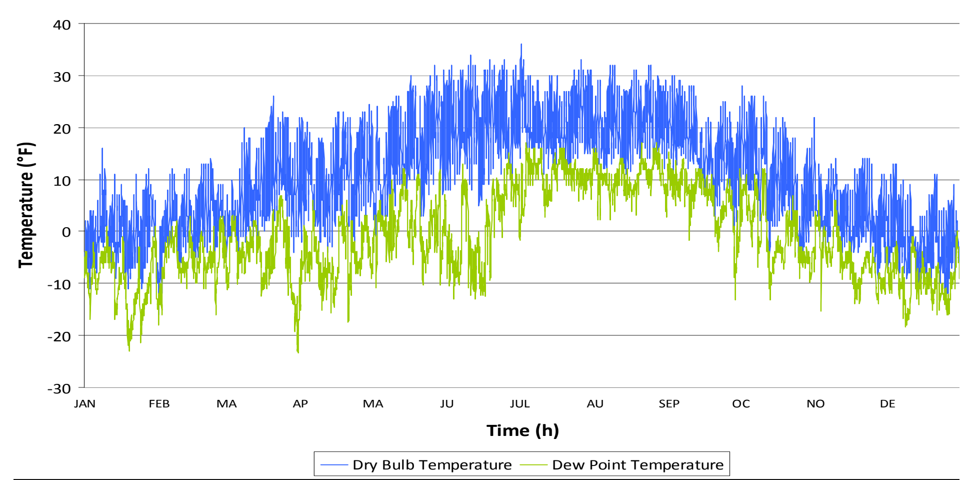


Figure A-55: Annual Dry Bulb and Dew Point Temperature Profiles

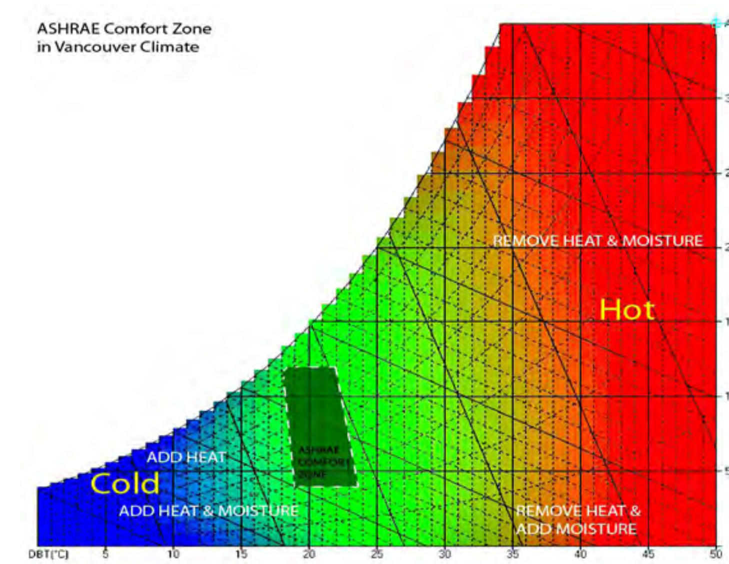
OUTDOOR DESIGN TEMPERATURES

Santa Fe is not listed in ASHRAE Standard 90.1 – 2007 Figure A-56, which prescribes location-specific winter and summer design temperatures.

The historical weather data for Santa Fe indicates an extreme minimum temperature of 13°F and an extreme maximum temperature of 95°F.

Santa Fe weather file minimum and maximum temperatures are 18.8°F in the winter and 81.9°F in the summer.

Another way of evaluating air humidity levels is to illustrate the hourly air temperature and humidity on a psychometric chart. When combined with the outline of the acceptable comfort zone established by ASHRAE, this method provides a simple visual representation of outdoor conditions compared with desired indoor conditions. See Figures A-57 through A-61. A general guide to reading psychometric charts is provided in A-56.



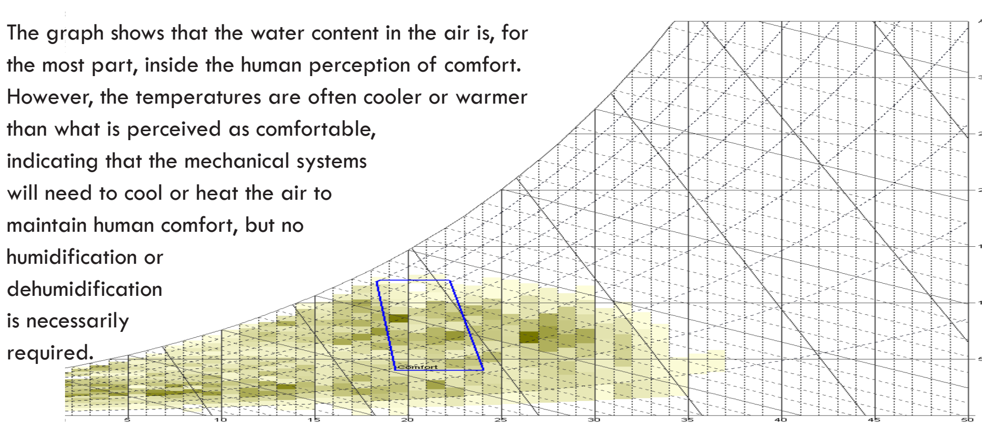
5°C	41°F
10°C	50°F
15°C	59°F
20°C	68°F
25°C	77°F
30°C	86°F
35°C	95°F
40°C	104°F
45°C	113°F
50°C	122°F

Note: On the following psychometric charts; the blue outline represents the ASHRAE comfort zone for each time period, and a darker green shade represents a higher frequency of air conditions in that range.

Figure A-56: A General Guide to Reading Psychometric Charts

Figure A-57: Psychometric Chart Showing Relative Frequency of Outdoor Air Conditions in Relation to ASHRAE Comfort Zone (Annual)

The graph shows that the water content in the air is, for the most part, inside the human perception of comfort. However, the temperatures are often cooler or warmer than what is perceived as comfortable, indicating that the mechanical systems will need to cool or heat the air to maintain human comfort, but no humidification or dehumidification is necessarily required.



This graph shows that, during the winter months, the air is very cool and dry. The mechanical systems will provide heating.

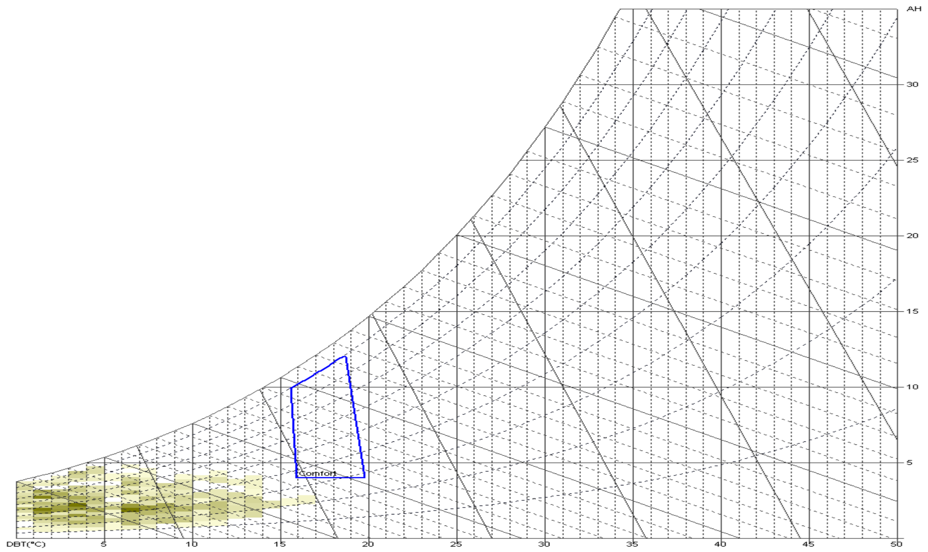


Figure A-58: Psychometric Chart Showing Relative Frequency of Outdoor Air Conditions in Relation to ASHRAE Comfort Zone (Winter)

The psychometric chart for the spring shows that the air temperature is closer to the desired temperature and humidity levels, which will reduce energy used to condition the building.

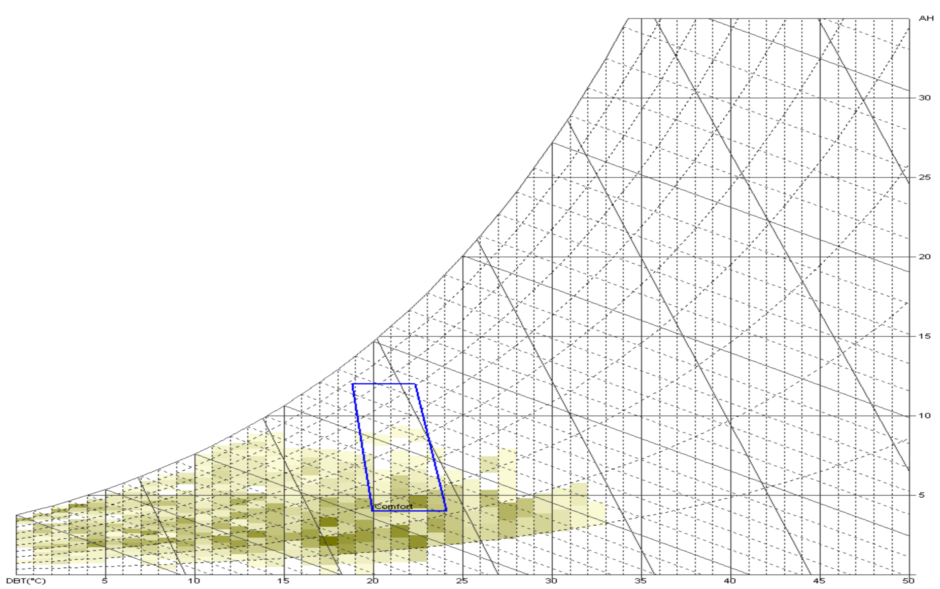


Figure A-59: Psychometric Chart Showing Relative Frequency of Outdoor Air Conditions in Relation to ASHRAE Comfort Zone (Spring)

The psychometric chart for the summer indicates that there are many days where the outdoor air temperature is within a desired comfort range. This is not to say that buildings will not cooled, as solar radiation is a large contributor to heat gain into a space.

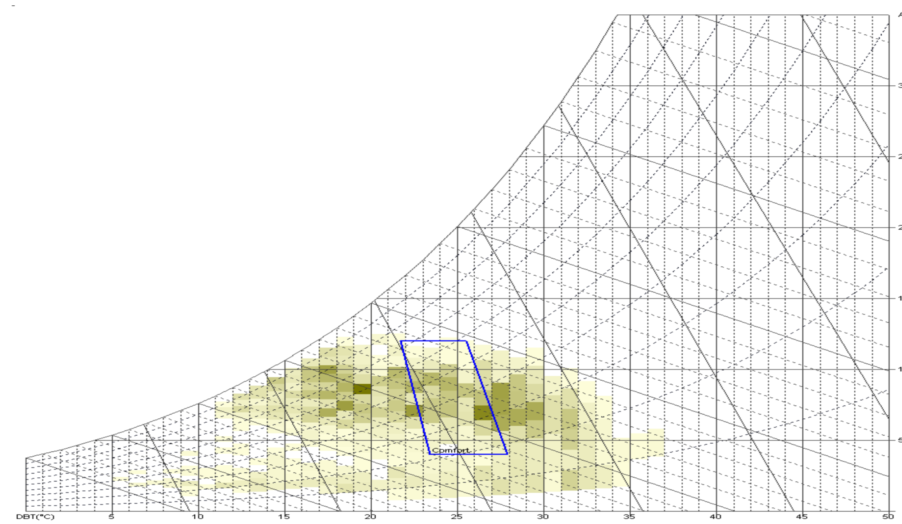


Figure 60: Psychometric Chart Showing Relative Frequency of Outdoor Air Conditions in Relation to ASHRAE Comfort Zone (Summer)

The fall chart is similar to that of the fall months. The air temperature is again outside the temperature range, but for the most part, water content levels in the air are close to desired.

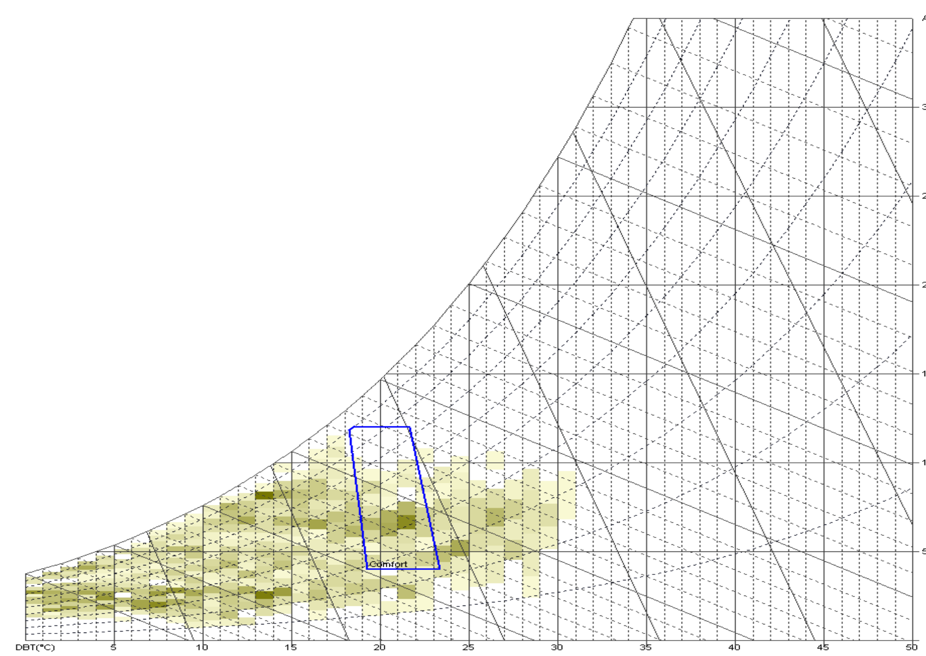


Figure A-61: Psychometric Chart Showing Relative Frequency of Outdoor Air Conditions in relation to ASHRAE Comfort Zone (Fall)

Overall the systems shall be designed for tempering the air temperature. Minimal focus shall be put on the humidification and dehumidification processes.

SOLAR RADIATION

Santa Fe receives consistently high levels of solar radiation intensity, with over 300 days of sunshine throughout the year.

The daily average solar profile for each week of the year is shown in the following figure.

Many days during winter receive up to 250 BTU/h/ft2 of global radiation (on a horizontal flat plane), and the maximum value in summer is 340 BTU/h/ft2.

This data is relevant to assessing building thermal massing, solar shading, glazing parameters, photovoltaic electricity and solar hot water heating.

Sun Up/Down December 21st: 7:30 to 16:30 (9 hours of daylight)

Sun Up/Down June 21st: 5:00 to 19:30 (14.5 hours of daylight)

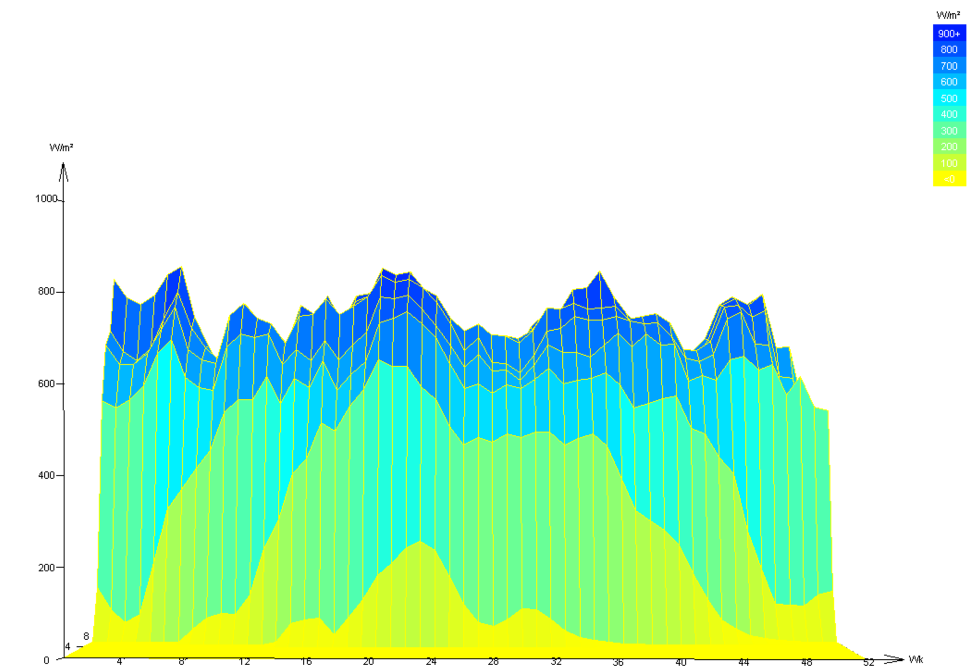


Figure A-62: Weekly Solar Radiation Intensity

WIND

The following two figures show wind roses generated from the Santa Fe weather file. Comparison of the annual wind rose with the monthly wind roses indicates that the prevailing wind direction is from the north, followed in frequency by easterly winds. Strong winds appear to come from all directions.

However, it should be noted that wind is very specific to the site, especially in a metropolitan area. Wind data is relevant to assessing natural ventilation strategies, operable window and louver placement, and local wind power generation. The installation of a weather station is highly recommended to collect wind direction and speed trends, should natural ventilation strategies be pursued.

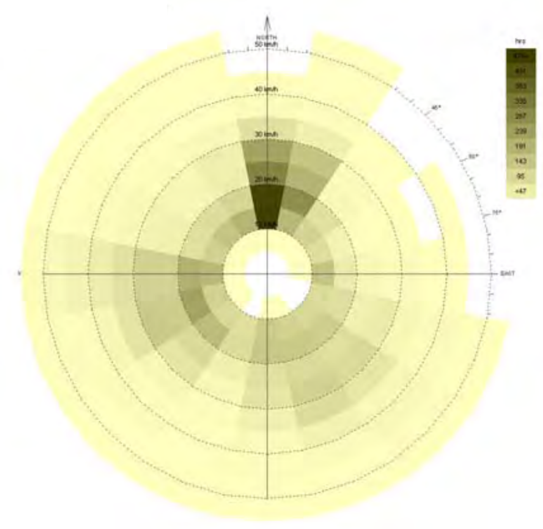


Figure A-63: Prevailing Winds, Annual Average

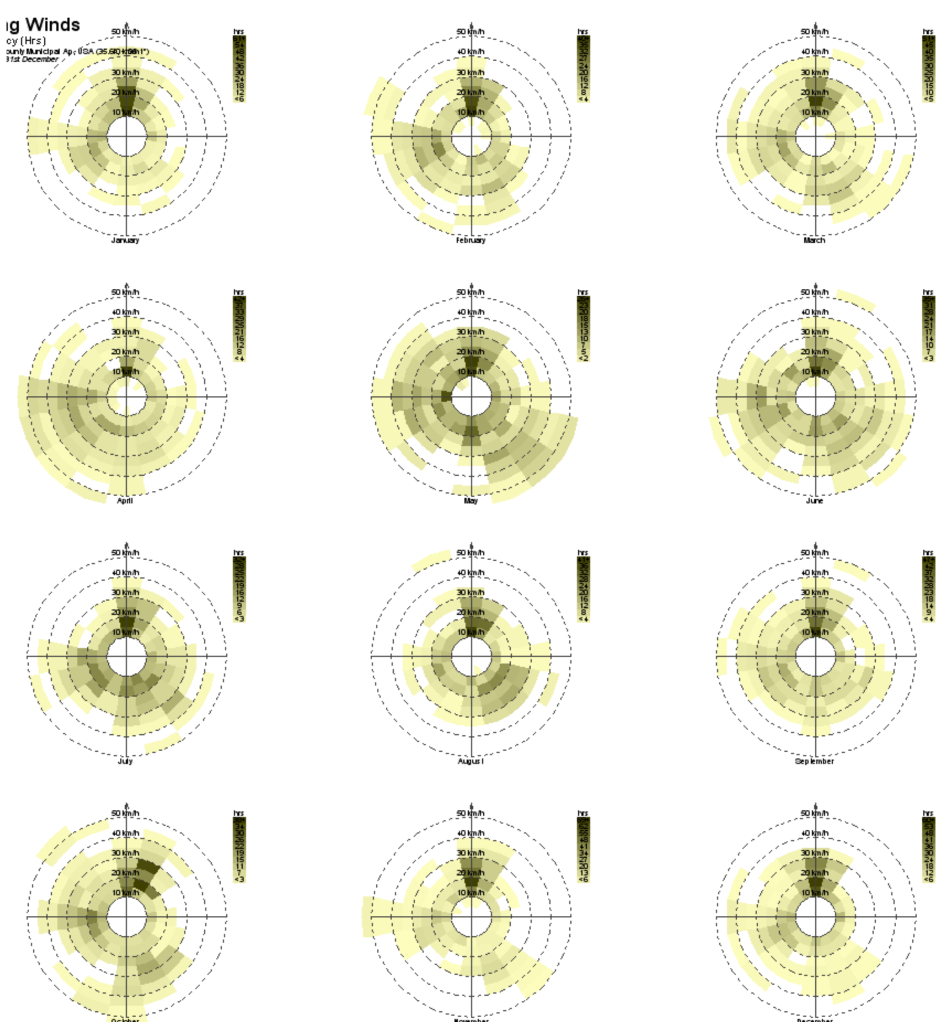


Figure A-64: Prevailing Winds, Monthly Averages

WIND PRECIPITATION - RAINFALL

The average total precipitation in Santa Fe ranges between 0.6" during January and 2.25" during July, the wettest month. The average annual total rainfall is 1.19" and cumulative annual rainfall is 14.22".

Rainfall quantity and patterns affect the feasibility of rainwater harvesting and the design of storm water management systems.

WIND PRECIPITATION - SNOWFALL

Santa Fe receives an average of 25.8" of snow per year, with a maximum depth accumulated in February averaging at 5.4".

This data is relevant to snowmelt design, as well as consideration of active solar systems which require roof-mounted solar collector panels.

MICROCLIMATE SUMMARY

The dry, continental climate of Santa Fe experiences wide diurnal temperature swings and sunny days throughout the year. The results of the climate analysis affect passive building features since the passive behavior of a building is a direct function of the climate. Therefore, the architecture and envelope must be designed to work in synergy with, rather than in opposition to, the local climate to achieve the most energy efficient performance from the installed mechanical systems. The summary of the micro-climate analysis identifies several climatic factors which are listed below with associated design opportunities:

- Global + diffuse solar radiation and cloud cover:
  Consistent solar radiation year round, and little to no cloud cover, provide the opportunity for passive heating in the winter months, solar hot water heating, solar absorption chillers for cooling and photovoltaics as a means of offsetting high-grade electrical energy.
- Dry bulb temperature
  To offset a wide daily temperature range, Santa Fe's cool night temperatures are ideal for passive night cooling of the heavy mass structure during the unoccupied evening hours, pre-cooling the building before the day begins. The heavy mass structure will allow the effects of the night cooling to last longer through the day.

NEXT STEPS

The microclimate is very site-specific and accounts for the localized effects of the surrounding terrain, including bodies of water, forests, buildings, high elevation, and even paved surfaces such as highways or parking lots.

A site-specific weather station is recommended for the South Capitol project, installed early to obtain the maximum benefit of the data for use during the project design phase. The weather station should be capable of measuring and recording the following parameters on an hourly basis:

- Global radiation
- Diffuse radiation
- Cloud cover
- Dry bulb temperature
- Humidity ratio
- Wind speed
- Wind direction

The dominant contributor to on-site renewable energy will be solar radiation. It is recommended that a detailed analysis of solar energy opportunities be performed to identify their extent for this site.

Similarly, understanding of the resultant behavior of the building in the microclimate will require detailed dynamic energy modeling.