WHITE PAPER
SUSTAINABLE ARCHITECTURE & GREEN DESIGN

1. Green Building Experience and Options

The Snowdon & Hopkins team is very aware of the green building approach. We have been designing green buildings for more than twenty years and members of our design team are at the forefront of sustainable architecture guidelines and development. We endorse the integration of green design strategies throughout the development of any public project.

The Vail Public Library was designed in 1983 to be energy efficient and to have minimal impact on the environment. Our solution was an earth-sheltered building that protected against the cold north wind but opened out to the sunny south with views of Gore Creek and the ski mountains. The sod roof preserves green space and aesthetically blends the project into the indigenous environment of the Colorado Rockies. The solar heat gained in the atrium is recycled to provide space heating for the library. This building was the largest earth-sheltered public building in the west when it was built. It has been a showcase project regarding earth-shelter architecture and was featured in the magazine *Solar Age*. Author and Landscape architect, Sherry Dorward, featured the Vail library in her internationally acclaimed book, *Design for Mountain Communities: A Landscape and Architectural Guide* (1990, Van Nostrand Reinhold, New York).

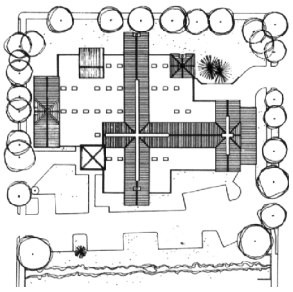
Vail Public Library

Since then we have applied green design principles on virtually all our public projects. We have worked with the same team of consultants on sustainable architecture and green design for twenty years. Our subsequent library and public building designs have incorporated high levels of energy-efficiency and daylighting strategies.

Our design team includes professionals at the very forefront of green architecture and who have a long, happy history of working together.

The City of Flagstaff was particularly interested in having a sustainable and green design for its new public library, designed by Snowdon & Hopkins. Its library includes the following energy conservation features:

- Day-lighting with light dimming controls
- Energy efficient light fixtures
- Occupancy sensors to control lights in seldom used rooms
- Direct/indirect evaporative cooling (the building does not have any refrigeration cooling)
- High efficiency motors
- High performance windows
- Overhangs in some areas to minimize solar gain in the summer
- Windows oriented toward the south to improve passive solar heating in the winter
- Operable windows to provide cooling in spaces near the windows and to allow for natural cooling effect without turning on the ventilation system



Flagstaff/Coconino County Public Library

- Optimized sizing of skylights to maximize daylighting while minimizing solar gain
- Wall and roof insulation exceeding standards
- Energy efficient variable volume system with variable frequency drive units.

Essential Sustainable Strategies

Sustainably-designed buildings aim to lessen their impact on our environment and the building's occupants through energy and resource efficiency. But beyond that sustainable development also has economic and social dimensions.

Our essential strategy in designing a project for a client who wants sustainable and green design is to make sustainable architecture an **equal priority** with other design criteria such as form, function, budget, and schedule early in the design process. We have the whole design team work together and with the client team to develop and optimize efficient, effective, and environmentally responsible solutions.

Sustainability involves trade-offs between various aspects of the building, so it takes the whole team to do it successfully. If woven into the very fabric of the project, sustainability can be very cost effective. When it is an after-thought however, it becomes an expensive and less effective proposition.

The essential strategy for sustainability is to make it integral, not an after-thought.

Our approach to the design of public buildings is to harness subtle interactions between design elements to minimize energy use, peak power demand, maintenance cost and capital cost. We accomplish these energy efficiencies through the following:

- Optimized building envelope with high performance glazing and sun control;
- Advanced efficiency mechanical systems;
- Efficient electric lighting that is well integrated with daylighting design;
- Heat recovery, digital mechanical, electrical and daylight control systems.

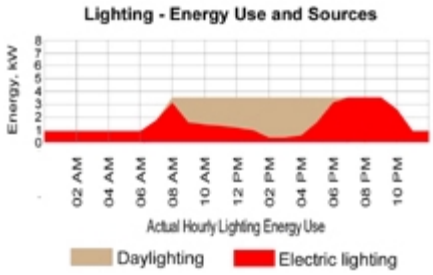
Daylighting

Our experience with daylighting has been so positive, we would consider it also an essential strategy. Filling a building's interior with natural light, yet avoiding harshness and glare, can improve visual performance and productivity, save energy and money, and create healthy, beautiful spaces. Our experience using glare-free daylighting as an essential design strategy in libraries has proven to reduce energy cost for electric lighting (typically one of the larger energy loads) by over 60%. The Flagstaff library has several rows of skylights defining the main axes of the building. That cost was more than covered by reductions in lighting

and air-conditioning equipment. Our Avon library uniquely incorporates skylights with perforated metal light reflectors to redirect sunlight, creating a soft distribution of natural light and brightening the ceiling. The result is excellent ambient lighting for reading books and viewing computers. The Gilpin County and Eagle libraries have high windows which provide daylighting. When daylighting is well done, it produces an environment that has high quality and cost-effective light.

To achieve quality daylighting we use both computer simulations and physical models to integrate daylight with architectural form, glazing and shading strategies, lighting design and controls, and interior details.

The side chart is a preliminary analysis of the daylighting opportunities for a public building in Montana. It shows that significant energy savings (shown in beige) can be achieved from effective daylighting design. From conceptual design through construction documentation, we maximize the benefits of daylight, avoid pitfalls, and make natural light an effective element of harmonious, cost-effective design. Glazing is selected based on the shading coefficient and light transmittance to control heat gain, maximize daylighting, and maintain view to the exterior.



Sustainable design involves more than energy however. Materials are chosen considering their environmental impact, with an emphasis on nontoxic, recycled content, locally manufactured, and rapidly renewable. Sensitive site design is incorporated to minimize our developmental impact and carefully integrate the building with its surrounds. Water use and impact are reduced within the building and the landscape.

Specific green measures worth considering for a public building include:

- Accommodation of the city's transit system on the site.
- Orientation of the building to promote energy efficiency.
- Building orientation and window design to capture the available views.
- Use of a well-insulated building envelope.
- Use of recycled, local, and recyclable building materials.
- Use of high performance glazing designed to maximize insulating levels yet optimize solar gain for spaces which can benefit from passive solar heating and can also minimize solar gain on some exposures and rooms that have high internal cooling loads and do not need significant heating.
- Use of overhangs to improve solar gain in the winter and reduce gain in the summer.
- Placement of glazing in optimal locations to maximize daylighting yet minimize solar gain where it is not needed.

- Use of shading of glazing to minimize solar heat gain during the summer.
- Provision of operable windows where possible to provide passive cooling.
- Use of high-efficiency lighting fixtures and provide dimming control in areas where daylighting is being used.
- Provision of occupancy sensors for lighting control in low-use areas.
- Use of high-efficiency motors on heating and cooling equipment.
- Use of high-efficiency boilers for heating.
- Use of indirect/direct evaporative cooling (which is ideally suited to this climate), eliminating the need for refrigeration cooling.
- Provision of variable volume air supply system to reduce fan energy and cooling energy and to provide more individual temperature control of occupied spaces.
- Use of a direct digital control system to provide optimal control of heating, cooling, and ventilation systems.
- Use of water-efficient plumbing fixtures.
- Use of energy-efficient computers, and other office machines.
- Use of low VOC materials (those giving off low levels of gas volatile organic compounds) to improve indoor air environmental quality.
- Use of non-potable water for irrigation.
- Use of water-efficient irrigation system and minimization of area irrigated.
- Use of drought-tolerant native plants.
- Minimization of site disturbance.
- Soil amendments to improve water-retaining capacity.
- Avoidance of unnecessary soil compaction.
- A grading/drainage plan that concentrate plantings where they will be watered by irrigation, snowmelt and stormwater run-off.
- Preservation of an undisturbed stream setback.
- Harvest and storage of water from roofs and parking areas.
- Use of trees to help even out energy requirements within the buildings.
- Sustainable use of fertilizers.
- Use of recycled paving materials.
- Restoration of the stream course if needed.
- Provision of a transit connection to the site in order to minimize on-site parking requirements.
- Development of a staff-efficient design.

There are many cost-effective measures to consider for a public building.

Possible additional innovations may suggest themselves as we proceed with the building design. Each building presents unique opportunities for green design innovations based on their function and site.

There is ample scope for innovations.

Other Considerations

We have found that careful integration of ideas through advanced computer-assisted design techniques often captures valuable synergies. For example, an artful combination of architectural form and building envelope characteristics may provide superior thermal, acoustic, and visual comfort while greatly reducing the cost of mechanical systems.

Our team's approach, however, transcends mere technical skill. It is built around interactive design sessions where alternative strategies are explored and innovative solutions discovered. From this creative collaboration emerges an architecture that effectively communicates, efficiently responds, and ultimately gives back. These benefits occur on many critical levels:

Environment:

- Site: this project provides an opportunity for site-sensitive urban and brownfield redevelopment. It accommodates alternative transportation, and through careful design we can minimize site disturbance, manage stormwater flows, reduce light pollution, and incorporate landscape and exterior design to minimize heat islands.
- Water efficiency: Considerations include water efficient landscaping, the use of innovative wastewater technologies, and reduced water use.
- Energy and atmosphere: Considerations include optimization of energy performance, use of renewable energy, elimination of HCFCs and halons, reduced emissions to atmosphere and use of clean-burning fireplaces, use of green power, use of measurement and verification systems.
- Materials and resources: The reuse of the existing depot will help minimize material and resource use, as well as the use of recycled content. Local, rapidly renewable, and sustainably-harvested materials will be used throughout the project. We are also committed to establishing a waste management program during construction and operation of the building.
- Indoor environmental quality: Considerations include carbon dioxide monitoring, use of increased ventilation, use of low-emitting and non-toxic materials, control of indoor chemicals and pollutants, thermal comfort, use of daylighting, and views.

Economic:

- Reduced staffing costs: design of the building so that it can be operated with minimal staffing.
- Reduced energy costs: through daylighting, efficient electric lighting and mechanical systems, building orientation and materials.

- Reduced capital cost: through resource and energy efficient design.

Social:

- Improved occupant health and safety: design of sunny and well-vented spaces, use of non-toxic materials and furnishings.
- Positive impact on the local community and its quality of life.
- Providing benefits to disadvantaged groups, e.g., the disabled. We prioritize ADA-conforming and sympathetic design.
- Stewardship: It is one thing to have a spectacular and sustainable building that exceeds all expectations when it opens. It is another to keep these qualities over the long term. The key is stewardship, the ongoing love and protection of your facility, continuing for years after it opens. We trust that our inclusive design and decision-making process will contribute to creating the institutional memory required here from long-serving members of the board and staff.

An essential element is stewardship: institution-alizing the love and protection of your facility so that future generat-ions will find it as wonderful as when it first opens.

LEED Green Building Rating System

We recommend that public buildings be designed and constructed using the LEED green building rating system. Applying the LEED™ criteria (Leadership in Energy and Environmental Design) assists us in the development of a public building that is progressive and consistent with these attributes.

LEED serves as a national benchmark in the areas of environmentally responsible siting, material selection, water and energy use, and indoor environmental quality. We use it as a design tool to help us define specific goals with regard to environmental impact and carry them through the design, construction, and operation of the facility.

LEED levels

There are four levels of LEED certification: certified, silver, gold, and platinum. The level is determined by the number of points a project scores on a checklist of sustainability factors.

Seeking a gold rating would be a bold goal. A gold rating might capture the imagination of the community and many major donors who live in an area and value its environment.

Seeking a gold rating is a commitment that impacts many aspects of the building and site. Before making this decision, a client should carefully assess the full implications of such a commitment. Our design team can present the tradeoffs, benefits, and costs to achieve a gold level. Whether or not you elect to seek a LEED certification, we would expect to design many green aspects into the project.