

PROPOSED PRINCIPLES FOR SUSTAINABLE FACILITIES FOR THE ORGANIZATION OF BIOLOGICAL FIELD STATIONS

Below is a series of findings and resolutions for the OBFS Executive Committee to adopt consistent with the resolution passed at the 2001 annual meeting on September 21. These are followed with explanation and rationale. The following definition and description of what is meant by sustainability is provided for purposes of clarity, . This definition is in part derived from the U.N.'s Report of the World Commission on Environment and Development entitled Our Common Future (1987).

Sustainability means meeting the needs of the present generation without compromising the ability of future generations to meet their needs. Hence, sustainable development consists of activities and economic growth that do not deplete or degrade the biodiversity, environmental resources, and ecosystem services upon which present and future societies depend. Sustainable uses and activities are those that can be continued without jeopardizing the ability of ecosystems to be fully renewed, and thus continue to provide undiminished resources each year long into the future.

Whereas part of the mission of OBFS member stations is to study and conserve natural resources, biological field stations should demonstrate a commitment to conserve those resources by striving to use them efficiently and productively in our facilities and infrastructure.

Whereas green building techniques decrease the amount of energy a building requires for optimal performance throughout its lifetime;

Whereas studies have shown that increases in natural light and ventilation typical of green buildings result in increased performance of students and productivity of building occupants;

Whereas decreases in lowered maintenance and energy costs provided by sustainable building practices lead to reduced future fiscal constraints on on field station budgets to maintain infrastructure, freeing up financial resources for more important programmatic and staffing needs;

Whereas investment in energy conservation measures often has a higher internal rate of return (See appendix, Financial Analysis Tools for definition) than the return currently received on expendable funds from invested endowment funds;

Therefore:

Resolved that OBFS encourages member stations to conduct a sustainability study of any new construction or retrofit project in the beginning stage of such projects, because then sustainable building techniques are most effectively and easily adapted to meet programmatic needs;

Resolved to take advantage of the wealth of architectural and engineering firms specializing in green building by contracting with such experts to conduct the sustainability studies if needed;

Resolved to encourage OBFS member stations to use those parts of The Leadership in Energy and Environmental Design (LEED) Green Building Rating System program established by the U.S. Green Building Council (<http://www.usgbc.org/>) that are appropriate to field stations to assess new building projects for their sustainability and that such buildings attempt to achieve at least a gold rating.

The members of the Organization of Biological Field Stations represent a unique community of learners and doers. Over the years we have shown how to take what we learn about ecosystems and the natural resources we steward and translate it into effective management and policy. We have demonstrated leadership in identifying and studying important environmental issues, from conservation biology to sustaining ecosystem services, from biomedical research to exotic species assessments and restoration ecology. We have been major (if often hidden) contributors to our understanding of the most important environmental issues of the past century.

However, there is one area, sustainability in facilities, where the mission of biological field stations needs to be more fully realized, not only for the message it sends about our own commitment, but because it bears directly upon our own long-term viability.

The OBFS research community boasts a truly unparalleled community of experts in the environmental sciences. It is an opportunity to learn from and contribute to that community of dedicated, exceptional people that drew many of us to our professions. It is the promise of working with that community's collective insights into the hard stuff of our field stations—and thereby addressing pressing needs of both our field stations and society—that prompts me to urge your support of OBFS's adoption of a set of principles that promote sustainability.

As a start toward such an effort, I am proposing the adoption of sustainability principles that relate directly to the facilities and infrastructure we provide for researchers, students, and staff. The need for leadership in energy conservation and related environmental performance has never been greater—not only as a means to further our own interests, but as a way to serve the interests of society at large.

For biological field stations, one of the most obvious means by which we can communicate our commitment to sustainability is to minimize the “environmental footprint” of the buildings and infrastructure we use to support research and education. The buildings we put in place are a tangible statement about what we want the world to know about who we are and what we do. I can't help but think about the words of Winston Churchill: “We shape our dwellings, and afterwards our dwellings shape our lives.” In keeping with our missions, the planning, design, and construction of facilities and infrastructure should be viewed as an opportunity to learn about the relationship between people, society, and the natural environment.

Examples of OBFS member stations that have successfully integrated sustainable strategies into field station facilities and infrastructure include:

Black Rock Forest Consortium
Jasper Ridge Biological Preserve, Stanford University
Raystown Field Station, Juniata College
Rocky Mountain Biological Laboratory

The Nature Conservancy Disney Wilderness Preserve
University of California James San Jacinto Mountains Reserve
University of California Sweeney Granite Mountains Desert Research Center

Notes and Comments on Planning, Design and Construction of Sustainable Building Features

We may want to encourage OBFS member sites, when planning new or upgraded facilities and infrastructure to: (1) require an objective sustainability study during the initial planning phase for any new building or retrofit project; and (2) to adopt some standardized methods of measuring and reporting the environmental performance and related costs of buildings.

Both of these steps are designed to provide field stations with the information needed to identify and exploit synergies between economic and environmental goals. Up-front sustainability studies allow energy efficient technology and environmentally responsible material selection to be integrated into the basic design of buildings without compromising program needs. It also avoids sustainable features becoming optional add-ons. This is important because add-ons are often cut at the eleventh hour to reduce construction costs. Even if they are not cut, added-on technologies tend to have compromised performance since they often work against rather than with other aspects of the building. Sustainability studies also provide options for improving energy efficiency and other aspects of environmental performance without compromising program needs.

Encouraging field stations to conduct sustainability studies enables them to address proactively the financial and environmental costs incurred over the life-cycle of each building and upgrade. Numerous studies have shown that sustainable or “green” building designs have significantly lower life-cycle costs than conventional buildings, largely due to their much lower maintenance and energy costs. This is an especially critical issue for field stations, since they often are subject to severe operating budget constraints. By adopting sustainable building practices, a field station can reduce future demand on their operating budget used to maintain infrastructure. Since such funds are typically the most difficult type of funds to acquire, it is crucial that field stations consider options like sustainable buildings that can help control escalating infrastructure costs.

What I am asking OBFS to do is something we have all learned to do as field station managers – think in terms of the whole system. By considering multiple systems and problems at the same time, interconnections and common solutions can be identified. This approach can result in significant cost-savings by adding multiple, energy- or water-saving technologies and design elements in a coordinated manner, even when the cost of any one of the technologies or elements would be prohibitive if implemented alone. For example, upgrading HVAC equipment by itself might not be cost-effective, but the benefits of the upgrade might be achieved at negative cost if it is combined with a lighting system overhaul and a better energy management system. At the same time, a

lighting system overhaul may reduce heating loads, thus significantly reducing the upfront cost of the HVAC system.

We have all come to realize that it is easier and cheaper to address environmental and social issues by investing time and planning effort up front than by considering them only at the later stages of a project. Although front-loaded design does add cost and time to the initial stages of a project, it often saves more than that amount of time and money in later stages by facilitating approvals, avoiding litigation, and minimizing construction delays. For example, upfront planning (what some architects would refer to as a “charrette”) might cost \$5,000 to \$50,000 initially, but it can generate equal or greater downstream savings by identifying cost-saving synergies among technological and other elements of the project—or simply by producing spaces in which everyone can work or live more comfortably and productively.

This planning is about designing spaces around human needs in ways that reduce water and energy use and/or simplify operations and maintenance. It often leads to the incorporation of natural daylighting and individually controllable lighting or ventilation systems.

Finally, sustainable planning and design is all about teamwork. In the green development context, this involves creating a broad-based team to carry out the initial planning process and ensuring that the key players in the development team support the project’s environmental and social goals.

A Brief Overview of the LEED Green Building Rating System

The information below is provided for your convenience. Not all aspects of this rating system are appropriate for field stations, so you may need to adjust some elements to address the unconventional or unique qualities or needs often associated with a functioning field station. However, LEED does provide many useful and important guidelines and also helps to identify issues that might otherwise be overlooked.

The Leadership in Energy and Environmental Design (LEED) Green Building Rating System is a priority program of the U.S. Green Building Council. It is a voluntary, consensus-based, market-driven building rating system based on existing, proven technology. It evaluates environmental performance from a ‘whole building’ perspective over a building’s life cycle, providing a definitive standard for what constitutes a ‘green building’.

LEED is based on accepted energy and environmental principles, and it strikes a balance between known effective practices and emerging concepts. Unlike other rating systems currently in existence, the development of LEED Green Building Rating System has been open to public scrutiny and was instigated by a group that represents all segments of the building industry— the U.S. Green Building Council.

LEED is a self-assessment system designed for rating new and existing commercial, institutional, and high-rise residential buildings. It is a feature-oriented system where credits are earned for satisfying each criterion. Different levels of green building certification are awarded based on the total credits earned. The system is designed to be comprehensive in scope, yet simple in operation.

The LEED system's criteria are divided into five broad categories:

1. ***Sustainable Sites***: This includes factors such as site selection, erosion and sedimentation control, site disturbance reduction, and alternative transportation.
2. ***Water Efficiency***: This includes water efficient landscaping, water use reduction, and use of innovative wastewater technologies.
3. ***Energy and Atmosphere***: This includes optimization of energy performance, use of renewable energy, reduction of CFC emissions, elimination of HCFCs and halons, and measurement and verification.
4. ***Materials and Resources***: This includes recycling, construction waste management, use of certified wood, reuse of materials or buildings, and use of materials with recycled content.
5. ***Indoor Environmental Quality***: This includes the use of low-emitting materials, carbon dioxide monitoring, thermal comfort, daylight, and controllability of ventilation and other systems.

In addition to earning credits in these five areas, project teams can earn innovation credits by addressing regional sustainability issues in the project or by deploying new technologies. This modular approach means that if one aspect of environmental performance must be compromised to meet special occupant needs, project teams can still meet the overall environmental standard that is set for a building by over-performing in other areas.

This overview was drawn from the U.S. Green Building Council's web site (www.usgbc.org/programs/leed.htm) and U.S. Green Building Council, *LEED Green Building Rating System Version 2.0* (March 2000).

Appendix: Tools and Sources of Information

[The following material could be added to the OBFS Operations Manual (<http://www.obfs.org/OpsMan/OpsIntro/OperationsManualIntro.html>).

Sections where this information might be added or linked are:

- Facilities Section F. Operations and Maintenance (in first 2 paragraphs)
- Planning Section A. Facilities Plan
- Planning Section B. Other Plans, 1. Construction Project Planning Process
- Finances Section, 2. External Funding Sources
- Facilities Policies, add a section concerning Resource Use]

Financial Analysis Tools

The items below are some of the more common tools use when trying to determine whether certain costs or investments are acceptable. Keep in mind that there are many different techniques for analyzing financial return and risk. The ones listed below are among the more common. In any case, such analyses are desirable when trying to evaluate different options with significantly different present costs.

Internal Rate of Return (IRR):

The internal rate of return is a financial technique for solving the interest rate for which dollar savings are just equal to dollar costs over a given period of time. This interest rate is the rate of return on the investment. It is compared to the investor's minimum acceptable rate of return to determine if the investment is desirable.

Other accounting techniques for making informed decisions include Discounted Pay-back and Life Cycle Cost (LCC) methods. There are several important considerations to keep in mind when using any of these financial tools in decision making:

- New buildings are usually depreciated over 30 years, while renovations are depreciated over 20 years (straight-line depreciation).
- It is important to establish common assumptions and parameters, and document how these were arrived at.
- Discount future costs to present value to account for the time-value of money.

Design Tools:

Among the most common tools used for sustainable building design are energy models. There are real, tangible benefits to assuring that the design team employs such models. Energy models such as DOE-2, eQUEST, and ENERGY-2 can be used to simulate the proposed design's response to climate and season. Designers can preview and substantially improve the performance of interdependent features such as building orientation, lighting, alternative building shell design, various mechanical systems, etc.. Energy modeling quickly evaluates cost-effective design options for the building envelope or mechanical systems by simulating the various alternatives in combination. This

process takes much of the guesswork out of sustainable building design and specification, and enables a fairly accurate cost/benefit forecasting. It also helps when performing financial analyses by providing more realistic data inputs and assumptions.

Useful Sources of Information

- **Guidelines, Rating Systems, And Manuals**

California State University Chancellor's Office, *CSU Architectural and Engineering Guidelines*. <http://www.calstate.edu/CPDC/AE/Standards/Energy.pdf>.

City of Santa Monica, *Green Building Design & Construction Guidelines*, April 1999. <http://greenbuildings.santamonica.org/introduction/introwhybuildinggreen.html>.

Commonwealth of Pennsylvania, *Guidelines for Creating High Performance Green Buildings*. <http://www.gggc.state.pa.us/publictn/gbguides.html>.

International Performance Measurement & Verification Protocol, *Concepts and Options for Determining Energy and Water Savings*, Volume 1, January 2001. www.ipmvp.org.

Minnesota Sustainable Design Guide (1999-2001). <http://www.sustainabledesignguide.umn.edu/>.

New York, *High Performance Building Guidelines* (April 1999). <http://www.nyc.gov/html/ddc/html/highperf.html>.

North Carolina Triangle Council of Governments, *High Performance Building Guidelines, Version 2.0* (September 2001). <http://www.tjcog.dst.nc.us/hpgtrpf.htm>.

Sieglinde K. Fuller and Stephen R. Petersen, *Life-Cycle Costing Manual for the Federal Energy Management Program*, US, Department of Commerce, Technology Administration, National Institute of Standards and Technology, 1995.

State University of New York at Buffalo, *Think Green, A UB Guide To Campus Ecology*, 1999. <http://wings.buffalo.edu/ubgreen>.

U.S. Green Building Council, *Leadership in Energy & Environmental Design (LEED 2.0)* (March 2000). <http://www.usgbc.org/programs/leed.htm>.

University of Oregon, *Sustainable Development Guidelines* (October 2000, effective February 2001). <http://darkwing.uoregon.edu/Euplan/sustainable.html>.

- **Materials**

GreenSpec: The Environmental Building News product directory Sortable by

products, manufacturers, CSI category, <http://www.greenspec.com/>.

Recycled content products manufacturers database, Updated annually.
<http://www.ciwmb.ca.gov/ConDemo/Products/default.asp>.

Searchable by CSI, Matrix of recycled content levels and product availability.
<http://www.ciwmb.ca.gov/GreenBuilding/Materials/Matrix.htm>.

State of CA Modular Office Furniture Specification.
<http://www.ciwmb.ca.gov/GreenBuilding/Specs/Furniture/default.htm>.

- **General Green Building Information and Organizations**

American Solar Energy Society. <http://www.ases.org/>.

Energy Efficiency and Renewable Energy Network (EREN), U. S. Department of Energy. <http://www.eren.doe.gov/>.

Home Power Magazine. <http://www.homepower.com/>.

Rocky Mountain Institute, <http://www.rmi.org/>.

Simpson. Walter, *Environmental Stewardship and the Green Campus – The Special Role of Facilities Management*, State, University of New York at Buffalo Green Office, 2001. <http://wings.buffalo.edu/ubgreen>.

Solstice: Sustainable Energy and Development Online.
<http://solstice.crest.org/index.shtml>.

UC Berkeley, Sustainable Design/Green Architecture Information Sources.
<http://www.lib.berkeley.edu/ENVI/GreenAll.html>.

University of Oregon (1999-2000 Development, Policy, Implementation and Transportation Subcommittee, University Planning Office,) *Sustainable Development Plan*, October 5, 2000.

- **Green Specifications (References For Model Specifications)**

Alameda County, *Resourceful Purchasing Manual*.
<http://www.stopwaste.org/fsfreeindex.html>.

Berg, Henry, *Environmentally Responsive Specifying, It's Not Easy Building Green Workshop*, PG&E Center, San Francisco, May 3, 2000.

Froeschle, Lynn M., *Environmental Assessment and Specification of Green Building Materials, The Construction Specifier*, October 1999, p. 53.

Hermannson, John, *Green Building Resource Guide*. <http://www.greenguide.com>.

Pennsylvania Lease Specs (Department of General Services, *General Performance Standards and Specifications for the Commonwealth of Pennsylvania Leased Facilities*. <http://www.gggc.state.pa.us/publictn/leaspecs.html>.

Resourceful Specifications. <http://www.stopwaste.org>

Spiegel, Ross and Meadows, Dru, *Green Building Materials: A Guide to Product Selection and Specification*, John Wiley & Sons, Inc., New York, 1999.

Wastespec. <http://www.tjcog.dst.nc.us/cdwaste.htm#wastespec>.