Greening of a Fisheries Laboratory in Alask

A Case Study of the NOAA/NMFS Research Facility, Juneau, Alaska

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Introduction

The National Oceanic and Atmospheric Administration (NOAA) is proposing to develop a consolidated office and research laboratory facility in Juneau, Alaska. The *NOAA/NMFS Juneau Research Facility* will house NOAA's Alaska Region administrative functions, and the National Marine Fisheries Service (NMFS) Alaska Fisheries Science Center's Auke Bay Laboratory. With this new facility NOAA/NMFS will be better able to continue to work on behalf of the American public to manage and sustain the nation's living marine resources and their habitats.

Proposed Improvements

The proposed project will include administrative offices, common areas, laboratories and warehouse facilities. The offices and common areas consist of approximately 46,000 square feet of interior space including offices, office support spaces, conference rooms, a multipurpose room, library, and cafeteria. The laboratory portion of the project consists of approximately 40,000 square feet of interior space and includes chemical and biology labs, genetics labs, seawater wet labs, computer labs and lab support facilities. warehouse of approximately 4,000 square feet of interior space will accommodate general and research projects storage. Exterior improvements include an outdoor research tank area of approximately 5,000 square feet, and an enclosed and secured storage yard of approximately 3,000 square feet.

Project Site

The site for the NOAA/NMFS Juneau Research Facility is located on a 22 acre tract that is currently operated as a commercial rock quarry. The site has been operated as a quarr for approximately 10 years. Approximately 16 acres of the site have been stripped of all vegetation and a significant amount of the subsurface material has been blasted and removed. The tract is in a very remote setting, bordered on the north by a park, Favorite Channel on the west and south, and a rural neighborhood on the east. The rock quarry provides an exciting and unique setting for the NOAA/NMFS Juneau Research Facility. The steep and rugged quarry walls contrast with the picturesque sweeping views of Favorite Channel and Admiralty Island in the background.

NOAA has made a serious commitment to addressing sustainability issues on this project. Combined with its commitment to the exploration, discovery and research of the ocean, the reclamation of the quarry site along the shore of Favorite Channel reiterates NOAA's environmental focus. Once excavation activities on the site have halted, the quarry will slowly be reclaimed through natural regeneration. If left undisturbed the site will evolve, although extremely slowly. Through the introduction of native pioneer plant species and creating a positive growing environment, the natural succession will be enhanced and

become an important aspect of the design. For more project information please visit NOAA's project website at www.fakr.noaa.gov/lena/default.htm

Incorporating Sustainable Design into the Project

In June 1999, President Clinton signed Executive Order 13123 "Greening the Government through Efficient Energy Management" which states that as the Nations largest energy consumer, the Federal government shall "promote energy efficiency, water conservation and the use of renewable energy products and help foster markets for emerging technologies." In addition, it was the first time that "sustainable building design" was identified in an executive order and those sustainable design principles shall be developed and applied to siting, design, and construction of new facilities.

As a result of this Executive Order, and NOAA's and the design team's commitment to sustainable design and development, the team has utilized the U.S. Green Building Council's (USGBC) LEED Green Building Rating System™ as the tool to evaluate the project's energy and environmental performance. It is a voluntary, consensus-based, market-driven building rating system based on existing proven technology. It provides a definitive standard for what constitutes a "green building" in the following five areas:

- Sustainable Sites
- Water Efficienc
- Energy and Atmosphere
- Materials and Resources
- Indoor Environmental Quality

At the beginning of the project, the team applied LEED™ Version 1.0 through a charrette in Anchorage with the entire design team and NOAA. Subsequently a draft of LEED™ Version 2.0 (LEED™ V.2) has been developed as a refinement to LEED Version 1.0. final version of LEED™ 2.0 was officially launched in Spring 2000.

The following pages reflect the team's effort to apply the LEED™ V.2 criteria to the design of the Consolidated Facilities. It identifies LEED™ objectives and strategies and then states the design team's intent for inclusion in the project. The design team strategies will be further refined and developed throughout the design development and construction documents phases.

1.0 Sustainable Site

1.1 Erosion and Sedimentation Control

LEED Objective: Control erosion to reduce negative impacts on water and air quality. Employ best management practices (BMP) for sediments and erosion control to reduce, prevent impacts to water, air and soil due to temporary construction disturbance.

LEED Strategy: Employ silt fencing, sediment traps, construction phasing and/or stabilization of steep slopes.

Design Strategy: EPA's NPDES requires measures to control the negative impacts of erosion during construction and operation of the facility. To meet EPA's requirements, the NOAA project will incorporate Recommended Best Management Practices (BMPs) into the design. Some BMP measures will include use of silt fencing, sedimentation pond, oil/sediment separator, topsoil and seeding. Storm water leaving the site will be filtered through mechanical and natural means to reduce the impact to downstream sites.

1.2 Reduce Site Disturbance

LEED Objective: Sustain land and water resources and promote biodiversity
Incorporate reduced site disturbance strategies and document in site plans and specifications

LEED Strategy: Reduce the development footprint (including building, utilities, access, and parking) to exceed the open space requirement for the site per local zoning by 25%.

Design Strategy: The NOAA project is situated in a City and Borough of Juneau zoning area D-3 (Single Family/Duplex). The CBJ open space requirement (maximum lot coverage) for this zone is 35%. To exceed the CBJ open space requirement by 25% would require that a minimum of 43.5% be dedicated to open space. The design of the facility currently has approximately 60% dedicated to open space and thus surpasses the LEED guideline.

1.3 Access to Alternative Transportation

LEED Objective: Reduce automobile use and sprawl.

LEED Strategy: Provide suitable means for securing bicycles for at least 5% of building occupants AND provide shower and changing facilities for cyclists. OR provide preferred parking for carpools.

Design Strategy: The NOAA project will provide all of the above including bicycle racks for at least 5% of the staff, as well as shower and changing facilities. Preferred parking will also be provided for staff members who carpool.

1.4 Storm Water Management/Treatment

LEED Objective: Mimic natural hydrology and limit disruption of natural water flo and infiltration.

Design Strategy: The NOAA project will implement stormwater management practice to control runoff. While these efforts may not meet the % target goals of the LEED system, they will help to minimize the adverse impact of stormwater runoff to the project site, as well as adjacent sites. The project will provide a stormwater filtering system, bio-retention basin/swales, and vegetated filter strips. The overflow parking / snow storage area will be utilized for on-site infiltration to recharge the groundwater. The existing wetlands in the southeast corner of the site will be preserved as part of this stormwater management program.

1.5 Landscaping and Exterior Design to Reduce Heat Islands

LEED Objective: Reduce heat islands (thermal gradient differences between developed and undeveloped areas) to minimize impact on microclimate, human and wildlife habitat. Employ design strategies, materials, and landscaping designs that reduce heat absorption of exterior materials.

LEED Strategy: Preserve and/or plant at least one (1) tree on the site located within every 1,000 square feet of impermeable grade surface on the building lot, including parking, walkways, and plaza, etc.

Use light color/high-albedo materials (with albedo reflectance of at least 0.3) for 30% of the property's' non-parking impervious surfaces (e.g. sidewalks, plaza, etc.)

Design Strategy: The NOAA project includes approximately 115,000 square feet of impermeable surfacing for roads, parking, pedestrian circulation and plazas. This LEED System goal would require that 115 trees be preserved or planted. Since the existing site has been stripped of a majority of the existing vegetation to allow for rock extraction, preservation of existing trees is a minor issue. The NOAA project currently has just over 120 trees designed into the landscape plan. These trees are located in parking islands, along roadways, in courtyards and designed as part of the quarry site reclamation. Existing trees along the site perimeter, which were not removed due to the quarry operations, will remain in place.

The need to meet parking and operations requirements dictates that a large portion of the developed area be paved with asphalt. The NOAA project will provide concrete sidewalks and pavers in pedestrian circulation and landscape areas to reduce heat islands. A gravel surface for the overflow parking/snow storage area will help reduce heat absorption to a degree, although the local greenstone material may be only slightly more reflective than asphalt pavement. Although this will not allow the project to meet the LEED system target goal of 30% use of high albedo material (with 0.3 minimum albedo reflectance), the aforementioned measures will help to reduce the overall heat absorption for the site.

2.0 Water Efficiency

2.1 Water Efficient Landscaping

LEED Objective: Reduce or eliminate potable water use for landscape irrigation b employing strategies and landscaping techniques such that no potable water is used for landscape irrigation after establishment of plantings.

Design Strategy: The NOAA facility is located in an area which can receive up to 80" of precipitation a year. This high quantity of rainfall can typically sustain most any landscape once the plant material is established. The landscape will be made water efficient through utilizing a high percentage of native and pioneer plant species, which can tolerate the climate, soils, and precipitation of Juneau. A limited amount of ornamental plant material will be situated in planting beds that can meet the needs of these plants. There is no or very little turf grass in the design, however native grasses will be used as part of the site reclamation. There is no irrigation system associated with this design.

2.2 Innovative Wastewater Technologies

LEED Objective: Reduce wastewater loads on municipal systems by pre-treating and recycling of water on-site, to promote aquifer recharge and reduce site water use. Reduce the use of municipally treated water for sewage conveyance by at least 50% of the regional average use; OR treat 100% of wastewater after use, by employing innovative on-site technologies.

Design Strategy: The NOAA project will provide an on-site Biologically Engineered Waste treatment system. The system will consist of a series of open top plastic tanks containing a wide variety of different species of plants and animals, which break down the wastes. The system is biological in that it depends entirely on living organisms to break down and stabilize the organic wastes. The system is capable of reliably and

consistently producing better than secondary quality effluent a defined by the Alaska Department of Environmental Conservation (ADEC).

2.3 Water Use Reduction

LEED Objective: Reduce burdens on municipal water supply and waste water systems. Promote self-sufficiency in building water use and minimize water consumption within buildings.

LEED Strategy: Install fixtures that in aggregate use 20% less water than the water usage requirements in the Energy Policy Act of 1992.

Design Strategy: All plumbing fixtures shall be institutional quality, minimum flow fixtures to comply with conservation guidelines. Urinals and water closets shall be provided with infrared automatic flush valves with 120v solenoids. Infrared automatic faucets with 120v solenoids and adjustable tempered water supplies shall be supplied at all toilet room lavatories. The percentage reduction will be determined in the next phase of design.

3.0 Energy and Atmosphere

3.1 Building Commissioning

LEED Objective: Verify and ensure that building's are designed, installed, and calibrated to be operated as intended.

LEED Strategy: Comply with the required elements of the LEED Commissioning Requirements document as noted in the LEED Reference Guide.

Design Strategy: The NOAA project will provide specifications in the bid documents to instruct the Construction Contractor to provide commissioning efforts consistent with the LEED Commissioning Requirements and appropriate for the construction contractors scope of work.

3.2 CFC Reduction in HVAC&R Equipment

LEED Objective: Reduce ozone depletion.

LEED Strategy: Use no CFC-based refrigerants HVAC&R systems.

Design Strategy: *Current HVAC system design has no CFC in any components . The facility chilled water heat rejection is via spent research laboratory seawater and titanium flat plate heat exchanger.*

3.3 Optimize Energy Performance

LEED Objective: Achieve energy performance above the minimum standard to reduce operating costs and environmental impacts associated with excessive energy use.

LEED Objective: For the Labs exceed the requirements of ASHRAE/IED Standard 90.1 – 1989 and subsequent revisions by 20% or more.

LEED Objective: For the Offices (and common areas), the objective is to exceed the requirements of ASHRAE/IED Standard 90.1 – 1989 and subsequent revisions by 30% or more.

Design Strategy: *Lighting will conform to Chapter 6 of ASHRAE 90. The design strategy will have high efficiency lighting fixtures with daylight controls. The office building also has clerestory windows in the corridor with openings to allow for the passage of natural daylight.*

The research functions of the laboratory will cause building internal equipment power loads to be above ASHRAE recommendations.

The building envelope requires wall r-values above the standard R-19 to meet the ASHRAE 90 requirements. It is the goal of the project team to exceed ASHRAE 90 requirements and realize a 30% improvement in the office building and 20% improvement in the laboratory building.

HVAC system DDC will have programmable night setback fo building zones unoccupied in the evenings. Duct construction will be required to meet SMACNA standards including leakage test and ratings. The 100% OSA laboratory ventilation will have heat recover off of the exhaust air to preheat the incoming OSA. All HVAC and DDC controls system will be tested balanced and commissions. HVAC design will adhere to the prescriptive requirements of ASHREA 90 except where Alaska climatic condition require other measures.

In addition, the laboratory seawater will be utilized to provide chilled water to the building HVAC systems. The spent laboratory water will be pumped through a titanium flat plate heat exchanger to cool the building HVAC system chilled water. The peak seawater flow if rejected at below 9 degrees C. will meet the entire complex cooling demand thus eliminating the need for central plant chillers and cooling towers. If the spent seawater is above 9 degrees C. provision have been made to provide seawater directly to the heat exchanger

from the seawater filter house and still have adequate seawater to meet both peak research and peak cooling demands.

3.4 Waste Heat Recovery

LEED Objective: Install a waste heat recovery system that recaptures at least 20% of total waste heat for use in pre-heating water or incoming air…

Design Strategy: All of the general exhaust from the laboratory facility will be exhausted through heat recovery coils. The recovered heat will be used to preheat the 100% OSA ventilation for the facility. The laboratory general exhaust includes the exhausted heat from all of the specimen freezers, laboratory furnaces, and all other heat producing equipment located under the canopy hoods.

3.5 Measurement & Verification

LEED Objective: Provide for ongoing accountability and optimization of building energy and IEQ performance over time.

LEED Strategy: Comply with installed equipment requirements in order to satisfy the Department of Energy's International Performance Measurement and Verification Protocol for energy consumption.

Design Strategy: The NOAA project will incorporate into the design and operations plan, IPMVP requirements for energy consumption.

4.0 Materials and Resources

4.1 Storage & Collection of Recyclables

LEED Objective: Facilitate the reduction of waste generated by building occupants that is hauled and dumped in landfills.

LEED Strategy: Provide a centralized ground-floor location for collection and storage of materials separated from each other for recycling, including: newspapers, glass, metals, plastics, organic waste (food and soiled paper) and dry waste.

Design Strategy: The design of the NOAA/NMFS Juneau facility includes an area at the loading dock / receiving area for the collection of recylclables. Due to the limitations on recycling in Alaska, it is anticipated that materials recycled will be initially limited to newspaper, cardboard and office paper. The NOAA/NMFS Juneau facility-recycling program will be expanded, as new markets for recycling in Alaska become available.

4.2 Construction Wast

LEED Objective: Reduce waste generated during land clearing, demolition, and construction thereby reducing landfill use.

LEED Strategy: Develop and implement a waste management plan and quantify materials diverted by weight. Recycle 50-70% (by weight) of construction, demolition, and land clearing debris.

Design Strategy: The State of Alaska, and the City of Juneau in particular, does not have local recycling operations / industries. In order for construction waste to be recycled, it will need to be barged out of Juneau to the "lower 48", most likely the State of Washington. This will result in additional shipping costs and will increase the costs to the project. The project team, however, is committed to conducting additional research during the next phase of design to identify other recycling options and partnership opportunities. The final construction documents will need to define appropriate parameters and requirements for reducing construction waste in Juneau.

4.3 Recycled Content

LEED Objective: Reduce the use or depletion of raw materials by replacing them with recycled materials and support the market and economic development of recycling.

LEED Strategy: Use a minimum of 20% of materials listed in EPA's Comprehensive Procurement Guidelines (CPG). For materials not contained in the CPG, a minimum of 50% recycled content (at least 20% post-consumer).

Design Strategy: The design team has actively researched materials that offer the greatest recycled content possible given the project's functional and financial considerations. The carpets specified must come from a carpet mill actively involved in a recycling program, ideally contain a percentage of recycled fiber, and ultimately be recyclable at the end of its useful lifetime. Competitive bidding precludes selecting one "best" carpet, however, as individual carpet criteria varies. Glass tile is being considered for the project, which is made of 100% recycled material and can be 100% recycled at the end of its useful lifetime. Looking into competitive sources for the glass tile lead us to our own Alaskan source for this product, decreasing the distance to our jobsite as well as fulfilling LEED recycled content requirements. We are also utilizing a ceiling tile that is manufactured using 60% or more recycled material.

4.4 Certified Wood

LEED Objective: Encourage environmentally responsible forest management.

LEED Strategy: Use a minimum of 50% wood-based materials certified in accordance with the Forest Stewardship Council guidelines.

Design Strategy: Due to the function of the facility, we are not utilizing a great amount of wood, however wood doors and wood cabinetry, where feasible, are 100% certified wood products. The wood doors are also half-lite to allow for shared light from the exterior to the interior of the building. The wood species being used is a light maple, which will serve to maximize available lighting.

5.0 Indoor Environmental Qualit

5.1 Indoor Air Quality Problem Avoidance

LEED Objective: Prevent or avoid the development of IAQ problems in the buildings thereby contributing to the overall quality of the indoor environment affecting the health and well being of the occupants. Meet the minimum requirements of voluntary consensus standard ASHRAE 62-1989, Ventilation for Acceptable Indoor Air Quality.

LEED Strategy: Locate building fresh air intake away from loading areas, building exhaust fans, cooling towers, and other sources of contamination.

Design Strategy: The HVAC system design will be in accordance to ASHRAE 62 Ventilation for Acceptable IAQ. Office and commons ventilation supply air will be filtered to 65% efficiency per ASHRAE Standard 52.1- .. The laboratory ventilation supply air will be filtered to 85% per ASHRAE Standard 52.1-92. All OSA intakes will be places at a minimum 20 feet away from building exhaust air streams. The laboratory fume hood discharges will be per the ACGIH Industrial Ventilation Guidelines. With high velocity vertical discharge stacks 10-15 feet above the building.

5.2 Environmental Tobacco Smoke (ETS) Control

LEED Objective: Prevent exposure to ETS by nonsmoker occupants and avoid contaminating the building system with smoke.

LEED Strategy: Provide properly engineered locations to contain and remove ETS at its source locations, validated by referenced test methods.

Design Strategy: The NOAA Juneau facility will be designed and operated as a non-smoking facility. An outdoor, covered smoking area will be provided for staff.

5.3 Permanent Carbon Dioxide (CO2) Monitoring System

LEED Objective: Provide for long term Indoor Air Quality monitoring to support sustained occupant health and comfort.

LEED Strategy: Install permanent carbon dioxide monitoring system that tracks the ventilation performance of the HVAC system and allows operators to make adjustments to maintain targets. Install sensors in areas of the building with high occupant densities and at the ends of the distribution ductwork. Select systems based on ease of calibration of all of the sensors should be performed on a quarterly basis.

Design Strategy: The building DDC system will monitor the return air CO2 levels from the commons and office building ventilation systems. OSA will be controlled by the cooling economizer and CO2 levels. High CO2 levels will alarm at the DDC monitoring central station.

5.4 Increased Ventilation Effectiveness

LEED Objective: Deliver fresh air effectively to building occupants to support their health, safety, and well-being.

LEED Strategy: Employ architectural and HVAC strategies to increase ventilation effectiveness and prevent short-circuiting of airflow. Techniques available include use of displacement ventilation and natural ventilation, and/or operable windows with an architectural strategy for natural ventilation and cross ventilation.

Design Strategy: See 5.1 and 5.3 for HVAC strategies

5.5 Construction IAQ Management Plan

LEED Objective: Protect construction workers and building occupants by preventing IAQ problems arising from the construction process and/or improper handling of building materials during construction.

LEED Strategy: Meet or exceed the minimum requirements of Sheet Metal and Air Conditioning Contractors National Associations (SMACNA) IAQ Guideline for Occupied Buildings Under Construction, 1995. Ventilate at a rate of one air change per hour minimum during construction or flush out for one week after construction ends and

before occupancy. Sequence and coordinate construction activities (pre-occupancy) to minimize adverse impacts on indoor air quality

Design Strategy: *The technical specification will instruct the construction contractor to meet or exceed these requirements.*

5.6 Select Low-Emitting Materials

LEED Objective: Reduce the quantity of possible indoor air contaminants that are odorous or irritating to building occupants to protect their health.

Adhesives: At a minimum, all adhesives must meet the VOC limits of South Coast Rule #1168 by the South Coast Air Quality Management District.

Architectural Sealants: (material with "adhesive" characteristics used as a filler: not material use as a "coating") At a minimum, all sealant must meet the limits of Regulation 8, Rule 51 of the Bay Area Air Resources Board.

Paints and Coatings: At a minimum, all paints and coatings must meet the requirements of New Jersey State Department of Environmental Protection, Title 7, Chapter 27, Subchapter 23. Select topcoat paints that meet the VOC and chemical component limits of Green Seal, Inc., third party certification.

Formaldehyde: Specify products that do not contain urea-formaldehyde or phenol formaldehyde resins.

LEED Strategy: Request and evaluate emissions test data from manufacturers for comparative products. Ensure that VOC limits are clearly stated in specification, General Conditions, or in each section where adhesives, sealants, and coatings are addressed.

Design Strategy: *Adhesives and architectural sealants have been selected to comply with all U.S. EPA VOC limits and requirements. Carpet adhesive, for example, shall be water based, acrylic adhesive and shall not contain any volatile organic solvents (VOC).*

All Paints and Coatings meet the requirements of the EPA and also the chemical component limits of Green Seal, Inc., although some have not been certified as of yet. The primary paint system being specified is Sherwin Williams' "HealthSpec Low Odor Interior Latex Eg-Shel B9 Series", a water-based paint with a VOC maximum of 0.0 pounds per gallon when tested in accordance with EPA Test Method 24. Specifications clearly denote solvent type, vehicle, VOC maximum complying with EPA test method, solids content minimum, gloss factor,

freight classification, and flash point. The LEED objective of reducing the quantity of possible indoor air contaminants that are odorous or irritating to building occupants is especially important to us due to our long winters of interior confinement.

Formaldehyde: The design team has been diligent in eliminating urea-formaldehyde from the project. We have found it necessary to utilize some phenol formaldehyde resin containing products to meet functional requirements but they must meet ANSI A208.1 and they do not emit any free formaldehyde. For example, where acoustical wall treatments are required we are utilizing acoustical ceramic fiber batting that has no friable glass fiber or formaldehyde based binders with a fabric stretched over it, fastening to wall mounted tracks rather than pre-manufactured acoustical panels that contain formaldehyde.

5.7 Indoor Chemical Pollutant-Source Control

LEED Objective: Avoid exposures of building occupants to toxic or hazardous chemicals that adversely impact air quality.

LEED Strategy: Design all chemical storage and mixing areas for lab and housekeeping products (central storage facilities and janitor closets, where appropriate) to allow for appropriate product storage in spaces that have water in chemical concentrate mixing areas, with drains plumbed for the appropriate disposal of liquid waste, separate outside venting, and negative pressure. In addition, include permanent architectural entryway systems (e.g. grills, grates etc) to catch and hold particles to keep them from contaminating the building interior.

Design Strategy: Chemical Storage. The facility is providing chemical storage that complies with the above requirements and meets the requirements of the Uniform Building Code, NFPA, and NOAA's internal standards and protocols for chemical storage, handling and safe laboratory practice.

Architectural Entryways. The goal of any well-designed architectural entryway is to remove as much particulate matter as possible prior to entering the building. The entry is the frontline defense against premature deterioration of interior building finishes, as well as insurance against costly maintenance. In addition to premature aging and maintenance factors, the entryway is the first impression upon entering a building and should have some aesthetic appeal along with practicality.

The NOAA/NMFS Juneau facility will provide a two-step approach in most major entryways and a three-step where appropriate. The first step will be an architectural grill at the exterior of the building,

directly in front of the entry doors to remove larger particulate matte such as mud or snow. The second step at the vestibules of each entryway will be a walk-off product designed to remove moisture as well as additional soil. Finally, the third step, at main entries such as the Commons will be carpet insets in a field of tile in order to extend the walk-off zone as far into the building as possible. With this approach soil travel should be minimized and the life expectancy of building finishes maximized.

5.8 Controllability of Systems

LEED Objective: Increase individual occupant control of HVAC, natural ventilation, and lighting systems to support optimum health, productivity, and comfort in the workspace.

LEED Strategy: In the offices, for 50% of the workstations, provide for individual or highly localized control for airflow, temperature and lighting, or provide operable windows and lighting controls for all occupants at the perimeter.

Design Strategy: The design of the project will provide localized control for airflow, temperature and lighting by providing operable windows for perimeter offices. Individual lighting controls for all occupants will be provided.

5.9 Thermal Comfort

LEED Objective: Provide a thermally comfortable environment necessary to the productive and healthy performance of the building occupants.

LEED Strategy: Comply with ASHRAE Standard 55-1992.

Design Strategy: The design will provide tempered air and hot water baseboard in each office for thermal comfort.

5.10 Lighting and Daylightin

LEED Objective: Provide a connection to daylight and outdoors to increase occupant comfort and integrate the indoor space with the outdoor environment.

LEED Strategy: Design to allow daylight to reach 20 ft. in from the perimeter (where windows are possible.) For interior areas with roof above, provide daylighting of 50% of the occupied space unless compelling reason prohibit (e.g. security, historic preservation considerations etc.) Techniques include daylight monitors, clerestory, glazing, sun controls/shading devices, and light shelves.

Design Strategy: *The NOAA project will include clerestory windows along the interior office corridor, which will bring daylighting into the interior of the office building. Offices off the interior corridor will be provided with windows to bring additional daylight into the offices. Offices along the perimeter will each have two windows for direct daylighting. The percentage of daylight provided will be calculated in the next phase of design.*