



BIOLOGICAL LABORATORIES - MANGO LAB

LEED-CI v2.0 SILVER

16 DIVINITY AVENUE, CAMBRIDGE, MA 02138

Mango Lab is a 4,046 square foot laboratory located on the 3rd floor of the Harvard's Biological Laboratories (BioLabs) Building. As a part of the Faculty of Arts and Sciences (FAS) Department of Molecular and Cellular Biology, Professor Mango and her team research organ development and physiology.

The project was a full gut renovation of an existing lab and office suite to accommodate the research and teaching needs of a newly appointed tenured senior faculty member. In addition to open laboratory space, the 2009 renovation included microscope rooms, equipment rooms, tissue culture space, a cold room, two office areas and a tea room. In support of Harvard's goal of reducing greenhouse gas emissions 30% below 2006 levels by 2016, inclusive of growth, FAS and the project team were committed to sustainability from the onset and throughout the duration of the project. They were able to develop more efficient lighting and HVAC systems to serve the space, as well as carefully select low-VOC furnishings and finishes to be used throughout.



Mango Lab

Photo: Harvard Green Building Services. 2009

PROJECT HIGHLIGHTS

LEED® Facts

Harvard FAS
Mango Lab
2009 Renovation



Location ... Cambridge, Massachusetts
Rating System ... Commercial Interiors v2.0
Certification Pending... Silver
Total Points Achieved ... 29 / 57

Sustainable Sites ... 4/7
Water Efficiency ... 0/2
Energy and Atmosphere ... 5/14
Materials and Resources... 4/14
Indoor Environmental Quality ... 11/17
Innovation and Design ... 5/5

59% of the total material value came from materials manufactured within 500 miles of the project site.

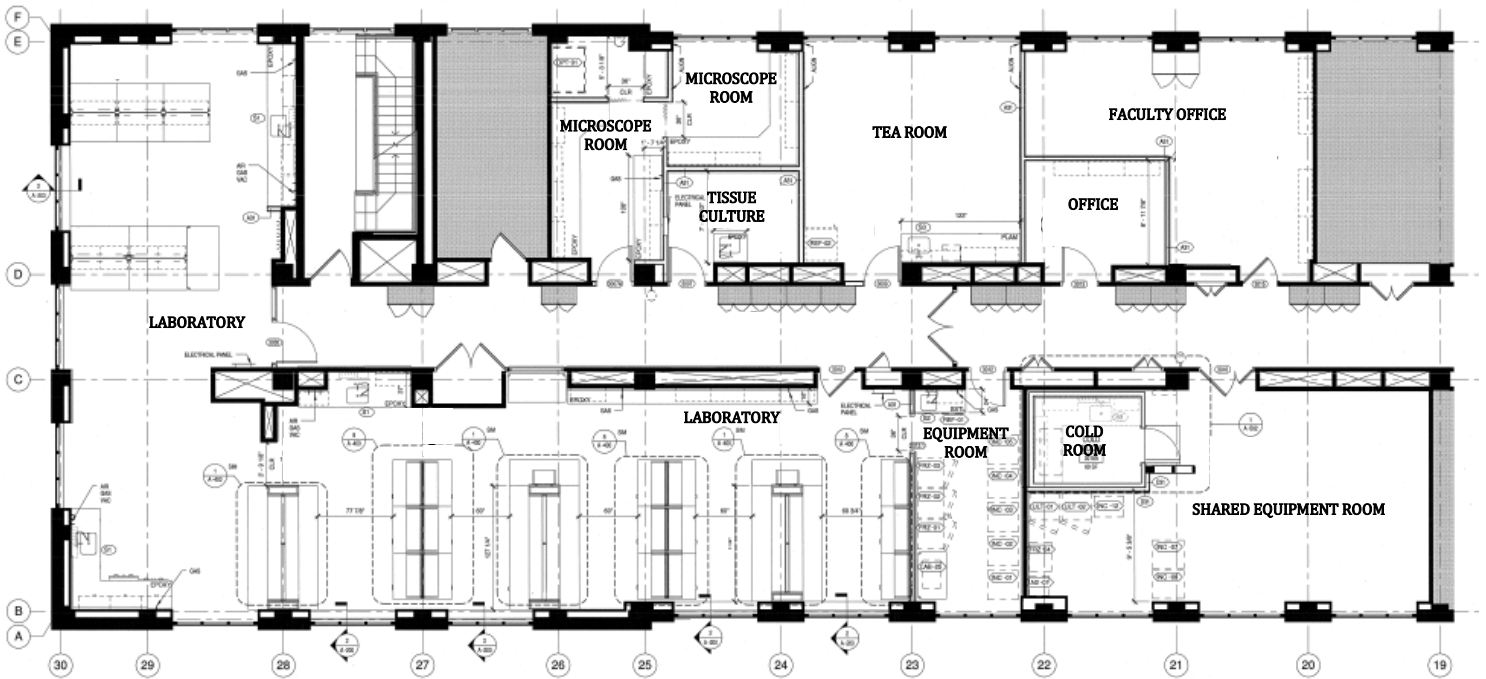
82% of the total percentage of construction waste was diverted from landfill.

100% of the adhesives, sealants, and paints used in the project were low-VOC.

100% of the equipment and appliances are Energy Star® rated.



PROJECT OVERVIEW



Mango Lab
 Photo: Harvard Green Building Services. 2009

PROJECT TEAM

Owner	Harvard Faculty of Arts and Sciences (FAS)
Project Manager	FAS Capital Projects
Architect	Perkins + Will
Contractor	Shawmut Design and Construction
MEP Engineer	Rist-Frost-Shumway Engineering
Commissioning Authority	Rist-Frost-Shumway Engineering
Sustainability Consultant	Harvard Green Building Services

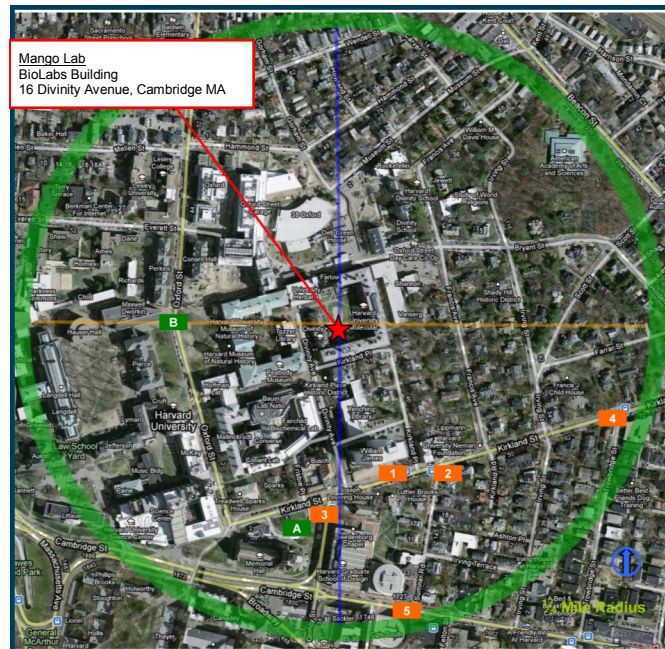


PUBLIC TRANSPORTATION

The BioLabs Building is located within a quarter mile of 5 MBTA bus stops and 2 Harvard shuttle bus stops. The building footprint is within the bounds of a vibrant urban area, which affords occupants plentiful access to amenities such as restaurants, banks, churches, and retail stores.

BUS STOPS AND SERVICES WITHIN 1/4 MILE OF MANGO LAB

Legend	Service Name or Bus Stop	Distance From Site	Line Name/ Number or Service type
1	Kirkland St @ Kirkland Place	0.13	86
2	Kirkland St & Summer Rd.	0.14	
3	Kirkland St & Quincy St.	0.14	
4	Kirkland St & Towbridge St.	0.22	
5	Cambridge St @ Prescott St	0.23	69
A	Memorial Hall	0.15	Quad Express and Mather Express
B	Maxwell Dworkin	0.12	
α	Harvard Yard Child Care Center	0.07	Daycare
β	Church of the New Jerusalem	0.2	Place of worship
γ	Queens Head pub	0.19	Restaurant
δ	Shady Hill Square	0.25	Park



FAS GREEN LABS

The FAS Green Labs Program works with researchers, staff, faculty, and building managers to implement sustainable practices and technologies in the FAS lab buildings. Because of the resource intensity of lab science and the unique conditions and requirements in each individual lab, lab sustainability approaches must be made from both a building-wide perspective, as well as a granular perspective aimed at identifying local opportunities at the lab level. FAS Green Labs Program initiatives, with the support of paid lab sustainability representatives, help mitigate resource intensity, while respecting the resource demands of science.

Lab Sustainability Assessments:

The Lab Sustainability Assessment program, a component of FAS Green Labs, operates under the conviction that scientific research can be conducted in more environmentally sustainable ways without adversely impacting research quality. By involving researchers in the process of assessing potential sustainability opportunities, the program aims to share best practices regarding lab energy efficiency, lab water efficiency, lab material recycling, lab material procurement, and toxic waste reduction/prevention.

Key Energy Conservation Measures (ECMs):

- Installing occupancy sensors on lights
- Setting back building temperatures and ventilation rates slightly at night
- Replacing inefficient lighting
- Converting constant volume fume hoods into variable volume fume hoods



ENERGY EFFICIENCY

The Harvard Faculty of Arts and Sciences has committed, along with Harvard University as a whole, to reduce greenhouse gas emissions 30% below 2006 levels by 2016, inclusive of growth. Therefore, energy efficiency was a main focus.

MECHANICAL SYSTEMS

All control points, space temperatures and set-points for Mango Lab are mapped to the facility's Building Automation System (BAS), which uses space conditions in its various energy management strategies, and adjusts the central HVAC system operations to match overall building loads. The local systems are then controlled to avoid simultaneous heating and cooling. Program spaces in Mango Lab operate individually, on an occupied/unoccupied scenario, to allow for the reduction of exhaust and makeup air rates.

- **Building Automation System:** All automatic temperature controls are Direct Digital Control (DDC). Automatic controls provide energy savings based on system zoning, scheduling, occupied/unoccupied setbacks & demand control ventilation. The system monitors all carbon dioxide (CO₂) sensors throughout the building and modulates the air handling unit return, exhaust and outdoor air dampers, as required, to maintain the CO₂ set-point for demand control ventilation.
- **Occupancy-based Ventilation:** Occupancy sensors allow for the reduction of exhaust and makeup air rates.
- **Set-backs:** Where allowed by use, set-backs reset the space's temperature in increments of 2 degrees Fahrenheit per hour, up to a total of 4 degrees above set-point in the cooling mode or below set-point in the heating mode.
- **Heat Recovery:** A heat recovery unit was added to the air handling unit to increase reduce the amount of heating and cooling required to condition ventilation supply air.
- **Commissioning:** The mechanical and electrical systems have been fully commissioned, prior to occupancy, by a 3rd-Party Commissioning Authority to ensure that energy-related systems were installed as designed and operating efficiently.
- **Renewable Energy:** Renewable Energy Certificates (RECs) were purchased from Sterling Planet (wind power) for 54,000 kWh, equivalent to 100% of the anticipated electricity over a two year period. The CO₂ emissions avoided is comparative to removing four passenger cars from the road for one year.

ELECTRICAL SYSTEMS

- **Occupancy Sensors:** Dual technology ceiling sensors turn the lights ON or OFF based on room occupancy. They include an integral light level sensor that prevents the lights from coming on if minimum light levels are met.
- **Lighting Fixtures:** Energy-efficient and low-mercury fluorescent lamps were carefully chosen to reduce electricity consumption while maintaining adequate lighting levels for each space.
- **Plug Loads:** Energy Star equipment was selected for all Energy Star-eligible equipment in the space. This includes computers, LCD screens, notebook computers and a commercial refrigerator.



Mango Lab Renovation
Photo: Harvard Green Building Services, 2009



Ventilation controls

Photo: Harvard Green Building Services, 2009



Occupancy Sensor
Watt Stopper Model DT-200
Photo: www.wattstopper.com



INDOOR ENVIRONMENTAL QUALITY

FAS is committed to providing a healthy indoor environment for all occupants. The project team was careful to maintain healthy indoor air quality during construction and to also ensure the space is designed to promote healthy indoor air quality during occupancy.

Indoor Air Quality During Construction: A comprehensive indoor air quality management plan was implemented during construction to maintain healthy indoor air quality for workers and future occupants. All ductwork and vents remained sealed and a HEPA Filtration unit maintained negative pressure to keep any construction debris from migrating into occupied spaces. Additionally, porous building materials were kept sealed and off the ground until installation.

Only products with **Low or No VOC Content** were used in Mango Lab. Volatile Organic Compounds (VOCs) are chemical compounds and known carcinogens found in many construction materials that are considered detrimental to indoor air quality. Reducing the use of VOCs whenever possible improves indoor air quality and consequently occupant health and productivity. VOC limits are set by Green Seal standards and the South Coast Air Quality Management District Rules #1168 and #1113.

- **COMPOSITE WOOD AND LAMINATE ADHESIVES** used have no added Urea Formaldehyde.
- **SYSTEMS FURNITURE:** VIVO® interior work stations by Herman Miller are GREENGUARD Certified. The Think® Chair by Steelcase, and the Molt Chair by Gunlocke are both SCS Indoor Advantage certified.
- **PAINTS AND COATINGS | ADHESIVES AND SEALANTS:** Examples of the products used:

Category	Product & Manufacturer	VOC Content (g/l)	VOC Limit (g/l)	Standard
Paints & Coatings	➤ Eco Spec Flat Finish 373	0.0	150.0	Green Seal GS-11
	➤ Eco Spec Eggshell Finish 374	0.0	150.0	Green Seal GS-11
Adhesives & Sealants	➤ Epoxy Adhesive / Smooth On	0.0	70.0	SCAQMD Rule #1168
	➤ Proform Multi Use	2.0	70.0	SCAQMD Rule #1168

Lighting and Temperature Control: To promote productivity, comfort and wellbeing, lighting controls enable 90% of occupants to suit individual needs. Additionally, thermostats and control units are installed within tenant spaces to promote a thermally comfortable environment.



Daylighting & Views: To provide a connection between indoor and outdoor environments, 95% of the occupied spaces have access to daylight and views.

Smoking Policy: In addition to prohibiting smoking in all facilities, (FAS) does not allow smoking within 25 feet of buildings with LEED certified spaces.

Mango Lab
 Photo: Harvard Green Building Services. 2009

Construction IAQ Measures Implemented During Construction

Photos: Harvard Green Building Services 2009



Source Control:
 Low VOC content paints



Pathway Interruption:
 Exhaust filtered and direct to outside



Housekeeping:
 Ductwork kept sealed after installation



MATERIALS AND WASTE

Selecting environmentally preferable materials and minimizing the amount of construction waste sent to landfill was important to the project. When selecting materials, preference was given to locally manufactured, low-emitting materials.

95% of the total value of wood is certified by the Forest Stewardship Council (FSC) to have come from sustainably managed forests.

59% of the total material value consists of products manufactured locally.

82% of the on-site generated construction waste was diverted from landfills.



Mango Lab

Photo: Harvard Green Building Services. 2009

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ENVIRONMENTALLY PREFERABLE MATERIALS AND FURNITURE IN MANGO LAB

- > Metal Casework (Mott Manufacturing LTD)
Recycled Content: **22%** post-consumer, **6%** pre-consumer
- > HM Frames (DeLa Fontaine)
Recycled Content: **7%** pre-consumer
Regional: **211 Miles** from site (Sherbrooke, Quebec)
- > Aluminum Frames (Wilson Partitions)
Recycled Content: **11%** post-consumer, **37%** pre-consumer
Regional: **154 Miles** from site (Stanford, CT)
- > Sheetrock Drywall (USG)
Recycled Content: **4%** post-consumer, **95%** pre-consumer
Regional: **248 Miles** from site (Montral, Quebec)
- > Metal Studs (Dietrch Steel)
Recycled Content: **37%** post-consumer
Regional: **46 Miles** from site (Lunenburg, MA)
- > Marmorette Linoleum (Armstrong)
Recycled Content: **35%** pre-consumer
- > Rubber Base (Johnsonite)
Recycled Content: **19%** pre-consumer
Regional: **475 Miles** from site (Waterloo, Ontario)
- > Wood Flooring (Mirage)
Regional: **260 Miles** from site (St. George's, Quebec)

ADDITIONAL RESOURCES

- > Harvard Faculty of Arts and Sciences <http://www.fas.harvard.edu/home/>
- > FAS Green Labs Program: <http://green.harvard.edu/fas/labs>
- > Harvard Green Building Services: <http://green.harvard.edu/green-building-services>
- > Follow Harvard Green Building Services: [Facebook](#) | [Twitter](#)