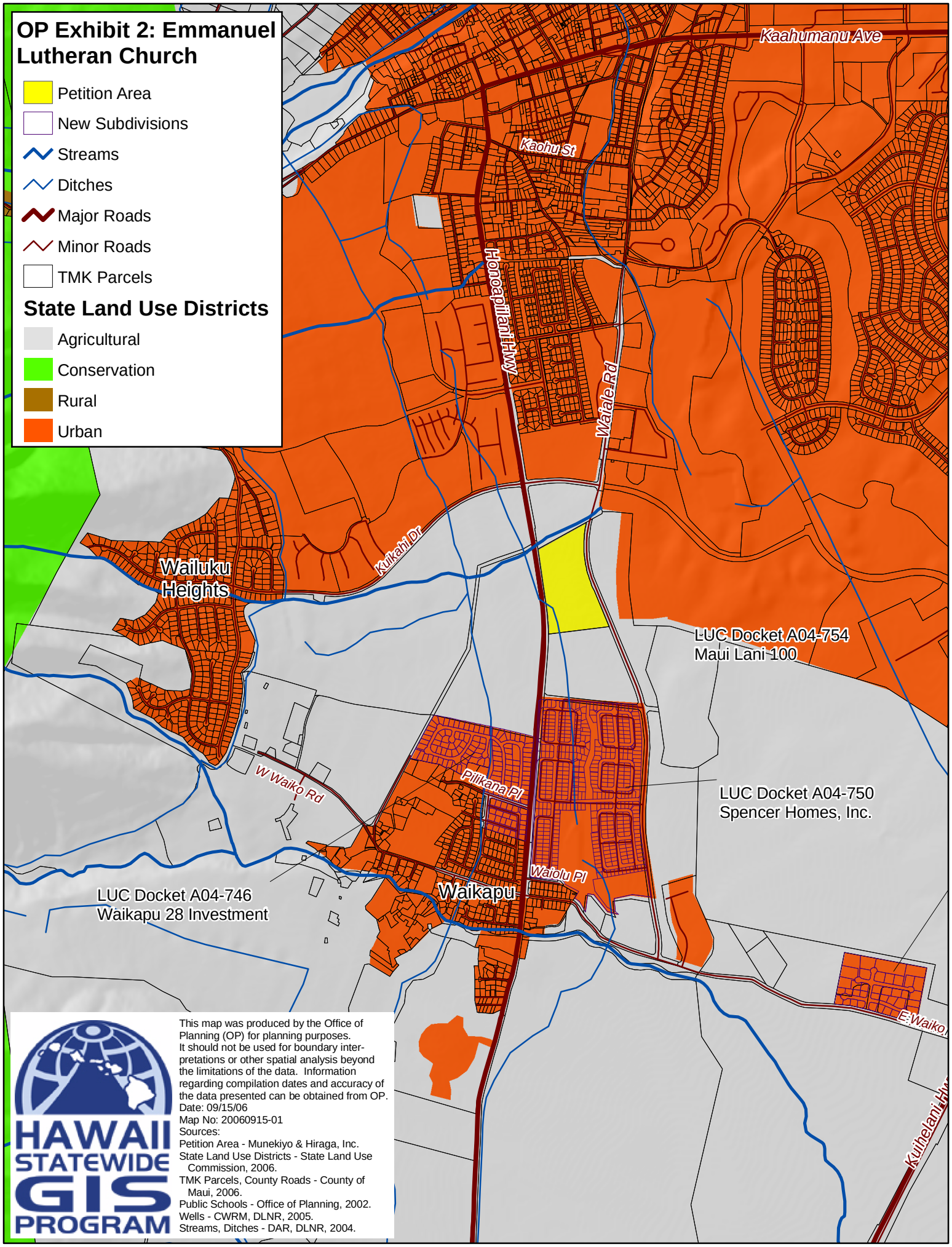
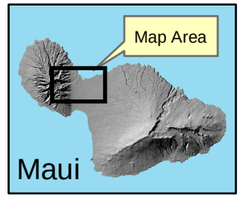

OP Exhibit 2: Emmanuel Lutheran Church
Petition Area
New Subdivisions
Streams
Ditches
Major Roads
Minor Roads
TMK Parcels
State Land Use Districts
Agricultural
Conservation
Rural
Urban
Kaahumanu Ave
Kaohu St
Honoapiilani Hwy
Waiale Rd
Kuikahi Dr
Wailuku Heights
LUC Docket A04-754
Maui Lani 100
W Waiko Rd
Pilikana Pl
LUC Docket A04-750
Spencer Homes, Inc.
Waiolu Pl
Waikapu
LUC Docket A04-746
Waikapu 28 Investment
E Waiko
Kuihelani Hwy
HAWAII STATEWIDE GIS PROGRAM
This map was produced by the Office of Planning (OP) for planning purposes.
It should not be used for boundary interpretations or other spatial analysis beyond the limitations of the data. Information regarding compilation dates and accuracy of the data presented can be obtained from OP.
Date: 09/15/06
Map No: 20060915-01
Sources:
Petition Area - Munekiyo & Hiraga, Inc.
State Land Use Districts - State Land Use Commission, 2006.
TMK Parcels, County Roads - County of Maui, 2006.
Public Schools - Office of Planning, 2002.
Wells - CWRM, DLNR, 2005.
Streams, Ditches - DAR, DLNR, 2004.

OP Exhibit 3: Regional Map

- Petition Area
- New Subdivisions
- Streams
- Ditches
- Major Roads
- Minor Roads
- TMK Parcels

State Land Use Districts

- Agricultural
- Conservation
- Rural
- Urban



Waiehu

LUC Docket A05-755
Hale Mua Properties

Wailuku

Kahului Harbor

Kahului Airport

Kanaha Pond

Kaahumanu Ave

Kahului

S Puunene Ave

Honoapiilani Hwy

Wahale Rd

LUC Docket A03-739
A&B Properties, Inc.

Wailuku Heights

Kuikahi Dr

LUC Docket A04-754
Maui Lani 100

Puunene

W Waiko Rd

LUC Docket A04-750
Spencer Homes, Inc.

LUC Docket A04-746
Waikapu 28 Investment

Waikapu

LUC Docket A04-748
Consolidated Baseyards

E Waiko Rd

Kuihelani Hwy

HAWAII STATEWIDE GIS PROGRAM

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TMK Parcels, County Roads - County of Maui, 2006.
Public Schools - Office of Planning, 2002.
Wells - CWRM, DLNR, 2005.
Streams, Ditches - DAR, DLNR, 2004.

PUBLIC NOTICE

IAO GROUND-WATER MANAGEMENT AREA DESIGNATION
ISLAND OF MAUI

STATE OF HAWAII
Commission on Water Resource Management
Department of Land and Natural Resources

On November 20, 2002, the Commission on Water Resource Management rendered a decision on a petition from the Maui Meadows Homeowners Assoc. to designate the Iao and Waihee Aquifer Systems as ground-water management areas. As part of that decision, the Commission specified that to protect the sustainability of Iao Aquifer System from potential adverse affects if the ground-water pumpage from the Iao Aquifer System exceeded 18 million gallons per day (mgd, based on a 12-month moving average) then the Iao Aquifer System would automatically be designated as a ground-water management area. As of June 30, 2003, the 12-month moving average from wells in the Iao Aquifer System was 18.050 mgd and thereby triggers ground-water designation in this aquifer system. The effective date of this ground-water management area designation for the Iao Aquifer System shall be on publication of this notice or July 21, 2003.

In a ground-water management area, no person shall make a withdrawal, diversion, impoundment, or consumptive use of ground water without first obtaining a ground-water use permit from the Commission on Water Resource Management. Only domestic consumption by individual users (i.e. residences) are exempt from filing an application. Existing users may continue their present pumpage pending action on their applications for a water use permit within the one-year window to apply for existing pumpages.

Any person, other than individual domestic users, presently making any withdrawal, diversion, impoundment, or consumptive use of ground water in the Iao Aquifer System areas must apply for a ground-water use permit by July 21, 2004 to continue their existing ground-water use. Failure to apply within this period creates a presumption of abandonment of the use, and the user, if the user desires to revive the use, must apply as a new water user. New ground-water users are subject to the availability of ground water determined by sustainable yield and existing water use permits.

Information regarding the Iao Aquifer System and application forms for a ground-water use permit are available at the Department of Land and Natural Resources, Commission on Water Resource Management, Kalanimoku Building Room 227, 1151 Punchbowl St., Honolulu, HI 91813 or at http://www.state.hi.us/dlnr/cwrm/forms.htm. Please call 587-0225 (Oahu), 1-800-984-2400-70225 (Maui), the Commission Regulation Branch for more information.

Publish in: Honolulu Star Bulletin issue of July 21, 2003
The Maui News issue of July 21, 2003

OP EXHIBIT 4

BEFORE THE
COMMISSION ON WATER RESOURCE MANAGEMENT
STATE OF HAWAII

In Re: Chairperson Recommendation)
to Designate the Iao and Waihee Aquifer Systems)
as Ground-Water Management Areas)

IAO AND WAIHEE AQUIFER SYSTEMS
STATE AQUIFER CODES 60102 and 60103
GROUND-WATER MANAGEMENT AREA DESIGNATION
FINDINGS OF FACT

Commission on Water Resource Management
Department of Land and Natural Resources
November 14, 2002

OP EXHIBIT 5

PREFACE

This FINDINGS OF FACT (FOF) has been prepared for the Commission on Water Resource Management (CWRM or Commission) for its consideration in designating the Iao and Waihee Aquifer Systems, State Aquifer Code 60102 and 60103, on the island of Maui as a ground-water management areas under the authority of Chapter 174C, HRS.

From February 1986 to August 1997, various Board of Land and Natural Resources and Commission initiated designation proceedings, investigations, findings of fact, and reports transpired and culminated in the Commission's latest action on August 13, 1997 to **not** designate the Iao Aquifer System. Although not designated, the Commission added the condition that if the 12-month moving average of pumpage from the aquifer ever exceeded 20 million gallons per day (mgd) in the future, the aquifer would automatically be designated. This condition remains active to date.

On July 12, 2001, Maui Meadows Homeowners Association submitted a petition to the Commission requesting designation of the Iao and Waihee Aquifer Systems as ground-water management areas. A copy of the petition is attached in Appendix A. This constitutes the third designation proceeding for the Iao Aquifer System and the first for the Waihee Aquifer System.

This FINDINGS OF FACT summarizes the CWRM staff investigations and research, comments from consultation with the County of Maui, the public's written and oral comments received at the public hearing, and other existing information on file with the Department of Land and Natural Resources.

organic contaminants. However, SDWB did detect inorganic contaminants; chromium and fluoride in concentrations well below EPA maximum contaminant levels (MCL).

3.4.11. Sustainable Yield

Under the State Water Code, sustainable yield is defined as follows:

HRS §174C-3 - *"Sustainable yield means the maximum rate at which water may be withdrawn from a water source without impairing the utility or quality of the water source as determined by the commission."*

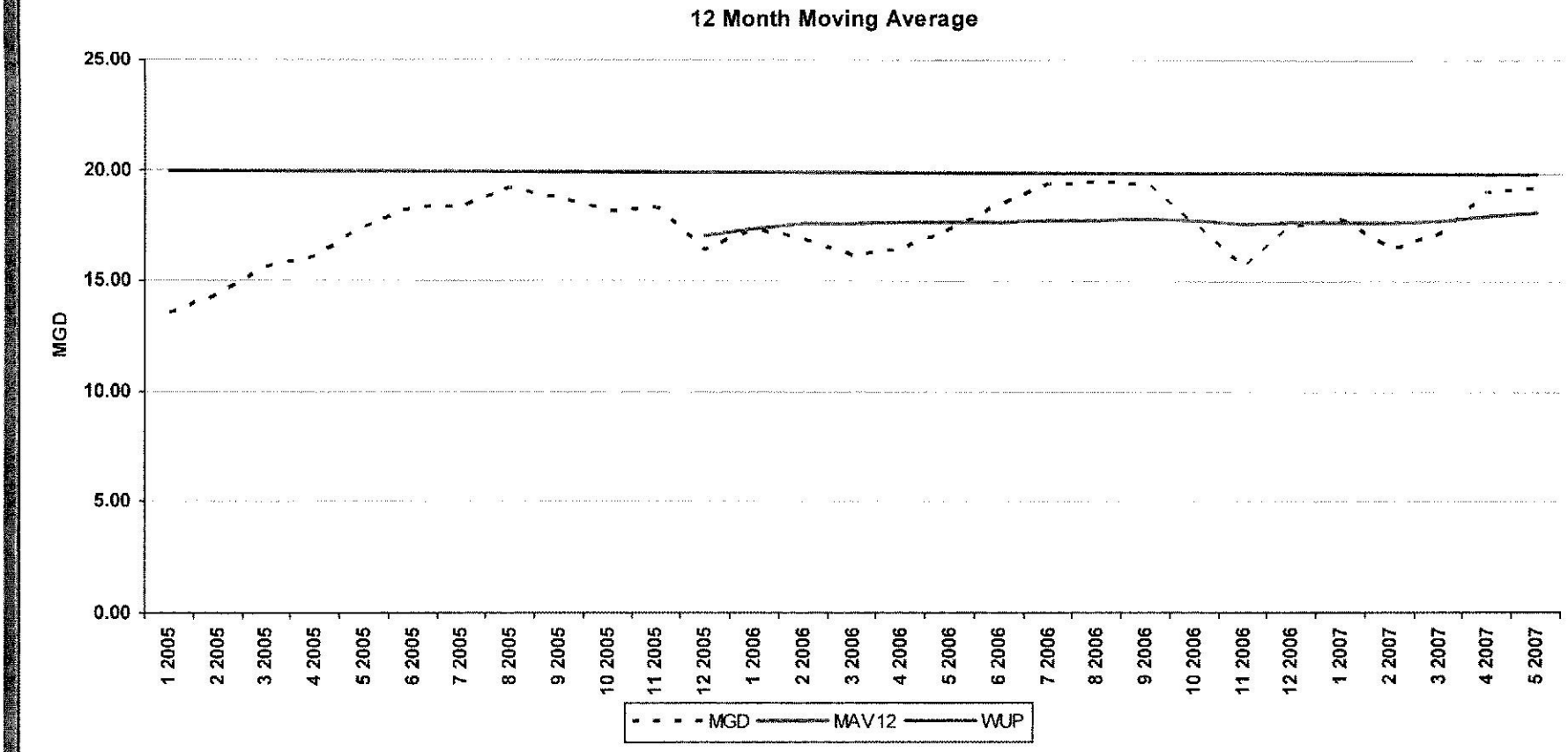
In determining sustainable yields, the Commission distinguishes between optimal potential development of an aquifer and the man-made limitation on withdrawals imposed by existing infrastructure. Under the WRPP, sustainable yields are derived by the RAM and address the optimal potential development perspective for planning and managing purposes. RAM was never intended to address constraints imposed by actual infrastructure perspective. Indeed, USGS Report WRI 00-4244 (Oki and Meyer, 2001) shows that predicted spatial distribution of water levels in an optimal development model such as RAM will differ from the predicted water-level distribution of a model that accounts for sub-optimal infrastructure. To address the infrastructure perspective, a regional numerical model is required. Also, it should be understood that there is no single optimal configuration of infrastructure given the need to balance economic vs. hydrologic constraints.

The Commission has revised sustainable yields when 'acceptable' numerical models have been developed **and** there has been competition amongst large users (e.g. Ewa-Kunia, Waipahu-Waiawa, and Kualapuu Aquifer Systems). There has been another numerical model developed to address infrastructure constraints to sustainable yield (e.g. Lanai, Ewa Caprock) but the Commission did not revise the WRPP sustainable yields. In the case of Lanai, sustainable yield was not revised due to the lack of competition between large users. In the case of the Ewa Caprock, the Commission determined to use chloride limits to non-potable individual wells to manage and protect the aquifer. Therefore, given the facts that the MDWS is the sole large user in Iao and no numerical model exists for Iao, it would seem more appropriate to use the optimal potential development perspective at this time. However, the county is pursuing the development of a 4.5-year, $1 million dollar numerical modeling project, that includes Iao, to be done by the USGS (June 28,2002 letter from USGS to MDWS). Once this project is done, the Commission may then consider revising Iao aquifer sustainable yield from the infrastructure perspective.

The current official CWRM sustainable yield estimate for Iao is 20 mgd, as adopted through the WRPP. However, the original official recharge estimate of 15 mgd is less than the sustainable yield of 20 mgd. Since 1995, revised estimates for recharge have been presented for Iao (see Table 2) but not officially adopted through the WRPP procedures. These studies suggest that recharge in the WRPP is too low and suggest that the current sustainable yield is appropriate.

Ultimately, actual field data should reconcile and verify that pumping at a sustainable yield estimate is not endangering the aquifer. Currently, data suggest that pumping at 20 mgd will not endanger the aquifer but may reduce the utility of some of the deeper MDWS sources (Mokuhau, Waiehu 1). The current 12-MAV is 16±mgd (80 percent of sustainable yield) is much less than that seen during the last Commission designation decision and may improve conditions at some pumping wells.

Aquifer Code	Aquifer System	SY MGD	Beginning:	Ending:	Exclude Saltwater?	Exclude Tunnel?	Exclude Caprock?	
60102	IAO	20	1/1/2005	6/30/2007	☑	☑	☑	Compute 12-Month Moving Average



Well Index | View Pumpage Selected Work | View Aquifer Wells Selected | View Final Output Detail | Print Report

OP EXHIBIT 6

Month	Year	MonthYear	MGD	MAV12	WUP
1	2005	1 2005	13.580		20
2	2005	2 2005	14.344		20
3	2005	3 2005	15.693		20
4	2005	4 2005	16.098		20
5	2005	5 2005	17.492		20
6	2005	6 2005	18.410		20
7	2005	7 2005	18.397		20
8	2005	8 2005	19.250		20
9	2005	9 2005	18.732		20
10	2005	10 2005	18.180		20
11	2005	11 2005	18.351		20
12	2005	12 2005	16.444	17.081	20
1	2006	1 2006	17.421	17.401	20
2	2006	2 2006	16.915	17.615	20
3	2006	3 2006	16.229	17.660	20
4	2006	4 2006	16.549	17.698	20
5	2006	5 2006	17.424	17.692	20
6	2006	6 2006	18.539	17.703	20
7	2006	7 2006	19.506	17.795	20
8	2006	8 2006	19.586	17.823	20
9	2006	9 2006	19.471	17.885	20
10	2006	10 2006	17.561	17.833	20
11	2006	11 2006	15.735	17.615	20
12	2006	12 2006	17.585	17.710	20
1	2007	1 2007	17.862	17.747	20
2	2007	2 2007	16.517	17.714	20
3	2007	3 2007	17.216	17.796	20
4	2007	4 2007	19.140	18.012	20
5	2007	5 2007	19.369	18.174	20

Ilco Aquifer System (60102)
12 month moving average
computed for Dec 2005
to May 2007

PUBLIC NOTICE

PUBLIC HEARING
To Consider
DESIGNATION OF THE SURFACE-WATER HYDROLOGIC UNITS OF WAIHEE, WAIEHU, IAO and WAIKAPU STREAMS (NA WAI EHA) AS SURFACE-WATER MANAGEMENT AREAS

COMMISSION ON WATER RESOURCE MANAGEMENT

The Commission on Water Resource Management (Commission) will be holding a public hearing to gather testimony regarding the petition to designate the surface-water hydrologic units of Na Wai Eha in the Wailuku District on Maui, as Surface-Water Management Areas, in accordance with Part IV (Regulation of Water Use) of the State Water Code, Chapter 174C, Hawaii Revised Statutes, and Title 13, Chapter 171 (Designation and Regulation of Water Management Areas), Hawaii Administrative Rules.

The State Water Code authorizes the Commission to designate water management areas for regulation where the Commission, after research and investigations, and consultation with the appropriate county mayor, county council, and county water agency, and after public hearing and published notice, finds that the water resources of the areas are being threatened by existing or proposed withdrawals of water.

In surface-water management areas, all surface-water uses within these hydrologic units, except for domestic consumption of water for individual users, would require water use permits from the Commission.

The land areas proposed to be designated are located in the Wailuku District and include Tax Map Keys from: (2) 3-1-006:001 to (2) 3-8-087:093 and from (2) 4-1-001:017 to (2) 4-8-001:002 (see map).

Call (808) 587-0234 or toll-free from Maui at 984-2400, extension 70234 for more information on the designation process or visit our website at www.hawaii.gov/dlnr/cwrm. The public is encouraged to attend and provide testimony. Written comments are due to the Commission at 1151 Punchbowl Street, Room 227, Honolulu, Hawaii 96813 no later than April 26, 2007.

DATE:	April 26, 2007, Thursday
TIME:	7:00 - 9:00 p.m.
PLACE:	J. Walter Cameron Center 95 Mahalani Street Wailuku, Maui 96793

COMMISSION ON WATER RESOURCE MANAGEMENT

PETER T. YOUNG, Chairperson

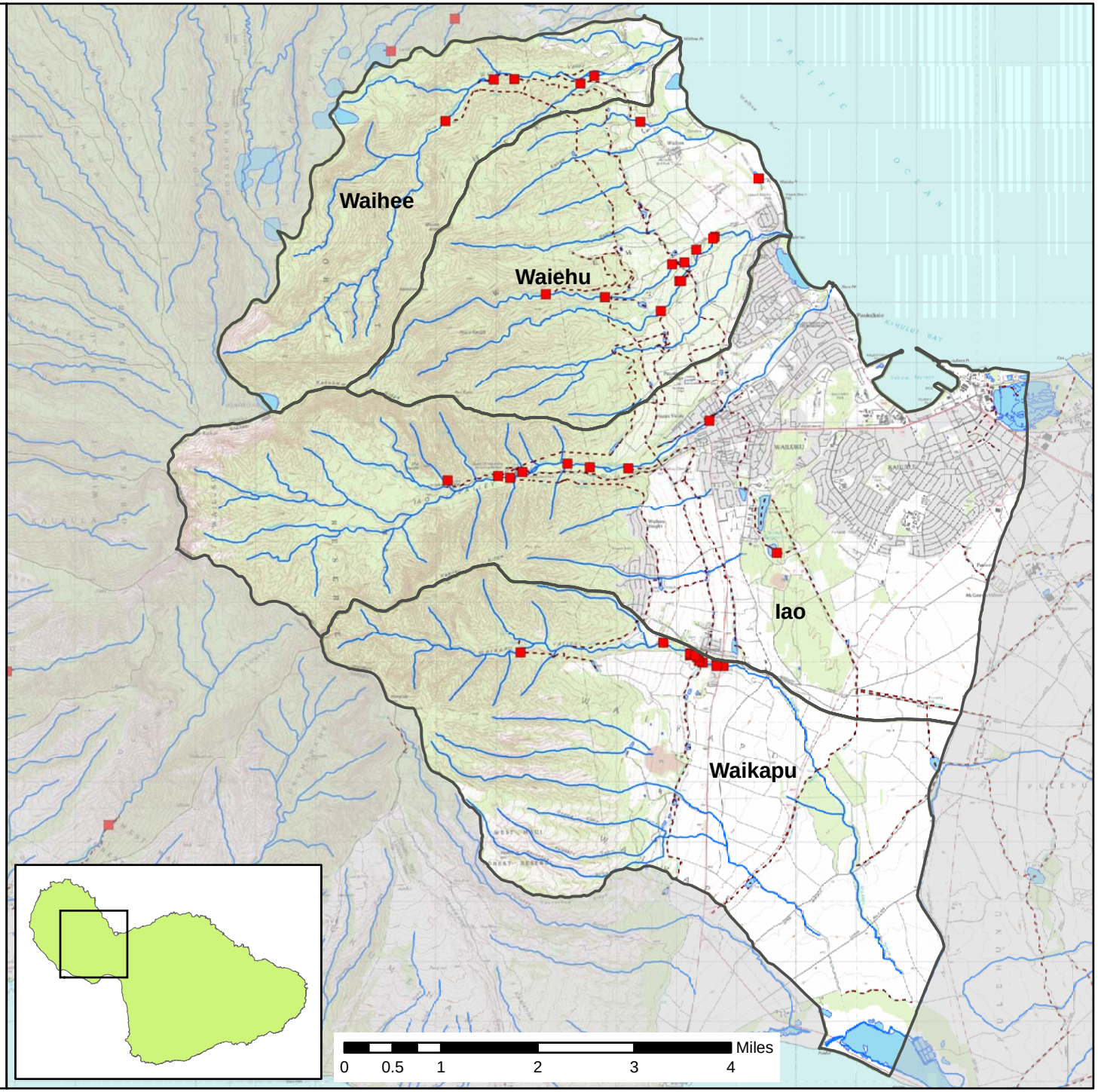
Dated: _____

Publish in: Honolulu Star Bulletin and Maui News issues of **March 28, April 4 & 11, 2007**

OP EXHIBIT 7

Department of Land and Natural Resources
Commission on Water Resource Management
Stream Protection and Management Branch

Surface-Water Hydrologic Units affected by the Na Wai Eha Petition to designate Surface-Water Management Areas, Maui



This map was produced by the Department of Land and Natural Resources (DLNR), Commission on Water Resource Management for planning purposes. It should not be used for boundary interpretations or other spatial analysis beyond the limitations of the data. Information regarding compilation dates and accuracy of the data presented can be obtained from DLNR.

Date: 02/20/2007
Datum: North American Datum 1983

Effort aimed at protecting water resources

By EDWIN TANJI, City Editor

Friday, December 08, 2006 11:39 AM

HONOLULU – A move to have the state water commission designate the Wailuku watershed as a surface water management area is linked to the effort to have the commission establish in-stream flow standards, an attorney for Earthjustice said Thursday.

Kapua Sproat said the latest move challenging use of water from four Wailuku-area streams is aimed at protecting the water resources in line with the mandates of the State Water Code.

"We're hoping it will provide the commission with the tools it needs to more effectively regulate water use in na wai eha (the four waters)," she said. "It is our effort to be sure the laws are complied with."

The petition asks the Commission on Water Resource Management to designate four streams in dispute – Waihee, Waiehu, Iao and Waikapu – based on allegations that the old Wailuku Sugar Co. irrigation system is being misused.

The water commission's surface water chief, Edwin Sakoda, said no other surface water systems in the state have been designated for management, but the process would be similar to groundwater management areas. If a water system is designated, all users would be required to apply for permits and to report on usage.

Under commission rules, Sakoda said, the staff will have 60 days to consult with the Maui County Council, the mayor and the Department of Water Supply to prepare a report for the commission. Mayor Alan Arakawa has written to the commission in support of designation of the watershed, but Arakawa's term in office will end Jan. 2 and the commission is expected to discuss the issue with the incoming mayor, Charmaine Tavares.

The commission four years ago designated the Iao Aquifer as a groundwater management district, requiring Maui County to apply for a permit to continue drawing water from the aquifer.

If the commission should designate the surface water systems, Sakoda said, "It would be folded into the existing groundwater management area and we would go through the same permitting process."

But designating the surface systems would mean other current users – the Wailuku Water Co. and the Hawaiian Commercial & Sugar Co. – also would be required to apply for permits to continue their water use and to report on their usage.

That is the ultimate goal of the petitioners, Maui Tomorrow and Hui O Na Wai 'Eha, which are community groups challenging the continued diversion of water from na wai eha streams in two contested cases already before the commission.

OP EXHIBIT 8

One seeks to have the commission establish in-stream flow standards, as mandated by the Water Code, to require the plantations to restore water to the streams. The other charges that Wailuku Water Co. has been dumping water from its irrigation system in an effort to "hoard" the water for other uses.

Sproat said she recognized the na wai eha request would be a first, since the commission previously has not designated any surface systems for management.

"That there hasn't been previous designations doesn't mean there hasn't been a need," she said.

■ Edwin Tanji can be reached at editor@mauinews.com.

LINDA LINGLE
GOVERNOR

BARRY FUKUNAGA
DIRECTOR

Deputy Directors
FRANCIS PAUL KEENO
BRENNON T. MORIOKA
BRIAN H. SEKIGUCHI

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:

HWY-PS
2.4994

JUL - 9 2007

TO: LAURA THIELEN, DIRECTOR
OFFICE OF PLANNING
DEPARTMENT OF BUSINESS, ECONOMIC
DEVELOPMENT AND TOURISM

FROM: BRENNON T. MORIOKA, PH.D., P.E.
DEPUTY DIRECTOR - HIGHWAYS

SUBJECT: EMMANUEL LUTHERAN CHURCH AND SCHOOL CAMPUS, STATE LAND USE DISTRICT BOUNDARY AMENDMENT A07-773, WAIKAPU, MAUI, TMK: (2) 3-5-002:11

We have the following comments on the subject application:

1. Honoapiilani Highway has a 45 mph speed limit and is functionally classified as a principal arterial in the vicinity of the proposed church and school. Principal arterials are intended to provide safe, efficient and rapid travel for relatively long trips from one region to another.

2. To preserve the function, safety and capacity of a principal arterial, the distances between accesses must be maintained or increased as the volume of traffic grows. No direct access to Honoapiilani Highway of any type, including emergency access, will be permitted for the proposed church and school.

3. The applicant should be required to comply with past conditions imposed by the State and County on the former large parcel designated as TMK: (2) 3-5-002:001, which has been subdivided into parcels 11, 12, and 13. This includes paying a share of regional improvements for the State Highway and providing and maintaining a landscaped strip of land along the entire school and church property adjacent to the Honoapiilani Highway right of way.

4. We do not agree that no mitigation is required for intersections with Honoapiilani Highway that are projected to operate at Level of Service D. The projected drop from Level of Service (LOS) C without the project to LOS D with the project at the East Waiko Road intersection with Honoapiilani Highway in the a.m. peak hour is not acceptable. The combined future growth in the Waikapu area will result in undesirable levels of service unless adequate mitigation is required.

OP EXHIBIT 9

5. The TIAR should be revised now to recommend mitigation measures that the applicant will take to reduce the total traffic generated by the school and to reduce the school's impact on the intersections of Honoapiilani Highway with Waiko Road, Waiolu Road, Pilikana Street and Kuikahi Drive. These recommendations should be required as conditions of approval for the requested land use district boundary amendment.

6. Recommendations for mitigation should include such Transportation Demand Management (TDM) measures as carpooling by teachers and staff and maximizing the number of students who take buses, ride bicycles or walk to school (no parental chauffeuring permitted).

7. After the school is opened, the applicant should be required to update the TIAR at the request of the Highways Division District Engineer and to provide recommended mitigation measures.

8. The TIAR should discuss the plan for the extension of Waiale Road to and beyond Waiko Road. Waiale Road will be an alternate route to Honoapiilani Highway for short trips in the Waikapu area. Perhaps the applicant's participation in the cost for extending Waiale Road could be a logical fair share of regional transportation improvements.

9. All required improvements in the State Highway right of way must be planned, designed and constructed to current AASHTO standards and State requirements and be provided at no cost to the State.

10. No additional storm water runoff will be permitted in the State Highway right of way. Storm water post construction Best Management Practices (BMP) must be included in the construction plans.

11. All maps, site plans, conceptual plans and sketches should clearly show that Road A does not connect to Honoapiilani Highway and that there is not direct access from the proposed school.

If you have any question, please contact Ronald Tsuzuki, Head Planning Engineer, Highways Division, at 587-1830.

bc: STP (DIR 0757), HWY-M, -T, -PS (07-176)

AW:th

LINDA LINGLE
GOVERNOR OF HAWAII

CHIYOME LEINAALA FUKINO,
M.D. DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378

In reply, please refer to:
File:

07-391 LY

June 18, 2007

TO: Kelvin Sunada, Manager
Environmental Planning Office

FROM: Keith E. Kawaoka, D.Env., Program Manager
Hazard Evaluation & Emergency Response (HEER) Office

SUBJECT: **Comments from HEER Office for the Petition for Land Use Boundary Amendment for the Emmanuel Lutheran Church of Maui**
TMK: (2) 3-5-002-011

Lands formerly used for sugarcane production are now being developed into communities where residential homes, schools, and commercial businesses are being constructed. Chemicals associated with the sugarcane industry persist in soils today and may be a threat to public health and the environment. The HEER Office has identified former sugarcane production areas for assessment throughout the state and plans to work with property owners to conduct environmental assessments to identify and address soil contaminants prior to finalizing development plans for the properties.

The parcel listed in the Petition for Land Use Boundary Amendments for the Emmanuel Luther Church of Maui was used for sugarcane and pineapple production and should be assessed for chemicals associated with the theses industries. Banana farmers operating at the parcel in 2004 maintained a chemical storage shed evident in Photo 14 of the Environmental Site Assessment Phase I that should also be included in an assessment. If contaminants are found at elevated levels, then additional assessment is needed to determine potential risks and the need for remedial action. Removal or remedial plans must comply with Chapter 128D, Environmental Response Law, HRS, and Title 11, Chapter 451, HAR, State Contingency Plan.

If you have any questions, please call Laura Young at 586-4249.

OP EXHIBIT 10

ABOUT LEED

1800 Massachusetts Ave, NW
Suite 300
Washington, DC 20036
T: 202 828-7422
F: 202 828-5110
www.usgbc.org

The LEED® (Leadership in Energy and Environmental Design) Green Building Rating System™, created by USGBC, is a voluntary building certification program that defines high-performance green buildings, which are more environmentally responsible, healthier, and more profitable structures. LEED was created to establish a common standard of measurement for what constitutes a "green" building. LEED serves as a design guideline for green building and offers third party validation of a building's green features.

LEED evaluates buildings in five areas: Sustainable Sites, Water Efficiency, Energy & Atmosphere, Materials & Resources and Indoor Environmental Quality. Within these credit areas, points are available and depending on the number of points a project earns determines the level of certification the building will be awarded. There are four progressive levels of certification: Certified, Silver, Gold and Platinum.

Developed by the U.S. Green Building Council, LEED addresses a variety of buildings and building project types through individualized systems, including:

- New Construction
- Existing Buildings
- Commercial Interiors
- Core & Shell
- Homes - *in pilot, to be released summer 2007*
- Neighborhood Development – *in pilot*

In addition, LEED application guides are in development to provide information and instruction about applying the LEED rating system to different building types such as Campuses, Retail, Labs, Healthcare and Schools. The application guides will be available in late 2007.

LEED rating systems are developed through an open, consensus-based process in USGBC committees. Each volunteer committee is composed of a diverse group of practitioners and experts representing a cross-section of the building and construction industry. Any USGBC member can serve on a committee, and all committee procedures and proceedings are available at www.usgbc.org.

LEED Certification Benefits
LEED certified buildings have lower operating costs, higher lease rates, and happier and healthier occupants than conventionally constructed structures. Certification under LEED is third party validation to the market that a building is green.

LEED Online
The LEED certification and documentation process has been designed to be more user-friendly than ever – the process is now entirely on-line. Projects register their project with an intent to certify before breaking ground. Project teams can submit design phase credits at the early stages and then move to the construction phase,

allowing ongoing feedback to the project throughout the project's progression. This will enable design teams to modify design documents prior to commencing construction, and will give teams and building owners confidence that the project is on track for certification.

Once the building is completed and all the documents have been submitted, the building will be reviewed by USGBC and awarded a LEED certification based on how many points the project earned.

LEED Adoptions
Various LEED initiatives including legislation, executive orders, resolutions, ordinances, policies, and incentives are found in 55 cities and 22 states in the U.S. For a complete list of LEED adoptions please click here.

How the Federal Government uses LEED
There are eleven Federal initiatives in agencies like the Department of Defense, Air Force, Army, Navy, Department of Agriculture- Forest Service, Department of Energy, Department of General Services, Department of State and the Environmental Protection Agency.

LEED Internationally
LEED registered projects are in progress in 30 different countries, including Canada, Brazil, Mexico, and India, to name just a few, and the World Green Building Council—an affiliation of seven national green building councils, including the U.S.--is helping to drive the international dialogue.

1800 Massachusetts Ave, NW
Suite 300
Washington, DC 20036
T: 202 828-7422
F: 202 828-5110
www.usgbc.org

FAQ

FREQUENTLY ASKED QUESTIONS

LEED® for New Construction

How are credit points awarded under LEED?
Credits are awarded based on five categories of performance: Sustainable Sites, Energy and Atmosphere, Water Efficiency, Indoor Environmental Quality, Materials and Resources. Within each of these credit areas a project can earn a certain amount of points. Projects can earn additional points under an Innovation in Design category, through demonstrating exceptional performance above LEED requirements. The number of points the project earns determines the level of LEED Certification the project receives.

Is LEED training available?
USGBC offers a variety of LEED training workshops including a basic introduction, technical reviews, and advanced application-oriented sessions. Workshops are available nationally in conjunction with local chapters, at industry tradeshows, and at Greenbuild. Private workshops can also be scheduled for your company.

Can products be certified under LEED?
No. LEED applies to green building projects. Individual products can contribute to points under the rating system; LEED criteria are performance-based. In attempting to meet these requirements, LEED practitioners identify products that have desired attributes. However, some LEED criteria do require specific product data as a part of a successful submittal.

How much does it cost to register a project?
The registration fee for a project is $450 for USGBC members and $600 for non-members.

What is a LEED Accredited Professional™ and how do you become one?
LEED Accredited Professionals are experienced building industry practitioners who have demonstrated their knowledge of integrated design and their capacity to facilitate the LEED certification process. To become an Accredited Professional you must take the exam. The exam tests an individual's understanding of green building practices and principles, and familiarity with LEED requirements, resources, and processes.

Do LEED certified projects cost more?
No, LEED certification does not have to cost a penny more. LEED projects completed and certified to date demonstrate that you can achieve LEED certification and reap its many benefits with a common-sense approach to design and no additional dollars. Depending on your green building strategy and the level of certification you want to achieve, however, there may be mid- and long-term ROI associated with additional green features that merits an investment in first costs.

What are the benefits of LEED certification?
LEED certification is third-party validation of a building's performance. LEED certified projects blend environmental, economic, and occupant-oriented performance. They cost less to operate and maintain, are energy- and water-efficient, have higher lease-up rates than conventional buildings in their markets, and are a physical demonstration of the values of the organizations that own and occupy them. For more information:
http://www.usgbc.org/DisplayPage.aspx?CMSPageID=220&

LEED for New Construction v2.2
Registered Project Checklist

Project Name:
Project Address:

Yes	?	No			
			Sustainable Sites		**14** Points
Y			Prereq 1	**Construction Activity Pollution Prevention**	Required
			Credit 1	**Site Selection**	1
			Credit 2	**Development Density & Community Connectivity**	1
			Credit 3	**Brownfield Redevelopment**	1
			Credit 4.1	**Alternative Transportation**, Public Transportation Access	1
			Credit 4.2	**Alternative Transportation**, Bicycle Storage & Changing Rooms	1
			Credit 4.3	**Alternative Transportation**, Low-Emitting & Fuel-Efficient Vehicles	1
			Credit 4.4	**Alternative Transportation**, Parking Capacity	1
			Credit 5.1	**Site Development,** Protect of Restore Habitat	1
			Credit 5.2	**Site Development,** Maximize Open Space	1
			Credit 6.1	**Stormwater Design,** Quantity Control	1
			Credit 6.2	**Stormwater Design,** Quality Control	1
			Credit 7.1	**Heat Island Effect,** Non-Roof	1
			Credit 7.2	**Heat Island Effect,** Roof	1
			Credit 8	**Light Pollution Reduction**	1

Yes	?	No			
			Water Efficiency		**5** Points
			Credit 1.1	**Water Efficient Landscaping**, Reduce by 50%	1
			Credit 1.2	**Water Efficient Landscaping**, No Potable Use or No Irrigation	1
			Credit 2	**Innovative Wastewater Technologies**	1
			Credit 3.1	**Water Use Reduction**, 20% Reduction	1
			Credit 3.2	**Water Use Reduction**, 30% Reduction	1

			Energy & Atmosphere		**17** Points
Y			Prereq 1	**Fundamental Commissioning of the Building Energy Systems**	Required
Y			Prereq 2	**Minimum Energy Performance**	Required
Y			Prereq 3	**Fundamental Refrigerant Management**	Required
			Credit 1	**Optimize Energy Performance**	1 to 10
				10.5% New Buildings or 3.5% Existing Building Renovations	1
				14% New Buildings or 7% Existing Building Renovations	2
				17.5% New Buildings or 10.5% Existing Building Renovations	3
				21% New Buildings or 14% Existing Building Renovations	4
				24.5% New Buildings or 17.5% Existing Building Renovations	5
				28% New Buildings or 21% Existing Building Renovations	6
				31.5% New Buildings or 24.5% Existing Building Renovations	7
				35% New Buildings or 28% Existing Building Renovations	8
				38.5% New Buildings or 31.5% Existing Building Renovations	9
				42% New Buildings or 35% Existing Building Renovations	10
			Credit 2	**On-Site Renewable Energy**	1 to 3
				2.5% Renewable Energy	1
				7.5% Renewable Energy	2
				12.5% Renewable Energy	3
			Credit 3	**Enhanced Commissioning**	1
			Credit 4	**Enhanced Refrigerant Management**	1
			Credit 5	**Measurement & Verification**	1
			Credit 6	**Green Power**	1

continued…

OP EXHIBIT 13

Yes	?	No			
			Materials & Resources		**13** Points
Y			Prereq 1	**Storage & Collection of Recyclables**	Required
			Credit 1.1	**Building Reuse**, Maintain 75% of Existing Walls, Floors & Roof	1
			Credit 1.2	**Building Reuse**, Maintain 100% of Existing Walls, Floors & Roof	1
			Credit 1.3	**Building Reuse**, Maintain 50% of Interior Non-Structural Elements	1
			Credit 2.1	**Construction Waste Management**, Divert 50% from Disposal	1
			Credit 2.2	**Construction Waste Management**, Divert 75% from Disposal	1
			Credit 3.1	**Materials Reuse**, 5%	1
			Credit 3.2	**Materials Reuse**,10%	1
			Credit 4.1	**Recycled Content**, 10% (post-consumer + ½ pre-consumer)	1
			Credit 4.2	**Recycled Content**, 20% (post-consumer + ½ pre-consumer)	1
			Credit 5.1	**Regional Materials**, 10% Extracted, Processed & Manufactured Regio	1
			Credit 5.2	**Regional Materials**, 20% Extracted, Processed & Manufactured Regio	1
			Credit 6	**Rapidly Renewable Materials**	1
			Credit 7	**Certified Wood**	1

Yes	?	No			
			Indoor Environmental Quality		**15** Points
Y			Prereq 1	**Minimum IAQ Performance**	Required
Y			Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control**	Required
			Credit 1	**Outdoor Air Delivery Monitoring**	1
			Credit 2	**Increased Ventilation**	1
			Credit 3.1	**Construction IAQ Management Plan**, During Construction	1
			Credit 3.2	**Construction IAQ Management Plan**, Before Occupancy	1
			Credit 4.1	**Low-Emitting Materials**, Adhesives & Sealants	1
			Credit 4.2	**Low-Emitting Materials**, Paints & Coatings	1
			Credit 4.3	**Low-Emitting Materials**, Carpet Systems	1
			Credit 4.4	**Low-Emitting Materials**, Composite Wood & Agrifiber Products	1
			Credit 5	**Indoor Chemical & Pollutant Source Control**	1
			Credit 6.1	**Controllability of Systems**, Lighting	1
			Credit 6.2	**Controllability of Systems**, Thermal Comfort	1
			Credit 7.1	**Thermal Comfort**, Design	1
			Credit 7.2	**Thermal Comfort**, Verification	1
			Credit 8.1	**Daylight & Views**, Daylight 75% of Spaces	1
			Credit 8.2	**Daylight & Views**, Views for 90% of Spaces	1

Yes	?	No			
			Innovation & Design Process		**5** Points
			Credit 1.1	**Innovation in Design**: Provide Specific Title	1
			Credit 1.2	**Innovation in Design**: Provide Specific Title	1
			Credit 1.3	**Innovation in Design**: Provide Specific Title	1
			Credit 1.4	**Innovation in Design**: Provide Specific Title	1
			Credit 2	**LEED® Accredited Professional**	1

Yes	?	No		
			Project Totals (pre-certification estimates)	**69** Points

Certified: 26-32 points, **Silver:** 33-38 points, **Gold:** 39-51 points, **Platinum:** 52-69 pc

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FACT SHEET

About LEED® for Schools

What is LEED for Schools?
The LEED for Schools Rating System recognizes the unique nature of the design and construction of K-12 schools. Based on LEED for New Construction, it addresses issues such as classroom acoustics, master planning, mold prevention, and environmental site assessment. By addressing the uniqueness of school spaces and children's health issues, LEED for Schools provides a unique, comprehensive tool for schools that wish to build green, with measurable results. LEED for Schools is the recognized third-party standard for high performance schools that are healthy for students, comfortable for teachers, and cost-effective.

What makes schools different from other building types?

- **Children's Health Issues -** Schools play the crucial role of providing healthy, safe environments for children to learn. Because children breathe more air in proportion to their bodies than adults, environments for children must be carefully designed to minimize indoor pollutant exposure.
- **Educational Mission -** As learning environments, schools can demonstrate the importance of efficiency and conservation. LEED for Schools offers a way to integrate environmental issues into the curriculum, allowing the built environment to become an interactive teaching tool.
- **Complex Programmatic Spaces -** Schools combine many functions into a relatively small space; from classrooms to gymnasiums, cafeterias to machine shops, the job of school designers is particularly complex. LEED for Schools gives project teams guidance on the specific needs of unique space types.

How does LEED for Schools work?
Designed for use in the design and construction phases of a building, LEED for Schools facilitates and encourages project teams to use an integrated design approach from start to finish bringing down overall costs and delivering project goals. Using this integrated approach, LEED promotes improved practices in:

- Site selection and development
- Water and energy use
- Environmentally preferred materials, finishes, and furnishings
- Waste stream management
- Indoor air quality and comfort
- Innovation in sustainable design and construction

To become certified, projects must meet all prerequisites and a minimum number of points within the credit areas listed above. The number of points the project earns determines the level of LEED certification the project receives.

How can I convince the school in my community to get a LEED certification?
We have a number of resources to help you make the case to your school or school district. First, you can check out our Press Kit for our Green Schools Talking Points sheet, which will help you learn some of the benefits of green schools. Also, encourage administrators to check out our free online tutorial, which covers the basics of green design in schools, including sections on financing, case studies, and more. It's also useful to engage your local USGBC chapter in working with the school district; the green building professional community can be very effective at helping schools understand the process of building green with LEED.

How do I register my project?
Project registration is the first step toward earning LEED certification for your building and is best done at the project outset. Once you register, you'll have access to **LEED-Online** and the **LEED credit interpretations database**. USGBC encourages you to keep your project profile up-to-date in LEED-Online. LEED-Online provides your team with an interactive project management tool, and the information you supply will help us track your project, answer credit interpretation requests, and prepare project case studies upon certification. Aggregate data for all registered projects will be used to expand the growing knowledge base of green building operations costs and trends.

How much does it cost to register a project?
The project registration fee is $450 for USGBC members and $600 for non-members.

Can I use LEED for New Construction if I can get more points in that system?
If you are a K-12 educational building undergoing either major renovations or building new, you will need to use LEED for Schools. This is because LEED for Schools is more appropriate for these spaces than LEED for New Construction, especially due to the protective nature of the system for children's health. Other projects, such as university educational buildings, K-12 athletic facilities, or interpretive centers, may choose to use LEED for Schools if they wish.

Where can I learn more about LEED for Schools?

USGBC has a variety of resources for you to get started with LEED for Schools:

- **Visit the Web site**: Go to www.usgbc.org/leed to learn more about LEED for Schools, download case studies and more. The Schools web pages contain links to relevant research, other useful websites, lists of currently LEED certified schools and more.
- **Take the free online introductory course**: This quick online tutorial is a great introduction to green schools and LEED. Community members, administrators, and others can use this to learn about the benefits of green schools and how they can get one in their community.
- **Attend a LEED workshop**: LEED workshops provide a detailed exploration of the rating system, case studies and effective strategies for designing and building a green school. A complete schedule of LEED workshops and other educational programs can be found at www.usgbc.org/education.
- **Purchase the LEED for Schools Reference Guide**: This is the user's manual for teams that wish to pursue a LEED certification. It contains supporting resources, calculation methodologies, approach and implementation strategies, and more. It is $150 for members, and $200 for non-members.
- **Become a member:** Encourage your company to join USGBC. USGBC members are not only recognized leaders in supporting a better built environment; member company employees have access to USGBC resources, can participate in committees and member circles, and enjoy a wide array of discounts on USGBC publications, programs and services.
- **Get involved with your local chapter:** USGBC chapters routinely host informative presentations and are a great way to connect with other professionals in your region who have experience implementing LEED. Find the USGBC chapter nearest you at www.usgbc.org/chapters.
- **Contact USGBC:** For questions related to LEED for Schools, e-mail schools@committees.usgbc.org or call 202-742-3780.

LEED for Schools 2007
Registered Project Checklist

Project Name:
Project Address:

Yes	?	No			
			Sustainable Sites		16 Points
Y			Prereq 1	**Construction Activity Pollution Prevention**	Required
Y			Prereq 2	**Environmental Site Assessment**	Required
			Credit 1	**Site Selection**	1
			Credit 2	**Development Density & Community Connectivity**	1
			Credit 3	**Brownfield Redevelopment**	1
			Credit 4.1	**Alternative Transportation**, Public Transportation Access	1
			Credit 4.2	**Alternative Transportation**, Bicycle Use	1
			Credit 4.3	**Alternative Transportation**, Low-Emitting & Fuel-Efficient Vehicles	1
			Credit 4.4	**Alternative Transportation**, Parking Capacity	1
			Credit 5.1	**Site Development,** Protect or Restore Habitat	1
			Credit 5.2	**Site Development,** Maximize Open Space	1
			Credit 6.1	**Stormwater Design,** Quantity Control	1
			Credit 6.2	**Stormwater Design,** Quality Control	1
			Credit 7.1	**Heat Island Effect,** Non-Roof	1
			Credit 7.2	**Heat Island Effect,** Roof	1
			Credit 8	**Light Pollution Reduction**	1
			Credit 9	**Site Master Plan**	1
			Credit 10	**Joint Use of Facilities**	1

Yes	?	No			
			Water Efficiency		7 Points
			Credit 1.1	**Water Efficient Landscaping**, Reduce by 50%	1
			Credit 1.2	**Water Efficient Landscaping**, No Potable Use or No Irrigation	1
			Credit 2	**Innovative Wastewater Technologies**	1
			Credit 3.1	**Water Use Reduction**, 20% Reduction	1
			Credit 3.2	**Water Use Reduction**, 30% Reduction	1
			Credit 3.3	**Water Use Reduction,** 40% Reduction	1
			Credit 4	**Process Water Use Reduction**	1

			Energy & Atmosphere		17 Points
Y			Prereq 1	**Fundamental Commissioning of the Building Energy Systems**	Required
Y			Prereq 2	**Minimum Energy Performance**	Required
Y			Prereq 3	**Fundamental Refrigerant Management**	Required
			Credit 1	**Optimize Energy Performance (2 pt minimum)**	1 to 10
				10.5% New Buildings or 3.5% Existing Building Renovations	1
				14% New Buildings or 7% Existing Building Renovations	2
				17.5% New Buildings or 10.5% Existing Building Renovations	3
				21% New Buildings or 14% Existing Building Renovations	4
				24.5% New Buildings or 17.5% Existing Building Renovations	5
				28% New Buildings or 21% Existing Building Renovations	6
				31.5% New Buildings or 24.5% Existing Building Renovations	7
				35% New Buildings or 28% Existing Building Renovations	8
				38.5% New Buildings or 31.5% Existing Building Renovations	9
				42% New Buildings or 35% Existing Building Renovations	10
			Credit 2	**On-Site Renewable Energy**	1 to 3
				2.5% Renewable Energy	1
				7.5% Renewable Energy	2
				12.5% Renewable Energy	3
			Credit 3	**Enhanced Commissioning**	1
			Credit 4	**Enhanced Refrigerant Management**	1
			Credit 5	**Measurement & Verification**	1
			Credit 6	**Green Power**	1

OP EXHIBIT 15

continued...

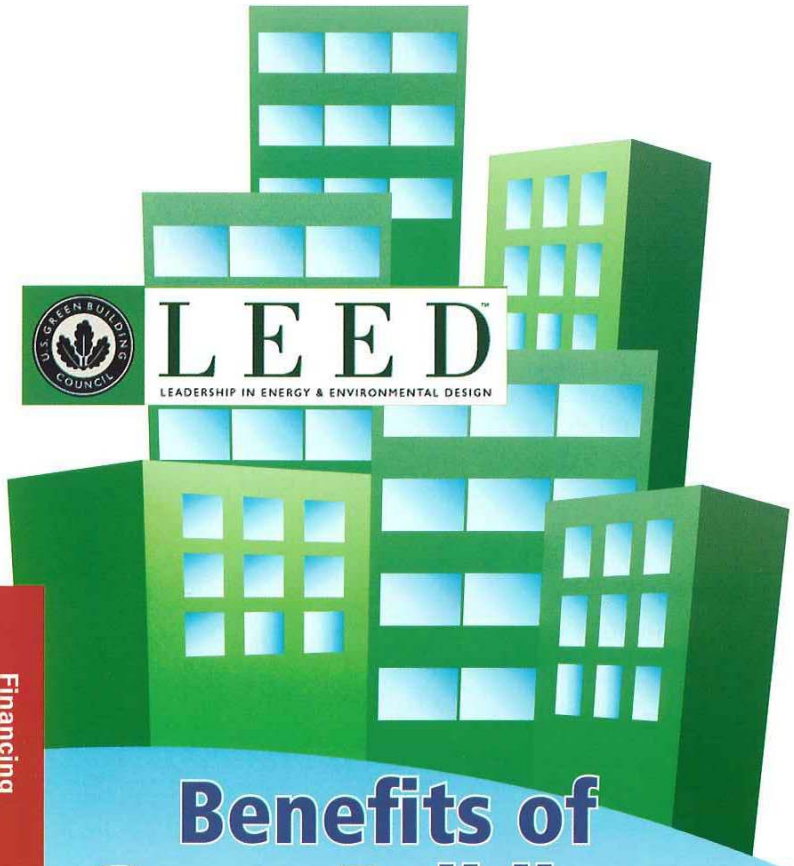
Yes	?	No			
			Materials & Resources		13 Points
Y			Prereq 1	**Storage & Collection of Recyclables**	Required
			Credit 1.1	**Building Reuse**, Maintain 75% of Existing Walls, Floors & Roof	1
			Credit 1.2	**Building Reuse**, Maintain 100% of Existing Walls, Floors & Roof	1
			Credit 1.3	**Building Reuse**, Maintain 50% of Interior Non-Structural Elements	1
			Credit 2.1	**Construction Waste Management**, Divert 50% from Disposal	1
			Credit 2.2	**Construction Waste Management**, Divert 75% from Disposal	1
			Credit 3.1	**Materials Reuse**, 5%	1
			Credit 3.2	**Materials Reuse**,10%	1
			Credit 4.1	**Recycled Content**, 10% (post-consumer + ½ pre-consumer)	1
			Credit 4.2	**Recycled Content**, 20% (post-consumer + ½ pre-consumer)	1
			Credit 5.1	**Regional Materials**, 10% Extracted, Processed & Manufactured Regiona	1
			Credit 5.2	**Regional Materials**, 20% Extracted, Processed & Manufactured Regiona	1
			Credit 6	**Rapidly Renewable Materials**	1
			Credit 7	**Certified Wood**	1

Yes	?	No			
			Indoor Environmental Quality		20 Points
Y			Prereq 1	**Minimum IAQ Performance**	Required
Y			Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control**	Required
Y			Prereq 3	**Minimum Acoustical Performance**	Required
			Credit 1	**Outdoor Air Delivery Monitoring**	1
			Credit 2	**Increased Ventilation**	1
			Credit 3.1	**Construction IAQ Management Plan**, During Construction	1
			Credit 3.2	**Construction IAQ Management Plan**, Before Occupancy	1
			Credit 4	**Low-Emitting Materials**	1 to 4
			Credit 5	**Indoor Chemical & Pollutant Source Control**	1
			Credit 6.1	**Controllability of Systems**, Lighting	1
			Credit 6.2	**Controllability of Systems**, Thermal Comfort	1
			Credit 7.1	**Thermal Comfort**, Design	1
			Credit 7.2	**Thermal Comfort**, Verification	1
			Credit 8.1	**Daylight & Views, Daylighting**	1 to 3
				75% of classrooms (*required for either points below)*	1
				90% of classrooms	2
				75% of other spaces	3
			Credit 8.2	**Daylight & Views**, Views for 90% of Spaces	1
			Credit 9	**Enhanced Acoustical Performance**	1 to 2
			Credit 10	**Mold Prevention**	1

Yes	?	No			
			Innovation & Design Process		6 Points
			Credit 1.1	**Innovation in Design**: Provide Specific Title	1
			Credit 1.2	**Innovation in Design**: Provide Specific Title	1
			Credit 1.3	**Innovation in Design**: Provide Specific Title	1
			Credit 1.4	**Innovation in Design**: Provide Specific Title	1
			Credit 2	**LEED® Accredited Professional**	1
			Credit 3	**School As A Teaching Tool**	1

Yes	?	No		
			Project Totals (pre-certification estimates)	79 Points

Certified: 29-36 points, **Silver:** 37-43 points, **Gold:** 44-57 points, **Platinum:** 58-79 poin



Financing

Benefits of Green Buildings

The concept is certainly not new but, what are benefits from a green building or sustainable design? Most people think of green buildings as those that are better for the environment. While this is true, there are many more benefits to green buildings. Green buildings consume less energy as well as use and re-use resources efficiently to meet the needs of the present without comprising the ability of future generations to meet their own needs. Just as importantly, a green design results in a high quality product that maximizes the owner's return on investment. The LEED rating system provides a standardized outlook on green building performances.

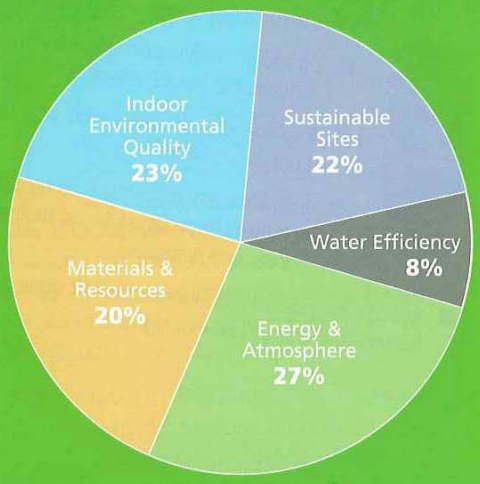
Green buildings use less energy than conventional buildings built to applicable building codes. Green buildings integrate the following elements:

- energy efficient building envelopes (e.g. low-e window glazing, higher R-value insulation, etc.)
- natural light or daylighting
- high efficiency air conditioning equipment,
- optimized energy performance through building energy simulation modeling
- commissioning of the HVAC (heating, ventilation, and air conditioning) systems.

LEED looks at the following five broad areas:

- *Sustainable site planning*
- *Safeguarding water and water efficiency*
- *Energy efficiency and renewable energy*
- *Conservation of materials and resources*
- *Indoor environmental quality*

Under the LEED™ rating system, a building can receive 69 possible points, spread out among the 5 categories.



LEED™ Categories Point Distribution
A building can receive one of the following four certification levels based on the number of points a building achieves.

LEED™ Certified	26 – 32 points
Silver Level	33 – 38 points
Gold Level	39 – 51 points
Platinum Level	52+ points (69 possible)

OP EXHIBIT 16

BUILD GREEN – EVERYONE PROFITS.

A Bit of Trivia: AIA's Honolulu Chapter Offices were the first to achieve Gold LEED-CI* in Hawai'i.

*CI denotes Commercial Interior

How Green Is My Building? To rate "how green a building is," the U.S. Green Building Council (USGBC) developed a rating system in the 1990's called Leadership in Energy & Environmental Design (LEED). LEED rates green buildings by how well the building performs in five key categories: sustainable sites, water efficiency, energy & atmosphere, materials & resources, and indoor environmental quality. Depending on the number of points earned, a building is certified, silver, gold, or platinum.

How Efficient Is My Green Building? To answer the question, 60 LEED rated buildings were analyzed. Table 1 shows the energy use reduction by the LEED rating level. On average, green buildings reduce energy use by 28% when compared to buildings that are built to standard building codes. To get a better feel for what 28% means, lets take a 100,000 square foot office building. At 22 kWh/square foot and an electric rate of $0.14 per kWh, the annual electrical costs are $308,000. Using the **28% energy reduction**, the building **saves $86,240 per year.**

Table 1. Energy Use Reduction in Green Building as Compared to Conventional Buildings

LEED Rating	Certified	Silver	Gold	Average
Energy Efficiency (above Code standard)	18%	30%	37%	28%

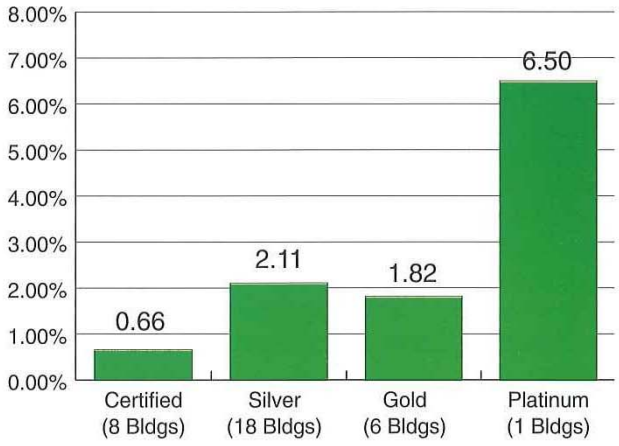
Source: U.S. Green Building Council, Capital E Analysis

In addition to the obvious financial benefits from energy savings, studies conclude that improved indoor air quality of green buildings also improves workers productivity. Improved worker productivity results from better ventilation, controllability of HVAC systems, less toxic materials, low-emitting adhesives & sealants, paints, carpets, and indoor chemical & pollution controls.

The increase in worker productivity is highly variable, but conservative numbers put it at about 1 to 1.5%. A 1% increase in productivity (about 5 minutes per working day) is equal to about $600 to $700 per worker per year. A 1.5% increase is equal to about $1,000 in savings per worker per year. Since employees salary are a large portion of a company's annual expense, a reduction of 1 to 1.5% is significant.

How Much More Does It Cost To Build Green? A study of 33 green buildings in the U.S. found that the average premium for building green was about 2% more than conventional buildings. A breakdown for the various LEED levels are shown in the figure below. Most of the premium cost is attributed to increased architectural and engineering time for green building design. However, as more and more green buildings are designed, the cost for design will decrease. In general, a green building's premium costs will be the lowest when green building features are incorporated early in the design process.

Average Green Cost Premium Over Conventional Buildings



The next time you renovate or build a new building, remember the benefits and go green. The following websites provides a great starting point:

Additional Resources:

US Green Building Council, www.usgbc.org

U.S. Environmental Protection Agency (EPA) Energy Star, www.energystar.gov

The Costs and Financial Benefits of Green Buildings

A report to California's Sustainable Building Task Force, a group of over 40 state agencies, with funding from seven.

Drawing on cost data from 33 green building projects and financial benefits data from over 100 buildings nationwide.

Principal Author: Greg Kats, Capital E

www.cap-e.com

Some Assumptions

- 20 year term
- 5% real interest rate
- $150-$250/ft^2 building costs
- LEED as a basis
- Consistently conservative assumptions
- Conclusions generally applicable nationally

Financial Benefits of Green Buildings Summary of Findings (per ft^2)

Category	20-year Net Present Value
Energy Savings	$5.80
Emissions Savings	$1.20
Water Savings	$0.50
Operations and Maintenance Savings	$8.50
Productivity and Health Value	$36.90 to $55.30
Subtotal	**$52.90 to $71.30**
Average Extra Cost of Building Green	(-$3.00 to -$5.00)
Total 20-year Net Benefit	**$49.90 to $66.30**

Source: Capital E Analysis

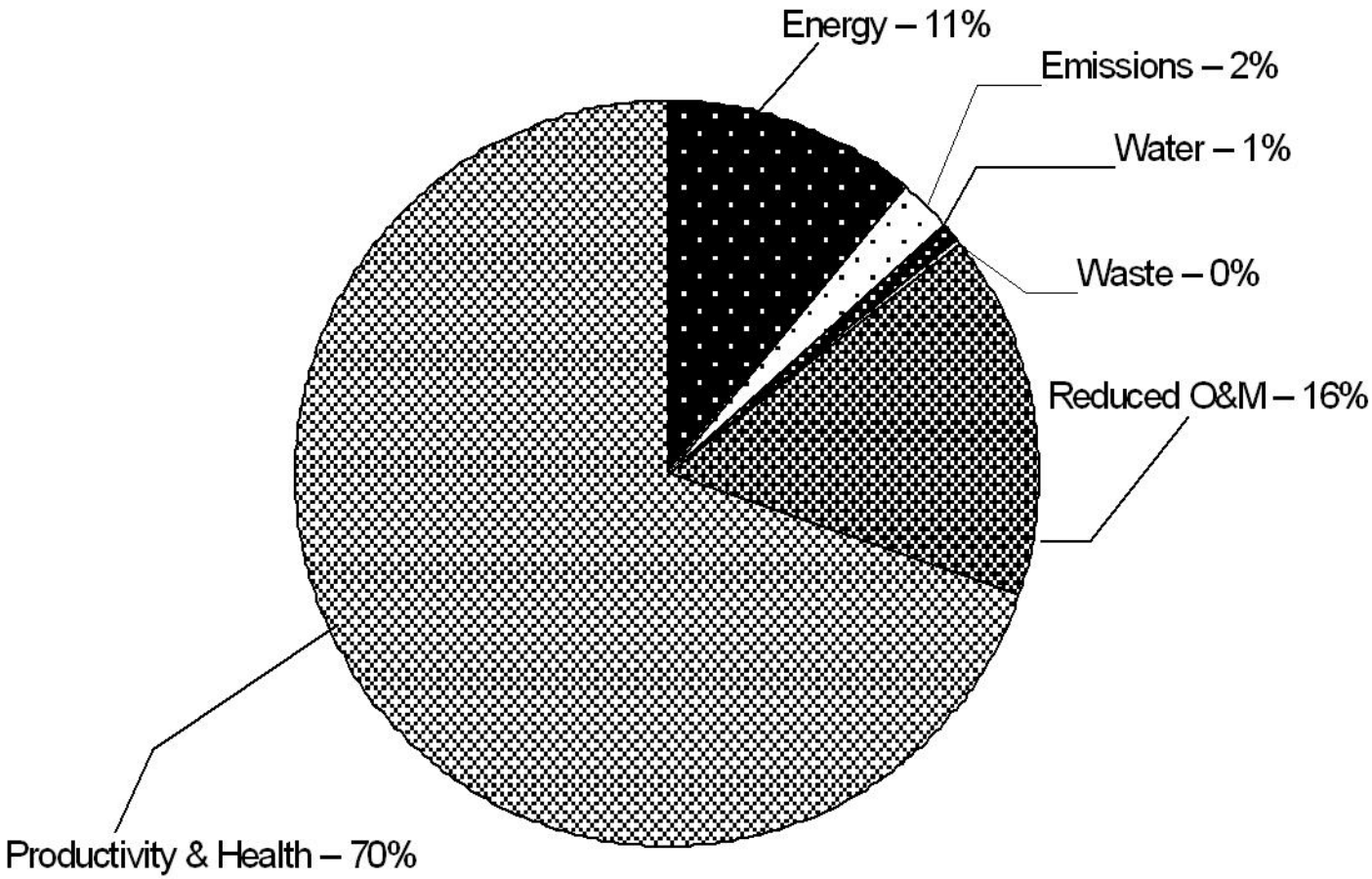
www.cap-e.com

Average Green Cost Premiums for 33 Green Buildings, by LEED level

Level of Green Standard	Average Green Cost Premium
Level 1 – Certified (8)	0.66%
Level 2 – Silver (18)	2.11%
Level 3 – Gold (6)	1.82%
Level 4 – Platinum (1)	6.50%
Average of 33 Buildings	**1.84%**

Source: USGBC Data, Capital E Analysis

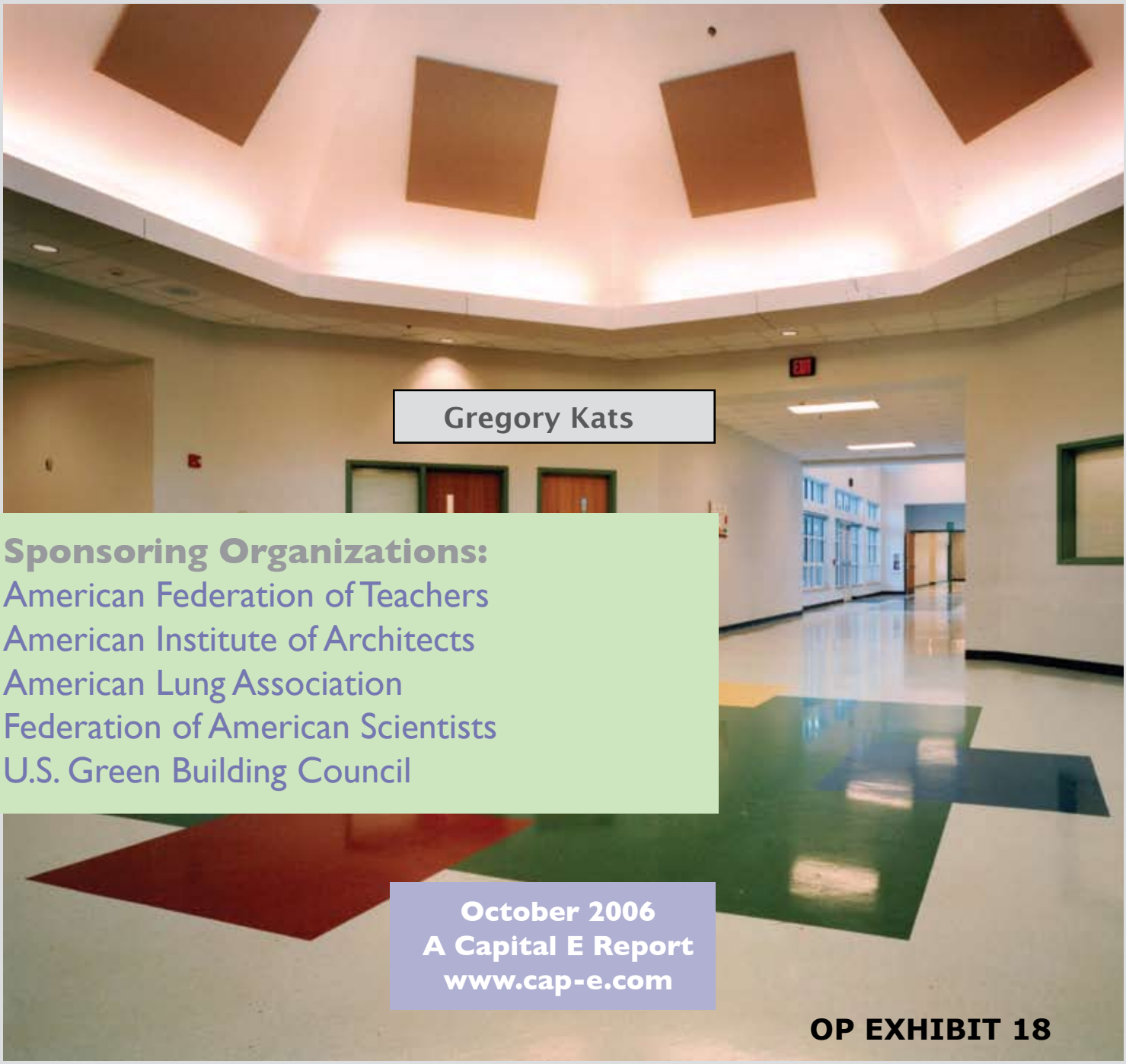
Breakdown of Green Building Financial Benefits (LEED Certified & Silver levels)



Source: Capital E Analysis

www.cap-e.com

Greening America's Schools
Costs and Benefits



Gregory Kats

Sponsoring Organizations:
American Federation of Teachers
American Institute of Architects
American Lung Association
Federation of American Scientists
U.S. Green Building Council

October 2006
A Capital E Report
www.cap-e.com

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www.gundfdn.org

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www.kendall.org

The US Green Building Council
www.usgbc.org

About the Author

Greg Kats is Managing Principal of Capital E, a national clean energy technology and green building firm. He serves as Senior Advisor to Cherokee Investment Partners (www.cherokeefund.com), the country's largest private brownfield developer (with over $5 billion in projected green developments). He is the Principal Advisor in developing $1 billion of green affordable housing, involving Enterprise Community Partners, JPMorgan, Chase, Citibank, NRDC, Fannie Mae, American Institute of Architects, and others (www.greencommunitiesonline.org). He serves as Senior Advisor to the Cheyne Carbon Fund, the leading investor in the voluntary carbon offset market. (Cheyne Capital Management is a $30 billion European hedge fund.)

Mr. Kats served as the Director of Financing for Energy Efficiency and Renewable Energy at the U.S. Department of Energy (1996-2001). With a billion dollar budget, it is the country's largest clean technology development and deployment program, including over $400 million annually in high performance building technology development and deployment. He co-founded and from 1995 to 2001 chaired the International Performance Measurement & Verification Protocol (www.ipmvp.org) that has served as a technical basis for $8 billion in building upgrades, and been translated into 10 languages. Mr. Kats serves as Chair of the Energy and Atmosphere Technical Advisory Group for LEED and serves on the LEED Steering Committee. Mr. Kats recently led a national technical review (for the US EPA) on the performance of Energy Star commercial and public buildings, and is a principal author of *Green Office Buildings: a Practical Guide to Development,* (Urban Land Institute, 2005).

Mr. Kats earned an MBA from Stanford University and, concurrently, an MPA from Princeton University on a Woodrow Wilson Fellowship, and is a Certified Energy Manager and a LEED Accredited Professional. He is a founder of New Resource Bank (www.newresourcebank.com), the country's first green bank, and the American Council of Renewable Energy (www.acore.org), and serves on a half dozen private and public boards. Mr. Kats regularly testifies, serves as keynote speaker at national conferences, and speaks to organizations such as the American Bar Association, the National Academy of Sciences, and the US Conference of Mayors.

Contributing Researcher:
Jon Braman, Capital E

This document is based on and draws from the 2005 report "National Review of Green Schools: Costs, Benefits and Implications for Massachusetts," a report for the Massachusetts Technology Collaborative. Principal Author Greg Kats, contributing author Jeff Perlman, contributing researcher Sachin Jamadagni. (Available at www.cap-e.com.)

This analysis also draws extensively on the 2003 Capital E report "The Costs and Financial Benefits of Green Buildings," a report to California's Sustainable Building Task Force, developed for 40 state agencies.[1] The report was the first to develop a rigorous analysis of the costs and benefits of green buildings, and found that the average cost premium for green buildings was 2%.

Front cover photo:
Third Creek Elementary School
Photography by Spark Productions

Back cover photo (from left to right):
Clearview High School
Photography by Jim Schafer

Mabel Rush Elementary
Photography by Michael Mathers

Third Creek Elementary
Photography by Spark Productions

Layout Design:
Robert Loftur-Thun
Global Environment & Technology Foundation

Reviews of *Greening America's Schools: Costs and Benefits*

"This carefully documented study conclusively demonstrates the financial, environmental, and other benefits of using green technologies in schools. In fact, failure to invest in green technologies is not financially responsible for school systems; the study uses conservative accounting practices to show that investments in green technologies significantly reduce the life-cycle cost of operating school buildings. And the public benefits of green schools are even larger than those that work directly to the financial advantage of schools. These include reductions in water pollution, improved environmental quality, and increased productivity of learning in an improved school environment."

- Henry Kelly, President, Federation of American Scientists

"USGBC is proud to be a sponsor of this important national analysis of the costs and benefits of greening our nation's schools. The report's conclusions provide confirmation of USGBC's position that by building green we all profit. For our nation's students this is particularly true. Children's health is disproportionately affected by indoor pollutants, while light and air quality affects their capacity to learn and succeed. This report shows that we owe it to our children - and ourselves - to make all our schools green."

- S. Richard Fedrizzi, CEO and Founding Chair, U.S. Green Building Council

"High performance, cost effective schools begin with good design. As this study details, nowhere is good design more important than for our schools. Enhanced learning environments that are also environmentally responsible continue to be an ongoing focus of AIA awards programs and government advocacy. But, as the study makes clear, all schools must also be green. Members of The American Institute of Architects believe good design makes a difference. This study underscores the enormous costs of poor design, and the critical impact that good design and operation has on the quality of our children's education. It deserves widespread consideration if we are to properly prepare students to address the environmental challenges of our new century."

- Kate Schwennsen, President, The American Institute of Architects

"This report makes the business case for greening America's schools, and it makes a compelling case indeed. But there is also a public health case to be made. Better indoor air quality, lower levels of chemical emissions, generous provision of natural daylighting, better humidity control--these and other features of green schools offer not only environmental and fiscal benefits, but health benefits as well. These health benefits, in turn, manifest in lower student and staff absenteeism, lower staff turnover, lower health care costs, and improved school and job performance. For the more than 50 million students and the more than 5 million teachers and staff who spend their days in schools, these benefits are substantial and precious. Health professionals, educators, parents, and policymakers should carefully consider the conclusions of this report, and do their part to support environmentally friendly, healthy, and sustainable schools."

- Howard Frumkin, M.D., Dr.P.H., Director, National Center for Environmental Health and Agency for Toxic Substances and Disease Registry, U.S. Centers for Disease Control and Prevention. Senior Editor, *Safe and Healthy School Environments* (Oxford University Press, 2006).

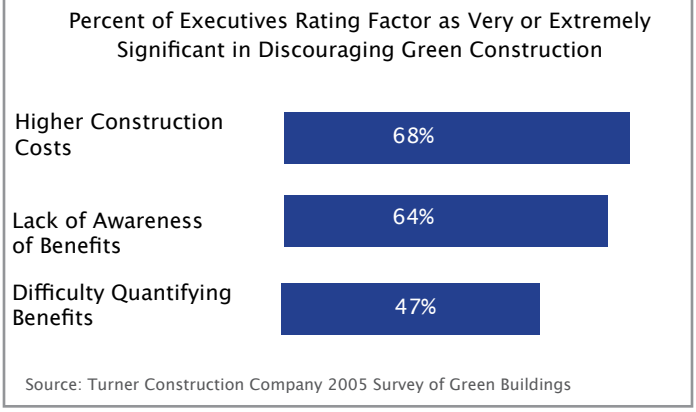
"This carefully documented study conclusively demonstrates the financial, environmental, and other benefits of using green technologies."

Executive Summary

Greening school design provides an extraordinarily cost-effective way to enhance student learning.

Some 55 million students spend their days in schools that are too often unhealthy and that restrict their ability to learn. A recent and rapidly growing trend is to design schools with the specific intent of providing healthy, comfortable and productive learning environments. These green, high performance schools generally cost more to build, which has been considered a major obstacle at a time of limited school budgets and an expanding student population. A 2005 survey by Turner Construction Company of 665 senior executives found that executives are discouraged from undertaking green construction because of concerns about cost, and a lack of awareness and available information on the financial benefits of green buildings.[2]

Figure A: Factors Discouraging the Construction of Green Buildings



Source: Turner Construction Company 2005 Survey of Green Buildings

This report is intended to answer this fundamental question: how much more do green schools cost, and is greening schools cost effective?

Conventional schools are typically designed just to meet building codes - that are often incomplete. Design of schools to meet minimum code performance tends to minimize initial capital costs but delivers schools that are not designed specifically to provide comfortable, productive, and healthy work environments for students and faculty. Few states regulate indoor air quality in schools or provide for minimum ventilation standards. Not surprisingly, a large number of studies have found that schools across the country are unhealthy - increasing illness and absenteeism and bringing down test scores.

This report documents the financial costs and benefits of green schools compared to conventional schools. This national review of 30 green schools demonstrates that green schools cost less than 2% more than conventional schools - or about $3 per square foot ($3/ft^2) - but provide financial benefits that are 20 times as large. Greening school design provides an extraordinarily cost-effective way to enhance student learning, reduce health and operational costs and, ultimately, increase school quality and competitiveness.

The financial savings are about $70 per ft^2, 20 times as high as the cost of going green. (Table A) Only a portion of these savings accrue directly to the school. Lower energy and water costs, improved teacher retention, and lowered health costs save green schools directly about $12/ft^2, about four times the additional cost of going green. For an average conventional school, building green would save enough money to pay for an additional full-time teacher. Financial savings to the broader community are significantly larger, and include reduced cost of public infrastructure, lower air and water pollution, and a better educated and compensated workforce.

Green schools provide a range of additional benefits that are not quantified in this report, including reduced teacher sick days, reduced operations and maintenance costs, reduced insured and uninsured risks, improved power quality and reliability, increased state competitiveness, reduced social inequity, and educational enrichment. There is insufficient data to quantify these additional benefits, but they are substantial and, if calculated, would substantially increase the recognized financial benefits of greening schools.

Table A: Financial Benefits of Green Schools ($/ft^2)

Energy	$9
Emissions	$1
Water and Wastewater	$1
Increased Earnings	$49
Asthma Reduction	$3
Cold and Flu Reduction	$5
Teacher Retention	$4
Employment Impact	$2
TOTAL	$74
COST OF GREENING	($3)
NET FINANCIAL BENEFITS	$71

Building healthy high performance school buildings is now far more fiscally prudent and lower risk than building conventional, inefficient and unhealthy school buildings.

Methodology and Assumptions

Net Present Value

Conventional schools usually have lower design and construction costs and higher operational costs, whereas green schools usually have higher design and construction costs and lower operational costs. To evaluate the current value of a future stream of financial benefits and costs, we use net present value (NPV) analysis, with 2006 as our base year. NPV represents the present value of an investment's discounted future financial benefits minus any initial investment. A positive number indicates a good investment.

Term

This report assumes a 20 year term for benefits in new buildings. A lower, 15 year term for energy efficiency savings in retrofitted existing buildings would be appropriate. A longer term is assumed for a new building because green design affects more permanent features – such as orientation, wall construction, and amount of insulation – which tend to last for the life of building, typically at least 50 years.

Inflation

This analysis assumes an inflation rate of 2% per year, in line with most conventional inflation projections. Unless otherwise indicated, this report makes a conventional assumption that most costs as well as benefits rise at the rate of inflation. The things that are not assumed to rise at the rate of inflation are energy, emissions value, water, waste water and health costs - which are assumed to rise faster than inflation. The rate increases for these are discussed in the relevant sections.

Discount Rate

To arrive at present value and net present value estimates, projected future costs and benefits must be discounted to provide a fair value in today's dollars. Present value calculations are made on the basis of a relatively conservative 7% discount rate (i.e., 5% real interest rate plus an assumed 2% inflation).[3] This is higher than the rate at which states, the federal government, and many corporations borrow money.[4]

Definition of Green Schools

All green school designs are to a substantial extent based on the US Green Building Council's Leadership in Energy and Environmental Design (LEED), which is the national consensus green building standard. An application of LEED for schools was developed for California schools, and is called Collaborative for High Performance Schools (CHPS).[5] This standard was then adapted for Massachusetts schools (MA CHPS),[6] and in 2003, Washington State released its own Washington Sustainable School (WSS) Protocol for High Performance Facilities,[7] also based on a variant of CHPS and LEED. The green schools we analyzed were based on either LEED, MA CHPS, or WSS.

The Cost of Building Green Schools

Average national school construction cost is $150/ft^2.[8]

The "green premium" is the initial extra cost to build a green building compared to a conventional building. Typically this cost premium is a result of more expensive (and sustainably-sourced) materials, more efficient mechanical systems, and better design, modeling and integration, and other high performance features. Many school architects use a state or school district's pre-determined budget as their metric for appropriate school cost. Some green schools are built on the same budget as conventional schools.

The report data are drawn from 30 green schools built in 10 states during the period 2001 to 2006. The data on costs as well as savings compared to a conventional design were generally supplied by the schools' architects. Some of the costs analyzed in the report are based on actual building performance, while some new school costs are estimates based on architectural modeling and engineering estimates. We generally relied on the costs reported by architects based on their actual and modeled green and conventional versions of the same building. For a breakout of all schools analyzed, see Table B.

Four of the green schools (in Georgia, Massachusetts and Oregon) cost no more than conventional design, while several schools cost substantially more. Six schools cost at least 3% more than conventional design while one – the Punahou School in Hawaii – costs 6.3% more. Typically green schools cost 1% to 2% more, with an average cost premium of 1.7%, or about $3/ft^2.

Increased cost of green design is typically partially offset by savings elsewhere, for example in reduced cost of HVAC systems or in reduced code compliance costs. Similarly, increased water retention through the use of a green roof or greywater system can avoid the capital cost of a water retention system normally required to comply with water codes. The model green school developed by the architectural firm OWP/P for the Chicago market includes a green roof that allows the building to avoid a water retention system, providing savings sufficient to reduce the school cost premium to 1%.[10] A recent evaluation of the impact of LEED adoption, developed for the Portland Energy Office, found that regional life cycle savings from adopting 15 individual green building technologies was over 8 times as large as the direct first cost of these measures.[11]

Achieving full cost savings requires early integrated design.

Benefits of High Performance Schools

Energy Cost Savings in Green Schools

Green schools use an average of 33% less energy than conventionally designed schools.

Green schools use an average of 33% less energy than conventionally designed schools (See Table B). Typical energy performance enhancements include more efficient lighting, greater use of daylighting and sensors, more efficient heating and cooling systems and

better insulated walls and roofs.

Reduced energy consumption in green schools has two distinct financial benefits: (1) direct reduction in school energy costs, and (2) indirect secondary impact from reduced

Some green schools are built on the same budget as conventional schools.

Table B: School Buildings Analyzed in This Report[9]

Name	State	Year Completed	2005 MA-CHPS	LEED Score	LEED Level or Equivalent	Cost premium	Energy Savings	Water Savings
Ash Creek Intermediate School	OR	2002			CERTIFIED	0.00%	30%	20%
Ashland High School*	MA	2005	19			1.91%	29%	
Berkshire Hills*	MA	2004	27			3.99%	34%	0%
Blackstone Valley Tech*	MA	2005	27			0.91%	32%	12%
Capuano	MA	2003		26	CERTIFIED	3.60%	41%	
Canby Middle School	OR	2006		40	GOLD	0.00%	47%	30%
Clackamas	OR	2002		33	SILVER	0.30%	38%	20%
Clearview Elementary	PA	2002	49	42	GOLD	1.30%	59%	39%
Crocker Farm School	MA	2001	37			1.07%	32%	62%
C-TEC	OH	2006	35	38	SILVER	0.53%	23%	45%
The Dalles Middle School	OR	2002			SILVER	0.50%	50%	20%
Danvers*	MA	2005	25			3.79%	23%	7%
Dedham*	MA	2006	32			2.89%	29%	78%
Lincoln Heights Elementary School	WA	2006			SILVER		30%	20%
Melrose Middle School	MA	2007	36			1.36%	20%	20%
Model Green School	IL	2004		34	SILVER	2.02%	29%	35%
Newton South High School	MA	2006		32	CERTIFIED	0.99%	30%	20%
Prairie Crossing Charter School	IL	2004		34	SILVER	3.00%	48%	16%
Punahou School	HI	2004		43	GOLD	6.27%	43%	50%
Third Creek Elementary	NC	2002		39	GOLD	1.52%	26%	63%
Twin Valley Elementary	PA	2004	41	35	SILVER	1.50%	49%	42%
Summerfield Elementary School	NJ	2006	42	44	GOLD	0.78%	32%	35%
Washington Middle School	WA	2006		40	GOLD	3.03%	25%	40%
Whitman-Hanson*	MA	2005	35			1.50%	35%	38%
Williamstown Elementary School	MA	2002	37			0.00%	31%	
Willow School Phase 1	NJ	2003		39	GOLD		25%	34%
Woburn High School*	MA	2006	32			3.07%	30%	50%
Woodword Academy Classroom	GA	2002		34	SILVER	0.00%	31%	23%
Woodword Academy Dining	GA	2003		27	CERTIFIED	0.10%	23%	25%
Wrightsville Elementary School	PA	2003		38	SILVER	0.40%	30%	23%
AVERAGE						**1.65%**	**33.4%**	**32.1%**

overall market demand and resulting lower energy prices market-wide. Direct savings are in the form of lower bills to the school. Indirect savings result from the impact that reduced demand has in lowering the market price of energy. This indirect impact shows up in minute changes in price across entire markets. For an individual school, this price impact is not measurable, but state-wide or nationally, the price impact of reduced energy consumption in schools could be substantial.

Average school energy use in 2005/2006 was $1.15/ft^2, of which electricity was 63% and natural gas 34%. For the 30 green schools reviewed in this report, the average energy reduction compared with conventional design is 33%, indicating an average savings of $0.38/ft^2 per year in green schools.[12] Average electricity prices are $0.09 kWh in 2006 and rose an average 6% per year over the last three years.[13] The average gas price rose 14% annually over the same period. Future prices are of course unknowable, but finite energy resources combined with rapid projected international demand growth suggests rising prices. This report projects recent rapid growth in average energy prices to slow to 5% per year, or

Clearview High School
John Boecker, Architect with L. Robert Kimball & Assoc.
Photo: Jim Schafer Location Photography

3% above inflation, over the next 20 years.

Over a 20 year period, and assuming 7% discount of future benefits of lower energy prices, the result is a present value of $6/ft^2 for energy savings in green schools. In green building upgrades of existing schools, the present value benefit of reduced energy use over a 15 year period at a 7% discount rate is $5/ft^2. Note that the costs and benefits numbers in this report have all been rounded to the nearest whole dollar amount. Uncertainties about the data, including future price escalation, make greater precision misleading.

Market-wide energy cost savings represent an important additional benefit often not included in energy efficiency financial analyses. The financial benefit of lowered energy prices is substantial and provides an additional reason for public entities such as states or cities to promote or require energy efficiency programs.

The price impact from efficiency-driven reductions in demand can be significant. A 2005 report from Lawrence Berkeley National Laboratory found that a 1% reduction in national natural gas demand can lead to a long-term average wellhead price reductions of 0.8% to 2%.[14] A 2004 Platts Research & Consulting review of nine separate studies determines that a 1% drop in gas demand could drive a 0.75% to 2.5% reduction in long-term wellhead prices. [15] In other words, these studies indicate direct reduction in consumption (and savings in energy costs from increased efficiency) could drive a reduction in long-term prices equal to 100% to 200% of the direct energy savings. A 2004 Massachusetts state report found that the indirect savings from lower overall energy prices due to lower energy demand from use of energy efficiency and renewables amounted to 90% of the direct savings.[16] To be conservative, we assume that the indirect price impact is 50% over 20 years from a broad shift to green, energy efficient school design. Thus, the impact of indirect energy cost reduction for new and retrofitted schools has a present value of $3/ft^2 over 20 years.

The total direct and indirect energy cost savings from a new green school compared with a conventional school is $9/ft^2. Total direct and indirect energy cost savings from a green as compared to a conventional upgrade of an existing school would be $7/ft^2. Note that these numbers have all been rounded to the nearest whole dollar amount, as noted above.

Emissions Reduction Benefits of Green Schools

Residential, commercial and industrial buildings use about 45% of the nation's energy, including about 75% of the nation's electricity. Air pollution, from burning fossil fuels to heat buildings (natural gas and oil) and to generate electricity for these buildings (by burning coal, natural gas and oil) imposes enormous health, environmental, and property damage costs. Demonstrated health costs nationally include tens of thousands of additional deaths per year and tens of millions of respiratory incidents and ailments.[17]

Reduced electricity and gas use in buildings means lower emissions of pollutants (due to avoided burning of fossil fuels) that are damaging to human health, to the environment, and to property. As noted above, green schools on average use one third less energy than conventional schools.[18]

Market-wide energy cost savings represent an important benefit often not included in energy efficiency financial analyses.

As a rough estimate, a green school could lead to the following annual emission reductions per school:

- 1,200 pounds of nitrogen oxides (NOx) – a principal component of smog.
- 1,300 pounds of sulfur dioxide (SO_2) – a principal cause of acid rain.
- 585,000 pounds of carbon dioxide (CO_2) – the principal greenhouse gas and the principal product of combustion.
- 150 pounds of coarse particulate matter (PM10) – a principal cause of respiratory illness and an important contributor to smog.

Over 20 years the present value of emissions reductions per square foot is $0.53/ft^2 from a green school.[19]

Mabel Rush High School
Heinz Rudolf, Boora Architects
Photo: Michael Mathers

This grossly underestimates actual emissions costs, particularly for CO_2, the primary gas causing global warming and resulting in increased severity of hurricanes, increased heat related deaths, sea-level rise, accelerating environmental degradation - such as erosion and desertification, and accelerating species extinction. A 2005 study by Harvard Medical School, Swiss Re and the United Nations Development Program summarizes a broad range of large economic costs that continued climate change and global warming, driven primarily by burning fossil fuels, will increasingly impose.[20]

Virtually all of the world's climate change scientists have concluded that human caused emissions – principally from burning fossil fuels – are causing global warming.[21] In 2004, *Science* published a review of over 900 scientific studies on global warming published in refereed scientific journals over the prior decade and concluded that there is a consensus among climate scientists that serious human induced global warming is happening.[22] In April 2005, James Hansen, Director of NASA's Goddard Institute for Space Studies, stated that "There can no longer be genuine doubt that human-made gases are the dominant cause of global warming."[23]

The building sector is responsible for over 40% of US CO_2 emissions – more than any entire economy in the world except China.

The USA is responsible for about one quarter of global greenhouse gas emissions. The building sector (including residential, commercial and industrial buildings) is responsible for over 40% of US CO_2 emissions – more than any other entire economy in the world except China.

The large health, environmental and property damages associated with pollution from burning fossil fuels are only very partially reflected in the price of emissions. As the health, financial and social costs of global warming in particular continue to mount, cutting greenhouse gasses through energy efficiency and greater use of renewable energy in buildings will become an increasingly valued benefit of greening buildings.[24]

Water & Wastewater Benefits of Green Schools

The 30 green schools evaluated achieved an average water use reduction of 32%. This reduction has direct savings for the building as well as substantial societal benefits from lower pollution and reduced infrastructure costs to deliver water and to transport and treat wastewater.

When there is heavy and extended rainfall, wastewater systems commonly overflow, causing water pollution and illness, river contamination and beach closings. The benefits of some green building water strategies - such as rainwater catchment and green roofs - are recognized by some municipalities. For example, in Dedham, MA, the school design team, through providing rainwater storage capacity on site, saved the town the cost of enlarging an off site stormwater detention facility. The city valued this infrastructure improvement at $400,000.[25]

A recent EPA report concludes that the expected gap between future revenues (based on historical price increases) and infrastructure needs for potable water and wastewater treatment will be approximately $148 billion over the next twenty years.[26] EPA found that nationally there is a gross under-investment in water delivery and treatment systems, indicating that current water utility rates will have to rise more steeply to secure the funds needed for required infrastructure upgrades.

An empirical study in Canada estimated that the price charged for fresh water was only one-third to one-half the long-run marginal supply cost, and the prices charged for sewage were approximately one-fifth the long run cost of sewage treatment.[27]

Prices typically reflect average rather than marginal costs. Because water and wastewater costs are generally rising, prices tend to

substantially understate actual marginal cost of additional water and wastewater capacity borne by utilities and society at large. Based on discussions with school and green building experts, we can assume conservatively that water and wastewater costs for schools average 5% of the cost of energy, or about $0.06/ft^2. Assuming an average rate of cost increase of 5% per year for water and wastewater, this provides an NPV estimate of $0.84/ft^2, or roughly one dollar, over 20 years. This almost certainly underestimates the financial benefits of reduced water and sewer cost associated with green design. Nor does it reflect the large savings from reduced water runoff from green schools and the cost savings from reduced water pollution and increased groundwater recharging.

New LEED program for K-12 Schools
Lindsay Baker, USGBC staff

In December 2006, USGBC is launching LEED for Schools, a market-specific application of LEED that recognizes the unique nature and educational aspects of the design and construction of K-12 schools. The rating system is based on LEED for New Construction, and addresses issues such as classroom acoustics, master planning, mold prevention, and joint use of facilities. The program launch (no pilot period will take place) is supported by a full set of tools tailored to schools: a reference guide, workshop, and LEED On-line with credit templates. In doing so, USGBC hopes to help school districts across the country better understand the business case for building green and to help them to implement their green building goals through a third-party certification program that is supported by educational offerings and a nationwide network of LEED Accredited Professionals, USGBC chapters and members. School districts can implement LEED without the additional cost of establishing in-house certification programs.
For more information on the LEED for Schools program, go to www.usgbc.org/leed.

Health and Learning Benefits of Green Schools

According to the US General Accounting Office, 14 million students (over a quarter of all students) attend schools considered below standard or dangerous and almost two-thirds of schools have building features such as air conditioning that are in need of extensive repair or replacement. This statistic does not include schools with less obvious but important health related problems such as inadequate ventilation. A recently published document by the American Federation of Teachers notes that the General Accounting Office found that the air is unfit to breathe in nearly 15 thousand schools.[28]

Poor health and study conditions in schools are of particular concern for a number of reasons, including:

1) There are some 60 million students, faculty and staff in schools.
2) The large majority of schools are built not to optimize health and comfort, but rather to achieve a minimum required level of design performance at lowest cost.
3) Few states regulate indoor air quality in schools or provide for minimum ventilation standards.
4) Almost no schools are designed with the specific objective of creating healthy and productive study and learning environments.
5) Chronic shortage of funds in schools means that schools typically suffer from inadequate maintenance, and experience degradation of basic systems such as ventilation, air quality and lighting quality, as well as poor control over pollutants (e.g., from cleaning materials).
6) Students and faculty typically spend 85% to 90% of their time indoors (mostly at home and at school), and the concentration of pollutants indoors is typically higher than outdoors, sometimes by as much as 10 or even 100 times.[29]
7) Children are growing, their organs are developing, and they breathe more air relative to their body size than adults, and as a result sustain greater health problems and risks than adults from toxics and pollutants common in schools.[30]

The costs of poor indoor environmental and air quality in schools, including higher absenteeism and increased respiratory ailments, have generally been "hidden" in sick days, lower teacher and staff productivity, lower student motivation, slower learning, lower tests scores, increased medical costs, and lowered lifelong achievement and earnings.

There is a large body of research linking health and productivity with specific building design operation attributes (e.g., indoor air quality and control over work environment, including lighting levels, air flow, humidity, and temperature).

However, many reviews of the effects of classroom healthiness on students look only at school-specific studies. This unnecessarily limits the relevant data available to understand and quantify benefits of high performance, healthy design in schools. The tasks done by "knowledge workers" (including most non-factory white collar workers) – such as reading comprehension, synthesis of information, writing, calculations, and communications

There is a large body of research linking health and productivity with specific building design attributes.

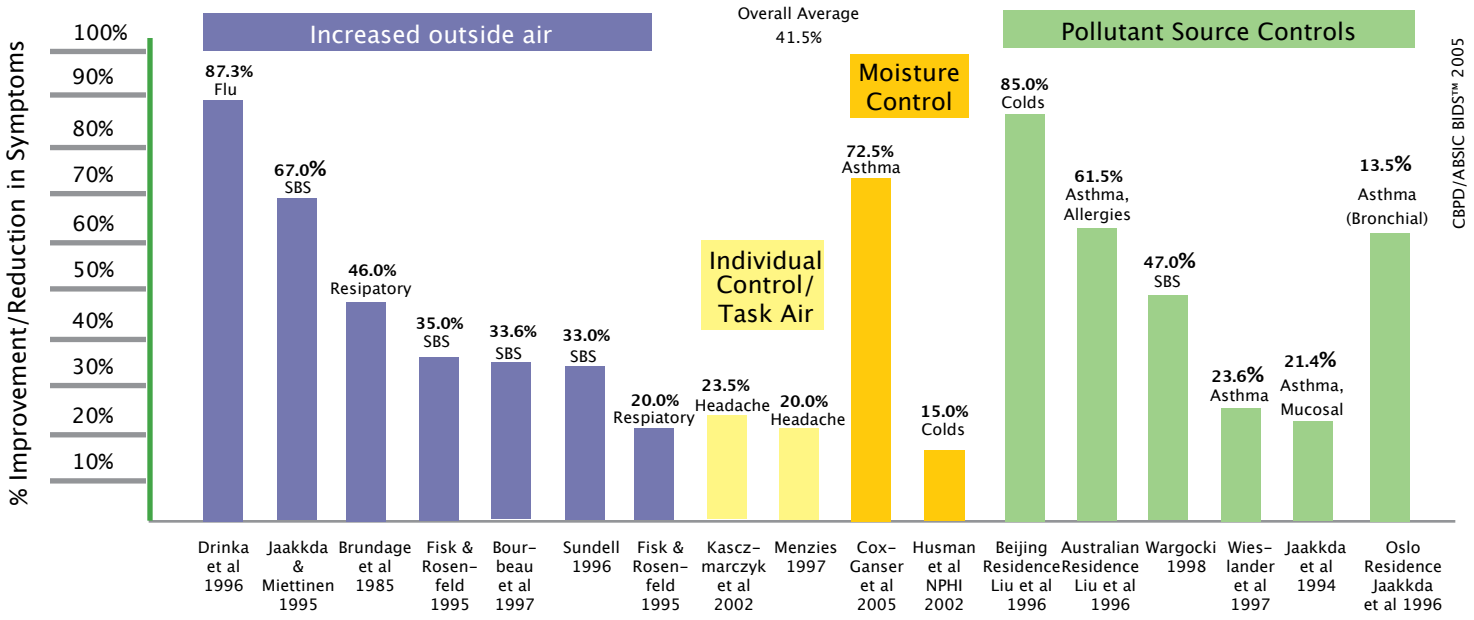
– are very similar to the work students do. Large-scale studies correlating green or high performance features with increased productivity and performance in many non-academic institutions are therefore relevant to schools.

17 separate studies all found positive health impacts from improved indoor air-quality, ranging from 13.5% up to 87% improvement.

Two studies of over 11,000 workers in 107 European buildings analyzed the health effect of worker-controlled temperature and ventilation. These studies found significantly reduced illness symptoms, reduced absenteeism and increased productivity relative to workers in a group whose workspace lacked these features.[31]

One of the leading national centers of expertise on the topic is the Center for Building Performance at Carnegie Mellon University. The Center's Building Investment Decision Support (BIDS) program has reviewed over 1,500 studies that relate technical characteristics of buildings, such as lighting, ventilation and thermal control, to tenant responses, such as productivity or health.[32]

Figure B: Health Gains from Improved Indoor Air Quality



Source: Carnegie Mellon University Center for Building Performance, 2005

Collectively, these studies demonstrate that better building design correlates with increases in tenant/worker well-being and productivity. The BIDS data set includes a number of controlled laboratory studies where speed and accuracy at specific tasks, such as typing, addition, proof reading, paragraph completion, reading comprehension, and creative thinking, were found to improve in high performance building ventilation, thermal control, and lighting control environments.[33]

Indoor Air Quality

The Carnegie Mellon building performance program identified 17 substantial studies that document the relationship between improved air quality and health. The health impacts include asthma, flu, sick building syndrome, respiratory problems, and headaches. These 17 separate studies all found positive health impacts (i.e. reduction in reported prevalence of symptoms) ranging from 13.5% up to 87% improvement, with average improvement of 41% (Figure B).

Temperature Control

Teachers believe that temperature comfort affects both teaching quality and student achievement.[34] Research indicates that the best teachers emphasized that their ability to control temperature in classrooms is very important to student performance.[35]

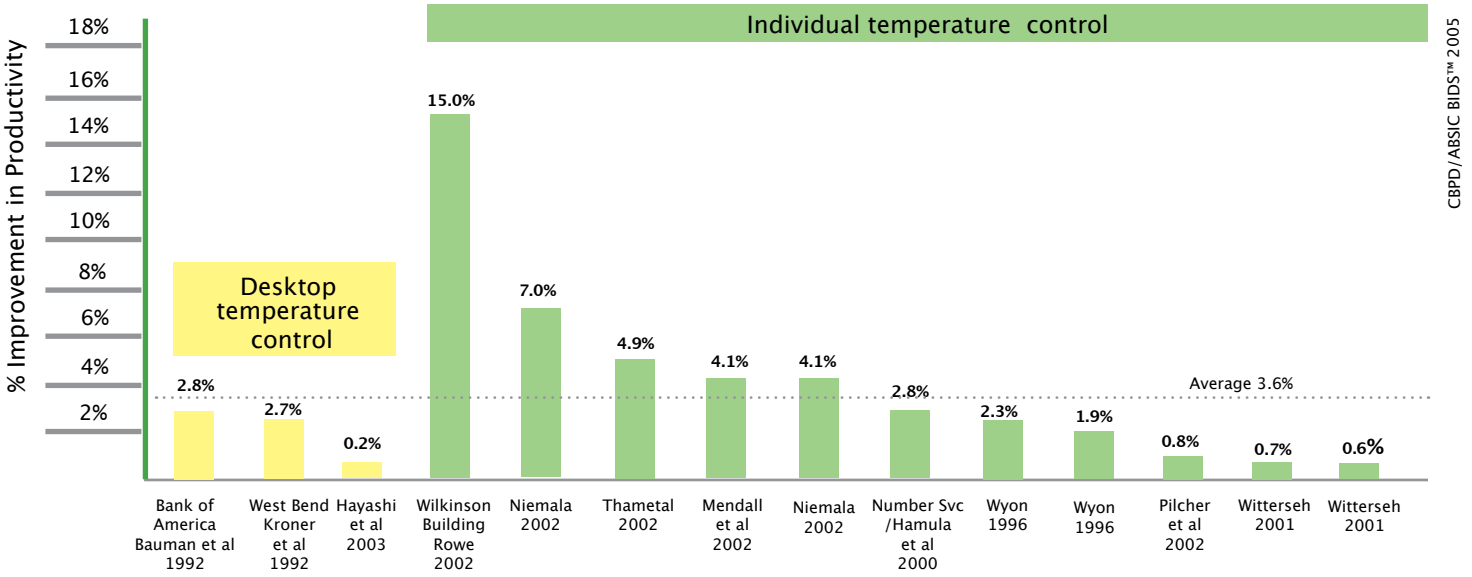
A review of 14 studies by Carnegie Mellon on the impact of improved temperature control on productivity found a positive correlation for all studies, with productivity improvements ranging from 0.2% up to 15%, and with an average (mean) of 3.6% (Figure C).

High Performance Lighting

Green school design typically emphasizes providing views and managing daylight – specifically increasing daylight while eliminating glare. These two design features have both been correlated with improvements in performance on tests of office workers. In a study of 200 utility workers, workers with the best views performed 10% -25% better on tests. Workers in offices without glare outperformed workers in offices with glare by 15% or more.[36]

The consensus findings in a review of 17 studies from the mid 1930s to 1997 found that good lighting "improves test scores, reduces off-task behavior, and plays a significant role in the achievement of students."[37] Another synthesis of 53 generally more recent studies also found that more daylighting fosters higher student achievement.[38]

Figure C: Productivity Gains From Improved Temperature Controls



Source: Carnegie Mellon University Center for Building Performance, 2005

North Clackamas High School
Note entirely day-lit corridor.
Heinz Rudolf, Boora Architects
Photo: Michael Mathers

Carnegie Mellon summarized findings from 11 studies documenting the impact of high performance lighting fixtures on productivity. Their analysis found that productivity gains ranged between 0.7% and 26.1% with an average (median) of 3.2%. (Figure D).

The high performance lighting attributes include efficient lighting and use of indirect lighting fixtures, features that are normal in high performance green buildings.

Improved Learning and Test Scores

In fall 2005 Turner Construction released a survey of 665 executives at organizations involved in the building sector. Of those involved with green schools, over 70% reported that green schools reduced student absenteeism and improved student performance.[39] (Figure E).

Good lighting "improves test scores, reduces off-task behavior, and plays a significant role in the achievement of students."

A large number of school specific studies indicate a significant positive impact. For example:

Greening school design is extraordinarily cost-effective compared with other available measures to enhance student performance.

- An analysis of two school districts in Illinois found that student attendance rose by 5% after incorporating cost-effective indoor air quality improvements.[40]
- A study of Chicago and Washington, DC schools found that better school facilities can add 3 to 4 percentage points to a school's standardized test scores, even after controlling for demographic factors.[41]
- A recent study of the cost and benefits of green schools for Washington State estimated a 15% reduction in absenteeism and a 5% increase in student test scores.[42]

Three of the green schools analyzed for this report demonstrate similar significant improvements in performance:

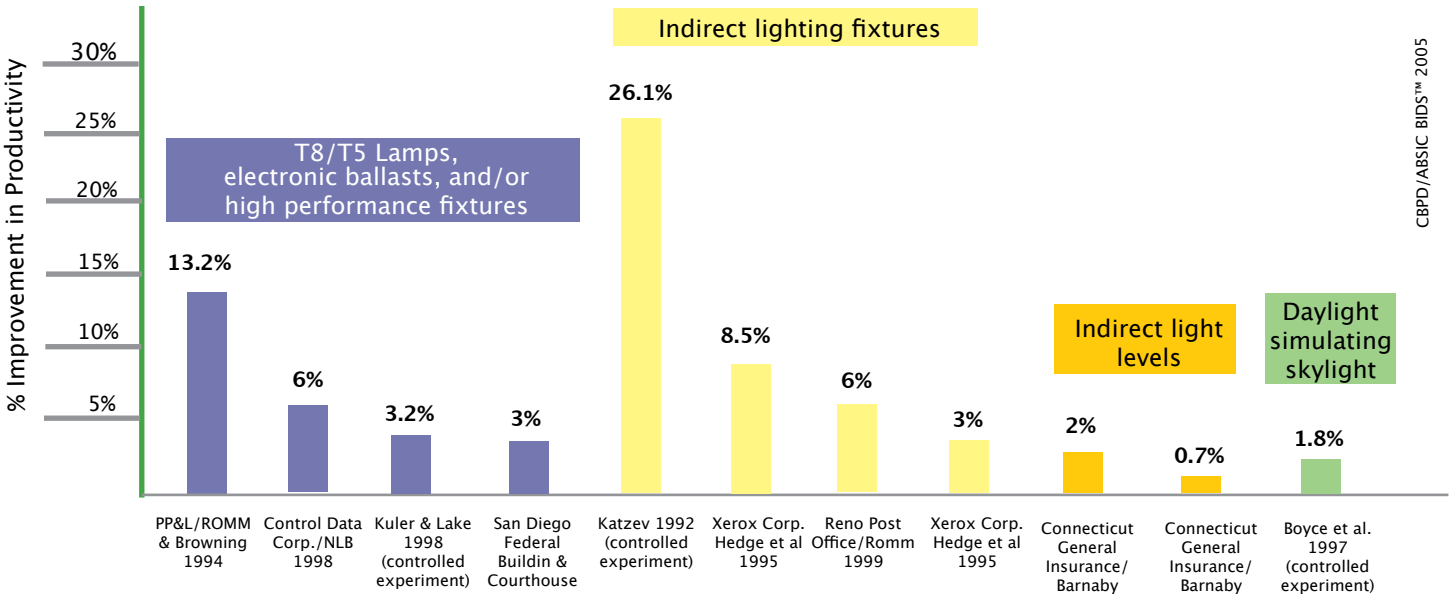
- Students moving into the Ash Creek Intermediate School in Oregon (See Table B) experienced a 15% reduction in absenteeism.[43]
- Students moving from a conventional school to the new green Clearview Elementary School, a 2002 LEED Gold building in Pennsylvania (See Table B and photo on page 13), experienced substantial improvements in health and test scores. A PhD thesis on the school found a 19% increase in average Student Oral Reading Fluency Scores (DIBELS) when compared to the prior, conventional school.[44]
- The Third Creek Elementary School in Statesville, North Carolina (See Table B and front cover photo) is the country's first LEED gold K-12 school. Completed in 2002, the 800 student school replaced two older schools. Documented student test scores before and after the move provide compelling evidence that learning and test scores improve in greener, healthier buildings.

According to Terry Holliday, the Superintendent of the Iredell Statesville Schools (which includes Third Creek Elementary School),

> "Third Creek Elementary School replaced ADR and Wayside Elementary Schools, schools that were two of the district's lowest performing school in regards to test scores and teacher retention/absence. This same group of students and teachers improved from less than 60% of students on grade level in reading and math to 80% of students on grade level in reading and math since moving into the new Third Creek Elementary School. Third Creek had the most gains in academic performance of any of the 32 schools in the school system. We feel that the sustainable approach to this project has had very positive results."[45]

CHPS, LEED and other green school certifications include a range of material, design and operation measures that directly improve human health and productivity. In addition to achieving the related

Figure D: Productivity Gains from High Performance Lighting Systems

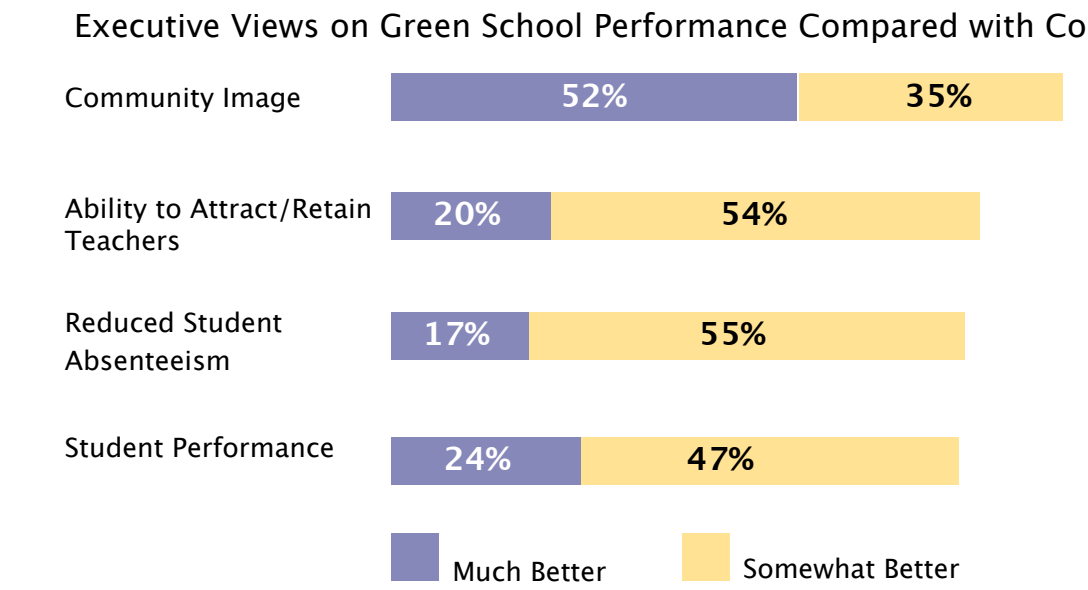


Source: Carnegie Mellon University Center for Building Performance, 2005

air and comfort quality prerequisites, the 30 green schools reviewed achieved about half the available indoor environmental quality points from features specifically designed to improve lighting, air quality and comfort.

Based on actual improvements in design in green schools and based on a very substantial data set (some of which is addressed above) on productivity and test performance of healthier, more comfortable study and learning environments, a 3-5% improvement in learning ability and test scores in green schools appears reasonable and conservative. It makes sense that a school specifically designed to be healthy, and characterized by more daylighting, less toxic materials, improved ventilation and acoustics, better light quality and improved air quality would provide a better study and learning environment.

Figure E: Benefits of Green K–12 Facilities



Source:Turner Construction 2005 Survey of Green Buildings

Clearview High School
John Boecker, Architect with L. Robert Kimball & Assoc.
Photo: Jim Schafer

Financial Impact of Improved Health and Learning in Green Schools

Future Earnings

Faster learning and higher test scores are significantly and positively associated with higher lifetime earnings.[46] A 2005 review of the financial benefits of education in an International Monetary Fund (IMF) publication concludes:

> [Recent] studies, which are based on different, nationally representative data sets that follow students after they leave the education system and enter the labor force, provide remarkably similar estimates: one standard deviation increase (moving from the average of the distribution to the 84th percentile) in mathematics performance at the end of high school translates into 12 percent higher annual earnings — an earnings gain that can be expected across the entire working life of the individual. And there are reasons to believe that these estimates provide a lower bound on the effect of higher educational achievement.[47]

A recent review of five separate studies found an average asthma reduction of 38.5% in buildings with improved air-quality.

An increase in test scores from 50% to 84% is associated with a 12% increase in annual earnings. As discussed earlier, a smaller improvement in test scores can be conservatively expected from high performance schools compared with conventional schools – in the range of 3% to 5%. Based on the IMF analysis cited above, a 3-5% improvement in learning and test scores is equivalent to a 1.4% lifetime annual earnings increase.

Many elements of green design, including efficiency, renewable energy and waste diversion, increase employment.

With average annual salary of about $38,000 per year, this improvement in learning and test scores implies an earnings increase of $532 per year for each graduate from a green school. We are assuming, conservatively, that the earnings benefits last only 20 years, even though studies indicate they last for the employment lifetime of about 40 years. Assuming that earnings rise only at the rate of inflation, the present value is about $6,800 per student, or about $49 per ft^2. (At a marginal combined federal state and local taxes rate of 40% this indicates an NPV over 20 years of additional tax revenue of $2,700 per student, or $20/$ft^2$. If one-third of students move to other states, state-specific employee earnings benefits decline to an estimated 20 year financial benefit of about $33/$ft^2$.)

Increases in earning represent the single largest financial benefit from building healthier, more productive learning environments. Greening school design is extraordinarily cost-effective compared with other available measures to enhance student performance.

Financial Benefits of Asthma Reduction

Asthma is a widespread and worsening disease among school children.[48] The American Lung Association has found that American school children miss more than 14 million school days a year because of asthma exacerbated by poor indoor air quality.[49] Nationally, about one in ten of all school children suffer from asthma.

An American Lung Association 2005 Fact Sheet on Asthma and Children notes that:

Newberg High School
Boora Architects
Photo: Michael Mathers

- Asthma is the most common chronic disorder in childhood, currently affecting an estimated 6.2 million children under 18 years; of which 4 million suffered from an asthma attack or episode in 2003.[50]
- Asthma is the third leading cause of hospitalization among children under the age of 15, and it disproportionately affects children.
- The annual direct health care cost of asthma is approximately $11.5 billion, with additional indirect costs (e.g. lost productivity) of another $4.6 billion.[51]

It costs nearly three times more to provide health care for a child with asthma than a child without asthma.[52] In 2006 dollars this amount is equal to $1,650 per child.[53] Note that most of these health costs are not borne by the schools but rather by the students and their families.

A recent review by Carnegie Mellon of five separate studies evaluating the impact of improved indoor air quality on asthma found an average reduction of 38.5% in asthma in buildings with improved air quality.[54]

We assume the impact of a shift from an unhealthy, conventional school to a healthy school results in a reduction in asthma incidence of 25%. In an average sized new school of 900 students, a 25% reduction in asthma incidence in a healthy school translates into 20 fewer children a year with asthma, with an associated annual cost savings $33,000.[55] Over 20 years, and assuming costs of medical treatment continue to rise at the recent historical rate of 5% per year,[56] at a 7% discount rate this translates into a benefit of over $3/$ft^2$. A small portion of this benefit would accrue directly to the school in the form of reduced need for nurse care and staff time, while the rest would benefit families and the larger community through reduced health-care needs. This calculation underestimates the asthma reduction benefits since it does not reflect health improvements in school faculty and staff, which are only partially captured in the analysis on faculty retention impact below.

Colds and Flu Reduction

Improved ventilation and air quality reduces a range of respiratory illnesses, including common colds and influenza. A review by Carnegie Mellon of two studies evaluating the impact of improved indoor air quality on colds and flu found an average reduction of 51% in buildings with improved air quality.[57] A major review of the literature by Lawrence Berkeley National Laboratory estimates that better ventilation and indoor air quality would reduce these illnesses by 9-20% in the general population, result in 16-37 million fewer cases of the cold and influenza and provide annual savings of $6-14 billion.[58] The average impact of $10 billion, adjusted to 2006 dollars is $13 billion,[59] or about $45 per person per year.

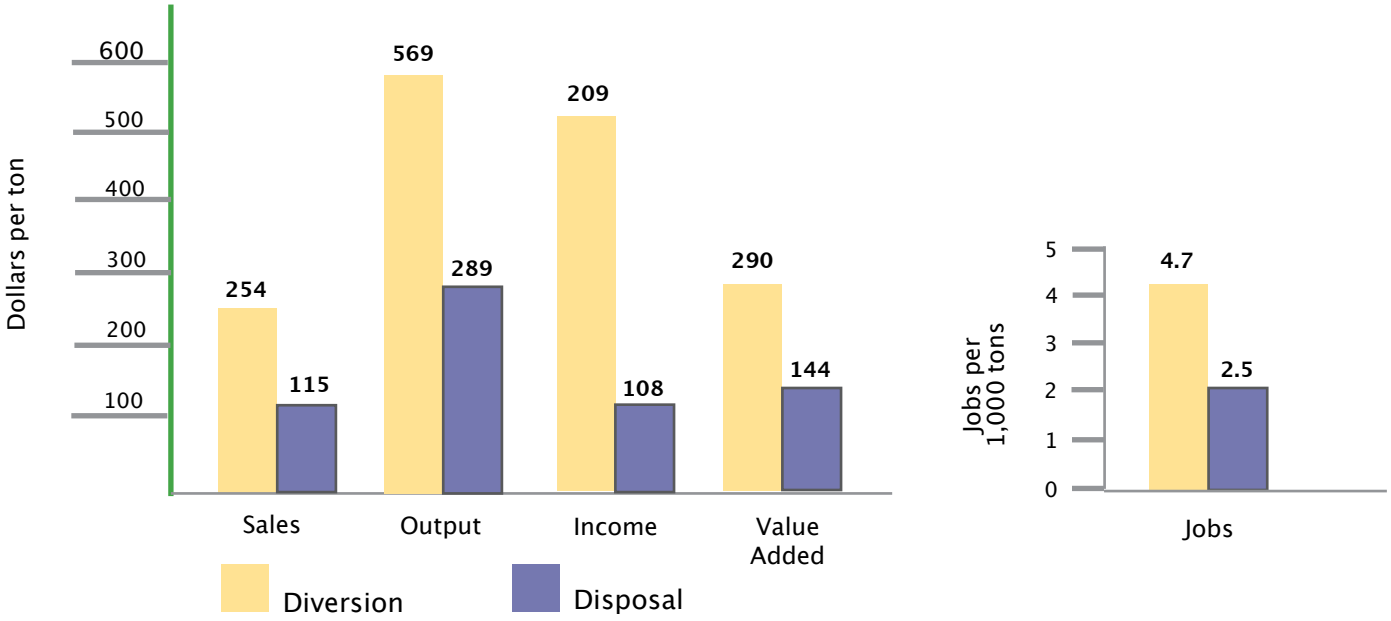
We assume for this study that the impact on children is the same as on adults. This may be a conservative assumption (i.e., it underestimates benefits of green schools for students) because children are more susceptible to the transmission of flu and colds. Adults typically earn much more than children, so the direct cost of a child's illness is far less than for an adult. However, a child sick from school commonly either obligates a parent to stay home from work or pay for childcare to attend the sick child, and is economically disruptive. These secondary costs of children's illness are large. Better ventilation and indoor air quality in high performance schools can therefore be estimated to cut costs per pupil from reduced cold and influenza by approximately $45 per student per year. Over 20 years, and assuming costs of illness continue to rise at the recent historical rate of 5% per year, the present value of reduced incidence of influenza and colds in green schools is over $5/ft^2. As noted above for asthma, a small portion of this benefit would accrue directly to the school.

Teacher Retention

Teachers commonly express concern about school facilities and highlight the issues that green design addresses – lighting quality, temperature control, indoor air quality, etc.

Average salary and benefits for public school teachers can be conservatively estimated at $65,000.[60] A recent report on the impact of green schools in Washington State estimated a 5% reduction in teacher turnover.[61] Cost of turnover is variously estimated to be 25% up to 200% of annual salary plus benefits (this includes costs of termination, hiring, loss of learning, etc).[62] If we assume a 3% reduction in teacher turnover and the relatively conservative estimate that the cost of teacher loss is 40% of salary and benefits - about $25,000, then a 3% increase in teacher retention (at an average estimated 2,300 ft^2 of school space per teacher) translates into a financial savings of about $4/ft^2 over a 20 year period from increased teacher retention.

Figure F: Job Impacts of Waste Diversion vs Disposal



Source:Goldman and Ogishi, UC Berkeley, 2001

Employment Impacts of Green Schools

One of the reasons for the adoption of green construction requirements by cities and states is to increase employment. For example, employment benefits are one of the reasons that the New York City Council passed legislation in September 2005 requiring that significant new construction be built green.[63]

A coalition of labor movements, public entities, NGOs and businesses, called the Apollo Alliance, is advocating an ambitious national clean investment program. An Apollo Alliance analysis models a $300 billion national investment over a decade in high performance green buildings, rebuilding public infrastructure, increasing energy efficiency and investing in industries of the future (such as clean technologies), and concludes that this would create 3.3 million jobs.[64] A 2004 report by Black & Veatch on the impact of establishing a minimum energy consumption target for Pennsylvania of 10% from renewables over 20 years would, compared to business as usual, generate a net increase of $10.1 billion in economic output, increase earnings in state by $2.8 billion and

Only 2.5 jobs are created for every 1,000 tons of waste disposed, while 4.7 jobs are created for 1,000 tons of waste diverted.

result in 20,000 more jobs.[65]

75% of senior executives believe that being green improves a school's ability to attract and retain teachers.

Green buildings typically involve greater initial costs to achieve important green objectives such as improved energy efficiency, increased use of renewable energy (on site and off site), and diversion of waste from landfills for reuse or recycling. These changes create local and US jobs and offset wasteful consumption of energy (some of it imported from anti-democratic nations) and improve productivity and the US trade deficit. Each of these aspects of green design – efficiency, renewable energy and waste diversion - involves increased employment compared with conventional non-green buildings.

Third Creek Elementary School
Moseley Architects
Photo: Spark Productions

Energy Efficiency

The typical green school uses one-third less energy than conventional schools. This reduction is a result of a combination of things, including better design, more energy efficiency equipment, and installation of energy efficiency measures such as increased insulation.

A 2004 Massachusetts report found that every $10 million in additional energy efficiency investments contributes about 160 short-term jobs and 30 long-term or permanent jobs. Assuming about $200,000 in additional energy efficiency related investments in a green school relative to a conventional school, investment in energy efficiency creates three short-term jobs through additional work and half of a long-term job per school.[66]

The average income for a permanent job created can be conservatively estimated as $38,000,[67] indicating a long-term annual increase in salary in-state for each green school of $19,000 (half of one fulltime job created from increased energy efficiency). On a 20 year discounted basis, and assuming salaries grow at inflation, this is $250,000 of direct in-state salary created, equal to $2/ft^2 for a typical 125,000 ft^2 school. This calculation does not include the positive net employment impact of short-term jobs created.

Increased Use of Renewable Energy

Green buildings generally use more renewable energy, both on site and off site, than conventional buildings, primarily from purchase of green power and renewable energy credits. Use of renewable energy generally displaces less labor intensive and more polluting energy sources such as imported heating oil, gas, and coal burned in power plants to make electricity.

A shift to more renewable energy would also increase employment. Compared with a business as usual energy growth mix, expanding renewable energy use to 20% nationally by 2020 would create roughly 100,000 net new jobs nationally. The majority of these jobs would be in manufacturing and construction, and would be relatively well paid and broadly distributed (all states would experience positive employment growth) and would particularly benefit sectors of the economy suffering relatively high unemployment.[68]

It is beyond the scope of this report to estimate the positive employment benefit from increased use of renewable energy in green schools. This increase in employment is expected to be significant, so not calculating it underestimates the financial benefits of requiring that schools be green.

Waste Diversion

A third way that green schools increase employment is by diverting waste from landfills to more labor intensive activities such as separation and recycling.

A recent UC Berkeley study found that total economic impacts

from diversion are nearly twice as large as the impacts from sending these materials to dumps. One ton of waste diverted to reuse/recycling generates about twice the employment impact of a ton of waste disposed in a landfill. Only 2.5 jobs are created for every 1,000 tons of waste disposed, while 4.7 jobs are created for waste diverted as recyclables (See Figure F). [69]

A comprehensive Massachusetts study on the environmental benefits of recycling calculated that the total benefits per ton were $151-$331.[70] As noted above, the UC Berkeley study found that diversion was about two times as labor intensive as disposal. This report does not calculate the employment benefits of increased diversion in green schools, but they appear substantial.

Conclusion on Employment Impacts

Clearly green schools create more jobs than conventional schools. Most energy used in schools comes from burning fossil fuels, some of which is imported from countries that fund terrorism. Thus, the shift to more energy efficiency, which includes in-state manufacturing, system design and installation labor for insulation, renewable energy systems, better windows, etc., would have significant positive employment, economic and security impacts. This report calculates only one of these – long-term employment impact of increased energy efficiency – and it is found to provide $2/ft^2 of benefits.

Additional Non-Quantified Benefits

Green schools provide a range of additional benefits compared with conventional schools. Some of these are discussed below.

Reduced Teacher Sick Days

Improved air, comfort and health in green school buildings positively affect teachers. As discussed above, improved lighting, ventilation and indoor environmental quality significantly improve measured health and productivity benefits for workers in buildings. As indicated in Figure E, three quarters of senior executives interviewed for the 2005 Turner Construction survey believe that being green improves the school's ability to attract and retain teachers. A PhD thesis on the Clearview Elementary School (See table B), a 2002 LEED silver building in Pennsylvania, found that teachers experience 1.41 fewer missed working days, a 12% decrease from previous traditional school.[71] If teachers experience a 7% decrease in sick days in green schools - one day a year less because of healthy air and a better work environment - the reduced cost of substitute teachers provides a present value of about $2/ft^2. Conservatively, this benefit is not included in this report.

Heat Island Reduction Measures

Non-reflective building surfaces absorb more sunlight, increasing temperature within buildings, as well as on exterior surfaces. In cities this effect creates urban "heat islands" and an associated need for increased air conditioning. Non reflective (typically dark) roofs can be substituted with reflective roofs or green, planted roofs – collectively known as "cool roofs" - and significantly reduce city or local temperature as light/heat is reflected back into space rather than absorbed and radiated locally. By reducing ambient urban temperatures, heat island reduction directly contributes to reduced ozone creation, in turn reducing the large human health costs associated with smog. In addition to positive energy and heat island impacts, cool roofs also experience less expansion and contraction than non-reflective roofs, which contributes to a significant extension of the roof life. Typically, highly reflective roofs last 20% longer than conventional roofs.[72] Green roofs (with plants in soil on an impermeable membrane) are expected to last 30-50 years or longer.

Lowered ambient air temperature cuts smog formation, improves comfort and health and cuts the cost of air conditioning. The financial benefits of this aspect of greening schools are substantial but are not quantified here.

Lower Operations and Maintenance (O&M) Costs

A major recent study of costs and benefits of green buildings for 40 state agencies found that the operations and maintenance (O&M) benefits of greening California public buildings provide savings worth $8/ft^2 over a 20 year period.[73] Green schools, like other green buildings, incorporate design elements such as commissioning and more durable materials that reduce O&M costs. For example, the Canby School in Oregon, designed by Boora Architects, (see Table B) at a level equivalent to LEED Gold, features exterior surfaces of brick and metal with a baked finish that require virtually no maintenance/painting, as well as a linoleum floor with lower maintenance than conventional flooring.[74] Estimating O&M benefits from green schools is beyond the scope of this study but the benefits are probably significant.

Enhancement of Generating System Reliability and Improved Power Quality

The benefits for businesses and competitiveness from improved power quality resulting from greater energy efficiency can be large. National annual cost of power quality problems and outages have been estimated by the New York State Energy Research and Development Authority and the Electric Power Research Institute at over $100 billion.[75] Power quality concerns are a significant issue for many businesses, and energy efficiency and renewable energy provide an important way to reduce power quality and reliability costs.

The Massachusetts Division of Energy Resources 2004 Annual Report on Energy Efficiency activities notes that:

> By reducing demand, the energy efficiency programs contribute to system reliability in terms of supply adequacy within a particular area or region… all energy efficiency measures… help maintain adequate margins of generation supply, and can help deter brownouts and blackouts…. By reducing load and demand on the power distribution network, the [efficiency] programs

Research has shown that it costs less to recycle most construction and demolition waste than to dispose of it.

decrease the costly likelihood of failures.[76]

This report does not quantify the power quality and reliability economic benefits of greening the nation's schools, but they appear substantial.

Greening public schools creates an opportunity to improve the health and educational settings for all students.

Construction & Demolition Waste Reduction Benefits of Green Schools

About 25% of the solid waste discarded nationally is construction and demolition (C&D) waste, adding up to 130 million tons of waste per year.[77] Fifty-seven percent of national C&D waste comes from non-residential building projects,[78] deriving from three sources: [79,80]

- demolition, which creates about 155 pounds of waste per square foot, and makes up 58% of national non-residential C&D waste;
- construction, which creates about 3.9 pounds of waste per square foot, and makes up 6% of national non-residential C&D waste;
- renovation, which makes up 36% of national non-residential C&D waste.

Research has shown that it actually costs less to recycle most C&D waste than to dispose of it. A rigorous 1999 study found that for all construction and demolition wastes (including mixed debris), the cost of recycling is less than the cost of disposal by at least 35%.[81]

C&D diversion rates are typically at least 50-75% in green buildings and have reached as high as 99% on some projects.[82]The green schools studied in this report have an average C&D diversion rate of 74%. The financial benefits of increased waste diversion are not estimated here but appear significant.

Insurance and Risk Related Benefits

Health related benefits from green schools have significant risk and insurance impacts. For example, according to the Chief Economist at the Insurance Information Institute, most insurers reported a tripling of mold-related claims in 2002. By early 2003, more than 9000 claims related to mold were pending the nation's courts, though most involve family homes.[83] Improved ventilation and greater commissioning in green buildings reduces the likelihood of mold and associated liability problems.

The Kats/California study characterized the potential insurance benefits of green buildings by mapping risk and insurance related benefits onto the credits of the LEED system. Each LEED prerequisite and credit was evaluated against seven types of risk: property loss, general liability, business interruption, vehicular, health & workers comp, life, and environmental liability. Of the 64 LEED points available (not including innovation credits) 49 (77%) are associated with measures that have potential risk-reduction benefits.

Insurance-related benefits of green, high performance design are summarized below (and reproduced from the Kats/California study). This report does not estimate the value of the risk and liability reduction benefits of green buildings.

Improving Equity and Addressing Spiritual Values

Lower income and minority children disproportionately suffer from poor indoor air quality and related problems in conventional schools. Children in low income families are 30% to 50% more likely to have respiratory problems such as asthma and allergies that lead to increased absenteeism, and diminished learning and test scores. This increase in respiratory problems results in large part from exposure to polluted and unhealthy air and study conditions in schools and at home. Wealthy families can move their children into better designed and healthier private schools. Less affluent families are less likely to have that luxury. Greening public schools creates an opportunity to improve the health and educational settings for all students, regardless of income or background, a process with clear moral benefits. The financial benefits of a less inequitable educational system are difficult to calculate but could be substantial in terms of increased diversity in the work force, community development, increased productivity, etc.

Insurance Benefits of Green Buildings

•Worker Health & Safety. Various benefits, including lower worker's compensation costs, arise from improved indoor environmental quality, reduced likelihood of moisture damage, and other factors enhancing workplace safety.

•Property Loss Prevention. A range of green building technologies reduce the likelihood of physical damages and losses in facilities.

•Liability Loss Prevention. Business interruption risks can be reduced by facilities that derive their energy from on-site resources and/or have energy-efficiency features. These risks include those resulting from unplanned power outages.

•Natural Disaster Preparedness and Recovery. A subset of energy efficient and renewable energy technologies make facilities less vulnerable to natural disasters, especially heat catastrophes.

Many people are spiritual and religious, and value environmental richness and environmental protection as an important spiritual issue. For example, a recent Le Moyne College/Zogby International Contemporary Catholic Trends Poll found that 87% of those polled said that protecting the environment is an important issue, with 21% placing it as "the most important issue" facing America today.[84] For many Americans, protecting the environment and God's creatures by cutting energy waste and air and water pollution is a very important part of their religious and spiritual value system.

While spiritual, religious and moral values are difficult to quantify they are important and are relevant for school design choices.

Educational Enrichment as an Aspect of Greener, Healthier Facilities

High performance schools provide hands-on educational opportunities that conventional schools do not. For example, on site renewable energy generation, water conservation features and other green technologies provide very valuable opportunities for hands-on learning. Sidwell Friends, a highly regarded Quaker affiliated school in Washington DC, is making greening a principal objective in its campus renovation and expansion. The ongoing effort to make the school's building more environmentally-friendly and healthy provides a rich source of hands-on educational material for both full time and summer students. Mike Saxenian, Assistant Head of the School and Chief Financial Officer says that "students have responded with enthusiasm to the school's decision to build green, and faculty are eager to use the new facilities as a laboratory to demonstrate solutions to environmental problems discussed in class. Trustees, faculty and administrators see the green building program as an affirmation of the school's core values."[85]

Summary of Additional Benefits

These additional benefits of greening schools – including reduced teacher sick days, lower operations and maintenance costs, improved electricity quality and reliability, reduced insurance and risk related costs, and improved educational quality - are all substantial benefits that are not quantified in this study. These additional benefits, if calculated, would greatly increase the recognized financial benefits of greening schools and further strengthen the case that building conventional relatively inefficient and unhealthy school buildings today is financially imprudent and even irresponsible.

Figure G: Executives' Views of Green Building Benefits

Source:Turner Construction 2005 Survey of Green Buildings

Note on Impact of Increased Experience with Green Buildings

There is a learning curve associated with designing and building green schools. For both public and private owners and developers of green buildings, subsequent green buildings generally cost less than the first. The trend of declining costs associated with increased experience in green building construction has been experienced in Pennsylvania,[86] as well as in Portland and Seattle. Portland's first three reported completed LEED Silver buildings incurred cost premiums of 2%, 1% and 0% respectively.[87] Seattle saw the cost premium of

The financial benefits of greening schools are about $70 per ft², more than 20 times as high as the cost of going green.

LEED Silver buildings drop from 3-4% to 1-2%.[88]

Similarly, a recent survey by the national construction firm, Turner Construction, found that the recognized benefits of green building in a range of areas, (including health benefits and productivity) increase significantly as they gain experience with green buildings (see Figure G).

Greening schools today is extremely cost-effective, and represents a fiscally far better design choice.

For example, 78% of executives in organizations not involved with green building believe that greening a building improves health and well being of occupants, while 88% of executives in organizations with experiences of green buildings hold this view. Thus, increased experience with green buildings both reduces costs of building green and increases the recognized benefits of green design. For school districts considering greening their schools, these trends highlight the large educational and financial benefits of greening both new and existing schools.

Conclusions

Greening school design is extremely cost-effective. Green schools cost on average almost 2% more, or $3 more per ft^2, than conventional schools. The financial benefits of greening schools are about $70 per ft^2, more than 20 times as high as the cost of going green. Only a portion of these savings accrue directly to an individual school. Lower energy and water costs, improved teacher retention, and lowered health costs save green schools directly about $12/$ft^2$, about four times the additional cost of going green, and enough to hire an additional full-time teacher.

Financial Benefits of Green Schools ($/ft^2)	
Energy	$9
Emissions	$1
Water and Wastewater	$1
Increased Earnings	$49
Asthma Reduction	$3
Cold and Flu Reduction	$5
Teacher Retention	$4
Employment Impact	$2
TOTAL	$74
COST OF GREENING	($3)
NET FINANCIAL BENEFITS	$71

Analysis of the costs and benefits of 30 green schools and use of conservative and prudent financial assumptions provides a clear and compelling case that greening schools today is extremely cost-effective, and represents a fiscally far better design choice. Building green schools is more fiscally prudent and lower risk than continuing to build unhealthy, inefficient schools.

Endnotes

1 This report draws extensively on two recent studies of the costs and benefits of green schools and green buildings: Kats, Greg et al. "National Review of Green Schools: Costs, Benefits and Implications for Massachusetts," a report for the Massachusetts Technology Collaborative (MTC), 2005. Principal Author Greg Kats, Capital E, contributing author Jeff Perlman, Capital E, contributing researcher Sachin Jamadagni, MTC. And Kats, Greg et al. "The Costs and Financial Benefits of Green Buildings," a report to California's Sustainable Building Task Force, 2003. Principal Author: Greg Kats, Capital E, Contributing Authors: Leon Alevantis, Department of Health Services, Adam Berman, Capital E, Evan Mills, Lawrence Berkeley National Laboratory "(on insurance issues)" and Jeff Perlman, Capital E. Task Force Chair: Arnie Sowell. Available at www.cap-e.com.

2 "2005 Survey of Green Buildings," Turner Construction. Available at: http://www.turnerconstruction.com/greenbuildings

3 7% (e.g., 5% real plus inflation) is consistent with the Kats/California Report and is higher (more conservative) than the "Washington High Performance School buildings: Report to the Legislature," which used 5% discount rate. (Washington State Board of Education and Office of the Superintendent of Public Instruction, prepared by Paladino & Company, January 2005)

4 The *Wall Street Journal* lists discount rates daily, dependent upon credit rating. See Market Data and Resources: http://online.wsj.com/public/site_map?page=Site+Map. See also: http://oregonstate.edu/Dept/pol_sci/fac/sahr/cf166503.pdf and http://www.jsc.nasa.gov/bu2/inflateGDP.html.

5 Collaborative for High Performance Schools http://www.chps.net

6 MA Collaborative for High Performance Schools: http://www.mtpc.org/RenewableEnergy/green_schools/chps_standards.htm Also see: http://www.mphaweb.org/pol_schools_green.html for valuable set of resources

7 O'Brien & Company, Inc. and Olympic Associates, Inc. "Washington Sustainable Schools Program – Phase 2. Pilot Project – Final Report."

8 See: http://www.peterli.com/global/pdfs/SPMConstruction2006.pdf, http://asumag.com/mag/university_stalled_momentum/ and also see: http://www.edfacilities.org/cd/dodge0606.pdf

9 Data supplied by the architects except for * - from Doug Sacra, HMFH Architects, November 2005. See: Kats, et al 2005.

10 Personal communication with architect Kevin Hall, OWP/P.

11 "Green City Buildings: Applying the LEED Rating System," Prepared for the Portland Energy Office by Xenergy Inc, and Sera Architects, June 18, 2000.

12 See: http://asumag.com/mag/university_coming_short/

13 See: http://www.eia.doe.gov/cneaf/electricity/epm/tablees1b.html

14 Wiser, Ryan, Mark Bolinger and Matt St. Clair. "Easing the Natural Gas Crisis: Reducing Natural Gas Prices through Increased Deployment of Renewable Energy and Energy Efficiency." Lawrence Berkeley National Laboratory, January 2005. p. 40. http://eetd.lbl.gov/EA/EMP

15 "Hedging Energy Price Risk With Renewables and Energy Efficiency," Platts Research &Consulting Sept, 2004

16 O'Connor, David, Commissioner of the Division of Energy Resources and Beth Lindstrom, Director of the Consumer Affairs and Business Regulation Agencies, "2002 Energy Efficiency Activities Report by the Division of Energy Resources." Summer 2004, Office of Consumer and Business Affairs, Commonwealth of Massachusetts.

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