MULTIFAMILY
GREEN BUILDING GUIDELINES

Getting Started:

An Overview of the Multifamily Green Building Guidelines

GREEN BUILDING
Alameda County Waste Management Authority
Alameda County Source Reduction and Recycling Board

Getting Started:

An Overview of the Multifamily Green Building Guidelines

This Getting Started guide is an abridged version of the Multifamily Green Building Guidelines. To obtain the complete Guidelines visit www.multifamilygreen.org to:

- Download a free electronic copy (6MB PDF file)
- Request a printed edition for free, if you are a design or building industry professional working on multifamily housing projects in Alameda County
- Or, find out where to purchase the printed edition (227 pages)

Visit www.stopwaste.org for other green building resources and tools from ACWMA, including:

- Green Building Guidelines for New Home Construction
- Green Building Guidelines for Home Remodeling
- Green Building Materials Database (searchable online database)
- Builders' Guide to Reuse and Recycling: A Directory for Construction and Demolition Materials
- Model Construction and Demolition Ordinance

Praise for the Multifamily Green Building Guidelines

"Proponents of sustainable communities will find **valuable, practical recommendations and resources** in ACWMA's Multifamily Green Building Guidelines, including strategies for creating healthier and more resource-efficient buildings, designing neighborhoods that encourage pedestrian and bike activity, developing mixed-use communities that take into account the needs of a diverse population, and much more."

Judy Corbett, Executive Director
Local Government Commission, Sacramento, CA

"ACWMA's Multifamily Green Building Guidelines can assist the multifamily development team by providing **a common starting point for the Owner, Architect, and Contractor** to address green building in a proposed project. It provides useful timelines for decision-making, as well as cost/benefit guidelines, technical information and references to additional resources that should facilitate effective discussions regarding green building considerations."

Kirk Wallis, President
Segue Construction, Inc., Pt. Richmond, CA

"**An excellent tool** — one of the best green building resources I've seen for developers of affordable and market-rate multifamily housing."

Lee Novak, Project Manager, A.F. Evans Company, Inc., San Francisco, CA

"With great graphics and easy-to-understand text, ACWMA's Multifamily Green Building Guidelines highlights key community issues such as how to design safe and enjoyable public spaces, strategies for providing walkable and bikeable streets, and ways to ensure ready access to public transit. Whatever your role in the community planning process, you'll find **a wealth of valuable information, resources and recommendations in these new Guidelines."**

Diana Williams, Executive Director
Urban Ecology, Oakland, CA

"Contractors wishing to learn about green multifamily housing will find the Guidelines to be extremely useful. This reference provides **practical, real-world advice**, and addresses the gray area between single family homes and larger commercial buildings. Many strategies can be put into use on current projects at little or no additional cost."

Ross Schaefer, LEED AP, Project Manager
Cahill Contractors, Inc., San Francisco, CA

"The Multifamily Green Building Guidelines will be an **indispensable resource for public policy makers and developers** in the Bay Area. At last, we have a green building guidebook specifically for multifamily housing, and affordable housing in particular."

Dianne J. Spaulding, Executive Director, The Non-Profit Housing Association of Northern California, San Francisco, CA

"ACWMA's Multifamily Green Building Guidelines provides **an in-depth overview of green building for housing developers,** and could be a textbook for any college course on greening affordable housing."

Jeff Oberdorfer, AIA, LEED AP, Executive Director
First Community Housing, San Jose, CA

These Guidelines give developers **concrete examples** of both small and large steps to begin creating the best possible multifamily housing.

Marie A. Lee, Executive Director
Allied Housing, Inc., Hayward, CA

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"Green building is gaining extraordinary momentum as every sector of the building industry begins waking up to the imperative that we create healthier, more resource-efficient buildings. For the multifamily housing sector, ACWMA's Multifamily Green Building Guidelines **provides policy makers, developers, architects and builders with the information and guidance** they need to start building better homes today."

David Gottfried, Founder, U.S. and World Green Building Councils
President, WorldBuild Technologies, Inc., Berkeley, CA

Who should use these Guidelines?

This Getting Started guide is an abridged version of ACWMA's Multifamily Green Building Guidelines. That publication offers detailed, cost-effective recommendations for reducing construction-related waste, creating healthier and more durable homes, lowering operating costs for building owners, and supporting local suppliers of resource-efficient building materials.

FIRST COMMUNITY HOUSING

Common rooms, such as this building at Murphy Ranch in San Jose, are an integral part of multifamily living.

The complete Multifamily Green Building Guidelines provides developers, designers and builders with more than 60 recommended measures for reducing the environmental impacts of building. Each measure contains details about design strategies, construction best practices, code considerations, cost and more. Topics covered include infill development, energy efficiency, indoor air quality, waste management, water conservation and smart resource use. The measures range from basic, commonsense recommendations such as designing entryways so that fewer contaminants are tracked in on people's shoes, to installing sophisticated renewable energy generation systems on site.

This abridged Getting Started guide is for people who want an overview of why to build green, without all the how-to details that make up the bulk of the Multifamily Green Building Guidelines. If and when you're ready for the complete Guidelines, visit **www.multifamilygreen.org** for a free download and ordering information for the 227-page book.

If you or your organization are new to green building, this Getting Started booklet—along with the complete Guidelines, and many other resources offered by ACWMA—will provide you with a solid foundation for getting started. You will find many of the measures to be quite easy to incorporate into projects immediately. Other measures that require more effort can be added to your practice as you gain experience and build support for green design within your organization.

If you are experienced with developing high-quality multifamily housing, some of the recommended approaches and products may already be part of your daily practice. In that case, the complete Guidelines will help you employ more advanced green-building strategies that will reinforce your organization's leadership position.

Does green really matter?

Creating green multifamily housing isn't about altruism. It isn't about doing good or feeling groovy. And it isn't about adding a few bells and whistles to a proposal so that it will pass muster with funders, community leaders or building officials.

VAN METER WILLIAMS POLLACK

Multifamily green buildings can blend harmoniously with contemporary design. The Nueva Vista project in Santa Cruz creates inviting spaces—inside and out.

Green building is about improving our design and construction practices so that the multifamily homes we build today will last longer, cost less to operate, and won't harm the health of workers and residents. It is also about protecting natural resources and improving the built environment so that ecosystems, people, enterprises and communities can thrive and prosper.

Green building represents a paradigm shift—a crucial change in the way we understand, design and build housing in today's world. It doesn't happen by accident—it requires thorough planning, thoughtful design and quality construction. With the budget and time pressures we're all under today, is it really worth the extra effort?

We think it is. Green housing is good for people, good for Bay Area communities, and good for the natural environment. Better buildings, it turns out, are also better for business. Developers, designers and other building professionals who follow "building as usual" practices may find themselves at a competitive disadvantage as regulatory and market forces shift the industry toward built environments that are healthier, more resource efficient and less polluting.

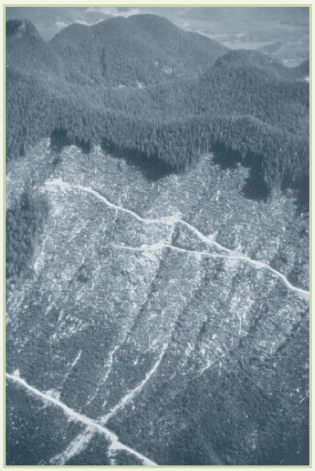
What is green building?

Green building is a whole-systems approach to the design, construction and operation of buildings—from the early stages of development through the final finishes. This approach benefits building industry professionals, residents and communities by improving construction quality, increasing building longevity, reducing utility and maintenance costs, and enhancing comfort and livability.

There's nothing mysterious about green building—it's really just applied common-sense. To move forward with greening your construction project, it is helpful to think of green building as the convergence of three fundamental objectives:

1. Conserve natural resources
2. Increase energy efficiency
3. Improve indoor air quality

ACHAMA



Poorly managed timber harvesting practices can damage ecosystems and harm the long-term economic well-being of local communities.

NATURAL RESOURCES CONSERVATION

Conventional building construction and operation needlessly consume large quantities of wood, water, metal, fuel and other natural resources. Wood, for example, is one of the most common building materials, but it is often used wastefully. Fortunately, advanced framing techniques have been developed that can substantially reduce lumber requirements. And using engineered lumber and wood products certified by the Forest Stewardship Council can help protect old-growth forests. In fact, there are a great variety of effective building strategies that conserve natural resources, as well as providing benefits such as cost savings. One approach is to avoid using unnecessary materials, such as by allowing structural elements like concrete floors to serve as finish materials. Other strategies include using durable products to reduce waste and specifying recycled-content products that reuse natural resources.

ENERGY EFFICIENCY

Energy efficiency is the cornerstone of any green building project. Improving energy efficiency and using renewable energy sources are effective ways to reduce the potential of energy supply interruptions, improve air quality and reduce the impacts of global warming.

Energy efficiency also makes economic sense for building owners and residents: an energy-efficient building saves money by reducing utility bills year after year.

NATIONAL RENEWABLE ENERGY LABORATORY

Advanced framing design elements, such as 24-inch stud spacing and headers made from engineered lumber, save resources while improving building performance. This photo was taken during construction at the Fruitvale Habitat for Humanity project in Oakland.

INDOOR AIR QUALITY

Poor indoor air quality is often caused by mold and mildew that build up as a result of moisture infiltration or poorly designed and maintained heating and cooling systems. Dust, another major source of indoor air pollution, can be reduced by using track-off floor mats at entryways, and by using easily cleanable flooring materials such as natural linoleum, wood or wood alternatives, or concrete. Another common source of indoor air pollution is the offgassing of chemicals found in many building materials. Pressed-wood products such as particleboard and plywood paneling, for example, are typically held together by adhesives that release formaldehyde—a probable human carcinogen—into the home for years after installation.

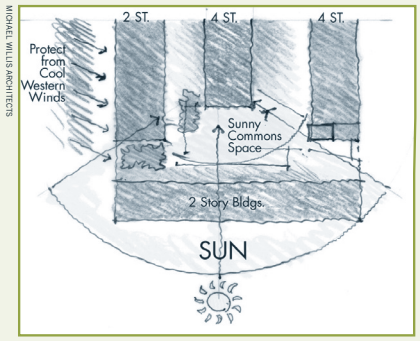
Many paints, floor finishes, adhesives and sealants also emit unhealthy volatile organic compounds (VOCs). Fortunately, the building products industry is responding to these indoor air pollution problems by developing safer products, including alternative glues in pressed-wood products, and low-VOC paint, finish and adhesive products.

Role of integrated design in green building

Too often, design and building disciplines remain highly fragmented: developers and funders select (or are given) a site; architects design the building; mechanical and electrical engineers design HVAC and lighting; and so on. It is rare, for instance, to involve the mechanical engineer in architectural decisions, even though those decisions might significantly affect equipment costs and energy use.

To minimize the cost and maximize the benefits of green building, use an integrated design process that involves people who represent these perspectives:

- Owner
- Occupant (may be represented by an experienced property manager)
- Architect
- Mechanical/electrical/plumbing engineers
- Civil engineer/landscape architect
- Builder/contractor
- Maintenance/operations personnel



MICHAEL WILLIS ARCHITECTS

Wind and sun are used as design elements in this schematic design sketch.

Integrated design aims to connect as many members of a project team as possible. It's important to introduce integration early. Hold meetings early with all the major stakeholders. Tour the site. Discuss green strategies early on and use them to identify the level of green desired for this particular project.

Set clear goals from the beginning. Whatever the goals are—reducing first costs, for example, or providing healthy interiors—every team member must be aware of the goals and committed to achieving them.

Integrating the design process allows for creative solutions to complex problems. Questions can be raised and answered openly through a charrette or team meeting. New technologies or practices are explored as a group, allowing enthusiasm, skepticism and solutions to surface at the same time. Misconceptions can be cleared up, and changes to standard practice can be highlighted as a learning experience.

It's no coincidence that buildings designed this way are better buildings. Strategies like passive solar heating take time and care to design, but can significantly reduce heating needs, improve comfort, and, except in extreme cases, eliminate the need for air conditioning.

How integrated design can reduce costs

While the health and environmental benefits of green building are well established, many people still assume that green building costs more. But taking an integrated approach to design can actually reduce construction and operating costs. A contractor, for example, can be engaged early in design to help steer the design away from expensive solutions and toward cost-effective ones. The options available during schematic design can easily include strategies such as simplifying a building's wall structure by changing the wall articulation to a flat wall with bolted-on overhangs and thick trim. Such a change can often save money and a lot of wood, but would be costly to do once construction documents were underway.

Just as the contractor can help the design team find cost-effective green solutions, so can the other team members. The mechanical engineer may be able to recommend increasing the exterior wall thickness to accommodate more insulation, which could result in reducing the size and cost of the heating system. If the developer is concerned with achieving HUD noise ratings and is part of this conversation, she may ask the engineer whether using special sound-rated windows will also help reduce cooling needs.

These collaborative discussions are powerful, but the range of cost-effective solutions narrows as the design progresses. Consider daylighting, for example. During schematic design, daylighting can be achieved by moving the glazing to the north and south walls and correspondingly adjusting the interior spaces. The cost of this change is close to zero. If daylighting goals aren't raised until the design development phase, it may be possible to provide daylighting by changing the heights of windows and the depth of roof eaves, for a moderate cost increase. But if daylighting goals aren't raised until the construction document phase, daylighting might have to be achieved by selecting high-end glazing and installing light shelves, for a considerable cost increase.

WEIGHING THE COSTS AND BENEFITS

KEMA

Durable roofing tiles such as these look like wood shake but will last 40 years or more.

For every recommendation in the Guidelines, we have carefully weighed the measure's cost against its benefits to justify its inclusion. While not all measures will be applicable to your project, we feel that the measures included are relevant and reasonable for multifamily developments built today.

Some of the recommended measures do cost more initially, but this additional cost needs to be evaluated in the context of the longer-term benefits provided: utility cost savings, better indoor air quality for residents, healthier jobsites for workers, and longer building life. When considering green building measures, it is very important to balance upfront design, product and construction costs with these other significant benefits (this process of evaluating the long-term costs of design decisions is often referred to as "lifecycle cost analysis").

Funding affordable housing involves unique challenges and opportunities, particularly if the design includes green building measures that may cost more upfront but provide long-term benefits. For good information about funding affordable, green multifamily buildings in the San Francisco Bay Area, refer to *The Materials Handbook: Guidelines for Affordable Sustainable Housing*, published by the San Francisco Mayor's Office of Housing and Asian Neighborhood Design (available from www.andnet.org).

Green building can be seen as pushing the design and construction industry to do things that may be new, such as integrating the design process. New practices sometimes cost money. But green buildings are more than just buildings. They are the end result of a collaboration between people on all levels of design and construction who are committed to improving on yesterday's practices.

Taking incremental steps toward building green

KEMA

Swales are attractive landscape features that absorb and filter stormwater runoff, reducing pollution.

Green design comes in many shades. Many projects are "light green": they include a handful of fairly conventional but effective strategies, such as energy-efficient lighting or high-efficiency heating. Other projects are "medium green"— they've taken bigger strides toward including high-performance attributes such as advanced framing or cool roofs. And then there are cutting-edge green projects that fully embrace integrated design and may even have advanced features such as building-integrated photovoltaics.

If you aren't able to take an integrated approach to design on your current project, you can still take steps toward creating a healthier and more energy- and resource-efficient building. Inside the complete Guidelines, you'll find many strategies that are easy to implement and add virtually no cost, such as low-VOC paints, sealants and adhesives, recycled-content carpet, and water-efficient fixtures. Your project may not be labeled "green," but you can still include many of these simpler measures. As your team's experience with green building grows, you'll likely find yourselves scaling up to ever healthier and more effective design and construction practices.

About the recommended measures

FRUITVALE DEVELOPMENT CORPORATION

Residential units located above ground-floor commercial spaces in the Fruitvale Transit Village in Oakland.

The remainder of this Getting Started guide lists the recommended measures (without the how-to details you'll find in the complete Guidelines). The measures are grouped into six sections, which are briefly described here:

Planning & Design. Includes recommendations on site selection, building orientation, mixed-use development, site design that promotes social interaction and physical activity, landscaping strategies, stormwater management, building adaptability and recycling.

Sitework. Includes recommendations on managing the construction process to minimize disruption to the site, protect worker health, use construction materials efficiently and reduce waste.

Structure. Addresses the building's structure and envelope, including concrete, framing, roofing and siding materials, insulation and windows.

Systems. Covers five categories of building systems: heating, ventilation and air conditioning; daylighting and electric lighting; appliances; onsite energy generation; and plumbing fixtures and systems.

Finishes & Furnishings. Addresses healthy, environmentally preferable finishes and furnishings, including adhesives, sealants, paints and metal coatings; flooring options including entryway design, carpet, linoleum and alternatives to wood flooring; reclaimed materials; cabinets, counters and trim; and furniture.

Operations & Maintenance. Covers O&M practices including maintenance manuals and training for residents and building staff, and educational signage and tours.

FIRST COMMUNITY HOUSING

Daylighting coupled with low-VOC finishes and furnishings combine to create enjoyable spaces like these common rooms at El Paseo Studios in San Jose.

BENEFITS CHECKLIST

Most of the measures offer multiple benefits, ranging from reduced waste to better indoor environmental quality to lower maintenance costs. In this Getting Started guide, the measures are presented as checklists that show each strategy's primary benefits. So if you are a policymaker who is particularly interested in enhancing community amenities, you can quickly scan the "Site/Community" column to find measures that can help you meet your goals. Likewise, if you are a project manager with a mandate to lower your project's energy bills, you can scan the "Energy Efficiency" column in each checklist for the most appropriate measures.

Here is a short description of the benefits categories in each checklist:

Health/IEQ: Reduces indoor pollutants, promotes better indoor environmental quality, and/or provides opportunities for improved public health.

Site/Community: Protects land, water and air on and near site from pollution or other environmental damage, uses municipal infrastructure more efficiently by redeveloping building or site, and/or provides important and needed amenities for the surrounding community.

Energy Efficiency: Reduces building energy consumption.

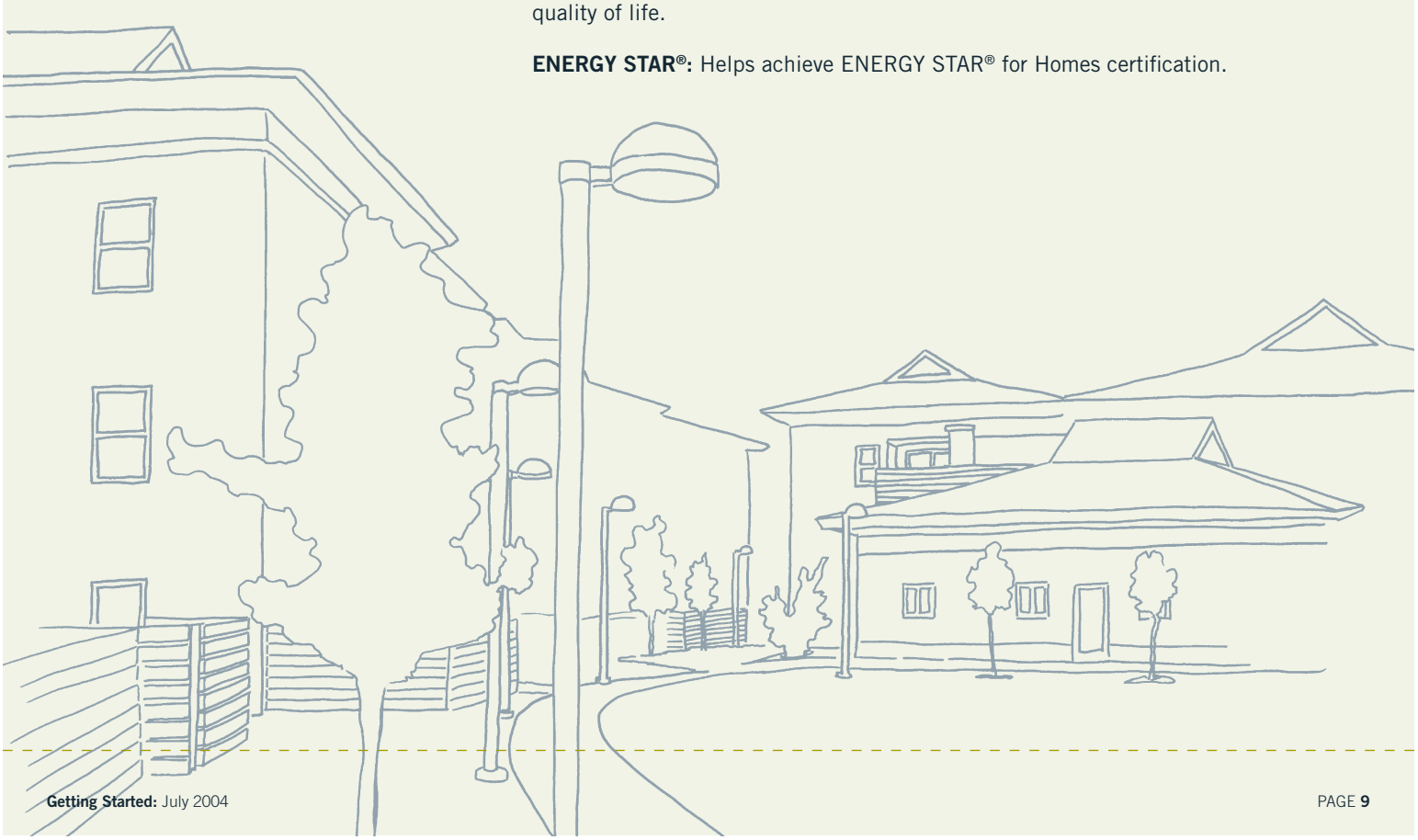
Water Efficiency: Reduces water use in building and/or on site.

Material Efficiency: Reduces, reuses and/or recycles materials that might have otherwise ended up in landfills, reduces materials needed to construct or operate the building, and/or uses materials produced in a way that minimizes environmental damage.

O&M: Increases building's durability, and/or reduces operating and maintenance expenses.

Resident Satisfaction: Saves residents money and/or improves residents' quality of life.

ENERGY STAR®: Helps achieve ENERGY STAR® for Homes certification.



PLANNING & DESIGN

FIRST COMMUNITY HOUSING

Good planning considers the needs of people and the environment. This multifamily development includes rooftop photovoltaic panels on a community building next to a playground.

OVERVIEW

The Planning & Design measures encompass fundamental decisions that, for the most part, need to be made very early in the development process. The choices made at this stage, such as site selection and building orientation, will have a profound effect on the project's success from an environmental, economic and social perspective. Many of these measures go well beyond improving an individual building's performance, by addressing ways in which a development can help strengthen a community's economy and improve quality of life for all its citizens.

The Planning & Design measures are fundamental to integrated design, and should be addressed with as much care, time and resources as the project can bear. Choices made at this stage may affect hundreds of decisions later on. For example, if a decision is made—either actively or by default—to not maximize a building's orientation for best solar access, that may preclude many green design strategies, from passive solar heating to daylighting to eliminating air conditioning.

MEASURE	BENEFITS: Health/IEQ	Site/Community	Energy Efficiency	Water Efficiency	Material Efficiency	O&M	Resident Satisfaction	ENERGY STAR®
01 **Infill sites.** Develop existing urban sites rather than greenfields.	✓	✓			✓		✓	
02 **Mixed-use developments.** Incorporate nonresidential uses in multifamily housing developments.	✓	✓			✓		✓	
03 **Building placement & orientation.** Consider ecology, energy and circulation patterns when orienting buildings.		✓	✓	✓		✓	✓	
04 **Design for walking & bicycling.** Design developments for safe, pleasant walking and bicycling.	✓	✓				✓	✓	
05 **Social gathering places.** Create pleasant outdoor gathering places for residents.	✓	✓				✓	✓	
06 **Design for safety.** Design buildings and landscapes to promote safety.	✓					✓	✓	
07 **Vandalism deterrence & management.** Reduce vandalism through proper design, jobsite management and maintenance.	✓	✓				✓	✓	
08 **Landscaping.** Create healthy landscapes, build healthy soils and reduce waste.		✓	✓	✓	✓	✓	✓	
09 **Cool site.** Mitigate the heat island effect.		✓	✓				✓	
10 **Stormwater management.** Implement strategies for retaining and treating runoff water during construction.		✓		✓		✓		
11 **ENERGY STAR®–certified homes.** Achieve ENERGY STAR® certification on low-rise buildings.	✓		✓		✓	✓	✓	✓
12 **Moisture shedding & mold avoidance.** Design for moisture drainage and sufficient ventilation.	✓					✓	✓	
13 **Recycling collection.** Make it convenient for residents to recycle.					✓	✓	✓	
14 **Recycled products.** Close the loop by specifying recycled products.					✓			
15 **Adaptable buildings.** Design for accessibility and future changes in technology and building use.	✓	✓			✓	✓	✓	

For details on how to incorporate these measures in your project, refer to the complete Multifamily Green Building Guidelines (www.multifamilygreen.org).

KEY CONSIDERATIONS

CONNECTIONS TO THE NATURAL AND BUILT ENVIRONMENT

Fundamental to green design is the relationship between a building and the environment—both the natural and the built environment. While affordable housing projects typically have more site constraints than market-rate housing, every site presents unique opportunities. The design team should carefully assess the site's natural elements—including solar access, wind conditions and existing plant and animal life—and strive to design in harmony with those elements to reduce energy use, increase livability and protect the environment.

Planning and design decisions related to the built environment—existing buildings, streets, commercial development, parks, schools and more—are as important as the decisions related to the natural environment. To assess how to best take advantage of the surroundings, the project team may need to do considerable analysis and develop a number of schematic designs.

COMMUNITY SUPPORT

An important aspect of green multifamily housing is creating conditions that foster economic and social well-being in the community. Many of the Planning & Design measures offer tremendous community benefits, ranging from reduced traffic congestion to more attractive opportunities for recreation to greater economic vitality. For the developer, engaging municipal representatives and community leaders early in the design process can pave the way to a much more successful project.

FIRST COMMUNITY HOUSING

The courtyard at Betty Ann Gardens affordable apartments in San Jose has many elements for natural surveillance: balconies that look toward a central area, benches to encourage leisure time, and proper site lighting.

CODE ISSUES

In some municipalities, density, zoning and other code issues may sometimes conflict with green design strategies, such as infill and mixed-use developments, improved pedestrian and bicyclist access, and even certain environmentally friendly landscaping practices. Early in the planning process, the development team should identify potentially problematic code issues and work with the appropriate officials to overcome these barriers.

COST

For local municipalities, the Planning & Design measures can provide many economic benefits. Developments designed to reduce dependence on cars help ease traffic congestion, which can improve business productivity. Mixed-use developments encourage economic vitality and a diversified municipal tax base. Infill projects help revitalize older urban areas.

For the developer, some of the Planning & Design measures can be done with little or no extra cost if incorporated early. Providing recycling collection facilities, for example, costs very little and can potentially reduce waste disposal fees for years to come. Other measures—such as choosing infill sites and creating mixed-use developments may require additional design time. But cost increases can often be offset or minimized by adopting an integrated design approach.

FOCUS ON PLANNING & DESIGN

Carmen Avenue

This 30-unit community, to be built in downtown Livermore by Allied Housing, was designed green from the start. The buildings are oriented on an east-west axis for passive solar heating and cooling, which will reduce energy consumption while providing comfortable homes. The buildings frame a courtyard that provides attractive outdoor space, and the contractor plans to preserve a large mature tree in the courtyard area. Parking was positioned to the rear of the site so that the homes connect with the community.

To learn more about this project, see the Case Studies section.

SITEWORK

KEMA

Ends and cut-pieces of joists, siding, framing and other building materials are stockpiled for reuse on this jobsite. Pieces not used are donated or recycled once construction is complete.

OVERVIEW

The Sitework measures are designed to protect the health of construction workers and future residents, reduce waste, and prevent pollution of air, soil and waterways. Some of these recommendations are basic good housekeeping procedures that promote safe, efficient work habits, such as using proper procedures to clean up spills. Even if these procedures seem like commonsense, it's important to have clear policies and to train subcontractors and hold them accountable for following best practices.

The three R's—reduce, reuse and recycle—are at the heart of a number of these Sitework measures. Reducing the amount of hazardous and nonhazardous waste at a jobsite is a key step toward protecting public health and the environment. It also saves money. Reuse and recycling are also both environmentally and economically sound practices: On a project where the builder makes an effort to manage waste, up to 80% of construction and demolition debris can be diverted from landfills. Much of this material can be put to good use—either reused on site, recycled or donated.

These recommended practices, in addition to being good for people's health and for the environment, are good for business. Safer, healthier jobsites mean increased productivity and reduced liability. Healthier buildings may also result in fewer callbacks after occupancy.

MEASURE	BENEFITS	Health/IEQ	Site/Community	Energy Efficiency	Water Efficiency	Material Efficiency	O&M	Resident Satisfaction	ENERGY STAR®
01 **C&D waste management.** Reduce, reuse and recycle waste created at the jobsite.			✓			✓			
02 **Efficient use of construction materials.** Organize cut-piles for lumber, drywall and other scrap.						✓			
03 **Construction IAQ management.** Reduce indoor air contamination with an IAQ management plan.		✓	✓				✓	✓	
04 **Hazardous materials and waste.** Reduce potential pollution and health risks.		✓	✓			✓	✓	✓	

For details on how to incorporate these measures in your project, refer to the complete Multifamily Green Building Guidelines (www.multifamilygreen.org).

KEY CONSIDERATIONS

CODES

Many jurisdictions in Alameda County and throughout California require a minimum of 50% construction and demolition (C&D) waste recycling, and some city and county ordinances mandate that a C&D Waste Management Plan be approved prior to obtaining building and demolition permits. The California Integrated Waste Management Board has also adopted a model ordinance that requires a range of diversion rates from 50% to 75%.

With trends in the Bay Area and other regions toward tighter control of waste and pollution, it is likely that these regulations will remain in force or even become more stringent in the future. Following ACWMA's recommended practices will help developers and builders stay ahead of the regulatory curve. It can also help enhance their reputation among stakeholders, including funders, building officials, subcontractors, workers and residents.

BAY AREA RESOURCES

ACWMA provides extensive information about C&D waste management. In addition to the complete Multifamily Green Building Guidelines, resources include a model waste management ordinance, and a specification Section 01505 and waste management plan for recycling C&D debris. ACWMA also publishes the "Builder's Guide to Reuse and Recycling: A Directory for Construction and Demolition Materials." To obtain these publications, call (510) 614-1699 or go to www.multifamilygreen.org.

SCHEDULING

Some of these Sitework measures require particular attention to scheduling. For example, an indoor air quality (IAQ) management plan for construction spells out appropriate strategies for minimizing construction-related IAQ problems. The plan will often specify that porous materials like carpet and furniture should only be installed after finish materials such as paints and sealants have cured, and that carpeting and furniture be aired out before installation. The plan may also require the contractor to schedule a preoccupancy flush-out of the building's interior to reduce the potential for post-occupancy IAQ problems.


ACWMA

Jobsite recycling bins.

SPECIFICATIONS AND CONTRACT DOCUMENTS

To ensure that your Sitework goals are met, include the required diversion levels of construction and demolition (C&D) waste in the Bidder's section of the project summary. Also, include language in the specification Section 01505 requiring C&D diversion. Contract documents should specifically state the role of each party in the construction waste management and construction IAQ management plans, from architect to subcontractor. The documents should clearly hold a responsible party accountable for failure to meet waste management and pollution prevention goals.

COST

Some of these procedures may increase costs initially but save money over the life of the building. An IAQ management plan, for example, will likely result in additional labor and time to develop and implement, but if it is well executed it may result in fewer call backs, and may extend the life of the HVAC system. Training staff on procedures for handling, use and cleanup of hazardous materials can add time but will reduce potential liability.


ACWMA

Using a cut-pile such as this one at the Habitat for Humanity Fruitvale development will greatly reduce waste during construction.

Some alternative, low-toxic materials cost more initially than standard products but result in lower disposal costs and a healthier jobsite and home. Other practices add little or no extra cost. Creating cut-piles for efficient material use, for instance, requires minimal training and labor, yet offers significant savings in material costs and dramatically reduces landfill fees. With the availability of mixed C&D recycling facilities in the Bay Area, implementing a C&D waste management plan requires no more labor than standard industry practice.

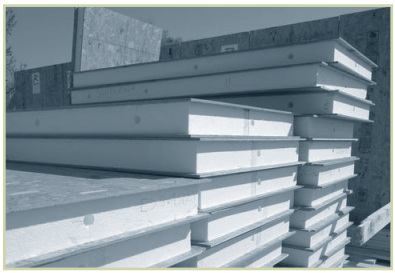
FOCUS ON SITEWORK

To learn more about this project, see the Case Studies section.

The Breakers at Bayport

At the Breakers at Bayport, a community to be built in Alameda by Resources for Community Development (RCD), the architect incorporated ACWMA's model specification 01505 for a construction and demolition waste management plan. The architect and developer reviewed the plan's implications with the contractor. The material recovery facility in nearby San Leandro is achieving high jobsite recycling rates from mixed construction debris boxes, so the project will divert at least 50% of construction and demolition waste.

STRUCTURE



NATIONAL RENEWABLE ENERGY LABORATORY

Structural insulated panels on a jobsite await installation.

OVERVIEW

The Structure measures address the building's structure and envelope, including concrete, framing, roofing and siding materials, insulation and windows. Following the recommendations in the Guidelines will result in more durable buildings that use energy and other resources more efficiently.

Most of the measures represent improvements to, not drastic departures from, standard construction practices. For example, fiberglass batt insulation with no added formaldehyde is installed, performs and costs the same as standard fiberglass batts, plus it helps protect health by reducing exposure to a hazardous air pollutant. Engineered lumber can replace many types of solid-sawn lumber; it is sometimes slightly more expensive, but is typically more dimensionally stable, straighter, lighter and stronger.

It's important that each of these measures be considered within an integrated design process. This will help maximize the building's energy efficiency while reducing costs for individual measures.

MEASURE	Health/IEQ	Site/Community	Energy Efficiency	Water Efficiency	Material Efficiency	O&M	Resident Satisfaction	ENERGY STAR®
01 **Recycled aggregate.** Specify recycled aggregate for fill, backfill and other uses.					✓			
02 **High-volume flyash in concrete.** Use concrete mixes with a high volume of flyash.					✓	✓		
03 **FSC-certified wood.** Use wood products certified by the Forest Stewardship Council.					✓			
04 **Engineered lumber.** Use resource-efficient engineered lumber instead of solid-sawn lumber.					✓			
05 **Advanced framing design.** Use less wood and improve energy efficiency with Optimal Value Engineering (OVE) framing.	✓		✓		✓		✓	✓
06 **Steel framing.** Use steel—a lightweight, durable and recycled framing material.	✓				✓			
07 **Structural insulated panels.** Specify structural insulated panels (SIPs) for walls, roofs and floors.			✓		✓		✓	✓
08 **Raised heel trusses.** Specify trusses with raised heels for better insulation.			✓		✓		✓	✓
09 **Insulation.** Use recycled-content insulation without added formaldehyde.	✓		✓		✓		✓	✓
10 **Durable siding.** Select environmentally preferable, long-lasting siding.	✓				✓	✓	✓	
11 **Durable roofing.** Use long-lasting roofing materials on pitched roofs.	✓				✓	✓	✓	
12 **Cool roof.** Reduce the heat island effect with cool roofing materials.	✓	✓	✓			✓	✓	✓
13 **High-performance windows.** Specify high-performance glazing and insulated windows.	✓		✓			✓	✓	✓

For details on how to incorporate these measures in your project, refer to the complete Multifamily Green Building Guidelines (www.multifamilygreen.org).

KEY CONSIDERATIONS


ACWMA

Cellulose insulation completely fills voids that would otherwise be difficult to insulate with fiberglass.

CONTRACTOR EXPERIENCE

Some of the recommended Structure measures require experience or specialized skills that aren't found on every construction crew. For example, the techniques for designing and working with high-volume flyash concrete are still new to many engineers and contractors. Similarly, if installing damp-spray cellulose insulation, you need an experienced subcontractor who knows how to avoid moisture-related problems. With steel framing, a more skilled labor force is usually needed. As early as possible in the design phase, the project team should identify any measures that might diverge from standard practice.

PRODUCT AVAILABILITY

Many of the recommended materials are readily available. For example, many cities in Alameda County have ordinances requiring construction site waste recycling, so there is plenty of recycled aggregate available. High-volume flyash mixes are also widely available in the Bay Area, as are recycled-content insulation with no added formaldehyde, engineered lumber, and high-performance windows. Other products may require more effort to obtain. For example, while hardwoods certified by the Forest Stewardship Council (FSC) are generally more readily available than FSC softwoods, supply fluctuates, which affects both availability and price. Early in the design phase, the project team should flag any products or materials that might have longer lead times or require extra effort to source so that the contractors can work to ensure that they will be on hand when needed.

ACWMA maintains an online database of green building products and materials available locally and suitable for multifamily buildings. The database, which is searchable by product category, product name and measure number, is available at www.multifamilygreen.org.


ACWMA

Cool roof sheathing being installed on a flat roof.

COST

An integrated design approach will help reduce construction costs as well as operating costs. For example, it may be possible to downsize or eliminate the air-conditioning system if the design includes a cool roof combined with other energy-saving features, such as overhangs, increased insulation, high-performance windows and proper building orientation.

Other measures may cost more than conventional construction if the product itself is more expensive, the technique is more labor intensive, or the contractors have limited experience with the technique and therefore submit higher bids. For example, studies have estimated that, overall, installed steel framing costs anywhere from 0% to 7% more than wood framing, mostly because of increased labor costs. However, steel prices are more constant than wood prices, resulting in longer price guarantees from manufacturers, which helps with project budgeting. Compared to conventional wood framing, advanced wood framing design does require some additional effort during design and careful oversight of the framing contractor in the field. But it can reduce lumber use by as much as 20% to 30%, while also providing more room for insulation and increasing the building envelope's energy efficiency.

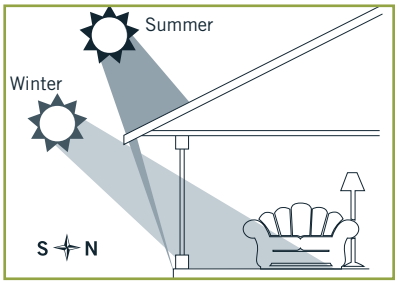
FOCUS ON STRUCTURE

To learn more about this project, see the Case Studies section.

Carmen Avenue

This 30-unit community, to be built in Livermore by Allied Housing, is designed to be comfortable and energy efficient even when summer temperatures exceed 100°F. The goal is to reduce the need for air conditioning to the point where it is rarely required. Almost all glazing is on the south and north sides, with overhangs on the south facades for shading. Passive solar heating and cooling have been incorporated into the design. Formaldehyde-free fiberglass batt insulation in the walls (R-19) and loose-fill cellulose in the roof cavity (R-38), plus low-e insulated glazing with vinyl windows, will help keep the units comfortable while reducing utility bills. Natural ventilation from consistent afternoon breezes and cool night air contribute to the comfortable, energy-efficient design.

SYSTEMS



Proper overhang design on south windows will keep out the summer sun while allowing sunlight into the space on winter days.

OVERVIEW

The Systems measures addresses five categories of multifamily building systems: heating, ventilation and air conditioning (passive and mechanical); daylighting and electric lighting; appliances and other energy-using equipment; onsite energy generation; and plumbing fixtures and systems.

These measures provide two main benefits: energy efficiency and better indoor environmental quality (IEQ). In green residential buildings, energy efficiency and IEQ are complementary goals. Buildings with high-efficiency heating and cooling equipment, for example, tend to be more comfortable. Effective duct systems and advanced ventilation practices provide better indoor air quality. Daylit spaces can save electric lighting energy and make a home more pleasant. And an energy-efficient building saves money for building owners and residents year after year.

MEASURE	BENEFITS: Health/IEQ	Site/Community	Energy Efficiency	Water Efficiency	Material Efficiency	O&M	Resident Satisfaction	ENERGY STAR®
01 **Passive solar heating.** Reduce mechanical heating by using passive solar design.	✓		✓		✓	✓	✓	✓
02 **Thermal mass flooring.** Use mass flooring together with passive solar design.	✓		✓		✓	✓	✓	✓
03 **High-efficiency heating.** Save energy with high-efficiency heating equipment.	✓		✓			✓	✓	✓
04 **Radiant hydronic space heating.** Use in-slab and baseboard radiant hydronic systems for comfortable, efficient heating	✓		✓			✓	✓	✓
05 **Solar water heating.** Use solar collectors to preheat domestic hot water.			✓		✓	✓	✓	✓
06 **High-efficiency water heating.** Specify high-efficiency water heaters or boilers.	✓		✓	✓		✓	✓	✓
07 **Avoid air conditioning.** Design buildings so that air conditioning can be eliminated.	✓		✓			✓	✓	✓
08 **High-efficiency A/C with advanced refrigerant.** Specify high-efficiency A/C with environmentally preferable refrigerant.			✓		✓	✓	✓	✓
09 **Duct effectiveness.** Properly size, seal and insulate ducts for better performance.	✓		✓			✓	✓	✓
10 **Advanced ventilation practices.** Reduce air infiltration and use effective, efficient strategies for natural and mechanical ventilation.	✓		✓			✓	✓	✓
11 **Garage ventilation.** Design parking structures for safe air quality and low energy use.	✓		✓			✓	✓	✓
12 **Daylighting.** Illuminate spaces with natural light.	✓		✓			✓	✓	
13 **High-efficiency lighting.** Specify linear and compact fluorescent lamps.	✓		✓		✓	✓	✓	✓
14 **Light pollution reduction.** Design outdoor lighting to minimize glare and light pollution.		✓	✓				✓	
15 **Onsite electricity generation.** Consider generating electricity on site with photovoltaics (PV), wind turbines or microturbines.		✓	✓			✓	✓	
16 **Elevators.** Specify gearless elevators; use biodegradable lubricating oils.		✓	✓			✓		✓
17 **ENERGY STAR® appliances.** Install ENERGY STAR® refrigerators, dishwashers and clothes washers.			✓	✓		✓	✓	
18 **Central laundry.** Locate clothes washers and dryers in central areas.	✓		✓	✓	✓	✓	✓	
19 **Water-efficient fixtures.** Specify faucets, showerheads and toilets that use less water.			✓	✓		✓	✓	

For details on how to incorporate these measures in your project, refer to the complete Multifamily Green Building Guidelines (www.multifamilygreen.org).

KEY CONSIDERATIONS

FIRST COMMUNITY HOUSING

Solar panels can double as covered parking.

KEMA

This tuck-under garage allows for natural ventilation with minimal visual impact.

INTEGRATED DESIGN

A few of the Systems measures, such as ENERGY STAR® appliances and water-efficient fixtures—could be treated as independent strategies that can be added to a project at any stage in its development. But the majority are closely tied to other recommended measures in the Guidelines and should be evaluated as part of an integrated design process. Measures such as daylighting, passive solar heating and eliminating air conditioning depend heavily on early decisions regarding orientation, building massing, glazing location and area, wall and roofing thickness, and insulation.

COST

Some of the Systems measures offer quick paybacks or cost no more upfront than conventional multifamily housing design; these include light pollution reduction, fluorescent lighting, gearless elevators in mid-rise buildings, low-flow fixtures and some ENERGY STAR® appliances. Other measures may increase first costs, either because of added design time or higher equipment costs, but save money in other areas. For example, if a building is designed with energy-efficient features such as increased insulation, air sealing, high-performance windows and high-efficiency duct systems, it may be possible to install smaller, more efficient heating systems, and to eliminate or downsize mechanical cooling systems. The savings in equipment costs may more than pay for the energy-efficiency upgrades.

Incentives are available for environmentally preferable onsite generation systems. For market-rate housing, the payback on photovoltaic systems is about 8 to 15 years. In some instances, affordable housing developers can acquire tax credits and incentives to cut the payback periods in half.

SPECIALIZED EXPERIENCE

To successfully incorporate some of the recommended Systems measures, it may be necessary to seek designers and subcontractors with specific expertise. For example, the principles of passive solar design are generally understood by most architects, but many are inexperienced with the required details; consulting an experienced passive solar designer will help ensure that the building is comfortable and performs as intended. Similarly, onsite electricity generation and solar water heating require designers and installers with proven expertise.

FOCUS ON SYSTEMS

Johnson Creek Commons

The Johnson Creek Commons project in Portland, Oregon, combined a green retrofit of an aging 15-unit complex with the development of a new duplex. As part of the retrofit, electric resistance baseboard heating was replaced with efficient radiant cove heaters, energy-efficient appliances were installed, and incandescent lights were replaced with compact fluorescents in kitchens and bedrooms. These measures, combined with envelope upgrades such as increased insulation, weatherstripping, and high-performance windows, cost $43,942, with an estimated payback of only 2.5 years. The new duplex was designed from the start with many of these energy efficiency features.

To learn more about this project, see the Case Studies section.

FINISHES & FURNISHINGS

KEMA

Permanent entryway grilles like this one help reduce tracked-in contaminants at central entrances.

OVERVIEW

The finishes and furnishings that help transform a building shell into a home play an important—and often highly visible—role in determining how green and healthy that home will be.

Certain conventional finishes and furnishings may undermine a project's green goals. For example, cabinets made with particleboard containing urea-formaldehyde binders may continue to release formaldehyde, a probable carcinogen, into a home for years after installation. Using environmentally preferable finishes and furnishings can help ensure that a building is durable, resource efficient, and healthy for workers and residents.

MEASURE	Health/IEQ	Site/Community	Energy Efficiency	Water Efficiency	Material Efficiency	O&M	Resident Satisfaction	ENERGY STAR®
01 **Entryways.** Design entryways to reduce tracked-in contaminants.	✓					✓	✓	
02 **Interior paint**. Specify low- and zero-VOC interior paint.	✓	✓				✓	✓	
03 **Adhesives and sealants.** Specify solvent-free (low- and zero-VOC) adhesives and HCFC-free foam sealants.	✓	✓				✓	✓	
04 **Radiant hydronic space heating.** Use in-slab and baseboard radiant hydronic systems for comfortable, efficient heating.	✓	✓			✓	✓	✓	
05 **Carpeting.** Select natural, recycled-content and low-VOC carpet.	✓				✓	✓	✓	
06 **Natural linoleum.** Use natural linoleum for resilient flooring.	✓				✓	✓	✓	
07 **Wood flooring alternatives.** Consider FSC-certified, reclaimed and engineered wood; cork; and bamboo.					✓	✓	✓	
08 **Reclaimed materials.** Reduce landfill waste by using reclaimed materials.					✓			
09 **Cabinets, counters & trim.** Specify low-toxic and durable cabinets, counters and trim.	✓				✓	✓	✓	
10 **Furniture & outdoor play structures.** Specify durable, healthy, resource-conserving furniture and play structures.	✓	✓			✓	✓	✓	

For details on how to incorporate these measures in your project, refer to the complete Multifamily Green Building Guidelines (www.multifamilygreen.org).

KEY CONSIDERATIONS

DESIGN PROCESS

Ideally, green finishes and furnishings should be specified early, as part of an integrated design process. It is possible, however, to make incremental improvements to a conventional building that is already underway by including some of the green finishes and furnishings measures. For example, if the original design calls for vinyl flooring, it may be possible to substitute natural linoleum if there is funding for the added cost. Low-VOC paints can readily be substituted for conventional VOC-compliant paints, although the cost may be slightly higher and allowances may need to be made for differences in paint coverage and drying time.

AVAILABILITY

Green and healthy finishes are now much more readily available than even a few years ago. All major paint manufacturers, for example, make low- or zero-VOC paints that meet performance requirements. There are many suppliers of linoleum and recycled-content carpet. Other products, while generally available, may require more effort to obtain, such as cabinetry with no added formaldehyde.

ACWMA maintains an online database of green building products and materials available locally and suitable for multifamily buildings. The database, which is searchable by product category, product name and measure number, is available at www.multifamilygreen.org.


FIRST COMMUNITY HOUSING

These cabinets have MDF cores that contain no added formaldehyde.

COST

It is critical that operations and maintenance costs be taken into account when considering the costs of finishes and furnishings. Some conventional products cost less initially than environmentally preferable options, but are inferior in quality and will require frequent and costly maintenance, repair or replacement. Many green finishes and furnishings are cost-competitive with conventional products and can be used in virtually any affordable multifamily housing project. These include low-VOC paints, HCFC-free sealants, recycled-content carpet, factory-applied metal coatings and entryways designed to reduce tracked-in pollutants. Certain materials, such as recycled ceramic tile and bamboo flooring, may tend to cost more than conventional products, requiring a special commitment from the developer. But some of these more expensive green products may provide a marketing advantage—attractive green materials have a certain cachet among environmentally aware renters, homebuyers, and perhaps even funders.

INSTALLATION AND SCHEDULING

On any jobsite, whether it's a green or conventional project, it is important to follow safe and healthy practices such as providing proper ventilation when applying paint, adhesives and sealants, which typically offgas the most when they are wet and being applied. Going beyond basic practices and carrying out an IAQ management plan for construction and preoccupancy phases is strongly recommended. This may affect scheduling. For example, flushing out interior spaces may require extra time in the construction schedule.


FIRST COMMUNITY HOUSING

Durable common area furniture.

PRODUCT SUBSTITUTIONS

Be sure the entire design and construction team understands the project's green building goals and requirements so that design intentions aren't compromised by product substitutions. To someone not familiar with the principles of green building, one brand of carpet, for example, may seem as good as another, but the specified product may have characteristics such as superior durability, recycled content or low emissions. In bidding and construction documents, clearly spell out product specifications, and, where appropriate, provide product brand names and even contact information for local suppliers.

MAINTENANCE

To ensure that finishes and furnishings continue to provide health, durability and environmental benefits, they need to be properly maintained, using effective but low-toxic cleaning products and maintenance techniques. Teach staff and residents about appropriate maintenance procedures, and give residents some guidance on where to find and how to choose green, healthy furnishings (see the Operations & Maintenance section).

FOCUSES ON FINISHES & FURNISHINGS

To learn more about this project, see the Case Studies section.

Betty Ann Gardens

In the Betty Ann Gardens Family Apartments in San Jose, low-VOC interior paints and varnishes were used throughout the project, helping to protect indoor air quality. All carpet contains recycled materials, minimizing the use of virgin plastics. Carpet tiles, rather than rolls, were used so that worn or damaged tiles can be selectively replaced rather than replacing large sections of carpet. Natural linoleum, a durable material made from renewable resources, was used for kitchen and bathroom flooring.

OPERATIONS & MAINTENANCE

AP/WWA

Signs like this one, from the media tour of the Livermore Centex zero net energy home, highlight environmental attributes of materials.

OVERVIEW

Green design isn't over when the contractors pack up and the residents move in. To maximize the benefits of energy efficiency, durability and indoor environmental quality, green buildings must be properly operated and maintained over their entire life.

Building operation and maintenance (O&M) shouldn't be an afterthought to the development process, and it shouldn't be reduced to a checklist of cleaning procedures and replacement schedules. It's important that the people who live and work in green multifamily housing be given information and encouragement so that they will be motivated to care for their homes, the common areas and the grounds. There are two important components to fostering this motivation:

» Provide training and manuals to staff and residents so they have the information and resources necessary to properly operate and maintain the building.

» Provide signs, displays or tours to demonstrate important green features to residents, staff, the public and the media.

MEASURE	BENEFITS	Health/IEQ	Site/Community	Energy Efficiency	Water Efficiency	Material Efficiency	O&M	Resident Satisfaction	ENERGY STAR®
01 **Training and manuals.** Provide residents and staff with training and information.	✓	✓	✓	✓	✓	✓	✓		
02 **Educational signage & tours.** Teach people about the project's green features.	✓	✓	✓	✓	✓	✓	✓		

For details on how to incorporate these measures in your project, refer to the complete Multifamily Green Building Guidelines (www.multifamilygreen.org).

KEY CONSIDERATIONS

INTEGRATED DESIGN

Good O&M practices actually start not with the building manager but with the developer and the architect, and should be addressed early in the design process. Specifying high-quality, durable, vandal-proof materials will make a project easier to maintain over time. Site and building designs that encourage community interaction will instill pride in residents and deter crime (for design strategies that provide the foundation for a well-maintained, durable project, see the Planning & Design section).

COMMISSIONING

Green building guidelines for commercial construction often recommend that the project be commissioned. Commissioning is a systematic process of ensuring that all new building systems perform and interact according to original design documents and the owner's intentions. However, in multifamily residential projects—and in affordable housing projects in particular—commissioning per se is not generally performed. One reason is that building systems in large commercial buildings tend to be much more complex than those in small-scale multifamily buildings. Also, affordable housing developers often own and operate their projects or represent the owner's interests, so they are typically closely involved in the design process and perform a high level of testing during construction. Design teams might want to explore the benefits of commissioning if they are developing a large, high-rise multifamily project with complex building systems.

KEY CONSIDERATIONS

COST

Over the life of a building, O&M costs will greatly outweigh construction costs, so it makes sense to take steps to design a durable, energy-efficient, low-maintenance building. No matter how well designed, however, every building needs to be properly operated and maintained if it is to perform well year after year. Energy-efficient homes, for example, will only offer substantial long-term cost savings if occupants understand how they work. This is especially true for design strategies that people may be unfamiliar with, such as passive solar heating.

It does take time to develop manuals, signage and displays and to provide O&M training to staff and residents. While it's difficult to quantify the cost savings that result from these efforts, it is reasonable to assume they will contribute to a healthier, longer-lasting, more energy-efficient building.

MARKETING AND COMMUNITY RELATIONS

Educational displays and tours can be an important marketing tool for developers. For affordable housing projects, these efforts can enhance a developer's reputation among stakeholders including community and political leaders and funders. For market-rate housing developers, displays and tours can attract positive media attention, which may help drive interest from potential tenants and buyers.

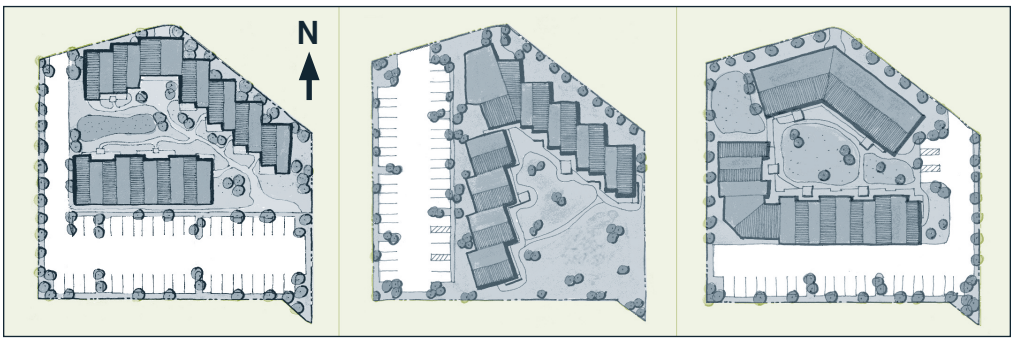
MULTIFAMILY GREEN BUILDING
CASE STUDIES

CARMEN AVENUE

Orientation, Orientation, Orientation

Allied Housing has designed a 30-unit community to be built in 2005–2006 on Carmen Avenue in downtown Livermore, California, across the street from a new library. The development was carefully planned from the outset to incorporate green design. Key features include passive solar cooling, natural ventilation, use of low-toxicity finish materials, extensive access for people in wheelchairs, a photovoltaic power system and a plan for jobsite waste minimization and recycling. The primary outdoor spaces are a central courtyard framed by the two buildings, and a parking lot in back.

The project architect's mantra during design was "orientation, orientation, orientation." Once a project's location is determined, the focus should be on getting the building orientation right to take advantage of solar access and prevailing winds, and to improve circulation patterns for residents.



KODAMA DISEÑO ARCHITECTS

Project architects analyzed multiple plans to optimize solar orientation, open space, views and access. The site plan on the far left was ultimately selected; it places the building on an east-west axis with parking hidden at the rear.

LOCATION
Carmen Avenue, Livermore, California

PARCEL SIZE/DENSITY
1.04 acres;
30 dwelling units per acre

BUILDING TYPE
Two buildings (2- and 3-stories) with rental apartments

TOTAL SQ. FT.
24,558 sq. ft.

TARGET POPULATION
Low-income adults with physical disabilities, and women who have suffered domestic violence and are graduating from shelters into permanent housing.

NUMBER OF UNITS
30 total
Studios: 2
1-bedroom: 5
2-bedroom: 16
3-bedroom: 7

COMPLETION DATE
2006 (estimated)

OWNER/DEVELOPER
Allied Housing, Hayward, CA

ARCHITECT
Kodama Diseño Architects, San Francisco and Oakland, CA

GENERAL CONTRACTOR
Sunseri, Chico, CA

CONTACT FOR MORE INFO
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EMAIL mlee@alliedhousing.org
WEB www.alliedhousing.org

What Makes it Green

ENERGY

The developer is taking a comprehensive and integrated approach to green design at Carmen Avenue. But there is one fundamental element that stands out: Hot summer temperatures of 100ºF and higher led Allied Housing and Kodama Diseño Architects to focus on heat gain and thermal mass, and to use the cool night air and the consistent afternoon breezes to make the design energy efficient and comfortable. The goal is to reduce the need for air conditioning to the point where it is rarely needed.

Some of the solar measures, like orienting the buildings along an east-west axis, took time to work out, but will cost nothing extra to build. Other measures, like the 3-foot overhangs, have a price tag, but will significantly reduce cooling loads and the tenants' energy bills. The table below shows how the design team approached the challenge of getting the cooling loads close to zero, beginning with the building orientation.

Cutting the Cooling Loads

1. **BUILDING ORIENTATION –** Elongated along east-west axis
2. **GLAZING PLACEMENT –** Almost all glazing is on true south and true north facades
3. **GLAZING TYPE & WINDOWS –** Low-e^2 insulated glazing with vinyl windows
4. **ROOF INSULATION –** R-38 loose-fill cellulose
5. **WALL INSULATION –** R-19 fiberglass batt with no added formaldehyde
6. **OVERHANGS & TREES –** Deep 6-foot overhangs on the south facade of one building; more modest 3-foot overhangs on the south facade of the other building. One large tree will be preserved in the courtyard between the two buildings.
7. **FLOOR MASS –** Outdoor walkways are concrete deck; interior floors are not mass construction
8. **WALL MASS –** 5/8-inch gypboard on all walls and ceilings
9. **RADIANT BARRIER** – Yes
10. **ATTIC VENTING** – Ridge vent
11. **SEALING DETAILS –** Sill plate gasket, outlet gaskets, caulking, taping and more

The apartments will also have combined water/space hydronic heating systems, ENERGY STAR® appliances, and fluorescent lighting in bedrooms as well as the kitchens and baths. An energy-efficient Kone Ecodisc elevator has been specified. Finally, a significant portion of the electricity needs will be met by a rooftop solar photovoltaic power system.

MATERIALS

In the spirit of "reduce, reuse, recycle," the project team focused on minimizing jobsite waste by specifying factory-built walls, setting up a plan to donate unused construction materials, and writing a Section 01505 construction and demolition waste management plan. Construction materials were selected for durability, mold avoidance, nontoxicity and recycled content. Dozens of green materials were specified, including high-volume flyash concrete, fiber-cement siding, engineered lumber, FSC-certified roof trusses and OSB sheathing. Floors are finished with recycled content carpeting and natural linoleum.

HEALTH

The apartments are insulated with fiberglass batts with no added formaldehyde. All interior paint is low-VOC. Wherever possible, metals will be prefinished to avoid using oil-based paints in the field. Ceramic tile, natural linoleum and low-emission carpet are planned for the flooring.

GREEN at a GLANCE

Key green aspects of Carmen Avenue are listed here.

PLANNING & DESIGN

- Proximity to public transit and neighborhood services
- Parking in back helps create pedestrian orientation
- Orientation for passive solar cooling, natural ventilation and community interaction
- Low-water landscape
- Existing mature tree preserved onsite
- Universal design

SITEWORK

- Section 01505 C&D waste management plan
- Plan to donate unused construction materials

STRUCTURE

- High-volume recycled flyash concrete FSC-certified roof trusses
- Engineered lumber and OSB sheathing
- Factory-built walls to minimize waste
- Roof insulation: R-38 loose-fill cellulose; radiant barrier
- Wall insulation: R-19 fiberglass batt with no added formaldehyde
- Fiber-cement siding
- Low-e^2 double-glazed windows with vinyl frames

SYSTEMS

- Passive solar cooling and thermal mass (concrete deck walkways, 5/8-in. gypboard)
- Combined water/space hydronic heating
- Sealing details: sill plate gasket, outlet gaskets, caulking, taping
- Fluorescent lighting in bedrooms as well as kitchens and bathrooms
- Photovoltaic system
- Energy-efficient Kone Ecodisc elevator
- ENERGY STAR® appliances
- Central laundry
- Good quality faucet aerators and low-flow showerheads

FINISHES & FURNISHINGS

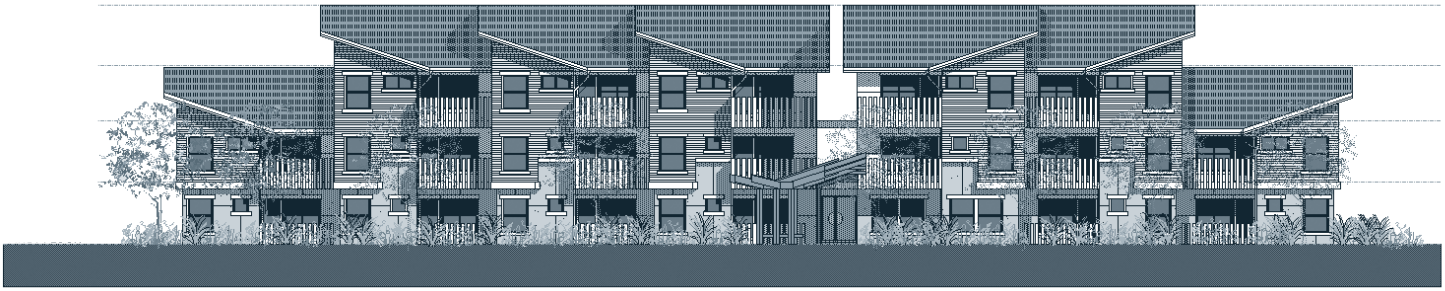
- Low-VOC interior paint
- Prefinished metals
- Recycled plastic benches
- Ceramic tile, natural linoleum and low-emission carpet

WATER

The landscape was designed to use very little water. With the exception of a small grassy play area, the plants are drought tolerant and many are native. The irrigation system uses high efficiency bubblers and drip to deliver water more efficiently than pop-up sprayers. ENERGY STAR® dishwashers, good quality faucet aerators and low-flow showerheads will also save water.

COMMUNITY DESIGN

Parking was moved to the rear of the site so that the homes could connect with the surrounding community. The site is located on two bus lines and within a short walk of a grocery store and public library. The contractor is planning to preserve a large mature tree in the courtyard. A central onsite laundry room saves capital and operating costs and space while providing commercial-grade washers and dryers that clean clothes better than residential machines.



KODAMA DISENO ARCHITECTS

■ Tips from the Trenches ■

Spend most of the design time and budget on low-tech solutions. Start the design of HVAC and lighting by trying to minimize or even eliminate anything that uses power or requires regular maintenance. Passive features that use standard construction materials are sometimes less expensive upfront, and are always less expensive over time. At Carmen Avenue, the passive features include the solar orientation; 5/8-inch gypboard throughout for thermal mass; exterior walkways to form deep south-facing overhangs; high-performance glazing; and high interior volumes for ventilation and daylighting. Only after maximizing the low-tech features should effort be spent on designing HVAC and lighting systems and controls.

Don't exclude good ideas early on just because they seem expensive. The Carmen Avenue buildings were designed from the start with large open roof areas sloping towards true south at an ideal solar pitch to allow for the possibility of installing photovoltaics. Recognizing that nothing ever gets funded that isn't already in the design, the team designed the solar electric system before funding was found. Good ideas, even if they seem expensive, should be kept on the table at least until the end of design documents. You may find money for it, you may find a cheaper method, or you may find a good deal that you weren't aware of.

In some areas technology is advancing rapidly. Elevators without machine rooms, for example, carried a significant premium when design began, but

CARMEN AVENUE

by the middle of construction documents their prices had fallen to nearly match traditional systems. Similarly, the estimated labor cost for installing the photovoltaic system fell dramatically during the year of design work. The bottom line is that cost information more than three months old is obsolete.

Encourage team members to learn from experienced colleagues. ACWMA had requested that high-volume flyash concrete be used on the Carmen Avenue project. The contractor had used this material before and was quick to accept it. On your projects, if your contractors aren't familiar with high-volume flyash mixes, telling them that it reduces landfill waste isn't likely to win them over. Instead, have your contractors talk with other contractors who have successfully used high-volume flyash concrete.

Put green product sales representatives to work. When making a case for lifecycle cost benefits or when managing the submittal process in construction, get product representatives to support you. Many sales reps have PowerPoint presentations, lifecycle cost analysis spreadsheets and studies that support the use of their products, and some will provide assistance with submittal review and even provide oversight of the installation. Linoleum flooring is a good example of a product that is widely recommended because of its durability and nontoxic nature, yet it requires a higher level of technical knowledge to install properly. On the Carmen Avenue project, Forbo Linoleum reviewed specifications and will oversee the installation.

Financing

Green building features were designed into this project from the beginning.

SITE ACQUISITION COSTS . . . . . $1 million

DEVELOPMENT COSTS

Construction	$6 million
Soft costs	$3 million
Total	$9 million

MAJOR FUNDING SOURCES

City of Livermore	$2.5 million
County of Alameda	$0.6 million
State MHP	$2.1 million
4% tax credit	$2.8 million
Permanent loan	$1.5 million
HUD	$0.5 million

AVERAGE COST/SQ. FT. . . . . . $360/sq. ft.

AVERAGE COST/UNIT $330,000

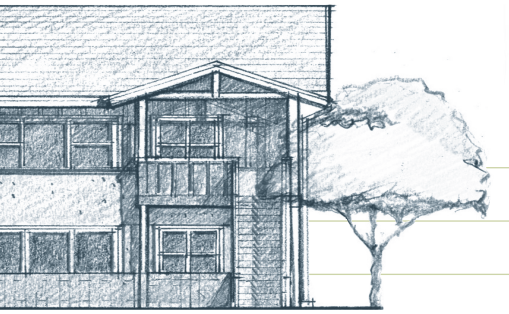
AFFORDABILITY TARGETS

30% of area median income	11units
50% of area median income	18 units
Onsite property manager	1 unit

This Case Study was written by the Alameda County Waste Management Authority as part of its Multifamily Green Building Guidelines. To obtain the Guidelines and many other waste-reduction and green building publications, visit **www.multifamilygreen.org** or call **510-614-1699**.

THE BREAKERS AT BAYPORT

A Good — and Affordable — Fit



Resources for Community Development (RCD) is developing a project of 52 apartments and 10 duplexes to be built in 2004–2005 within a neighborhood of single-family houses on Alameda Island. Because of the scale of the existing homes, the city limited the height of the multifamily project to two stories. This project's green building features need to "fit in," meaning they cannot look drastically different from the surrounding homes.

Key green building attributes will include hydronic heating, 2x6 stud walls insulated to R-19, efficient fluorescent lighting in most rooms, and low-emission cabinets. Some units will have low-e windows with vinyl frames, and all ground-floor units will be built with natural linoleum flooring. The only green elements noticeable to the neighbors will be onsite bioswales and drought-tolerant landscaping. In the Bay Area, low-water landscaping techniques are common even among high-end homes, so this feature was acceptable to the community.

LOCATION
Alameda, California

PARCEL SIZE/DENSITY
3 acres;
21 dwelling units per acre

BUILDING TYPE
2-story; 52 apartments and 10 for-sale duplexes

TOTAL SQ. FT.
65,300 sq. ft. (net)

TARGET POPULATION
Families with low incomes

NUMBER OF UNITS
62 total
2-bedroom: 34
3-bedroom: 28

COMPLETION DATE
2005 (estimated)

OWNER/DEVELOPER
Resources for Community Development, Berkeley, CA

ARCHITECT
JSW/D Architects, Berkeley, CA

GENERAL CONTRACTOR
Segue Construction, Point Richmond, CA

CONTACT FOR MORE INFO
Brian Saliman
Resources for Community Development
TEL 510-841-4410 ext. 17

Debbie Potter
City of Alameda
TEL 510-749-5800

Pedestrian paths through the community lead to an exceptional community center with an after-school care program.

What Makes it Green

ENERGY

The building shell is insulated beyond code requirements with R-19 batt insulation in the walls. As part of the design assistance offered by ACWMA, raised heel trusses were recommended. The architect was pleased that this low-cost item would improve energy efficiency, and the contractor verified that the additional cost, if any, would be very small.

Some of the double-pane, vinyl-frame windows will have low-e glazing. The drywall is 5/8-inch thick, which helps improve the sound separation between units. An efficient combined hydronic system provides space and water heating. Fluorescent lights are used throughout the homes, except in the dining areas where people generally prefer dimmable lights (dimmable fluorescent fixtures are available but cost considerably more than nondimmable fluorescent fixtures).

MATERIALS

Durability is a major focus of this affordable housing project, so the architect selected low maintenance fiber-cement siding, 30-year roofing, and high quality hinges for cabinets. The Hardiplank fiber-cement siding is composed of cement and recycled wood fibers and is designed to look like traditional wood siding. Linoleum flooring was too expensive to include in all the units, so a decision was made to install it in all the ground-floor units, where the installation was least expensive. On upper floors, the lightweight gypcrete would have made it necessary to add an additional layer of plywood subfloor on top to guarantee proper adhesion of the linoleum.

Recycled flyash is specified to replace 28% of the cement in concrete, helping reduce CO_2 emissions associated with cement production and helping keep flyash out of landfills. Exterior benches are made from a composite of recycled plastic and wood fiber.

The architect incorporated ACWMA's model specification 01505 for a construction and demolition waste management plan. The architect and developer reviewed the implications of this specification with the contractor. The material recovery facility in nearby San Leandro is currently achieving high recycling rates from mixed construction debris boxes, so a jobsite recycling level of at least 50% is planned for this project.

HEALTH

To help protect indoor air quality, the design team specified low-VOC paints and glues, fiberglass insulation with no added formaldehyde, and low-emission carpet and linoleum.

The design team also specified medium-density fiberboard (MDF) cabinets instead of particleboard or other cabinet materials that contain urea formaldehyde. While the cost of MDF cabinets may be slightly higher, they are expected to last longer and provide better air quality. The contractor's green building allowance (see Tips from the Trenches below) made it easier to consider items like this that add upfront costs but offer long-term benefits.

GREEN at a GLANCE

Key green aspects of the Breakers at Bayport development are listed here. To learn about incorporating these and other green features in your project, turn to the corresponding section of the *ACWMA Multifamily Green Building Guidelines.*

PLANNING & DESIGN

- Detailing for moisture shedding and mold avoidance
- Bioswales
- Native plants and mulch in landscaping
- Community center and social gathering spaces

SITEWORK

- Construction and demolition waste management plan (ACWMA model specification 01505)

STRUCTURE

- 2x6 stud walls
- Raised heel trusses
- Wall insulation: R-19 fiberglass with no added formaldehyde
- 5/8-inch drywall
- Fiber-cement siding
- 30-year roofing
- Low-e, double-glazed windows with vinyl frames

SYSTEMS

- Combined hydronic system for space and water heating
- Fluorescent lighting throughout (except dining areas)
- ENERGY STAR® dishwashers
- Low-flow showerheads, faucet aerators and toilets

FINISHES & FURNISHINGS

- Low-VOC interior paints and glues
- Low-emission carpet
- Linoleum flooring in ground-floor units
- Low-emissions cabinets (MDF) with high quality hinges
- Recycled plastic benches

WATER

The landscape plan includes native species and mulch on non-turf areas. Stormwater from the roofs and landscaped areas will be collected in swales between the buildings. The project team initially explored permeable asphalt and loose-laid pavers for stormwater runoff, but the price for these options was high and the dense soil made drainage problematic. Also, new stormwater requirements (NPDES) are steering projects toward swales and away from filters that require regular maintenance. The swales turned out to be the least expensive, and probably the best, option.

Inside, the homes will have ENERGY STAR® dishwashers, and low-flow showerheads and faucet aerators. The specifications give preference to 1.6 gpf toilets that are approved by the East Bay Municipal Water District. EBMUD's list of preferred toilets gives designers a tool to differentiate between all the 1.6 gpf toilets on the market and select one with better performance (some toilets rated at 1.6 gpf actually operate over 2.5 gpf once the original flapper valve is replaced).

ILLUSTRATION: JSWD ARCHITECTURE

COMMUNITY DESIGN

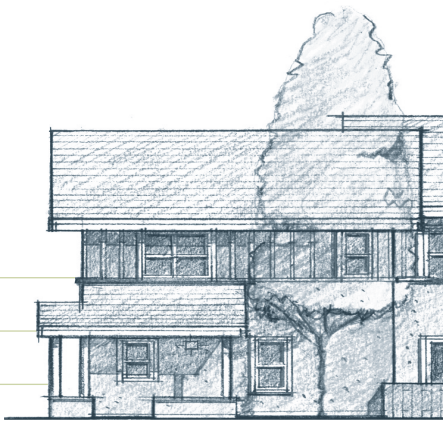
Initial discussions between the city and the design team favored laundry hookups inside each unit. Noting the benefits of centralized laundry facilities, including water and energy savings and more community interaction, the decision was made to include the option for centralized laundry. In the final plan, most units were designed to accommodate a washer and dryer inside a closet, while the common house will include a central laundry facility for residents who do not wish to purchase their own equipment.

Other community design features include pedestrian paths through the community that lead to an exceptional community center with an after-school care program, including outdoor play areas and a computer room. Next to the community center is a pervious hard surface area with rolled decomposed granite, allowing water to drain into the soil, reducing runoff and municipal stormwater system volume.

■ Tips from the Trenches ■

Create a budget allowance for the contractor to pay for green measures with higher capital costs. Green design sometimes requires additional upfront investment. For market-rate housing, it may be possible to recover that

THE BREAKERS AT BAYPORT



investment through higher rent or sale prices. But for affordable housing, it may be necessary to find creative ways to fund these upfront costs. At the Breakers at Bayport Apartments, the developer selected a contractor early in design and then explicitly designated a portion of their base budget to cover green building-related costs. By not making the total fee larger, Segue Construction, the general contractor, had a strong incentive to guide the green design toward one that could be built as simply as possible using standard construction practices. By starting with an expectation that money will be spent on green building, the process feels fair and doesn't get bogged down in controversies about basic green building concepts.

Focus on durability and mold avoidance. JSW/D Architects spent considerable effort detailing the project's waterproofing elements, including details such as flashing and capillary breaks at the bases of posts. The project's drawings include a diagram showing proper window flashing details, and specify particular materials to achieve the best results. Roofing elements are also important. Roof overhangs help keep water out of the walls as well as provide important shading. The roof has a 30-year warranty.

Hire an interested general contractor. The best way to keep costs in line is to hire a contractor who is willing to work with their subs to educate and train them if they are not familiar with particular green measures or materials. This helps counter the common practice of charging more for something just because it is unfamiliar.

Financing

The cost data shown in the table are for the 52 rental units. Data were not available for 10 units for sale at the time the case study was written.

SITE ACQUISITION COSTS . . . . . $1/yr long-term ground lease

DEVELOPMENT COSTS

Construction	$8.5 million + $0.5 million contingency
Total	$13.2 million

FUNDING SOURCES

4% tax credit partner	$5.3 million
State MHP (Multifamily Housing Program)	$3.1 million
Permanent debt	$2.4 million
City of Alameda	$1.2 million
General partner	$585,000
Alameda County	$385,000
AHP through Federal Home Loan Bank	$229,000

AVERAGE COST/SQ. FT. $168

AVERAGE COST/UNIT $174,000

AFFORDABILITY TARGETS

30% of median income	18 rental units
50% of median income	23 rental units
60% of median income	10 rental units
100% of median income	10 for-sale units
Onsite property manager	1 unit

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BETTY ANN GARDENS FAMILY APARTMENTS

Mainstreaming Green

FIRST COMMUNITY HOUSING

The Betty Ann Gardens

affordable housing project in San Jose, California, demonstrates the successful confluence of mainstream construction practices with environmental sensibilities. Completed in 2003, the 76-unit suburban development lies on 3.9 acres along the banks of the Penitencia Creek, a riparian preserve on North King Road.

This project exemplifies the goals of its San Jose-based developer, First Community Housing (FCH), to make a positive impact on the community "by building sustainable, high-quality, affordable housing developments and offering resident services that meet the needs of those who earn less than the area's median income."

LOCATION
North King Road at Berryessa Road, San Jose, California

PARCEL SIZE/DENSITY
3.87 acres;
20 dwelling units per acre

BUILDING TYPE
3-story building with rental apartments

TOTAL SQ. FT.
Floor area: 85,169 sq. ft.
Building footprint: 27,504 sq. ft.

TARGET POPULATION
Families with low incomes

NUMBER OF UNITS
76 total
1-bedroom: 16
2-bedroom: 36
3-bedroom: 20
4-bedroom: 4

COMPLETION DATE
August 2003

OWNER/DEVELOPER
First Community Housing, San Jose, CA

ARCHITECT
Office of Jerome King, AIA, San Jose, CA

GENERAL CONTRACTOR
Branagh Construction, Oakland, CA

OTHER
Engineering Network performed Title 24 analysis; Plogco Inc. provided HVAC design; Betty Ann Gardens, LLP, to own and operate; FCH will remain a general partner.

CONTACT FOR MORE INFO
Marty Keller,
Director of Construction Management
First Community Housing
2 N. Second Street, #1250
San Jose, CA 95113

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The initial design approved by the City of San Jose was not specifically for a green building project. However, a change of staff at First Community Housing opened the door to more aggressive incorporation of green features. Since this happened after the project was well underway, it was too expensive to pursue major changes to siting and orientation. But it was still possible to include many green materials and efficient systems.

The development's key green building attributes include proximity to public transit, use of low-toxicity materials, energy-efficient lighting and appliances, and recycled-content roofing and flooring materials. Residential features are designed to encourage community interaction, and include a children's play lot, a community center with kitchen, activity rooms and offices, and lawn and mini-plaza areas.

What Makes it Green

ENERGY

Overall, the project uses 26% less energy than allowed by California's Title 24 energy code. All Betty Ann Gardens apartments feature ENERGY STAR® air conditioners, dishwashers, refrigerators and compact fluorescent lamps. ENERGY STAR® products save electricity and reduce residents' utility bills. Insulation above levels required by code and vinyl-frame double-glazed windows and sliding doors also help conserve energy and keep the homes comfortable. The apartments include combination water/space hydronic heating and cooling systems, which are generally more energy efficient and less costly to operate than conventional water heating and forced air systems.

MATERIALS

Many of the building materials used on this project contain recycled content or are otherwise resource efficient. Engineered joists and trusses and OSB sheathing were used in place of solid wood and plywood. Fiber-cement siding was substituted for solid wood siding, with the added benefit of greater durability and reduced maintenance. The community center's roof is a blend of cellulose fiber and 100% recycled plastic, molded to resemble slate tiles. All cabinets and trim are medium-density fiberboard (MDF) with no added formaldehyde; this material is manufactured with more than 90% preconsumer recycled wood. All carpeting contains recycled content, and carpet tiles, rather than large rolls, were installed so that worn sections can be selectively replaced.

GREEN at a GLANCE

Key green aspects of Betty Ann Gardens are listed here. To learn about incorporating these and other features in your project, refer to the corresponding section of the *ACWMA Multifamily Green Building Guidelines.*

PLANNING & DESIGN

- Bus stop in front of development; free public transit passes provided to residents
- Design for community interaction: children's play lot; community center with lounge, computer learning center, kitchen, activity rooms and offices; lawn and mini-plaza areas
- Restoration and protection of nearby creek
- Preservation of existing trees onsite

STRUCTURE

- Engineered joists and trusses, and OSB sheathing
- Fiberglass batt insulation with no added formaldehyde
- Fiber-cement siding
- Community center roof: 100% recycled plastic and cellulose
- Double-glazed, vinyl-framed windows and sliding doors

SYSTEMS

- Combination water/space hydronic heating
- Compact fluorescent lights
- ENERGY STAR® air conditioners, dishwashers and refrigerators

FINISHES & FURNISHINGS

- Low-VOC interior paints and varnishes
- Recycled-content carpet tiles
- Linoleum flooring
- Cabinets and trim: MDF with no added formaldehyde; more than 90% preconsumer recycled wood

FIRST COMMUNITY HOUSING

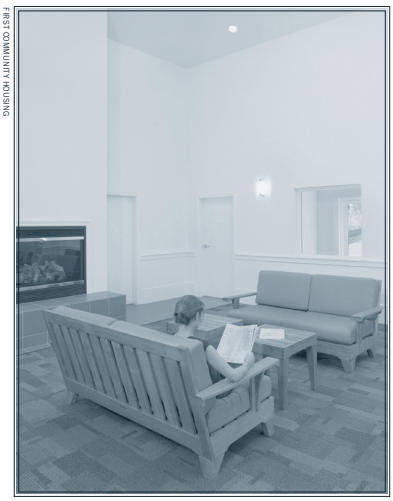
HEALTH

To reduce harmful offgassing, batt insulation with no added formaldehyde was used, as well as MDF cabinets and trim (see Materials above). In kitchens and bathrooms, linoleum flooring was laid instead of vinyl. Low-VOC interior paints and varnishes were used throughout the project, which also help maintain good indoor air quality.

WATER

By restoring and protecting the nearby Penitencia Creek, project designers contributed to improved water quality and stormwater runoff management. Restoration work involved cleaning out garbage, replanting areas and adding temporary irrigation for the newly planted trees. Installation of ENERGY STAR® dishwashers helps reduce overall water and energy use. Unfortunately, due to the project's relatively late integration of green building features, other water-conserving measures such as permeable paving and drought-tolerant landscaping could not be implemented without adding burdensome costs.

Betty Ann Gardens demonstrates the successful confluence of mainstream construction practices with environmental sensibilities.



FIRST COMMUNITY HOUSING

COMMUNITY DESIGN

A bus stop is located in front of Betty Ann Gardens and residents are provided free "Eco-passes" for unlimited use of local public transportation. The developer pays $30 per person per year for these passes. A community center with lounge, computer learning center, activity room, kitchen and office space supports interactive community life. The site's heritage trees have been protected, which, along with landscaped lawn and plaza areas, provide natural beauty, open space and recreational opportunities.

Tips from the Trenches

Embed green building features at the earliest stages. The decision to more aggressively pursue green building strategies came late, after the project had already received approvals from the City of San Jose. As a result, the project team had to work within the bounds of the approved design. Some green features, like changing the heights and orientations of the buildings, would have been feasible early on, but required changes in the City's development approvals and were therefore technically and economically unfeasible at the later date. Fortunately, the general contractor accommodated the developer's green building goals, and worked with the architect to develop an alternative set of cost estimates for the green features.

BETTY ANN GARDENS FAMILY APARTMENTS

FIRST COMMUNITY HOUSING

Work collaboratively throughout the process. From preliminary design through finishing touches, the project's general contractor, developer and architect worked together in a highly collaborative environment. Goals and processes were established at pre-bid and pre-construction, which helped minimize change orders and contain costs. It wasn't until after the initial design approval that a change in staff at First Community Housing precipitated the addition of more green building features. The developer presented alternative materials and practices and because of the existing collaborative relationship, these ideas were quickly evaluated and many were adopted.

Financing

Wherever possible, the developer worked with the architect and general contractor to incorporate green building practices in a cost-effective manner. Given the relatively late introduction of green measures, the project demonstrates practical green building strategies while staying within an acceptable budget.

SITE ACQUISITION COSTS $2,720,000

DEVELOPMENT COSTS

Construction	$11,124,300
Soft costs	$7,775,700
Total	$18,900,000

FUNDING SOURCES

City of San Jose (loan)	$5,129,744
City of San Jose (grant)	$934,370
Tax credit limited partner	$6,058,696
CitiBank	$7,610,000
General partner	$66,065

AVERAGE COST/SQ. FT. $130.61

AVERAGE COST/UNIT $146,373

AFFORDABILITY TARGETS

30% of median income	8 units
50% of median income	15 units
60% of median income	52 units
Onsite property manager	1 unit

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JOHNSON CREEK COMMONS

Giving New Life to an Aging Building


MICHAEL O'BRIEN

In 1998, an aging apartment complex in outer Southeast Portland, Oregon, was transformed by a green retrofit into a thriving community for residents with low incomes. The community, called Johnson Creek Commons, includes a renovated 15-unit complex and a new duplex unit. Developed by Sustainable Communities Northwest (SCNW) and ROSE Community Development, the project helps address the area's lack of affordable housing.

As a retrofit project, Johnson Creek Commons might already be considered a green development, based on reuse of existing buildings and materials. In addition, both the retrofitted units and the new duplex incorporate green attributes such as energy efficiency, water conservation, reduced waste, and improved indoor air quality. A common garden and other community features enhance residential life.

SCNW founder Rosemarie Cordello's guiding vision for the project was based on her philosophy that "living in a way that is healthy, that preserves resources, needs to be something that is accessible to everyone." Funding was provided by the Portland Development Commission and ShoreBank Pacific. SCNW has since closed, but the project is still owned and operated by ROSE Community Development.

LOCATION
Brentwood-Darlington neighborhood, SE 72nd Avenue, outer Southeast Portland, OR

PARCEL SIZE/DENSITY
0.9 acres;
17 dwelling units per acre

BUILDING TYPE
Existing two-story building with rental apartments; new duplex unit

TOTAL SQ. FT.
Apartments: 11,436 sq. ft.;
Duplex: 1,680 sq. ft.

TARGET POPULATION
Families with low incomes

NUMBER OF UNITS
17 total
1-bedroom: 1
2-bedroom: 16

COMPLETION DATE
August 1999 (apartment retrofit);
March 2002 (new duplex)

OWNER/DEVELOPER
Sustainable Communities Northwest and ROSE Community Development, Portland, OR

ARCHITECT
Duplex: Allen Scott and Chris Bensman Davis, Portland, OR

GENERAL CONTRACTOR
Retrofit: All Weather Remodeling, Portland, OR
Duplex: Longshot Construction, Portland, OR

OTHER
Duplex suppliers: Environmental Building Supplies; ReBuilding Center; Metro; American Aldes

CONTACT FOR MORE INFO
Mike O'Brien (former SCNW board member), Green Building Specialist, Office of Sustainable Development, City of Portland, Jean Vollum Natural Capital Center, 721 NW Ninth Ave., Room 350, Portland, OR 97209

TEL 503-823-5494
EMAIL mobrien@ci.portland.or.us

What Makes it Green

ENERGY

A key goal was to increase the apartments' energy efficiency. Floor insulation was increased from none to R-30. Existing walls had R-8 batt insulation; rigid foam insulation was added in conjunction with new siding. Ceiling insulation was upgraded from R-11 to R-38. Also, air tightness was increased through weather-stripping and caulking, and vapor barriers were installed in crawl spaces.

The single-pane aluminum-frame windows were replaced with double-pane, low-e windows with vinyl frames. The electric resistance baseboard heating was replaced with efficient radiant cove heaters high on the walls with separate thermostats by room. ENERGY STAR® appliances were installed, and conventional lights were replaced with compact fluorescent lamps in kitchens and bedrooms.

The energy efficiency retrofit cost $43,942, and was so effective that payback was estimated to be 2.5 years. The new duplex included many of these energy efficiency features at the design stage.

MATERIALS

At Johnson Creek Commons, rotten wood siding on the apartments was replaced with Hardiplank, a fiber-cement product that is durable and uses less tree fiber than wood siding. Sinks, countertops, doors and other fixtures were replaced with higher quality salvaged products. And 90% of the lumber used in the duplex construction was salvaged from old buildings (see Financing section below for more information). Additionally, the duplex was built with advanced framing techniques, which use about 20% less lumber than traditional framing. The small amount of new wood that was used was FSC-certified to be sustainably harvested.

Long-lasting linoleum replaced the old vinyl flooring. Recycled-content carpeting was installed in units and common areas. Recycled latex paint was used for the exteriors, helping keep leftover paint from other projects out of the landfill.

WATER

The Portland Water Bureau worked with the project owners to undertake a water efficiency pilot program in the complex. Measures included installing flow-reducing devices in toilets and showerheads; replacing old washing machines with water-efficient front-loading machines; and using automated meter-reading technology to monitor the entire complex's water consumption. A water-efficient landscape design and drip irrigation system were installed. Bioswales in the parking area enabled the site to disconnect from the storm sewer system and instead divert stormwater runoff into landscaped areas.

HEALTH

At Johnson Creek Commons, linoleum replaced vinyl flooring. The linoleum was the only item that had a significantly higher first cost than standard materials, and it was chosen both for health and durability reasons.

GREEN at a GLANCE

Key green aspects of Johnson Creek Commons are listed here. To learn about incorporating these and other green features in your project, turn to the corresponding section of the *ACWMA Multifamily Green Building Guidelines*.

PLANNING & DESIGN

- Retrofit of existing building
- Community garden, playground, barbeque and picnic areas
- Water-efficient landscape design and irrigation system
- Bioswales for stormwater runoff

STRUCTURE

- FSC-certified wood
- Advanced framing
- R-30 floor insulation
- Rigid insulation added to existing walls
- Ceiling insulation upgraded to R-38 from R-11
- Vapor barriers installed in crawl spaces
- Fiber-cement siding
- Double-pane, low-e, vinyl-framed windows

SYSTEMS

- Efficient radiant cove heaters
- Weather-stripping and caulking
- High-flow fans in all bathrooms
- Compact fluorescent lights
- Energy-efficient appliances
- Flow-reducing devices in toilets and showerheads
- Water-efficient front-loading washing machines

FINISHES & FURNISHINGS

- Zero-VOC interior paint
- Recycled latex exterior paint
- Recycled-content carpet
- Linoleum flooring
- Salvaged lumber, sinks, doors and other fixtures
- Low-emissions cabinets

MICHAEL O'BRIEN

Double-pane, low-e windows were installed to increase energy efficiency.

The owners specified zero-VOC interior paints and cabinetry made of exterior-grade plywood with phenol formaldehyde (the waterproof phenol formaldehyde–based binders offgas much less than urea formaldehyde binders, which are typically found in interior-grade plywood). Given the high humidity levels of the Pacific Northwest, effective ventilation of bathrooms is especially important. Many apartments were first cleaned of mold, and high-flow Broan/Nutone fans were installed in all bathrooms to reduce moisture levels and inhibit mold growth.

COMMUNITY DESIGN

Under the guidance of SCNW, Johnson Creek neighbors worked collaboratively to design and plant a community garden, as well as create a playground and barbeque and picnic area. The original complex's parking lot was larger than needed, so the owners used part of it for the duplex, and included a retention pond and bridge as design elements to connect the new and retrofitted buildings.

"Living in a way that is healthy, that preserves resources, needs to be something that is accessible to everyone."

– ROSEMARIE CORDELLO

Tips from the Trenches

MICHAEL O'BRIEN

Salvaged countertops are used in the kitchens.

Plan ahead. Some contractors were unfamiliar with some of the alternative building materials, or how to source them economically. The developers worked closely with their suppliers and contractors to prepare them for the project and make the appropriate product purchases. Some circumstances—such as weather conditions—were out of anyone's control. (The owners caution against installing windows during December storms, if at all possible!)

Provide ongoing support for community activities. Since project completion, resident participation in the community garden has waned. This is partially attributed to a lack of ongoing support from community agencies, whether through volunteer or paid staff. The Johnson Creek garden is still growing, but with involvement from fewer households than at the beginning of the project.

Expect challenges when retrofitting an occupied building. The developers did not want to displace residents during the retrofit, and therefore had to work carefully with contractors and residents to accommodate sometimes conflicting schedules. A representative of the owner personally went to talk with each family about what to expect during construction, which went a long way toward helping the work flow smoothly.

JOHNSON CREEK COMMONS

Financing

From the outset, this project was intended to show how low-income housing can be durable, healthy and environmentally responsible. The owners made a realistic assessment of which green building measures they could include, and prioritized key environmental goals: energy efficiency, resource conservation, low toxicity and durability. Some features, such as solar hot water or photovoltaics, were never considered, due to budget restraints. Other green items—such as wheatboard cabinetry, permeable pavers, and damp-spray cellulose insulation—were initially considered, but later rejected due to cost or availability barriers.

Still other items, such as hydronic heating for the duplexes, were installed with the perspective that the energy savings and reliability make this technology a good long-term investment. The duplex portion of the project also benefited from excellent support from the ReBuilding Center, which worked hard to supply the salvaged lumber package at a reasonable cost.

PROJECT FINANCES (15-UNIT RETROFIT PORTION ONLY)

Site acquisition costs	$660,000
Retrofit and deferred maintenance costs	$230,000
Total	$890,000

FUNDING SOURCES

Portland Development Commission (equity gap grant)	$284,622
Portland Development Commission (loan)	$350,000
ShoreBank Pacific (loan)	$242,010
U.S. Bank (grant)	$10,000

AVERAGE COST/SQ. FT. (RETROFIT) $20

AFFORDABILITY TARGETS

30% of median income	5 units
50% of median income	10 units

This Case Study was written by the Alameda County Waste Management Authority as part of its Multifamily Green Building Guidelines.

To obtain the Guidelines and many other waste-reduction and green building publications, visit **www.multifamilygreen.org** or call **510-614-1699**.

ALAMEDA COUNTY WASTE MANAGEMENT AUTHORITY & SOURCE REDUCTION AND RECYCLING BOARD

The Alameda County Waste Management Authority (ACWMA) is a public joint-powers agency comprised of the County of Alameda, each of the fourteen cities within the county, and two sanitary districts that also provide refuse collection services. ACWMA is governed by a Board of Directors made up of elected officials, primarily mayors and city council members, appointed by each member agency. Funding is derived solely from waste disposal and waste import mitigation fees collected at the Altamont, Tri-Cities and Vasco Road landfill sites. The agency receives no general tax funds.

Together with its specialized arm—the Alameda County Source Reduction and Recycling Board—ACWMA offers a wide range of programs in the areas of public education, green building, recycled product procurement, waste reduction, market development and technical assistance.

Construction and demolition debris comprise up to 21% of the materials disposed in Alameda County landfills. The Alameda County Waste Management Authority and Recycling Board is working in partnership with the construction and building industry on ways to reduce this waste stream. Through job site recycling, efficient use of materials, use of recycled content or highly durable building materials, the Multifamily Green Building Guidelines provide an effective tool to decrease the amount of material that ends up in landfills.

In November 2002, ACWMA asked Alameda County and cities in Alameda County to nominate projects in their communities to take part in a design assistance program for affordable multifamily housing projects. Three pilot projects were chosen to receive technical assistance in exchange for participating in the development of these Multifamily Green Building Guidelines. A development committee of multifamily developers and architects helped define the audience and purpose of the guidelines and, along with other reviewers, provided feedback on the technical content.

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ACKNOWLEDGEMENTS

Special thanks to the following building industry professionals for their commitment, input and direction in developing these Guidelines.

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DESIGN & PRODUCTION

Celery Design Collaborative, Design & illustration
www.celerydesign.com

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DISCLAIMER

The information in these Guidelines should be considered by contractors, architects and other professionals, as well as owners, in the course of designing and constructing new or modified structures. They are provided as a public service by the Alameda County Waste Management Authority and Recycling Board in an attempt to provide environmental benefits and reduce costs. The Guidelines are not a substitute for exercise of sound judgment in particular circumstances and are not intended as recommendations for particular products or processes.