

# IMPLEMENTING LOW-TECH SUSTAINABLE SOLUTIONS IN ECO MODERN FLATS: A CONSTRUCTED RETROSPECTIVE

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## INTRODUCTION

*ECO Modern Flats is an award-winning rehabilitation of a 96-unit market rate apartment complex built between 1968 and 1972. Each of the project's four buildings consists of three floors of eight one-bedroom apartments on a sloping site in central Fayetteville, Arkansas. The existing complex had great bones of precast concrete and split face block, but was drastically lacking in thermal comfort, air quality, and aesthetic appeal. The developer's goals were to deliver a product not currently available in the local market—modern, urban, green multi-family rentals—and to save operations costs through energy- and water-saving updates. The architect saw an opportunity to re-imagine healthy interior space, creating open and light-filled studios by implementing low-tech sustainable solutions.*

*The renovation completely overhauled the living systems of each unit and transformed the entire complex's visual presence in the community. The new design provides connections to the re-integrated and re-imagined landscape of the site, elevating the greater community and local tenant experience by capturing a demographic that seeks modern design and sustainable living...previously unattainable in Northwest Arkansas. ECO has been fully leased with a waiting list since its completion in 2011, and its management team boasts that the only hindrance for prospective tenants is the one-bedroom lifestyle. ECO Modern Flats was the first multifamily development in the state to attain any level of LEED certification and the first project in Washington County to qualify for the LEED Platinum standard. Since its completion in 2011, ECO has transformed its previously dilapidated infill site into a thriving and remarkably conscious community. A 2012 AIA Merit Award winner and 2013 ULI Global Awards for Excellence finalist, the development has become an educational resource for students, conference attendees, storm water educators, and others interested in sustainable building.*

## KEYWORDS

renovation; rehabilitation; low-tech sustainable solution; low-impact design strategy; retrofit

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## I. DESIGN THINKING

Modus Studio was first approached by Specialized Real Estate Group in early 2010 to tour the dilapidated Glendale apartment complex adjacent to the University of Arkansas in downtown Fayetteville, Arkansas. This was not only the first look at a potential rehabilitation project, but also the first opportunity for the two extremely creative firms to combine their visions for the property into a fresh and sustainable design solution.

As design thinkers, Modus Studio attests that sustainability is inherently found in an architecture that is embraced by the people who use it. This idea fuels our design process, where every potential solution contributes to the place as a whole. Rather than chaining ourselves to a relentless checklist of sustainable features, we choose to address the tangible aspects of “green” design by providing healthy places for people, doing right by the planet, and helping our clients achieve their goals. These ideas embody the practices, functions, and true value of well-designed places.

Through careful design and decisions, we can **reduce energy consumption, conserve water, embrace our natural sites, create healthy space, capitalize on local resources** and properly handle the **byproducts of our daily lives**. This is the beginning of sustainable architecture.

**FIGURE 1.** View of ECO courtyard from community roof deck.





## II. EXISTING CONDITIONS

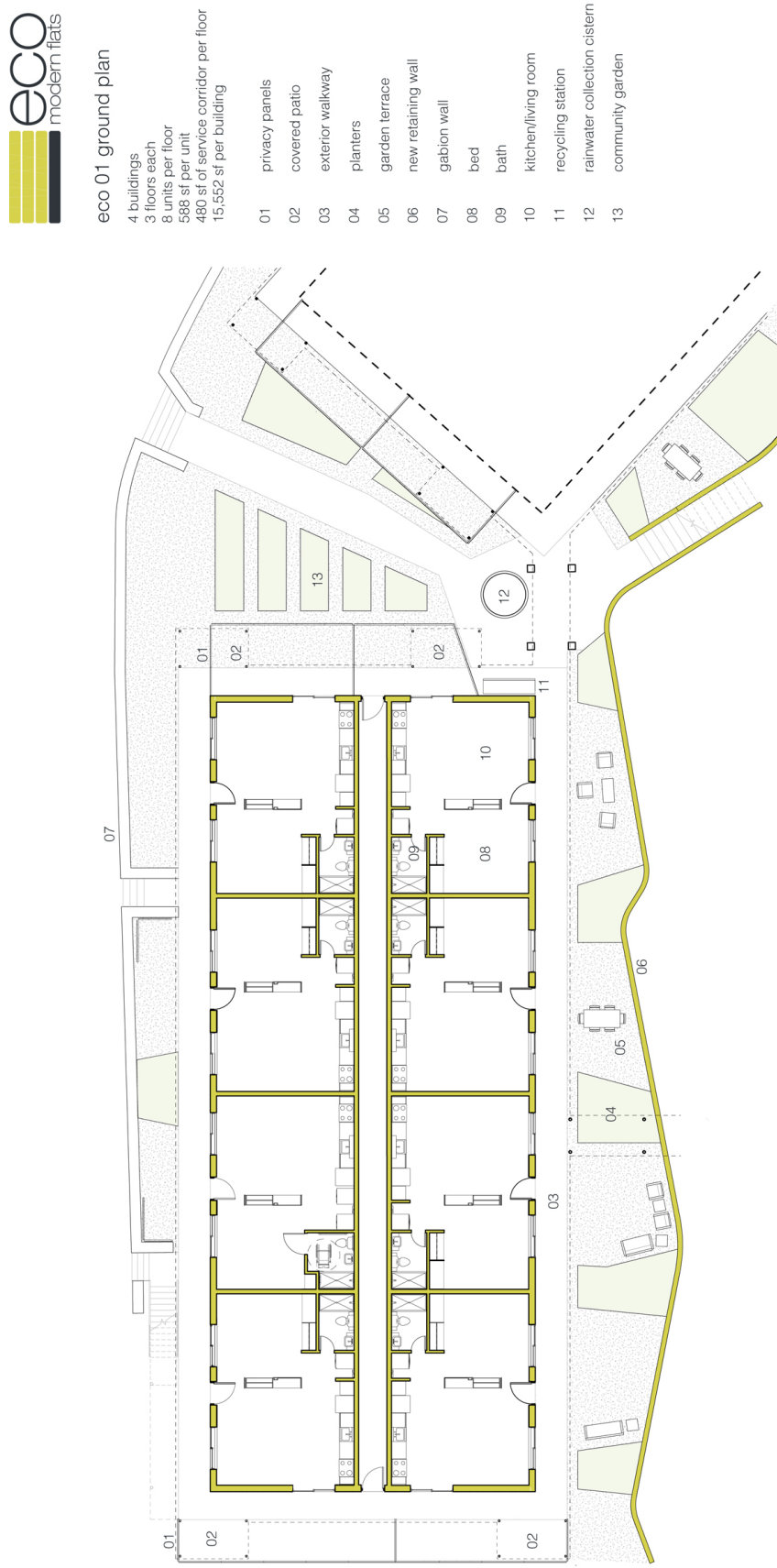
The existing apartment buildings were poorly configured on the site, with no recognizable community features. The lackluster material palette and dull exterior spaces were a hindrance to the idea of modern community. Despite its naturally walkable location, the property provided no space for people to happily gather, little curb appeal, and despite the rundown pool, few marketable amenities. The salmon-colored split face block, rough precast concrete floor slabs, and U-channeled roof were dated and uninviting. A structural examination, however, revealed the true potential of the ‘bones’ of the building and initiated their consideration as an armature for a second life. These “dated” building materials are uncommon in modern American multifamily construction and presented new aesthetic and technical possibilities during the renovation.

The plan arrangement of each building was simple—two rows of four apartments placed back-to-back on each of the three levels. A 4' wide chase formed the systemic spine and provided an adequate conduit for the retrofitting of new systems such as HVAC, plumbing, and fresh air intake and exhaust. This space not only facilitated the rehabilitation work during construction, but also acts as an organizing element for the new units, cleverly dictating alignment of kitchens and bathrooms. The precast concrete floor slabs cantilever walkways at each level and naturally provide a universal shading mechanism for the project, albeit devoid of thought to solar orientation. This simple layered and stacked form, though seemingly banal in architectural language, proved to be a great substructure for creative input.

**FIGURE 2.** Existing Glendale apartment complex.



**FIGURE 3.** First floor plan.



### III. EMBRACING THE SITE

Nestled among the Ozark Mountains, Fayetteville is a place of varying topography. One can imagine the strong and consistently sloping hillside that once existed at the site. The cut of the given site was typical of development in the 1960s and 70s, but problematic. The project is in a hole, which creates haphazard landscape zones and accelerates water infiltration.

#### *Water Management*

One of the most basic tenets of low-impact design strategies is to simply slow water down. This idea, along with overall better management of the building systems, efficient plumbing fixtures, and dual-flush toilet retrofits, enabled us to drastically alter the water consumption of the complex.

While performing one of the initial site walkthroughs, Jeremy Hudson of Specialized Real Estate Group had an insightful observation when he realized the downspouts were trickling water. It was in the middle of summer and there had been a period of no rain for many days. When the maintenance man of many years was queried about this oddity, he quickly explained that in the heat of summer they must run sprinklers on the roof to keep the top floor units cool enough. The lack of insulation and antiquated mechanical system was simply not adequate.

One can imagine the horror at the scale of the quantity of water that was needlessly lost due to this practice, not to mention the untold years of costly water utilities.

To amend this wasteful practice and begin to heal the damage done to the site, we installed two 4600-gallon cisterns made from locally-sourced galvanized culvert pipes turned vertical. These cisterns serve as visual icons for the sustainable features of the property and provide spatial gateways to the community areas within. Approximately 50% of the water shed from each roof is now funneled into a cistern, then stored for use in drip irrigation systems that water native plantings and the community vegetable garden. If the cisterns overflow, surplus water cascades gently around the spiraling edges of the reservoir and into a drainage basin below.



**FIGURE 4.** Rain garden with galvanized culvert cistern used to capture storm water from roof.



Low-impact development strategies were used in the waterworks courtyard and rain garden on the west side of the complex, where well-watered plants grow tall and shield the ground floor units from headlights in the parking lot. The native plantings in this garden act as inhibitors and filters for runoff coming across the parking lot, cleaning particulates from the water before it re-enters the existing drainage patterns of the site.

On the opposite side of the complex, a serpentine concrete retaining wall acts as a dam for the courtyard, similarly capturing water and directing it in a controlled manner to the existing drainage infrastructure. This wall also creates appropriately-scaled exterior terrace spaces underneath the green screen. On the eastern edge of the lower building, gabion walls relieve the previously bermed areas of the site and create an entry courtyard flanked by a community garden where blackberries and heirloom tomatoes flourish in raised steel beds.

### **Shading**

While solar orientation was secondary to the original design, we looked for opportunities to use shading and solar movement strategies to merge the rigid manmade materials of the existing buildings with the natural site during the renovation. A low-tech steel cable trellis provided one such solution: By attaching the cable to the top of a new retaining wall below and the new structural gutter/fascia at the roofline, we created a simple armature for purple hyacinth bean plants to inhabit. These vines grow from the base of the cable to the top annually, creating a flowering canopy for the seating areas below. By late July the plant provides ample shade to the western exposure of the lower two buildings and creates a pleasantly veiled screen of dappled light between the units and the pool, as well as a haven for ruby-throated hummingbirds.

### **Façade Integration**

We developed a kit-of-parts panel system to combine the modern durability of steel with the natural warmth of cedar in order to connect the juxtaposed existing structures. Ground-based cedar panels carve out new terrace spaces, while new balconies extend beyond the wraparound walkways at the second floor. New cantilevered stairs span from the third floor walkways to the roof and allow people to access previously unobtainable views of the university, city, and mountains.

Residual spaces between buildings were made into community spaces and gardens and the new architectural elements of the building reside within and tangent to these spaces, further integrating the interior and exterior into a seamless and expansive living unit, far more suitable for human habitation than the original design allowed.

**FIGURE 5.** Ground floor passageways covered by cable vine trellis system.



## IV. HEALTH + EFFICIENCY

### *Renovation + Rehabilitation*

To kick off the unit renovation process, interiors were gutted of all mildewed and fibrous materials to ensure a clean living environment for future tenants. A new high-quality material palette of solid surfaces, custom wood millwork, concrete countertops, polished concrete floors, porcelain tile, soybean-based foam insulation, and no-VOC paints and adhesives, ensures that materials don't have to be removed and thrown away at each tenant changeover, as often happens with carpeted apartments, further reducing waste over time. These inviting surfaces combine to create gallery-like living spaces that are durable and healthy. By treating each unit as a museum for living, the movements and belongings of the resident are on display. His life is the art.

Flexibility plays an important role in sustainable design: flexible space is efficient and multivalent, bending to the needs of its user and minimizing wasted resources. The transformer wall incorporated into each ECO unit is an example of this flexibility. The 180-degree rotation of the unit allows the tenant to view his or her television or computer screen from any point in the unit. This not only limits the number of extraneous electronic components a tenant might buy, but also ensures the maximum functionality of the items in use with minimal energy waste. Mini-split HVAC systems are similarly efficient additions to the renovated units, providing personalized comfort controls to each tenant. This is a significant improvement to the original 2-pipe system, which could only heat or cool the property on a global level.

**FIGURE 6.** Interior view of studio apartment.



From the standpoint of an apartment-dweller, each existing unit was exactly the same: a closed-in box chopped into tiny rooms with little or no defined outdoor space. Our first step was to add natural daylight wherever possible and subsequently sliding-glass patio doors were carved into the solid block walls in the corner units. We added operable, low-e windows throughout the complex to add another level of user-control and comfort to each space. Each unit now has an outdoor living space—a terrace, a walled patio, a balcony, or a large rooftop terrace—carved from existing unused or underutilized space.

### ***Reduce Energy Consumption***

The issue of energy conservation was addressed from the exterior to the interior in a fully comprehensive strategy to make the apartments drastically more efficient, exemplify the use of the chosen systems through aesthetic representation, and ultimately create more thermally comfortable dwellings.

The most visibly active system is the solar hot water collector system carefully articulated on the roof of each building. These systems provide up to 80% of the hot water demand required for the tenants of each building. The glycol heat exchangers are connected to a large capacity gas-fired hot water heater that simply does not activate until the sun is no longer capable of doing the job. Luckily, the peak use hours for hot water occur during daytime hours and the system is extremely efficient.

The next systematic layer to reduce energy is the use of ceiling-mounted mini-split heat pump systems, capable of providing both air conditioning and heating from a single interior component and a small condenser on the roof. The previous 2-pipe system could only be set to heat or cool an entire building, which made for many uncomfortable days in Arkansas' notoriously fickle spring and fall. Each unit now has a remote control that also acts as the thermostat, enabling residents to move the point of thermal comfort sensing with them in the apartment and provides easily controlled options for circulating, cooling, or heating air for the space.

These small systems adequately perform because of the tight and properly insulated envelope that was created during the renovation. All exterior block walls that were part of any unit were furred-out with 2×2 framing and a soybean-based spray foam insulation was added to seal off all air infiltration and provide adequate R-value to the walls.

Finally, the use of efficient fluorescent and LED fixtures placed in the right locations, combined with new power outlet locations allowing tenants to use task lighting within each living space, helped reduce the overall electrical load of the apartment complex.

## **V. BUILDING COMMUNITY**

### ***Walkability + Neighborhood Amenities***

Perhaps the most significant sustainable elements of this project are the site and location: A dilapidated, under-occupied apartment complex in the city center has been transformed into a lush, efficient community. The project is extremely bike-friendly, positioned mere minutes from the nearby university, entertainment and arts districts, farmer's market, and shopping, with easy access to the urban trail system. ECO Modern Flats enjoys a WalkScore of 85 in a car-dependent city with an average WalkScore of 27.



### ***Capitalize on Local Resources***

The original buildings provided tremendous opportunity for reuse—the structures themselves, as well as plumbing fixtures and the pool, were refurbished rather than destroyed, saving countless resources. This ideology extended to the reuse of as many porcelain toilets and sinks as possible.

New cabinetry was sourced and constructed locally with low VOC products. The true plywood and MDF construction of this millwork as opposed to lesser compressed board products ensures a more durable and longer life product that results in far less material waste at turnover and less contribution to the landfill. A simple wall mounted base cabinet was installed underneath the previously mentioned reused porcelain sinks in each bathroom, adding much needed storage.

Locally fabricated concrete countertops were installed within price point, due to the ability to modularize and repeat the countertop formwork process 96 times, once for each unit. These countertops are extremely resilient and modern in aesthetic.

Additionally, in the landscape, the use of low-tech gabion retaining walls, filled with local limestone are outwardly expressive design elements that provide identity and interest in the sustainable solution. At the same time, the extensive amount of existing concrete in the central space between the buildings was removed in favor of a more inviting combination of hard and soft-scape with native plantings. The removed concrete was reused as carefully laid pieces into the drainage areas and other existing bermed areas of the site to control run-off and erosion.

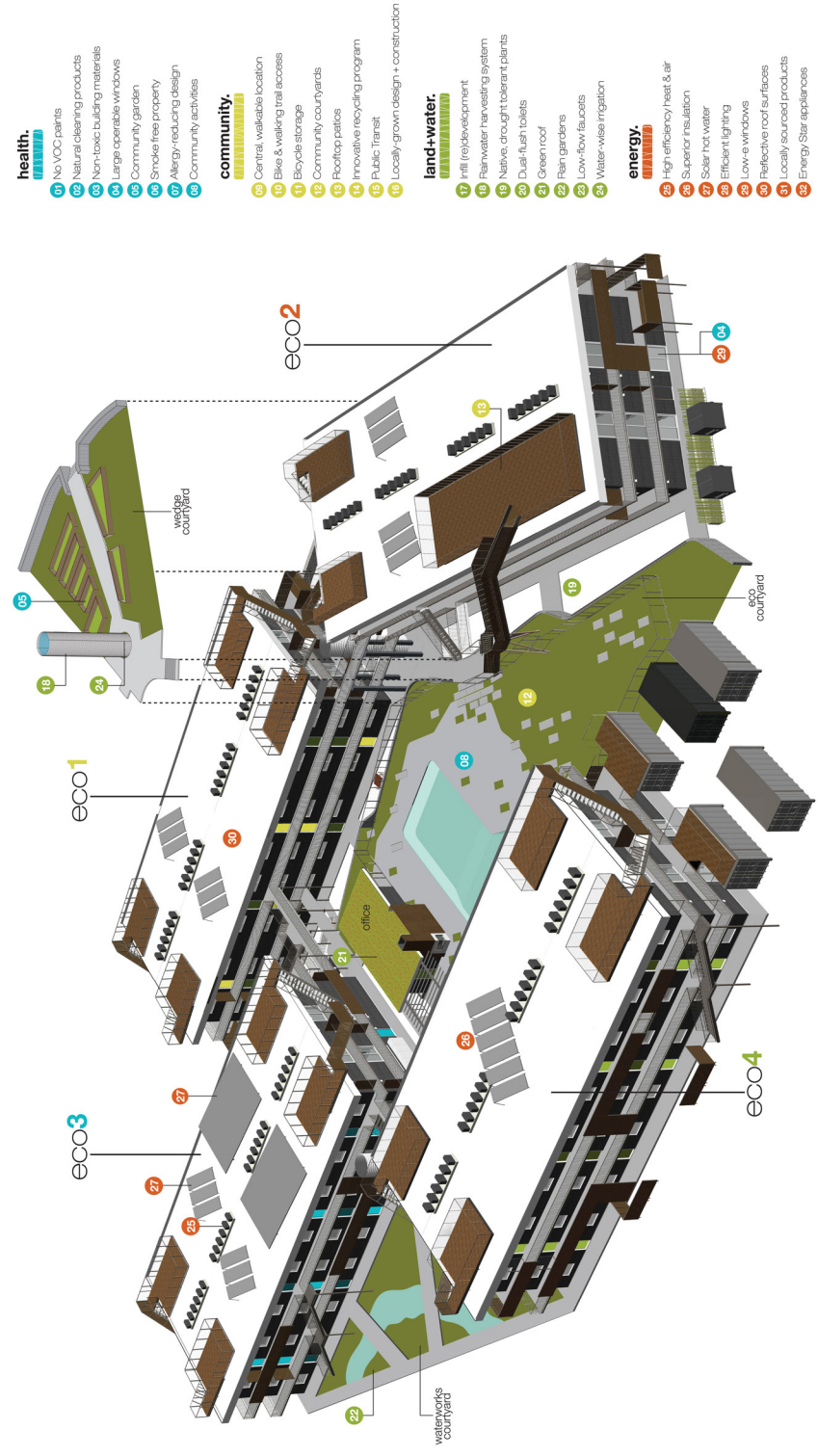
One of the greatest local resources utilized in this project was the collective design and construction team. By working with local developers, designers, engineers, sustainability consultants, fabricators, and craftspeople, the goals of sustainability were supported by people who understand the place. Modus Studio also was able to directly translate the design of the kit-of-parts panel system, which is a compositional and spatial delineator for the various terraces, balconies, and railings for the project, into a fabrication project through the Modus Shop arm of our studio. Through hands-on fabrication, we could directly compose, in a warm palette of recycled steel and natural cedar, one of the key compositional architectural elements for the rehabilitation of the existing structures.

### ***Recycling/Compost***

The renovation of ECO Modern Flats was not simply a transformation of the buildings, but also an examination and reinvention of each system, including waste. Each unit is equipped with recycling bins, but at the time of the renovation, Fayetteville did not offer a recycling program for multifamily properties. To ensure the most sustainable lifestyle for our tenants, we designed and built custom recycling stations for the project and worked with the City of Fayetteville to deliver materials collected to their recycling station in South Fayetteville.

The City of Fayetteville Solid Waste and Recycling Division documented 12,900 pounds of glass, paper, aluminum, cardboard, and plastic between January 2012 and June 2013—nearly six and a half tons of diverted waste from this project alone. Inspired by the success of our efforts at ECO, the city has launched a pilot multifamily recycling program, and is now collecting data from five local apartment communities. In response to resident demand, ECO has recently installed a composter, which will divert food and garden waste from the waste stream and create compost for use in the community garden.

**FIGURE 7.** Educational diagram of ECO complex with 32 sustainable design strategies.



## VI. CONCLUSION

### *Educational Tool*

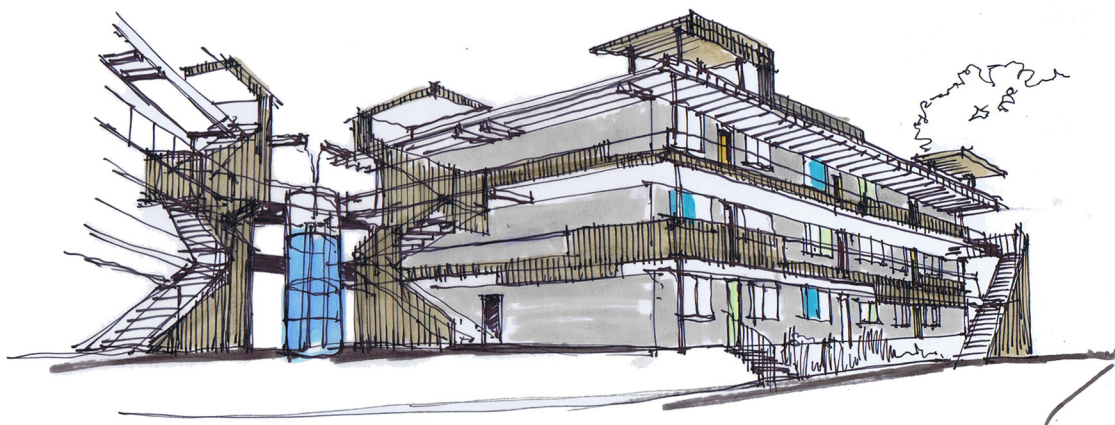
The client's goals for this project were to deliver a living environment not currently available in the local market—modern, urban, green multi-family rentals—and to cut operations costs down to a more manageable level through energy- and water-saving updates. As the design developed, it became clear that ECO Modern Flats could be an educational resource, both for residents and the community at large. In addition to the rehab itself, a blog and other informational resources were developed, and hundreds of people have toured a model unit highlighting 32 sustainable strategies employed in the project. Modus Studio had the privilege of working directly with Specialized Real Estate Group to develop and design the logo, marketing materials, and educational infographics for ECO modern flats. This bridging of design language provided the opportunity to merge the architecture and the branding into a cohesive and valuable tool for modern and sustainable design while exceptionally marketing these concepts to the prospective tenants.

The project has become a frequent case study assignment for students from the Fay Jones School of Architecture in Fayetteville, and was featured in a series of interviews and videos by the U.S. Green Building Council in 2012. ECO has since been selected by the Urban Land Institute for a 2014 ULI Case Study and will be featured alongside the Sullivan Center, Harper Court, and other illustrative projects in *Urban Land* magazine this spring.

### *Byproducts of Daily Lives (Conclusion)*

When Modus Studio begins a project with a sustainable mission, we ask one quintessential question: Are we counting points or counting people? We find great value in the quantitative tools, checklists, and systems that are available for guiding and ranking design; however, the guiding principles must be ideas and these ideas must be rooted in making a place. Sustainability is inherently found in providing a project that is embraced by those who use it, love it, and care for it. Building green must move beyond the buzz and checklists and into the realm of tangible architecture, admirable on a daily basis. As the subject of architecture is in fact people, we must seek to make our sustainable design a beacon for those who will use the spaces we create. While ECO is certainly a success according to the checklists, we measure its

**FIGURE 8.** Conceptual sketch of Eco view from parking lot.





**FIGURE 9.** ECO tenant seated at transformer desk.



success by the almost universal response of each visitor, who walks into the space and immediately tries to visualize his or her life in 600 square feet.

Finally, we observe that far too often people are so overwhelmed with life and work that the idea of community seems out of reach. A byproduct of living at ECO is the happy immersion into a community atmosphere. This goal was purposefully outlined as a sustainable design strategy on the path to green building, and is arguably the most critical. We are encouraged to hear that, in stark contrast to typical apartments, residents know their neighbors and shared weekend brunches and impromptu dinners by the pool are common.

The collective design and development team knew that for this project to succeed, we needed to understand and speak to the people who would embrace a project like this:

Those seeking a sustainable community and who are ultimately thrilled by modern design.

Those seeking modern design who happily evolve into living sustainably.

Those seeking both modern and sustainable living.

As a result of the low-tech and low-cost sustainable solutions employed at ECO Modern Flats, all-inclusive rent rates are within reach of renters in our area, and all of these paths are winning options when sustainable is made obtainable.