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A Case Study of Large-Scale Sustainable Neighborhood Development

C. Alan Nichols Jason A. Laros

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Dedication

In memory of Carol Goodwin, Civano's first resident.

December of 1995 was a critical time for Civano. The outcome of a single City Council vote was to seal the fate of the Solar Village. Carol Goodwin, a strong supporter of the Solar Village concept, stood at the podium and insisted that she would be the very first to reside in the Village. With her support, and the support of other people with such conviction, the Solar Village dream survived. Sadly, Carol did not survive to see her home built, but her mortal ashes were freed in Civano at the lot she had purchased. Today, Carol is remembered by a tree in the center of the Neighborhood Center courtyard.

About the Authors

C. Alan Nichols, P.E., LEED AP, established Al Nichols Engineering in 1995. He has served as Project Engineer at Western Electric, Process Engineer for W. L. Gore, and Project Engineer for Tierney Manufacturing. Nichols has over 30 years' experience in heating, air conditioning energy systems, and plumbing. As a member of the Tucson/Pima County Metropolitan Energy Commission, he was instrumental in writing the sustainable energy standard (SES) for Civano. Additionally, Mr. Nichols was part of a volunteer group that led the development of building code guidelines that have resulted in Civano's 50% reduction of heating and cooling energy and 60% reduction in potable water usage. In 2002, he received the Energy Users News Award for Best Mixed-Use Facility for the Civano project, and he is Past Chairman of the Tucson/Pima County Metropolitan Energy Commission.

Jason A. Laros, LEED AP, is Sustainability Analyst at Al Nichols Engineering as well as Membership Committee Chairperson and Governing Council Member for the United States Green Building Council, Southern Arizona Branch.

FOREWORD

The following story is about a group of people who recognized a once-in-a-lifetime opportunity and took it upon themselves to reinvent the future and work for its realization. The great vision of this project was understood long before those still preoccupied with the status quo could accept its premise. Yet, the story unfolds despite all the resistance and pitfalls in its path. While the final outcome was never assured, the dream and ultimate value of this opportunity would never be shaken. And so this is the story of the Tucson Solar Village Project later to be renamed Civano.

The 1970s was a decade much like the present period–protracted energy crisis, a long global recession, major changes in our monetary system, high unemployment, conflict and wars, heightened global competition for resources and markets, inflation, and growing interest in solar energy and new, more efficient technologies. In short, the world was burdened with uncertainty but also drawn to the possibilities of great and needed change.

The key scientific finding during the seventies was that Planet Earth is a finite system and that unconstrained growth would lead to dangerous resource shortages and degradation of natural systems. When the bad news would arrive in the future—when the limits to growth would be reached—was debated endlessly among "experts." However, in everyday terms, these limits seemed so far off in time that more immediate, pressing issues absorbed most people's attention. Except for a relatively small community of scientists and environmental thinkers, the value of alternatives to growth was very low. Why pursue sustainability when the presumed nature of the economy and the world's capacities is to always grow.

In the United States, the seeds of the sustainable development movement germinated in the seventies in response to these scientific findings and the social and cultural fallout from economic instability. For those of us who came to see this coming paradigmatic change, many would have to carry this knowledge patiently into the eighties and nineties before the time was right to actually work on planning, engineering, and building a different world.

The story of Civano is a story of many diverse people and events coming together at different points in time to move forward the proposition that now is the time for a prototype sustainable community development. The designs changed and evolved, but the vision was always a comprehensive treatment of all functions of the human built environment in harmony with the natural cycles of energy, water, materials, and eco-systems.

When this opportunity appeared to the first wave of Tucson innovators in the 1980s, it was clear that the next evolutionary phase was beginning. We would lead the first

major experiment in the desert Southwest for learning how to create a community land development based on regenerative cycles and significantly reduced resource consumption. The promise of wide-scale utilization of solar energy in the future would be furthered by this single venture in a new approach to development.

The chronology of Civano spans three decades with important milestones achieved in each. At many points, the realization of the dream stood in doubt as challenges overwhelmed the participants and the institutions backing its progress. But key actors always kept the effort moving forward up to its current state as a living, breathing place where people and families live their lives.

An experiment should never be labeled either a success or failure because the underlying purpose of an experiment is to test hypotheses and learn about something which often has never been attempted before. Civano provides us with a unique set of valuable lessons for designing ongoing responses to the intensifying sustainability crises unfolding all around us.

The story of Civano is ultimately a story of local heroes carrying forward a noble and important mission. In particular, I want to acknowledge Al Nichols, engineer extraordinaire, for his many roles throughout the past two decades in bringing Civano into being and making its beneficial lessons available to all those now and in the future who will take on the next critical sustainability challenges.

Robert Cook
Former Chair, Tucson/Pima County Metropolitan Energy Commission
Co-Founder, Sustainable Tucson

PREFACE

What's in a name? That which we call a rose by any other name would smell as sweet.

—SHAKESPEARE, *Romeo and Juliet,* II ii 1–2

The quote above may have been true in the century William Shakespeare wrote, but in the current age of information, labeling matters. A community called Military Compound indicates a distinctive purpose and ambiance which differs widely from the expectations for a community named Green Meadows. If we follow the history of names given or associated with the project known as Civano from its inception in 1982 to the present fruition in 2009, we find a richness of meaning in parallel stories and an evolution of the purpose from a singular ideal to a complex of ideology and practicality.

The Tucson Solar Village was conceived as a solar demonstration project on the scale of a community rather than a single residence. The goal for the project as envisioned was straightforward—to build a housing project which showed how to use the abundant solar energy of the Sonoran desert to reduce grid energy use. Over the next decade the purpose for the project grew. Civano began took shape through a unique planning process which included private citizens, businesses and public officials from government and universities. By the time this project was officially named Civano the purpose had grown to encompass a complex blend of sustainable lifestyle ideals and the demonstration of community design for high efficiency green building techniques.

"Civano" is the name of a historical phase of a remarkable Native American civilization, the Hohokam, who inhabited this area 700 years ago. Parts of the Hohokam history parallel our present day challenges and gives deeper context to the namesake project. This Civano Phase was an environmentally difficult time following a comparatively less challenging period of expansion in population and cultural sophistication. Recurrent flooding and drought compounded challenges the Hohokam were experiencing beyond their ability to maintain their organization structure or centralized authority. The Civano Phase marked a decline of the sheer extent of Hohokam development, but it was not a decline of their civilization. Faced with new social and environmental circumstances, the culture adapted. The name Civano was derived from a word which indicated the chief of a great house. Stories indicate that it was such a

chief who helped foster a new way of thinking—a surge of innovation and a departure from earlier Hohokam traditions.

Civano Phase I now stands as the pre-eminent example of how to develop an entire growth corridor during a time barraged by environmental and economic challenges. To date, approximately 10,800 acres are under master planning. The requirements for energy efficiency and solar use have spread as Sierra Morado by Pulte Homes, The Orchards by Pepper Viner and The Presidio by Ducette continue to meet the standard for high efficiency building at a community scale established by the first Civano planners.

The Houghton Area Master Plan (HAMP) planning effort is largely modeled after the Civano project—with the significant exception of the environmental standards which, to date, have been omitted from the HAMP requirements. As studies about affordability and life-cycle costs of high performance buildings utilizing solar energy become apparent, there is a desire by the Metropolitan Energy Commission to make the Houghton corridor follow the Civano environmental standards as well.

This is the story of the inception, planning and performance of Civano; a master planned, high performance community. The state of the project is monitored by yearly audits which have yielded data and lessons learned which can be used to help citizens, building officials and developers relate to the burgeoning industry of high performance (a.k.a. green) building. Civano is the grand experiment which demonstrates affordable and increasingly sustainable development practices that incorporate renewable solar energy; for living soundly into the future.

If our planet were a beach, Civano would be a mere pebble, but move a pebble where no one has before and it will perhaps create a cascade of consequences which will alter the universe. While we continue to develop a remarkable global civilization we move mountains in an attempt to mold our environment to meet our needs, wants and desires. An old adage, "Necessity is the mother of invention," reminds us it is logical to move forward as if we have the potential to take a mere pebble, a seed of thought, and nurture it as though these are the early motions which will lead to the natural outcome of our civilization. But with each new tool we wield, our actions increasingly mold the future and our conquests of nature play a real and measurable role in altering the course of earthly environmental evolution.

We believe there have been defining moments in the history of our civilization when a single vision—a Civano—has changed the inevitable outcome with hope for a better future.

As resources continue to become more and more limited, a grand plan such as the Civano project is a rational progression towards sustainability that takes advantage of our most abundant renewable energy resource, solar energy, while reducing oil-fueled transportation and consumption of our irreplaceable water resources. Although the journey to Civano began in 1981, systematic approaches to green building are only now becoming mainstream. There are numerous programs springing up around the country. Some are developed by municipalities like Santa Monica or Scottsdale.

Leading this transformation are professional organizations like the National Association of Home Builders (NAHB) and the United States Green Building Council (USGBC). The USGBC's LEED—Neighborhood Development pilot program is the

only program being specifically developed for community-sized building projects at the time of this writing, but it takes the advances being made on all fronts of the building industry to help transform our built environment and nurture a new vision of how we will live more sustainable now and on into the unforeseen future.

Civano demonstrates the marketability of sustainable community development on a large scale at affordable prices. This 820 acre traditional neighborhood development utilizes proven, available technology to reduce natural resource usage substantially below current levels. The property is located on State Trust land in the City of Tucson, southeast of Houghton and Irvington Roads, where special zoning was approved to support the Civano project.

Civano addresses the growing desire for a new development pattern that enables people to meet their economic needs, yet maintain social values and ecological harmony. Civano, with an approximate population of 2,500 at the time of this writing, will become home to more than 5,500 people and the location of light industry, offices, a hospital, schools and retail businesses. Commercial, cultural, and civic activity clustered in the village center will foster a small town ambiance. The New Urbanism zoning goal is for half the population and two-thirds of the jobs to be located within a five minute walk of Civano's downtown commercial center.

Civano's master plan envisions construction of approximately 2,500 homes using significantly fewer natural resources than conventional homes. The challenge to builders is to develop housing with these features in a wide range of prices. This goal recognizes both the public policy intent of the plan and the economics of the competitive market area. The City of Tucson supports innovative approaches to these issues. To attain these goals, aspects of regional development, community design and building science must work in harmony.

Potable water reductions were gained using the technology of the City of Tucson's reclaimed water distribution system and the design of residences with smaller yards and community xeriscape. Reductions in home heating and cooling energy is achieved through a proactive building code called the Sustainable Energy Standard (SES)—which leads to the most practical utilization of available technologies that help achieve that goal (added insulation, high efficiency HVAC equipment, solar water heaters, excellent windows). Zoning was used to make commercial and mixed use areas within Civano to create the one job/two resident potential and place services within the community. This serves to lessen vehicular travel and the impacts associated with the traditional sprawling neighborhood. One of Civano's most outstanding examples is the mandatory use of solar energy to at least meet minimum Civano code requirements. At the early time of this writing a large private developer, WESTCOR, was in negotiation to take over the Houghton Area Master Planned site—as well as additional surrounding acreage. Will they use this opportunity to adopt the Civano model, including the Sustainable Energy Standard, and develop what would undoubtedly be the world's largest high-performance master-planned development project? Civano was a hard-earned stepping stone born of a public/private partnership of citizens, professionals and officials who utilized advanced planning that encompassed issues of ecology, energy, resource scarcity and community. It is from this stance that people can change

and influence a very old existing paradigm that promotes sprawling bedroom communities to the detriment of our society.

So, as work on the HAMP continues, will the citizens and officials of Tucson move once again to require these standards are met or exceeded? Why wouldn't they? The developers and builders at Civano took the original risk. By their 25-year efforts, the groundwork has been laid, the foundations have been poured and the homes have been occupied. Indeed, the numbers are coming in, the builders have been making money, and the buildings are running lean. The gauntlet has been thrown down.

Whatever comes to pass today, years from now when we walk along Civano's stretch of South Houghton Road in Tucson, Arizona, we will be able to look at the structure of the buildings there and know exactly how they function the way they do; how their walls, roofs and windows derive resistance to heat transfer and how they use solar energy to heat water, make electricity and light buildings. We will see the various urban design approaches: mixed use zoning, the walking paths, open spaces, beautiful low-water-use desert landscape and narrow streets that make it such a pleasant environment to be in. What we must carry with us as we walk away are Civano's seeds: the original intentions of the men and women who built it—so greatly improved over the developments that came before, and at little or no additional cost.

Inside the Civano Project includes the general steps that must be considered before and during any development projects that alter the built and natural environment—much of the language in this 26-year story has been guided by the current programs and trends that are becoming mainstream. This work provides insight into those elements of the planning of Civano that have proven fruitful and those that could be improved upon; for Civano came before its time.

As you read, please remember that green is a color, and sustainability is an ideal. Although we use these terms in this book, the search for sustainability is conducted by making each generation of the economy and the built environment higher performance than the last at a rate that exceeds our demands. As of yet, modern practice and technology are anything but sustainable—only improving a little bit at a time. Such paradigm shifts are a slow process, but like the Hohokam civilization once was, we are faced with many challenges and may be running out of time.

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Interviewees (in alphabetical order):

Richard Barna
Pam Bateman
Simmons Buntin
David Butterfield
David Case
Bob Cook
Doug Crockett
David Elwood
Rick Hanson
Karen Hidel
Vinnie Hunt
Kevin Kelly
Katharine Kent, P.E.
John Laswick
Hector Martinez
John Miller
Wayne Moody
Valerie Raluk
Paul Rawlins
Lee Rayburn
Sandy Reichhardt
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Ardi Whalen
Gal Whitmer
Martin Yoklic
Jerry Yudelson

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