



TERRASYSTEMS SOUTHWEST, INC.

Company Profile

Founded: 1998

Principals: Howard Ward
Cheryl Thurman

Locations: Tucson, Arizona
Chandler, Arizona

36 + years of experience

Affiliations & Boards

ESRI Business Partner since 1998

*Arizona Geographic Information Council –
Private Sector Representative, Legislative
Authorized body*

*Past President, AZ Chapter of Geospatial
Information Technology Association*

*Tucson Clean and Beautiful
Vice President, Executive Board (10
years)*

Awards & Recognitions

*National Hammer Award for
Innovative Use of Technology*

Public Sector Clients

State of Arizona – Government Information
Technology Agency; Secretary of State; State
Land Department

Albuquerque, Lovington, Silver City (NM)

Central Arizona Association of Governments

City of Oahu & Maui County (Hawaii)

City of Tucson (Arizona)

La Plata County (Colorado)

Maricopa Association of Governments (Az)

Pima County (Arizona)

Tampa Bay Regional Planning Council
(Florida)

Taos County, New Mexico

Private Sector Clients

AMEC Infrastructure

Arizona Land and Water Trust

Community by Design (nationally recognized
sustainable planning firm)

H3J Consulting

Prescott College Global Climate Change
Program

The Nature Conservancy

The WLB Group

Tucson Electric Power

Willdan Inc.

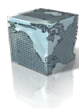
TerraSystems Southwest, Inc. (TSSW) is a Geographic Information Systems (GIS) consulting firm and an ESRI Business Partner with the main office located in Tucson, Arizona and a satellite office in Chandler, Arizona. Founded in 1998, the mission of TerraSystems is to assist organizations, both public and private sector, efficiently acquire and successfully apply GIS technology to enhance planning and decision-making processes. TSSW offers a full spectrum of GIS-related services including strategic planning, system design and installation, data conversion, spatial analyses, application development, decision support tools, on-call technical support and customized training. Our team of professionals has a wide range of experience, with over 35 years of GIS technical and managerial experience. TSSW is nationally recognized for our innovative use of technology, analytical methodologies and sharp attention to detail resulting in exceptional products and accomplished goals for our clients.

In order to maintain our leading edge in software development and to provide our clients with the most convenient and innovative solutions, TSSW uses ArcGIS Server with TSSW developed applications and mapping services available for TSSW clientele.

Valued Clients

Since its inception, TSSW has been involved with a number of progressive GIS projects throughout the southwestern United States, as well as such diverse locals as the Triangle-J area in North Carolina, Bozeman Montana, and Oahu, Hawaii. As a client-oriented consulting firm, TSSW has fostered a long list of successful projects and satisfied clients ranging from governmental agencies to planning and consulting firms, utilities, non-profit organizations and for-profit corporations.

As demonstrated by our partial list of clients, they are as varied in their size as they are in their mission. TSSW works closely with each client to define and customize a solution that meets their specific needs. From simple data conversion to complex application development, on-call technical support or strategic planning, TSSW has the flexibility to respond to the needs of our varied clientele.



TERRASYSTEMS SOUTHWEST, INC.

738 N. 5th Avenue, Suite 203 Tucson, Arizona 85705
520.322.0334 520.990-8366

25 + years of experience

Affiliations & Boards:

Arizona Geographic Information Council –

*Private Sector Representative
(2007 – present)*

*Tucson Clean & Beautiful Board Vice
President (2000-present)*

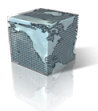
*Geospatial Information Technology
Association/Arizona Chapter
2008-09 President*

Accomplished Staff

Mr. Ward has been a practicing GIS professional for over 20 years, five of which he served as the GIS Manager for the Pima County Department of Transportation (PCDOT). While at PCDOT, he directed the creation of the multi-million dollar parcel and street network databases, and developed and marketed the Pima County Land Information System (PCLIS) CD. He was integral in guiding the strategic development and integration of GIS technology into various County departments.

As a principal of TSSW, Mr. Ward has conducted hundreds of GIS support projects for both public and private organizations since 1998, ranging from simple data acquisition to complex application development, data conversion and geospatial analyses. He has written countless GIS applications including the Spatial Growth Model for the Global Climate Change Program at Prescott College. TSSW co-developed the Spatial Groan Model (SGM), through NASA support, as tool designed to assist communities in addressing future growth issues and help them better manage and prepare for that growth. The first version of this application debuted in 2000 and has been updated as the ArcGIS platform continues to be modified and improved. He also participated in the development of several related growth impact modules developed as extensions to SGM, used to evaluate impacts on transportation, water infrastructure and to assess fire risk due to growth and climate variables. These models have been in applied in communities nationwide.

Mr. Ward has conducted and supervised countless Needs Assessments and Strategic Plans for organizations of varying size and complexity. This area continues to be one of Mr. Ward's most fervent interests in establishing and supporting the infusion of GIS technology into organizations. As the technology continues to rapidly grow and becomes increasingly intertwined with other areas of information technology, this integration of technologies is becoming critical to organizations of all sizes, both private and public. His constant pulse on new and forthcoming trends makes the implementation of GIS technology for TSSW clients one that is fluid, robust and empowers the very best that this evolving technology has to offer today and in the future.



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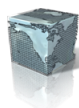
15 + years of experience

Mr. Ward is active in several statewide GIS professional organizations and has developed an extensive network of public and private GIS/Information Technology contacts throughout Arizona and the United States. Mr. Ward is currently the private sector representative to the Arizona Geographic Information Council a governor-appointed group coordinating GIS activities across the State of Arizona and past President of the Arizona Chapter of the Geospatial Information Technology Association (GITA), a GIS infrastructure management group. Howard has a proven track record of hands-on success in working in and for large public organizations backed up by decades of technical and managerial experience and strong employer and client references.

Cheryl Thurman, Principal, GISP –

Prior to founding TSSW, Ms. Thurman was employed by Pima Association of Governments, the Council of Government (COG) and regional planning agency for Pima County. In five years as a Water Quality Planner/Hydrologist and GIS Specialist, she conducted various regional water quality planning projects as well as hydrologic studies in Pima County, AZ. Ms. Thurman produced countless datasets used by local jurisdictions, as well as high quality cartographic products for internal and public presentations, publication and distribution. She was instrumental in bringing GIS technology into the PAG organization, having conducted the first departmental needs assessments and guided the overall organizational strategic plan process. She coordinated many regional GIS efforts with PAG member agencies such as Pima County, City of Tucson, the Town of Marana, as well as the Town of Oro Valley.

In the past 11 years as a Principle with TSSW, Ms. Thurman has managed numerous projects ranging from GIS needs assessments to strategic planning support, data creation, conversion, and cartographic production, as well as complex spatial analyses for governmental agencies, planning and engineering firms, non-profit groups, and for-profit entities. Her talents include database design, as well as database management, not only within the context of complex projects, but also organization-wide management of data through streamlined workflows and integration of data into a seamless environment. Ms. Thurman enjoys employing the latest in enhanced cartographic trends to deliver a superior visual component showcasing project results for



Numerous Strategic Plans and Needs Assessment completed for both public and private organizations, large and small.

Creative database designs with consideration of future needs and application demands.

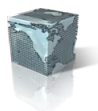
TSSW clients. She also actively pursues new developments in technology to optimize the distribution of maps, data, analyses and more through a variety of innovative web-based data publishing solutions.

Ms. Thurman is an ESRI ArcMap/ArcInfo expert and an AutoCAD user since 1994. She is proficient with all components of the ArcGIS Desktop Suite through the current 10.0 version.

AREAS OF EXPERTISE

Needs Analysis and Strategic Planning – TSSW has conducted and participated in numerous GIS needs assessments and strategic planning processes for organizations of varying size and complexity. Beginning with Mr Ward's leadership of Pima County's effort to acquire and deploy an enterprise-wide GIS database in the early 1990's through successful plans for Tucson Water, the Town of Oro Valley, the City of Casa Grande and the Central Arizona Association of Governments, TSSW has a proven record of listening to clients and helping them design GIS approaches that fit their culture and budget. TSSW can help any size organization adopt and adapt to the ever-changing GIS technology landscape by thinking carefully about what needs to be done and then identifying the right technology at the right scale to accomplish the goals.

Database Design and Implementation – TSSW staff have designed and implemented numerous complex spatial and non-spatial databases over the course of their careers. While at PCDOT, Mr. Ward directed the creation of the multi-million dollar parcel and street network databases. This was a complex task involving the design and implementation of workflows, programs and procedures for converting parcel data from its source in AutoCAD into a single, county wide GIS layer. TSSW staff assisted Tucson Water in the conceptual design of the GIS representation of their AutoCAD valve map database. TSSW Staff assisted the Maricopa Association of Governments convert and quality control numerous socio-economic and transportation databases for use in their GIS modeling efforts in Maricopa County. We regularly research, acquire, evaluate, convert and quality check spatial databases using ESRI products. This work includes a number of spatial and attribute cross-checks as well as topology rules and validation. We build and maintain our own internal SQL Server geodatabase and we are familiar with the workflows for installation, operation and maintenance of enterprise-level geodatabases. We are



Creative database designs with consideration of future needs and application demands.

also power users of Access and Excel products and use them to do extensive database translation and prototyping.

Data Creation/Conversion, Spatial Analyses, GIS Support Services – TSSW has completed countless data creation/conversion efforts for a variety of clientele, from small consulting and engineering firms, to large governmental entities, to local and national non-profit entities working under tight budget constraints. Often intertwined with data acquisition/creation/conversion is geospatial analyses – ranging from simple overlay analyses to complex suitability analyses built in ModelBuilder. TSSW has the capacity to meet the specialized needs of each client regardless of their size or the scale of their needs.

TSSW has extensive experience in supporting Conceptual Plan and General Plan project requirements, using innovative techniques to support the often complex planning process, as well publication quality cartographic products to communicate clearly to those unfamiliar with mapping and planning conventions. We routinely work as an extension of several planning firms which we have developed long lasting, supportive relationships over the years. Community by Design (CBD) is one such firm. TSSW and CBD have had a very successful collaborative relationship since 2000. CBD, nationally recognized for its dynamic urban design and sustainable community development, has included TSSW as a team member in countless Conceptual Plans, General Plans, Growth Management Plans as well as Downtown Development plans in Arizona, New Mexico and Colorado. TSSW provides CBD with a range of services from data research and acquisition, data creation/conversion, cartography, to complexity suitability analyses and growth modeling. Another long time collaborative partner is David Williams & Associates. Known as a leader in the Arizona planning community for common sense community-based solutions, DWA has utilized TSSW for GIS services support on a wide variety of projects ranging from small rezoning applications, to large scale planning projects such as the Town of Oro Valley Environmentally Sensitive Lands Project, culminating in a new ESL ordinance for the Town in 2010.

GIS Application Development and Integration - TSSW staff and independent contractors have written

Flexibility and the responsiveness TSSW is known for –both necessary for successful GIS support services in projects of all scales and budgets.



TSSW applies the newest technological capabilities resulting in the most effective application development process and final products.

Fluent in the following programming languages:

*Python
Visual Basic
C#
.NET
JavaScript*

Expert knowledge of ArcGIS Desktop and Server object models, as well as ArcSDE.

Publication quality cartographic products acknowledged by State and Local jurisdictions and private industry clients as top notch for graphic design presentation while delivering desired data and information in the most understandable manner possible.

numerous GIS applications for data processing and analyses, including ones for data translation and loading, data quality control, infrastructure management programs, and spatial analysis. We program using Python, .NET/ArcObjects, VB/ArcObjects, JavaScript, VBScript, VBA and others. TSSW built a population Build-Out Model (BOM) for the Central Arizona Association of Government and a Spatial Growth Model for the Global Climate Change Program at Prescott College. The CAAG BOM is written in Python, runs in ArcToolbox, and estimates the total dwelling units, population and jobs in Pinal County at build out. This application has reduced the time for model update from weeks to less than one hour. SGM is a ArcMap 3.x and 9.x extension designed to assist communities address future growth issues and help them better manage and prepare for that growth. SGM has been applied in various communities nationwide and was part of a project that won a National Re-Inventing Government.

Cartography - TSSW is known for its high quality cartographic products and inventive use of desktop graphics software to display GIS data, analyses and model results. Through the use of ESRI's ArcTIN and ArcSCENE, TSSW works with clients to create 3D visualizations which can be used as an effective decision-making support tool.

Web Mapping and Publication - TSSW maintains an ArcGIS Server Enterprise license for publishing prototype maps and applications for clients. We have created 3D Models in 3D Analyst and published them to our server to create multi-variable analysis interface by draping 2D maps of one or more variables over a 3D surface of another. We maintain an Image server license and have several active project and statewide image services online. TSSW has developed a number of ArcGIS Server web maps using primarily the Web ADF, REST and JavaScript API's.

In addition to maintain our own web servers and services, TSSW employs techniques of the "digital earth" to assist our clients in viewing and interacting with their GIS data and model results with Google Earth. TSSW has developed a prototype GE application using a slider bar to display building permit issuance data in Pima County over a several year time period. We routinely place GIS information into the GE environment for clients to review. We have also used Google Earth to extrude parcel data based on various attributes such as land use intensity and land value to help clients more intuitively grasp conditions on the ground.



Project Samples & References

Local Government Enterprise GIS Implementation Services & On-call GIS Services Support



CENTRAL ARIZONA ASSOCIATION OF GOVERNMENTS (CAAG)

On-Call GIS Consulting Services (2006-2009)

From 2006 to 2009, TerraSystems Southwest, Inc. (TSSW) provided CAAG with a wide variety of on-call and project GIS support including database design, data conversion, application development, phone support and ad-hoc training to upgrade their ability to perform advanced GIS tasks in-house. Projects ranged from GIS strategic planning, through hardware and software specification, database design, data collection and maintenance, complex spatial analysis, application development and custom training. TSSW helped CAAG staff design and implement an enterprise GIS database, including maintenance, documentation and distribution workflows.

TSSW developed and applied innovative and creative approaches to re-align census blocks polygons and update existing land use layers saving thousands of dollars in conversion time, providing CAAG with more accurate data than had ever been available prior to this effort. TSSW designed, built and implemented an ESRI ModelBuilder and Python application to simulate future build-out scenarios and designed and implemented an ArcObjects application to more efficiently identify changes in geometry and land use attributes for future updates to the existing parcel-based land use data.

“TerraSystems provided invaluable help to us in our initiative to build GIS capabilities within the CAAG organization. TSSW went the extra mile to be sure we received quality products and services on-time and within our allotted budget. I would gladly recommend them to any organization facing similar needs.” – Jack Tomasik, Director of Regional Planning, Central Arizona Association of Governments

Jack Tomasik

*Director of Regional Planning
Central Arizona Association of
Governments
1075 S. Idaho Road, Suite 300
Apache Junction, Arizona 85120
(480) 671-0059
jtomasik@caagcentral.org*

Mr. Tomasik can speak to the wide variety of on-call and project GIS support TerraSystem’s provided including database design, data conversion, application development, phone support and ad-hoc training to upgrade their ability to perform advanced GIS tasks in-house.





STATE OF ARIZONA – ARIZONA BROADBAND MAPPING PROJECT

GIS Database Design, Creation, Verification and Collaboration for the National Broadband Mapping Project (2009-Present)

Beginning in late 2009, TerraSystems Southwest, Inc. (TSSW) was selected to provide GIS database and conversion support for this leading-edge nationwide project. The TSSW Team is responsible for a variety of complex database design and progressing tasks that have required extensive coordination with technical staff from the National States Geographic Information Council (NSGIC) and the National Telecommunications Information Administration (NTIA) to refine the initial NSGIC geodatabase model to be compatible with Congressional requirements for the submittal of broadband information.

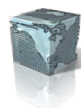
The TSSW Team developed, tested, and refined a very detailed workflow to process data coming from scores of different broadband providers into a standardized series of tables and geodatabase feature classes. This work is documented in a series of working papers, checklists and applications that ensure repeatability when the State takes over the maintenance of the broadband database. Nearly 3 million records of raw data have been processed into almost 200,000 features submitted to the NTIA

The TSSW team's database design, tracking mechanism, documentation and related analyses were recently acknowledged by the Geospatial Information Officer (GIO) of the Federal Communications Commission as an important contribution to the development and maintenance of the National Broadband Map; and our analytical approach was noted by the GIO as a technique that the National Broadband Mapping unit and other states could learn from. He further commented that our novel insightful approach, together with our long history of GIS expertise, has resulted in exceptional data.

"TerraSystems Southwest is the GIS consultant for the Arizona Broadband Mapping Project. Their services include processing data obtained from broadband service providers into NTIA and FCC compliant geospatial data format, conducting quality control and quality assurance measures on the data they process, contributing to improving data processing methodologies, and advising the management team on issues regarding GIS and mapping aspects of the project. In addition, they contribute advice on a wide variety of topics, based on their extensive knowledge of GIS and project management that has been a very valuable asset to our project." – Gene Trobia, State Cartographer for the State of Arizona

Gene Trobia
Arizona State Cartographer
State of Arizona
1616 W. Adams
Phoenix, Arizona 85007
(602) 373-4126
GTrobia@land.az.us

Mr. Trobia would be happy to discuss the complex database design and processing tasks TerraSystems is responsible for on this project. It has required extensive coordination with technical staff from the National States Geographic Information Council (NSGIC) and the National Telecommunications Information Administration (NTIA) to refine the initial NSGIC geodatabase model to be compatible with Congressional requirements for the



Gene Trobia
Arizona State Cartographer
(cont)

submittal of broadband information. TerraSystems has processed millions of records of raw data into the almost 200,000 features submitted to the National Telecommunication and Information Administration (NTIA) in the first submittal of the database. This involved data analysis and processing in both SQL Server and ArcGIS.



CITY OF CASA GRANDE, ARIZONA

GIS Implementation Planning and On-Call Services (2006-2009)

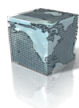
From 2006-2008, TerraSystems Southwest, Inc. (TSSW) provided GIS implementation planning and on-call GIS support to the City of Casa Grande, Arizona. TSSW assisted the IT Department in getting GIS re-started in five core City departments (Information Technology, Transportation/Engineering, Planning, Fire and Police). TSSW worked with Casa Grande staff to conduct a very basic needs analysis. A rough draft/working document was completed quickly and then incremental and iterative improvements were made continually over the next 18 months. TSSW also lead the production of an updated street centerline file, creation of a hardcopy and electronic map atlas, as well as the evaluation and update of numerous GIS databases. TSSW staff provided extensive on-call GIS support to City staff members from various departments, ranging from simple technical questions to complex explanations needed on GIS theory, data conversion and analyses. Over time, TSSW assistance has become less necessary as City staff have become more empowered through our knowledge transfer efforts.

"Howard was invaluable as the main GIS Consultant for the City of Casa Grande. He assisted in implementing the GIS for the City and was always on time and exceeded the requirements for services by going above and beyond to provide good service. I have recommended Howard many times to other colleagues and would hire him again given the opportunity. He is personable and honest in his work ethic. He also happily follows through with support for all of his decisions and deliveries to ensure the customer receives what they required. Howard also gives of his time and himself tirelessly for the promotion and the improvement of the GIS Industry, volunteering for many GIS organizations. Plus, he is a spectacular sailboat Captain!" -- Karen Thomas, former GIS Coordinator for the City of Casa Grande, Arizona

Karen Thomas, GISP *
GIS Team Lead
Northrop Grumman Information Systems
US Army Corps of Engineers
Honolulu District
(808) 438-7067
Karen.R.Thomas@usace.army.mil

** Ms. Thomas is no longer employed with the City. Her current contact information is listed.*

Ms. Thomas can provide information on the GIS Implementation and on-call GIS support TerraSystem's provided to the City from 2006-2008. Specifically, she can speak to disorder of the City's GIS in 2006 and how in 2 short years it was transformed into a cohesive, functional department with the help of Mr. Ward.



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TOWN OF ORO VALLEY, ARIZONA

GIS Strategic Plan, Implementation and Support Services (1999-2005)

In 1999, TerraSystems Southwest, Inc. (TSSW) assisted Global Systems Modeling Ltd. with a comprehensive GIS Strategic Plan for the Town of Oro Valley. This included a Departmental User Needs Analysis, recommendations for workflows and personal, software/hardware recommendations, cost analyses and proposed implementation scheduling. From 1999-2005, TSSW provided the Town with GIS Support services including a variety of data creation, conversion and update projects and provided on-call technical support ranging from simple technical issues to complex spatial analyses guidance.

“Having worked with TerraSystems Southwest on data conversion and GIS implementation projects at the Town of Oro Valley, I have found that their staff’s knowledge and expertise in small government GIS indispensable. They not only have the ability to manage complex projects and deliver diverse deliverables on time but they take pride in their work to insure the highest quality product is delivered to their clients. It is important to know about GIS data and systems, but knowing how it can best benefit and work within your organization is a skill that TerraSystems does best. I would highly recommend them to anyone looking for a highly skilled and knowledgeable GIS Firm.” – Raul Duato, former GIS Analyst for the Town of Oro Valley

Raul Duato *

*GIS Data/Programmer/Analyst
Eugene Water & Electric Board
500 E. Fourth Avenue
Eugene, Oregon 97401
(541) 685-7000*

** Coordinating Town Staff from 1999-2003, is no longer with the Town and current contact information is unknown. The subsequent GIS Analyst for the Town from 2003-2005 was Raul Duato. His contact information is listed.*

Mr. Duato can speak to the GIS Support Services that TerraSystem’s provided during his time as GIS Analyst for the Town. He is also aware of the extensive work done previous to his employment, the attention to detail we have, and the quality of the numerous end products created and updated.



On-call GIS Support Services – Private Sector



COMMUNITY BY DESIGN – ALBUQUERQUE, NM & TUCSON, AZ

On-call GIS Support (2000-Present)

TSSW has provided Community by Design, a nationally recognized and accomplished planning firm in the area of dynamic urban design and sustainable communities, with GIS services since 2000. From data research and acquisition, to complex spatial analyses and modeling, TSSW routinely provides responsive service with the anticipation and flexibility of a seasoned staff member. Projects includes Taos County, Colorado Growth Management Plan; La Plata County, Colorado Comprehensive Community Plan; Galisto, New Mexico Village Plan, Las Vegas, New Mexico Downtown Action Plan; Los Duranes Sector Development Plan (Albuquerque, New Mexico); Lovington, New Mexico Downtown Master Plan; Sawmill Land Trust/Wells Park Metropolitan Redevelopment Plan (Albuquerque, New Mexico); Silver City Downtown Action Plan (Silver City, New Mexico); Virden Comprehensive Plan (Virden, New Mexico); and numerous Arizona State Land Department (ASLD) Conceptual Plans for the greater Tucson and southern Arizona area.

“CommunityByDesign has utilized TSSW’s GIS services for over 15 years on a variety of innovative modeling and analyses related to land use planning, growth and development scenarios, and population projections and governmental jurisdiction needs assessments. We have found TSSW to be responsive and thorough with a high level of quality control. We look forward to working with them for another 15 years!” – Charlie Deans, Principal & AICP, CommunitybyDesign

**Community By Design
Albuquerque, New Mexico
& Tucson, Arizona**

*Charlie Deans
Principal, AICP
621 Vassar Dr. NE
Albuquerque, New Mexico
(505) 508-3361
(520) 444-1267*

Mr. Deans has over ten years of experience working with TerraSystems Southwest in a wide variety of jurisdictional planning projects ranging from General Plans and county-wide Comprehensive Plans, to urban design and sustainable community planning. Mr. Deans can speak to our ability to work on projects remotely, responsiveness under tight deadlines, exceptional quality of work and ability to work well with governmental entities, especially the challenges facing smaller and rural communities.



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