

# USING GEOGRAPHIC INFORMATION SYSTEMS TO MAP CRIME VICTIM SERVICES

## **A Guide for State Victims of Crime Act Administrators and Victim Service Providers**

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# MESSAGE FROM THE DIRECTOR OF THE OFFICE FOR VICTIMS OF CRIME



As more crime victims exercise their rights and seek services, state Victims of Crime Act (VOCA) crime victim compensation and assistance administrators and victim service providers are challenged to assess victim needs, allocate available resources effectively, and advocate for additional resources. Since the 1986 infusion of federal VOCA funds, many victim service programs have been established and preexisting ones have grown. During the past 15 years, state legislatures have raised funding for crime victim compensation and assistance, increasing the money available to victims and victim services. At the same time, field reports indicate that obtaining sufficient funds is a continuing challenge as we reach out to previously unserved victims.

Because of its growth, the victim service field is improving its administrative and management skills. Calls from policymaking bodies and the public for accountability on the use of public funds have led to an examination of tools that can support data-driven decisionmaking and outcome evaluation. To provide state administrators and victim service providers with one such tool for assessment, planning, and operations, the Office for Victims of Crime (OVC) has partnered with the National Institute of Justice (NIJ) Mapping and Analysis for Public Safety (MAPS), formerly the Crime Mapping Research Center, to introduce Geographic Information Systems (GIS) technology to the victim service field.

GIS technology can help analyze information, such as types of crime by location, victim population groups served and underserved, and the location of victim service organizations and their geographic service areas. This information can be used to examine the availability of basic services and the sufficiency of services for specialized population groups. It can

visually display multiple funding sources in a geographic area to help in fair distribution of resources. It can be extremely useful in developing strategic program and financial plans for the maintenance and development of victim services.

OVC is honored to work with NIJ to publish this valuable report. We also wish to extend our appreciation to individuals in the states and municipalities that provided the data used to create maps for this report. Our hope is that you will find GIS and this report useful in your efforts to advance crime victim services.

**John W. Gillis, Director**

*Office for Victims of Crime*

# MESSAGE FROM THE DIRECTOR OF THE NATIONAL INSTITUTE OF JUSTICE



For more than a decade, the criminal justice community has realized the valuable analytic benefits of Geographic Information Systems (GIS). This powerful technology enhances the ability of researchers and practitioners to identify problem areas and target scarce resources. To promote the use of GIS throughout the criminal justice system, the National Institute of Justice (NIJ) established Mapping and Analysis for Public Safety (MAPS), formerly the Crime Mapping Research Center, in 1997. A year later, NIJ created the Crime Mapping and Analysis Program, a training resource at the National Law Enforcement and Corrections Technology Center–Rocky Mountain, in Denver, Colorado. NIJ’s investment in crime mapping was timely because the value of GIS had been demonstrated with early successes in the analysis of criminal behavior. As a result, NIJ has supported the allocation of resources, the organization of data, and the evaluation of programs and initiatives to increase awareness of GIS as a crime-fighting tool.

NIJ’s crime-mapping efforts have yielded five national conferences on the study and use of crime mapping, each drawing more than 600 attendees. MAPS conducts research in the field of analytic crime mapping and offers guidance and leadership to criminal justice agencies nationwide. In addition, MAPS promotes, evaluates, develops, and disseminates GIS technology. Through partnerships and other federally funded programs, NIJ has helped develop crime-mapping software. Some software applications can be downloaded free from the MAPS Web site at [www.ojp.usdoj.gov/nij/maps](http://www.ojp.usdoj.gov/nij/maps).

Although great strides have been made in disseminating GIS technology to local law enforcement agencies, NIJ continues to explore new uses for GIS in the criminal justice field.

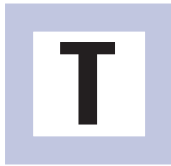
One natural application NIJ is focusing on is the more efficient allocation of victims' services and resources.

This report introduces GIS to state Victims of Crime Act (VOCA) administrators and victim service providers to improve the methods by which victim compensation and victim assistance are provided to states. VOCA administrators will learn how to manage the strategic planning efforts behind crime mapping and how GIS can serve as a key vehicle in the decisionmaking process.

**Sarah V. Hart, Director**

*National Institute of Justice*

# CRIME MAPPING



The use of Geographic Information Systems (GIS) in the criminal justice field has its roots in the earlier generation of police crime maps. Historically, law enforcement agencies and other organizations used hardcopy pin maps to chart criminal activity; but these maps were static and, as crime rates increased, difficult to maintain. In recent years, with advances in quick and user-friendly software, manual pin mapping has given way to computerized crime mapping.

GIS is an application that links database<sup>1</sup> software to graphics software to create visual images of various types of data in map format. It is a unique tool for analyzing physical space and conveying perspective. Presenting data in the form of a map helps agencies understand the significance of where, when, and by whom crimes are committed.

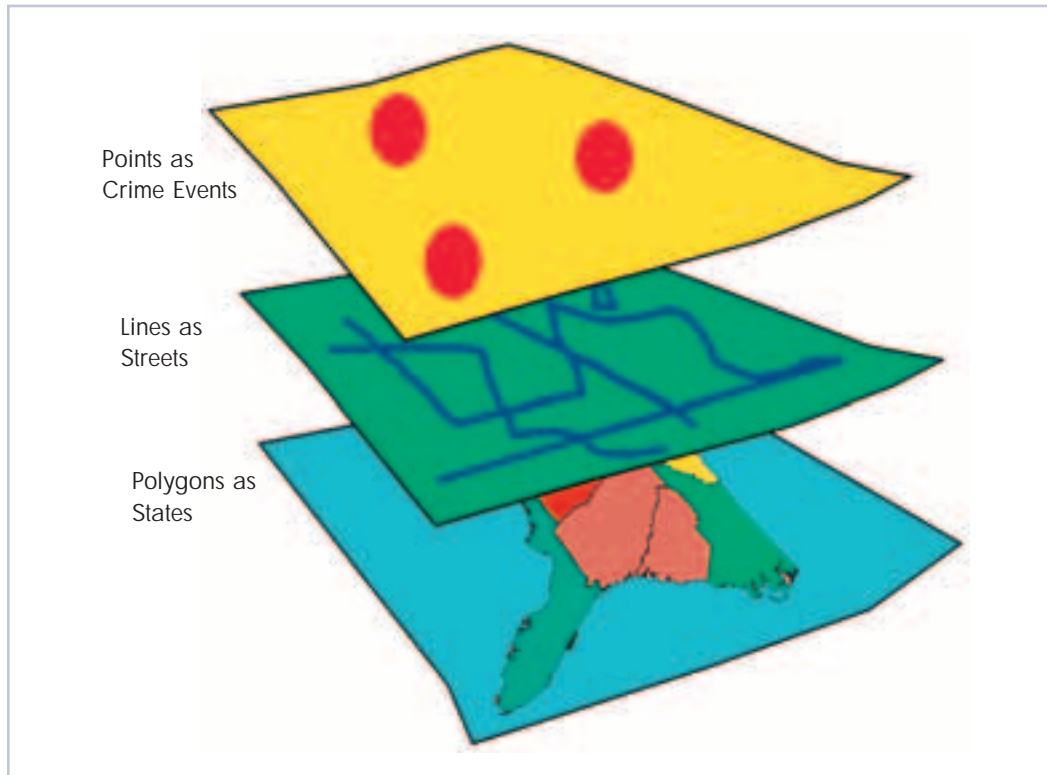
Technological advancements have enabled agencies to collect enormous amounts of data. In the law enforcement field, a rise in crime and an increase in the number of calls for service have led to a greater need to sort, organize, analyze, and disseminate data. As a result, criminal justice agencies are turning to GIS software and the latest crime-mapping techniques to deliver data in a more efficient and instructive manner. In addition, using GIS to map crime and criminal behavior eliminates the rampant duplication of efforts among agencies.

This has prompted the introduction and application of GIS technologies in the victim service field. Consequently, there is a growing need to educate and guide agencies that rely on other means of recording their data in the direction of implementing GIS. For example, if a VOCA compensation administrator wants to create a visual depiction of the location of applicants, street addresses and other relevant information can be converted into a database format and linked to a graphics software application. In this example, the link is based on the street address. Other spatial or geographic identifiers<sup>2</sup> that could be used include ZIP Codes and census tracts.<sup>3</sup> This particular example would allow administrators to analyze locations that generate victim compensation claims. Areas that lack applications could be

examined to determine whether additional applications can be generated and if administrators need to plan for outreach to those areas.

GIS software represents data on a map using points, lines, and polygons.<sup>4</sup> Features that can be represented as points include streetlight poles, crime events, and bus stops. Bus routes, streets, and rivers are usually represented using lines; counties, states, and ZIP Codes are depicted using polygons. GIS software is designed to capture, store, manage, integrate, and manipulate various layers of data, allowing the user to visualize and analyze the data in a spatial environment (exhibit 1).

### Exhibit 1: Graphics Representing Data

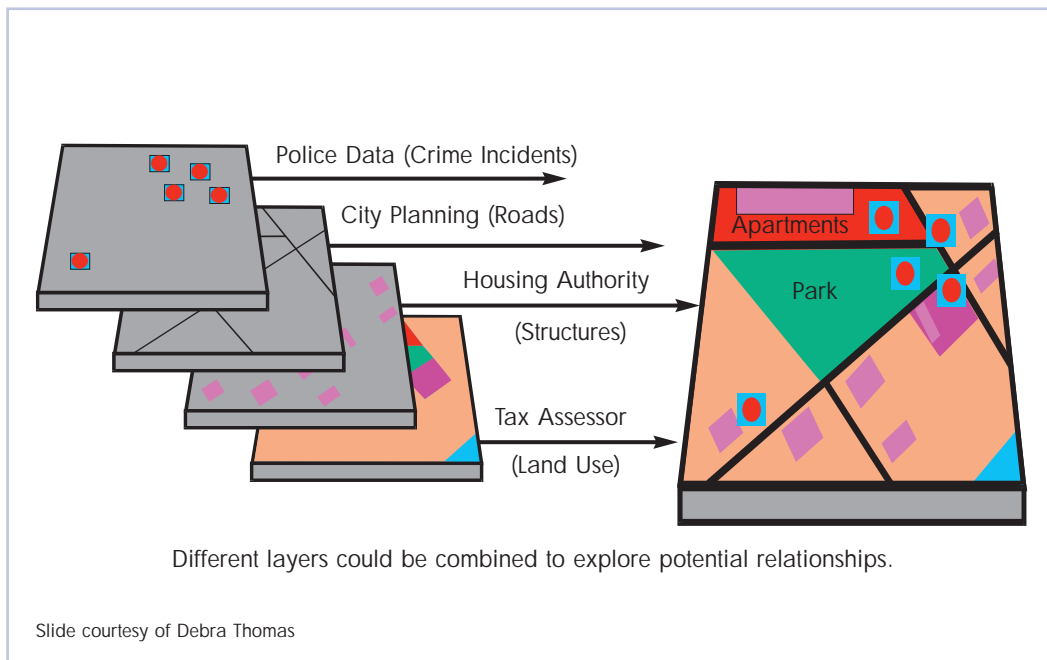


Most GIS applications contain base information that orients the map to the reader. Some examples of base information include roads and state and county boundaries. One easy way to visualize base layers is to think about the information found in a road atlas.

In GIS, a database can represent a layer of information and that can be expanded to create additional layers. For example, the OVC Subgrant Award Report System (SARS) could be one layer, with the location of all subgrantees defined as individual points on that layer. Another layer of data could be added by querying the SARS database for a particular type of service provider, such as programs for survivors of homicide victims. This additional layer would be mapped using a different color or graphic symbol.

The real power of GIS is that it gives users the ability to analyze multiple layers of information. Not only can users create additional layers from a single database, they can also integrate disparate datasets<sup>5</sup> from other sources such as police departments, planning and housing agencies, and the tax assessor's office (exhibit 2). Each agency's data would become another layer of information in GIS. With this layering of information, users can discern spatial relationships among previously disassociated data. For example, the layer of SARS information could be overlaid with incidents of domestic violence data from local police departments about locations of courts handling domestic violence cases and locations of public transportation systems. With this displayed information, users could examine how accessible services and the criminal justice system are for domestic violence victims.

### Exhibit 2: Multiple Layers of Information



GIS can pinpoint the physical location of features<sup>6</sup> in every layer. It allows an administrator to conduct spatial searches or queries in addition to tabular database queries. For example, a tabular database query can retrieve information about the increase or decrease in the number of crime victim compensation claims submitted in a particular region. What a tabular query cannot show is whether there has been a spatial displacement or diffusion of claims. In other words, has the number of claims remained the same but shifted from one neighborhood to another, or has the number of claims been diffused due to additional resources in an area?

Another example of a spatial search would be to determine the proximity of one location to another. For instance, one dataset or layer shows school locations, while another indicates



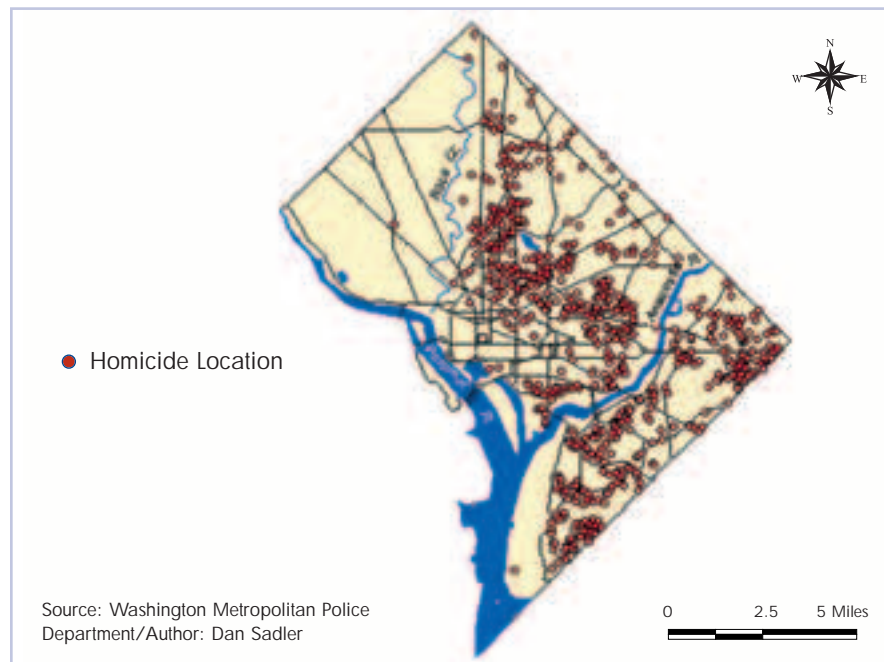
## Creating Maps

Crime mapping has its roots in cartography<sup>8</sup> and comes with its own set of rules and limitations. When publishing an article, authors always cite information resources. When constructing a map, cartographers always cite the source of the data and the software used to create the map. If citations are left out, the map is incomplete and users may misinterpret the information displayed. It is also recommended that mapmakers include disclaimers and/or additional information to eliminate any misinterpretation of the material. A variety of maps can be created using GIS software, but the three most common are pin maps, thematic maps, and association or integrated maps.

### Pin Maps

Pin maps—which use push pins to identify important locations—have long helped police officers patrol neighborhoods and detectives investigate crimes. GIS enables law enforcement agencies to create, update, duplicate, and distribute pin maps more efficiently and easily. Administrators of VOCA victim assistance can plot the locations of victim service providers on pin maps to identify gaps in and duplication of services. Victim service providers can display the vicinity of crime victims to better coordinate their efforts with other providers. The pin map is one of the easiest maps to create. Exhibit 5 shows the locations of all homicides that occurred in Washington, D.C., in 1994 and 1995. During the 2-year period, there were 756 murders and all but one occurred east of the Rock Creek Park.<sup>9</sup> Although the points on the map only show location, they reveal a spatial significance that cannot be discerned using a tabular query.

**Exhibit 5: Homicides in Washington, DC 1994–95**



## Thematic Maps

A thematic map can identify the density value of a particular attribute, such as the number of assaults, crime victim service centers, or victim compensation claims in a geographically defined boundary composed of a state, police precinct, county, neighborhood, census tract, or victim service provider catchment area (see exhibit 10). In exhibit 6, density values are used to create a map, with shaded colors representing the different values between the boundaries, that allows users to examine patterns across selected boundaries. The shading of thematic maps ranges from light to dark, with the lightest shade representing the lowest value and the darkest shade representing the highest value. Exhibit 6 shows the density of California VOCA subgrantees by county.

## Questions To Consider (Exhibit 5)

One of the unique qualities of GIS is that it creates new information and stimulates questions. For instance, some questions that could be generated from the Washington, D.C., pin map include

- ▶ Were the number of applications for crime victim compensation consistent with the number of homicides that occurred in the area?
- ▶ Are services available to the survivors of homicide victims?
- ▶ Where are services located?

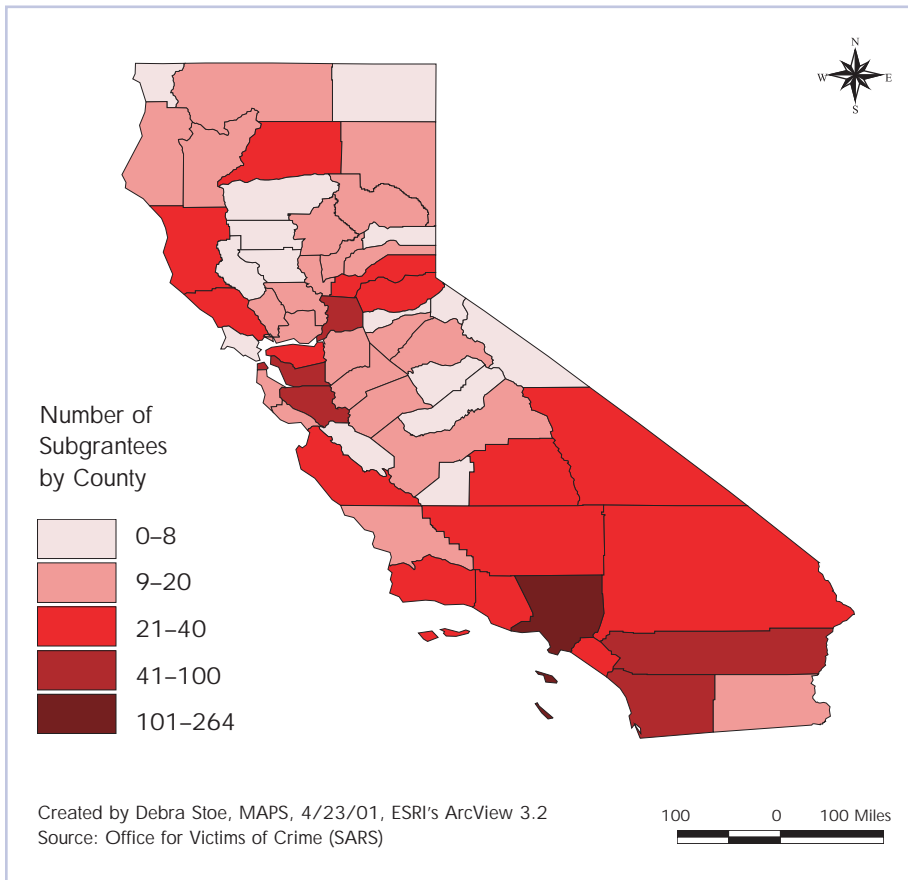
## Association or Integrated Maps

Association or integrated maps are usually a combination of a pin map and a thematic map. Exhibit 7 combines data from North Carolina's Winston-Salem Police Department (WSPD), the Winston-Salem Housing Department, and the U.S. Census Bureau. In this map, aggravated assaults and public housing units are identified with points, while the population demographics are represented with various shades of the same color and organized by police district boundaries.

This map spatially contextualizes<sup>10</sup> the data. Here, WSPD chose to view census data re-aggregated to police beat boundaries. With this type of map, WSPD can view income, population, gender, race, and other factors within the boundaries that represent the department's work environment. Winston-Salem manages and allocates police department resources by police districts. By reaggregating census data, information has been made more applicable to department needs. For instance, WSPD may choose to increase resources in communities with large numbers of public housing units. Integrated crime mapping allows WSPD to make strategic administrative decisions based on contextualized data.

## How GIS Is Used in Law Enforcement

GIS does not replace a law enforcement agency's process of collecting and storing information in a database. Rather, it enhances the agency's ability to use the data. However, the use

**Exhibit 6: Density of California VOCA Subgrantees**

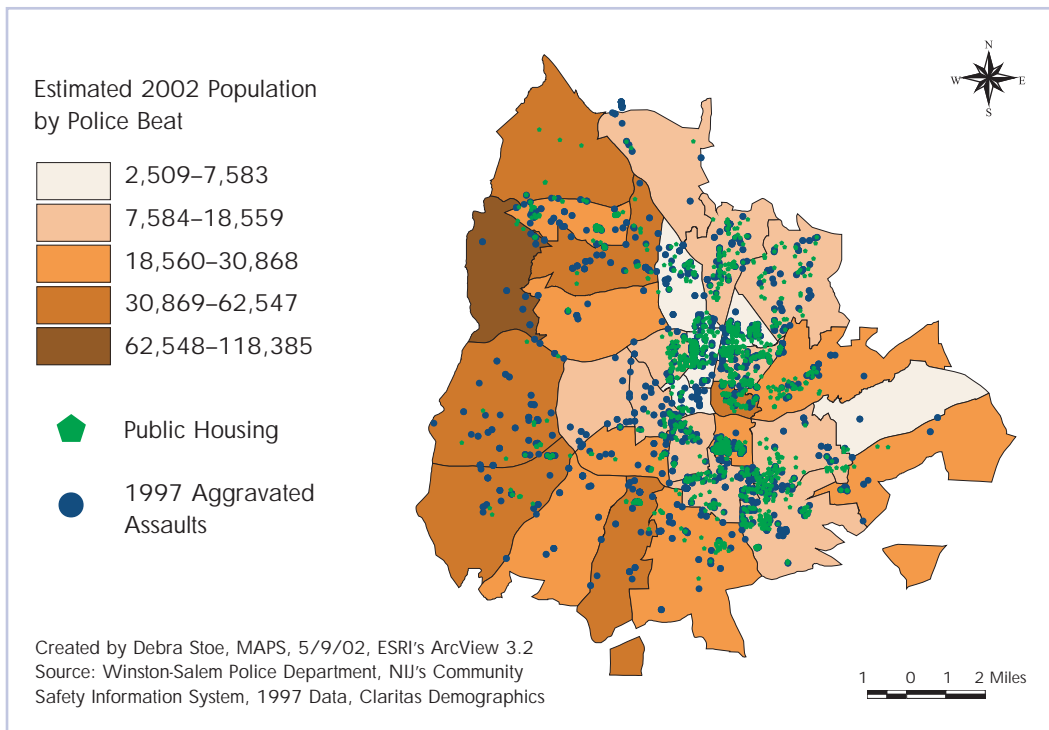
of contextualization raises new concerns about the need for privacy and confidentiality guidelines.

For example, a map can be created to show when and where a crime occurred with what type of weapon was used, whether a victim was present, whether the victim was male or female, and so forth. Once data, such as the income level of Hispanic females between ages 18 and 25, is entered into a GIS database, the user can overlay that information with a specific crime, such as recent homicides or rapes occurring in the neighborhood between 8 p.m. and midnight. Overlaying specific crimes with ethnicity, age, and gender may inadvertently reveal the

### Questions To Consider (Exhibit 6)

- ▶ Is the density of subgrantees consistent with population?
- ▶ Is the density of subgrantees consistent with the crime rate?
- ▶ What types of services are provided in all counties?
- ▶ Where are the gaps?

## Exhibit 7: Winston-Salem, NC



identity of a victim. Therefore, the creators of GIS data layers must be aware of confidential and sensitive data and the need to take precautions to protect victims' rights and privacy.

GIS usage enhances a police officer's time on the streets. An officer with access to GIS software and additional datasets, such as parolee and probationer data, can run queries from a

In 1998, the U.S. Department of Justice launched the Strategic Approaches to Community Safety Initiative, a multiagency collaborative approach to reduce crime in communities by using data-driven problem solving. One major component of this project has been the development of the Community Safety Information System (CSIS), a GIS that provides spatial analysis capabilities for addressing crime. Exhibit 7 is an integrated map created from CSIS data collected in Winston-Salem, North Carolina, the pilot site for the initiative.

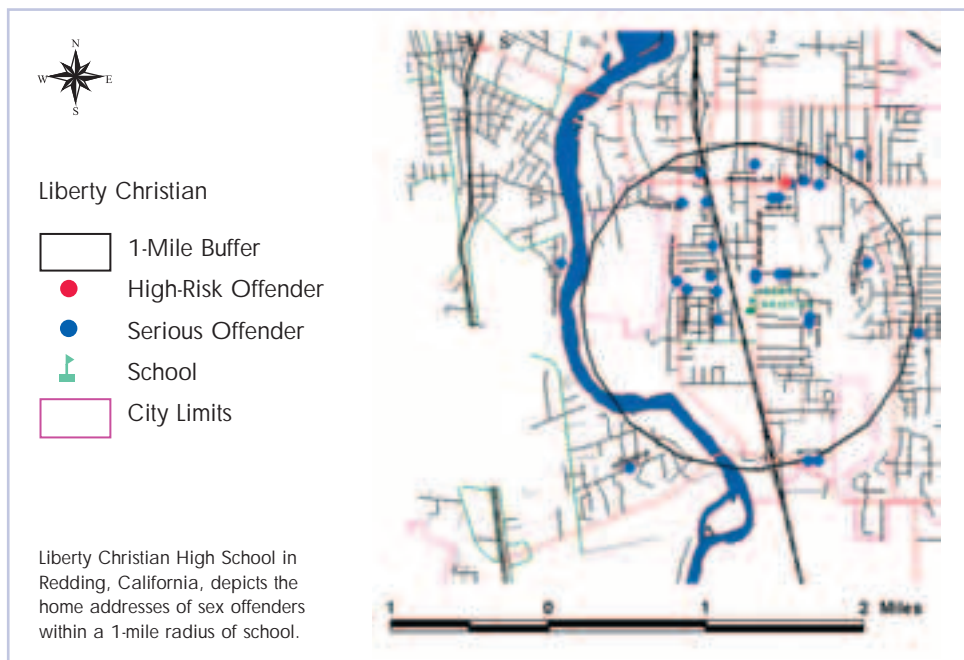
laptop in the patrol car using the Community Policing Beat Book. The Community Policing Beat Book is a crime-mapping tool created by Environmental Systems Research Institute (ESRI), funded by NIJ,<sup>11</sup> and tailored for law enforcement agencies. Officers can use it to check how many parolees or probationers were recently released on their beat, the conditions of their release, and if they have violated any of these conditions.

In addition to plotting the geographical attributes of criminal phenomena, law enforcement agencies seek answers to why a specific crime occurs in a certain area. In 1982, George L. Kelling and James Q. Wilson developed the Broken Windows theory to describe the relationship between disorder and crime in a neighborhood. They concluded that as the physical environment in a neighborhood deteriorates the crime rate increases. Newly opened adult bookstores selling pornographic materials, check cashing stores, and vacant housing are predictors of declining neighborhoods. By highlighting aspects of a crime on a map with

## Questions To Consider (Exhibit 7)

- ▶ Are a sufficient number of claims being generated based on this assault data?
- ▶ Where are hospital emergency rooms located?
- ▶ Are admission staff trained in compensation?
- ▶ Is there a victim advocate in the police department in areas with higher assault rates?
- ▶ Are other state and federal resources, in addition to victim compensation and assistance, being integrated in the public housing communities?

### Exhibit 8: Crime Mapping Registered Child Sex Offenders



**Disclaimer:** Please note that the symbols identifying the street location *do not* represent the exact location of where the offender lives. The symbols have been enlarged and offset to keep an exact location from being determined. This map can be found at [http://ci.redding.ca.us/rpd/rpdmap\\_libertychristian.html](http://ci.redding.ca.us/rpd/rpdmap_libertychristian.html).

neighborhood attributes, crime analysts can contextualize the data and gain insight about why crimes occur.

Some law enforcement agencies use crime mapping to show where registered child sex offenders live. They compare the locations of child sex offenders with the locations of the town's schools. A buffer zone is drawn around each school to observe how close the known offenders live to these potential target areas. The sheriff's department in San Bernardino County, California, is one agency that uses this technique. Exhibit 8 shows how the Redding Police Department in Redding, California, uses this technique to map registered child sex offenders.

One department goal is to register sex offenders with local law enforcement, a requirement under Section 290 of the California Penal Code. Another goal has been to arrest individuals who have violated the conditions of their parole or probation. In 1999, 3 of 36 targeted registrants were arrested for noncompliance with the penal code or some violation of parole or probation. In addition, county officers issued warrants for 25 other registrants. For more details, check out *Crime Mapping Case Studies: Successes in the Field*, Volume 2 (La Vigne and Wartell, 2000).

Similarly, a victim service provider could use GIS to track and map the location of both offenders and/or victims who were issued protection orders in stalking cases. GIS software can map the home address of an individual, taking into consideration the conditions of the protection order associated with the offender. Distance buffers can then be drawn around these locations and reveal violations or compliance with the specified restrictions.