

## Is Data Driving Your Fire Engine? Part 1

Finding, understanding, maintaining, and mapping spatial data for public safety

By Mike Price, Entrada/San Juan, Inc.

**Editor's note:** The author is the president of Entrada/San Juan, Inc., a natural resources and public safety consultancy. He is a licensed engineering geologist with more than 30 years of experience. For the last 12 years, he has been writing articles for *ArcUser* magazine that help GIS users understand, manage, model, and use data. Although this article targets managers of GIS data for fire departments and others involved in public safety, this data framework can be used throughout local government.

Public safety service providers everywhere are tasked with serving populations that are growing (or at least remaining static) as budgets decrease and resources become more scarce. In this budgetary environment, cost containment measures may include reducing staffing; redeploying apparatus; closing stations; and—in some cases—ceasing to serve some areas. Nonetheless, agencies still strive to provide the highest level of service through improving internal operating efficiencies, implementing interagency agreements, and creating regional authorities.

I am often asked by public safety mapping and administrative staff which datasets are necessary to perform various mapping and analytical studies. They are especially interested in the order of importance of these datasets. I keep careful notes on these essential public safety datasets and have noted which datasets provide the best value, how incorrect or inappropriate data can damage or derail a study, and what the best sources are for essential information.

In public safety, we perform many mapping and analytical tasks that include resource allocation and deployment, dynamic response modeling, historic incident analysis and reporting, and mapping of affected populations and values. These tasks combine to support large studies such as strategic, capital, master, and Standard of Cover plans. In this article, I have summarized my thoughts on and findings about public safety data. Public safety data is a very broad theme. In this article, I introduce and discuss framework data, as defined by the Federal Geographic Data Committee (FGDC).

Kent Fire/Fire District 37 is a career, rather than a volunteer, department in southern King



*Kent Fire/Fire District 37 in southern King County, Washington, protects an area of approximately 49 square miles that encompasses urban, suburban, and rural areas. Here an engine travels to the City of Covington to a new station that provides a high service level in the eastern portion of the district.*

County that protects a population living in approximately 49 square miles that encompasses urban, suburban, and rural areas. The district includes large warehouses and light industrial development. The district lies on a major north-south interstate freeway and a second high-speed arterial, and major north-south railroads traverse the city's downtown core. The district lies immediately southeast of SeaTac International Airport and approximately 10 miles from Port of Seattle's Duwamish seaport. Their fixed facilities include eight staffed fire stations and a Fire Prevention Bureau. In 2009, emergency responses exceeded 15,000 calls. Of these, approximately 76 percent were rescue and emergency medical service (EMS) calls; 5 percent were fire, explosion, and Hazmat calls; and 19 percent were service and other calls. The department serves a total population of more than 138,000 and protects assets that were assessed in 2009 at approximately \$18 billion.

The Valley Communications Center (Valley

Com), the region's dispatch center, is upgrading software and services. The district actively participates in the development of regional public safety datasets for deployment on mobile mapping and communication platforms.

### Framework Data for Public Safety

FGDC, through the National Spatial Data Infrastructure (NSDI), has developed a framework for assembling and supporting geographic data on a nationwide basis to serve a variety of users. The seven key data elements identified by the FGDC are (listed in order): geodetic control, cadastral, orthoimagery, elevation, hydrography, administrative units, and transportation. These familiar datasets are typically developed, maintained, and used by public and private organizations within a specific geographic area. Public safety mapping uses data from all these framework data types. For more information about the FGDC Data Framework, visit [www.fgdc.gov/framework/frameworkoverview](http://www.fgdc.gov/framework/frameworkoverview).

## My First Choice—Transportation

To create and maintain time-based emergency response networks, current, accurate transportation data is essential. Detailed street data that supports both time-based travel and incident geocoding is essential. Geocoding incidents also supports risk analysis by allowing historic incidents to be posted on maps. To start a study, I first look for the best available street dataset(s). Sometimes, the same street dataset will support both functions, but often two street sets, obtained from the same or similar sources, are enhanced, then maintained separately to support each task.

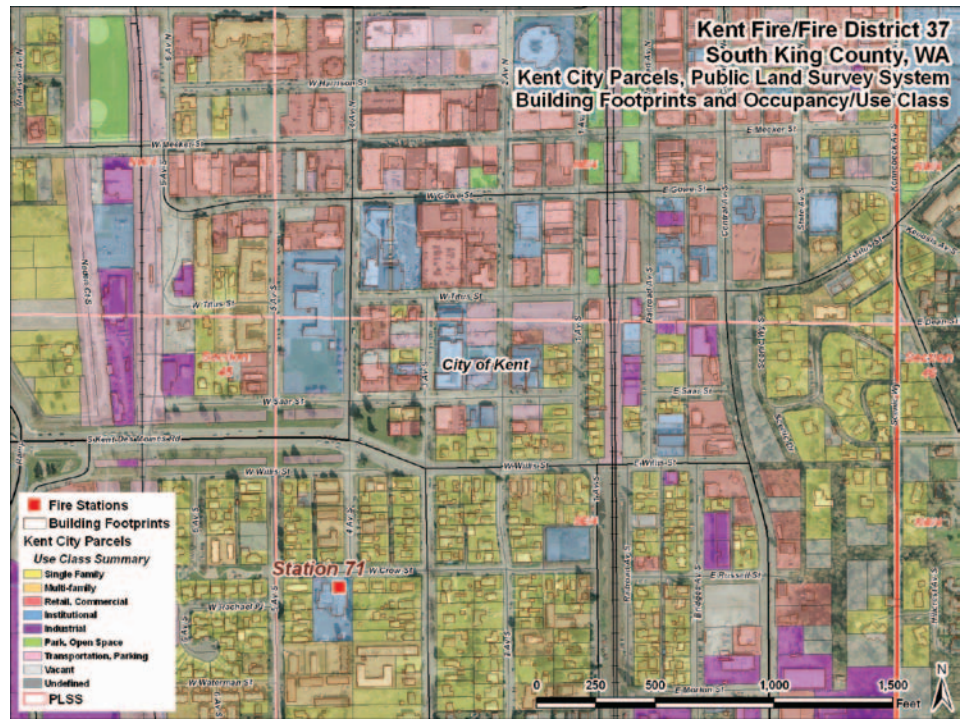
High-quality street data is available from commercial vendors. Reasonably current and accurate data is also available without charge from vendors and through the U.S. government. In many cases, locally constructed and maintained streets provide the most current, accurate, and adaptable solution.

For streets inside the district, Kent City Public Works maintains current streets for geocoding and, with minor enhancements, for emergency routing. For areas outside the district and throughout the South Valley, King County GIS provides regional streets. Valley Com is building a composite regional street dataset to support its dispatch and communications software implementation. County agencies provide their best street sets, which are being merged and standardized by a consultant. *[For more information about network streets, download "It's All about Streets" at [www.esri.com/news/arcuser/1009/networkstreets.html](http://www.esri.com/news/arcuser/1009/networkstreets.html). To learn more about geocoding, check out "The Call Comes In" at [www.esri.com/news/arcuser/0410/mp\\_geocoding.html](http://www.esri.com/news/arcuser/0410/mp_geocoding.html).]*

The U.S. Census Bureau is updating its MAF/TIGER Database (MTDB) for the 2010 Census. These streets should be available after they have been finalized. TIGER 2009 streets can also be downloaded from [www2.census.gov/cgi-bin/shapefiles2009/national-files](http://www2.census.gov/cgi-bin/shapefiles2009/national-files). Since 2000, there have been many significant changes in TIGER streets. Positional alignment has been improved, and addressing is more complete. Although TIGER 2009 streets provide a good address geocoding reference, they do not include the network impedance values or appropriate directionality and crossing relationships needed for performing time-based analysis. While it is possible to build a network dataset from TIGER 2009 streets, it requires considerable effort and extensive local knowledge.

## Second Pick—Cadastral

Next on my public safety wish list is county assessor parcel data. Parcels are constructed on the broader cadastral framework. County assessors typically use the Public Land Survey System (PLSS) to catalog and store parcel information. The availability, content, and spatial representation of assessor parcels varies considerably by jurisdiction. In the best case, attributes may include owner/occupant information, occupancy and use type, appraised and assessed valuation,



Fire District 37 GIS technicians use current high-resolution imagery to update live maps showing parcel-based occupancies, values, hazards, and essential facilities.

and structural information. A robust, current assessor parcel dataset will support hazard and value mapping throughout a county. Obtaining this data can necessitate developing a relationship with the county assessor, which can take time and require the appropriate introductions.

Since property values can quickly change in either direction, obtaining parcel data for several years may help. Assessor parcels are a key dataset when defining and structuring agency consolidations and developing or updating an agency's revenue stream. Also, with sufficient single-family and multifamily residential information, the occupancy percentage and average family size can be estimated prior to the release of Census 2010 data.

At Kent Fire/Fire District 37, assessor parcels provide information about new subdivisions and construction and changes in values and building occupancies. They define and support tax rates and are used for updating the Fire Benefit Charge. Parcel data can provide a reasonable estimate of street width and define candidate locations for proposed easements and new access. This data can also provide a framework for Fire Prevention Bureau staff as they perform inspections and update prefire plans. *[Fire Prevention Bureaus provide public education, inspection and code enforcement, and detailed plan review.]*

There is one more use for assessor parcels: if you convert the parcel polygons to centroid points and associate the highly accurate and standardized assessor site addresses, you have an excellent, reasonably current E-911 geocoding point file! *[See "The Call Comes In" in the Spring 2010 issue of ArcUser for more information on geocoding point files.]*

The district uses traditional cadastral data to define and map Fire Demand Zones (FDZs) and

design response zones (or Fire Boxes). FDZs are defined by quarter section aliquots in PLSS. *[An aliquot part is a standard subdivision of the area of a section based on an even division by distance along the edges, rather than equal area. Half section, quarter section, or quarter-quarter section are examples of these units.]* In Washington State, the PLSS is administered by the Washington Department of Natural Resources. In your state, the land subdivision could be administered by the U.S. Bureau of Land Management or other agency. For additional information and to download PLSS data in the western or central United States, go to [www.geocommunicator.gov/geocomm/lis/\\_home/home/index.shtm](http://www.geocommunicator.gov/geocomm/lis/_home/home/index.shtm).

## Third Choice—Orthoimagery

With street alignment and parcel boundaries on a map, the next step is checking those layers against imagery. Imagery is the third item on my list because it can be used for visually validating the streets and parcels in coordinate space. Current, high-resolution imagery is an invaluable tool for viewing and understanding many aspects of a street dataset including street alignment, lane count, intersection geometries, road width, and new construction. Aerial imagery shows the relationship between street edges, street centerlines, and parcel edges. It also shows the placement and orientation of structures on parcels. This is especially helpful when mapping and addressing apartments or condominiums that have many residential units on a single tax parcel.

At the wildland-urban interface, imagery provides a quick way to visualize fuels and measure the distances separating hazardous fuels from structures. In these areas, it is best to obtain two recent imagery sets—one with leaves on trees and one with leaves off trees.



*Assessor parcels, high-resolution imagery, transportation systems, and the Public Land Survey System (PLSS) combine to map parcel and building-level occupancies in the City of Kent.*

In the district, recent, high-resolution imagery that was carefully rectified was used for validating the location, orientation, and footprint area for structures; the preferred method of access for large parcels; points of building ingress and egress; placement options for fire apparatus; and even fire hydrants. Public safety mappers are highly visual people who are continually finding new uses for aerial imagery. Kent City updates its high-resolution imagery every one or two years. In addition, a contractor provides biannual updates of registered vertical and oblique imagery. District staff is just starting to use the oblique imagery for prefire planning, building inspections, and tabletop scenarios.

#### **Fourth on My List—Administrative Units**

With streets and parcels mapped and studied, administrative boundaries can now be refined. Boundaries, including county lines, city limits, fire districts, and Urban Growth Areas (UGAs) *[boundaries designed to contain urban sprawl]* are defined and maintained on a cadastre. The county clerk/recorder or surveyor often maintains this data at the local level. Regional boundary information may be recorded by state agencies (e.g., transportation, public lands, environmental). Federal agencies, such as the U.S. Forest Service, Bureau of Land Management, and Federal Emergency Management Agency (FEMA), can also provide boundary information.

At the Kent Fire Department, municipal and district boundaries are maintained by King County and Kent City. King County also maintains county, special district, and other boundaries countywide. Examples of special district boundaries for natural hazards and areas of environmental sensitivity are defined and maintained by the Washington Department of Ecology, Washington State Emergency Management District, FEMA, and other agencies.

The district includes regions of rapid urban and suburban growth. State-defined UGAs are essential, as they predict where and when additional services will be needed. During the 2009 reaccreditation, UGA-based growth projections provided key planning information. In a broad sense, all strategic/master plans and capital facility plans are guided by growth boundaries.

#### **Fifth and Sixth—Elevation and Hydrography**

As an old firefighter and geologist, I have com-

bined these two framework pieces and placed them toward the bottom of the list. However, in areas with certain natural hazards, these datasets should probably be listed first. Digital terrain data, including 10-meter digital elevation data, is available nationally from the U.S. Geological Survey (USGS) Seamless data site ([seamless.usgs.gov](http://seamless.usgs.gov)). Digital hydrography is available nationally from the National Hydrography Dataset at [nhd.usgs.gov/data.html](http://nhd.usgs.gov/data.html). Riverine inundation data may be previewed at FEMA's Map Service Center at [msc.fema.gov](http://msc.fema.gov). Data may be ordered from this site or it may be available without charge through your county or state emergency manager. Other terrain and water-based hazard information could be available through county or state emergency or engineering agencies.

In the district, 10-meter USGS terrain data provides a regional base. The Puget Sound Lidar Consortium provides terrain data as grids with 6-foot pixel resolution throughout the southern county. By combining high-resolution terrain with imagery, hydrography, geology, and transportation, district staff model new construction, flooding, critical slopes, winter operations, and travel slowdown on steep roadways. By combining different types of framework data, district personnel can model, understand, and solve many complex problems.

#### **And Finally—Geodetic Control**

Public safety mappers perform spatial mapping and analysis in a carefully defined and controlled coordinate-based world, though they tend not to focus on positional and spatial accuracy and instead are more concerned with getting trained personnel and sufficient and appropriate emergency equipment to incidents as efficiently and safely as possible. Behind the scenes, mapping data is carefully connected to a precise system of points and arcs that includes benchmarks, survey control points, and regional traverses. Local agencies rely on federal, state, and county agencies to establish and maintain the control

net. For most agencies, the county surveyor is the resident expert.

Accurate and extensive survey control supports all that emergency response personnel do. Survey control is important and becomes more so as regional response models and communication protocols are developed. For now, public safety mappers should get acquainted with their county surveyor and engineer!

#### **Special Data—Shape of Things to Come**

This article briefly summarized seven types of framework data that are used every day by public safety mappers. There is an extensive set of essential information that does not fit directly into framework categories. Here is a short list of special data used for risk/hazard/protection/value mapping:

- Fixed and Portable Facilities (Protection)
- Apparatus
- Personnel
- Special Services
- Other Essential and Critical Facilities (Protection, Value)
- Historic Incident Data (Risk)
- Water Supply (Protection)
- Land Use/Zoning (Hazard, Value)
- Growth Management (Hazard, Value)
- Special Hazards and Occupancies (Hazard, Value)
- Industrial
- Natural, Environmental
- Cultural
- Census Demographics (Value)
- Communications, Command and Control (Protection)

#### **Acknowledgments**

The author thanks the staff and administration of Kent Fire/Fire District 37 and their contributing agencies. Special thanks to Kent City Public Works, Valley Com, and the Zone 3 mapping group. Through partnering and mutual commitment, great things are possible.



*Current, accurate transportation data is essential to support time-based travel.*

# Is Special Data Driving Your Fire Engine? Part 2

## Finding, understanding, maintaining, and mapping special public safety data

By Mike Price, Entrada/San Juan, Inc.

- Facilities
  - Infrastructure
  - Location and description
  - Demographics
  - Hazards
  - Historic risk and program
  - Modeled and derivative
- ### 7 Categories of Special Data

Every jurisdiction needs not only framework datasets, such as transportation and cadastral layers, but also highly localized datasets on facilities, infrastructure, and other assets. These resources, typically used on a daily basis, must often be captured or derived by local government. Having a strategy for acquiring, organizing, and maintaining this data is every bit as important as framework datasets.

This article builds on a previous article, “Is Data Driving Your Fire Engine? Finding, understanding, maintaining, and mapping spatial

data for public safety,” in the summer 2010 issue of *ArcUser*. It presented Federal Geographic Data Committee (FGDC) framework datasets that are often used by public safety service providers. In this article, the processes of Kent Fire Department in southern King County, Washington, were used to illustrate how these datasets are acquired and used. The six framework types discussed in the previous article and descriptions of typical data types and sources of the Kent Fire Department are listed in Table 1. For more detailed information, please read that article at *ArcUser Online* ([www.esri.com/arcuser](http://www.esri.com/arcuser)).

### Introduction to Special Datasets

There are datasets necessary for public safety activities that do not fit into framework categories discussed in the previous article. These are extensive datasets that responders use daily for mapping station locations, recent incidents, coverage areas, and protected values. Many non-framework or loosely connected datasets have also been included in this second group, which we will call *special data*.

The scope, content, and sources of special data vary considerably. Many special datasets are generated and maintained by local jurisdictions using locally defined formats, styles, and standards. While framework data is closely aligned with FGDC standards for accuracy, scale, and completeness, special datasets are much more free form. These datasets typically meet the needs and answer concerns of one or several agencies. Their structure is typically defined by commercial software and data providers. Computer-aided dispatch (CAD) and fire service record management systems (RMS) are two closely aligned datasets that often vary considerably between jurisdictions, so sharing special data is not always easy.

The National Fire Protection Association (NFPA) recognized the need for guidelines and standards for special data. NFPA recently formed a committee to evaluate domestic and international public safety data sharing needs. The Committee on Data Exchange for the Fire Service is now reviewing and preparing recommendations, guidelines, and standards for public



| Dataset         | Description  | Source                                      |
|-----------------|--|---|
| Transportation  | High-quality streets for time-based geocoding and incident geocoding | Kent Public Works, King County, TIGER 2009  |
| Cadastral       | Assessor parcels with complete attribution                           | King County Assessor                        |
|                 | Washington Public Land Survey System (PLSS)                          | Washington Department of Natural Resources  |
| Orthoimagery    | High-resolution orthoimagery   | Commercial providers                        |
| Political units | City, district boundaries, and urban growth areas                    | State, county, and municipal data providers |
| Elevation       | 10-meter digital elevation model                                     | U.S. Geological Survey                      |
|                 | 6-foot LiDAR   | Puget Sound LiDAR Consortium                |
| Hydrography     | Stream centerlines, water body polygons, flood maps                  | U.S. Geological Survey and FEMA             |

Table 1: FGDC framework datasets

safety data. In this article, special data has been divided into seven categories that will each be discussed separately. To provide a real-world example, the strategies and sources used by Kent Fire will be described.

### Facilities—Essential and Critical

Facilities are locations and resources. Although they are usually fixed, they can sometimes be mobile. They contribute to or are affected by emergency response and public safety activities. Facilities can be divided into two subgroups: essential facilities and critical facilities.

Essential facilities include services (e.g., apparatus, equipment, and personnel) to provide public protection and effect an emergency response. Critical facilities are major recipients of emergency assistance and have special needs during an incident. However, facilities are not always only essential or critical. A particular facility, such as a school, might fall under critical rules during one emergency, such as an evacuation or a safety lockdown, but during an evacuation sheltering scenario might perform an essential function. Table 2 contains a short and intentionally incomplete list of essential and critical facilities. Use local expert knowledge and intuition to add more valuable datasets to these lists.

Each of these facilities requires mapping and on-site assessment to determine the role, effectiveness, and interplay of these resources during an emergency. Facilities are often mapped as location points or parcel/building footprint polygons. Attribution varies by jurisdiction and facility. Fire stations include apparatus and staffing; schools list student and staff occupancies and available evacuation resources. As a critical facility, a hospital might list typical patient and staff occupancies, areas with special evacuation needs, and hazardous or controlled substances. As an essential facility, resources for trauma service, patient handling, and medical quarantine might be listed.

Kent Fire maps essential and critical facilities at the parcel and building footprint level. For location points, aerial imagery allows points to be placed at front doors or street entrances for facilities such as fire stations. Attribution varies

by facility type. Essential facility data includes available resources, such as equipment and personnel, contact information, and staffing schedules. Critical facilities information includes populations at risk, temporal occupancy data, contact information, and emergency response plan links.

### Infrastructure

Infrastructure can become a very broad category. In the fire service, water for fire suppression quickly comes to mind, but there are many more infrastructure players to consider. Table 3 lists several infrastructure types and the associated datasets that are important for Kent Fire.

The Kent Fire Department maintains a close relationship with the Kent City Public Works Department, the primary water provider within the city. Data is updated and shared regularly, and neighboring water companies provide hydrant location and testing information. Prefire plans include information about buildings with sprinkler systems.

Emergency communications are managed by Valley Com, a regional center located in Kent's southeast suburbs. The communications links between agencies are tested regularly and are always improving. The regional center maintains call lists and radio frequency information for commercial service providers and utility employees who often participate during emergency drills. The Kent Fire Public Information Office has developed excellent relationships with the media and citizens in the fire district.

Kent Fire supports close relationships with commercial utility providers throughout its jurisdiction. Appropriate information is carefully shared and incorporated into emergency response plans. Utility data often includes secure, private information, so special arrangements between the two organizations protect sensitive information.

### Location and Descriptive Information

This category can become a catch-all for a variety of data. It is sometimes difficult to distinguish between a critical facility with very special needs and a target hazard exhibiting lesser hazard or risk. This data has location or position informa-

tion that is important to public safety mappers. Data types are typically points or polygons. Data sources can include assessor parcels, fire pre-plans, Environmental Protection Agency (EPA) inventories, or similar datasets.

Important location-based data might include

- E-911 address points
- Target hazards
- Cultural values
- Areas of critical environmental concern

Kent Fire works closely with the King County E-911 office to maintain a complete, current E-911 point set. Information collected from assessor parcels, building footprints, building permits, and field inspections keeps this data current. Kent Fire uses this point data as the source for its first order incident geocoding address locator because this data places incident points directly on the involved structure.

| Essential Facilities   |
|--|
| Fire stations  |
| EMS facilities   |
| Emergency operation centers                                    |
| Hospitals, medical centers                                     |
| Medical resources  |
| Airports   |
| Emergency landing zones  |
| Evacuation centers   |
| Critical Facilities  |
| Public buildings   |
| Hospitals and medical centers                                  |
| Public transportation centers and systems                      |
| Convalescent homes and care facilities                         |
| High-occupancy residential complexes                           |
| High-hazard industrial, commercial sites                       |
| Other high-risk sites that have a history of frequent response |
| Historic and culturally significant structures and sites       |

Table 2: Some examples of essential and critical facilities

## Demographics

Demographic data is often the best way to identify which resident populations are at risk. The U.S. Census Bureau updates block-level statistics every 10 years. It is 2010, and Census 2000 data is out of date in many parts of the country. Kent and other agencies anxiously await the release of this 2010 data. In the interim, locally collected summary information is used to update census population counts. Many regional associations of governments estimate annual population increases for municipalities, but it is much more difficult to determine growth within special districts that do not match city boundaries. Growth studies often use Traffic Analysis Zone (TAZ) projections to estimate future population in reasonably small areas. At the local level—and until Census 2010 data is released—emergency service planners use a variety of spatial and tabular information to update current populations and estimate future growth.

Sources of demographic data might include

- U.S. Census Bureau
- Community census updates
- Business statistics
- Building permits (both issued and finalized)
- Planning and community growth projections
- Local expert knowledge

At Kent Fire, GIS analysts filter current assessor parcel data to separate single family from multifamily dwellings. Building permits, fire preplans, and housing authorities provide multifamily data including unit counts and occupancy rates. Once the unit count is established, Census 2000 block records provide typical family composition throughout the jurisdiction. Population summaries are performed at the census block level and compared to city- and districtwide estimates for validation.



Kent Fire analysts use risk maps to compare primary station response capabilities to urban, suburban, and rural areas within the district.

## Fire Suppression Water Supply

| Type                      | Example   |
|---------------------------|---|
| Water sources and storage | Reservoirs, wells, tanks, and towers              |
| Water distribution system | Pipes, pumps, valves, pressure regulators         |
| Water delivery systems    | Fire hydrants, fixed fire protection (sprinklers) |

## Communications

| Type                             | Example   |
|----------------------------------|---|
| Emergency services communication | CAD center, emergency operations center, repeaters, portable and fixed radios |
| Public telephone                 | Land line and cell towers   |

## Utilities

| Type                      | Example   |
|---------------------------|---|
| Culinary water            | Location, quality, and security, emergency backups                              |
| Electrical service        | Distribution systems, service areas, emergency backups                          |
| Gas service               | Distribution systems, service areas, emergency shutoffs and shutdown procedures |
| Sewer, storm sewer system | Collection systems, treatment facilities, environmental sensitivities           |

Table 3: Infrastructure types and datasets



Kent Fire Station 73, located in the southwest corner of the district, protects residential and commercial occupancies along a major interstate highway.

## Hazards

Hazard data often comes from various federal, state, and local sources. Typical hazard types might include

- Commercial and industrial hazards
- Cultural hazards
- Natural and environmental hazards
- Land use and land cover (existing and proposed)
- Zoning (existing and proposed)

Kent Fire maps and analyzes many sources of hazard data, including Federal Emergency Management Agency (FEMA) floodplain mapping, parcel-based occupancy data, EPA hazardous substance inventories, insurance service data, and site inspection notes. Earthquake, lahar (volcanic mudflows), terrain, slope failure, and

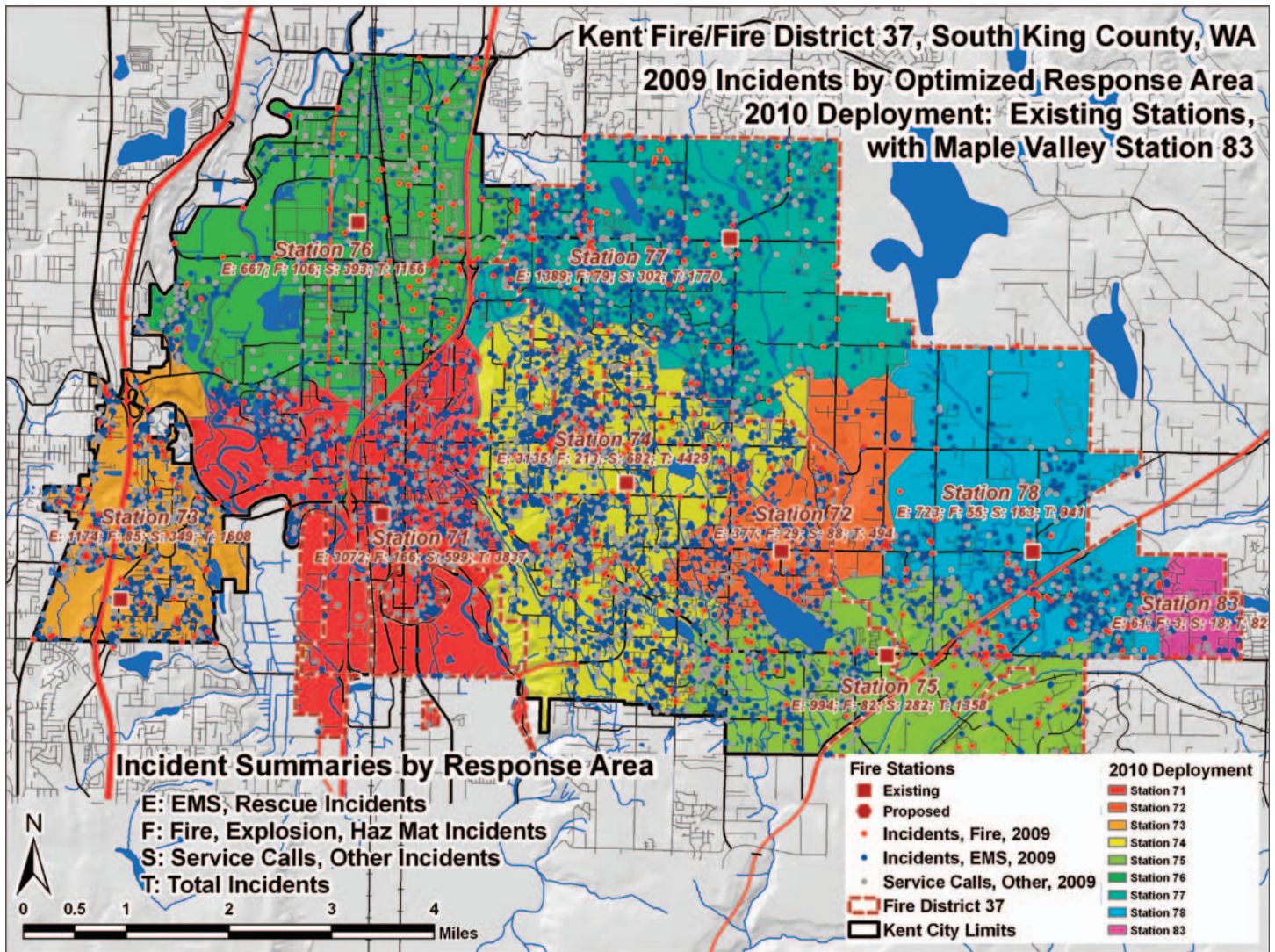
other hazards come from U.S. Geological Survey, the Washington State Department of Natural Resources Geology and Earth Resources Division, and private studies. Hazardous inventories and substances on-site are mapped from EPA Tier II (chemical inventory) data, Superfund Amendments and Reauthorization Act (SARA) Title III material safety data sheets, and site inspections.

The department protects a major interstate highway corridor, two major railroads, and the second largest warehouse facility on the West Coast of the United States. Hazardous substances that are being stored or transported in the county are monitored through shipping documents and on-site storage information. Kent Fire supports a geographically distributed and highly trained Hazmat response team. King County and Kent City land-use and zoning maps identify areas where hazardous occupancies often cluster.

## Historic Risk and Program Data

For many emergency service agencies, the number one item on a special data list has been historic incident and response data. This information is essential for mapping response activity, measuring performance and risk factors, and assessing program development. Emergency service mappers geocode and analyze incident response data to understand program effectiveness, overload, and limitations. Incident-level data provides an incident location, incident type and severity, and time stamps that monitor the overall incident from call received to call complete.

Apparatus-level records include time information for each responding unit including when it is notified, how long it is en route, time spent on



One year's incidents, mapped and symbolized by type, provide excellent benchmarks to analyze response effectiveness and identify regions where very high incident loads might overwhelm assigned resources.

the scene, time when the scene is released, and the time in service. Apparatus data identifies the response time and capabilities of the first unit on scene and tracks the arrival and departure of all dispatched units. Postincident analyses recall when full concentration (i.e., sufficient apparatus) and a full effective response force are reached at the scene. Historic incident data reveals possible gaps in service in space and time. It provides invaluable baseline data for program tracking and modification, including performance studies, growth analysis, and public awareness/reporting. Incident analysis is

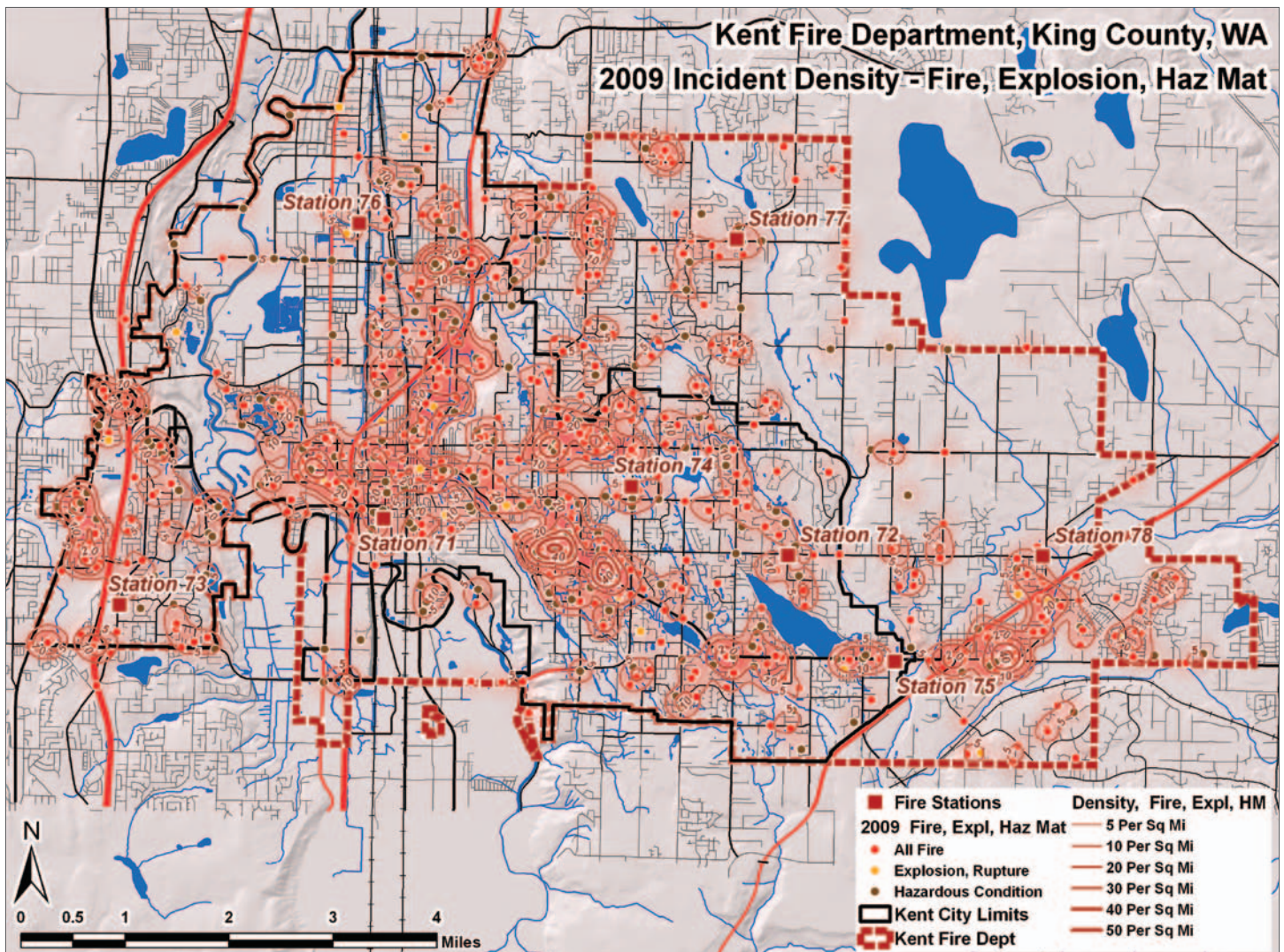
a fundamental piece of the Standard of Coverage (SOC) study, now performed by many agencies to measure level of service and demonstrate to government officials and the public that the department is effective.

- Risk and program data typically includes
- Historic emergency responses (by incident and apparatus)
  - Fire inspections and preplans
  - Special studies

The Kent Fire Department obtains incident data in real time from Valley Com. All information is transferred into the department's RMS

for inspection. Once addresses are standardized, call types confirmed, and time stamps verified, the incidents are geocoded, mapped, and analyzed. In 2009, Kent Fire was reaccredited by the Center for Public Safety Excellence (CPSE). Historic incident data, analyzed to demonstrate agency performance and improvement, played a key role in the reaccreditation process. Kent Fire also monitors risk through special studies, including multiple responses to the same address, suspicious fires, and frequent false alarms. These studies guide fire operations planning and fire prevention programs.

| Title   | Issue       |
|---|-------------|
| Under Construction: Building and calculating turn radii   | Winter 2010 |
| Run Order: Modeling and mapping public safety arrival orders  | Fall 2009   |
| Do It Yourself: Building a network dataset from local agency data                                   | Summer 2009 |
| Convincing the Chief: Proving that time-based networks really work                                  | Spring 2009 |
| Using 9.3 Functionality and Scripts: Calculating transportation network slope and travel parameters | Winter 2009 |



Incident density, or "hot spot," maps show where fire, explosion, and hazardous materials incidents occur with greatest frequency.

**Modeled and Derived Data**

After obtaining and validating a variety of framework and spatial datasets, public safety GIS analysts create even more data. These derived datasets might include

- Primary station response areas
- Emergency response
- Operation plans
- Mutual, automatic aid relationships
- Growth analysis
- Capital facility plans
- Standard of coverage

As they assemble information, Kent GIS analysts apply many standard and innovative workflows to analyze data. They will compare and contrast data reflecting value, hazard, and risk with levels of protection. They monitor growth within the community and carefully plan for today's operations and for the future.

Recent *ArcUser* articles include many examples of public safety modeling that use actual data provided by Kent Fire and address topics

such as the fundamentals of planning, preparedness, response, and recovery; the use of data for master plans and capital facility plans; planning operations; and assessing and presenting performance measures.

On April 27, 2010, southern King County voters approved a proposition that merged the Kent Fire Department and Fire District 37 into a new Kent Regional Fire Authority (RFA), effective on July 1, 2010. The new Kent RFA continues to provide the highest level of fire and emergency medical service throughout the cities of Kent and Covington and in unincorporated areas of King County previously within Fire District 37.

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