FINAL REPORT

Date: 12/28/09

Agreement Number: 08HQAG0063

Project title: Building Stewardship Capacity for Structures and Transportation Geodata within the Iowa Geospatial Infrastructure

Organization:

Iowa Geographic Information Council, 291 Durham, Ames, IA 50011, http://www.iowagic.org/

Principal Investigator:

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Collaborating Organizations:

Iowa State University, GIS Support and Research Facility

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Data themes: Building structures and transportation road centerlines

Executive Summary

The 2008 Iowa Structures and Transportation CAP grant was partially successful in attaining its goals. Problems with the state's lidar acquisition prevented the timely extraction of building footprint data from lidar. Three counties of building footprint data are in review and will be available shortly. IDOT provided statewide road centerline data but was unable to make public a WFS to provide updates due to security concerns with its server. Project partner Iowa State University GIS Support and Research Facility completed a hardware upgrade for servers housing the statewide data sets used in a wide variety of applications, including this project. They also successfully developed an online Structure Maintenance Tool (SMT) that will allow smaller local governments to update the structure footprint data layer through online editing polygon features and attributes. Stewardship agreements with local governments for maintenance of the structure layer were deferred to allow the state's $1.3 million Geocoding Project to develop comprehensive data sharing and maintenance agreements that include all Iowa Geospatial Infrastructure framework layers, including structures.

Project Narrative

A. Describe the project; its tasks, highlights, challenges, and accomplishments.

The 2008 CAP project's main goal was to develop processes for providing structures and transportation data from Iowa to the NSDI and maintain them over the long term. Project tasks included:

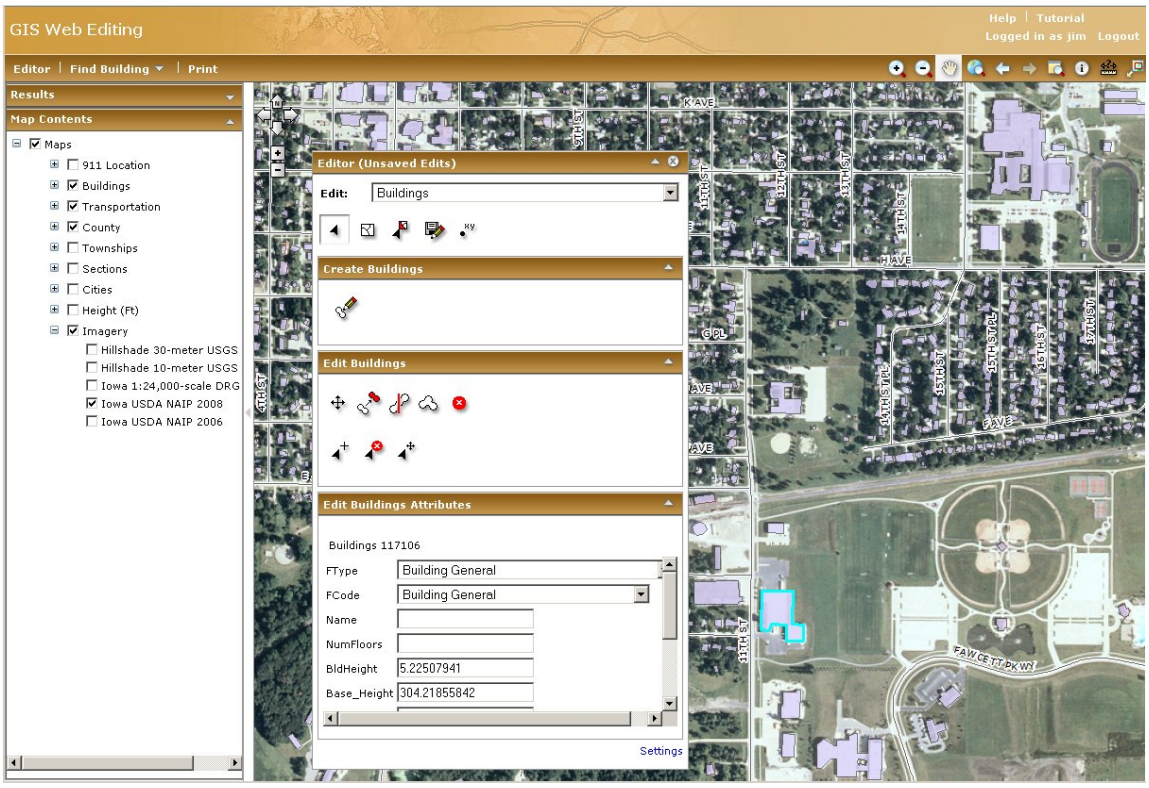
Task 1 - the Iowa Geographic Information Council will seek agreements for the stewardship of a structures GIS framework layer by local governments and transportation GIS framework layer by the Iowa DOT.

This project did not develop any agreements for structures stewardship because this work is being taken over by the state of Iowa's $1.3M Statewide Geocoding Project, which commenced July 1, 2009, and will continue over the next 4 years. It was decided that the task of developing agreements would be better accomplished by the larger Geocoding project in conjunction with other statewide projects, and that any initial agreements for structures would be premature and have to be redone. Ultimately, we are seeking comprehensive IGI data sharing and stewardship agreements between IGI partners (including federal, state, local and private) and data producers that will include all framework layers: orthophotos, control points, administrative boundaries, cadastral, elevation, hydrography, transportation as well as structures. The Geocoding project is in the process of developing more comprehensive contacts with various local government entities and their data contractors that maintain and use high-quality GIS data, especially in regard to address points and road centerlines available from local E911 PSAPs. The state homeland security division is in the process of developing an RFP for contractors to supply components of the Next Generation 911 system, which will include maintenance of high-quality GIS data needed for tagging IP based 911 calls (voice, text, data and video). The proposed NG911 system will have to address maintenance of the GIS data, including address points and road centerline address ranges on a statewide, centralized basis. Combined with building structure footprints provided by local entities, it is believed this system will have the best chance of successfully maintaining these three framework data layers for the long term..

The Iowa DOT, Office of Transportation Data has agreed to provide its linear referencing system based road centerline file and other transportation layers on an annual basis.

Task 2 – Develop GIS technical infrastructure to support the maintenance and stewardship of the structure data layer by developing a web editing service. This task was accomplished by the Iowa State University partner GIS Support and Research Facility (GISSRF) using ArcGIS server technology. GISSRF set up an ArcGIS Server application to perform online editing of building footprints (called the Structure Maintenance Tool or SMT). This password accessible application is intended for jurisdictions that do not have extensive in-house GIS capabilities or rapidly changing urban settings. In Iowa, rapidly changing areas usually have good GIS programs and updates to the structures database will be handled through the exchange of files. The SMT currently has pilot structure data derived from lidar for Polk and Story Counties, as well as current NAIP background imagery. GISSRF has produced two documents for this application – one describing how the application was set up using ArcGIS Server 3.0 and a tutorial. The set-up and tutorial documents are available on the IGIC web site: http://www.iowagic.org/igi/structures-and-transportation-cap-grant-2008

Figure 1 – screenshot of Structure Maintenance Tool showing tools for editing polygons and attributes.



Task 3 – Upgrade critical orthoimagery server at Iowa State University used in a variety of base mapping application and data development processes throughout the state (including this project). This task was accomplished by the ISU GISSRF. The Iowa Geographic Map Server (aka Iowa Ortho Server - http://ortho.gis.iastate.edu/) has been in operation since 1999 and was a cooperative development of the USDA Natural Resources Conservation Service and the Massachusetts Institute of Technology. The Iowa Ortho Server provides online access and viewing of several statewide raster layers including USGS funded orthophotos and DRG topographic map rasters, It has 2004-2009 USDA National Aerial Imagery Program data for Iowa as well as 2' 4-band orthoimagery collected under the current statewide ortho program. The complex of servers and attached storage that make up the ortho imagery services critical to a variety of base mapping applications and data development processes was upgraded with more robust hardware and the storage space doubled to roughly 14 terrabytes. This new space will allow for easy access to LiDAR data as it is acquired, higher resolution aerial photography, other supporting data, and the output of the LiDAR application built to develop the NSDI structures database for Iowa. The high-end server is able to use specialized GIS software to provide the data more reliably and quickly than the previous arrangement.

Imagery stored on the ISU server is directly used in the SMT application.

Task 4 – Develop of a extraction and translation service to automate transportation data from from IDOT's Linear Referencing System and GIMS database and store it in a centralized road centerline layer. This task was partially successful in that a road centerline layer from LRS/GIMS will be available through the IGI portal (igi-ftp.gis.iastate.edu) by the end of February 2010. This layer will be updated yearly, but not through an automated WFS process. DOT developed a WFS for internal DOT use, but was unsuccessful in getting a public deployment due to security concerns over a reverse proxy needed by the public service. The service is operating internally, and will be hopefully deployed publicly later in the spring of 2010 or FY 2011.

Approaches for participating in the NSDI: Iowa is a very GIS data rich state, with 75% of counties having some sort of GIS program, a statewide 2' 4-band leaf-off orthoimagery project

and a statewide 1 meter lidar project. The USGS state geospatial liaison for Iowa has played a very central role in helping coordinate these projects and injecting funding for critical pieces. That being said, Iowa has had little centralized GIS coordination over the past 20 years, with no state GIO or coordinator currently and a weak volunteer-led geographic council that only meets quarterly. With the state's economy and poor budget outlook, there doesn't appear much likelihood for any state funding for the long term staffing needed to run IGI. Using the IGI business plan and return on investment analysis from our 2007 50 States CAP Grant, we are proceeding to build key IGI components using project funding. So far this approach has resulted in $650k for the first half of the statewide geocoding project, which we are using to leverage other framework data layers into products needed by local GIS programs, in exchange for access to local GIS data. Obtaining the good will of local data producers is critical to IGI, NSDI and *TNM*.

Table 1 shows a comparison of *TNM US Topo* base layers and IGI framework layers. *US Topo* base layers were taken from the draft specification v0.5.10 document, and shows which layers and sources are currently being used or not. IGI framework layers are categorized as best available and future. Many of the future IGI layers will be collected from local sources and merged into statewide coverages by either a state and/or county GIS service bureau. There are two proposals pending to fund parts of a county and a state GIS service bureau.

Table 1 - Comparison of *TNM/US Topo* base layers to Iowa Geospatial Infrastructure framework layers.

US Topo v0.5.10 base layers	included - source	not included	**IGI framework layers**	best available - source	future - source	funding available - years to complete
orthoimage base	1m color leaf on - NAIP		*orthoimagery*	1m color leaf on - NAIP 2' 4-band leaf off - state	1' and 6" color - IFTN	$1.5M for 2' ARRA grant pending for higher resolution
transportation	roads - census airports - GNIS	rails, trails, other transportation features	*transportation*	roads, rails, airports - IDOT trails - IDNR	private roads – counties and cities	Possibly NG911?
boundaries	national, 1000 m USNG	state, county, PLSS	*boundaries*	municipal - IDOT county - IDNR	municipal, county - counties	none
structures	schools and hospitals - GNIS	other large structures (from HSIP?)	*structures*		building footprints - state	$1.3M geocoding project - 4 yrs
geographic names	populated and unpop places, natural features - GNIS hydro - NHD	other features	*no plans*			none
elevation	5', 10', 20' contours - NED	spot elevations	*elevation*	10 m NED	1 m lidar bare earth and 2' contours - state	$4.3 M - 2 yrs
hydrography	NHD 24k hi-resolution		*hydrography*	NWI 24k update - IDNR	local resolution stream centerlines from lidar - IDNR	none
control		benchmarks	*Geodetic control*	NGS, county GPS monuments		intern - 2 yrs
land cover		wetlands, urban areas, forest	*land cover (not an IGI framework layer)*	15 m 2002 landsat land cover - IDNR	1 m land cover - IDNR	DNR internal - 3 yrs
			cadastral	PLSS - IDNR	PLSS, parcels - counties	none
			address points	driveway points - county E911	building points and footprints - state	$1.3M geocoding project - 4 yrs

B. Describe the data content provided to *The National Map*.

For this project the Iowa DOT, Office of Transportation Data produced a 2009 transportation base map geodatabase containing several layers. This public data is available to *The National Map*. The Office of Transportation Data is the data custodian for road centerline GIS data representing all federal, state, county and municipality maintained roads in the state. DOT collects new road graphics and tabular attributes for secondary roads from county engineers and from the 100 largest cities every year. On a four year cycle it collects city road information from the remaining 847 smaller municipalities in the state. Data collected from local governments can either be in GIS, CAD or paper form, which are used along with aerial photography to update the GIS road centerline data. DOT does not maintain private roads unless that information is supplied by the local government. Other DOT base map layers include airports and mile markers.

DOT also collects legal descriptions, plats and surveys of changes to municipal corporate boundaries from the state's City Development Board, which handles all annexation requests in the state. With this information DOT maintains GIS data for city boundaries with yearly updates. This layer is also included in the 2009 transportation base map geodatabase. These data layers will be available before February 28, 2010 through the IGI portal (igi-ftp.gis.iastate.edu).

Despite difficulties with the lidar data, there were three counties of structure footprints and address points produced during the project. These pilot data products use the Structures Best Practices Model and the NENA/URISA draft address standard. These data products are undergoing internal review and will be made available for external review by January 30, 2010, through the IGI portal. Upon final approval, these data files will be made publicly available with metadata registered through the Iowa Geospatial Data Clearinghouse (http://www.iowagis.org/), which is an NSDI clearinghouse node. Additional counties are in progress and will be available by July 1, 2010.

This CAP project intended to derive structure footprints using statewide lidar data collected through USGS CSC-2 contract vehicle, task order #01014C0050. Difficulties encountered during the project have been numerous, not the least of which was the lack of usable lidar data.

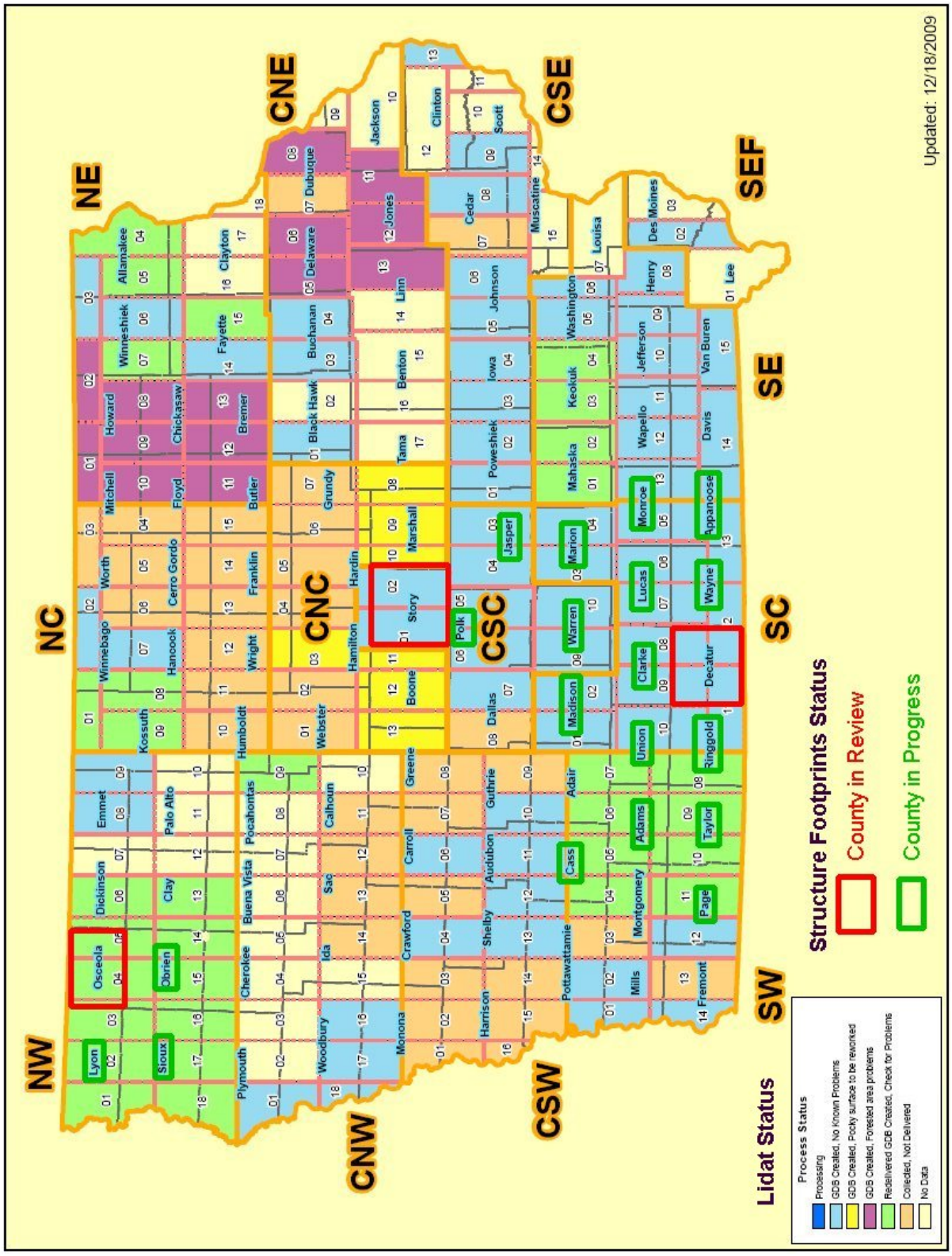


Figure 2 – Status of extracting structure footprints from lidar, overlaid on lidar delivery status as of 12/18/2009.

While more than half of the state has been collected to date, less than half has been delivered and many tiles have processing issues including noise (striping and pock marks), missing data points, missing classifications and missing metadata. Additional difficulties have been encountered with accurately extracting building footprints. While large buildings are extracted cleanly, houses in older neighborhoods with tall trees are problematic, needing manual extraction and/or editing. Automating this process has not been possible, so current plans are to extract a "cartographic product" usable above a specified scale (probably 1:12,000), and possibly edit building polygons into a cleaner form as part of the statewide geocoding project.

Our follow-on plans for the structures data is to develop this framework layer as a part of the state's geocoding project which focuses on a statewide address point layer and geocoding service. The geocoding project will complete the address point and structures layer over the next 4-5 years. The initial 2-year project will complete 30-50 counties, with the remainder finishing up over the next 2-3 years.

C. Describe the operational capability to maintain and update data through periodic updates of data made available to *The National Map*.

It is our intent to use the ArcGIS server-based structure maintenance tool (SMT) developed by this project to maintain a centralized structures polygon layer and address point layer for the state. The public rollout for this service will be July 1, 2010. As the state develops its Next Generation 911 system over the next several years, the location and custodian organization will likely change. Data files will continue to be available through the IGI portal and other traditional Iowa data nodes described below.

The operational capability for periodic updates will continue for specific framework and other GIS layers at the following data repository nodes in Iowa:

- DOT - transportation data -http://www.iowadot.gov/gis/default.htm
- DNR - natural resource data - http://www.igsb.uiowa.edu/webapps/nrgislibx/
- ISU Ortho Server – statewide raster data - http://ortho.gis.iastate.edu/
- Iowa County Information technology Group's (ICIT) Data Repository - GIS vector data created by local governments - https://www.iowagisdata.org/gisdr

The DNR NRGIS library has been providing free online GIS data in the UTM projection (with FGDC metadata) to the public since 1994. While this service will continue indefinitely, DNR's site can not provide the same data sets in multiple formats and/or projections. Using hardware purchased through this CAP project, the ISU GISSRF will provide a new data node for strictly IGI framework data products, including structures, centerlines, and orthoimagery from local sources in multiple formats and projections typically used by local entities.

In the near future, there are plans for providing basic GIS framework layers using web services (WMS, WCS, WFS). Orthoimagery is already being delivered via WMS by ISU GISSRF (http://ortho.gis.iastate.edu/tools.html). Using ArcGIS Server map caches, the Iowa Basemap will feature more than 20 different vector datasets that are used to create a common reference map reusable by other state agencies. The Iowa Basemap, initiated by the Iowa DNR, will eventually be a collaborative effort by multiple state agencies including the Iowa DOT and Iowa Homeland Security and Emergency Management Division. State agency data stewards will contribute framework and other data along with a standardized symbology to the Iowa Basemap. The Iowa Basemap will be available as a shared web service to other agencies. Updates are planned on a yearly or semi-annual basis once the service is established.

D. Discuss the issues, difficulties, and challenges (technical, institutional, and organizational) that were encountered.

We were invited to participate with the USGS state geospatial liaisons last June in Ft. Collins at a central region coordination meeting. This was a very good meeting and it should be held again at least every other year. What was most encouraging to see from the federal side was the solid direction that USGS mapping programs were taking with a renewed commitment to *The National Map* and the sister programs that support it. For a long time this was not the case and federal mapping was drifting along with no real direction.

What was most lacking about the *TNM* presentation at the Ft. Collins meeting was an assessment of the costs of a fully functioning program and the societal benefits of the product itself. Comments were made about the 11 to 1 leveraging of state/local funds to federal funds. While

on paper this sounds good, it hides the fact that the state/local side might consist of very little actual funding - definitely not enough to sustain programs like *TNM* that are relying on the state/local component for maintaining data content and currency. While ambitious technical goals were set out for the 3-year PDF cycle, no mention was made about the cost of getting there, especially for future products that will include all the basic data layers needed to recreate basic topographic maps. As a state person, the implication is that USGS assumes the resources will be there on the state/local side, but there is no recognition that this requires lots of planning and a realistic assessment of available resources to do the intended job.

During one of the presentations, a slide was shown that listed a large number of topographic map stakeholders, but no data indicating how beneficial the maps would be to these stakeholders, or to society in general in financial terms. This is an important part of the overall analysis and we urge USGS to calculate return on investment for the *TNM* products. This analysis should be part of a *TNM* business plan, done in partnership with the state/local data providers. States are being asked to complete business plans for state spatial data infrastructures, so doesn't it make sense that *TNM* should do one as well? This idea should be extended to the NSDI as a whole. It has been our experience that this will help with obtaining additional funding for mapping programs.

This brings up one final comment: on the home page of *The National Map*, there is a introductory paragraph that states "*The National Map* is a significant contribution to the NSDI". It has never been clear how the two are related: is *TNM* the map product of NSDI or are they complimentary but parallel programs? Nowhere is this confusion more evident than in data standards, with FGDC meticulously working for years on data standards for all kinds of GIS data, while *TNM* pushes the best practices models on their web sites. This was a very confusing issue during this project for both structures and transportation layers. Everyone is likely struggling with the issue of which standard to use or best practice model.

E. Describe your relationship and issues with the USGS.

Given the above comments about a TNM business plan, our follow on efforts shall include meetings with our USGS geospatial state liaison to develop an outline of how data will get into TNM from Iowa, including comparing likely schedules for TNM and IGI. We have a 10 year

IGI business plan to build all the framework data layers for Iowa, but how does that fit in with the various 3-year PDF cycles for TNM? Where are there overlaps and where will there be gaps, both in terms of coverage and resources? There are several opportunities for substantial cooperation.

Iowa DNR has recently completed a data stewardship agreement with our state liaison for the National Hydrography Dataset (see attached PDF file). We are trying to create a new stream centerline file derived from our new statewide lidar data at local scale (probably 1:4,800). Our local WRD office is completing its STREAMSTATS analysis using the hi-resolution NHD available in the national database. Corrections made to the hi-res NHD are not being stored back in the national database. We have provided our WRD office with 1 meter bare earth lidar DEMs for one 8-digit HUC to test stream extraction procedures developed during their STREAMSTATS analysis. DNR also has update National Wetland Inventory line work and attributes that it would like to conflate with lidar centerlines. We need to work with our state geospatial liaison to try to merge these efforts into a coherent workflow so that no efforts are wasted.

After the great flood of 2008 Iowa has a mandate from its legislature to produce new floodplain maps for the whole state in 5-7 years. With this mandate came $14M in one time funding plus ongoing staff costs for a revitalized floodplain management program. This represents a good opportunity to coordinate and cooperate on base maps for both TNM and floodplain programs. We will be working closely with local governments to include their GIS information as layers in local scale base maps as well.

CAP PROGRAM EVALUATION QUESTIONS

What are the program strengths and weaknesses?

The greatest strength of the program is that it exists and consistently helps move different groups and states in the right general direction. The greatest weakness is not funding, but having an overall TNM or NSDI business plan that everyone can refer to, chart progress and plan cooperative activities over several years rather than just seeing what turns up through a yearly competition. We have found that having a business plan for IGI allows us to more quickly take advantage of unexpected opportunities that arise, as well as plan year to year.

Where does the program make a difference?

For this project, the program got us going in the right direction and helped us leverage additional funding needed to actually create the building structure data. Initially we overestimated how much building structure data we could create as a by-product of another funded project (lidar processing). This led to leveraging additional funding so the job could be done correctly. We now have half of what we need ($650k) to complete the statewide address point and building structure layer, with the expectation of successfully acquiring the rest from the same state technology fund.

What would you recommend doing differently?

One issue that could help both USGS and groups applying for future grants is for USGS to make clearer their goals for each grant category, especially for data centric grants like this one. While developing the proposal for Iowa's application for this grant it was not clear that the USGS wanted actual data that could be included in TNM and not web services such as WMS or in developing technology to update databases online, as we did in this project. We were also not as keenly aware that the program was looking for HSIP data updates. This became clearer during one of the project conference calls. Now that these grants are more closely tied to TNM needs, these requirements should be easier to spot.

MEMORANDUM OF UNDERSTANDING BETWEEN

THE DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

AND

THE STATE OF IOWA
DEPARTMENT OF NATURAL RESOURCES

FOR

THE STEWARDSHIP OF THE NATIONAL HYDROGRAPHY DATASET

I. PURPOSE

The purpose of this agreement is to identify the activities that the State of Iowa, Department of Natural Resources (IADNR) and the U.S. Geological Survey (USGS), referred to as partners, will undertake to maintain, update, and improve the National Hydrography Dataset (NHD) in a program of data stewardship. The partners to this agreement represent Federal and State government with an interest in providing current, accurate, and consistent surface water geospatial data to meet the requirements of the National Spatial Data Infrastructure for hydrography. This agreement applies to local-resolution NHD data only. Secondarily, the Agreement identifies the important relationship between stewardship of the NHD and stewardship of the Watershed Boundary Dataset (WBD) although it is recognized that national stewardship of the WBD will be addressed in a future Agreement with the Natural Resources Conservation Service (NRCS).

II. BACKGROUND

The success of the NHD will depend on the partnerships established with a wide variety of organizations that work with geospatial hydrographic data. It is recognized that the most current, highest resolution and continuously maintained geospatial information reside with state and local governments, private entities, educational institutions, resource oversight organizations, and other Federal agencies. These organizations will need to work cooperatively to implement a program to exchange updates and improvements to the NHD.

Parties to this MOU recognize that maintaining NHD consistency, currentness, and accuracy will benefit all users of the NHD. The most direct benefit of shared maintenance is the ability to be informed about changes on the landscape and to receive spatial data that faithfully represents those changes. The best sources for information about changes are those closest to the change, such as State and local governments and organizations.

The NHD is a comprehensive set of digital spatial data that contains information about surface water features such as lakes, ponds, streams, rivers, springs and wells. The NHD interconnects and uniquely identifies the stream segments or reaches that make up the Nation's surface water drainage system. The NHD is a national framework for spatial position or surface water features, their attribution, their connectivity in a flow network, and an addressing system of linking additional related data known as events. Each reach in this framework is referenced by a permanent feature identifier known as a reach code. Each linear reach is also segmented into linear addresses measures along the reach. The USGS is the authority for reach codes and measures. Because the NHD provides a consistent framework for addressing and analysis, water-related information linked to reach addresses by one organization (national, state, local) can be shared with other organizations and easily integrated into many different types of applications for the benefit of all.

The State of Iowa, Department of Natural Resources (IADNR) and the USGS recognize the importance of establishing and maintaining vertical integration between the NHD and WBD datasets. This will maximize the return on investment for both datasets. At the national level, development of stewardship strategies for these two framework datasets is proceeding, but at this time, there is a better understanding of stewardship requirements for the NHD than there is for the WBD. The WBD is in a certification phase across much of the country. It is anticipated that, in the future, stewardship at the national level will be linked for these two datasets. In the meantime, stewardship between the two will be integrated to the greatest possible extent for the IADNR datasets.

III. DEFINITIONS

For definition purposes in this Agreement, "stewardship" is defined as the overall programmatic coordination to maintain an up-to-date statewide NHD dataset while "maintenance" is defined as the necessary revisions, corrections, updates, etc. to a particular sub-basin or set of sub-basins.

IV. AUTHORITIES

All activities conducted under this Agreement will be in accordance with the applicable laws, executive orders, regulations, and policies of the United States and the State of Iowa.

This Agreement is entered into under the MOU between the USGS and the State of Iowa for The National Map. This MOU establishes a framework for coordination and cooperation between the USGS and Iowa for facilitating the conduct of cooperative activities in areas of mutual interest in support of The National Map. This Agreement is also entered into under the authority of Public Law 99-591 which bestows permanent authority to USGS to "prosecute projects in cooperation with other agencies, Federal, State, and private" (43 U.S.C. 36c).

V. SCOPE

Both parties of this MOU recognize that maintaining NHD consistency, currency, and accuracy will benefit both agencies and all users of the NHD. The most direct benefit of shared maintenance is the ability to be informed about changes on the landscape and to receive spatial data that faithfully represents those changes. The best sources for information about changes are those closest to the change, such as state and local governments and organizations.

The Scope of the NHD stewardship activity defined here shall be the within the state boundaries of Iowa. This MOU further defines that the new stewardship scale for the State of Iowa is 1:4,800-scale, also known as Local Resolution. IADNR is working now to conflate the existing Iowa High-Resolution NHD (1:24,000) data to Local Resolution.

IADNR is recognized as the State's Authoritative Source for all edit decisions regarding the NHD in Iowa.

This agreement covers sub-basins in Iowa as identified in Appendix D. Stewardship of sub-basins shared with adjacent states will be coordinated between IADNR, USGS, and with those adjacent states and their corresponding stewardship representatives.

The objectives in this Agreement have been jointly coordinated and mutually agreed upon between the two partner agencies so that each agency's office can implement the programmatic and technical procedures and processes necessary to meet the required stewardship responsibilities for the NHD in Iowa.

VI. RESPONSIBILITIES

The State of Iowa, Department of Natural Resources agrees to:

1. Act as the single entity the USGS will interface with on stewardship issues within the State.
2. Take stewardship responsibility of 60 Hydrologic Units as documented in Appendix D.
3. Represent the interests of the user community concerned with hydrography in the State by providing the USGS with the most widely accepted representation of the surface water in the NHD.
4. Accept input from other agencies and organizations. Consider any change submitted and decide authoritatively if it will be accepted or not, and report the decision publicly.
5. Be responsive to the input received by responding to proposed updates within an agreed upon reasonable time. For purposes of this agreement, that timeframe shall be 60 days. Updates to the USGS shall be provided in a timely manner at intervals to be determined.
6. Maintain an awareness of the activities of other agencies and organizations involved in stewardship in order to include all applicable input for a given area.

7. Provide contact information for management and technical issues.
8. Provide publicly available information on status of data stewardship activities.
9. Provide updates in the agreed upon format (Appendix A).
10. Provide metadata that clearly describes the sources used in the update and the process used to make the changes.
11. Provide the USGS with updates that meet agreed upon quality standards. Maintain quality assurance as follows:
    a. Strive to ensure that the data is error free so that it will work in (1) the transaction process, (2) input to the working NHD geodatabase, (3) routine validation checks, (4) distribution, and (5) normal applications. The partner shall perform a quality assurance check on the data before it is delivered to the USGS. The method used to perform this check will be at the discretion of the partner.
    b. Ensure that the core content (features, attributes and relationships identified in the NHD standards) is included (Appendix B).
12. Rework updates returned for correction and resubmit to the USGS.
13. Utilize nationally consistent reach codes.
14. Provide the USGS with test transactions to demonstrate the ability to meet the standards.
15. Provide the USGS with updates on known and reported errors within 90 days.

The U.S. Geological Survey agrees to:

1. Be responsive to IADNR by processing transactions to the point of distribution in a timely manner.
2. Be responsive to IANDR by providing the necessary information and assistance to allow IADNR to stand up a stewardship program.
3. Provide the tools, documentation, and training to edit and update the NHD (Appendix C).
4. Work with the IADNR to develop solutions to incorporate hydrographic data needed by the State, but not normally included in the NHD framework.
5. Provide notification, documentation, and assistance in response to submitted updates that do not meet the requirements established and agreed upon by the partners. Return updates that need to be reworked to meet requirements.
6. Provide an Internet accessible reach code allocator and validate reach codes in update submissions.
7. Notify IADNR of any changes to the NHD structure, format, or content that may affect the State.
8. Provide clear guidance on expectations for acceptable updates.
9. Provide documentation on validation criteria applied to updates (Appendix B).
10. Provide documentation on formats for update transactions (Appendix A.)
11. Provide contact information for management and technical issues (Section XI).
12. Make updates submitted by the steward available in the geodatabase within 60 days.

VII. DATA OWNERSHIP AND RIGHTS

All data produced, updated, and maintained in the NHD is public domain and thus is available to any interested party.

This Memorandum is not intended to and does not create any contractual rights or obligations with respect to the signatory agencies or any other parties.

VIII. FINANCIAL COMMITMENTS

This MOU does not constitute a financial commitment on the part of either partner. The MOU is designed to serve as a mechanism under which each will work cooperatively to exchange updates and continually make improvements to the NHD.

IX. STANDARDS, DEFINITIONS, QUALITY ASSURACNE (QA/QC) SPECIFICATIONS, AND TECHNICAL REFERENCES

See Appendix A & B for the current references to NHD delivery formats, standards, definitions, and QA/AC.

X. PERIOD OF AGREEMENT

This agreement becomes effective on the date of signature by both partners and continues until modified by mutual consent or unless terminated within 60 days written notice by either partner. The agreement will be reviewed periodically and amended or revised when required.

XI. POINTS OF CONTACT

The USGS and IADNR designate the following persons as points of contact for this MOU and Stewardship Program:

	NHD Stewardship **U.S. Geological Survey**	**NHD Stewardship** **Iowa Department of Natural Resources**
Name:	**Bob Lemen**	**Chris Ensminger**
Title:	**USGS Geospatial Liaison for Iowa**	**GIS Section Supervisor**
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XI. APPROVALS

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Organization: U .S. Geological Survey

DATE: 9/29/09

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Organization: I owa Department of Natural Resources

DATE: 10-28-09

Appendix A

DATA DELIVERY FORMAT

All data transactions shall be in Extensible Language (XML) format, as defined in ISO Standard 15022. For more information on this standard, go to:

http://www.iso15022.org/ISO15022XML/defaultXML.htm

Appendix B

STANDARDS and QUALITY ASSURANCE SPECIFICATIONS

Many of the following documents are modernized versions of older documents. They are being posted under Technical References at the NHD web site http://nhd.usgs.gov/techref.html. For access to the latest copy see the USGS Point of Contact.

For standards on data content, use:

- **NHD Feature Catalog** (Replaces: Standards for National Hydrography Dataset - High Resolution)

For reference documents on features, attributes and relationships in the NHD:

- **NHD Stewardship Handbook** – April 2009 or later – In-depth guide to the philosophy, implementation, administration, and operation of geospatial data stewardship.
- **NHD Data Dictionary** - Replaces Introducing the NHDinGeo – Detailed guide to all NHD features.
- **NHD FCode List** – Revised August 2009.
- **NHD Metadata Guide** – Powerpoint – Guidance on how to best create and utilize metadata for the NHD.
- **NHD Quickstart** - The "NHD Quickstart" is a condensed reference document to help users obtain and view NHD data, and navigate the NHD Flow Path.
- **NHDinGEO Tasks** - The "NHDinGEO Tasks for ArcGIS 8.3 and Higher" is an in-depth reference document which describes how to use the NHD with ESRI's ArcGIS system.
- **NHDinGEO Schema** - Diagram of the tables, the table items, the item definitions, and the relationships between the tables in the NHDinGEO data model.
- **NHD Fact Sheet** - A brief summary of the history and characteristics of the NHD, with additional information concerning obtaining, and maintaining the NHD.
- **Geographic Names Information System (GNIS)** - Access GNIS to check, submit new, or make changes to names in GNIS.
- **NHD Best Practices** – Due December 2009 – Overview of revision and collection practices.

Appendix C

SOFTWARE TOOLS TO BE USED

A tool is needed to specifically edit NHD data since the NHD structure is somewhat complex. This complexity is part of the design that makes the NHD so suitable for a stewardship environment. Many components are tracked in special tables that trace the legacy of the data. The NHDGeoEdit Tool was developed by the U.S. Forest Service and made available to the partner for use. The USGS has assumed responsibility for the maintenance of the NHDGeoEdit tool being shared with the partner.

The NHD Geo Edit Tool can be accessed at:
http://webhosts.cr.usgs.gov/steward/scripts/st2_software.pl

For user-developed applications, go to: http://nhd.usgs.gov/applications.html

In order to produce local resolution data the High-Resolution NHD Dataset must be conflated with IADNR's local hydrographic data. The USGS has developed a software tool to perform this conflation. This tool, NHD GeoConflation Tool, along with other miscellaneous NHD software tools (NHDUtilities and NHDFlowCheck) will be provided by the USGS.

Appendix D

IOWA HYDROLOGIC UNIT CODE LIST

HU8	NAME
10170203	Lower Big Sioux
07020009	Blue Earth
10170204	Rock
07040008	Root
07080201	Upper Cedar
07060001	Coon-Yellow
07080202	Shell Rock
07100003	East Fork Des Moines
07080203	Winnebago
10230003	Little Sioux
07100002	Upper Des Moines
07060002	Upper Iowa
07080102	Upper Wapsipinicon
07060004	Turkey
10230002	Floyd
07080207	Upper Iowa
07100005	Boone
07080204	West Fork Cedar
07100004	Middle Des Moines
07060003	Grant-Little Maquoketa
07100006	North Raccoon
10230004	Monona-Harrison Ditch
10230005	Maple
10230001	Blackbird-Soldier
07060005	Apple-Plum
07060006	Maquoketa
07080205	Middle Cedar
10230007	Boyer
07080105	South Skunk
07080208	Middle Iowa
07100007	South Raccoon
07080206	Lower Cedar
07080103	Lower Wapsipinicon
07080101	Copperas-Duck
10240002	West Nishnabotna
07080106	North Skunk
07100008	Lake Red Rock
10240003	East Nishnabotna
10230006	Big Papillion-Mosquito
07080209	Lower Iowa
10240001	Keg-Weeping Water
10240009	West Nodaway
07080107	Skunk
07100009	Lower Des Moines

10280102	Thompson
07080104	Flint-Henderson
10240010	Nodaway
10240005	Tarkio-Wolf
10240012	Platte
10280201	Upper Chariton
10280101	Upper Grand
10240013	One Hundred and Two
07110001	Bear-Wyaconda
10240004	Nishnabotna
07110002	North Fabius
10280103	Lower Grand

Creating a GIS Web Editing Tool for Building Footprint Maintenance

By Pipat Reungsang
Iowa State University
GIS Support and Research Facility

Federal Geographic Data Committee
CAP Grant Project 08HQAG0063
Iowa Geographic Information Council
January 29, 2010

Table of Content

Introduction

With ArcGIS Server, you can create Web applications for editing data with a minimum amount of writing code. You create these applications in ArcGIS Server Manager. Creating the application is actually the final step of a larger workflow. The first step is to make your data available through an ArcSDE geodatabase. Once you have your data available through ArcSDE, you need to create a map from the data and symbolize it appropriately. You publish this map document to ArcGIS Server so that it will be available to users of your Web application. Then, you create and configure the Web application with the Editor, Query, and Print tasks. As a final step, you configure your web application for secure access over the Internet This document explains each part of the workflow for creating the Structure Maintenance Tool - web editing application for the 2008 CAP Grant project.

FGDC/USGS Agreement Number 08HQAG0063

Software requirements

To create an ArcGIS Server service with authenticated web editing, the following software needs to be installed on, or accessible from, your system.

Microsoft products

- IIS Web Server Version 5.X or higher
- .NET Framework 2.0
- ASP.NET 2.0 Ajax Extension 1.0
- Microsoft Visual Studio 2005 or higher
- Microsoft SQL 2005 Express

ESRI products

- ESRI ArcSde 9.3 or higher
- ESRI ArcGIS Desktop 9.3 or higher
- ESRI ArcGIS Server 9.3 or higher

Data requirements

To create an ArcGIS Server service for web editing, all resources below need to be accessible from your system. Note that you can find the map document and all feature classes on the accompanying CD disk.

- ArcGIS 9.3 map document contains layers and symbols template (*Maps.mxd*).

- Feature class contains subtype and Domain template for CAP Grant building structure layer (*CAPGrant_Lidar_Structure*).
- Example Feature class for Lidar building structure layer (*Example_Lidar_Structure*).
- Feature class for 2008 DOT transportation layer (*DIRECT_LANE_2008*).
- Feature class for IDNR county layer (*county_boundaries*).
- Feature class for IDNR townships layer (*pls_townships*).
- Feature class for IDNR sections layer (*pls_sections*).
- Feature class for IDNR cities layer (*incorporated_areas*).
- Raster dataset for IDNR last returned lidar layer (*INT_CSC02LR*).

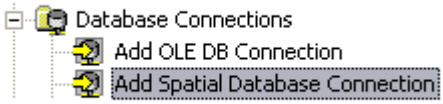
- WMS layer for hillshade 30-meter USGS DEM
- WMS layer for hillshade 10-meter USGS DEM
- WMS layer for DRG 1:24,000-scale
- WMS layer for Iowa USDA NAIP 2006
- WMS layer for Iowa USDA NAIP 2008

Preparing the map document

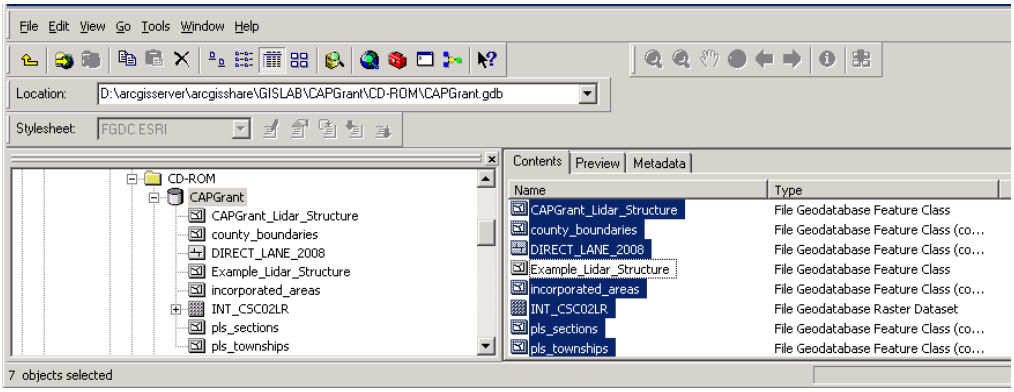
The map document (Maps.mxd) you will use for the web editing application contains both editable and noneditable layers. Before you make any changes to the map document, you need to make your data available through an ArcSDE geodatabase first. Follow these steps to prepare your dataset.

Making the data available through ArcSDE

1. Start ArcCatalog, and make a new connection to your ArcSDE geodatabase from ArcCatalog with a spatial database connection.



2. Insert the CD that comes with this report into your CD drive.
3. In the Catalog tree, go to the CD drive. Under CAPGrant folder, select a raster dataset and all feature classes, except Example_Lidar_Structure from the CAPGrant personal geodatabase.



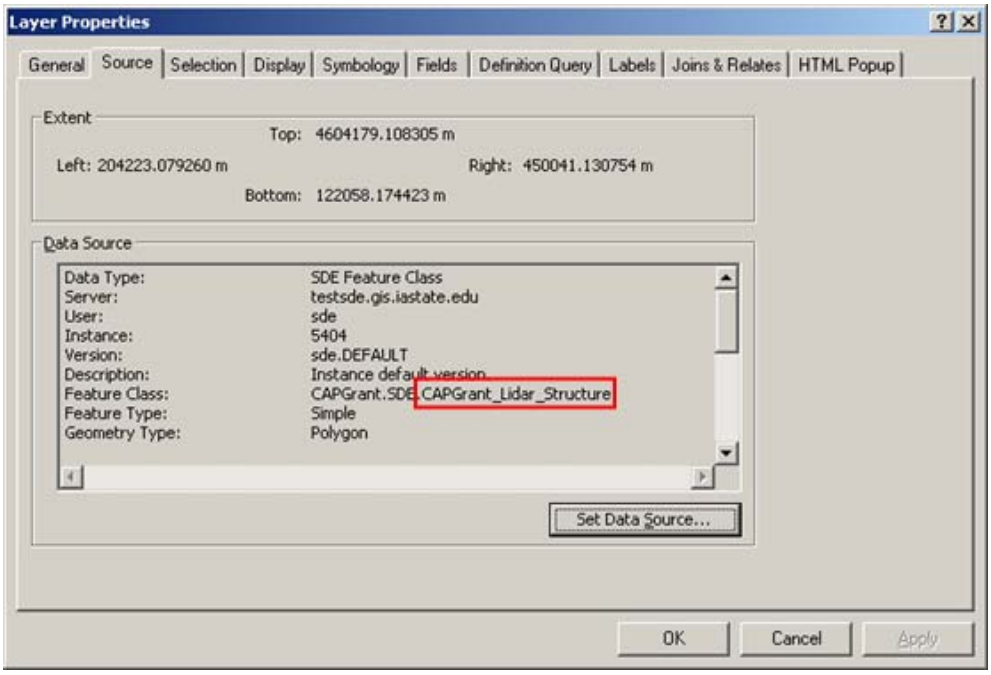
4. Right-click the selected items and click Copy.
5. Double-click on the geodatabase you've just created at step 1 and click Paste.
6. On the Data Transfer dialog box, confirm that all items you want to transfer are listed. Click OK.
7. Right-click on the CAPGrant_Lidar_Structure on the geodatabase, choose Load, and Load Data option.
8. Click Next.
9. At the Input data, browse to building feature data that you want to import into this layer. If you don't have one, you can import an example of building feature data from Example_Lidar_Structure on the CAPGrant personal

geodatabase. Click Open, Add, Next, Next, Next, Next, and Finish.

Modifying the map document

Once all required data from the previous section are available through an ArcSDE geodatabase, you need to change the source locations of the data being displayed in the map document (Maps.mxd) to the ArcSDE geodatabase. Do the following:

1. Start ArcMap if it isn't already running.
2. Click the Open button on the Standard toolbar.
3. Click the Look in drop-down arrow and navigate to the folder that contains the Maps.mxd file.
4. Click the Maps.mxd, and click Open.
5. Locate the Buildings layer in the table of contents. Right-click the layer and click Properties.
6. Click the Source tab. Note that the name of the feature class is shown at Data Source box.



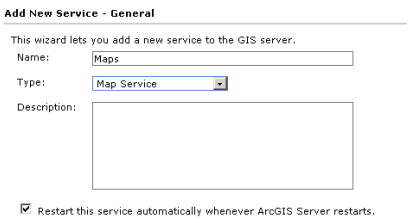
7. Click the Set Data Source button, navigate to the data source on the ArcSDE geodatabase, and click Add.
8. Click OK, and repeat step 6-8 to change the data source for Interstate, U.S.Route, Iowa Route, Local Route, County, Townships, Sections, and Cities layers.
9. After all are fixed, click Save button and close ArcMap.

Publishing map service

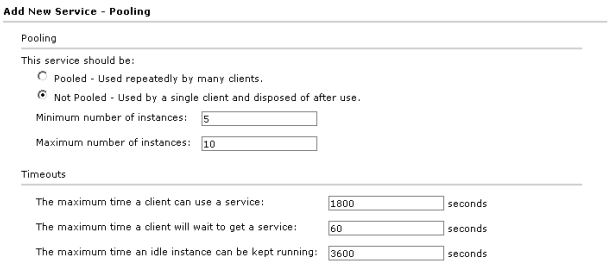
Once your map document is completed, you can publish it as a map service. When you publish a map service, you make it available on your ArcGIS Server so that many users can access it at once.

Follow these steps to publish a map service that you can use for editing:

1. Log in to ArcGIS Server Manager and click Services link from the left panel.
2. Find **CAPGrant** folder from the Services. If you don't have the folder, click the Manage Folder link, choose Add to add the **CAPGrant** folder. The **CAPGrant** folder is the folder where you have to publish the service.
3. Select the **CAPGrant** folder and click the icon to Add New Service.
4. On the first page of the wizard, you're prompted to give your service a name. Enter **Maps** for Name: and click Next.



5. Find the resource that you want to publish. This is the map document (Maps.mxd) you just created from the previous section. If it's in a shared directory, you can browse to the map document. If it's not in a shared location, carefully type the path of the map document.
6. Click Next to move to the next page of the wizard. Notice that the Mapping capability is enabled by default. Uncheck all other options and click Next.
7. At the Pooling wizard, select **Not Pooled** option and change the Minimum and Maximum number of instances to **5** and **10**, respectively.
8. Increase the maximum time a client can use a service to **1800** seconds. Increase the maximum time an idle instance can be kept running to **3600** seconds. Click Next twice.



9. The final page of the wizard explains that the service will be created and gives its URL. Click Finish to publish the service and close the wizard.

Creating web application

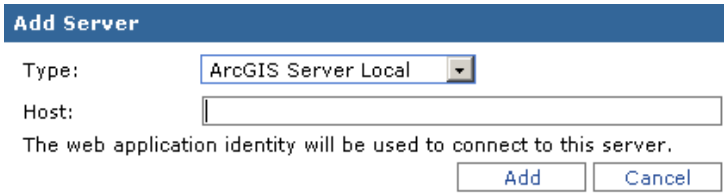
To start creating your web application, you need to be logged in to Manager. Once you've logged in to Manager, follow these steps to create an application:

Create web site

1. Click the Applications tab and click Web Applications.
2. Click Create Web Application.
3. Type a name for your application for example, **CAPEditing**. The Applications tab in Manager lists all the Web applications you have deployed on your server. The name that you enter here will be used in that list.
4. Type a more detailed description of the Web application. This description will also be visible from the Applications tab.
5. Optionally, click Advanced Options to change the default Web server, port number, and host URL for the application. These options can be useful if you want to create a Web application on a different machine or if you want an outward-facing URL that doesn't expose a machine name.
6. Click Next to continue to the layer selection panel.

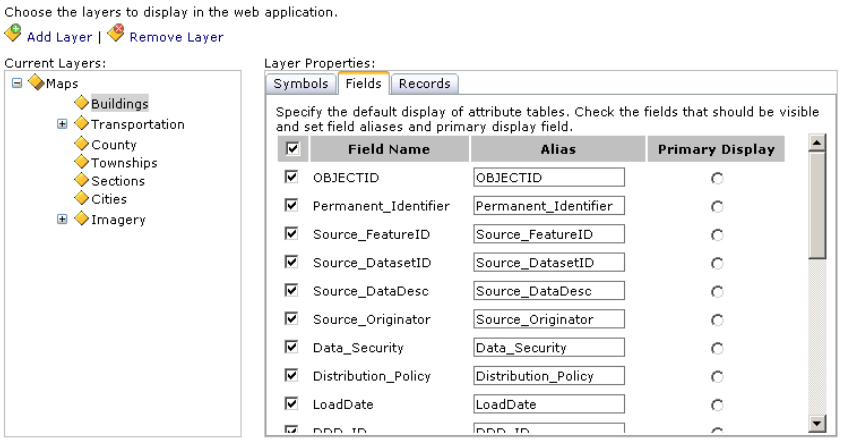
Adding layer to the map

1. Click Add Layer on the Layers tab.
2. Examine the list of available GIS servers. If the server containing your layer does not appear on the list, click Add GIS Server and choose the **ArcGIS Server Local** type and enter name of server for Host.



Once you have entered the connection information for the server as described above, click Add.

3. Double-click on the server name you just added, double-click on **CAPGrant**, and select **Maps**, and click Add.
4. Once you've added **Maps** layer to the Current Layers list, click on the +sign in front of the Maps layer.
5. Clicking the Buildings sublayer inside the Maps layer reveals additional properties for the sublayer. You'll see three categories of properties: Symbols, Records, and Fields.
6. Click on the Fields tab, and make sure only the following fields are checked (by default, all fields will be checked):
   - FType
   - FCode
   - Name
   - NumFloors
   - BldHeight
   - Base_Height
   - Address
   - City
   - County
   - State
   - Zipcode
   - LastUserUpdate
   - LastUpdateDate



The Fields tab controls the display of field attributes for the layer when viewed in tabular form, such as when using Map Identify tool.

7. When you're done selecting layers and are ready to configure tasks for your application, click Next to move on to the next portion of the wizard.

Configuring tasks

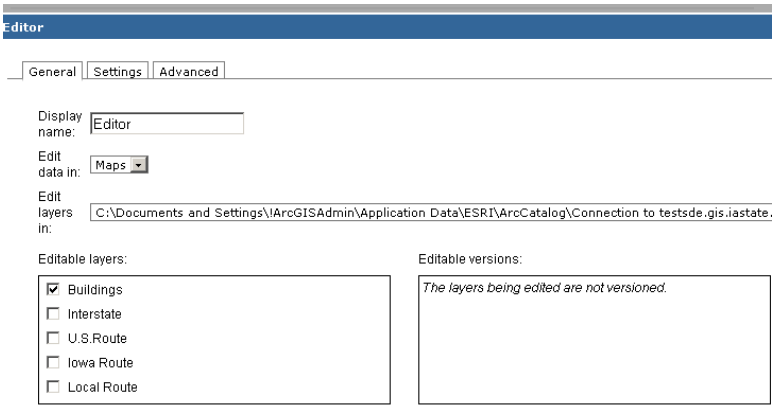
You define the GIS functionality in your Web applications by selecting and configuring tasks. Tasks encapsulate specific functionality for your application, such as querying or editing. For this report, three tasks will be added into the web application including Editor, Query Attributes, and Print tasks.

Editor task

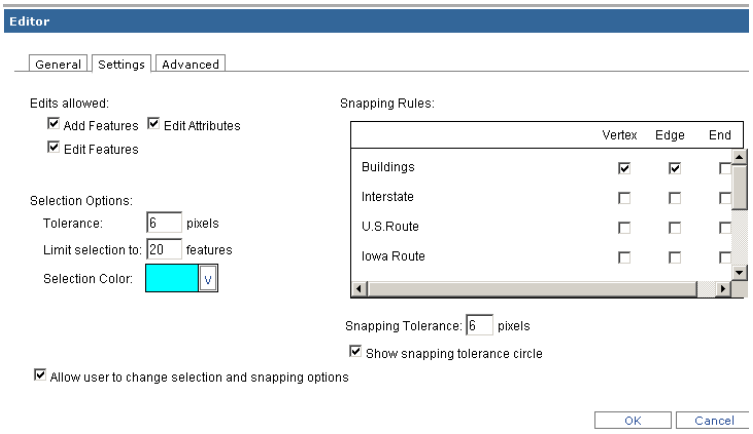
The Editor task provides a suite of tools for Web-based editing of features and attributes in ArcSDE geodatabase. This task requires that your application contain a map service accessed through an ArcGIS Server local connection that includes at least one layer from an ArcSDE geodatabase.

1. On this panel, you want to include the Editor task, so click Add Task. In the Available Task Items list, click Editor and click OK.

2. With the Editor task still selected, click Configure. You can use the resulting dialog box, the task configurator, to do the following things:
    - **Choose the layers and versions you can edit**
      On the General tab, make sure the Buildings layer is checked.



- **Choose the types of edits users can make**
  On the Settings tab of the configurator, set all the options as shown below.



3. When you've configured the Editor task the way you want it, click OK to close the dialog box.

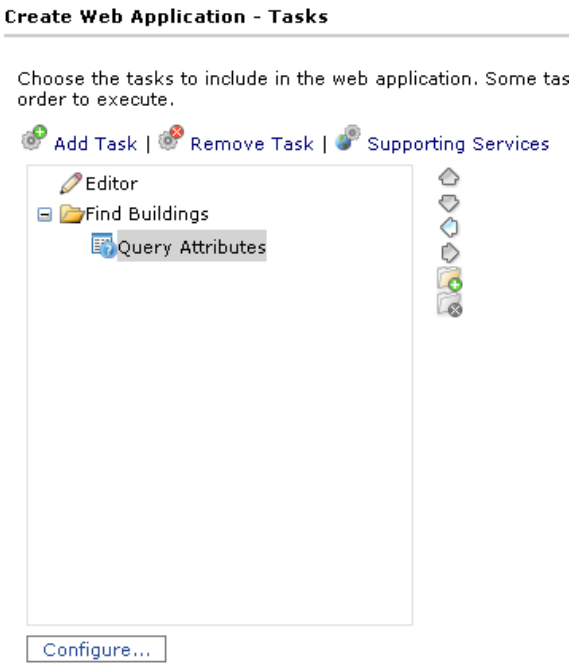
Query Attributes task

The Query Attributes task helps users select or view certain data on the map based on that data's attributes. A Query Attributes task creates a single query on one map layer. The web application allows us to have multiple Query Attributes tasks; to group them all together, tasks can reside in a folder.

For this web application, four Query Attributes tasks will be created inside a folder including By Username, By Building type, By County, and By Date.

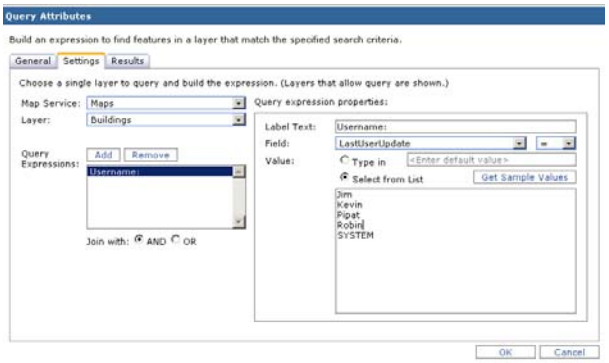
1. To add a New Folder, click on the icon from add task panel.

2. Double-click on the **New Folder** in the task list, type **Find Building,** and hit the enter key to finish.
3. With the Find Building folder still selected, click Add Task. Select Query Attributes from the Available Tasks items. Click OK.



4. After adding a Query Attributes task into the folder, click the Configure button to display the task configuration settings.
    - At the General tab, enter **By Username** for the Task Name.
    - Click the Setting tab, click Add button at for Query Expression.

- Enter **Username:** for the Label Text.
- Change Field to **LastUserUpdate.**
- Click on **Select from List** option for Value.
- Click on the **Get Sample Value** button.
- You can modify the value of the box below by using the keyboard if you want.

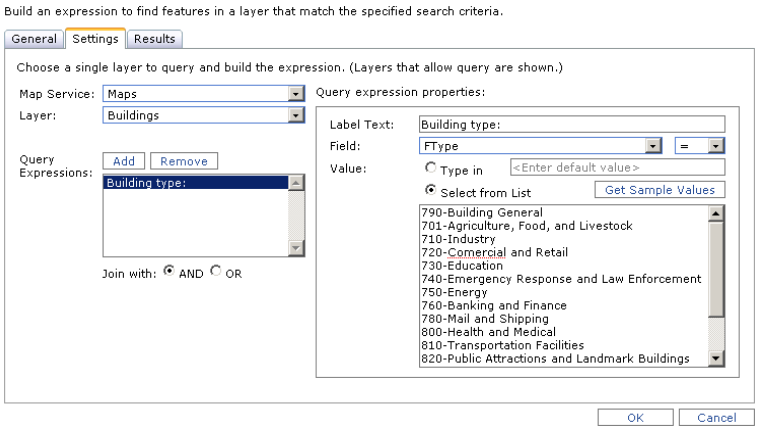


- When you've finished the task click OK to close the dialog box.

5. Click the Find Building folder, click Add Task. Select Query Attributes from the Available Tasks items. Click OK.
6. Click the Configure button to display the task configuration settings.
    - At the General tab, enter **By Building type** for the Task Name.
    - Click the Settings tab, click the Add button to create a Query Expression.
    - Enter **Building type:** for the Label Text.
    - Change Field to **FType.**
    - Click on **Select from List** option for Value.
    - Click on the **Get Sample Value** button.
    - Add the following items in the box below.

      790-Building General
      701-Agriculture, Food, and Livestock
      710-Industry
      720-Comercial and Retail
      730-Education
      740-Emergency Response and Law Enforcement
      750-Energy
      760-Banking and Finance
      780-Mail and Shipping
      800-Health and Medical
      810-Transportation Facilities
      820-Public Attractions and Landmark Buildings
      830-Government and Military
      840-Weather
      850-Water Supply and Treatment

880-Information and Communication



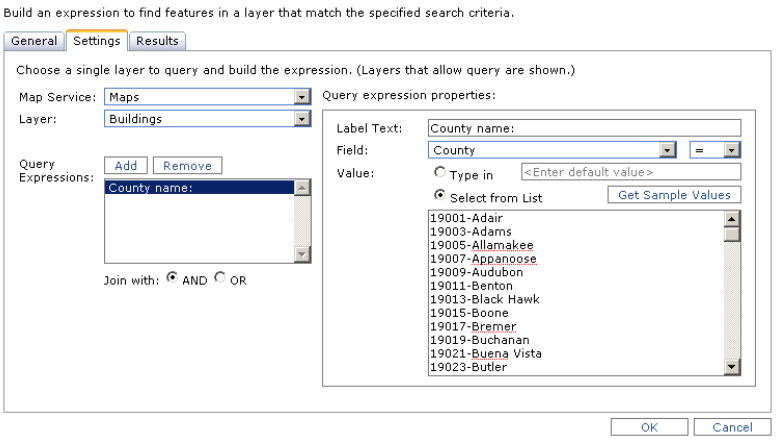
- When you've finished the task click OK to close the dialog box.

7. Click the Find Building folder, click Add Task. Select Query Attributes from the Available Tasks items. Click OK.
8. Click the Configure button to display the task configuration settings.
    - At the General tab, enter **By County** for the Task Name.
    - Click the Settings tab, click the Add button to create a Query Expression.
    - Enter **County name:** for the Label Text.
    - Change Field to **County.**
    - Click on **Select from List** option for Value.
    - Click on the **Get Sample Value** button.
    - Add the following items in the box below.

      19001-Adair
      19003-Adams
      19005-Allamakee
      19007-Appanoose
      19009-Audubon
      19011-Benton
      19013-Black Hawk
      19015-Boone
      19017-Bremer
      19019-Buchanan
      19021-Buena Vista
      19023-Butler
      19025-Calhoun
      19027-Carroll
      19029-Cass
      19031-Cedar
      19033-Cerro Gordo

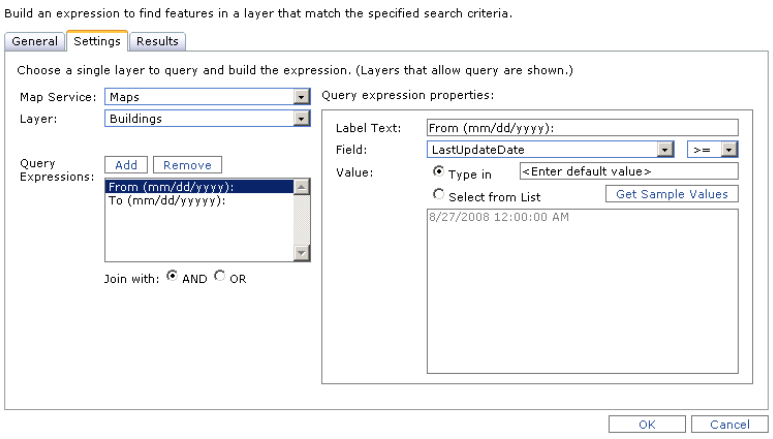
19035-Cherokee
19037-Chickasaw
19039-Clarke
19041-Clay
19043-Clayton
19045-Clinton
19047-Crawford
19049-Dallas
19051-Davis
19053-Decatur
19055-Delaware
19057-Des Moines
19059-Dickinson
19061-Dubuque
19063-Emmet
19065-Fayette
19067-Floyd
19069-Franklin
19071-Fremont
19073-Greene
19075-Grundy
19077-Guthrie
19079-Hamilton
19081-Hancock
19083-Hardin
19085-Harrison
19087-Henry
19089-Howard
19091-Humboldt
19093-Ida
19095-Iowa
19097-Jackson
19099-Jasper
19101-Jefferson
19103-Johnson
19105-Jones
19107-Keokuk
19109-Kossuth
19111-Lee
19113-Linn
19115-Louisa
19117-Lucas
19119-Lyon
19121-Madison
19123-Mahaska
19125-Marion
19127-Marshall

19129-Mills
19131-Mitchell
19133-Monona
19135-Monroe
19137-Montgomery
19139-Muscatine
19141-Obrien
19143-Osceola
19145-Page
19147-Palo Alto
19149-Plymouth
19151-Pocahontas
19153-Polk
19155-Pottawattamie
19157-Poweshiek
19159-Ringgold
19161-Sac
19163-Scott
19165-Shelby
19167-Sioux
19169-Story
19171-Tama
19173-Taylor
19175-Union
19177-Van Buren
19179-Wapello
19181-Warren
19183-Washington
19185-Wayne
19187-Webster
19189-Winnebago
19191-Winneshiek
19193-Woodbury
19195-Worth
19197-Wright



- When you've finished the task click OK to close the dialog box.

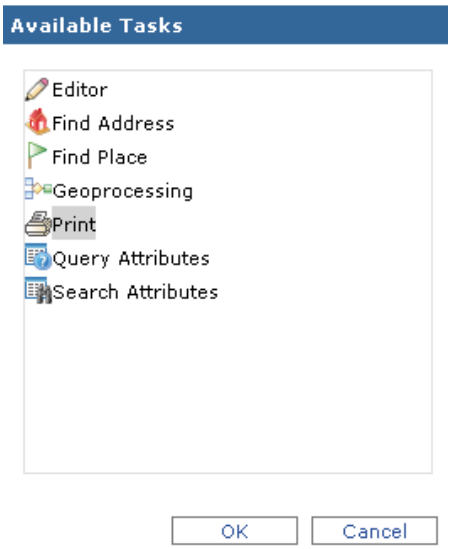
9. Click the Find Building folder, click Add Task. Select Query Attributes from the Available Tasks items. Click OK.
10. Click the Configure button to display the task configuration settings.
    - At the General tab, enter **By Date** for the Task Name.
    - Click the Setting tab, click the Add button to create a Query Expression.
    - Enter **From (mm/dd/yyyy):** for the Label Text.
    - Click the Add button to create a Query Expression.
    - Enter **To (mm/dd/yyyy):** for the Label Text.
    - Click OK to close the dialog box.



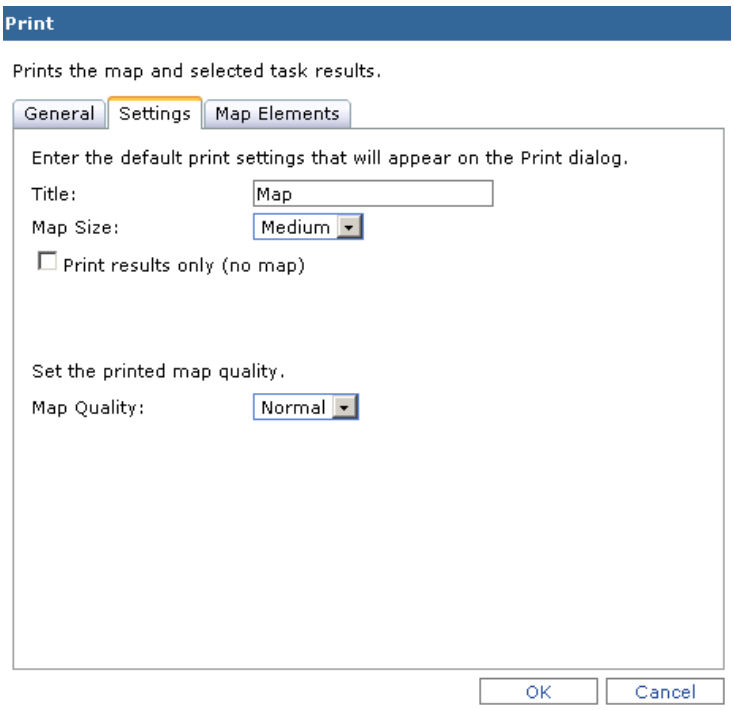
Print task

The Print task allows the user to print the map along with any task results they choose. When invoked from the Web application, the task displays a print dialog box that allows the user to enter a title for their map, set the map size and quality, and choose any task results to print under the map.

1. To add and configure the Print task in Manager, click the Add Task option in the Task Items list.
2. Click the Print task and click OK.



3. With the Print task still selected, click Configure, which displays the configuration dialog box for the Print task.
4. Click on the Settings tab, change any of these settings as follows:
   - The **Map Size** setting to Medium.
   - The **Map Quality** setting to Normal.



When setting the page size and quality, keep in mind that the GIS server imposes limits on the maximum image size it can return. If the print task map request exceeds the limits of the GIS server, the particular service will not print.

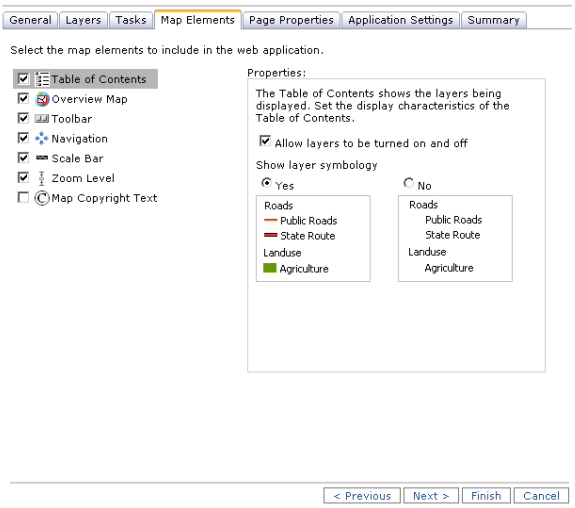
Choosing the look and feel of the application

After choosing layers and tasks, you'll set the supporting details for the application such as title, links, and which map elements to display.

Two panels within the Manager assist you in configuring the look and feel of your application. The first panel includes a list of map elements that you can enable and configure for the application. The second allows you to set the page properties, namely the title text, theme, and links to external Web sites.

Enabling and configuring the map elements

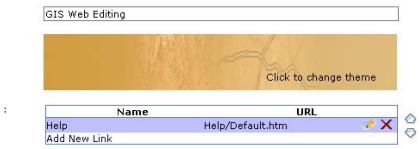
1. Click on the **Map Elements** tab.
2. Modify and ensure that you are setting the Map Elements options as shown below.



3. Click Next to go to the **Page Properties** tab

Setting the page properties

1. Enter **GIS Web Editing** as the title text for your application. This is the text that users will see on the top banner of the application. This text will also appear in the Web browser's title bar.
2. Change theme color as shown below.



3. Remove ESRI and ESRI Support Center links by clicking on the ✕ icon.
4. Click Finish.

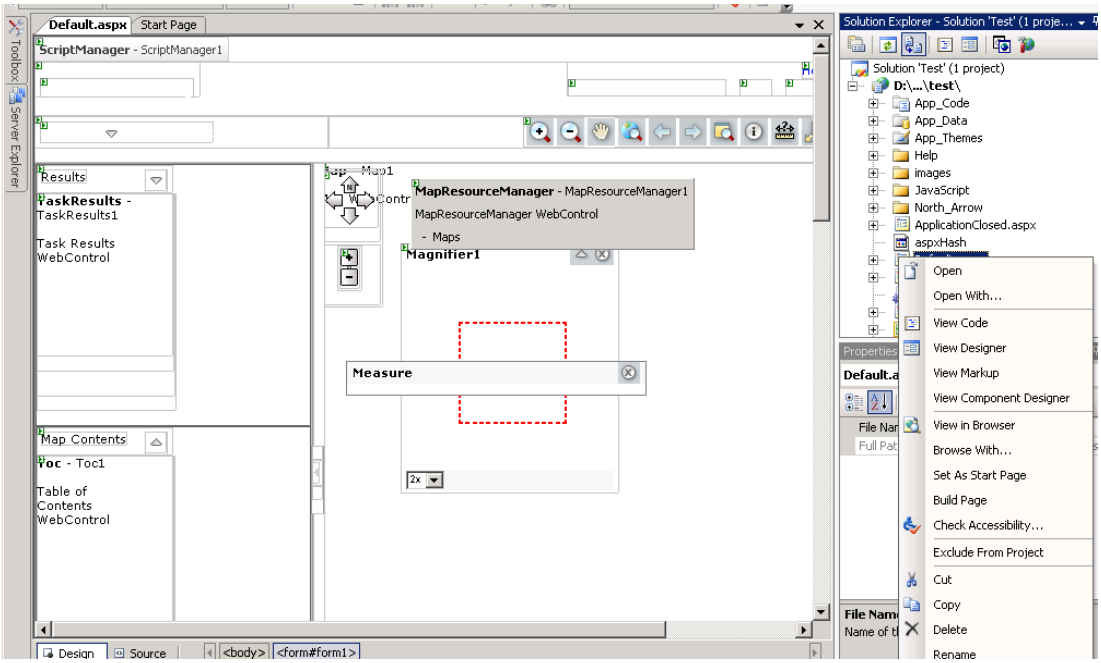
Customizing the Web Mapping Application

After the CAPEditing web application is generated by Manager, Visual Studio 2005 can be used to customize it to meet specific needs. For this report, the web querying and editing solutions will require customizing the behavior of those tasks. The following customizations to the out-of-the-box functionality are listed below.

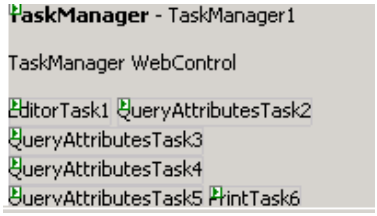
- Modify Query Attributes Task for Find Building by Building type.
- Modify Query Attributes Task for Find Building by Date.
- Hide certain fields in the Building layer when using Editor Task.
- Automatically update the LastUserUpdate and LastUpdateDate fields when using Editor Task.

Whether the application is created in Manager or Visual Studio, a Web Mapping Application contains both standard Web page design elements and Web controls. The Web controls include both standard ASP.NET Web controls, as well as those specific to ESRI's Web ADF. Do the following to customize the CAPEditing web application.

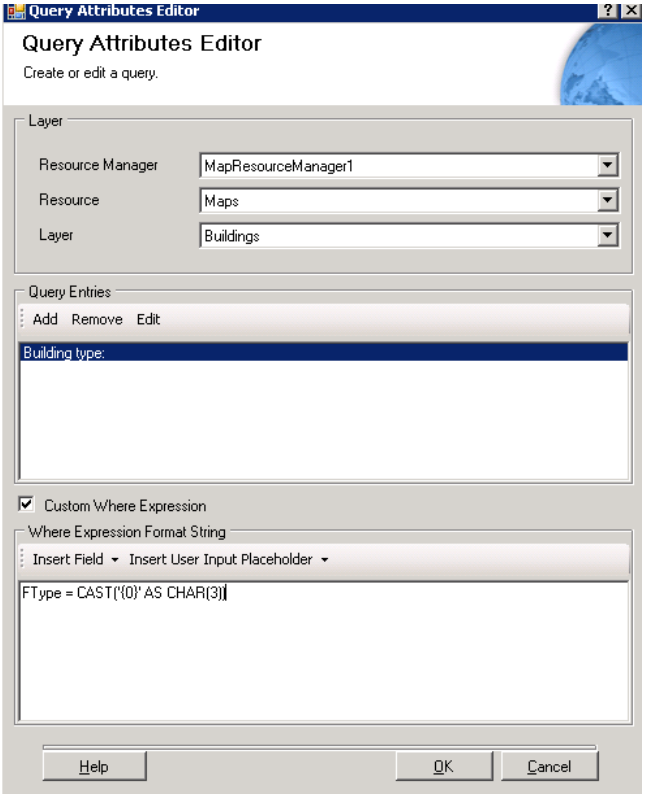
- Launch Microsoft Visual Studio 2005 and open the CAPEditing solution where you created the web application from the previous section.
- In the Solution Explorer, open the Default.aspx by right clicking on it and select View Designer option.



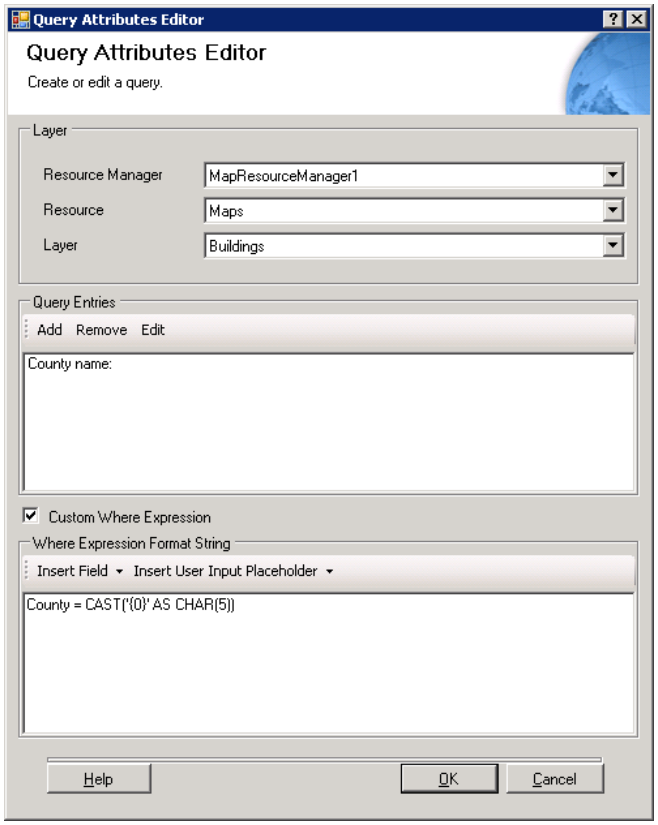
- Find the **TaskManager** component, and click on the **QueryAttributesTask3** object.



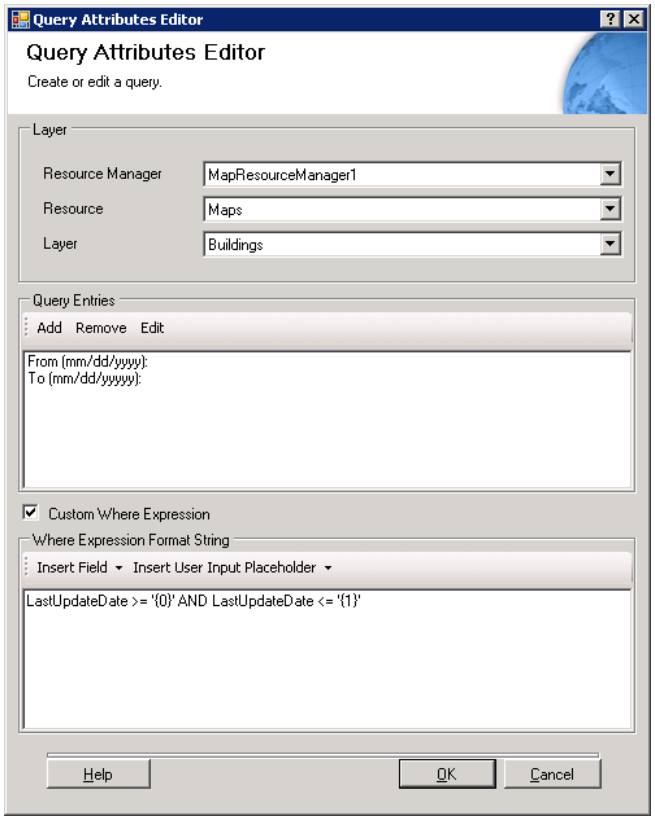
- In Properties, click on the button at the PredefinedQuery option to open the Query Attributes Editor dialog box.
- Ensure that the Custom Where Expression is checked and modify the Where Expression Format String as show below.



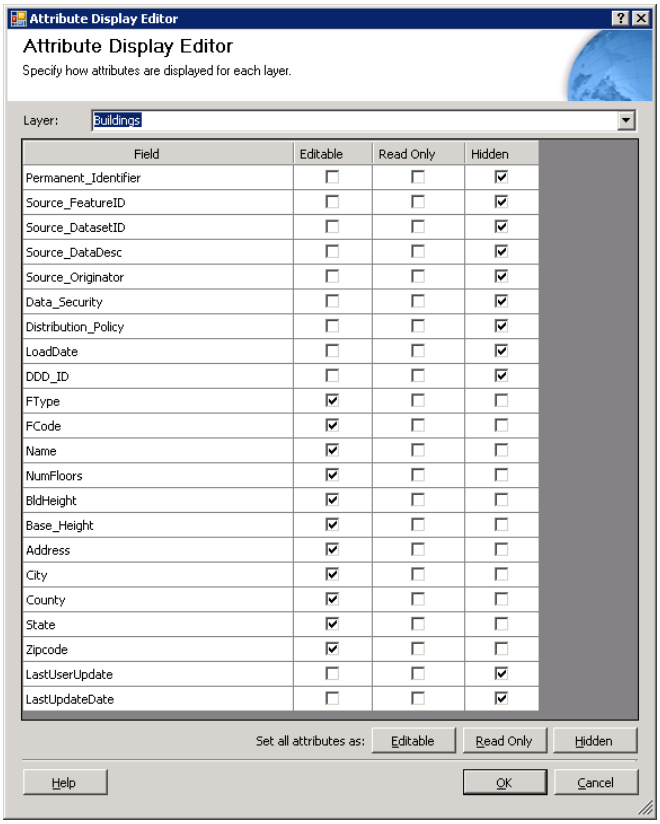
- Click OK to close the dialog box.
- At the **TaskManager** component, click on the **QueryAttributesTask4** object.
- Again, in Properties, click on the button at the PredefinedQuery option to open the Query Attributes Editor dialog box.
- Ensure that the Custom Where Expression is checked and modify the Where Expression Format String as shown below.



- At the **TaskManager** component, click on the **QueryAttributesTask5** object.
- Again, in Properties, click on the  button at the PredefinedQuery option to open the Query Attributes Editor dialog box.
- Ensure that the Custom Where Expression is checked and modify the Where Expression Format String as shown below.



- Click OK to close the dialog box.
- At the **TaskManager** component, click on the **EditorTask1** object.
- In Properties, click on the  button at the AttributeDisplay option to open the Attribute Display Editor dialog box.
- Click on the Hidden button at the bottom of the dialog box.
- Ensure that the following fields are checked as Editable option: FType, FCode, Name, NumFloors, BldHeight, Base_Height, Address, City, County, State, and Zipcode.



- Click OK to close the dialog box.
- At the **TaskManager** component, double-click on the **EditorTask1** object to open the Default.aspx.cs file.
- Click on the +sign in front of the Page Methods module to expand the page.
- Insert the yellow highlight lines into the file:

```
.
.
.
using ESRI.ArcGIS.Server;
using ESRI.ArcGIS.ADF.Web.DataSources.ArcGISServer;
using ESRI.ArcGIS.ADF.ArcGISServer.Editor;
using ESRI.ArcGIS.ADF.ArcGISServer.Editor.Tools;
using System.Collections.Generic;
using ESRI.ArcGIS.Geodatabase;
.
.
.
namespace WebMapApp
{
.
.
.
    protected void Page_Init(object sender, EventArgs e)
    {
    .
    .
    .
        EditorTask1.PreAttributeEdit += new PreAttributeEditEventHandler(EditorTask1_PreAttributeEdit);
        EditorTask1.PostToolExecute += new PostToolExecuteEventHandler(EditorTask1_PostToolExecute);
    }

    void EditorTask1_PreAttributeEdit(object sender, PreAttributeEditEventArgs e)
    {
```

```
            string userName = Context.User.Identity.Name;
            if (string.IsNullOrEmpty(userName)) userName = "SYSTEM";
            int fieldIndex = e.Feature.Table.FindField("LastUserUpdate");
            if (fieldIndex > -1) e.Feature.set_Value(fieldIndex, userName);
            DateTime editTime = System.DateTime.Now;
            int dateIndex = e.Feature.Table.FindField("LastUpdateDate");
            if (dateIndex > -1) e.Feature.set_Value(dateIndex, editTime);
        }

        void EditorTask1_PostToolExecute
        (object sender, ESRI.ArcGIS.ADF.ArcGISServer.Editor.Tools.EditorToolEventArgs e)
        {
            if (e.ServerAction.Editor.SelectedLayerName == "Buildings")
            {
                IFeatureClass featureClass = e.ServerAction.Editor.FeatureLayer.FeatureClass;
                if (e.ServerAction is AddVertex)
                {
                    AddVertex addVertex = (AddVertex)e.ServerAction;
                    UpdateLastModifiedTime(addVertex.Features, featureClass);
                }
                else if (e.ServerAction is MoveVertex)
                {
                    MoveVertex moveVertex = (MoveVertex)e.ServerAction;
                    UpdateLastModifiedTime(moveVertex.Features, featureClass);
                }
                else if (e.ServerAction is DeleteVertex)
                {
                    DeleteVertex deleteVertex = (DeleteVertex)e.ServerAction;
                    UpdateLastModifiedTime(deleteVertex.Features, featureClass);
                }
                else if (e.ServerAction is MoveFeature)
                {
                    MoveFeature moveFeature = (MoveFeature)e.ServerAction;
                    UpdateLastModifiedTime(moveFeature.Features, featureClass);
                }
                EditorUtilities.RefreshAttributes(e.ServerAction.Editor, null);
            }
        }

        private void UpdateLastModifiedTime
        (List<int> fids, ESRI.ArcGIS.Geodatabase.IFeatureClass featureClass)
        {
            string userName = Context.User.Identity.Name;
            if (string.IsNullOrEmpty(userName)) userName = "SYSTEM";
            int dateIndex = featureClass.Fields.FindField("LastUpdateDate");
            int userIndex = featureClass.Fields.FindField("LastUserUpdate");
            foreach (int fid in fids)
                {
                    IFeature feature = featureClass.GetFeature(fid);
                    feature.set_Value(dateIndex, DateTime.Now);
                    feature.set_Value(userIndex, userName);
                    feature.Store();
                }
        }
    .
    .
    .
    }
```

- Click Ctrl+S to save the Default.aspx.cs file.
- When finished, close the Microsoft Visual Studio.

Securing the web application

To implement security for the CAP Grant web application, users and roles need to be stored in a Microsoft SQL Express database. SQL Server is one of several options for users and roles. This option is often used when users of the server are on the Internet, but can also be used on local networks.

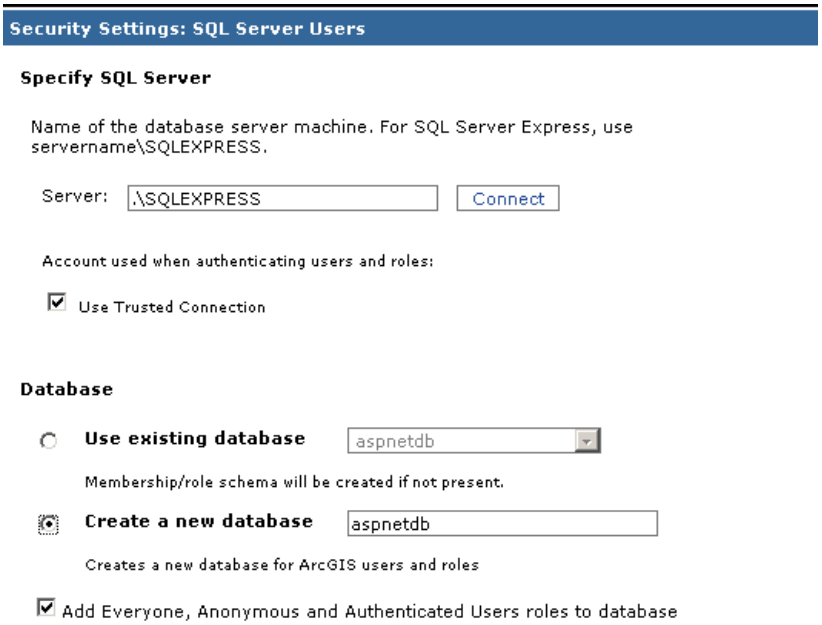
For this report, it is assumed that you already have Microsoft SQL Express installed on your system. You will configure the user and role location in Manager and set permissions for the web application.

Configure the user and role location in Manager

After you have installed the prerequisites, use Manager to configure SQL Server Express as the user and role location.

1. Start ArcGIS Server Manager and log in.
2. In Manager, expand the Security panel and click **Settings**.
3. Click the **Configure** link.
4. In the dialog that opens for Location for Users, choose **SQL Server**. Click Next.

5. In the dialog for specifying settings for SQL Server, enter the database server name in the **Server** text box as .\SQLEXPRESS.
6. Click **Connect** to display a list of available databases and options (if the connection fails, check to ensure your database server is running and available on the network, and that the account you used to log into Manager is allowed to administer the SQL Server).



7. If using SQL Server Express, verify that the option to **Use Trusted Connection** is checked. This means that applications will use the account that runs ASP.NET to authenticate users and to check roles. If using the full version of SQL Server, and the SQL Server is installed on a separate machine, uncheck the Use Trusted Connection option, and enter a SQL database login. For full SQL Server on the same machine, the trusted connection option is recommended, but a SQL login may also be used.
8. Click the option to **Create a new database**, and enter a name (such as aspnetdb). Verify that the option is checked to "Add Everyone, Anonymous and Authenticated Users roles to database". Then click **Next**.
9. In the panel for password recovery, leave the option unchecked. You can re-run the wizard later if needed to enter settings for the mail server, which is required to recover passwords. Click **Finish**. The wizard dismisses with the entry **SQL Server users and roles** displayed in the **Location** box.

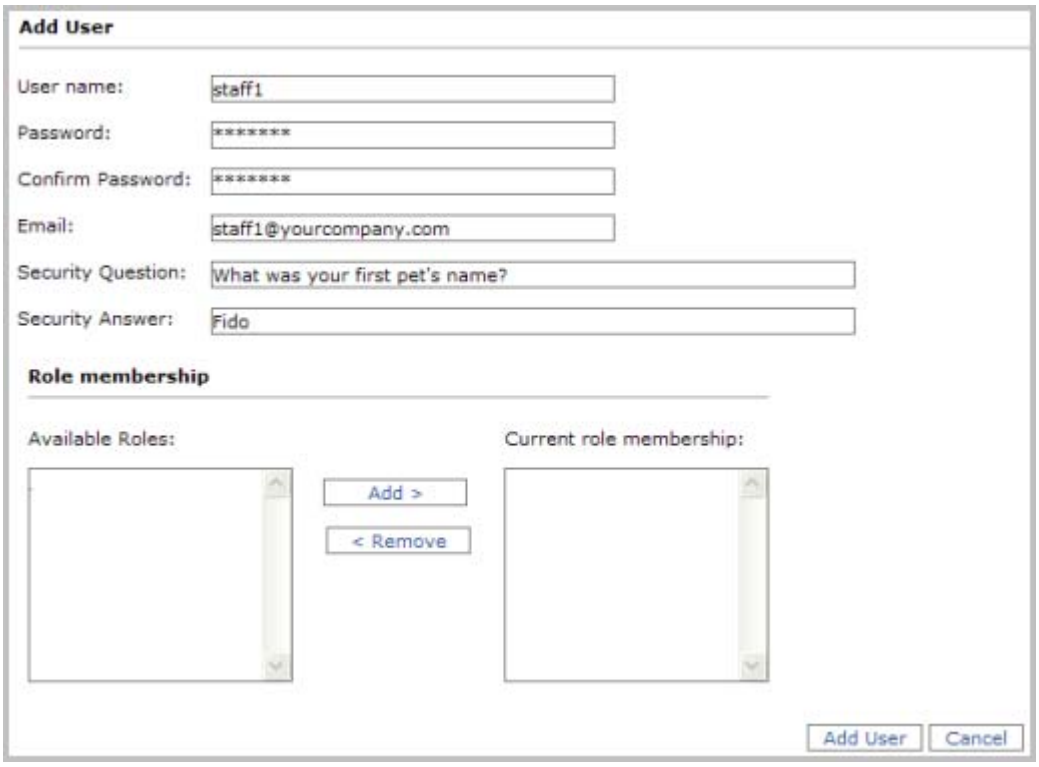
Notice that security for services is set to **Not Enabled**. Do not enable security at this point.

Add users and roles

Before you can assign permissions to applications or services, you need to add some users and roles.

1. In Manager, click the **Security** tab on the left side, then click **Users**. No users will be listed if you just created the database by following the steps above.

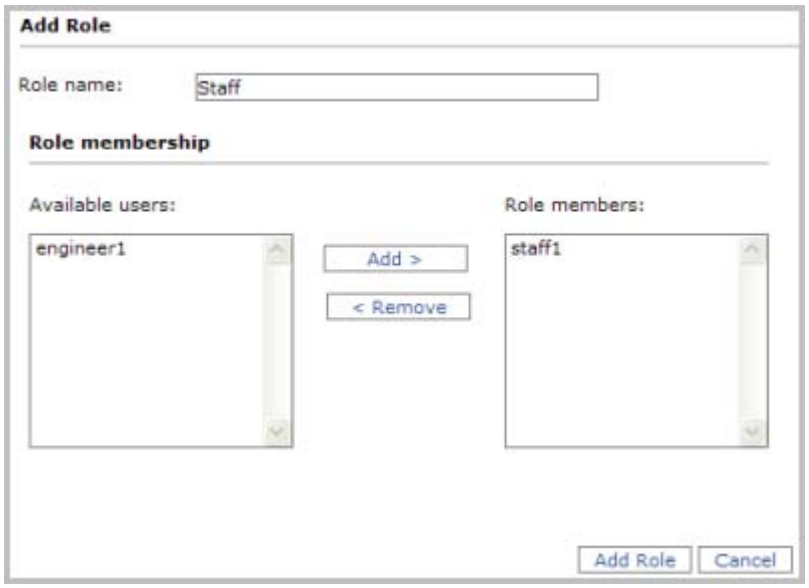
2. In the Users panel, click the **Add User** link to display the dialog for adding a new user.
3. In the new-user dialog, enter the information for the new user. The following is a suggestion, but you may enter your own user settings. **Note**: by default, passwords must have *at least seven characters*, and at least one character must be *non-alphanumeric (such as @, #, $, or %; but avoid using &)*.
   - User name: staff1
   - Password: staff1$
   - Email: staff1@yourcompany.com
   - Security Question: What was your first pet's name?
   - Security Answer: Fido



4. No roles have been defined yet, so leave that box blank. Click **Add** to add the new user. Manager should return to the Users list and display the new user.

5. Add another user, such as engineer1. Make up your own values for password, etc. Optionally, you may add more users at this point.
6. Click the **Roles** link in the Security section. No roles will exist yet.

7. In the Roles panel, click the **Add Role** link to display the dialog for adding a new role.
8. In the new-role dialog, enter a name for the role, such as Staff. Then highlight the user you created earlier, such as staff1, and click the **Add>** button to add it to the **Role members** list.



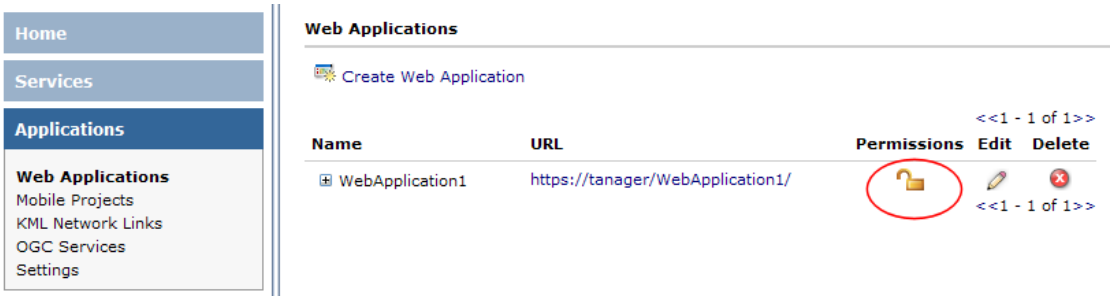
9. Click Add Role to add the role and return to the Roles list. The new role should appear in the list.
10. Create one more role, such as Engineers, and add the second user you created earlier to this role.
11. Notice that you can expand the roles list to show the members of the role.

12. Optionally, add more users and roles. Always add each user to at least one role. As we will see next, permissions for services and applications are based on roles, not individual users.

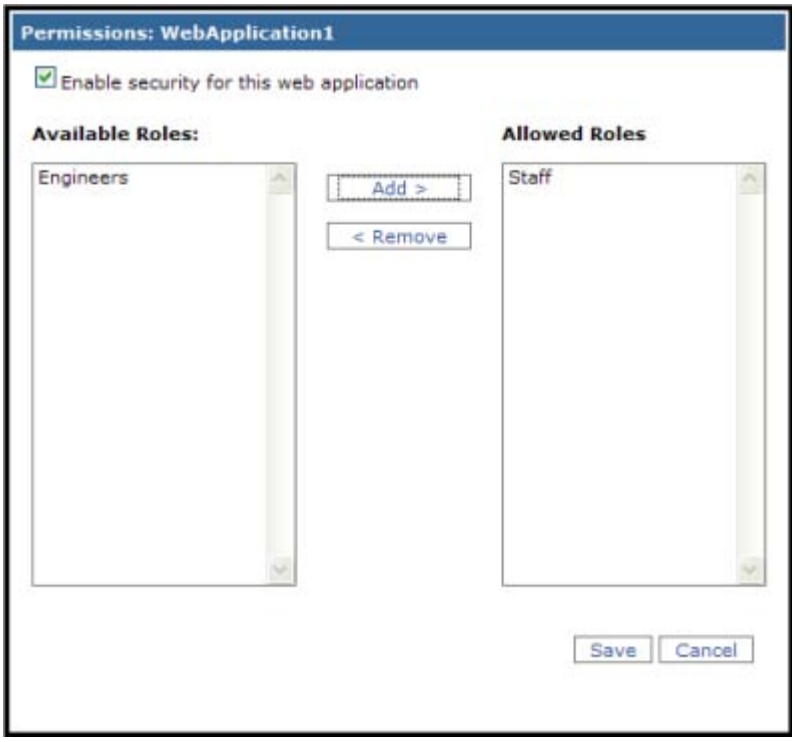
Secure a Web application

Now you will secure a Web application by limiting access to designated roles.

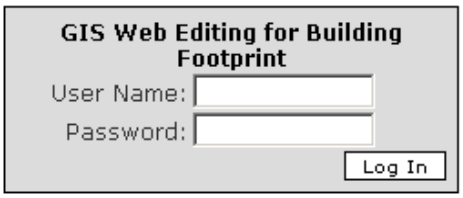
1. In Manager, click **Applications** to list the Web applications. Find the application you want to secure in the list. In the **Permissions** column, you will notice the unlocked icon . This indicates that the application is not restricted, so that users currently are not required to log in.



2. Click the permissions icon , which displays the **Permissions** dialog for the Web application.
3. Check the box for **Enable security for this web application**. This enables the lists of available and allowed roles.
4. Highlight the **Staff** role (or other role you added above) in the **Available Roles** list. Click the **Add>** button to add it to the list of **Allowed Roles**.



5. Click **Save** to save the permissions and return to the list of applications. Notice that the permissions icon changes to a locked appearance, which shows that it now requires a login to access the application.
6. Test the application by clicking its URL hyperlink in the list of Web applications. The application should open in a new browser window, and it should be redirected to the Login page.



Enter the username and password for a user who is a member of the role you permitted (for example, the staff1 user added above). Upon a successful login, the application will proceed to the ArcGIS Server web application page.

7. Click the Logout link on the Web application page.

The application returns to the Login page. Optionally, attempt to login with another user login that is not permitted based in role membership, the user will not be allowed to log in. Close the application and return to Manager.

Structure Maintenance Tool

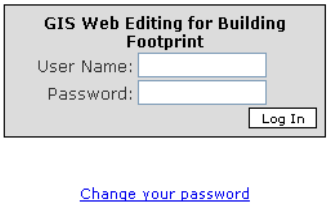
TUTORIAL

By Pipat Reungsang, December 2009
Iowa State University, GIS Support and Research Facility

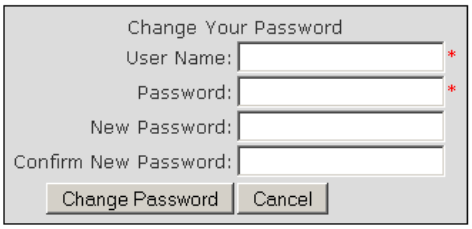
Using the Web Editing application

Open your web browser and go to the following address: http://ortho.gis.iastate.edu/CAPEditing

Enter your User Name, Password and then click the “Log In” button to log on to the website.



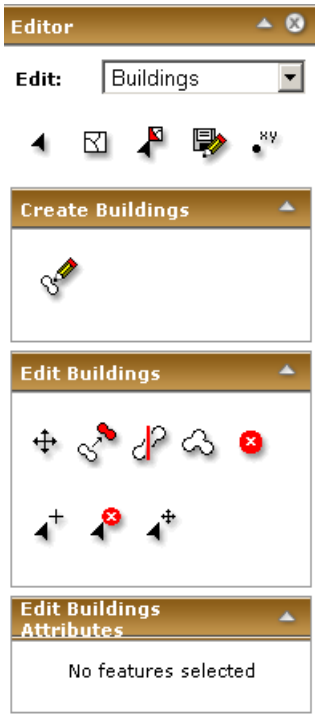
If you want to change your password, click the “**Change your password”** link and enter all required information then click the “Change Password” button.



Once you are logged on to the website, you'll see a list of tasks across the top of the map. There are three tasks including Editor, Find Building, and Print.

Editor task

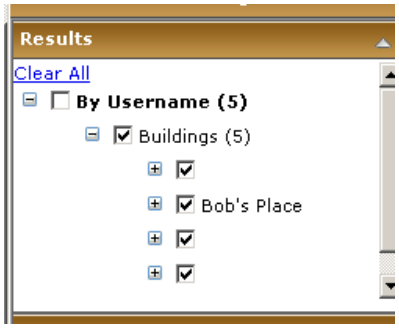
You can open the Editor task from this task bar by clicking on the Editor link. The Editor task runs inside its own floating panel, which you can move around the screen.



The application has built-in help that you can access by clicking the Help link in the upper right corner. The help screen has an Editing data section that explains each tool on the Editor task dialog box. This help function was created in HTML so that it can be customized if needed.

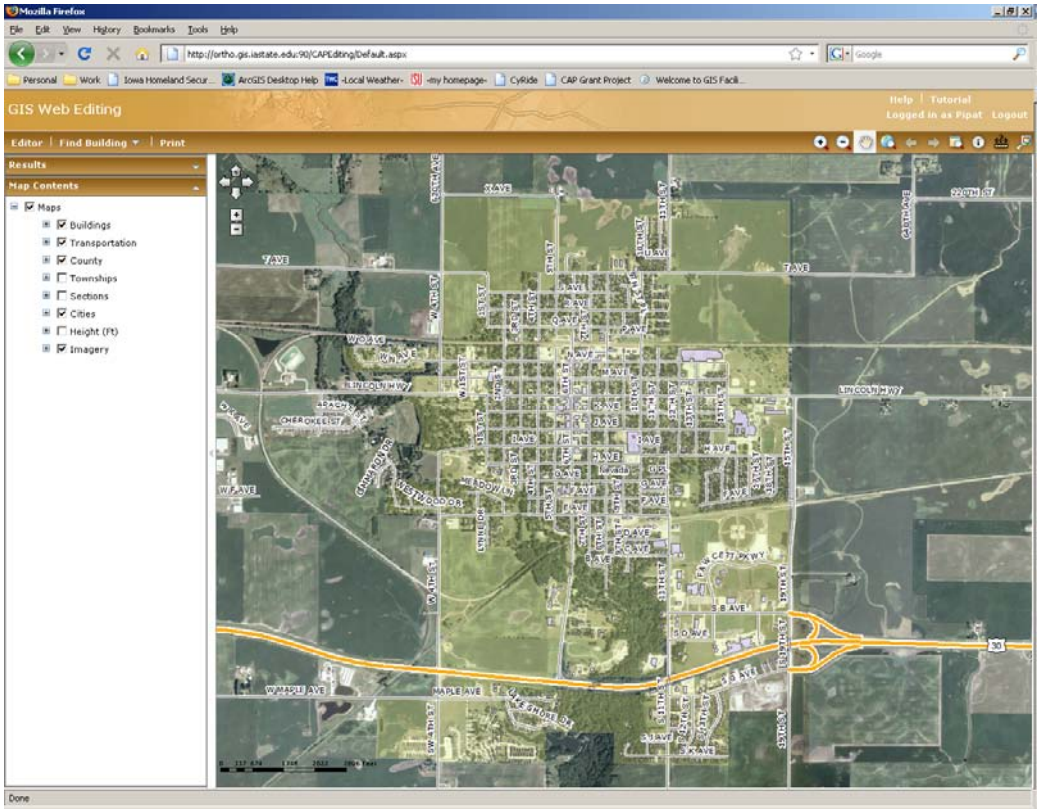
Editing in the Web application has a slightly different feel from editing in ESRI's ArcMap. When using the Editor task, you'll often need to point and click in situations where you may be accustomed to clicking and dragging in ArcMap. Also, when snapping, the pointer does not automatically jump to the snap point on the screen, but the snapping will occur if you place the point within the snapping threshold.

For this tutorial, before you start editing the map, first make sure that all features from the Results panel have been unchecked or click on Clear All link to remove all features.

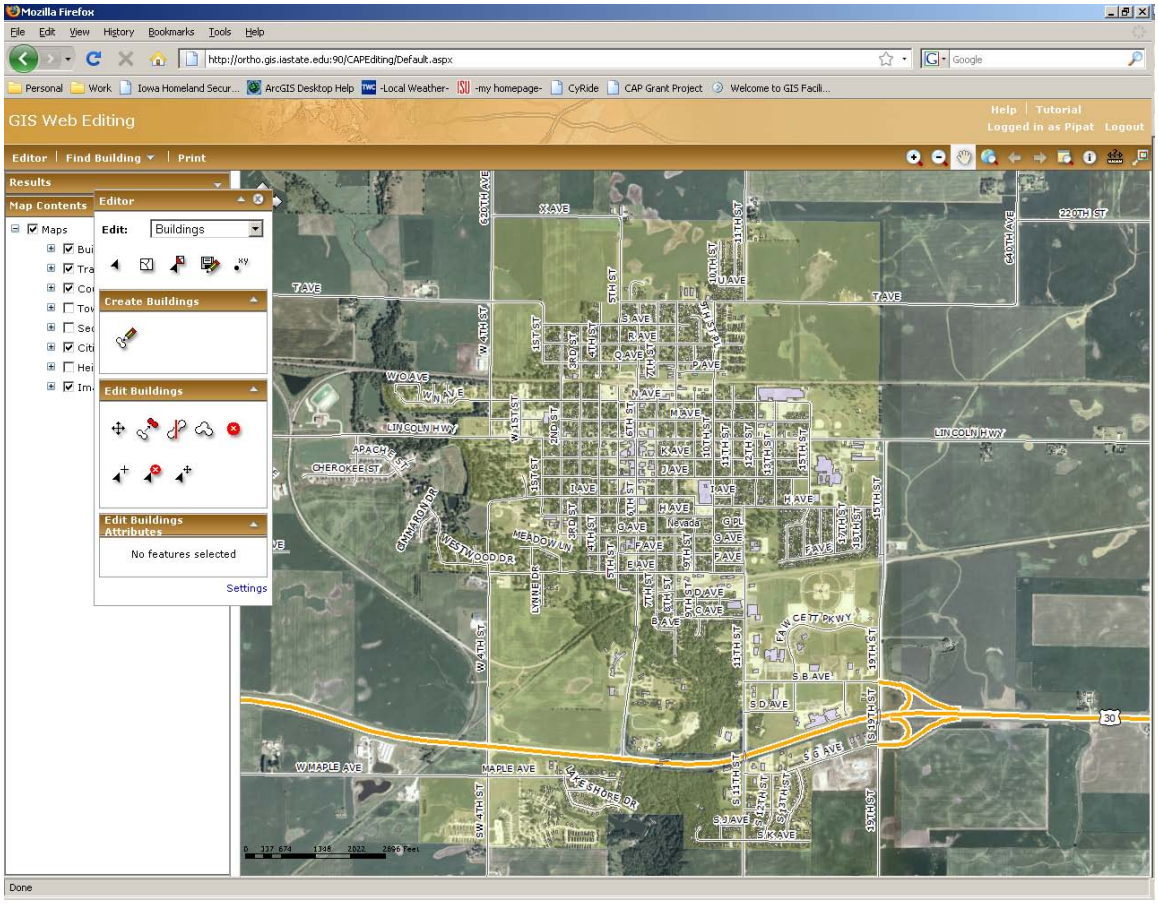


Turn on an imagery layer by clicking on checkbox in front of Image option under Map Contents panel.

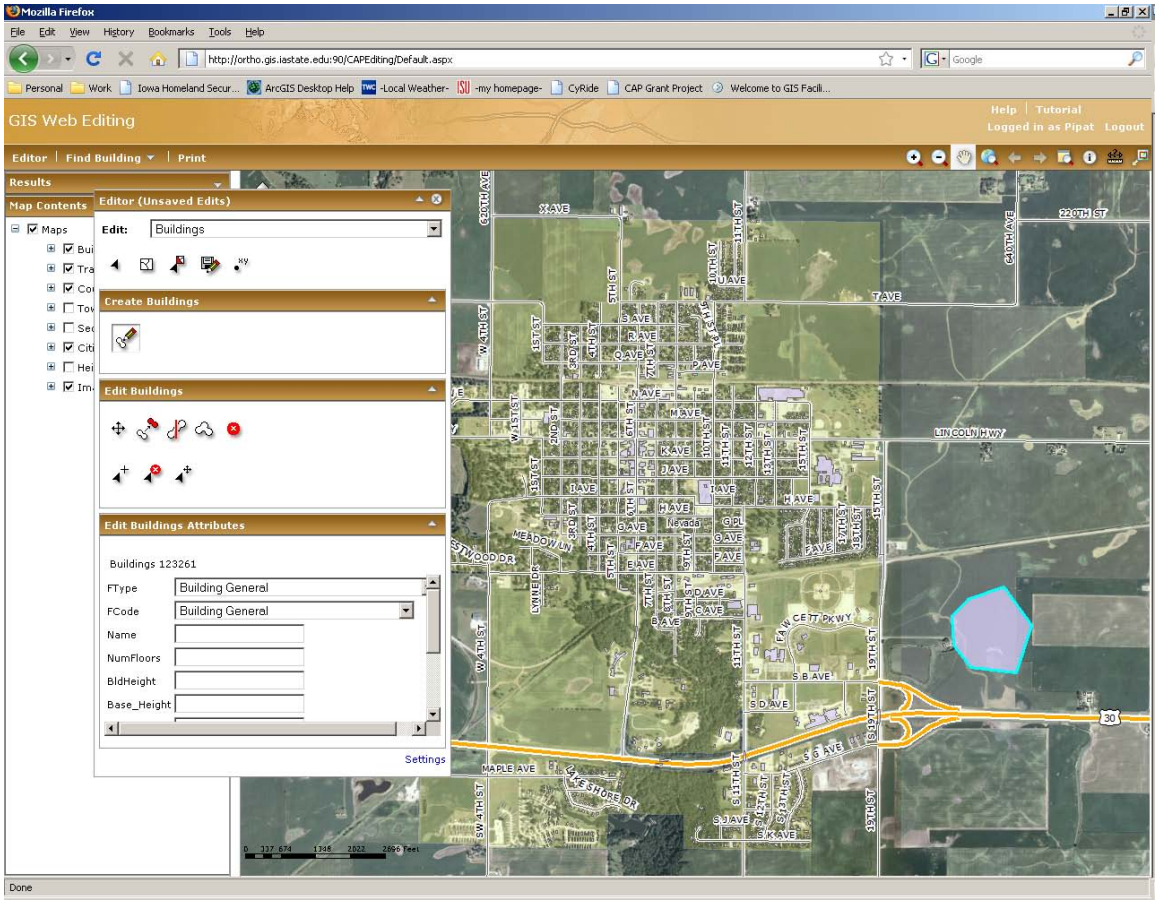
Find a larger area that you want to edit from the map. If you cannot see the edge of the building clearly enough, use the **Zoom In** tool at the top-right corner to zoom into the map.



Now, launch the Editor task by moving the mouse over "**Editor"** in the task bar and clicking on it.



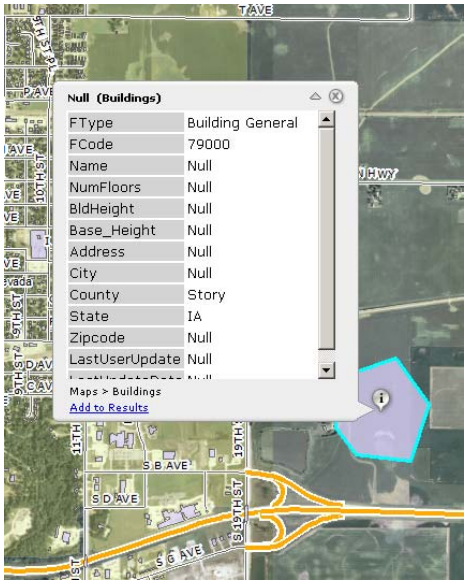
To create new building, click on the  icon. Left-click the mouse to add polygon vertices and double-click to complete the polygon. Now, add a new polygon as shown outlined in blue below.



After you have completed the polygon, the **Edit Building Attributes** panel will show up automatically. Leave the FType and FCode options as Building General. Enter Name, NumFloors, BldHeight, Base_Height, Address, City, State, and Zipcode textboxes with following values unnamed, 1, 30, 300, unknown, Des Moines, IA, and unknown respectively. Select appropriate County from the dropdown listbox.

Click the  icon to save the polygon.

Use **Map Identify** tool  to identify the new polygon. Once you click on the blue polygon, you should see similar information as pictured below.



Click on the icon to close the Identify dialog.

Click on the icon to show the vertices. Now the blue polygon shows green dots at each vertex.

Click on the icon and click on the top-right green dot to remove that vertex of the polygon. Now, your polygon should look similar to the picture below.

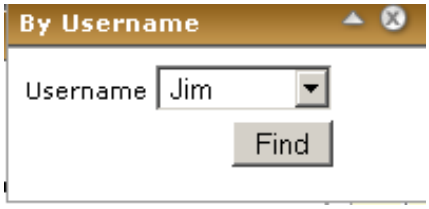
Finally, click on the icon to remove the blue polygon. Wait until the blue polygon disappears and then click the button and click the icon to close the Editor task.

Find Building task

To find existing buildings from the map, click on the **Find Building** task. Under this task, you will see three options to choose from including find **By Username**, **By Building type**, **By County,** and **By Date** option.

Find building By Username option

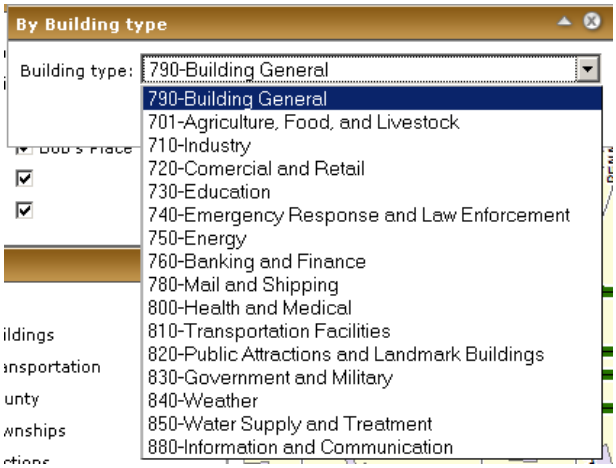
- Launch this option by selecting the By Username option under the Find Building task. This option finds buildings by the user who created them.
- Select one of the options shown in the dialog box and click Find button.



- After the dialog has been closed, all buildings that have been found will be added to the Results panel.

Find building By Building type option

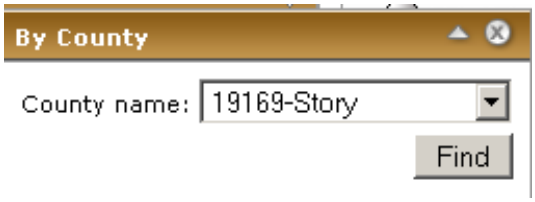
- Launch this option by selecting the By Building type option under the Find Building task. This option finds building by their standardized type.
- Select one of the options shown in the dialog box and click Find button.



- After the dialog has been closed, all buildings that have been found will be added to the Results panel.

Find building By County option

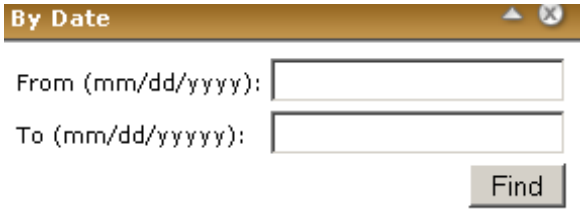
- Launch this option by selecting the By County option under the Find Building task. This option finds buildings by the county where they were created.
- Select one of the options shown in the dialog box and click Find button.



- After the dialog has been closed, all buildings that have been found will be added to the Results panel.

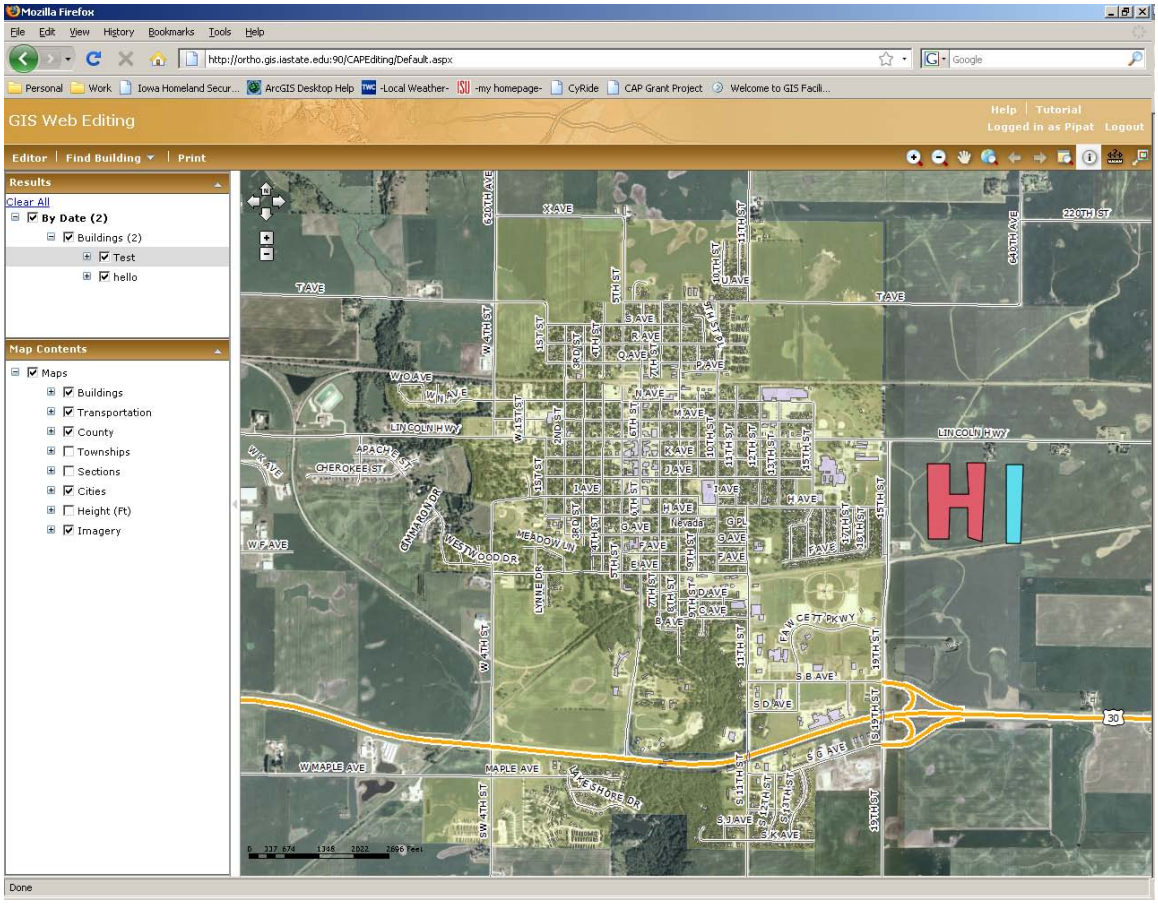
Find building By Date option

- Launch this option by selecting the By Date option under the Find Building task. This option finds building by the date they were created.
- Enter the date range, for example 7/1/2009 and 8/15/2009 for From and To textboxes, and click the Find button.

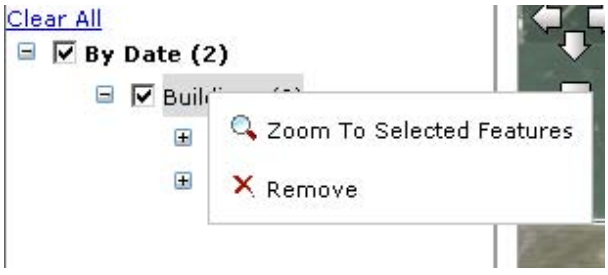


- Again, after the dialog has been closed, all buildings that have been found will be added to the Results panel.

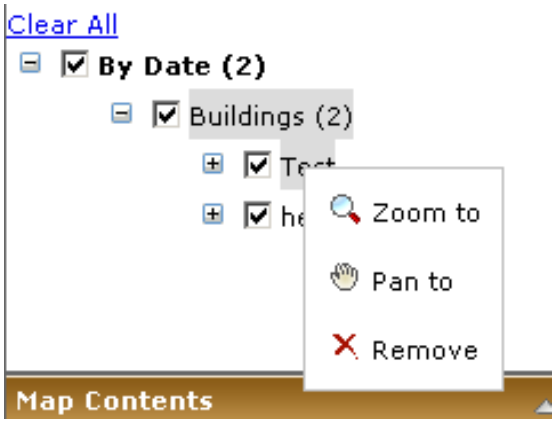
Once the results from the **Find Building** task have been added into the Results panel, you can turn on/off the features by clicking on the checkbox in front of each item. If you move the mouse over the item, the selected feature will be highlighted in red.



To zoom to all highlighted buildings, right-click on Buildings (11), and choose the Zoom To Selected Feature option as shown in the picture below.

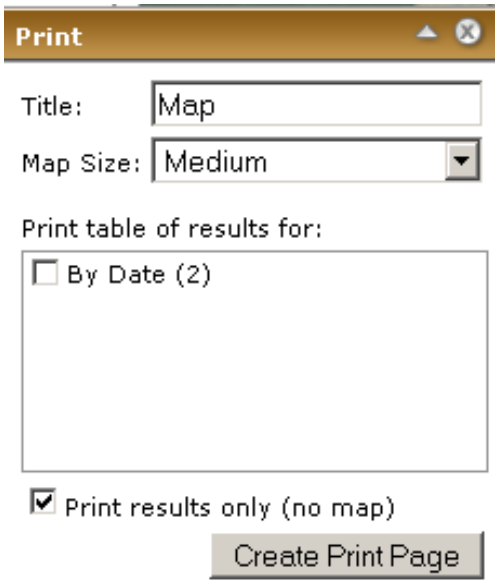


To zoom to a specific building, right-click on the name (for example Bob) and choose the “Zoom to” option as shown in the picture below.



Print task

To print the map and the results from your search, click on the **Print** task.



In the Print dialog, choose the options as desired for printing. Some options that may be available are:

- **Title**: title to display at the top of the print page.
- **Map Size**: set the size of the map. The actual size depends on how the administrator configured the website.
- **Print table of results for**: if displayed, the listed items may be printed from the Results area. Check the boxes for results items to print.
- **Print results only**: if enabled for your application, only results items will be printed without map.

Click **Create Print Page** to generate the print-preview page, which opens in a new window. If the window does not open, check to ensure that any pop-up blockers in your browser are not blocking this website.

In the browser print-preview window, click the browser's Print button, or choose File-Print. From the Print dialog, you may print to any device available on your system.

After finished, click **Logout** at the top-right corner.