GIS for a Large Chemical Warfare Materiel Investigation/Remediation Project in Washington, DC

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Introduction
Introduction

• WWI: US gov’t established the AUES in NW Washington, DC, to investigate testing, production, and effects of noxious gases, antidotes, and protective masks.

• Spring Valley currently comprises about 1200 homes, multiple residences of foreign ambassadors, a university, a seminary, and various commercial properties.
Introduction (cont’d)

Spring Valley Site
Introduction (cont’d)

- Buried military ordnance uncovered in 1993.
- Over 700 pieces of ordnance collected in the neighborhood, and extensive testing conducted to determine CWM-contaminated locations.
- Since 1993, 5 phases of sampling expanded to over 1000 properties from only a few.
Introduction (cont’d)
What is GIS?

- GIS Stands for Geographic Information Systems.
- It allows users to store geographic information electronically, and then display, query, and analyze that information.
- GIS has intuitive visual impact: reveals new patterns, allows uninitiated to analyze and draw conclusions.
What is GIS? (Cont’d)
GIS Applications to Spring Valley
GIS Applications

• Sampling Applications
  – Rights of Entry and Sampling Data Tracking
  – Ensuring Randomness of Sampling Locations
  – 3D Visualization

• Spatial Analysis
  – Creating a Cut & Fill Layer
  – Classification Scheme

• Stakeholder Involvement
Rights of Entry (ROE) and Sampling Data Tracking

- Extensive sampling effort requiring coordination between different parties.
- GIS played a large role, from obtaining rights of entry (ROE) to displaying sampling results.

Diagram:

- Obtain ROE
- Schedule Sampling
- Produce Base Map
- Sample
- Analyze Sample
- Obtain and Analyze Results
- Map Results
- Send Result to Homeowner
- Elevated Result => Grid Sampling
- Remediate Contaminated Soil
Ensuring Randomness of Sample Locations

- Sampling process in accordance with EPA Soil Screening Guidance.
- Properties divided in either halves or quadrants.
  - Half: 8 randomly located subsamples per half.
  - Quadrant: 6 randomly located subsamples per quadrant.
Ensuring Randomness of Sample Locations (cont’d)

- Used GIS software to place random sample locations for over 1000 properties.
- Process took only about half a day.
Ensuring Randomness of Sample Locations (cont’d)

- If quad/half sampling results elevated, grid sampling is required.

- Grid samples taken every 20 feet. Sample locations determined using GIS software and data sent to surveyor.
3D Visualization

- GIS allows viewing sampling results in 3D.
- Easily allows determination of locations with extremely high results, since color scale for 2D maps did not differentiate between arsenic results such as 50 mg/kg and 1,000 mg/kg.
Creating a Cut & Fill Layer

- Cut & Fill layer one of the most used layers.
- Created to show difference in elevation between 1918 and today.
- Layer created from 1917 USGS topo map and 2000 elevation contours (from aerial survey).
- Information used extensively to determine depth of borings, and eliminating areas unlikely to contain buried ordnance.
Creating a Cut & Fill Layer (cont’d)
Classification Scheme

• Classification system developed to determine most likely locations to contain unexploded ordnance.
• System based on historical photograph analysis from four different years (1918, 1922, 1927, 1928), elevation difference (using Cut & Fill layer), and arsenic sampling results (over 10,000).
• System coded using GIS software customization language. Allows to rerun the script whenever new data is received.
Stakeholder Involvement

- Web site created to keep residents informed.
- Sampling results made available online to USACE employees.
- ArcIMS mapping service created to allow residents and Corps employees to view geographic data.
Stakeholder Involvement (cont’d)

Welcome,

This site was designed for the residents of Spring Valley seeking answers to their questions. Please email the webmaster with any questions or comments.

To the left you will see 5 tabs: Reports, Maps, Interactive Map, Contact Information, and Results.

- The Reports tab will allow you to view reports in PDF format.
- The Maps tab contains maps frequently used by the Army Corps of Engineers.
- The Interactive Map tab allows you to interactively create your own map.
- The Contact Information tab lists important phone numbers and email addresses to contact the Army Corps of Engineers as well as the webmaster.
- The Results tab lists validated sample results. This page is accessible only by authorized personnel for privacy issues.

To return to this page, click on the USACE logo at the top left of your screen.

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Stakeholder Involvement (cont’d)
Lessons for Effective Management of Large GIS Databases
Standardization & Automation

• ArcView GIS extension written to automate and standardize map production.
• Approximately 3000 maps produced in the last 4 years.
Standardization & Automation (cont’d)
Data Organization

- Originally only 1 main GIS Analyst working on project at any one time, but 3 analysts over the length of the project.
- Project started small, grew to become full-time work.
- Data from many different sources.
  - Need for restructuring GIS database.
Data Organization (cont’d)

• Followed basic structure of SDSFIE.

• Currently converting all data to the USACE’s new OE Life Cycle Data Management GIS Data Standard.
Conclusion
Conclusion

• GIS extremely useful.

• Beneficial for GIS personnel to:
  – Understand larger picture.
  – Attend monthly partnering meetings.

• GIS expanded from cartographic output to programming and spatial analysis.
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