

GIS IN SUB-SURFACE UXO AND MEC INVESTIGATION AND REMOVAL

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FORMERLY USED DEFENSE SITES (FUDS) PROGRAM

- | Environmental Restoration of Former Department of Defense (DoD) Properties
- | Established Mid 1980s
- | 2,700 properties out of a potential 10,000 properties
- | Project sites from one acre up to hundreds of thousands
- | Different Programs:
 - Installation Restoration (IR) Program:
 - | Clean up of Hazardous, Toxic and Radioactive Waste (HTRW)
 - | Building Demolition and Debris Removal (BD/RD)
 - | Military Munitions Response Program (MMRP)
 - | Removing Unexploded Ordnance (UXO) and Munitions and Explosives of Concern (MEC)
- | US Army Corp of Engineers (USACE) Management
- | US Army Oversight
- | Clean up pursuant to Comprehensive Environmental Response, Compensation, and Liabilities Act (CERCLA)



COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT (CERCLA)

- | CERCLA, aka Superfund Act
- | Enacted in 1980
- | Response to Environmental Disasters and Hazardous Waste Sites
- | Two Goals
 - Clean up sites contaminated with hazardous substances
 - Provide authority to various agencies to recover damages caused by releases of hazardous substances
- | Two Actions:
 - Removal Actions
 - | Short-term response to threats that require immediate attention
 - Remedial Actions
 - | long-term response actions that seek to permanently and significantly reduce the risks associated with releases or threats of hazardous substances
- | UXO and MEC projects are subject to both types of actions



FORMER CAMP ELLIOTT

- | Located in San Diego, California
- | One of the first sites to be entered in to the FUDS Program
- | Pre World War I up to 1941
 - Camp Kearny
 - Army artillery and machine gun training ranges
- | 1941 to 1946
 - Navy Command – encampments, bivouac areas, and forty-one different firing ranges used for live fire exercises
- | 1946-1960
 - Navy Command – training and distribution
- | 1960
 - Decommissioned – land was turned over to different military branches and/or was acquired by the City of San Diego

TIERRASANTA

- ┆ Located in San Diego, California on Former Camp Elliott Property
- ┆ Founded in 1971
- ┆ 1983 – Two boys killed playing with a UXO found in a canyon behind their house

TIERRASANTA ORDNANCE REMOVAL

- ; Response to the 1983 incident
- ; One of the first major removal actions under the FUDS Program
- ; Located in Tierrasanta , San Diego CA on Former Camp Elliott Land
- ; UXO removal action on over 1,900 ac.
- ; Did not have the benefit of advances in digitally recorded detectors, positioning equipment, and software (GIS)

SITE CHARACTERIZATION

- | Looking at various natural features that can impact your project by either limiting access or restricting the type of investigation that you can conduct.
- | Two types
 - Desktop
 - | GIS-based analysis
 - Site Visit
- | Factors to consider and look at:
 - topographic features
 - water features
 - vegetation
 - sensitive biological resources

SITE CHARACTERIZATION – TOPOGRAPHIC FEATURES

- | Tierrasanta Ordnance Removal
- | Sources
 - USGS Topographic Maps
- | Limitations
 - Static map can't do much
 - May be outdated
- | Current Projects
 - Sources
 - | DEM or Lider
- | Advantages
 - Slope Analysis – Steep slopes can affect how and if you do your work!

SITE CHARACTERIZATION – WATER FEATURES

- | Tierrasanta Ordnance Removal
- | Sources
 - USGS Topographic Maps
- | Limitations
 - Static map can't do much
 - May be outdated
- | Current Projects
 - Sources
 - | Many!
- | Advantages
 - Readily available, easy to access, easy to visualize

SITE CHARACTERIZATION – VEGETATION

- | Tierrasanta Ordnance Removal
- | Sources
 - None
 - Site Visit
- | Limitations
 - No way to know ahead of a site visit
- | Current Projects
 - Sources
 - | Local Data Sets
 - | Aerial Photo
- | Advantages
 - Easy to visualize
 - Easy to plan for

SITE CHARACTERIZATION – SENSITIVE BIOLOGICAL RESOURCES

- | Tierrasanta Ordnance Removal
- | Sources
 - None
 - Site Visit
- | Limitations
 - No way to know ahead of a site visit
- | Current Projects
 - Sources
 - | Local Data Sets
- | Advantages
 - Easy to visualization
 - Easy to plan for

GRID STAKE OUT

- | Grid large project area in to smaller more manageable areas
- | Tierrasanta Ordnance Removal
 - Licensed surveyor and rodman
 - | Expensive
 - | Slow
 - | Inefficient
- | Current Projects
 - Grids established in ArcGIS (Grid Index Features)
 - Corner points and coordinates established in ArcGIS
 - Points loaded into handheld device and staked out
- | Advantages
 - Simplified work flow
 - More efficient and less costly

TARGET DETECTION – “MAG AND FLAG” SURVEY

- | Used on the Tierrasanta Ordnance Removal
 - Equipment:
 - | Sweep teams, metal detectors or magnetic locators, flags
 - Workflow
 - | TBD
- | Limitations
 - No track log
 - Not able to discriminate between ordnance and non-ordnance items
 - Little to no QA

TARGET DETECTION – DIGITAL GEOPHYSICAL MAPPING

| Preferred method on projects

- Equipment:
 - | Operator, DGM Sensor, RTK positioning gear
- Different types
 - | Towed Array, Hand Towed Array, Cart/Litter
- Work flow

| Benefits

- Digital Recordings
 - | Tack logs and coverage files
 - | QA
 - | Integrates with GIS
- Target List
 - | Integrates with GIS
 - | Target Discrimination
 - Reduce digs

TARGET DETECTION – ENHANCED MAG AND FLAG

- | Can't always use DGM
- | Just like Mag and Flag, but with positioning
- | Benefits
 - Accurate recordings of targets

DATA COLLECTION

- | Tierrasanta Ordnance Removal
 - Dig Sheets
 - | Paper sheets recording the results of the investigation
- | Work Flow
 - “Ring off”, investigate, record results on dig sheets, enter into database
 - | Limitations
 - Lots
 - | Data entry errors in the field, transcription errors, lack of QA

DATA COLLECTION

| Current Projects

- Electronic dig sheets
 - | Dig sheets in electronic form
 - Designed to run on handheld devices ranging from a GPS enabled handheld device to a tablet to another data logger

| eDigs

- Electronic dig sheets designed by InDepth
 - | Cross platform software to replace paper dig sheets
- Advantages
 - | Customizable
 - | Seamless data integration
 - | More efficient
 - | Reduce errors
 - | Reduce data entry time
 - | Better integration with GIS software

DISPLAY AND VISUALIZATION

- | Reporting – the final stage
 - Tierrasanta Ordnance Removal
 - | Text, text and text
 - | Very few figures
 - Current projects
 - | Lots of figures