



Amplified Inventory Tracking System

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Background - OSM

- Who do we regulate?
 - Through the Surface Mining Control and Reclamation Act (SMCRA), OSM regulates the coal mining activities throughout the country, to ensure that mining is carried out in an environmentally responsible way. Most coal-mining states now have primary responsibility to regulate coal mining on lands within their jurisdiction, with OSM performing an oversight role. OSM also partners with states and Indian tribes to regulate mining on Federal lands.



Background - OSM

- What is currently in our inventory?
 - Federal Program
 - Indian Lands
 - States with primacy (regulatory authority) keep their own inventories. We are hoping to include their impoundments in our inventory in the future.



Problems with traditional inventories...

- Not enough personnel “on the ground”
 - Track changes that might affect hazard classification
 - Verify information already in inventory
- Sharing of data between offices is difficult
 - Distance between office locations and headquarters offices often mean staff don’t communicate changes/updates well/timely
 - Paper records (such as inspection reports) are kept at field office locations
- Sharing of data with the public



New solutions to “old problems”

- Information easily available online and at no cost
 - GIS data
 - Aerial photography
 - Geo-referenced information makes combining material from different sources easy
- Other information sources are available
 - Information obtained from permit files and maps
 - Scan and geo-reference the material, then digitize into a GIS, or other database or map system
 - Cooperation with other government agencies (local, state and federal)
 - NRCS Geospatial Data Gateway
 - National Geospatial-Intelligence Agency (NGA)

Obtaining online data – one example

- NRCS Geospatial Data Gateway
 - Go to <http://datagateway.nrcs.usda.gov>
 - From there, go to Get Data
 - Follow the steps to order the information covering the area of interest.
 - The site provides a variety of data:
 - GIS Data Sets
 - Topographic maps
 - Elevation datasets
 - Orthographic Imagery





Software tools used to create and verify inventory system

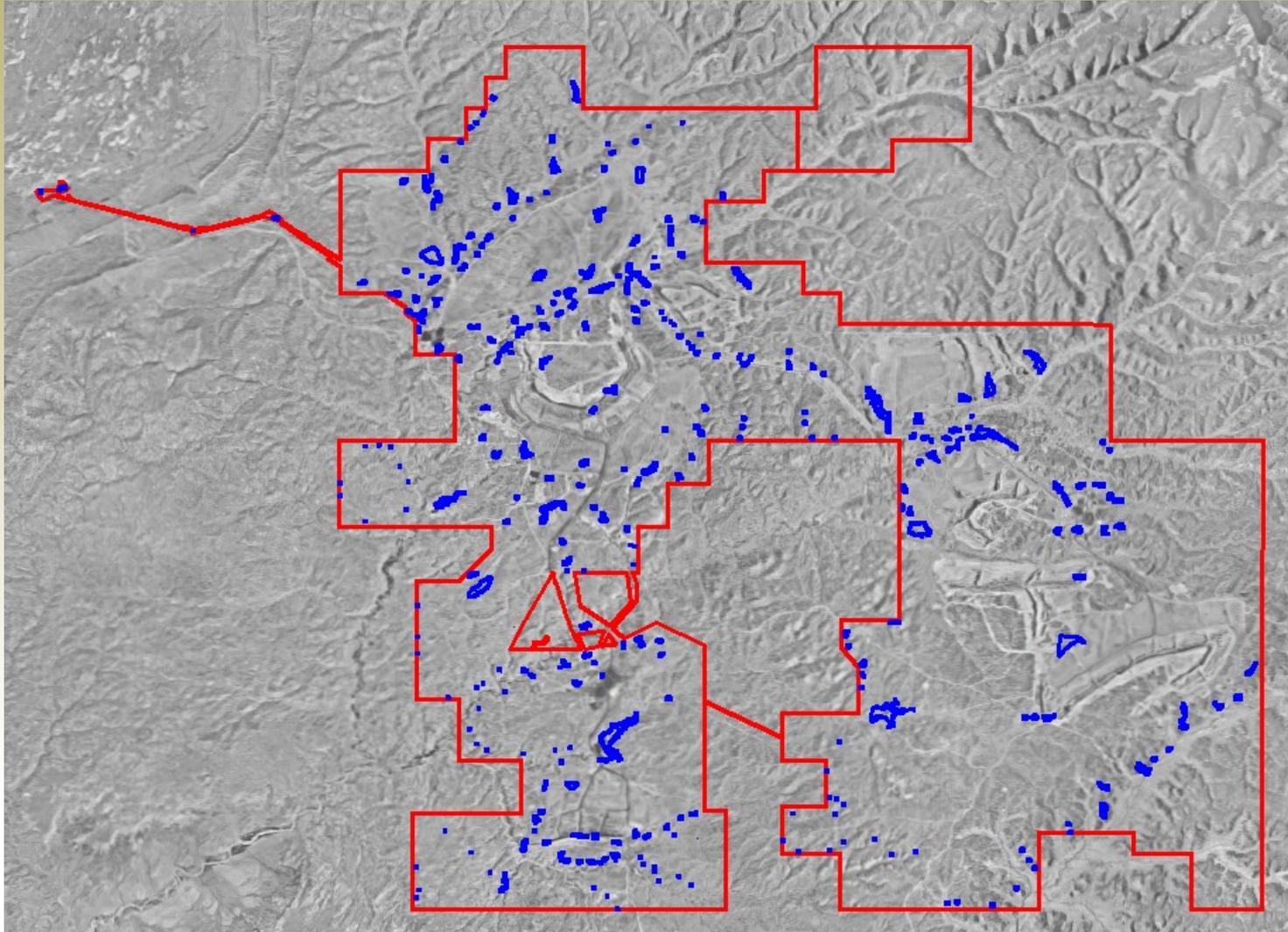
- Internet
- AutoCAD Map 3D 2009
- AutoCAD Raster Design 2009
- Google Earth
- Google Earth Planimeter
- ArcGIS 9.3
- Microsoft Office: Excel and Access



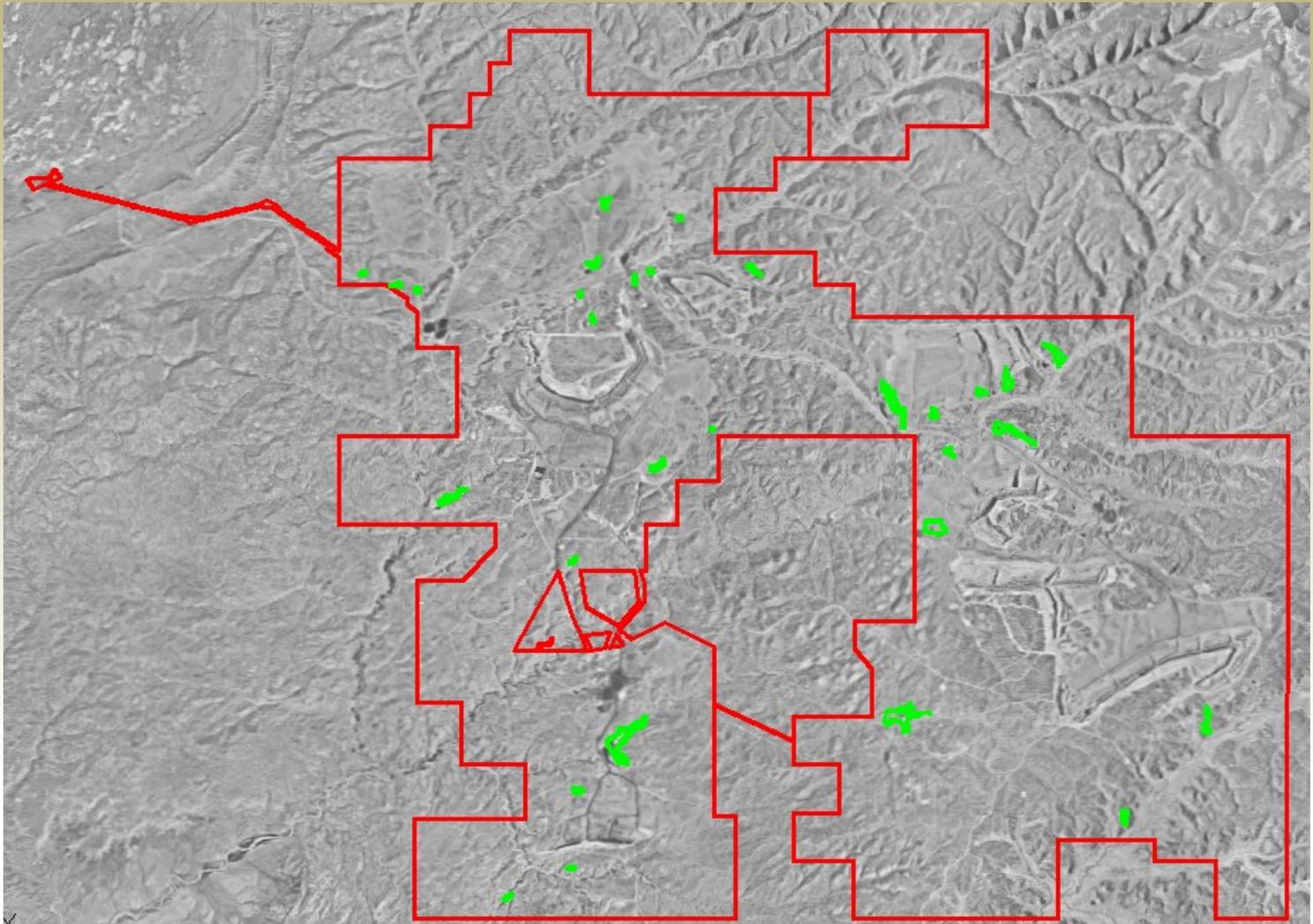
Different approaches/results

- Using AutoCAD Map 3D, with ArcGIS, we can create a GIS that can be shared with ALL offices across the country, and even between agencies
- These can be shared either via the Internet (using password protected access) or via an Intranet site where log-in information can be created and used for verification
- A map can be made with a correlation between a database, photography, GIS data and other pertinent data and presented as one map.
- Features (such as dams) can be mapped accurately, with attribute data attached, so that one click can pull up important information
- Using our Western Region's GIS and a downloaded aerial photo, a map was created of the permit boundary and **all ponds** in this mine area as shown on the next slide.

Map of mine with all ponds shown (blue) with permit boundary (red)

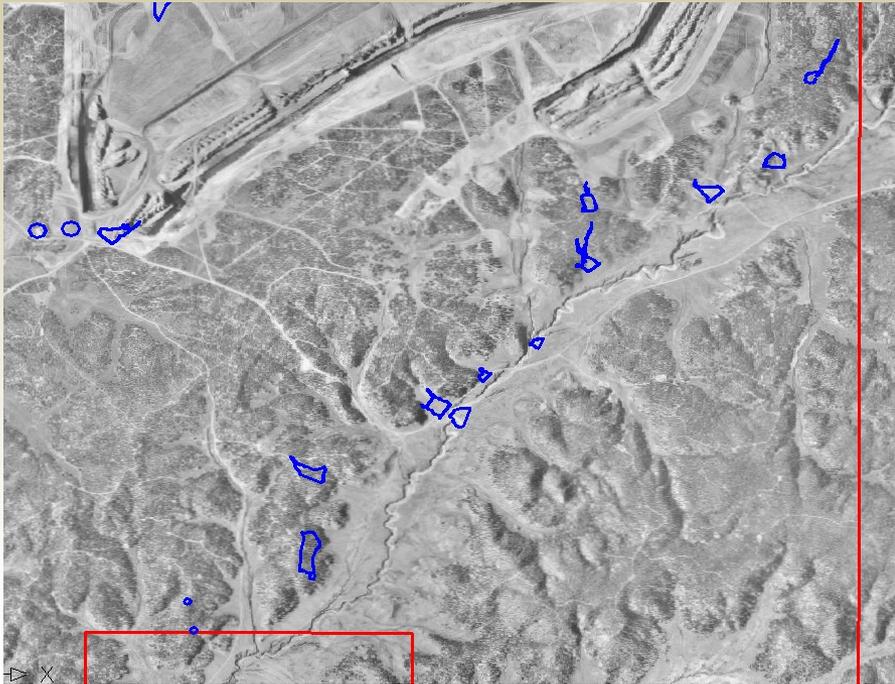


Map with only impoundments from our inventory (green) with permit boundary (red)



Between these two maps, we can identify some issues

- Several areas of the mine have ponds in series, though not all of those ponds appear on the inventory (J-21 series shown here)



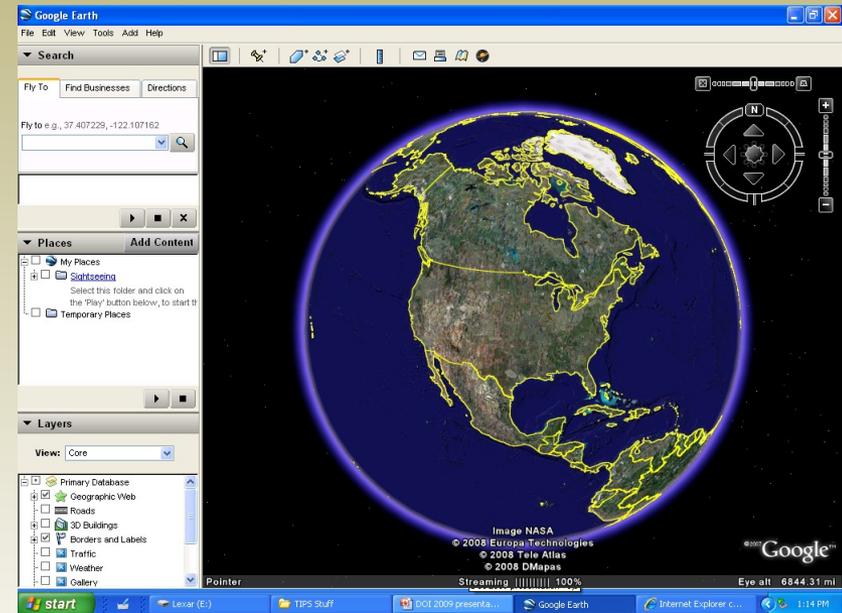


Additional information we can find from available data

- From readily available PUBLIC information:
 - Elevation data (DEM)
 - Census information (as GIS data)
 - Aerial photography (both current and historical) can show changes in the impact area
 - Aerial photography can also allow for evaluation of “other” features in the area of the dam:
 - Evaluation of dams along the same flow path (dam in series) either upstream or downstream from the dam in question
 - Measurements can be done to evaluate the dam remotely:
 - Length, width and height of dam
 - Area of the impounding structure can give a rough estimate of capacity

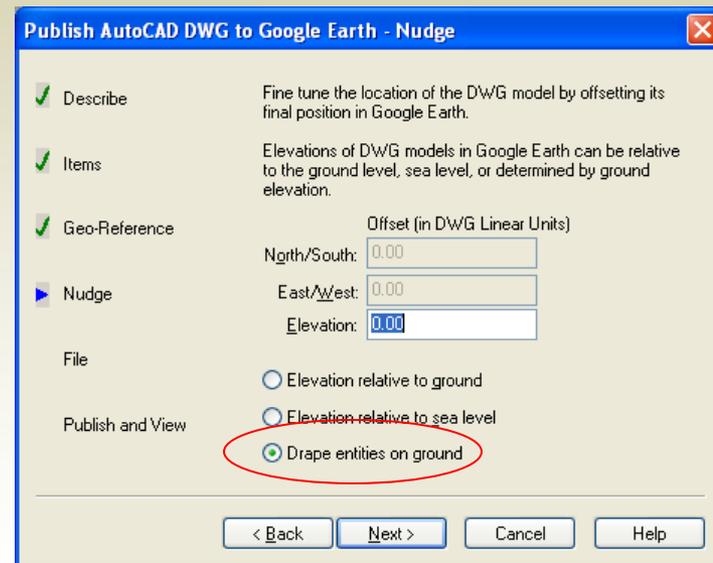
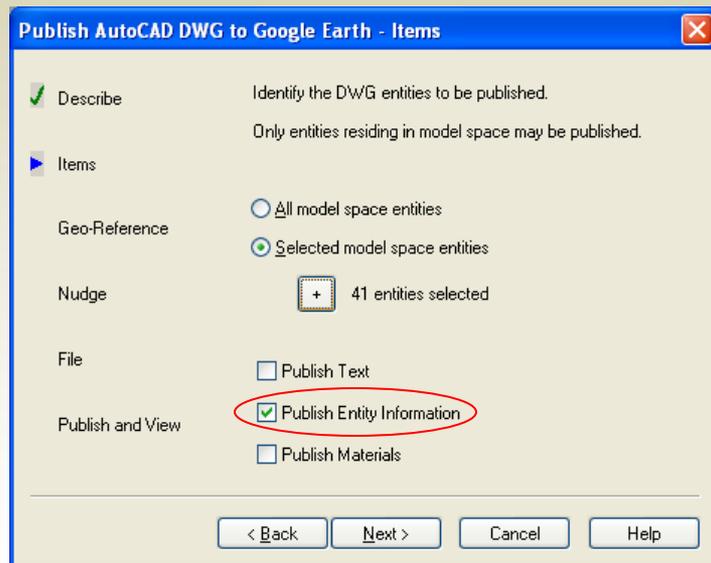
Google Earth

- A user-friendly program available from Google at <http://earth.google.com>
- Displays satellite images of varying resolution of the Earth's surface
 - Can select which features to view – including cities, roads, weather, and terrain at varying angles
 - Search for locations using street address, lat/long information, locality name, or navigate using the mouse



Publishing from AutoCAD Map 3D to Google Earth

- Using the same data and information that is created in AutoCAD Map 3D, we can export the information to Google Earth where it can be shared.
- Any data we have attached to the entities in AutoCAD can be brought along with the entities when being published. Objects can also be “draped” on the ground surface.



- This KMZ file contains the entire mine site we've been looking at:
[AZ map with Classification.kmz](#)

Comparing attached data

- Here is the same impoundment from our inventory viewed in AutoCAD Map 3D and Google Earth

The screenshot shows the AutoCAD Map 3D interface. On the left, the Properties palette is open to the 'DD:Default_AZ_Ponds_Export_0' tab, displaying a table of properties for the selected object. The main view shows a 3D model of a dam impoundment with a blue polyline boundary overlaid on a grayscale aerial photograph.

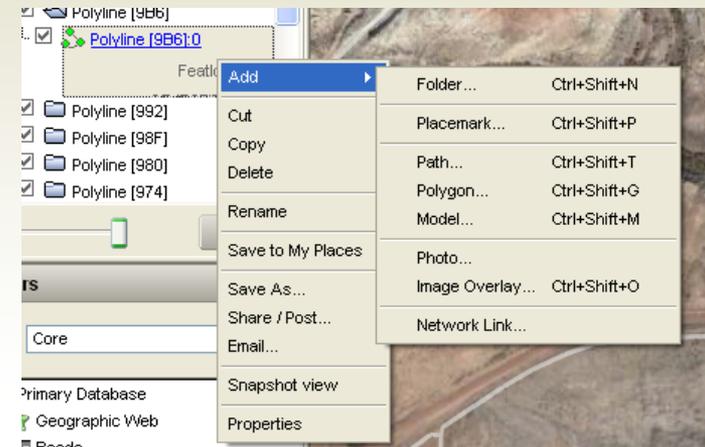
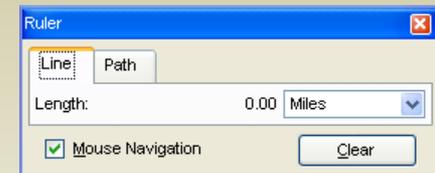
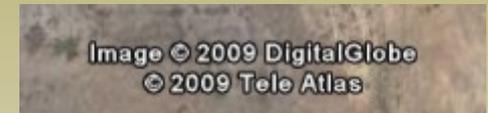
| DD:Default_AZ_Ponds_Export_0 | |
|------------------------------|--------------|
| FeatId | 269 |
| OBJECTID | 269 |
| Name | J7-DAM |
| Type | Water |
| Permit | Interim |
| LifeSpan | Permanent |
| FieldStatus | Existing |
| OSM_Status | Approved |
| NPDES | Y |
| MSHA | Y |
| Depth | 0 |
| Remedial | N |
| Acres | 51.6800 |
| Constructi | 1973 |
| RemovedDat | |
| WaterSyste | N |
| StateID | AZ0901195-11 |
| NID | N/A |
| Haz_Class | Low |
| Dam_Type | Earthen |
| Max_Storage | 669.4000 |
| Normal_Storage | 329.0000 |
| Height | 24.0000 |
| Crest_Length | 1800.0000 |
| Spillway_Width | 0.0000 |
| OSM_InspFreq | Quarterly |

The screenshot shows the Google Earth interface. A data popup window is open over the dam impoundment, displaying a table of properties for the selected object. The background is a color satellite image of the same area.

| Polyline [9B6]0 | |
|--------------------|--------------|
| FeatId | 269 |
| OBJECTID | 269 |
| Name | J7-DAM |
| Type | Water |
| Permit | Interim |
| LifeSpan | Permanent |
| FieldStatus | Existing |
| OSM_Status | Approved |
| NPDES | Y |
| MSHA | Y |
| Depth | 0 |
| Remedial | N |
| Acres | 51.68 |
| Constructi | 1973 |
| RemovedDat | |
| WaterSyste | N |
| StateID | AZ0901195-11 |
| NID | N/A |
| Haz_Class | Low |
| Dam_Type | Earthen |
| Max_Storage | 669.4 |
| Normal_Storage | 329 |
| Height | 24 |
| Crest_Length | 1800 |
| Spillway_Width | 0 |
| OSM_InspFreq | Quarterly |
| Generic Properties | Polyline |

Google Earth tools/features

- Image dates appear on lower part of view
- Images on Google Earth are of varying resolutions, depending on the source
- Digital ruler function allows for judging linear distances
- Time-lapse feature allows one to show the change in an area over time, if available
- Can link mapped locations to links with different types of information
 - Either online or offline material can be linked, if available



Google Planimeter

- A planimeter is a measuring instrument used to determine the area of an arbitrary 2D shape
- Online Planimeter available from:
<http://www.acme.com/planimeter/>
- Easy to measure areas such as pool area, drainage area, etc.

Google Planimeter
Measure areas using Google Maps!

Map Satellite Hybrid Topo DOQ

Drag the map with your mouse, or double-click to center.

Click on the map to place points.

Once you have placed at least three points, the enclosed area will be computed.

Delete Last Point

Clear All Points

Ads by Google

Planimeters Area Measure
New Digital, Linear and Polar
Planimeters by
Planx and Placom
www.EngineerSupply.com

POWERED BY Google | 5000 mi | 5000 km

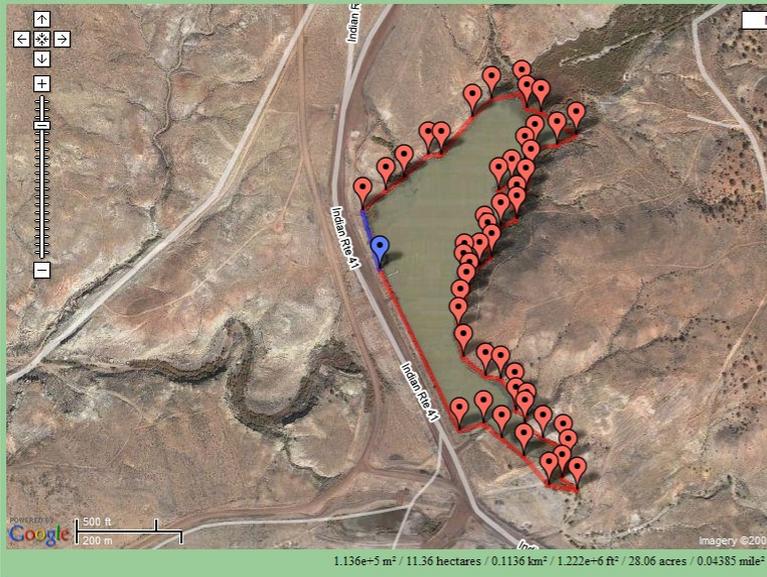
Terms of Use

Google Planimeter

- Here is the same impoundment shown previously

Google Planimeter

Measure areas using Google Maps!



Google Planimeter

Measure areas using Google Maps!





Looking towards the future

- There are a wide variety of areas that we are exploring for future use of these technologies:
 - The National Geospatial-Intelligence Agency (NGA) is a Department of Defense combat support agency that develops imagery and map-based intelligence solutions (<https://www1.nga.mil>)
 - Under a pilot project, OSM is obtaining satellite imagery from NGA and then post-processing the high-resolution satellite imagery to obtain a variety of information
 - Other data may be available from other federal agencies – we are currently exploring this – no need to duplicate efforts across agencies!



Questions??

- Again, there are lots of opportunities to cooperate across agencies using both publicly available information and other agency information.
- Any ideas or suggestions are appreciated!

The presenter would like to thank:

- OSM Dam Safety Team
- Everyone else at OSM, and the TIPS (<http://tips.osmre.gov>) program