



# **GCMRC's Online Mapping and GIS Resources**

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**Grand Canyon Monitoring and Research Center**

U.S. Department of the Interior  
U.S. Geological Survey

# GIS – Admin background

- Previously under DASA, 2005 – 2012 and GCMRC IT Program 2000 - 2004
- FY2015 – 2017 Workplan, Project 14.
- Added 1.5 FTE to GIS Project at beginning of FY2015.
  - Current work force has 2 FTEs, 2 ½ time FTEs.

# GIS – Role in current work plan

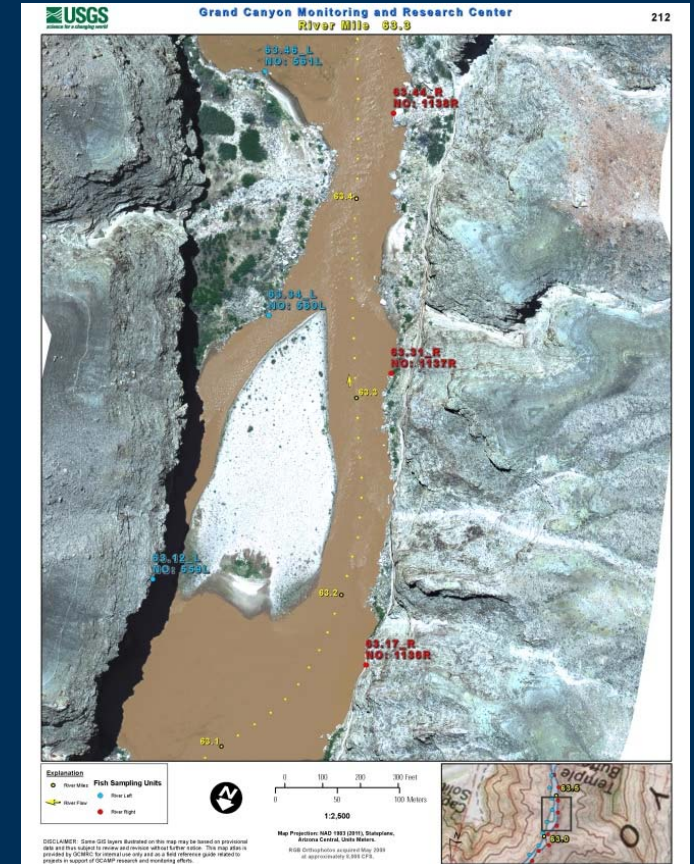
- Balance between Center-wide GIS support and specific, project-level involvement
- 1/2 time devoted to GCMRC Projects
  - Worked with PIs to develop role of GIS in projects for TWP
  - In some cases, GIS Lead listed as Co-PI for certain project elements (see Projects 3 & 10)
- 1/2 time reserved for Center-wide support

# Project Support – FY15

- **Fisheries**
  - Natal Origins, Downstream Fish Monitoring (ADGF), Lees Ferry Fisheries, Little Colorado River Fish Monitoring (USFWS and GCMRC), Humpback Chub Mainstem Monitoring
- **Other Biological**
  - Aquatic Foodbase Monitoring, Vegetation Monitoring
- **Physical**
  - Geomorphology, Surveying

# GIS Support – Fish

- Fish Sampling Units
  - Glen Canyon Dam to Pearce Ferry
  - 250-meter set units
- Cross-Reference System
  - Consistent framework for relating prior fish efforts
- Units used in Fish Database



# GIS Support – Geomorphology

- **Channel Mapping efforts**
  - Field support, data processing, applying finished data to other projects.
- **Sandbar Monitoring Sites**
  - Triangulated Irregular Network (TIN) Processing Script for calculating volumes
  - Maintaining GIS layers
  - Photogrammetry of historic photography

# GIS Support – Geomorphology

- 1984 Sandbar Digital Terrain Extraction
  - GIS-lead project element
  - Photogrammetry of 1984 B&W aerial photography
  - Digital Terrain Model (DTM) extraction
    - 3D model development
    - Volumetric calculation of sandbars in 1984

# 1984 Photogrammetry of sandbars





# 1984 Photogrammetry of sandbars

**Triangulation Summary**

Triangulation Iteration Convergence: Yes  
Total Image Unit-Weight RMSE: 0.6856

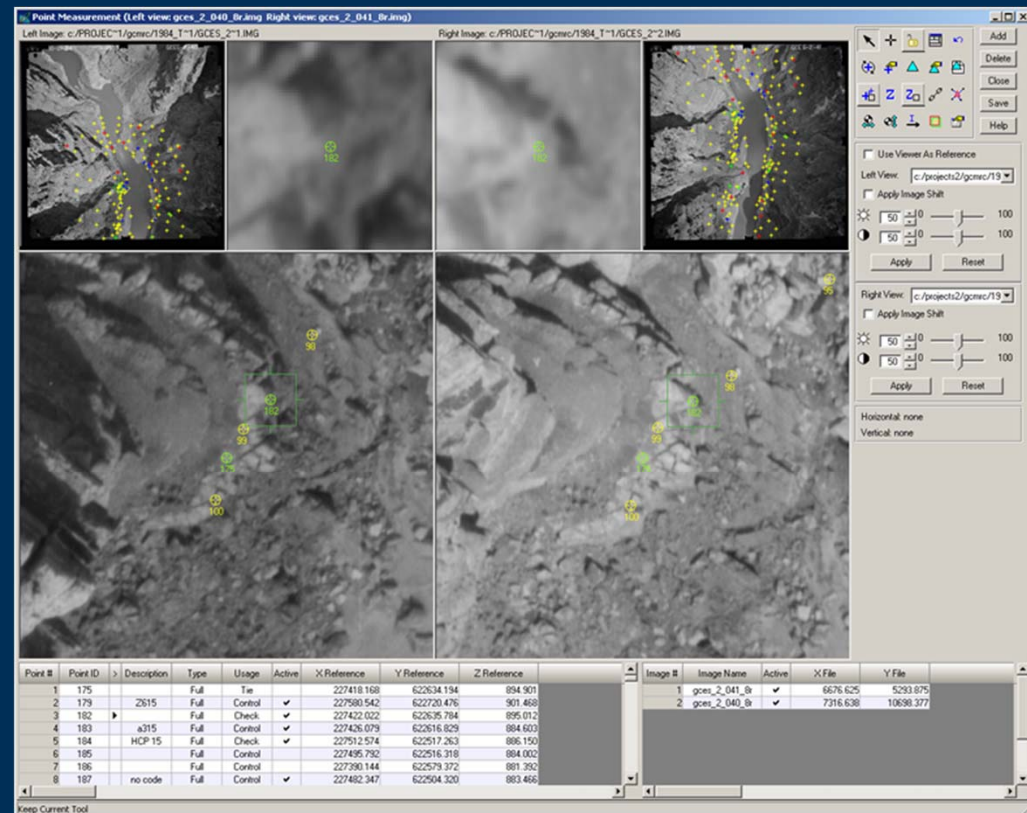
Control Point RMSE: Check Point RMSE:

Ground X: 0.1402 (5)	Ground X: 0.0000 (0)
Ground Y: 0.0714 (5)	Ground Y: 0.0000 (0)
Ground Z: 0.0374 (2)	Ground Z: 0.0000 (0)
Image X: 1.1014 (11)	Image X: 0.0000 (0)
Image Y: 0.5478 (11)	Image Y: 0.0000 (0)

RMSE Significant Digits: 4

Buttons: Close, Update, Accept, Report..., Review..., Help

Triangulation Results



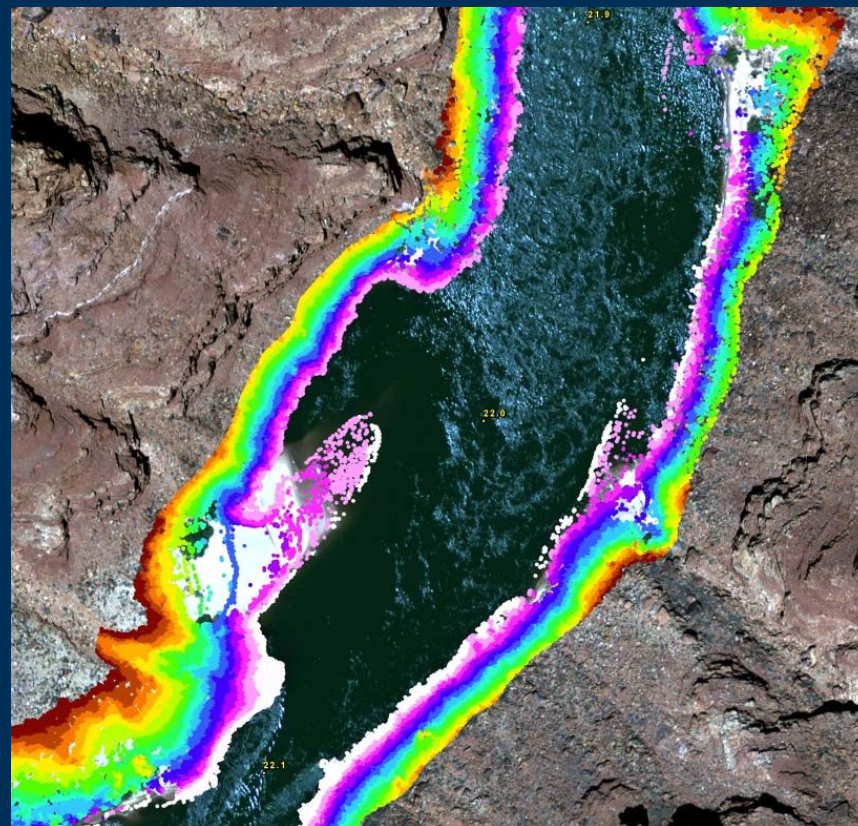
Ground Control and Tie Points in block adjustment

# 1984 Photogrammetry of sandbars

2009 Imagery & Ground  
Control Points (GCP)



1984 DTM Points



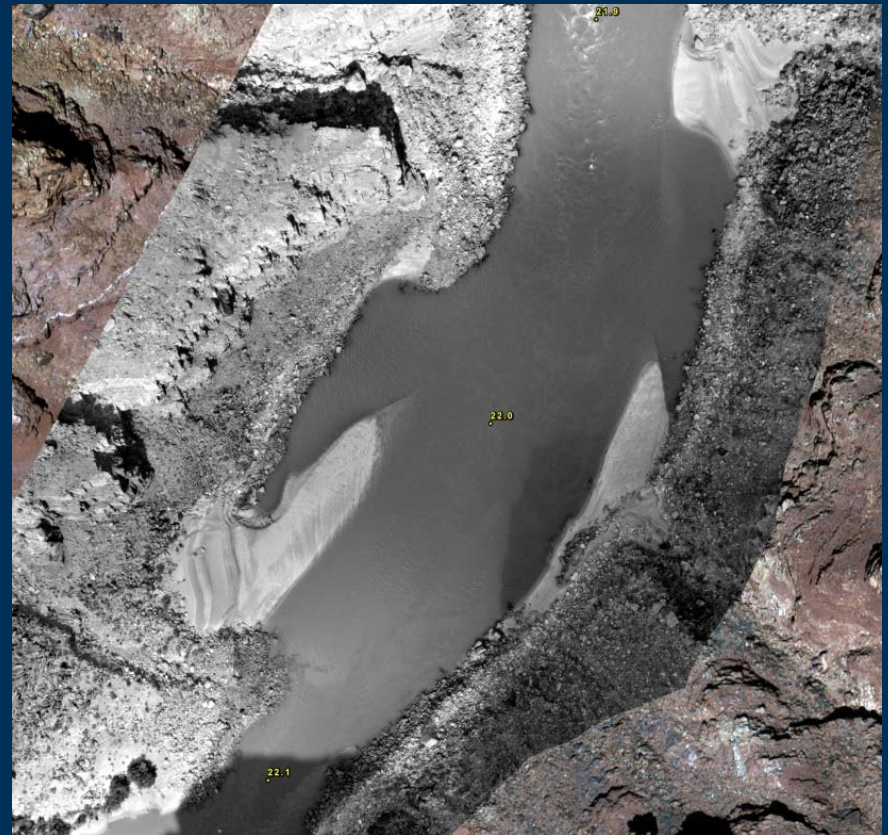


# 1984 Photogrammetry of sandbars

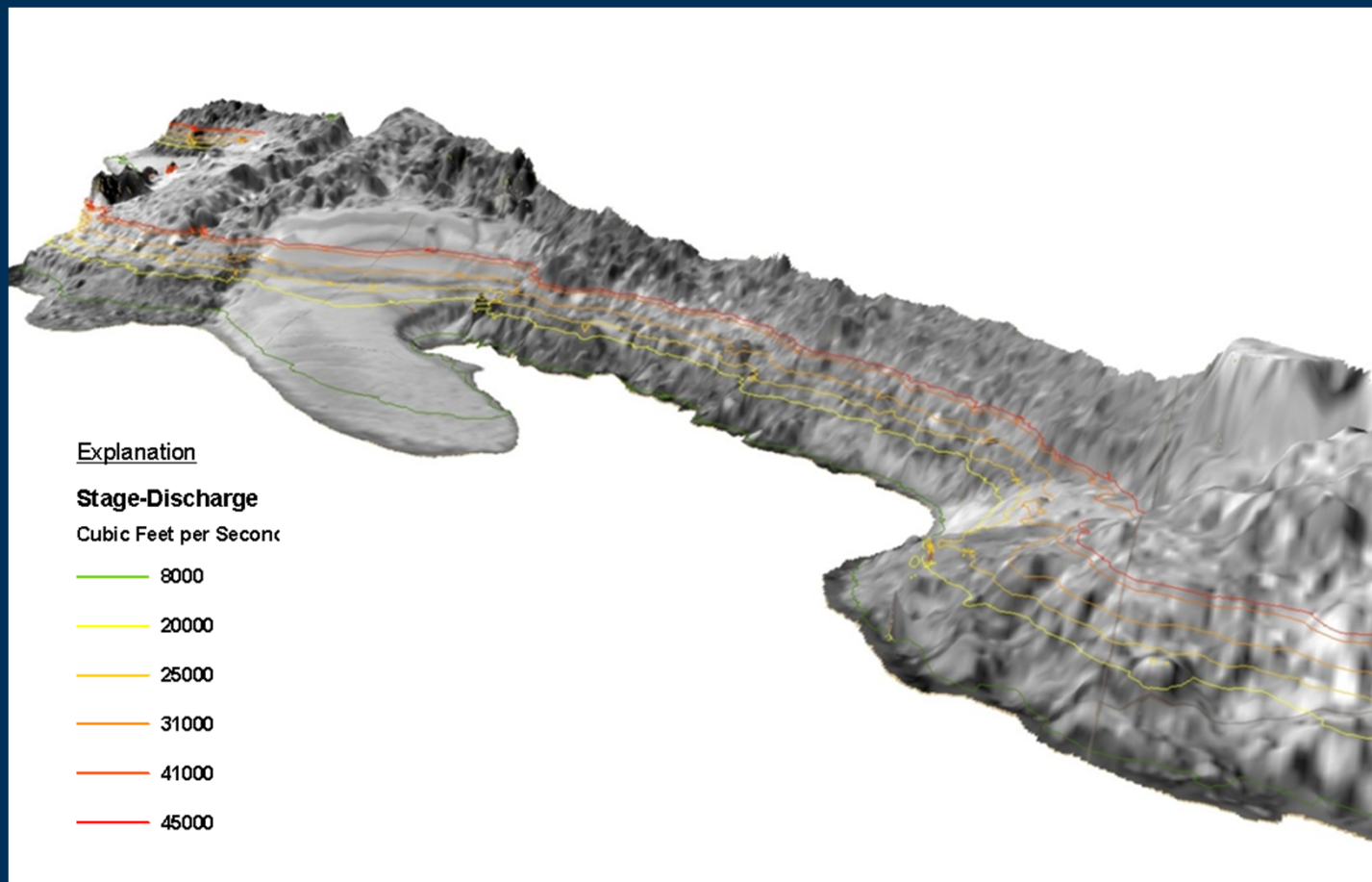
1984 TIN



1984 Ortho

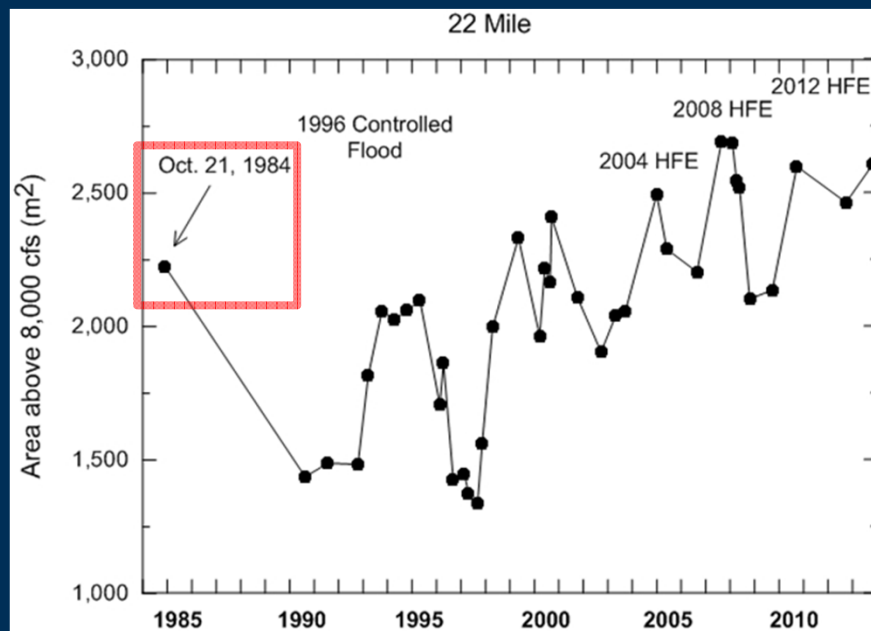


# 1984 Photogrammetry of sandbars

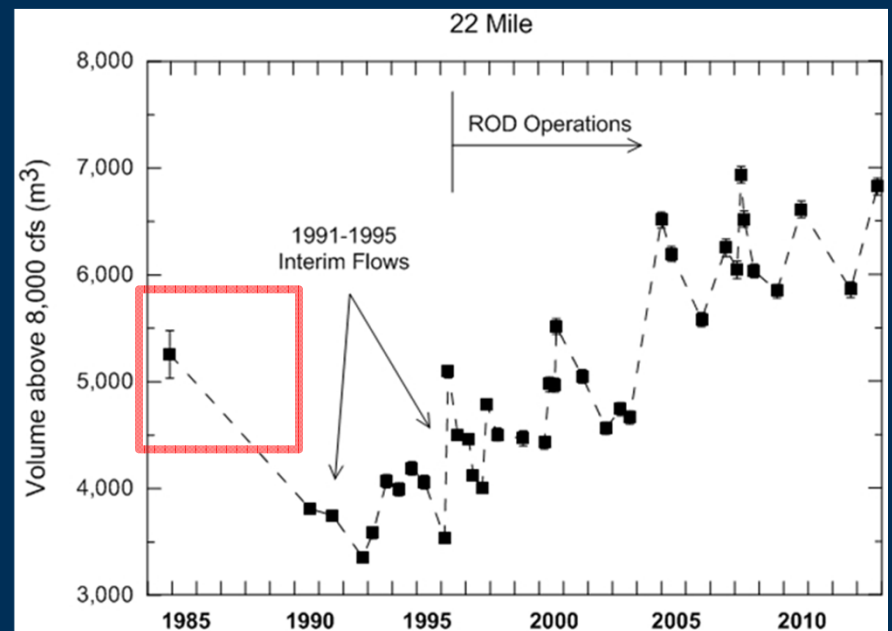


# 1984 Photogrammetry of sandbars

## 1984 Area above 8,000 CFS



## 1984 Volume above 8,000 CFS



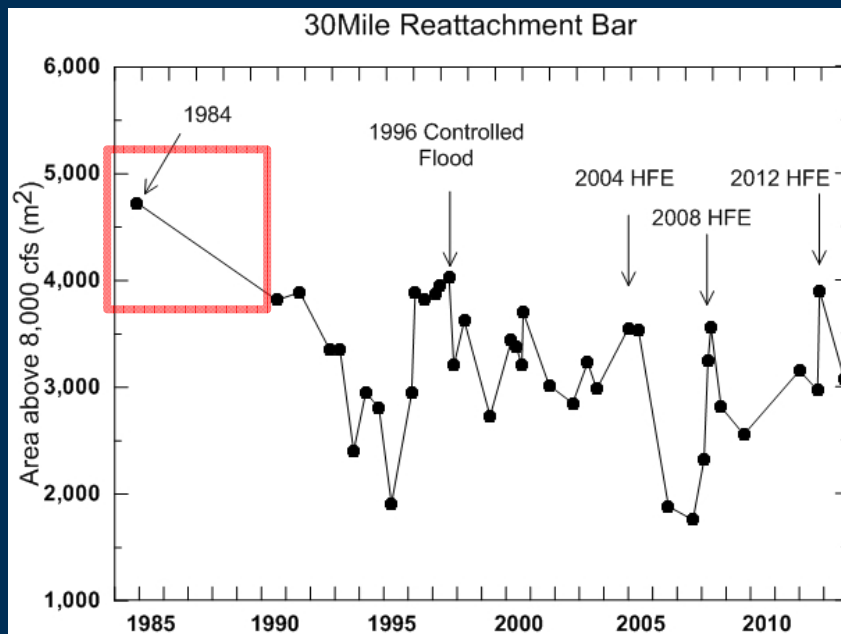
22-Mile



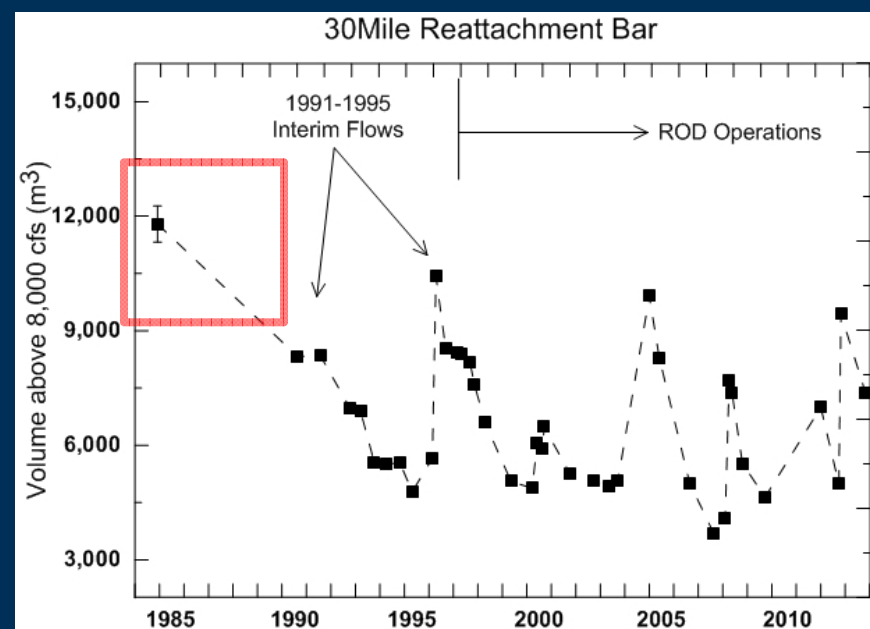
(Joe Hazel, Northern Arizona University. Preliminary data, do not cite.)

# 1984 Photogrammetry of sandbars

## 1984 Area above 8,000 CFS



## 1984 Volume above 8,000 CFS



30-Mile



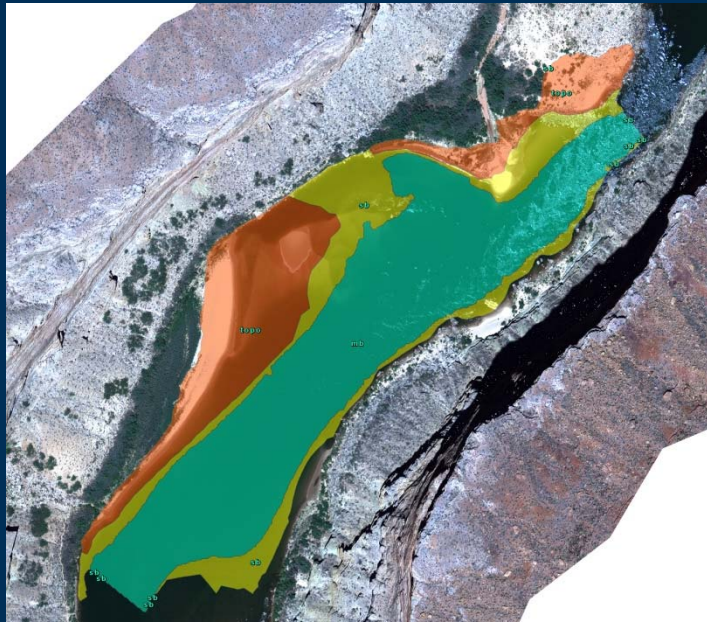
(Joe Hazel, Northern Arizona University. Preliminary data, do not cite.)



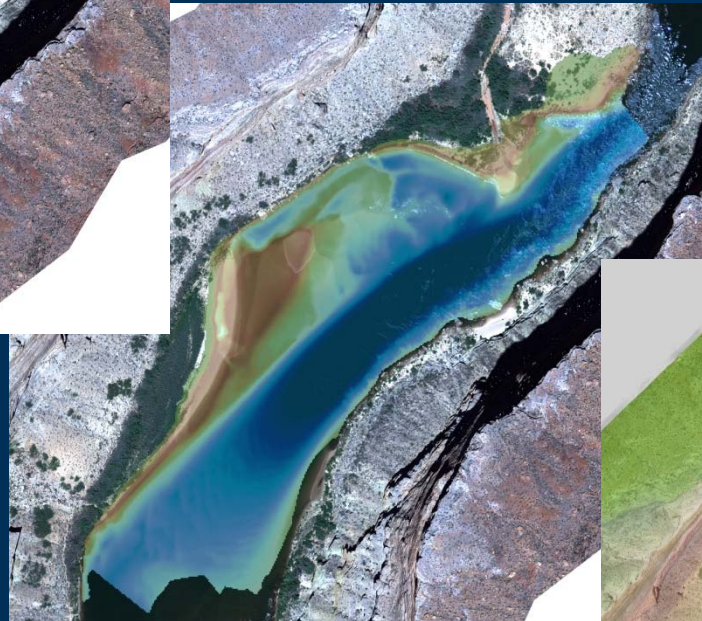
# GIS Support – Project 10

- Mosaic data sets from Overflight and Channel Mapping (Project 3)
- Determine appropriateness of combining / interpolating between data sets
- Pre-processing work: Vegetation removed from Digital Surface Models (DSM), Water masked out

# GIS Support – Project 10



Channel Map Data

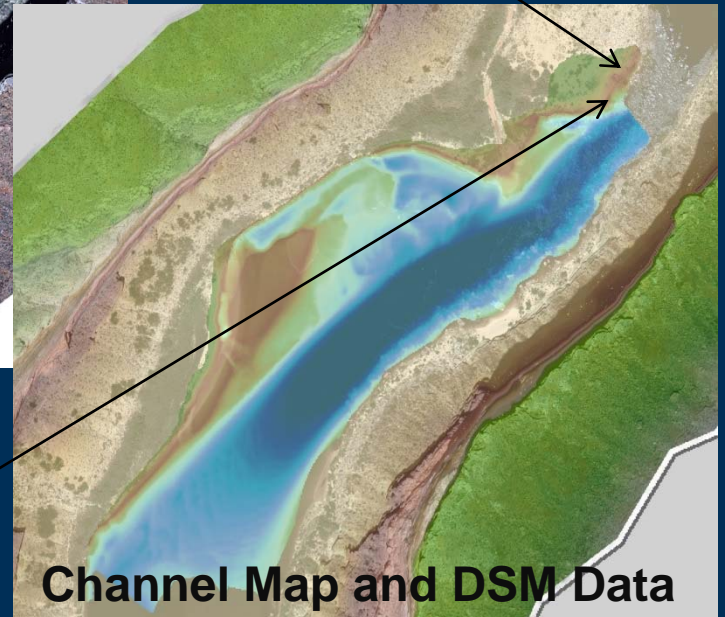


Seg\_039\_2012\_1m  
842.110352  
NO3\_CR\_2009\_05\_DSM\_VegRemoved  
842.099976

Diff Z = -0.010376 m

Diff Z = 0.117065 m

Seg\_039\_2012\_1m  
843.382935  
NO3\_CR\_2009\_05\_DSM\_VegRemoved  
843.500000



Channel Map and DSM Data





# **Project 14. Geographic Information Systems, Services and Support**

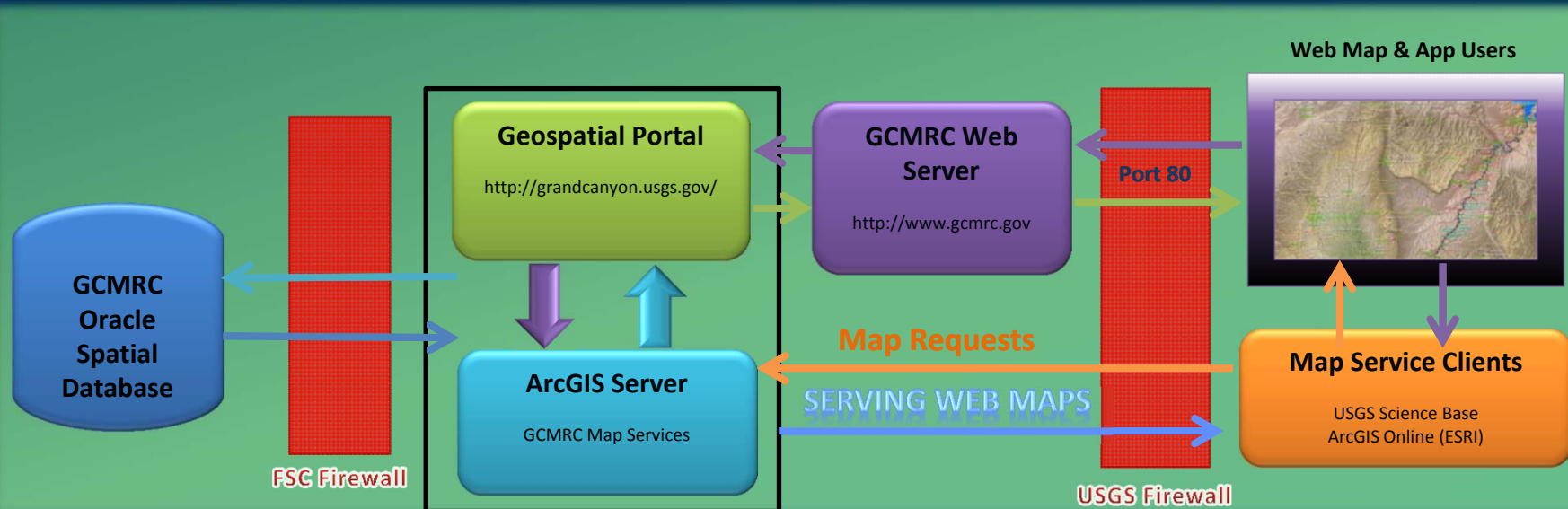
- **GIS Process and Data Set Documentation**
- **Geospatial Data Management**
- **Access to Geospatial Holdings**

# GIS Process and Data Set Documentation

- **GCMRC River Mile System Open File Report**
  - Recently edited river centerline and miles below RM 260 to more accurately follow channel
  - Previously cited as “Spatial Database” by other works
  - Open-File report needed for others to cite.
- **Metadata Development, “How-To” Docs, etc.**

# Project 14. Geographic Information Systems, Services and Support

- **Geospatial Data Management**
  - File-based data sets (e.g. ESRI Geodatabases, Shapefiles, ASCII text files, etc.)
  - Oracle Spatial Database – enterprise database designed for storing and serving geospatial data.



# Access to Geospatial Data Holdings

- GIS Services hosted by GCMRC
  - Web page with links to GCMRC Geospatial Services
  - Pages for ArcGIS Server versions 10.0 and 10.2.2
  - Designed for GIS users (ESRI, OpenSource, Google Earth)
- <http://www.gcmrc.gov/geospatial/index.html>

# Access to Geospatial Data Holdings

- Geospatial data using ArcGIS Online (ESRI)
  - Industry-standard platform for hosting web maps and applications
  - Searchable platform of web-based geospatial data sets, maps, applications, etc.
  - <http://www.arcgis.com/features/>

# ESRI Maps for Office

- Consume map services into Microsoft Office applications (PowerPoint & Excel)
- Add-In that needs to be installed
- Can leverage ArcGIS Online content or services from a another Portal

# ESRI Maps for Office



# Access to Geospatial Data Holdings

- ScienceBase Data Catalog (USGS)
  - Open to the public
  - Fulfills DOI-mandated initiatives to make data more accessible
  - <https://www.sciencebase.gov/catalog/item/55366b07e4b0b22a15807caf>



# Access to Geospatial Data Holdings

- GCMRC Website → Maps and Data Portal
  - Links to custom, web-based applications that highlight GCMRC science
    - Ex. Discharge, QW and Sediment Data, Geomorphology, Campsites, Aquatic Foodbase, Lake Powell monitoring
  - <http://www.gcmrc.gov/dasa/>
- Web Accessible Folder for downloading
  - <http://www.gcmrc.gov/geospatial/data/>

# Access to Geospatial Data Holdings

- GCMRC Website → Beta projects
  - Sandbar Remote Cameras
    - Began in 1990s as part of sandbar monitoring
    - 40+ Sites monitored
  - Campsite Photos (Adopt-A-Beach)
    - Approximately 200 campsites monitored since 1996
    - Includes Weeden Inventory photos from 1970s and associated repeat photography from 2007

# GCMRC GIS & Online Mapping

- Questions?

**THANK YOU !**

Launch