

A topographic map of a mountainous region, likely the Sierra Nevada, showing various peaks, ridges, and valleys. The map uses a color gradient from light tan to green to represent elevation, with blue lines indicating rivers and streams. The text is overlaid on the map.

# Internet Map Server Demonstration

Steve Mietz  
Cory Lochridge  
Chris Flaccus



## Building an Integrated Ecological Spatial Database for the Grand Canyon using SDE, IMS, and Oracle

**by Steve Mietz, Chris Flaccus, Cory Lochridge, Tom Gushue, Mike Breedlove, and Tim Andrews, Grand Canyon Monitoring and Research Center, Flagstaff, AZ**

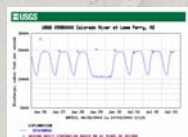
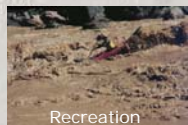
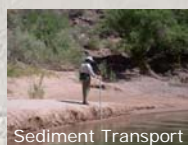
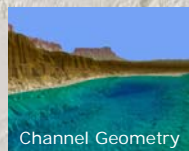
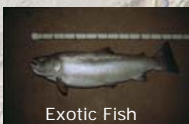
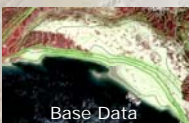
## ABSTRACT

The Grand Canyon Monitoring and Research Center (GCMRC) measures the effects from Glen Canyon Dam operations on the status and trends of resources along the Colorado River from Glen Canyon Dam to Lake Mead. The goals of the GCMRC are to develop monitoring and research programs as well as related scientific activities that evaluate short- and long-term impacts of the Glen Canyon Dam on the biological, cultural, and physical resources of the Grand Canyon. Managing the Grand Canyon is a complex task that requires the integration of a variety of distribution and analysis of spatial and tabular data collected within the CRE. The consolidation of disparate datasets from numerous sources provided a unique challenge. To address this challenge, spatial and temporal keys were used to organize the data in a single, comprehensive database using ESRI's Spatial Database Engine (SDE) and Oracle's Spatial Manager. Managing the data in a single database allowed for the integration of a variety of query and analysis tools including Internet Map Server, SQL, web-based forms, OBDC and GIS client connections.

## SPATIAL DATABASE ENGINE/ORACLE DATABASE MANAGEMENT SYSTEM

## QUERY/ANALYSIS TOOLS

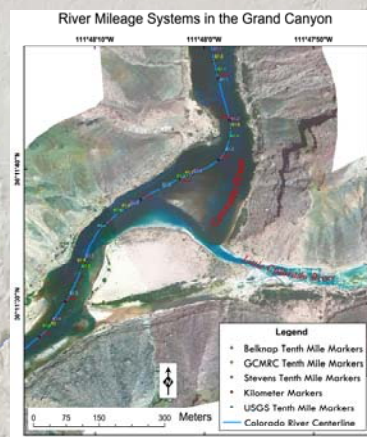
## SUBJECT AREAS



## Subject Areas Datasets organized by:

## Spatial Key

All datasets are given a spatial key by tying to river reach, kilometer marker, and river side. Historic river mile systems converted to kilometers using cross-reference tables.

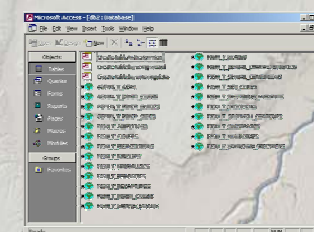


## Temporal Key

All datasets are given a temporal key based upon field trip launch date or specific date/time.



## ODBC Connection



## Internet Map Server



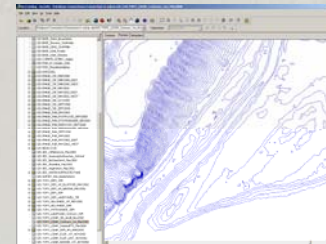
## SQL Query

[illegible]

## Web-based Forms

[illegible]

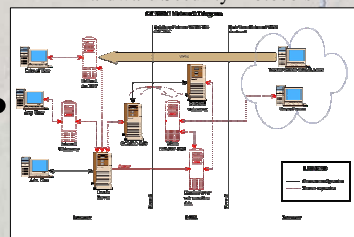
## GIS Clients



### Study Areas Requiring Special Security Protocols



## Hardware Security Protocols





# Oracle Database Management System

- Centralized repository for tabular and spatial data
- Backup and Archive
- Robust tabular query



# Spatial Database Engine

- Connection to Oracle
- Allows storage of large datasets
- Robust query and display

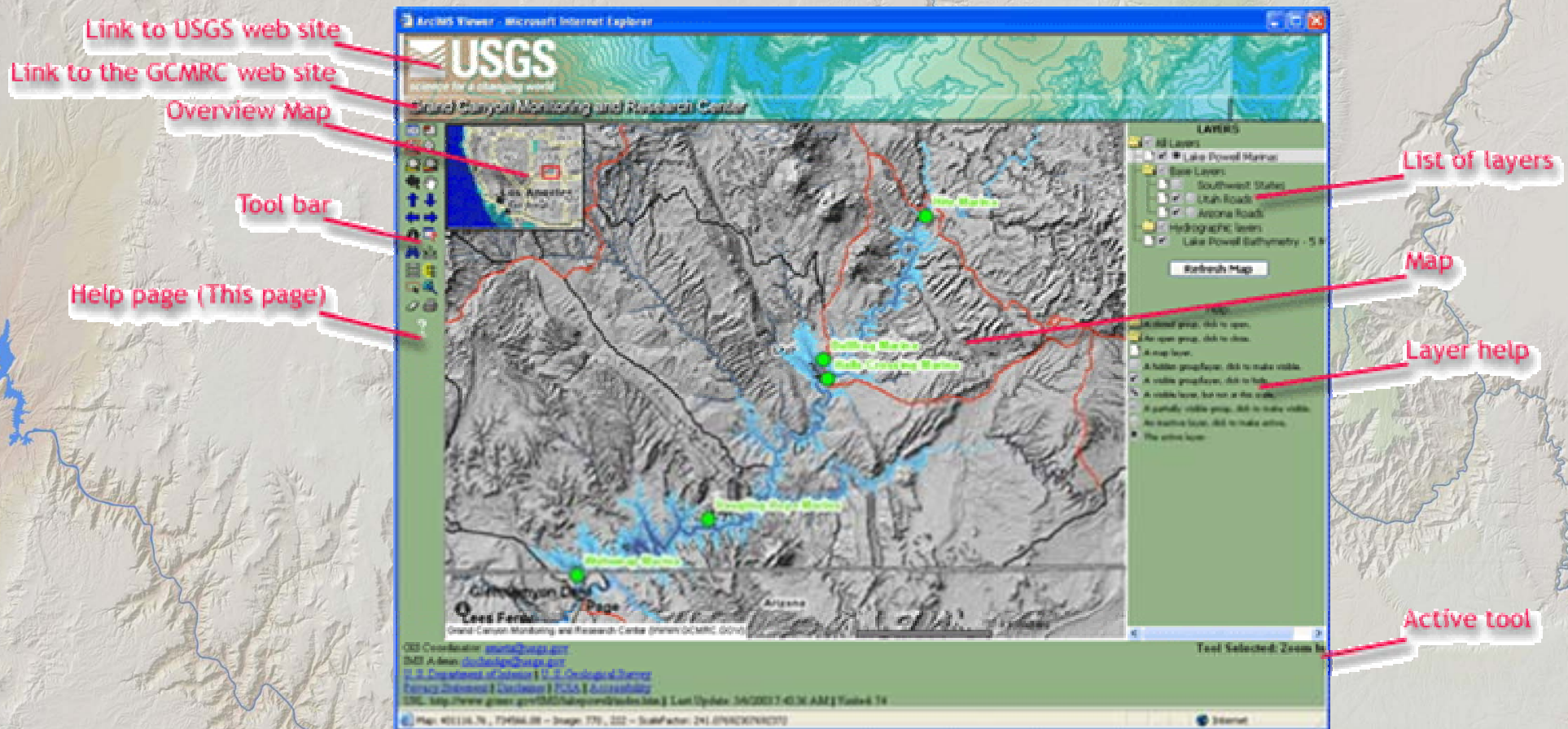


# Minimum Required Specifications

- Internet Explorer 5.0 or newer
- Netscape 4.6 or newer
- Mac – Safari 1.0
- Internet Connection – 28.8kb/sec










# Overview





# IMS Tools

<b>Layer/Legend Toggle</b>			<b>Overview Map Toggle</b>
<b>Zoom In</b>			<b>Zoom Out</b>
<b>Zoom to Full Extent</b>			<b>Zoom to Extent of Active Layer</b>
<b>Return to Previous Extent</b>			<b>Pan</b>
<b>Pan Up</b>			<b>Pan Down</b>
<b>Pan Left</b>			<b>Pan Right</b>
<b>Identify Feature Attributes</b>			<b>Query Feature Attributes</b>
<b>Find Text String Tool</b>			<b>Measure Tool</b>
<b>Set Units</b>			<b>Buffer Tool (if active)</b>
<b>Select an Area</b>			<b>Select by Line/Polygon</b>
<b>Clear all Selections</b>			<b>Creates Map Layout for Printing</b>

For addition info on help go to (or click the ?):  
[http://www.gcmrc.gov/IMS/IMS\\_Help/IMS\\_Help.htm](http://www.gcmrc.gov/IMS/IMS_Help/IMS_Help.htm)



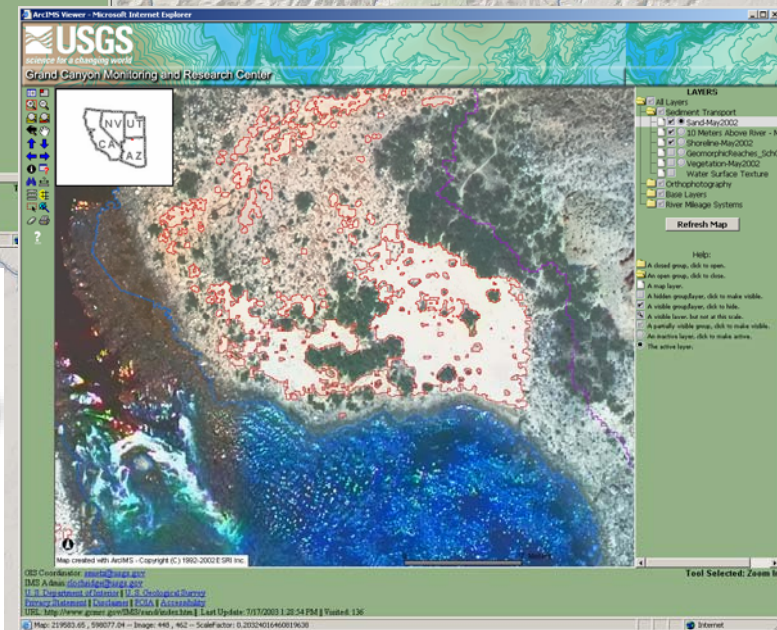
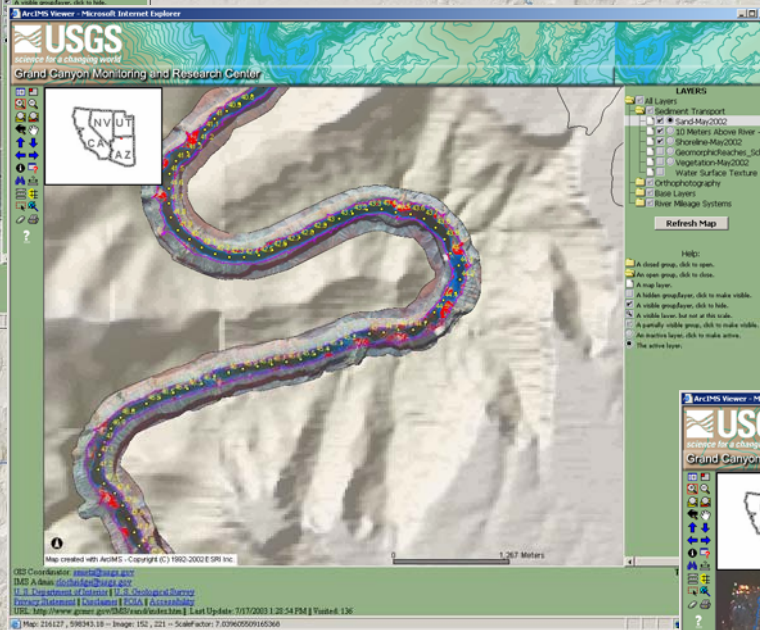
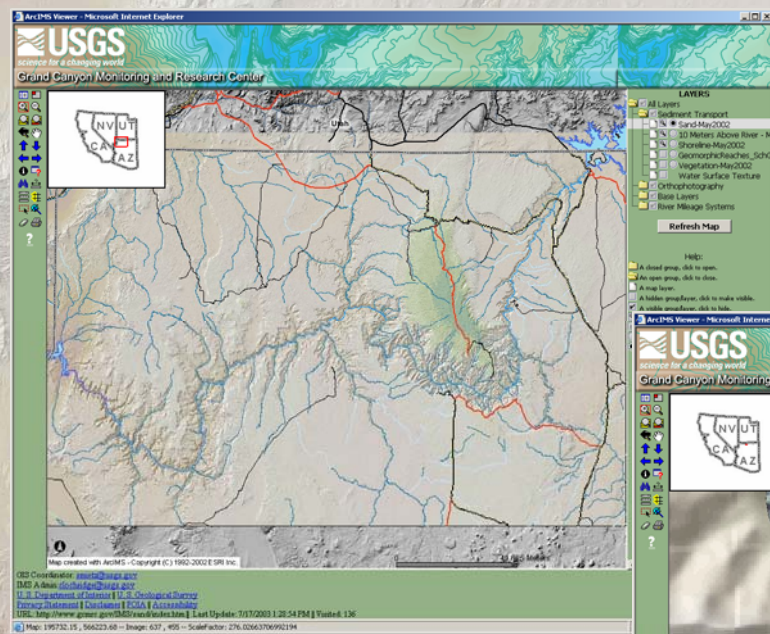
# Demo of IMS - Web

<http://www.gcmrc.gov/IMS/IMS.htm>

- Pan/ZoomIn/ZoomOut
- Identify Tool Query
- Select by area Query
- Tabular Query of Habitat
- Measure Tool



# Pan/ZoomIn/ZoomOut



Zoom In



Zoom Out



Zoom to Full Extent



Zoom to Extent of Active Layer



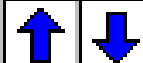
Return to Previous Extent



Pan



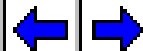
Pan Up



Pan Down



Pan Left

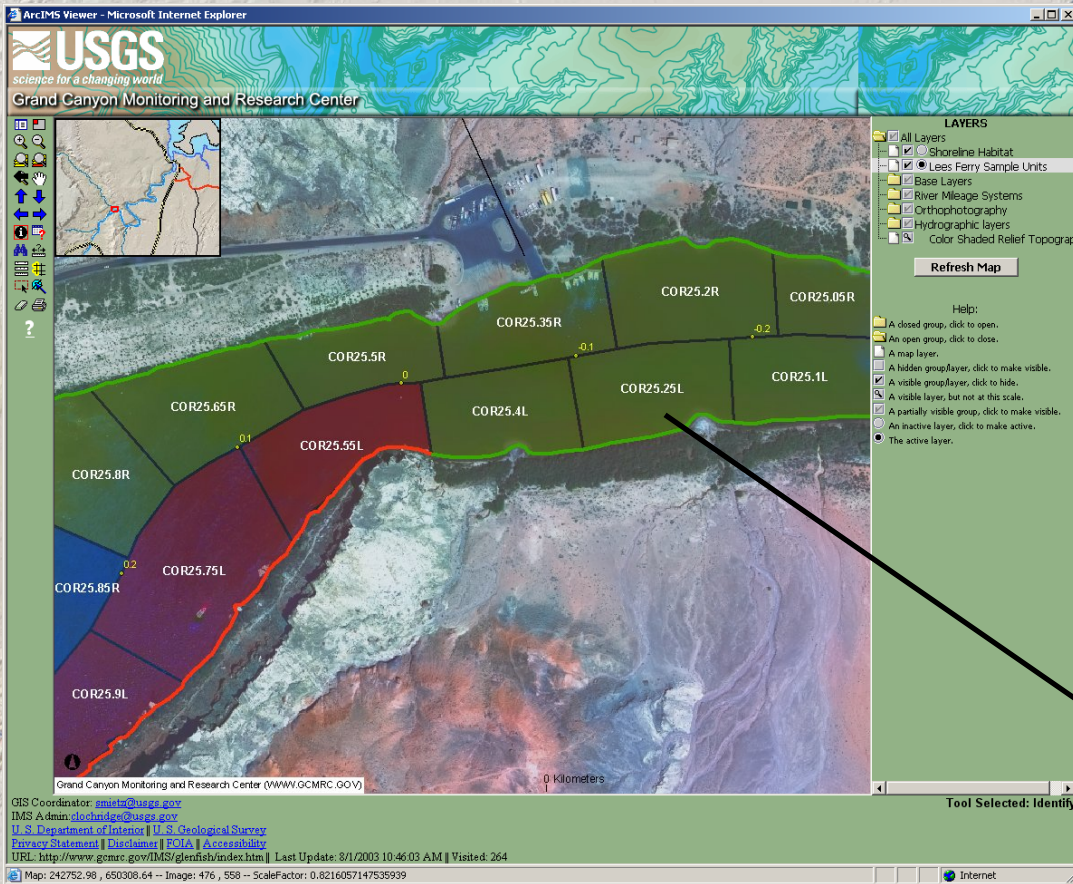


Pan Right





# Identify Tool Query



Identify Feature Attributes



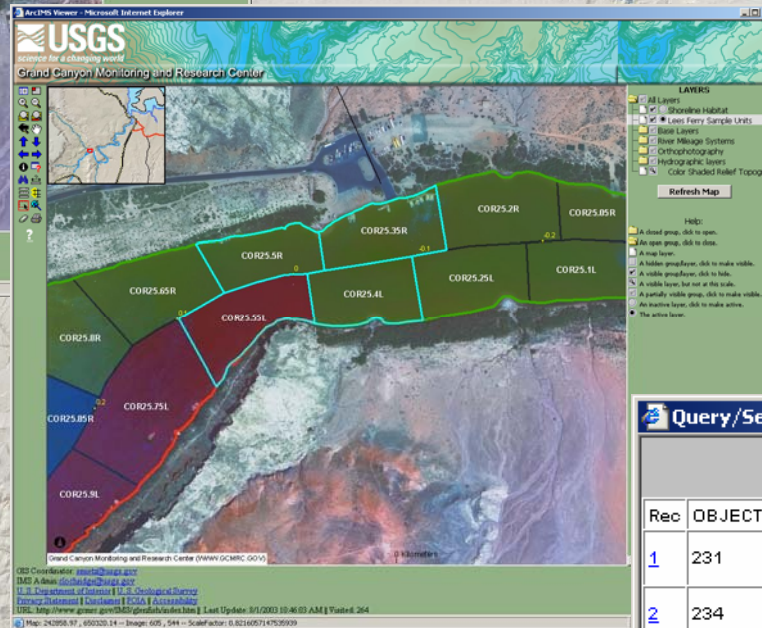
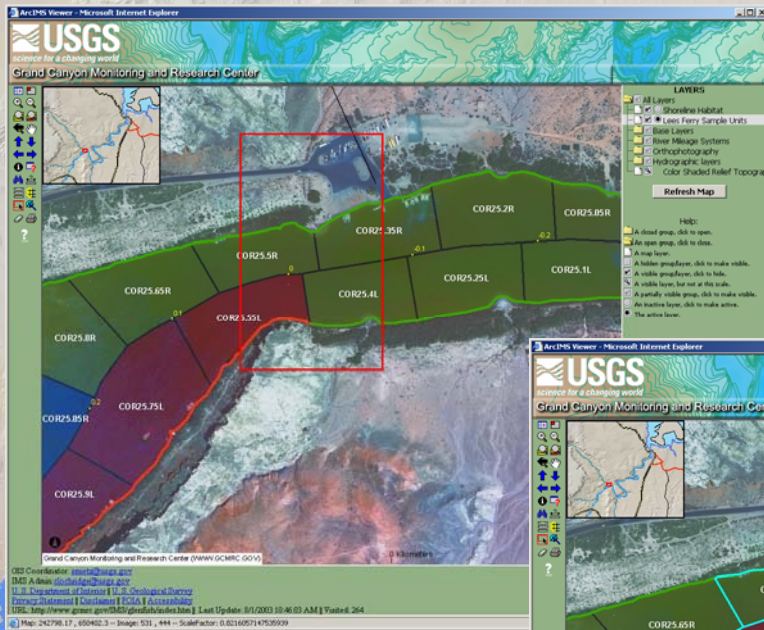
Query/Selection Results - Microsoft Internet Explorer

Lees Ferry Sample Units

Rec	OBJECTID	UNIT	SHORE_LEN	HABITAT	KM	SIDE	STATION_ID	UP_KM	DOWN_KM
1	236	LOWER	145.12264352	SB	25.25	L	COR25.25L	25.2	25.3



# Select by Area Query



**Query/Selection Results - Microsoft Internet Explorer**

**Lees Ferry Sample Units**

Rec	OBJECTID	UNIT	SHORE_LEN	HABITAT	KM	SIDE	STATION_ID	UP_KM	DOWN_KM
<a href="#">1</a>	231	LOWER	164.79561799	SB	25.35	R	COR25.35R	25.3	25.4
<a href="#">2</a>	234	LOWER	165.43547122	SB	25.5	R	COR25.5R	25.4	25.6
<a href="#">3</a>	240	LOWER	144.17427229	SB	25.4	L	COR25.4L	25.3	25.5
<a href="#">4</a>	243	LOWER	166.64010042	TA	25.55	L	COR25.55L	25.5	25.6

[Zoom to these records](#)

Select an Area



Select by Line/Polygon



# Tabular Query of Habitat

**USGS**  
science for a changing world  
Grand Canyon Monitoring and Research

**Query Tool:**  
Field: HABITAT, Operator: =, Sample Values: "TA"  
Add to Query String: HABITAT = "TA"  
Execute, Undo, Clear

**Layers:**  
☒ All Layers  
☒ Shoreline Habitat  
☒ Lees Ferry Sample Units  
☒ Base Layers  
☒ River Mileage Systems  
☒ Orthophotography  
☒ Hydrographic layers  
☒ Color Shaded Relief Topograph  
 Refresh Map

**Query/Selection Results - Microsoft Internet Explorer**

Lees Ferry Sample Units											
Rec	OBJECTID	UNIT	SHORE_LEN	HABITAT	KM	SIDE	STATION_ID	UP_KM	DOWN_KM	LON_SH_ST	LA
1	7	UPPER	156.58146136	TA	0.46	L	COR0.46L	0.4	0.5	-111.4810399	36
2	8	UPPER	138.98141568	TA	0.5	R	COR0.5R	0.4	0.6	-111.48304401	36
3	9	UPPER	155.90288489	TA	0.6	L	COR0.6L	0.5	0.7	-111.48034919	36
4	10	UPPER	139.36761369	TA	0.6	R	COR0.6R	0.6	0.7	-111.48199991	36
5	11	UPPER	155.69651561	TA	0.75	L	COR0.75L	0.7	0.8	-111.47987525	36
6	12	UPPER	140.14098829	TA	0.75	R	COR0.75R	0.7	0.8	-111.48199991	36

Grand Canyon Monitoring and Research Center (WWW.GCMRC.GOV)

GIS Coordinator: [smeltz@usgs.gov](mailto:smeltz@usgs.gov)  
 IMS Admin: [clochridge@usgs.gov](mailto:clochridge@usgs.gov)  
 U.S. Department of Interior | U.S. Geological Survey  
[Privacy Statement](#) | [Disclaimer](#) | [FOIA](#) | [Accessibility](#)  
 URL: <http://www.gcmrc.gov/IMS/glenfish/index.htm> | Last Update: 3/1/2003 10:46:03 AM | Visited: 264

Map: 243017.54, 650169.79 -- Image: 798, 727 -- ScaleFactor: 0.8216057147535939

Tool Selected: Query



# Measure Tool

ArcIMS Viewer - Microsoft Internet Explorer

**USGS**  
science for a changing world  
Grand Canyon Monitoring and Research Center

Total: 92.14 METERS Segment: 5.6 METERS

Map created with ArcIMS - Copyright (C) 1992-2002 ESRI Inc.

Map layers and legend:

- Layers
  - All Layers
  - Sediment Transport
    - Sand-May2002
    - 10 Meters Above River - M
    - Shoreline-May2002
    - GeomorphicReaches\_SchG
    - Vegetation-May2002
    - Water Surface Texture
  - Orthophotography
  - Base Layers
  - River Mileage Systems

Refresh Map

Help:

- A closed group, click to open.
- An open group, click to close.
- A map layer.
- A hidden group/layer, click to make visible.
- A visible group/layer, click to hide.
- A visible layer, but not at this scale.
- A partially visible group, click to make visible.
- An inactive layer, click to make active.
- The active layer.

Measure Tool

0 47 Meters

Tool Selected: Measure

GIS Coordinator: [smietz@usgs.gov](mailto:smietz@usgs.gov)  
IMS Admin: [clochridge@usgs.gov](mailto:clochridge@usgs.gov)  
U. S. Department of Interior || U. S. Geological Survey  
[Privacy Statement](#) || [Disclaimer](#) || [FOIA](#) || [Accessibility](#)  
URL: <http://www.gcmrc.gov/IMS/sand/index.htm> || Last Update: 7/17/2003 1:28:54 PM || Visited: 137

Done Internet



# Demo of ArcMap Service

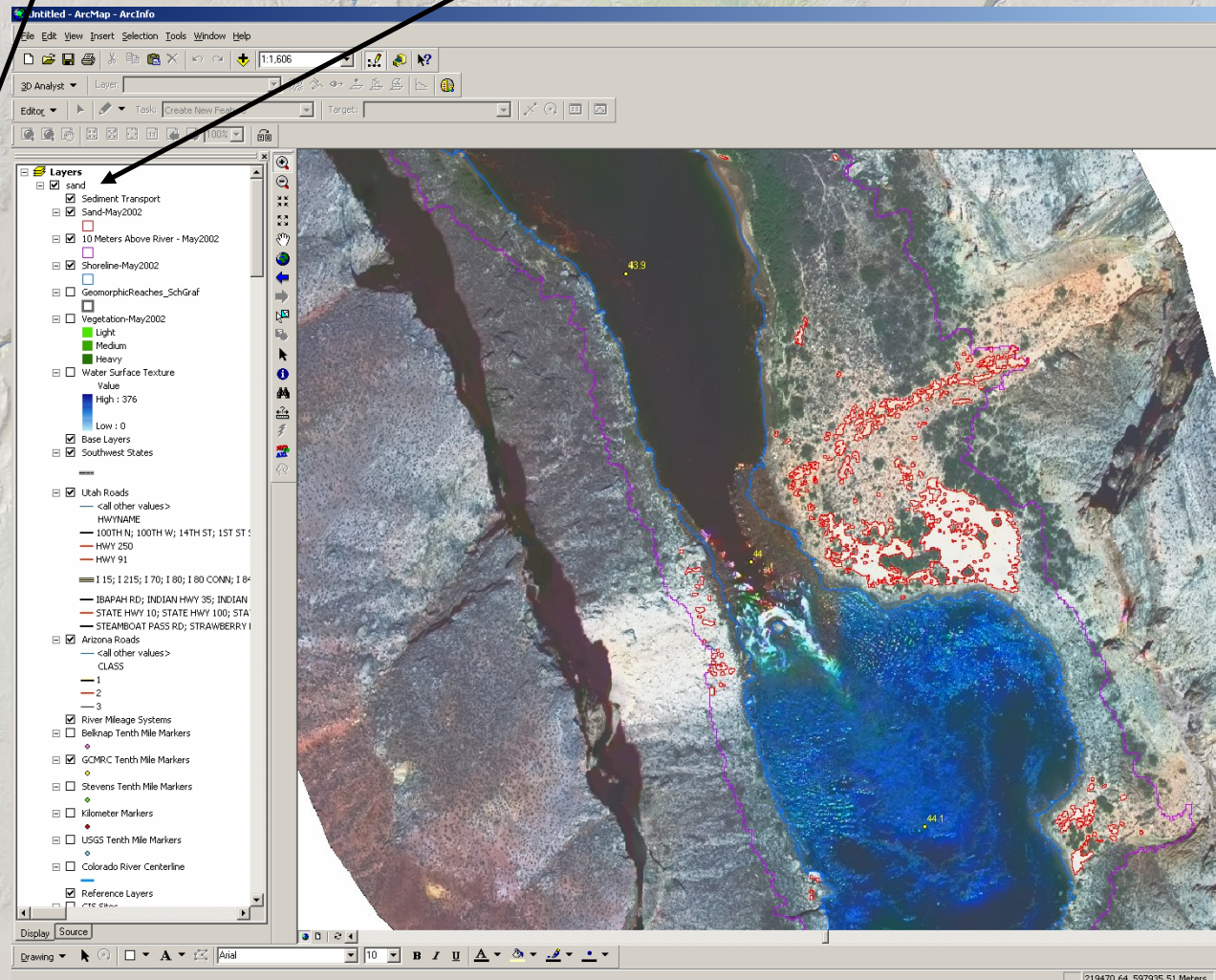
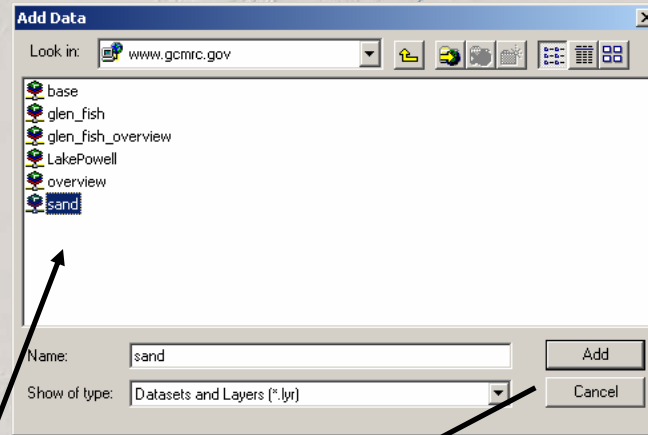
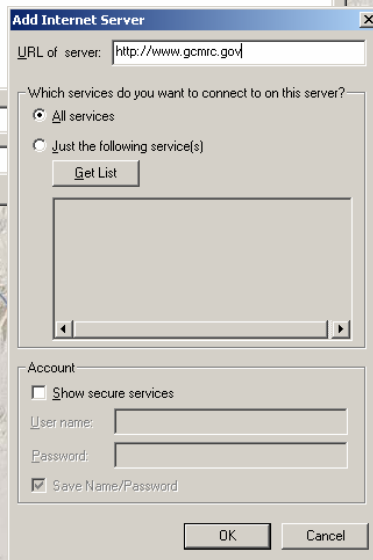
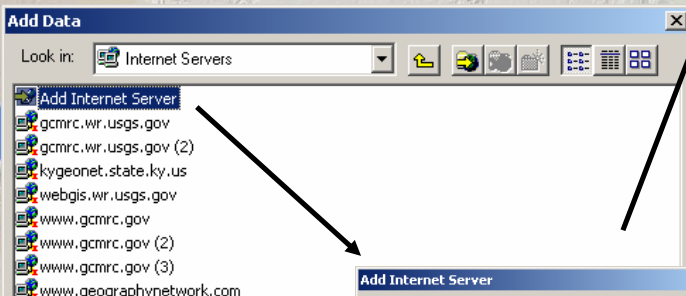
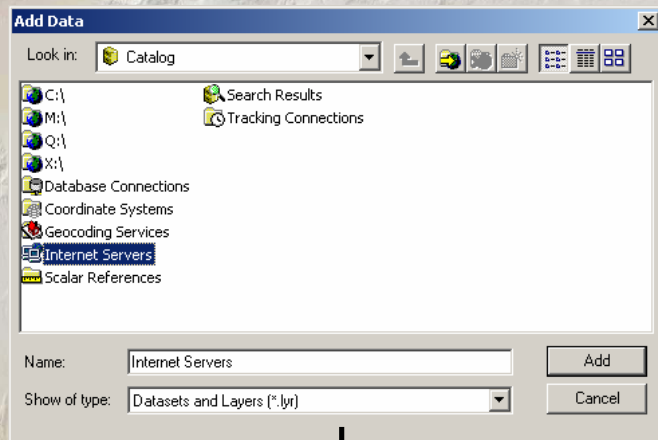
- Connect to service
- Identify Multiple Layers
- Query Builder
- Buffer Wizard
- Download data
- Create map



# Connect to service



Add Data

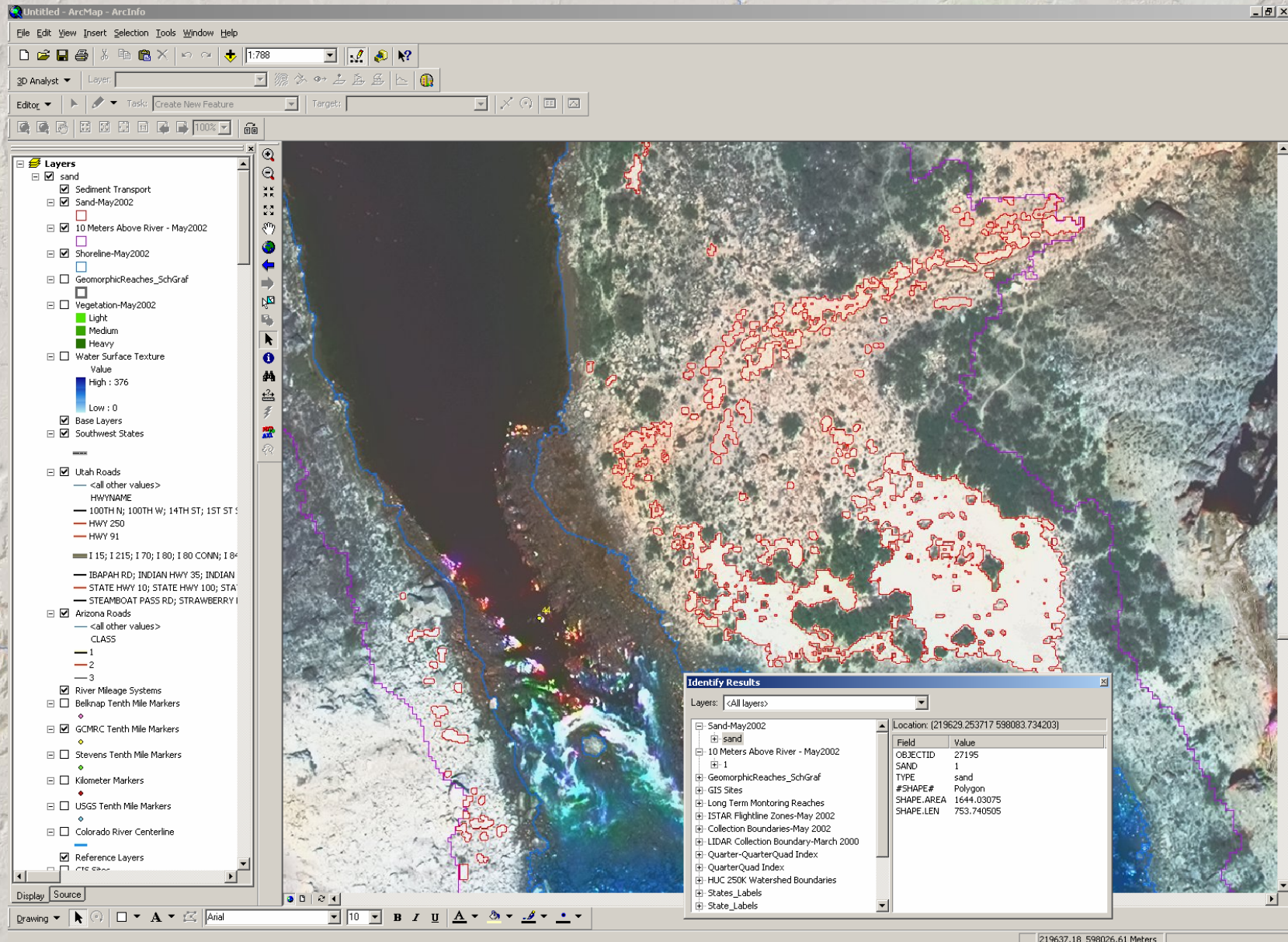




# Identify Multiple Layers



## Identify Tool





# Query Builder



## Select by Attributes

**Select By Attributes** [?] [X]

Query Wizard...

Layer: Sand-May2002

Method: Create a new selection

Fields:

OBJECTID	=	< >	Like
SAND	>	> =	And
TYPE	<	< =	Or
SHAPE.AREA	_ %	( )	Not
SHAPE.LEN			

Unique sample values

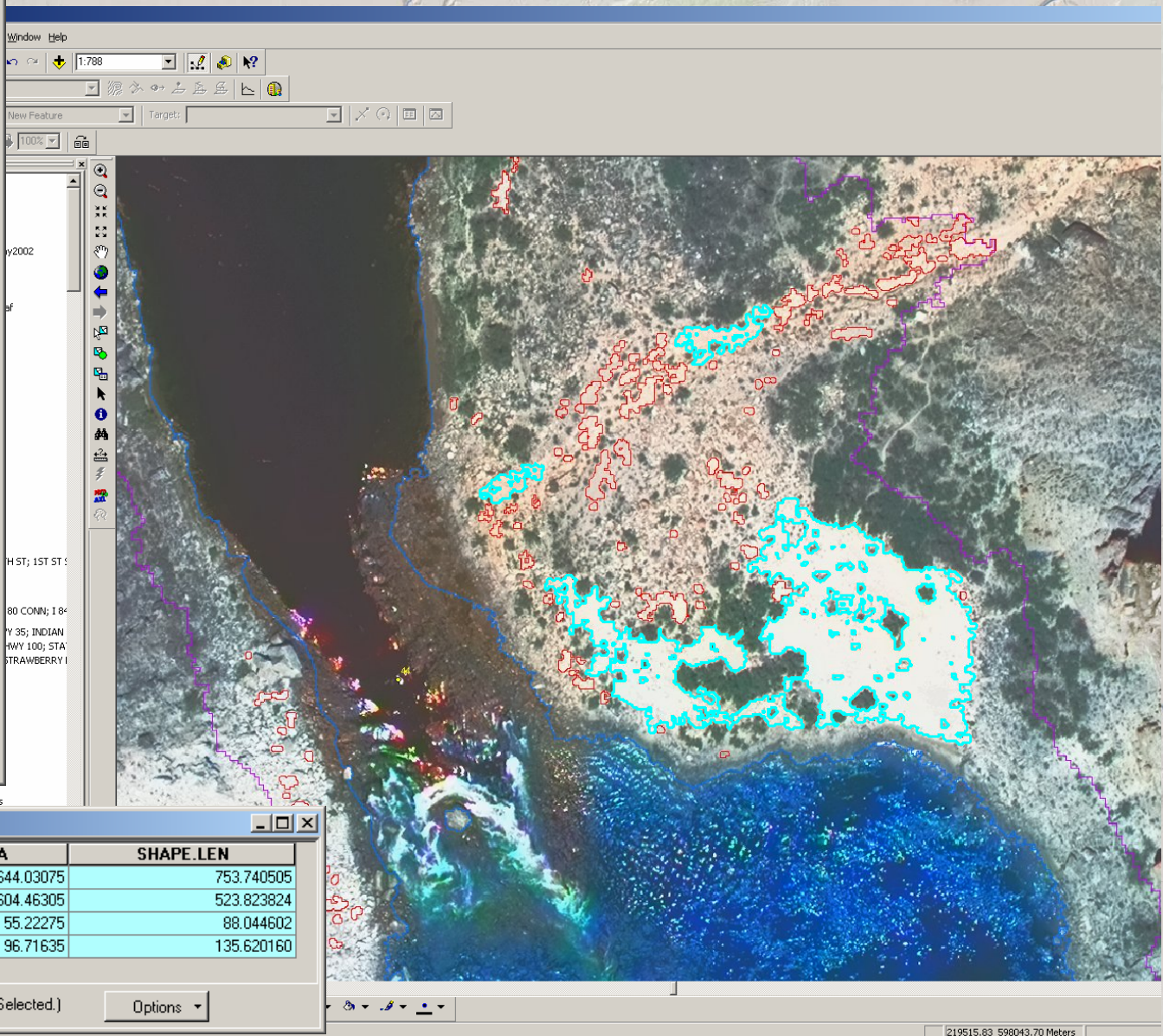
4.00315
4.34555
10.46385
15.50735
16.7137
21.7338
65.08895
106.97965
273.5083

SQL Info... Complete List

SELECT \* FROM Sand-May2002 WHERE:

SHAPE.AREA > 50

Clear Verify Help Load... Save... Apply Close



**Selected Attributes of Sand-May2002**

	OBJECTID	SAND	TYPE	#SHAPE#	SHAPE.AREA	SHAPE.LEN
▶	27195	1	sand	Polygon	1644.03075	753.740505
	27229	1	sand	Polygon	604.46305	523.823824
	27175	1	sand	Polygon	55.22275	88.044602
	27126	1	sand	Polygon	96.71635	135.620160

Record: 1 Show: All Selected Records (4 out of 2000 Selected.) Options



# Buffer Wizard

**Buffer Wizard**

**About buffers**  
Buffers are rings drawn around features at a specified distance from the features.

What do you want to buffer?

☐ The graphics in the data frame (Default Annotation Target)

☒ The features of a layer

Sand-May2002

Number of features: All Features  
Number of features selected: 2000

☒ Use only the selected features

**Buffer Wizard**

How do you want to create buffers?

☒ At a specified distance 5 Meters

☐ Based on a distance from an attribute SAND in Meters

☐ As multiple buffer rings

Number of rings: 3  
Distance between rings: 1 Meters

Buffer distance  
Distance units are: Meters

**Buffer Wizard**

Buffer output type

Dissolve barriers between ☐ Yes ☒ No

Create buffers so they are

☐ inside and outside the polygon(s)

☐ only outside the polygon(s)

☐ only inside the polygon(s)

☒ outside polygon(s) and include inside

Where do you want the buffers to be saved?

☐ As graphics layer in data frame

☐ In an existing editable layer

☒ In a new layer. Specify output shapefile or feature class:  
C:\Temp\Buffer\_of\_Sand-May2002.shp

< Back Finish Cancel

Untitled - ArcMap - ArcInfo

File Edit View Insert Selection Tools Window Help

3D Analyst Layer

Editor Task Create New Feature Target

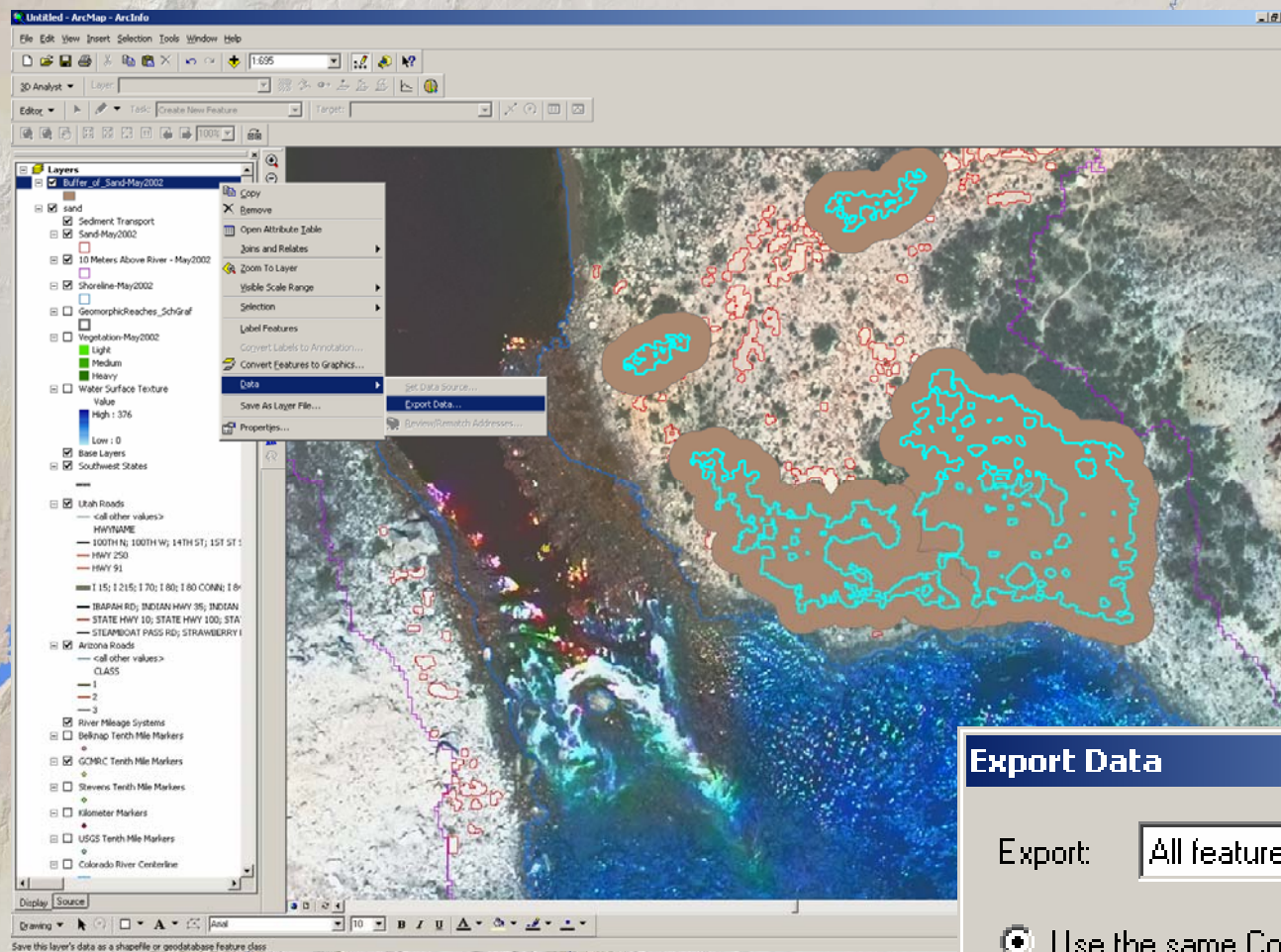
Layers

- Buffer\_of\_Sand-May2002
- sand
- Sediment Transport
- Sand-May2002

Map view showing a river and surrounding areas with buffers applied to the 'Sand-May2002' layer. The buffers are shown as brown rings around the features. The map also displays other layers like 'sand' and 'Sediment Transport'.



# Download Data



## Export Data

Export: All features

- ☒ Use the same Coordinate System as this layer's source data.
- ☐ Use the same Coordinate System as the data frame.

Output shapefile or feature class:

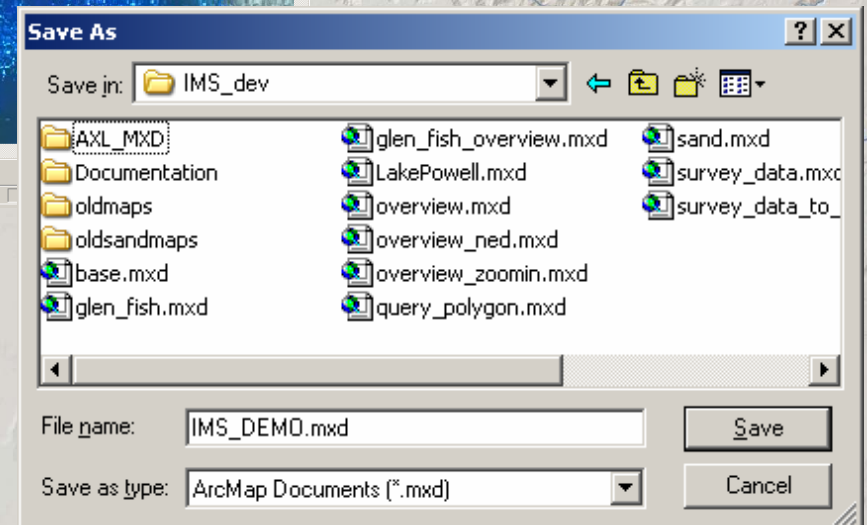
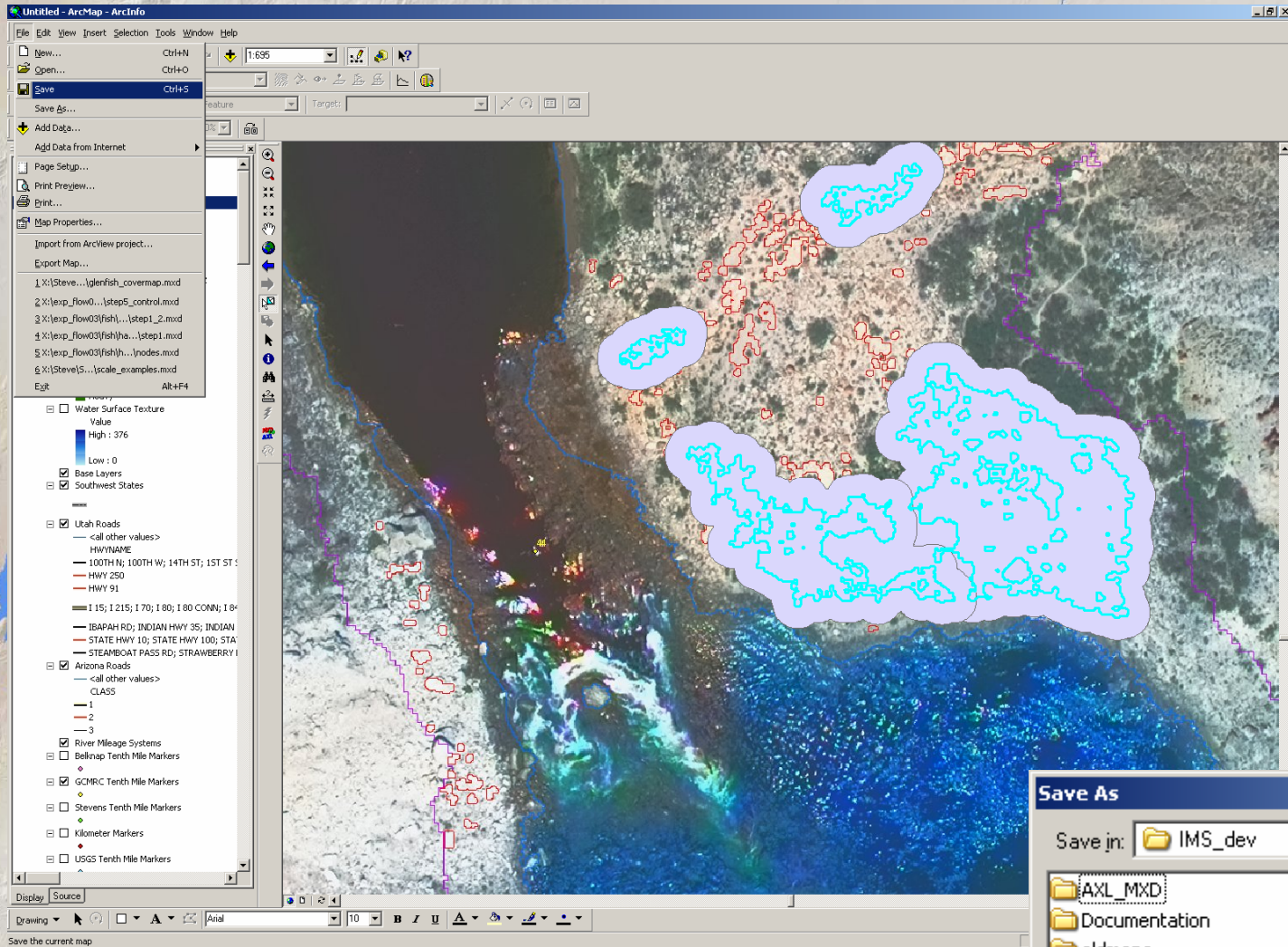
C:\Temp\Buffer\_demo.shp

OK

Cancel



# Create Map





# Future Expansion

1. More project-specific maps
2. Metadata server customization
3. Feature-linked metadata
4. Downloadable data layers
5. Publication of GCMRC IMS services
6. Training for Staff, cooperators, AMWG/TWG members
7. Latitude/Longitude and Stateplane Coordinates cursor locations at bottom of map



# Future Expansion con't

- 8. Zoom to River Mile button
- 9. River Mile Query Tool
- 10. Bookmark function on web like Arcmap