Data Management

Introduction	What is eCoastal?
Exercise A	Browsing the Geodatabase
Lecture	Importance of Spatial Data Standards
Exercise B	Using the SDS Feature Browser
Exercise C	Importing Data into the SDS Geodatabase

Module Introduction

Overview

This module will explain the importance and use of the eCoastal architecture. You will be asked to use the skills and knowledge you gained in this course to access, browse and populate the eCoastal geodatabase.

During this module we will be accessing and populating a **personal geodatabase**. Personal geodatabases have a 2GB limit and do not support sub-types or raster layers. The presented exercises will take you through the necessary steps to format and load vector data into the SDS geodatabase.

Skills Learned

- Definition of eCoastal
- Understanding of the eCoastal Architecture
- Understanding of Spatial Data Standards
- Data import techniques to add to the geodatabase

Tools and Technology

ArcGIS Components

- ArcMap
- ArcCatalog

Other Software

- SDSFIE Feature Browser

Introduction: What is eCoastal?

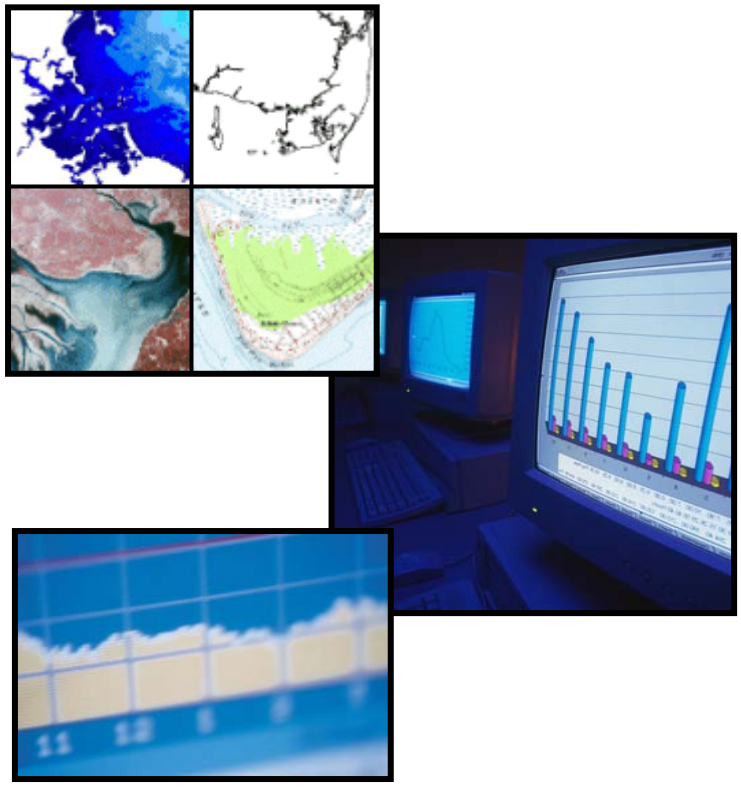
Enterprise GIS is defined as *the integration of geospatial technology infrastructure to deliver spatial information products, services and standard datasets to all business elements and processes of the organization.*

The concept of enterprise GIS (eGIS) is taking a complete organizational approach to sharing, using, and managing spatial information.

eCoastal is an enterprise GIS developed for coastal engineering business practices. It was developed to concentrate on the specific needs of the coastal engineer.

eCoastal is an architecture developed by the U.S. Army Corps of Engineers that addresses spatial data standards (SDS), geodatabase development, and desktop and web applications. It was designed as data management solution to provide baseline information for effective planning and prediction of regional and local coastal processes.

This architecture allows adjacent coastal projects to effectively share and access data contained in the system.



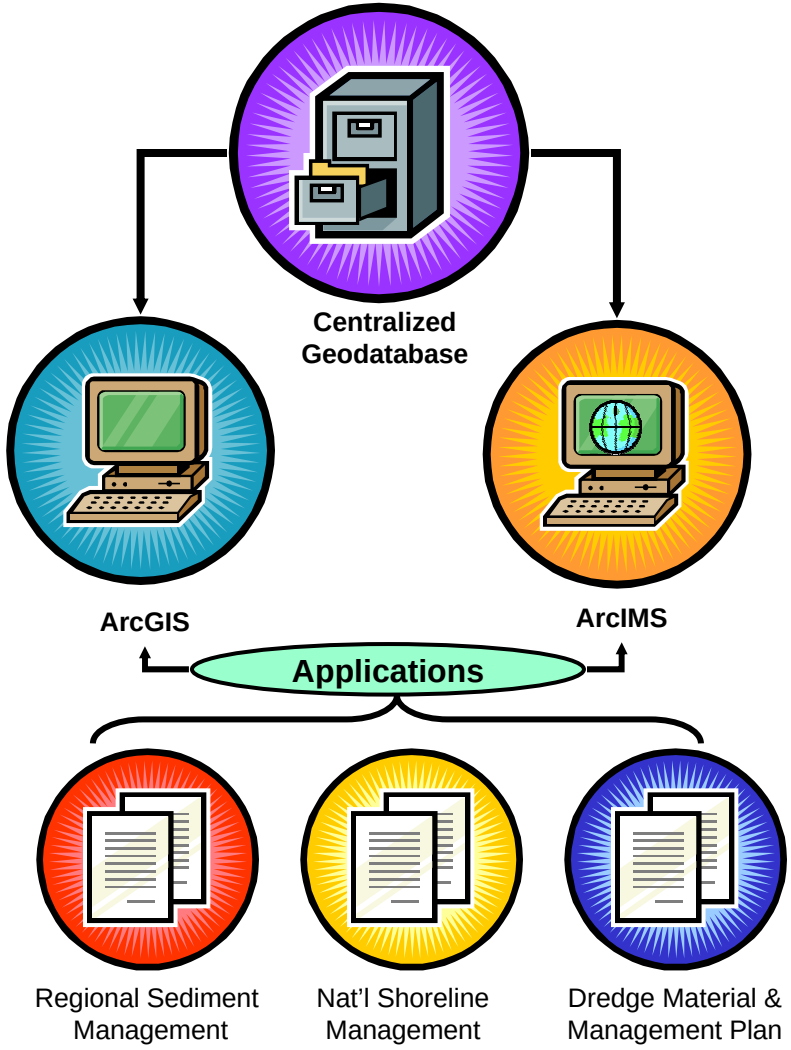
Introduction: Architecture Overview

The centralized geodatabase serves as the data repository for all spatial data accessed by the enterprise GIS applications. The underlying format of the enterprise database (SQL or ORACLE) is at the discretion of the local District Office.

Data collected or created for all coastal projects are imported into the geodatabase. Only one geodatabase exists to serve data to the public, via the Internet accessible interface, and to support the internal applications.

Natively, users can browse the geodatabase using ESRI's ArcCatalog™ or ArcMap™. However with eCoastal, a series of custom applications have been developed for ESRI's desktop products as well as the internet accessible, ArcIMS™ platform.

These applications were designed to assist the users of the enterprise system with access and analysis of the coastal data. Applications have been developed to support the needs of the existing and future coastal projects, such as the Regional Sediment Management, Dredge Material and Management Plan, or the National Shoreline Management projects.



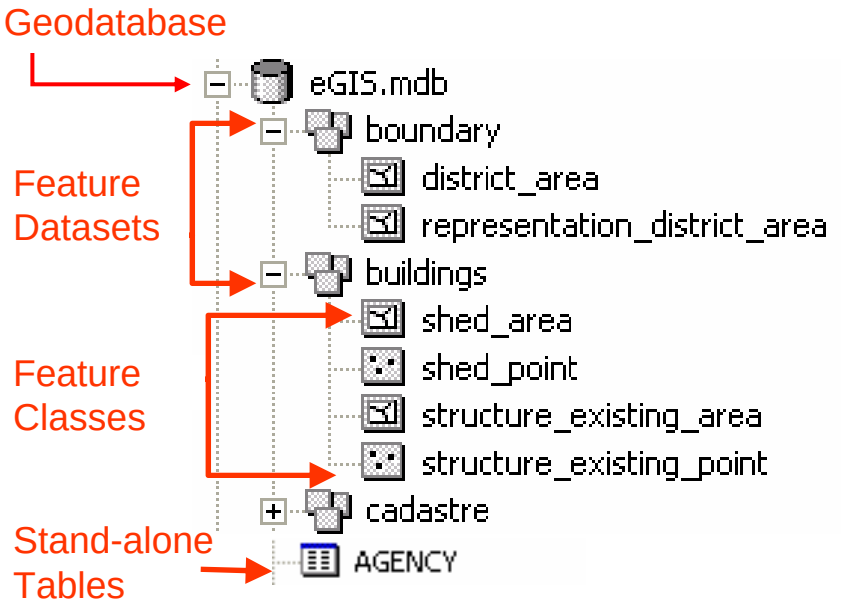
Introduction: Data Storage

The Geodatabase

A Geodatabase is a proprietary (ESRI/ArcGIS) storage format that represents geographic features and attributes as objects and is hosted inside a relational database management system. It is organized into a variety of feature datasets and sub-divided into feature classes, as defined by the ***Spatial Data Standard***.

- Enterprise Level
  - SQL, ORACLE format
  - Allows for raster data and vector data storage
  - Requires ArcSDE for management, ArcEditor/ArcInfo for editing
- Personal Geodatabase
  - MS Access format
  - Allows only vector data storage (depending on software version)
  - Does not require ArcSDE or ArcInfo licenses for editing
  - 2 GB Limit

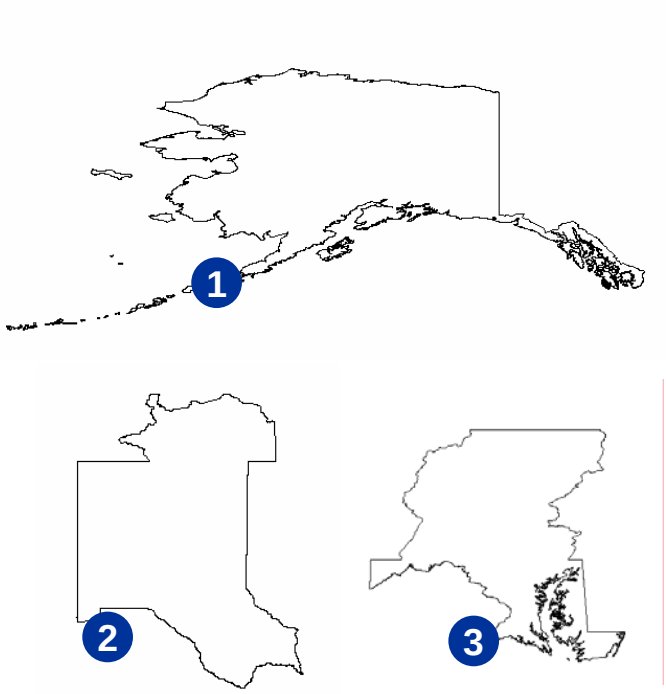
All training modules will use a personal geodatabase.



Introduction: Data Storage

The Feature Class

Feature classes are a collection of geographic features with the same geometry type (such as point, line, or polygon), the same attributes, and the same spatial reference. Feature classes can stand alone within a geodatabase or be contained within shapefiles, coverages, or other feature datasets. Feature classes allow homogeneous features to be grouped into a single unit for data storage purposes.



Below is the table view of the USACE boundary feature class. Here, attributes (DIST_NAME, DIST_NUM, etc.) describe the individual pieces of data and the SHAPE column stores the geometry of the feature.

Using Spatial Data Standards, all features representing the same data type, such as Survey points, are stored within the same feature class. Attribution of the data record identifies the survey details, such as collection date or name.

	OBJECTID*	SHAPE*	SUBTYPEID	distct_id	map_i	met	me	coor	dis_typ_d	dist_name	dist_num
▶	1	Polygon Z								Alaska	
	2	Polygon Z								Albuquerque	
	3	Polygon Z								Baltimore	

Exercise A: Browsing the Geodatabase

Background

The geodatabase stores all of the geospatial data contained in eCoastal. Though custom applications have been designed to allow browsing of the geodatabase, this exercise will take a look at the geodatabase blueprint for the eCoastal system.

Goals

After this exercise the user will be able to connect and browse the contents of the geodatabase in ArcCatalog.

Objectives

1. Connect to geodatabase
2. View feature datasets
3. View feature classes

Exercise A: Browsing the Geodatabase

The geodatabase stores all of the geospatial data contained in eCoastal. To view the geodatabase use the following steps:

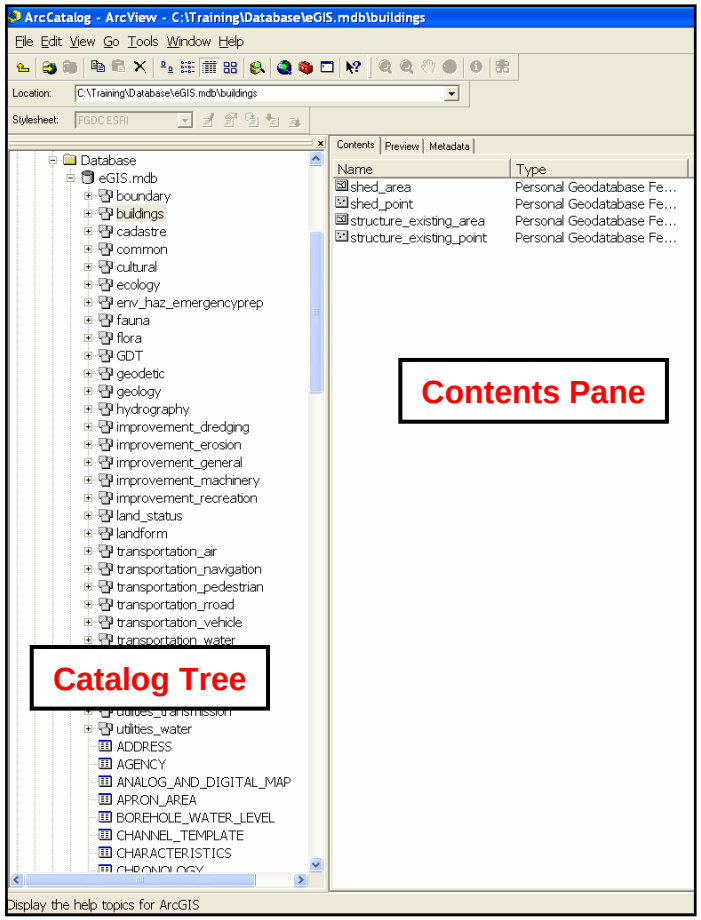
1. Open **ArcCatalog**.

☐ Locate **eGIS.mdb** in C:\Training\Database. Click to select 'eGIS.mdb'.

*If the geodatabase is not stored as a personal geodatabase, in the directory tree located in the right pane, expand 'Database Connections'. Double-click on the existing database connection.

☐ This will open the geodatabase in the Contents pane. You can also browse the database by clicking the '+' or '-' in front of feature datasets.

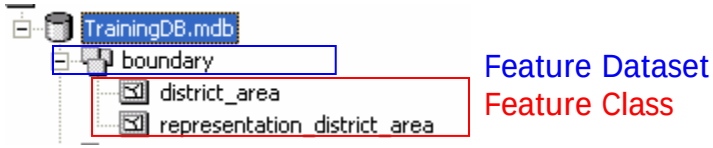
*USACE requires all data to be stored in a standardized format. The nomenclature of the geodatabase reflects the Spatial Data Standards developed by the CADD/GIS Center in Vicksburg, MS.



Exercise A: Browsing the Geodatabase

2. In the eCoastal geodatabase, one feature class can be a collection of multiple datasets. We will now look at the district_area feature class. It contains the geometry and attribution for both the USACE Districts and Divisions.

   ☐Click the '+' to expand the **boundary** feature dataset.

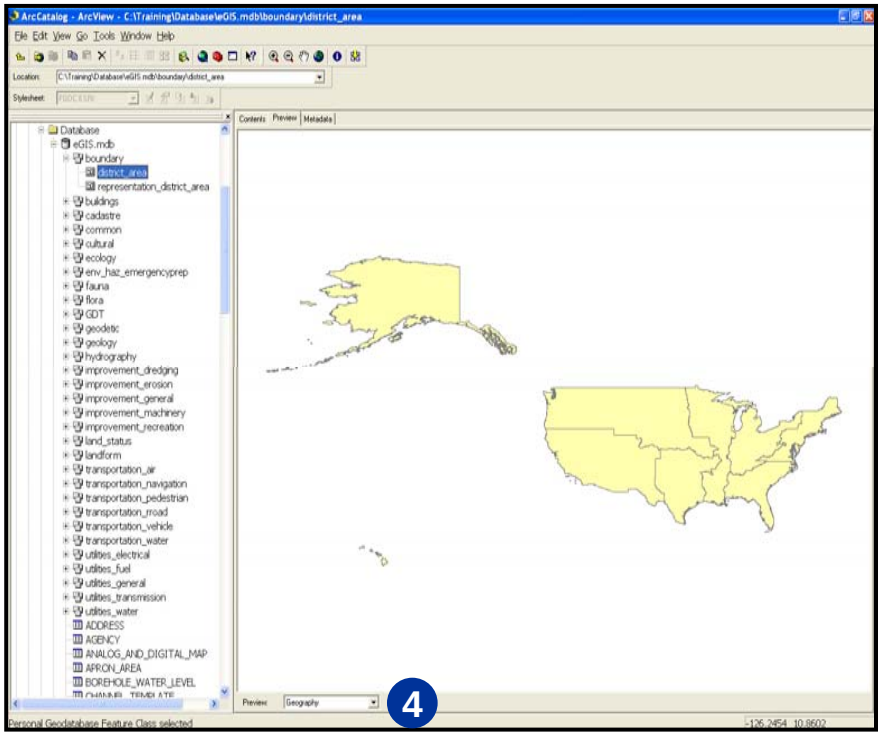


3. In the eCoastal geodatabase, one feature class can be a collection of multiple datasets. We will now look at the **district_area** feature class. It contains the geometry and attribution for both the USACE Districts and Divisions.

   ☐Click on the **district_area** feature class.
   The contents of the district_area feature class will be displayed in the contents pane.

4. You have the option to view the data's geography or its attribute table by selecting the preview option on the **Preview Tab**.

   Near the bottom of the application, change the Preview option from 'Geography' to 'Table'. 4



Exercise A: Browsing the Geodatabase

5. The sounding_point feature class is the table that stores ALL of the lidar survey data.

   ☐ In the geodatabase, expand the **landform** feature dataset and click to select the **sounding_point** feature class.

6. View the **Geography** of the feature class on the **Preview Tab**.

7. View the **Table** of the feature on the Preview Tab.

   Notice the 2 fields, **HYDSRV_ID** and **PROJECT_ID**.

   Each record is marked with a value for the survey id and a project ID. These fields are used to define the details of the collected survey point.

HYDSRV_ID*	QUASOU_D	PROJECT_ID*	ELEVATION*	SHAPE*
0025	<Null>	C005	-26.5100002288818	Point
0025	<Null>	C005	-13.6199998855591	Point
0025	<Null>	C005	0.75	Point
0025	<Null>	C005	-47.5099983215332	Point

Exercise A: Browsing the Geodatabase

Understanding Record Identifiers

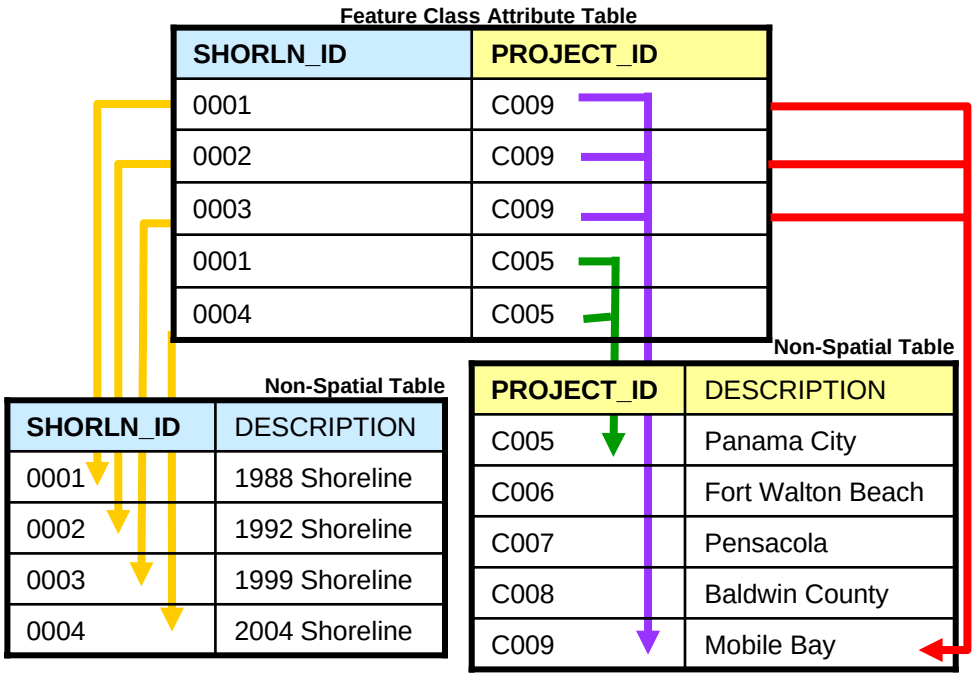
Since features of the same types are loaded into one table in the geodatabase, records need to be marked to distinguish unique surveys, data collection dates, project areas, etc.

In the eCoastal database, all records are marked with a value for PROJECT_ID attribute. This allows many sets of data to be loaded into a feature class, while maintaining a link to the base project. Though we approach eCoastal from a regional perspective, it is important to also retain the metadata on the who, what, and why the data was collected. The PROJECT_ID can help us recall this data. Suggested formats for defining PROJECT_IDs will be discussed in Exercise C.

Other identifiers, such as SURVEY_ID, are used to further distinguish records within a project. All elevation profile point data are loaded into a signal feature class. A number of different surveys from different dates are loaded as records in the table. The only way to identify points from a specific survey, is to store a value for the SURVEY_ID in the attribute table.

Example:
4 different shorelines were collected that covers the Mobile Bay project (C009) and the Panama City inlet project(C005).

All features are loaded within the shoreline feature class. The only way to differentiate the shoreline non-spatially is to designated the feature with the respective PROJECT_ID and SHORLN_ID.



Exercise A: Browsing the Geodatabase

Exercise Summary

This module introduced you to the eCoastal geodatabase. The geodatabase is the central repository for all spatial data within the eCoastal Architecture.

In this exercise you were able to access and browse a geodatabase. The structure of the geodatabase is mirrored after the Spatial Data Standards produced by the CADD/GIS Center. In the next exercise we will begin to explore the value and use of standards in a GIS environment.,

END OF EXERCISE A

Lecture: Spatial Data Standards

The ***Spatial Data Standard for Facilities, Infrastructure, and Environment*** (**SDSFIE**) provides a standardized grouping of geographically referenced (i.e., geospatial) features (i.e., real-world features or objects depicted graphically on a map at their real-world location (i.e., coordinates). Each geospatial feature has an "attached" attribute table containing pertinent data about the geospatial feature.

The SDSFIE is the only "nonproprietary" GIS data content standard designed for use with the predominant commercially available off-the-shelf GIS and CADD (e.g., ESRI ArcInfo and ArcView; Intergraph MGE and GeoMedia; AutoDesk AutoCAD and Map; and Bentley MicroStation and GeoGraphics), and relational database software (e.g., Oracle and Microsoft Access). This nonproprietary design, in conjunction with its universal coverage, has propelled the SDSFIE into the standard for GIS implementations throughout the Department of Defense (DoD), as well as the de facto standard for GIS implementations in other Federal, State, and local government organizations; public utilities; and private industry throughout the United States and the World.

The Spatial Data Standard represents an organization of data without regard to application. The assignment of specific entities to entity sets is a function of data maintenance rather than data use. In this way, it is possible to reduce redundancy of information within the standard. This schema meets data sharing requirements of the National Spatial Data Infrastruc-ture (NSDI).

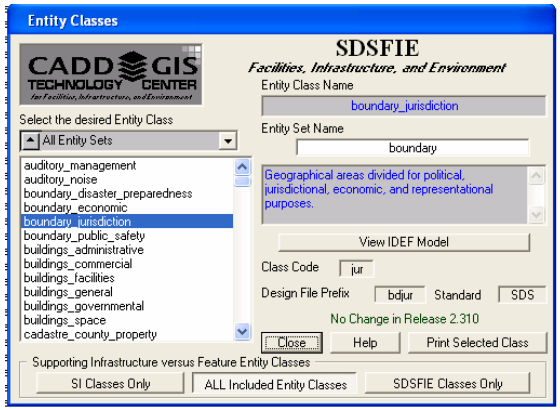
Lecture: Spatial Data Standards

Effect of Standards on eCoastal

The USACE eGIS program desired a standardized Geodatabase to

- Allow custom GIS applications could be built upon a common framework.
- Allow easy distribution of applications with little to no reprogramming.
- Allow easy data sharing across various Corps Districts and the public.
- Have an easy and cost effective way for distribution to other Districts.

Spatial Data Standards define the nomenclature of the feature datasets, feature classes, and attribution of all features stored within the geodatabase. This standardization allows the data and custom applications, that interface directly with datasets, to be easily shared among other districts or with those agencies using Spatial Data Standards.



To download the Spatial Data Standards software, visit:
https://tsc.wes.army.mil/products/tssds-tsfms/tssds/projects/sds/sds_toolbox.html

Using the SDS Feature Browser – Instructor Demonstration

Notes:

Exercise B: Using the SDS Feature Browser

Background

Prior to data being imported into the geodatabase, the appropriate feature dataset/feature class must be determined. The CADD/GIS Center has developed the SDS Feature Browser. This allows users to search the database to locate the suitable standard for the selected feature.

In this exercise, we would like to find the SDS feature class for a Shoreline shapefile.

*This exercise references the SDSFIE Release 2.40 application.

Goal

After this exercise the user will be able to search the Spatial Data Standards using the SDS Feature Browser.

Objectives

1. Search and locate suitable standard for selected feature.
2. Find SDS feature class in the geodatabase

Exercise B: Using the SDS Feature Browser

1. From the **Start** Menu Select **Programs**> **Spatial Data Standards** > **SDSFIE Browser**.

2. From the **Browse** menu, select **By Keyword**. Enter in a Keyword.

   ☐ Enter “shoreline”

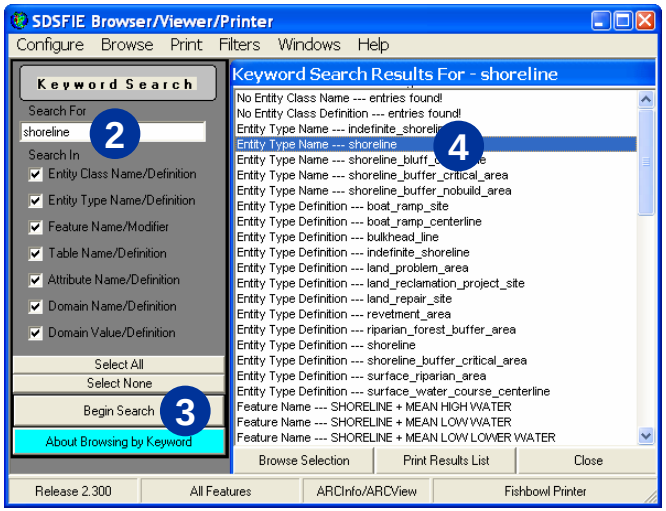
3. Click the Begin Search button. This will retrieve a list of matching results.

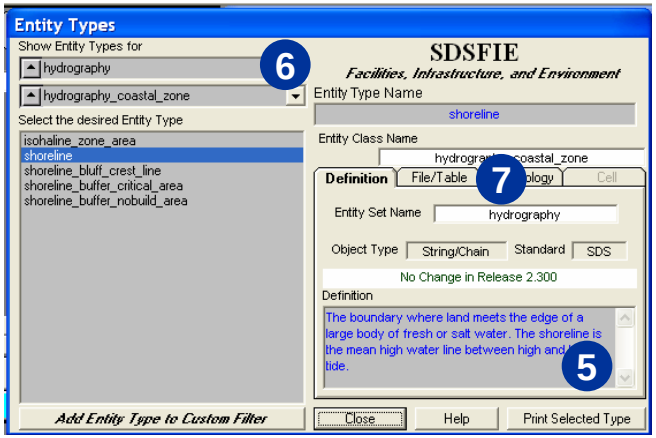
   ☐ Double-click on the desired record. This will display details on the selected record.

   ☐ Double-click on **Entity Type Name -- shoreline**

4. Verify the description meets your datasets.

5. Notice that the Entity Set is **Hydrography and the Entity Class is Hydrography_coastal_zone**. This will be the general feature dataset in the geodatabase.





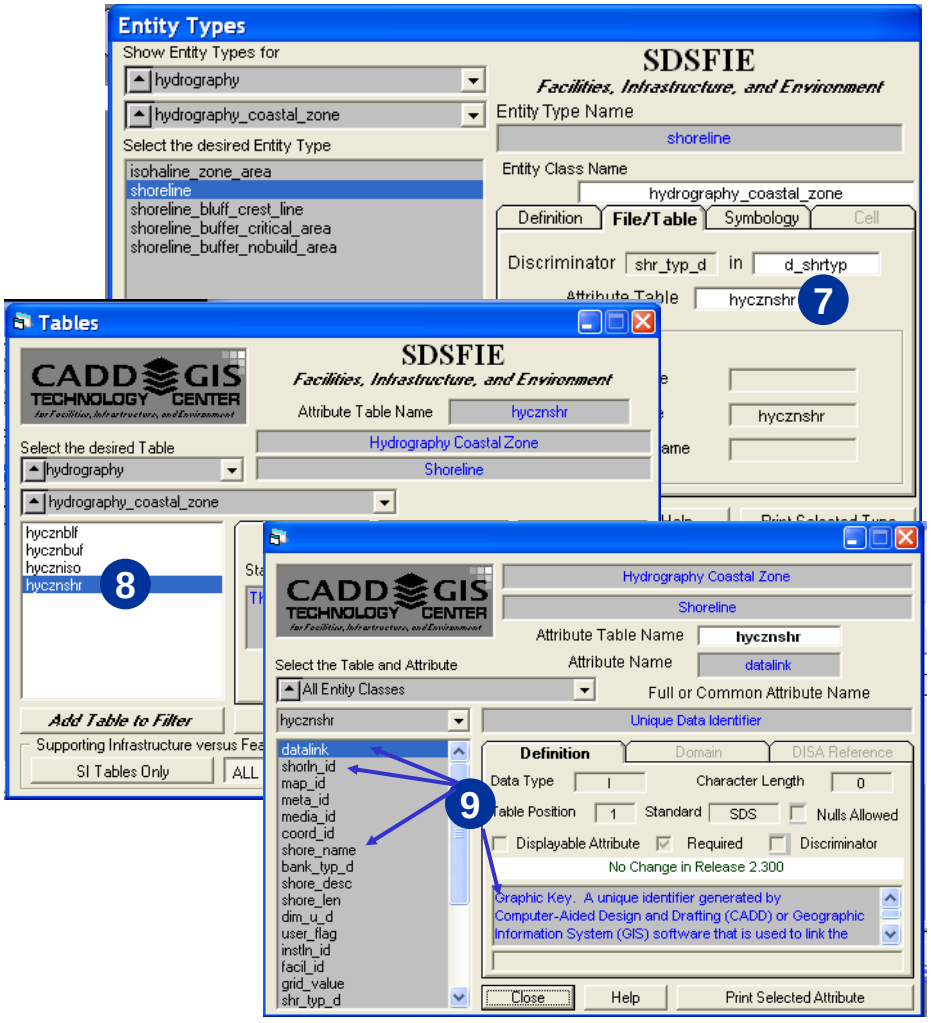
Exercise B: Using the SDS Feature Browser

6. To view the attribute definitions of this table, click on the File/Table tab.

   ☐ Double-click on the Attribute Table name **hycznshr**. This will display a list of available attribute tables.

7. Double-click on the Attribute Table named **hycznshr**. This time a definitive of field attributes will be displayed.

8. Click to select attribute names in the list. Descriptor information will be listed in the lower-right corner of the application dialog. This information will assist you in determining what values should be stored in which columns.



Exercise B: Using the SDS Feature Browser

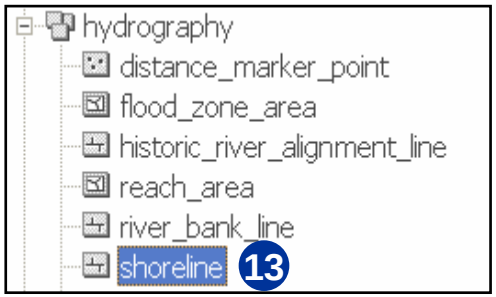
9. Open ArcCatalog. We use ArcCatalog to browse the geodatabase to locate the SDS feature dataset that matches our Shoreline data.

10. Browse C:\Training\Database\eGIS.mdb

11. Expand (+) the eGIS database.

12. Locate the dataset that most closely matches the Entity Set (Hydrography) from the SDS Feature Browser.

    ☐ Expand the **hydrography** feature dataset.



13. Select the desired feature class.

    ☐ Select **shoreline**

14. Preview the attribute table of the feature class

    ☐ From the preview tab, change the preview option to “Table”

15. Notice the attributes of the feature class match the attributes from the SDS Feature Browser.

Glossary

Entity Set:
The name of a generalized thematic group, the highest level of graphic and non-graphic data hierarchy represents data organized at project level. Entities are generally assigned to *Entity Sets* based on data maintenance responsibility to allow users to focus on smaller elements within the standard.

Entity Class:
The logical grouping of geographical features or entities within a given class. In some applications, this grouping corresponds to the design file or drawing file which contains the entities. The names of the ***Entity Classes*** are chosen to logically group the entities.

Exercise B: Using the SDS Feature Browser

Creating a Correlation Matrix:
A correlation matrix is used to match existing, non-SDS attributes, to the SDS attributes found in the SDS Feature Browser application. At the current time, an application does not exist to assist in the data entry. It is recommended that a Microsoft Excel Spreadsheet is created that maps the existing attribute names to appropriate SDS attribute name. The spreadsheet will be used for the metadata description and when importing a non-SDS feature class into the SDS geodatabase.

1. In ArcCatalog, browse to **alshrln_1982.shp** located in C:\Training directory.

2. Preview the attribute table of this shapefile.

   ☐ The attributes are listed in the table to the right.

3. In the SDS Feature Browser, find the attributes that most closely match the that of those in the non-SDS feature class.

   ☐ If attributes are questionable, check the Metadata!

   ☐ For this example the SDS attributes have been supplied in the table to the right.

NON-SDS	SDS
alshrln.shp	shoreline
ALSHR_ID*	SHORLN_ID
F_NAME	SHORE_DESC
LENGTH	SHORE_LEN
SHR_TYP_D	F_CODE

*In this example the ALSHR_ID is an identifier given by the data supplier. In Exercise C we will create an ID value to populate this field.

Exercise B: Using the SDS Feature Browser

Individual Exercise.

Using the skills learned in this exercise, populate the data matrix for the WaterFeatures.shp located in C:\Training.

HINT: Use the **hysurwbd** table.

Non-SDS	SDS
WaterFeatures.shp	
FEATURE	
NAME	
STATE	
ID	

Exercise B: Using the SDS Feature Browser

Exercise Summary

This exercise introduced you to the Spatial Data Standards. These standards are the foundation of eCoastal. Database structure and applications are intentionally designed to work directly with this industry standard. You were able to browse the standards with the SDS Feature Browser, find a desired dataset in the geodatabase and create a simple correlation matrix.

Answers to Exercise Questions

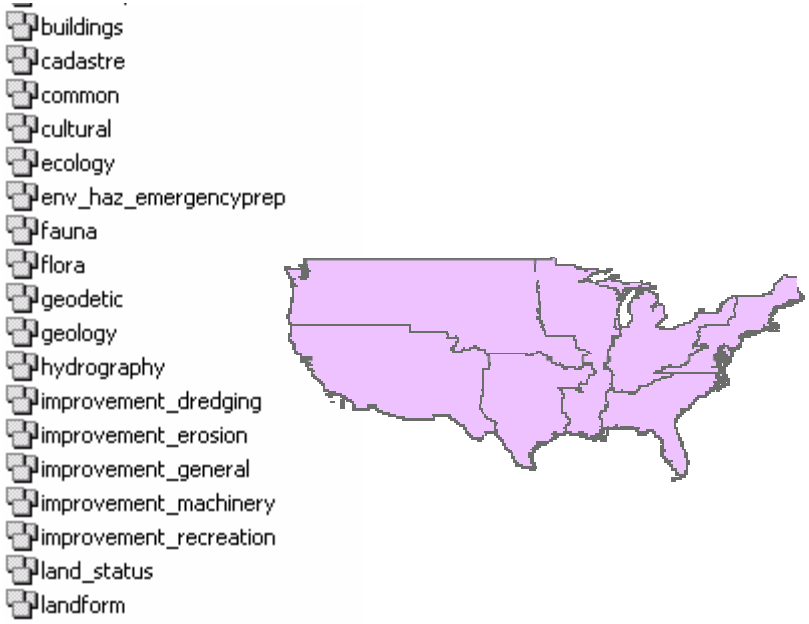
Non-SDS	SDS
WaterFeatures.shp	surface_water_body_area
FEATURE	body_typ_d
NAME	body_name
STATE	body_desc
ID	sur_bod_id

END OF EXERCISE B

Exercise C: Importing Data into the SDS Geodatabase

Background

All acquired data, vector or raster, should be loaded into the SDS Geodatabase. With eCoastal, a template geodatabase is distributed. This database is an export from the Spatial Data Standard that is compiled of common datasets used in coastal engineering.



Goal

Using the correlation matrix for the Shoreline shapefile created in exercise B, you will be able to import the original shapefile into its target feature dataset and feature class. You will also learn how to use attribute identifiers to retain dataset details in a SDS format.

Objectives

1. Load a shoreline shapefile into the SDS geodatabase using ArcCatalog's Simple Data Loader.
2. Populate the attribute table with necessary ID values.
3. Create a Layer file with a query definition.

Exercise C: Importing Data into the SDS Geodatabase

1. In the ArcCatalog browser, right-click on the appropriate feature class and select ***Load > Load Data***.

   ☐ Right-click on the **shoreline** feature class contained in the **hydrography** feature dataset and select **Load > Load Data**.

2. When the Simple Data Loader dialog box appears, click on the **Folder** button,  , to browse to the directory containing the shapefile file to be migrated. Double click on the shapefile name.

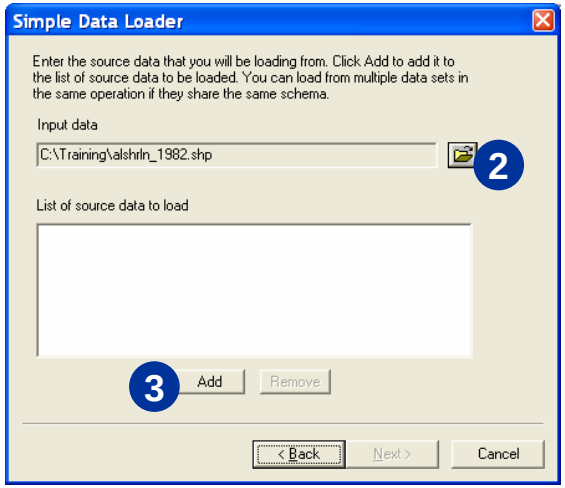
   ☐ Select **alshrln_1982.shp** in the C:\Training directory.

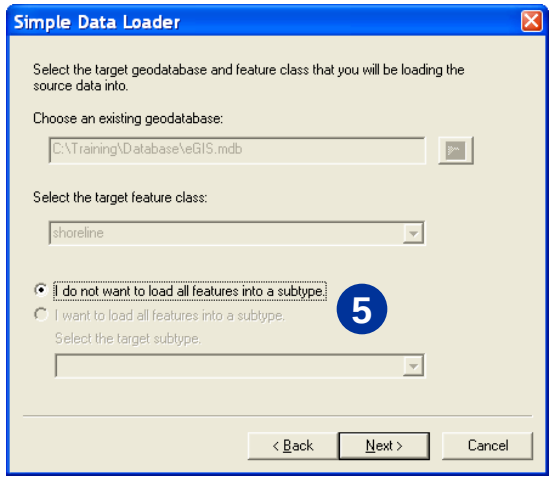
   The shapefile geometry type selected must match the feature class geometry type in the correlation matrix. Click on the **Open** button to select the data.

3. Click on the ***Add*** button to move the data source from the 'Input data' window to the 'List of source data to load' window.

4. Click Next.

5. Since we are importing into a personal geodatabase, that does not support sub-types, select "I do not want to load all features into a subtype". Click Next.





Exercise C: Importing Data into the SDS Geodatabase

6. Associate source data attribute fields with existing fields in the feature class, using the correlation matrix to determine which target field is associated with which matching source field.

   ☐Match **shore_name** to **F_NAME**.

   If your source data has many attributes, all source fields will need to be matched to a target field. We are only matching one in this example.

   ☐Click on the **Next** button to go to the next screen.

7. Since all the source data is to be migrated, leave the 'Load all of the source data' radio button selected.

   Using the Query Builder, users can import only a portion of a dataset if desired.

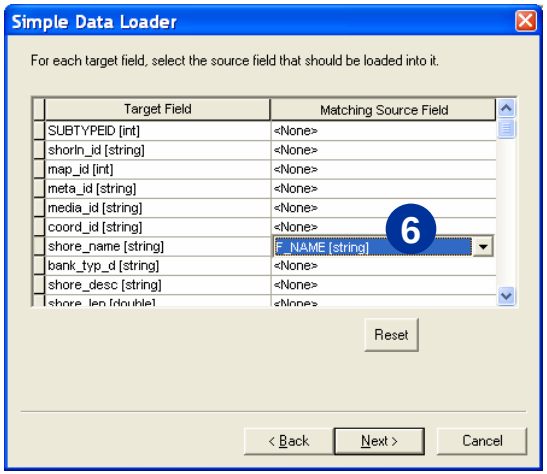
8. Click on the **Next** button to go to the next screen. A summary is displayed of all the parameters used to load the data.

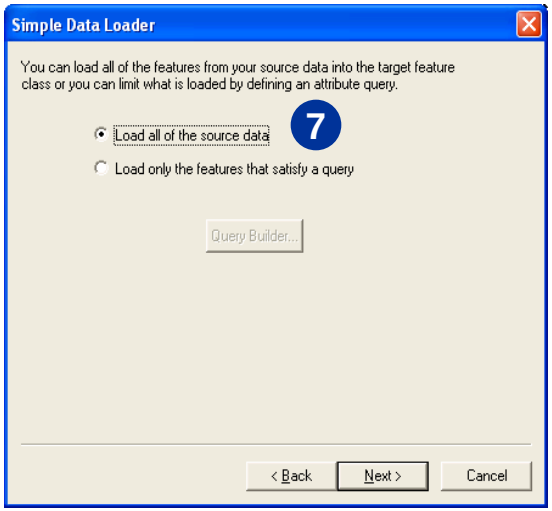
9. Review and select the **Finish** button to start the loading process.

10. The shapefile has now been loaded into the geodatabase. To view the results, browse to hydrography > shoreline.

11. Click on the Preview tab to display the table and geography.

    ☐ Notice the PROJECT_ID attribute is empty. In the following steps we will be populate this field with the appropriate value.





Exercise C: Importing Data into the SDS Geodatabase

Project Codes

Project Codes are used to assign records within a feature class to a specific project. Because of the restrictions of the Spatial Data Standards, features of the same type must be loaded or appended to the same feature class. For example, you have acquired a shoreline dataset that covers a large portion of your coastline and branches multiple project boundaries. You would prefer that when a user calls a specific project, only the portion of the shoreline that intersects the project boundary be visible. In order to disseminate this shoreline among a variety of projects, Project Codes can be assigned to specific lines segments.

The Mobile District's Spatial Data Branch uses a 4-character project code. Project codes are prefixed with the appropriate code as indicated in Table 1 - Standard Project Codes. The project code has a numeric identifier appended to this project code beginning with 000. Using this format, this will allow a maximum of 1000 coastal projects. Standard project codes are maintained in the ***GIS Management Database***. The GIS Management Database will be discussed later in the next module.

Table 1 - Standard Project Codes

- **C –** Coastal
- **D –** Dredging
- **E –** Real Estate
- **F –** Flood Control
- **G –** Regulatory
- **H –** Harbor
- **I –** Inlet
- **L –** Lake
- **M –** Military
- **N –** Navigation
- **P –** Permitting
- **R –** Riverine
- **S –** Study
- **T –** Natural Resources
- **V –** Environmental
- **X –** Miscellaneous
- **Y –** Emergency

Exercise C: Importing Data into the SDS Geodatabase

12. Once all datasets are loaded inside the geodatabase, the PROJECT_ID can be assigned.

    ☐ Open ArcMap using the launch button in ArcCatalog. Open **Shoreline.mxd**.

13. Right-click on the shoreline feature class and select **Open Attribute table**.

14. Scroll to the PROJECT_ID column.

15. Right-click on the column header and select the "**Calculate Values**" option.

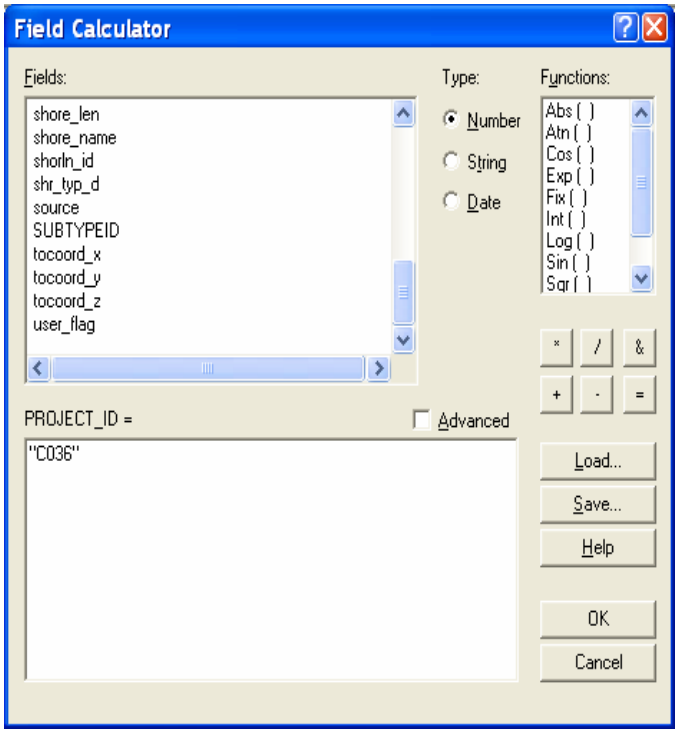
16. Type in text string.

    ☐ Enter **"C036"**. Don't forget the quotation marks.

    ☐ Click OK.

17. Close the Field Calculator dialog, and follow the same steps to populate the **SHRLN_ID** attribute with the value **0001**.

18. Now, all records in the shoreline feature are assigned to the Training Project (C036) and are noted as coming from the 1982 Shoreline Survey (0001).



Exercise C: Importing Data into the SDS Geodatabase

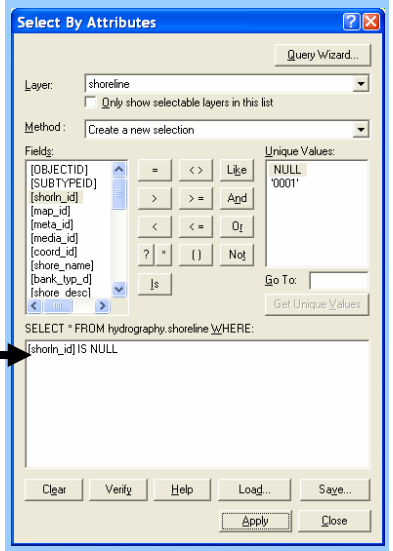
1. Keeping ArcMap open, go back in ArcCatalog and follow the steps 1-18 to import the 1986 Shoreline. The shapefile, **alshrln_1986**, is located in C:\Training.

2. In ArcMap, assign **ONLY** the 1986 records, of the Shoreline feature class, the SHORLN_ID of **0002** and a PROJECT_ID OF **C036**.

   HINT: Once the 1986 records are imported into the database, the PROJECT_ID value for these records will be blank. First use an attribute query to select all values where the PROJECT_ID is empty (null). Then, using only the selected values, calculate the SHORLN_ID and PROJECT_ID.

Did You Know?

You can query null or empty values in an attribute table by using an attribute query. To do so, from the Selection menu chose **Select by Attributes..**



Double-click on the attribute name and type IS NULL in the formula box. Click **Apply** to perform the selection.

Exercise C: Importing Data into the SDS Geodatabase

8. Now that the feature class is populated and IDs assigned, we will create a Layer File to query the feature class. We use query definitions in layer files to filter which records of the feature class to be displayed.

9. Right-click on the shoreline feature class in the table of contents and select **Properties**. On the **General Tab**, change the Layer name to **1982 Shoreline**.

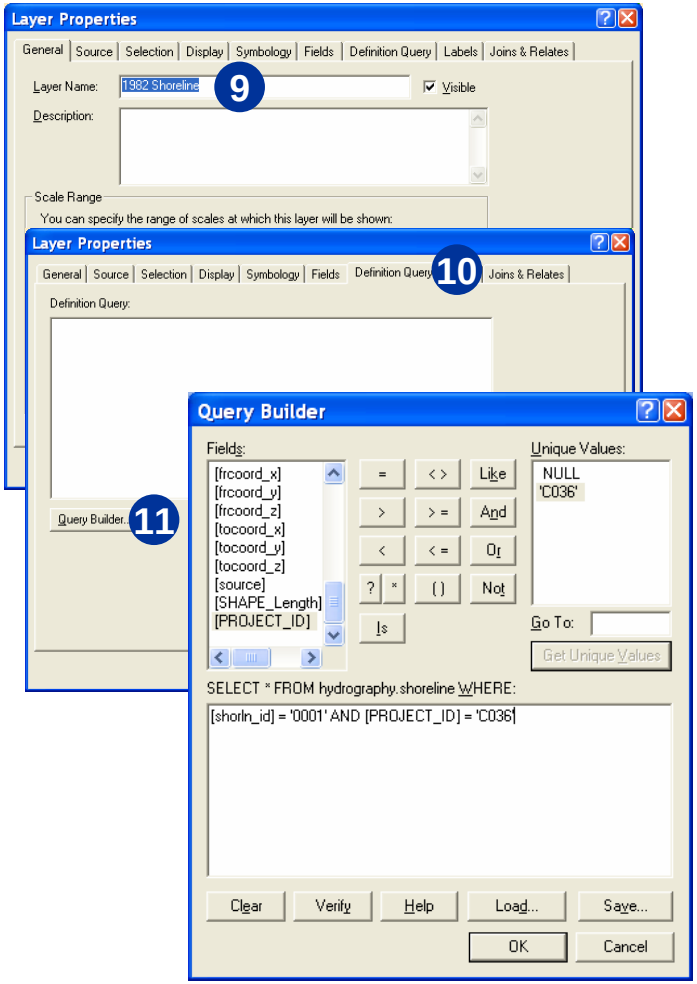
10. Click on the **Definition Query** tab.

11. Click on the **Query Builder** button.

12. Construct a query string to represent the 0001 (1982) Shoreline with the Project ID C036.

    ☐ Double-click on SHORLN_ID in the fields list
    ☐ Click the **=** button or type an equals sign, =
    ☐ Type **'0001'**
    ☐ Click the **And** button or type AND
    ☐ Double-click on PROJECT_ID in the fields list
    ☐ Click the **=** button or type an equals sign, =
    ☐ Type **'C036'**
    ☐ Click OK twice.

13. Notice only the 1982 Shoreline is displayed in your map view.



Exercise C: Importing Data into the SDS Geodatabase

14. To save your changes, right-click on the 1982 Shoreline layer in the table of contents. Select **Save as Layer File…**

15. Browse to **C:\Training\Spatial_Server\Work_C036\Layer** and save the file, **1982 Shoreline.lyr**.

16. Now let's create another layer file for the 1986 Shoreline.

    ☐ Right-click on the 1982 Shoreline layer in the Table of Contents and select **Properties...**

    ☐ On the General Tab **rename** the Layer Name to **1986 Shoreline**.

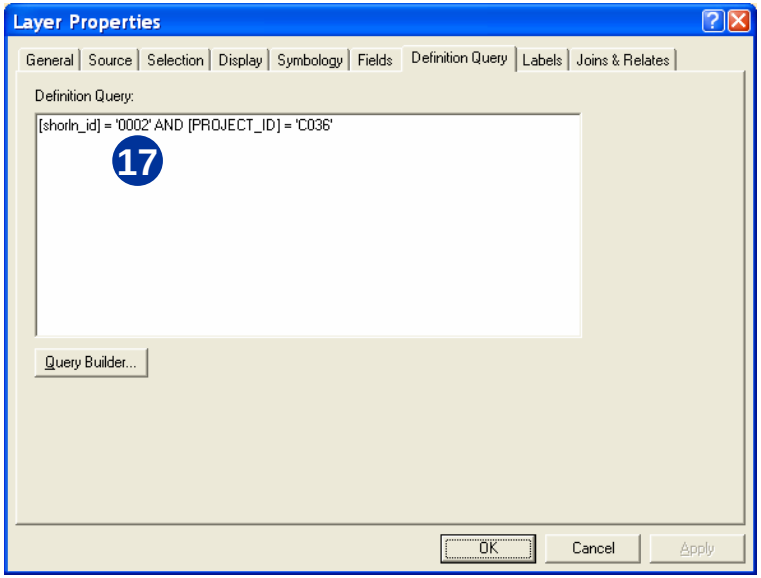
17. On the Definition Query Tab, change the SHORLN_ID to '**0002**'.

18. Click OK. Notice that only the 1986 Shoreline is now displayed in the map view.

19. Browse to **C:\Training\Spatial_Server\Work_C036\Layer** and save the file, **1986 Shoreline.lyr**.

20. Using the Add Data button,  , add in the **1982 Shoreline** layer that is located in C**:\Training\Spatial_Server\Work_C036\Layer**

21. Notice the difference between the 2 shoreline layers. What happens if you remove a definition query from the layer properties?



Exercise C: Importing Data into the SDS Geodatabase

Exercise Summary

This exercise introduced you to importing vector data into the SDS geodatabase. Every spatial dataset to be included in eCoastal should be imported to the geodatabase. Using layer file definitions, you can filter features to display only the desired data records.

Answers to Exercise Questions

Question 21.

If the query definition is removed from the layer properties, all records in the selected feature class will be rendered in the map display.



END OF EXERCISE C

Module Overview

In this module you learned the basic architecture of the eCoastal system and the importance and use of Spatial Data Standards inside the geodatabase. This foundation will allow you to more efficiently manage and organize GIS projects.