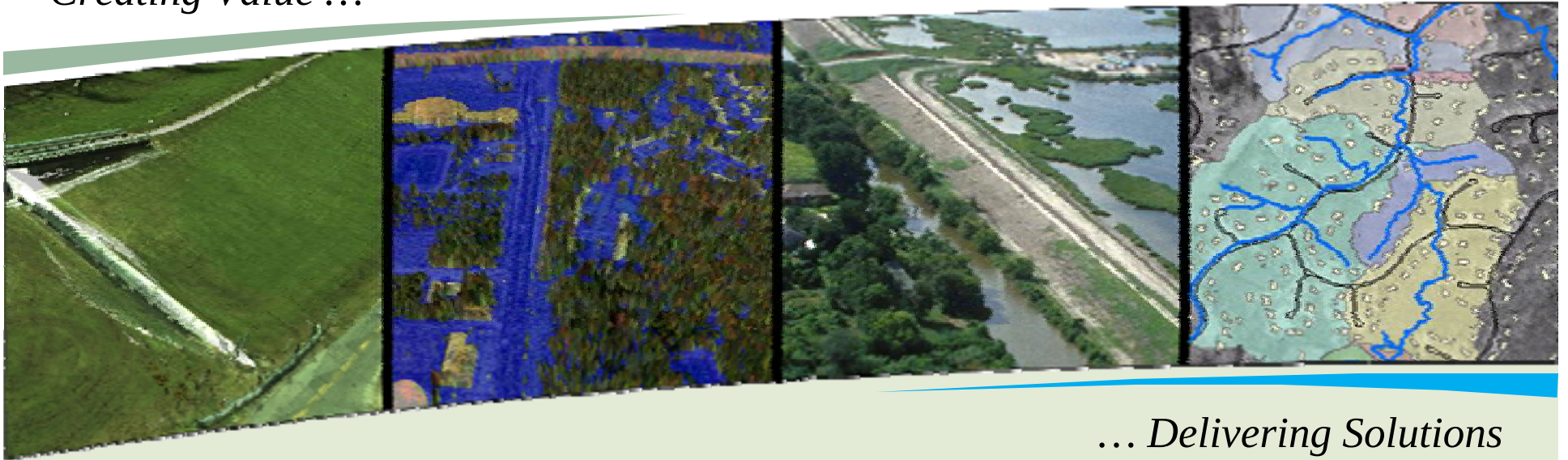


Creating Value ...



... Delivering Solutions

Developing a Custom Tool to Support USACE's National Levee Database

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2010 ESRI Federal User Conference

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Outline

- **Levee Definition**
- **Background**
- **Custom Tools**
- **Benefits**
- **Current Status**
- **Future**



Photo from USACE Digital Visual Library (Sacramento District)

Levee Definition

- **Embankment built alongside a river to prevent high water from flooding bordering land**
- **Soil or other materials deposited to contain the flow of water**



Photo from USACE, Vicksburg District website

Background

- **USACE is the lead in developing the levee inventory (long-term) for the nation**
- **USACE efforts are designed to inventory and develop levee data for all USACE project levees and levees in the PL 84-99 Emergency Assistance program**
 - Supports levee inspection and rehabilitation
 - Aids in Emergency Management efforts



Photo from USACE, Kansas City District website

National Levee Database

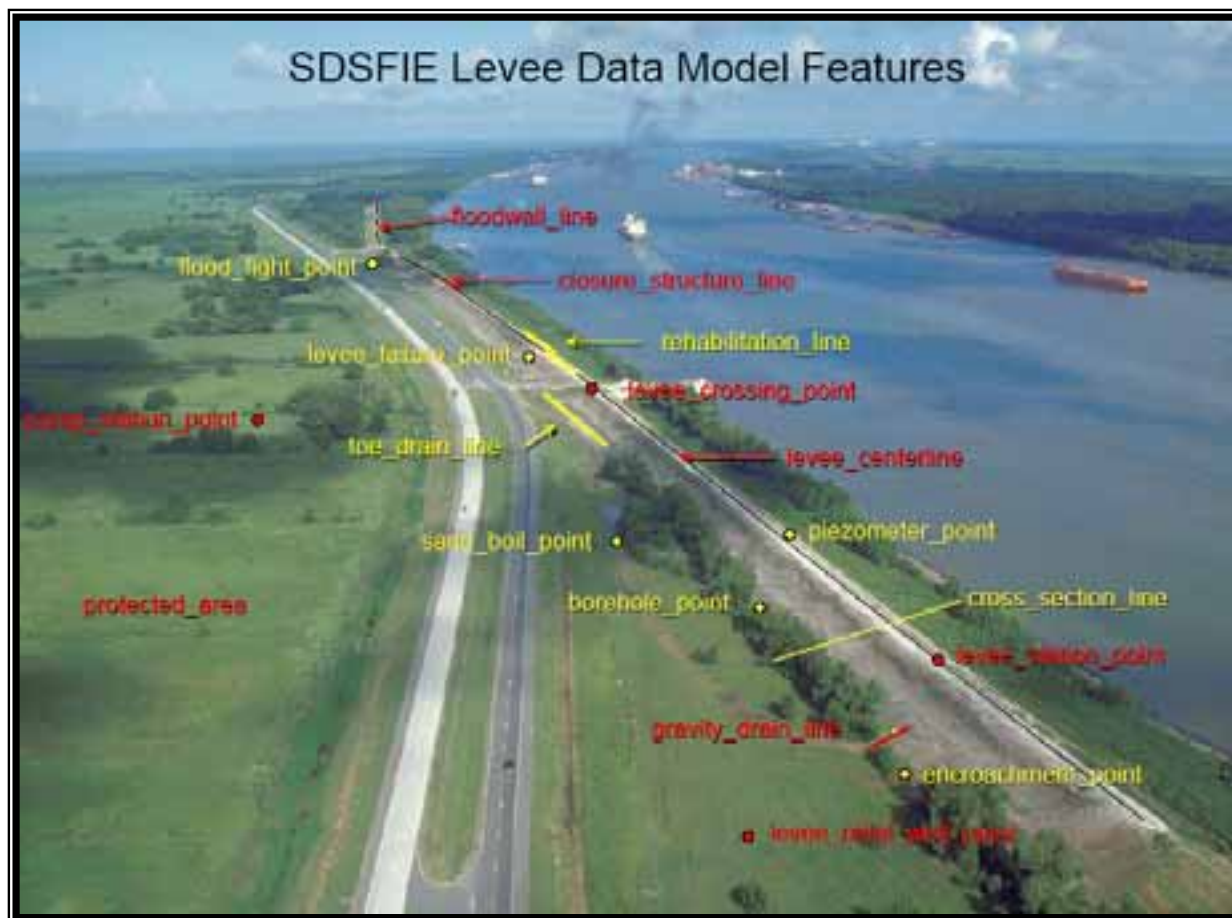
- **USACE Database design team has completed the National Levee Database data model**
 - Database model is consistent across all Districts
 - Standardized data layers and tables
 - Data dictionary
 - Domain values
 - E-R diagram
 - **SDSFIE (Spatial Data Standards for Facilities, Infrastructure, and Environment) structure for tables, relationships, attributes, and naming conventions**



Photo from USACE, Huntingdon District website

USACE Data Collection

- **NLD collects comprehensive data related to all USACE levees at the District level**
 - Ownership entities
 - Levee and related structure entities
 - Levee failure entities
 - Levee inspection entities
 - Protected area
- **Developed and maintained at the District-level then compiled into a national database**



Problem to Solve

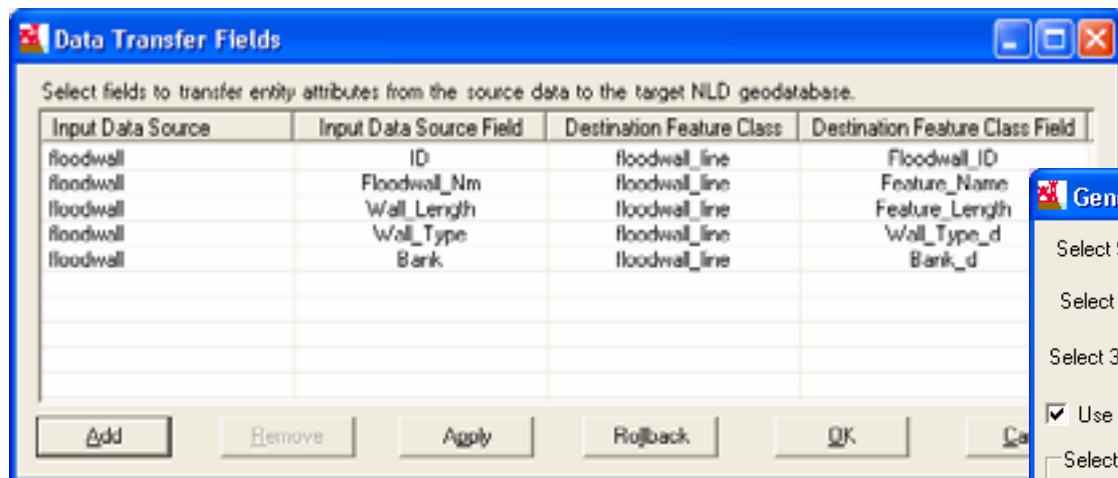
- **Varying knowledge of the NLD standards at the District-level**
- **District-level data must pass a validation before being incorporated into the NLD**
 - Specific checks are 'unknown' at the District-level; often data is returned for edits multiple times.
 - Data validation should be more comprehensive
- **Districts have different software/hardware capabilities; need a solution for all.**
- **Fields and values for NLD are evolving; need to keep everyone current with standards and allow the tools to evolve with the NLD**
- **Multiple data sources and a non-linear process; need flexibility to discover issues at different points in the process.**

USACE Levee Inventory Tools Extension

- **Extension for ESRI ArcMap 9.2/9.3**
- **Utilizes PGDB data in NLD schema**
- **3 toolbars**
 - **USACE Levee Load Data** 
 - **Load Data tool**
 - **Highlight Required Fields tool**
 - **Reverse Direction tool**
 - **USACE Levee QC** 
 - **Quality Control tool**
 - **USACE Levee Profile Plot** 
 - **Levee Centerline Profile Plot tool**
 - **Cross Section Profile Plot tool**
- **User guide accessible on every toolbar**

USACE Levee Load Data Toolbar

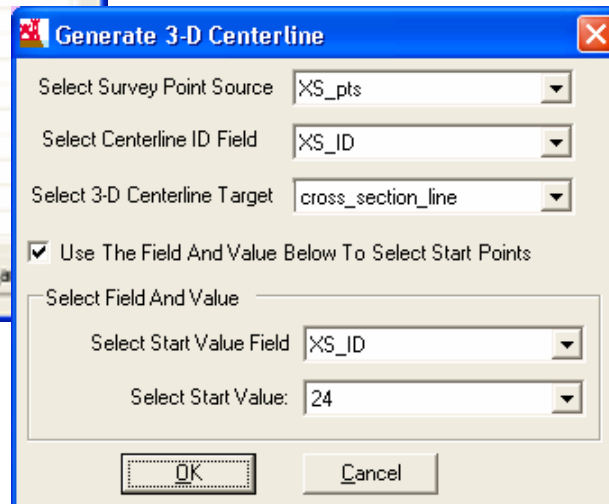
- **Batch transfer of data into the NLD PGDB**
 - Multiple sources of data can be mapped to NLD fields
 - Only transfer appropriate NLD attributes/features from a spatial/tabular source
- **QC data prior to transferring into the NLD PGDB**
- **Generate Zpolylines from point data**



Select fields to transfer entity attributes from the source data to the target NLD geodatabase.

Input Data Source	Input Data Source Field	Destination Feature Class	Destination Feature Class Field
floodwall	ID	floodwall_line	Floodwall_ID
floodwall	Floodwall_Nm	floodwall_line	Feature_Name
floodwall	Wall_Length	floodwall_line	Feature_Length
floodwall	Wall_Type	floodwall_line	Wall_Type_d
floodwall	Bank	floodwall_line	Bank_d

Buttons: Add, Remove, Apply, Rollback, OK, Cancel



Generate 3-D Centerline

Select Survey Point Source: XS_pts

Select Centerline ID Field: XS_ID

Select 3-D Centerline Target: cross_section_line

☒ Use The Field And Value Below To Select Start Points

Select Field And Value

Select Start Value Field: XS_ID

Select Start Value: 24

Buttons: OK, Cancel

USACE Levee Load Data Toolbar

- Required fields are highlighted in data

Attributes of FC_SEGMENT

	OBJECTID	Primary Key	FOREIGN KEY JOIN to FC_SVS	FOREIGN KEY JOIN to ORG	FOREIGN KEY JOIN to PAL	Segment Name	District Code	Construction Start	Construction Comp
	1	3604000022	3605000016	3607000016	<Null>	Egypt Levee S Drainage Distri	Kansas City	<Null>	<Null>
	2	3604000023	36050000138	36070000138	<Null>	MRLS 500-R	Kansas City	2/22/1990	7/7/1993
	3	3604000024	36050000140	36070000140	<Null>	MRLS 497-L	Kansas City	9/28/1996	6/29/1992
	4	3604000026	36050000146	36070000146	<Null>	Lower Charlton River Levee D	Kansas City	<Null>	5/16/1972
	5	3604000027	36050000100	36070000100	<Null>	South Topeka Unit	Kansas City	<Null>	1/6/1999
	6	3604000028	36050000118	36070000118	<Null>	Rushville-Sugar Lake	Kansas City	<Null>	<Null>
	7	3604000029	36050000087	36070000087	<Null>	Cody Lake Levee District	Kansas City	<Null>	<Null>
	8	3604000030	36050000055						
	9	3604000031	36050000020						

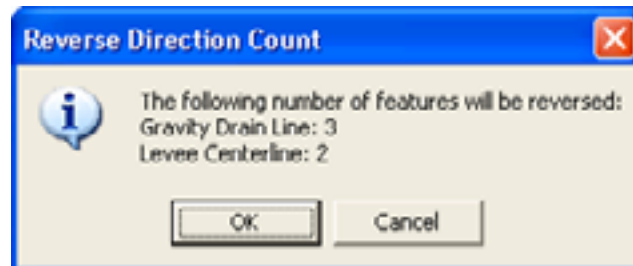
Record: 1 Show: All Selected

Attributes of levee_centerline

	OBJECTID	SHAPE *	Primary Key	FOREIGN KEY JOIN to FC_SEG	Up River Mil	Down River	Feature Name	Feature Length	Gage Code
	1	Polyline ZM	3601000383	3604000009	147.7	151.1	Manhattan Unit	1980.197227	MH-KK1
	2	Polyline ZM	3601000001	3604000001	6.8	0.2	Armourdale Unit	4506.924324	KCDM7
	3	Polyline ZM	3601000002	3604000001	6.8	0.2	Armourdale Unit	676.305933	KCDM7
	4	Polyline ZM	3601000003	3604000001	6.8	0.2	Armourdale Unit	16316.498476	KCDM7
	5	Polyline ZM	3601000004	3604000001	6.8	0.2	Armourdale Unit	39.560053	KCDM7
	6	Polyline ZM	3601000005	3604000001	6.8	0.2	Armourdale Unit	6762.03201	KCDM7
	7	Polyline ZM	3601000006	3604000053	3.39	0.06	Abilene Unit	4766.679575	ALEK1
	8	Polyline ZM	3601000007	3604000053	3.39	0.06	Abilene Unit	72.385461	ALEK1
	9	Polyline ZM	3601000008	3604000053	3.39	0.06	Abilene Unit	3562.910609	ALEK1

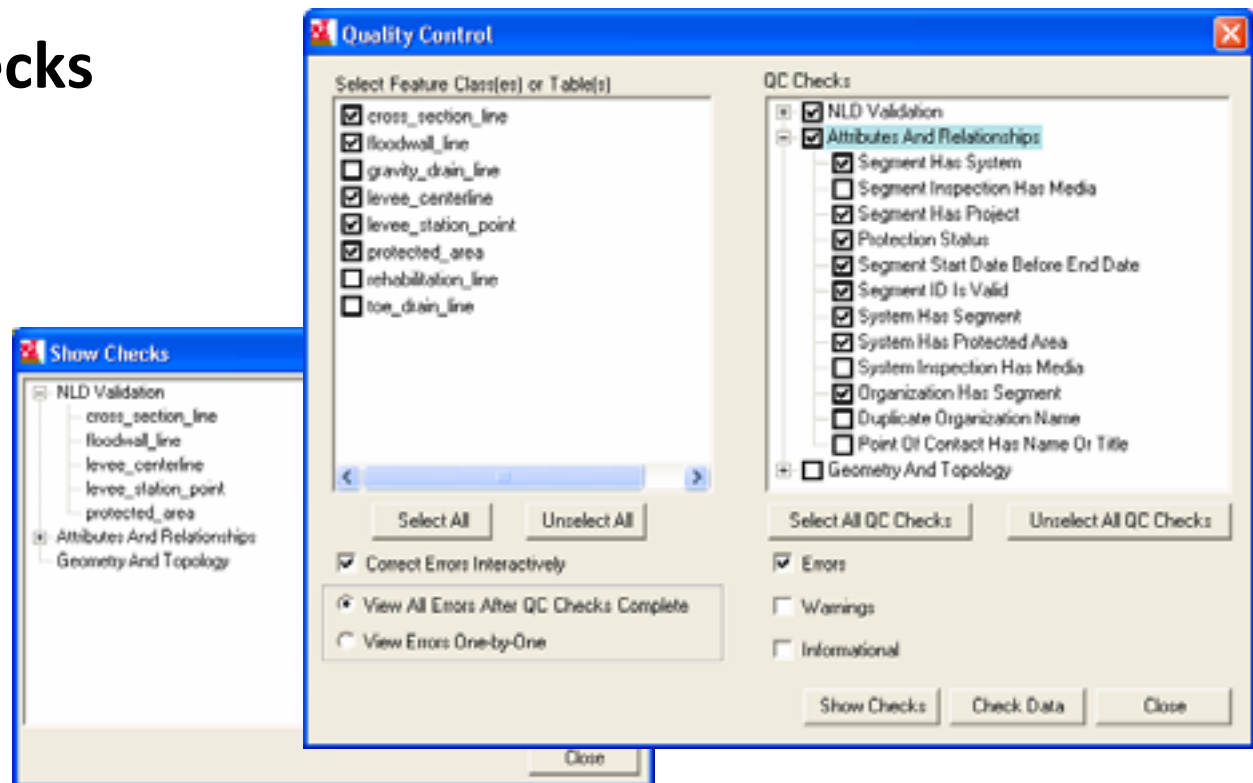
Record: 1 Show: All Selected Records: (0 out of 383 Selected) Options

- Reverse direction of line features



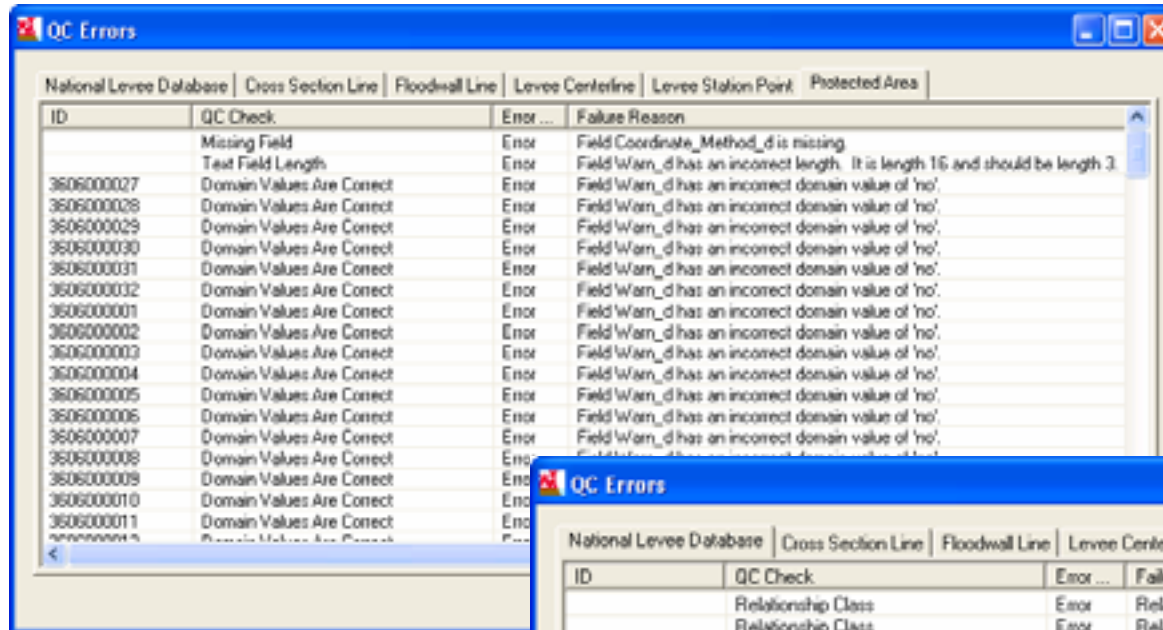
USACE Levee Quality Control Toolbar

- Run customized QC checks in batch or single feature class mode
 - NLD Validation checks
 - Attribute and Relationship checks
 - Geometry and Topology checks
- 3 levels of checks reported
 - Errors
 - Warning
 - Information



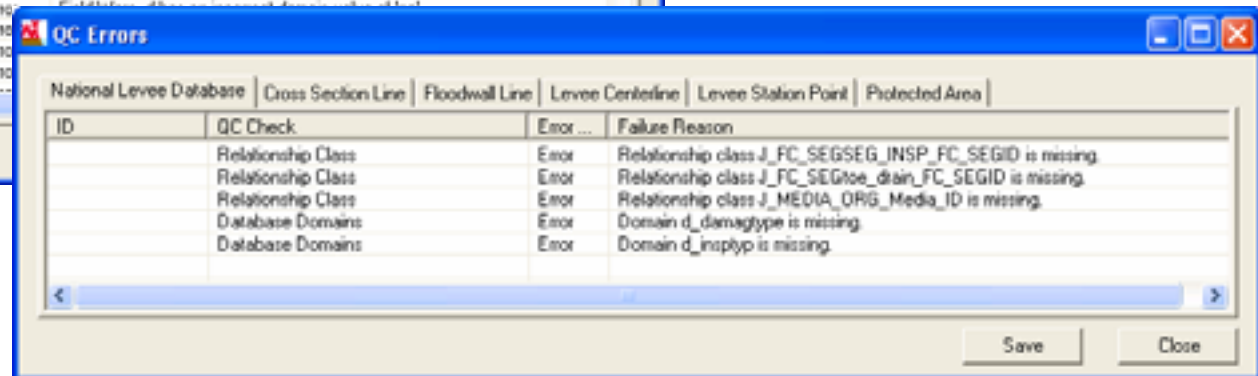
USACE Levee Quality Control Toolbar

- Options for correcting
 - Interactively, either 1-by-1 or all at the end
 - Save error report



QC Errors

ID	QC Check	Error ...	Failure Reason
	Missing Field	Error	Field Coordinate_Method_d is missing.
	Test Field Length	Error	Field Warn_d has an incorrect length. It is length 16 and should be length 3.
3606000027	Domain Values Are Correct	Error	Field Warn_d has an incorrect domain value of 'no'.
3606000028	Domain Values Are Correct	Error	Field Warn_d has an incorrect domain value of 'no'.
3606000029	Domain Values Are Correct	Error	Field Warn_d has an incorrect domain value of 'no'.
3606000030	Domain Values Are Correct	Error	Field Warn_d has an incorrect domain value of 'no'.
3606000031	Domain Values Are Correct	Error	Field Warn_d has an incorrect domain value of 'no'.
3606000032	Domain Values Are Correct	Error	Field Warn_d has an incorrect domain value of 'no'.
3606000001	Domain Values Are Correct	Error	Field Warn_d has an incorrect domain value of 'no'.
3606000002	Domain Values Are Correct	Error	Field Warn_d has an incorrect domain value of 'no'.
3606000003	Domain Values Are Correct	Error	Field Warn_d has an incorrect domain value of 'no'.
3606000004	Domain Values Are Correct	Error	Field Warn_d has an incorrect domain value of 'no'.
3606000005	Domain Values Are Correct	Error	Field Warn_d has an incorrect domain value of 'no'.
3606000006	Domain Values Are Correct	Error	Field Warn_d has an incorrect domain value of 'no'.
3606000007	Domain Values Are Correct	Error	Field Warn_d has an incorrect domain value of 'no'.
3606000008	Domain Values Are Correct	Error	Field Warn_d has an incorrect domain value of 'no'.
3606000009	Domain Values Are Correct	Error	Field Warn_d has an incorrect domain value of 'no'.
3606000010	Domain Values Are Correct	Error	Field Warn_d has an incorrect domain value of 'no'.
3606000011	Domain Values Are Correct	Error	Field Warn_d has an incorrect domain value of 'no'.



QC Errors

ID	QC Check	Error ...	Failure Reason
	Relationship Class	Error	Relationship class J_FC_SEGSEG_INSP_FC_SEGID is missing.
	Relationship Class	Error	Relationship class J_FC_SEGtoe_drain_FC_SEGID is missing.
	Relationship Class	Error	Relationship class J_MEDIA_ORG_Media_ID is missing.
	Database Domains	Error	Domain d_damagtype is missing.
	Database Domains	Error	Domain d_insplyp is missing.

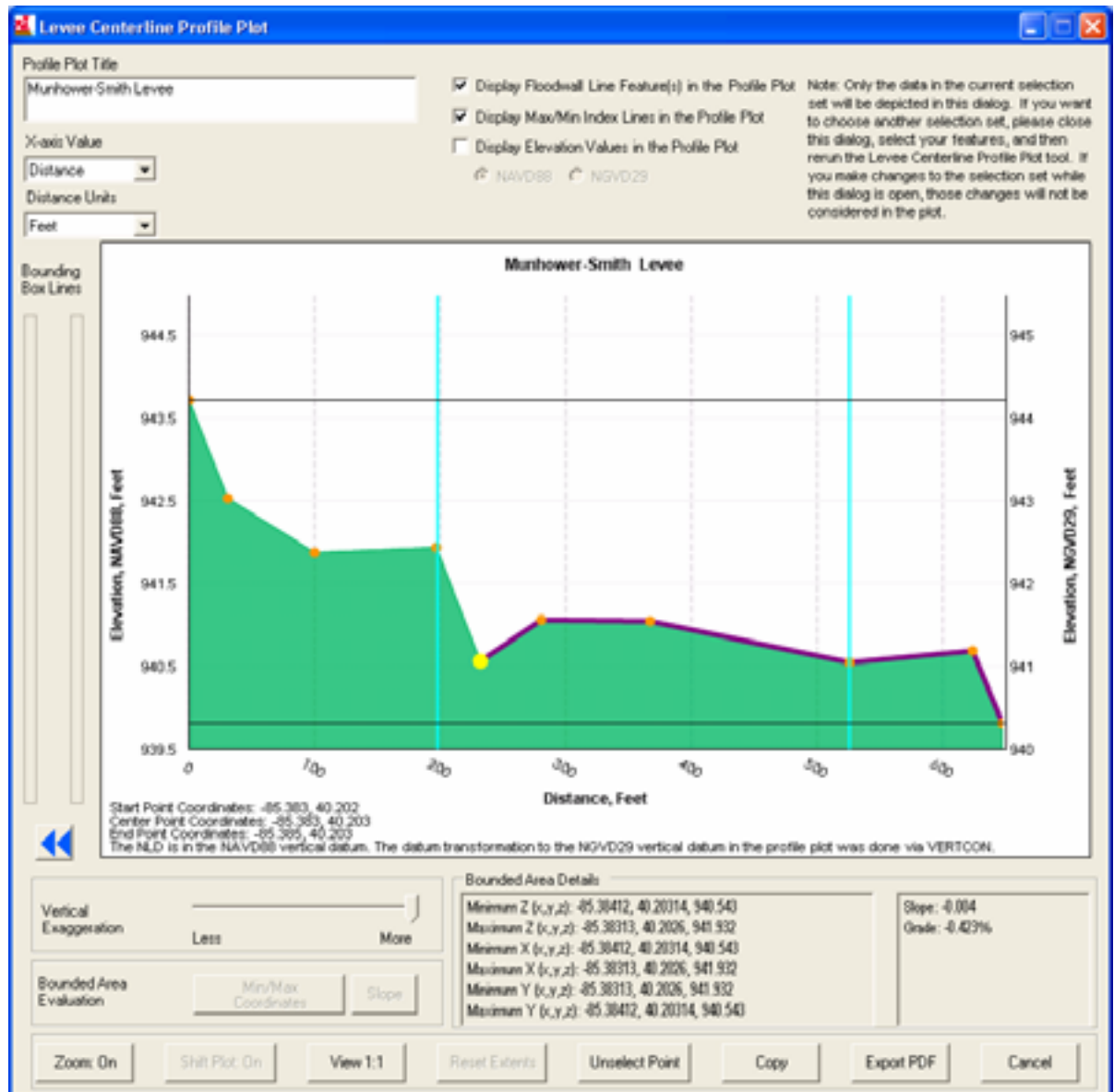
Save Close

USACE Levee Profile Plot Toolbar

- **Visually examine elevation profiles**
 - Longitudinal view of levee centerlines/floodwalls
 - Face view of cross sections
- **Isolate a portion of the whole for analysis**
 - Find max/min elevations
 - Calculate slope/grade
- **Displays the elevations in NAVD88 and NGVD29 vertical datums**
- **Ability to copy plot or export to PDF for dissemination**
- **QC data via error trapping**

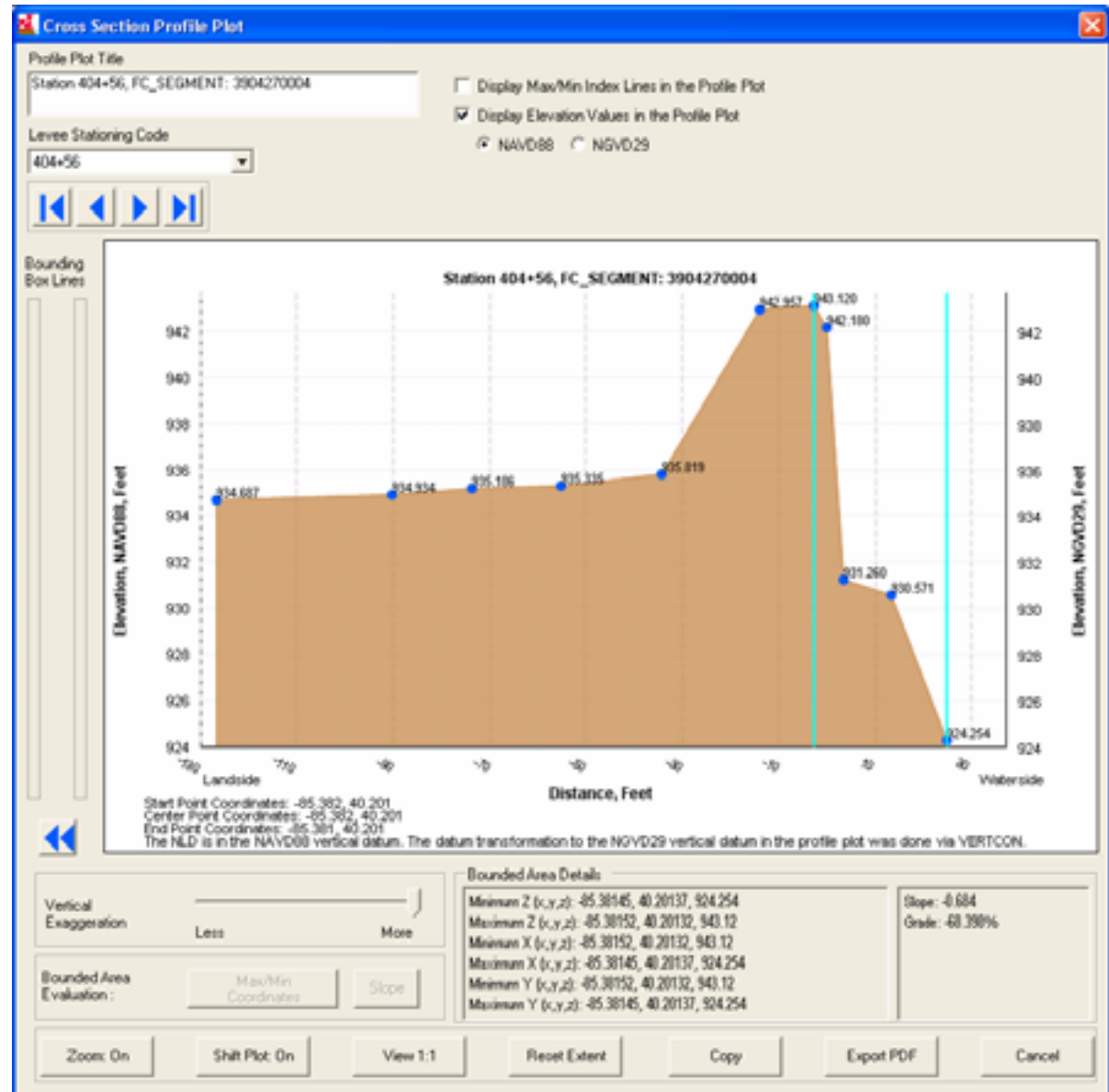
Levee Centerline Profile Plot Tool

- Display multiple adjoining levee centerlines and floodwalls within the same system
- X-Axis can be labeled as total distance or by nearest levee station point
- Select vertex in plot and zoom to point in map
- QC via error trapping



Cross Section Profile Plot Tool

- Display a series of cross section plots
- Distances are measured from the intersection of the cross section and the levee centerline and/or floodwall
- Positive and negative distances indicate direction to flooding source and landward-sides respectively



Benefits

- Ensured strong compliance with the NLD data standards
- Increased efficiency in developing and maintaining data at the District-level
- Lessened learning curve for Districts moving forward
- Reduced validation effort at the National-level



Photo from USACE Digital Visual Library (New Orleans District)

Current Status

- **5 USACE Districts are currently using the USACE Levee Inventory Tools Extension**
- **21 USACE Districts are currently in the different stages of the initial field inventory or validation process**
- **Goal is to have all Districts completing the NLD by end of FY10**
- **Update tools to account for new NLD schema**
- **In-person training session for USACE Districts**
- **Continued technical support as Districts roll on**
- **Enhanced user guide**



Photo from USACE Digital Visual Library (New Orleans District)

- **Update tools to account for changes to NLD schema**
- **Ongoing tool enhancements as requested by users**
- **Expand access to NLD by other agencies, states, etc.**
- **Allow incorporation of data from non-USACE levees into the NLD**



Photo from USACE Digital Visual Library (Nashville District)

Questions?

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