

Creating a Bathymetric Database & Datum Conversion



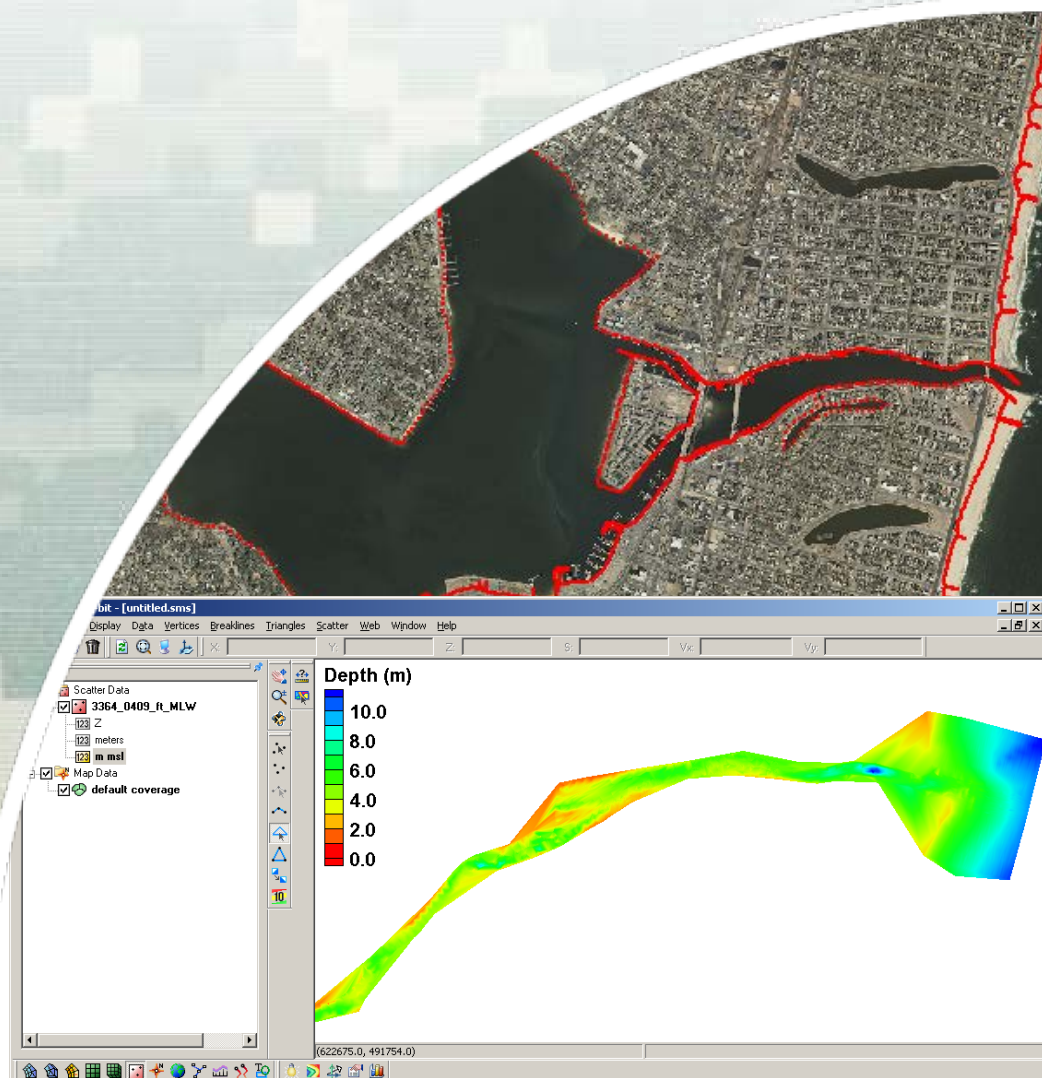
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US Army Corps of Engineers
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Introduction to Bathymetric Databases in SMS



- Introduction to working with bathymetric datasets
 - ▶ *Importing Datasets (xyz, points, shapefiles, other ascii)*
- *Datum Conversion*
 - ▶ *SMS conversion (Corpscon; Global Mapper)*

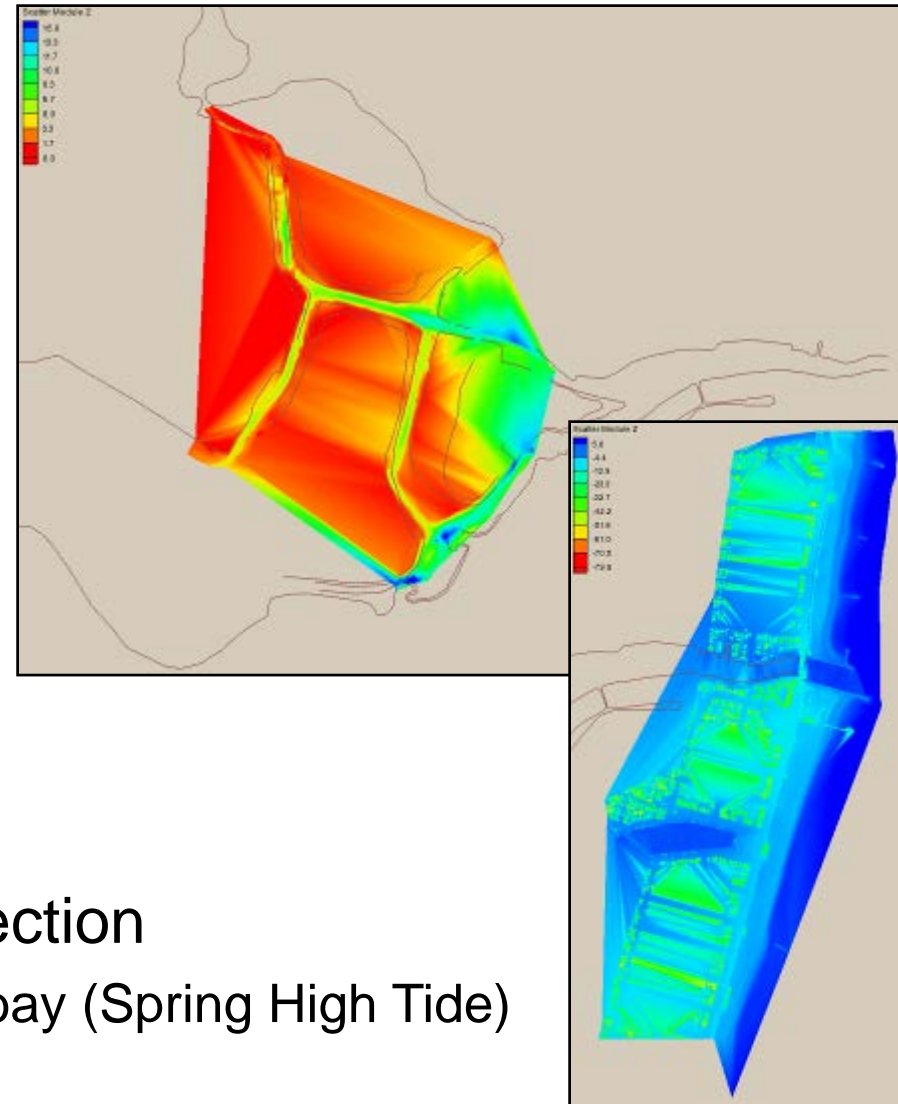




Multiple Bathymetric Datasets

CIRP

- Limited bay bathymetry
- NOAA – Offshore datasets
- LIDAR – Shoreline and nearshore (important for structure resolution)
- Channel
 - ▶ NJ State maintains north channel and north bay channel
 - ▶ Federally maintained entrance and south channel (15 years)
- NAN-supported field data collection
 - ▶ Included bathymetry of the backbay (Spring High Tide)



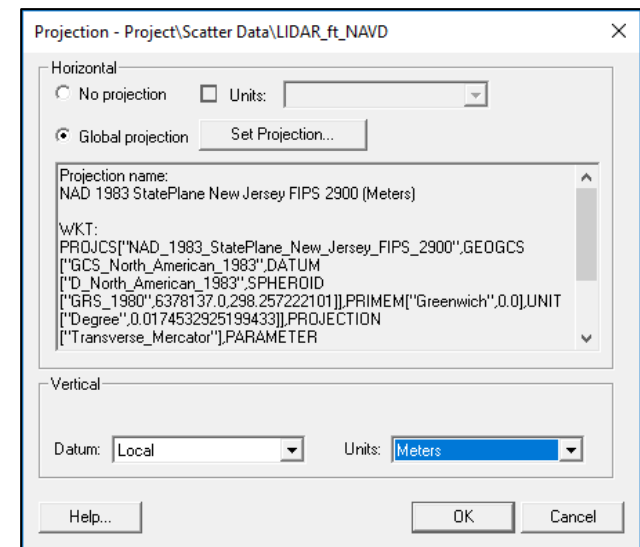
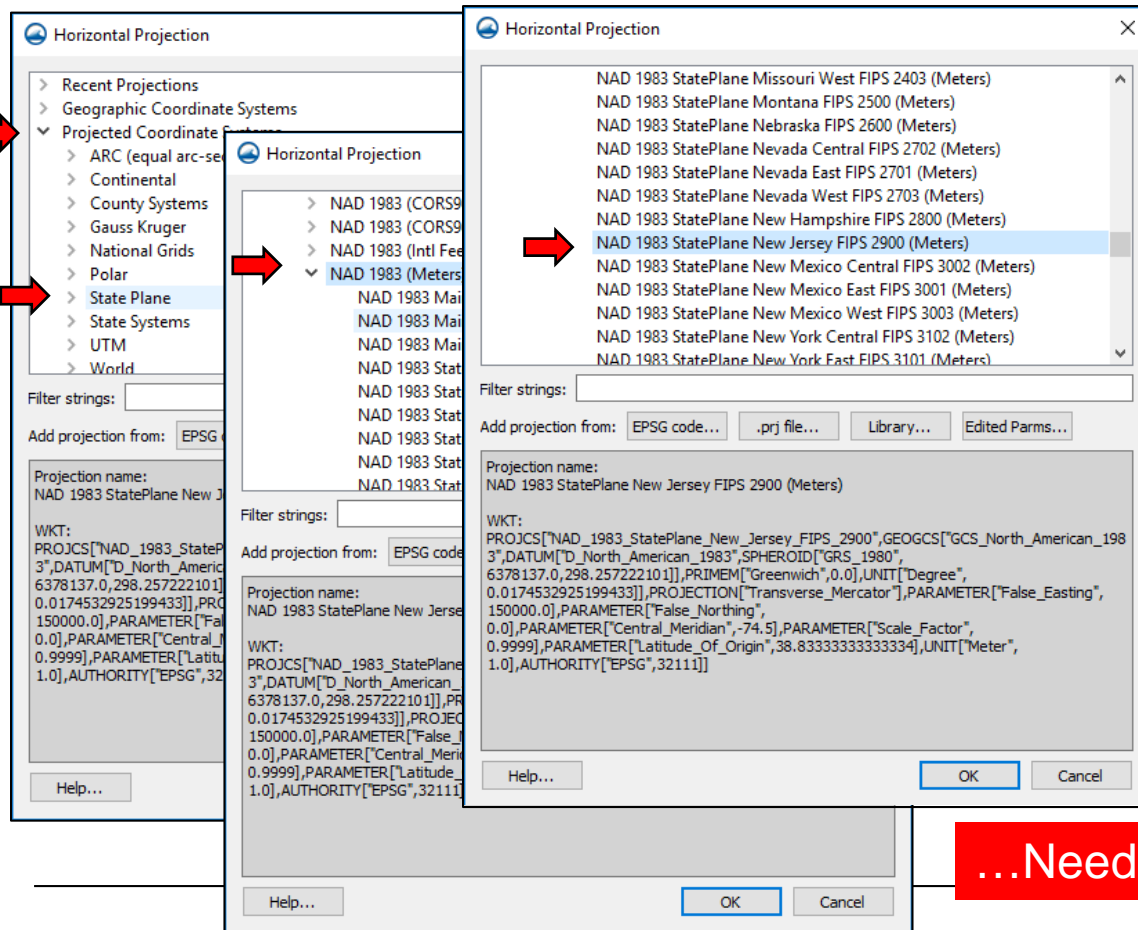


Common Spatial Reference Datum & Vertical Datum

CIRP

Horizontal Projection & Datum: Pick a system in metric units that is planar (UTM; State Plane)

Vertical Projection & Datum: Must be in metric as well; Datum is not necessary (Local)

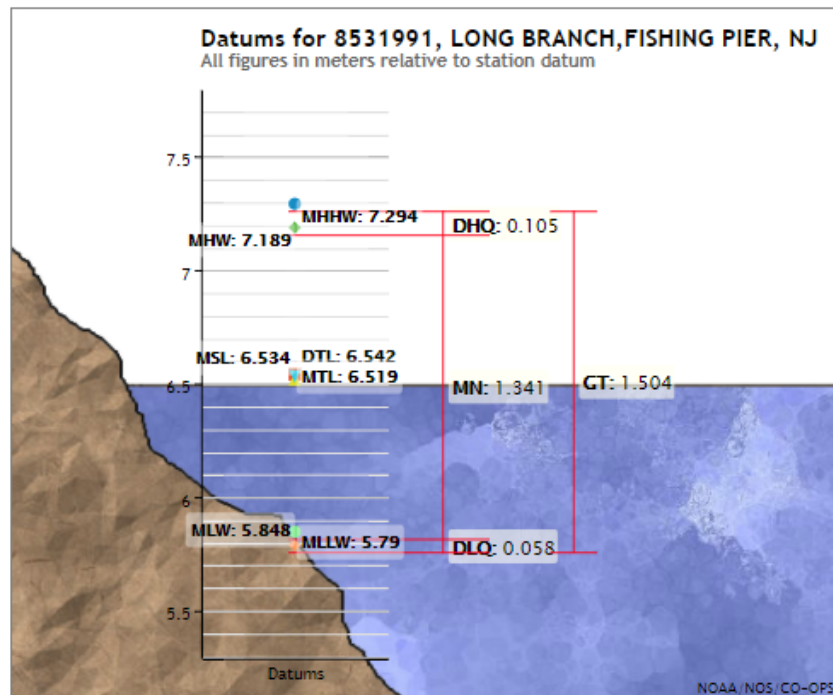


...Need to convert all bathymetric data

Elevations on Station Datum

Station: 8531991, LONG
BRANCH, FISHING PIER, NJ T.M.: 75
Epoch: 1983-2001
Status: Accepted (Apr 17 2003) Datum: STND
Units: Meters

Datum	Value	Description
MHHW	7.294	Mean Higher-High Water
MHW	7.189	Mean High Water
MTL	6.519	Mean Tide Level
MSL	6.534	Mean Sea Level
DTL	6.542	Mean Diurnal Tide Level
MLW	5.848	Mean Low Water
MLLW	5.790	Mean Lower-Low Water
NAVD88	6.609	North American Vertical Datum of 1988
STND	0.000	Station Datum
GT	1.504	Great Diurnal Range
MN	1.341	Mean Range of Tide
DHQ	0.105	Mean Diurnal High Water Inequality
DLQ	0.058	Mean Diurnal Low Water Inequality
HWI	12.260	Greenwich High Water Interval (in hours)
LWI	6.040	Greenwich Low Water Interval (in hours)
Max Tide	8.269	Highest Observed Tide
Max Tide Date & Time	01/02/1987 09:12	Highest Observed Tide Date & Time
Min Tide	4.389	Lowest Observed Tide
Min Tide Date & Time	01/10/1978 21:00	Lowest Observed Tide Date & Time
HAT		Highest Astronomical Tide
HAT Date & Time		HAT Date and Time
LAT		Lowest Astronomical Tide



Showing datums for

8531991 LONG BRANCH, FI...

Data Units ☐ Feet
☒ Meters

Epoch ☒ Present (1983-2001)
☐ Superseded (1960-1978)

Submit



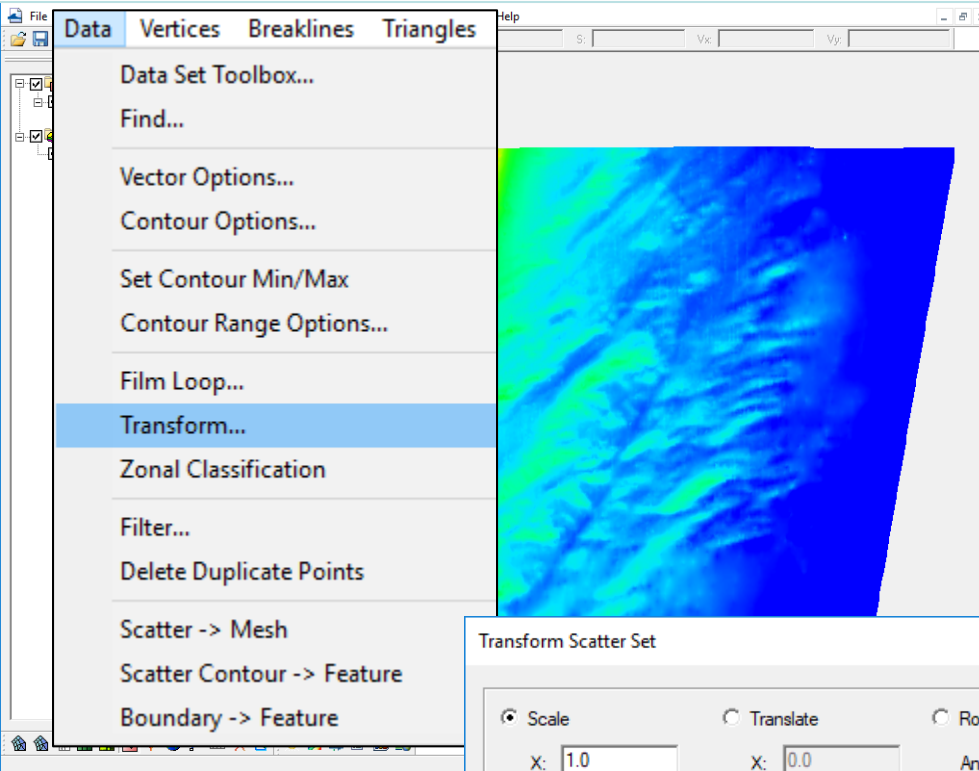
Prep for the Coastal Modeling System



- Based off of a Cartesian grid
 - Planar coordinate system
 - Model computation is in metric and depths are positive from zero (elevations are flipped)
 - Grid is generated based off of a single bathymetry file stored in SMS scatterset file format
 - Vertical datum is not specified and is assumed local
 - The boundary condition forcing (tidal) must be in the same datum as the bathymetry
 - Typically modeling grids are brought to a mean datum such as mean sea level (msl) or mean tide level (mtl)
- → This requires that all datasets are brought in to unified projection, datum, and units
 - Shark River Inlet bathymetry will be converted to State Plane horizontal coordinates in meters with the vertical datum set to MSL in meters

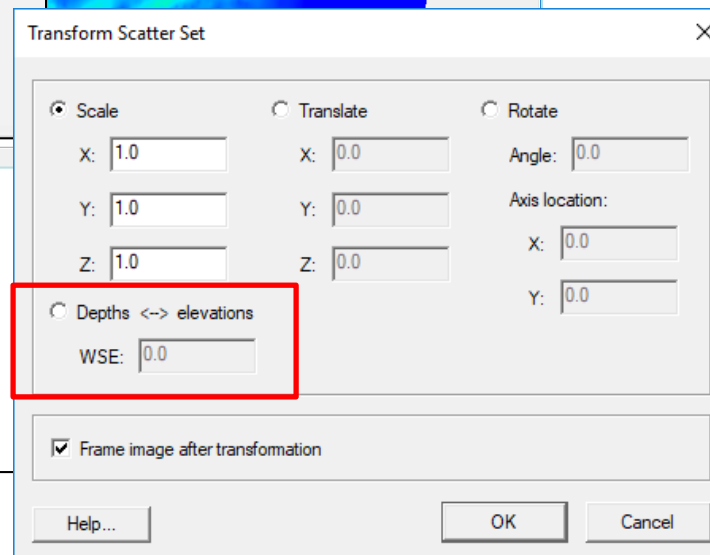


Converting Elevations to Depths (CMS Requirement)



Data → Transform

Can adjust scatterset data by scaling, translating (adding/subtracting), or rotating horizontal or vertical



Select Depths ↔ Elevations
Flips negative elevations to positive depths.
Necessary for CMS model calculation.

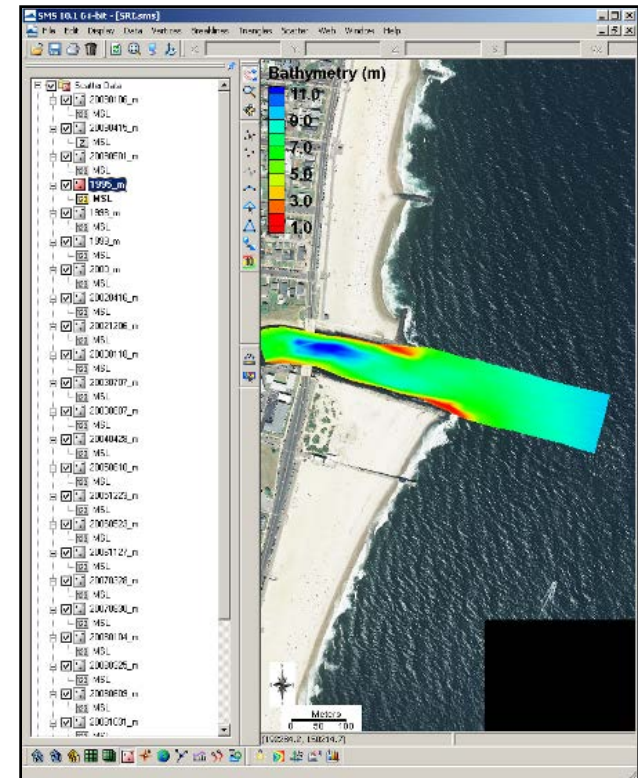


NAN Channel Surveys



15 Year Record of Bathymetry

Date	Survey Type	Date	Survey Type
1-Jan-1995	Condition	28-Mar-2007	Condition
6-Jan-1998	Condition	30-Aug-2007	Before Dredge
6-May-1999	Condition	4-Jan-2008	After Dredge
11-Apr-2000	Condition	25-Mar-2008	Condition
16-Apr-2002	Condition	9-Jun-2008	After Dredge
6-Dec-2002	Before Dredge	31-Oct-2008	After Dredge
18-Jan-2003	After Dredge	8-Dec-2008	Before Dredge
7-Jul-2003	Condition	6-Jan-2009	After Dredge
7-Aug-2003	After Dredge	15-Apr-2009	Before Dredge
28-Apr-2004	Condition	1-May-2009	After Dredge
10-Jun-2005	Condition	20-Aug-2009	Before Dredge
23-Dec-2005	After Dredge	10-Dec-2009	After Dredge
23-May-2006	Condition	6-Jan-2010	After Dredge
27-Nov-2006	Condition		



Horizontal Datum:

State Plane NAD27 New Jersey 2900 (ft)

Vertical Datum:

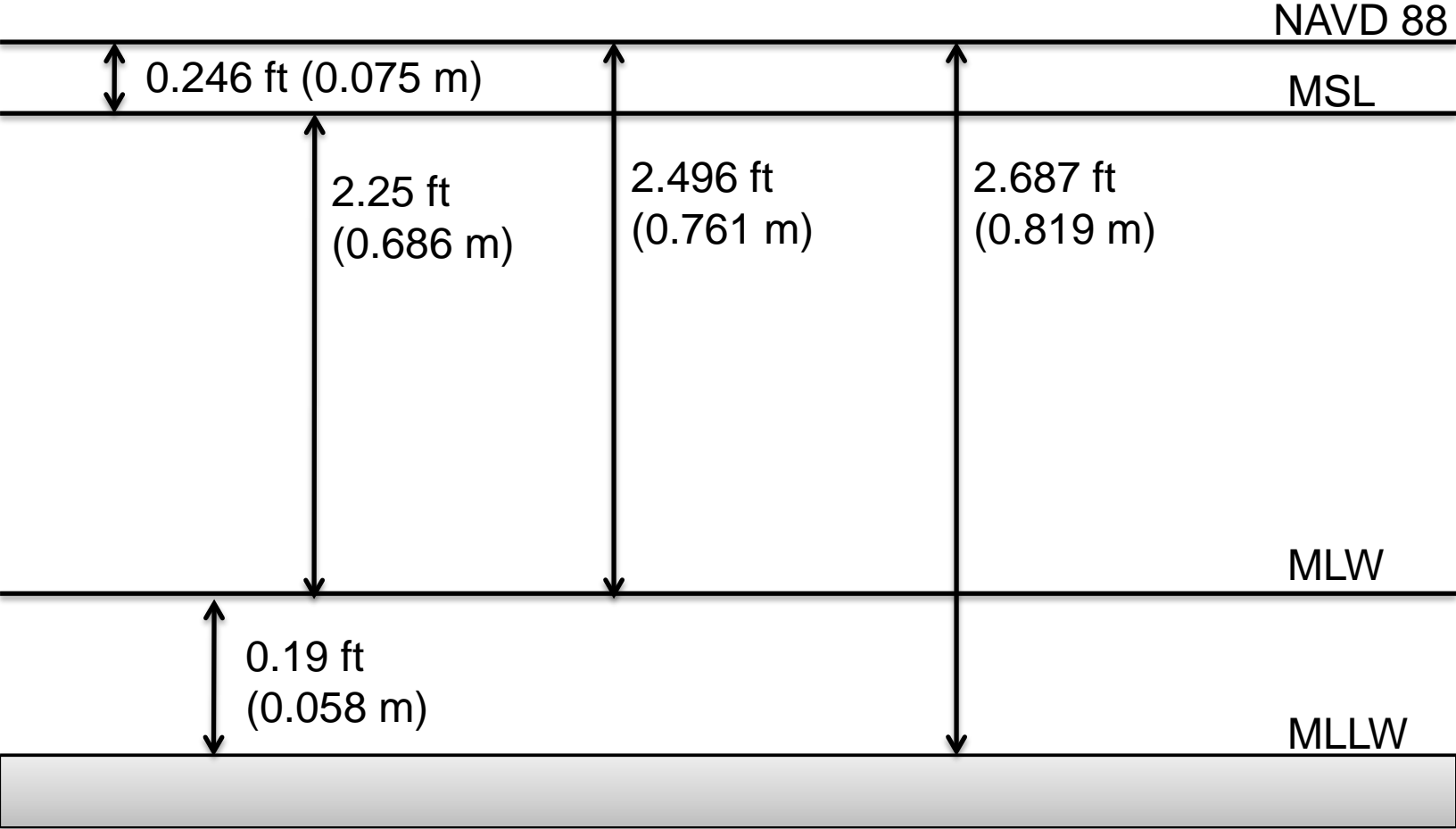
MLW (ft) – COE Datum (not local NOAA benchmark)



Vertical Datum Relationships



NOAA (Long Branch)

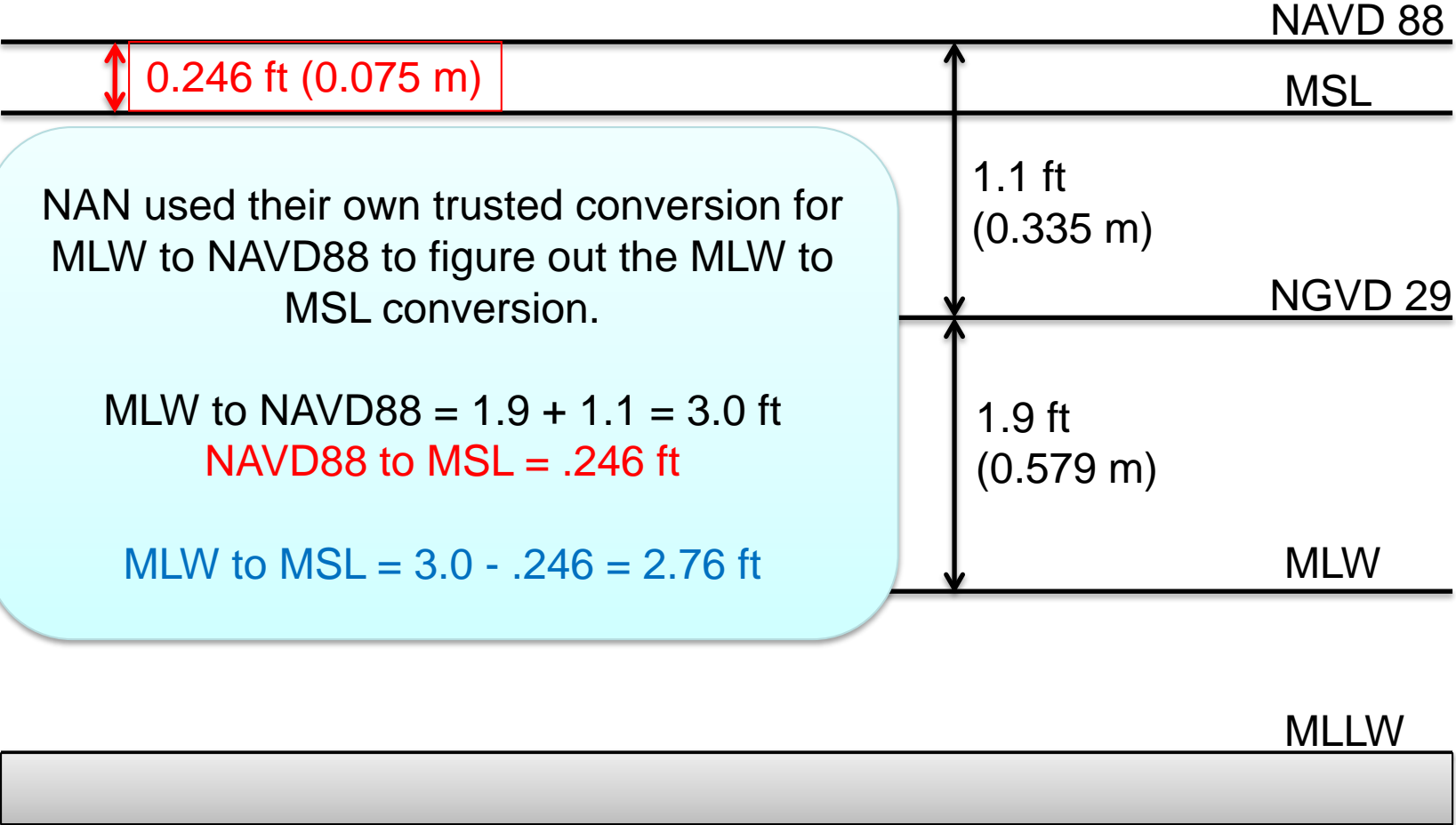




Vertical Datum Conversions



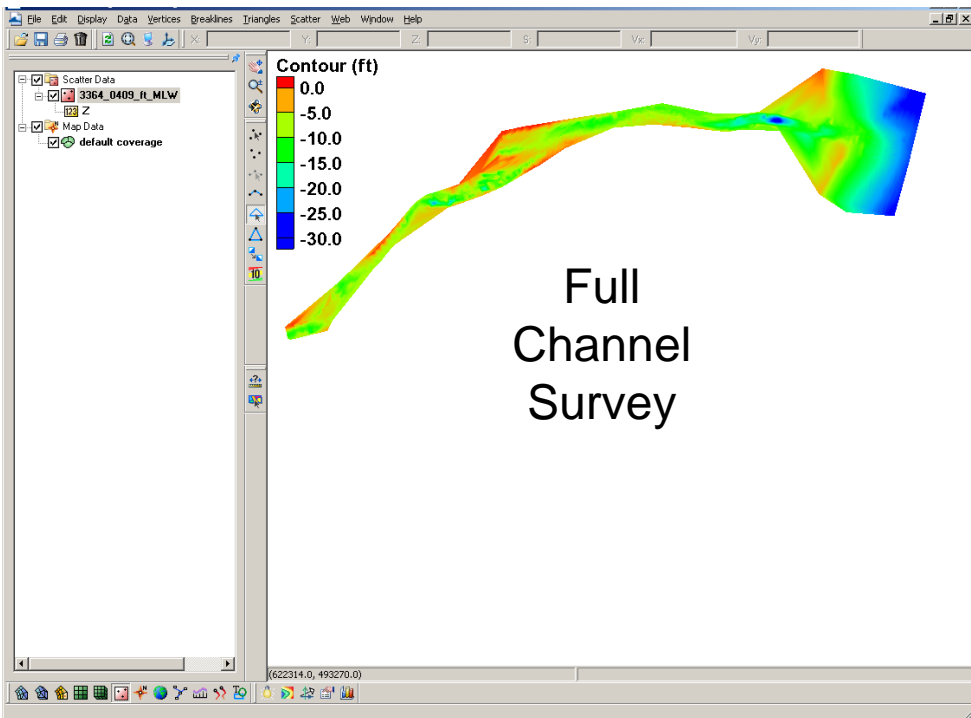
COE NAN Benchmarks



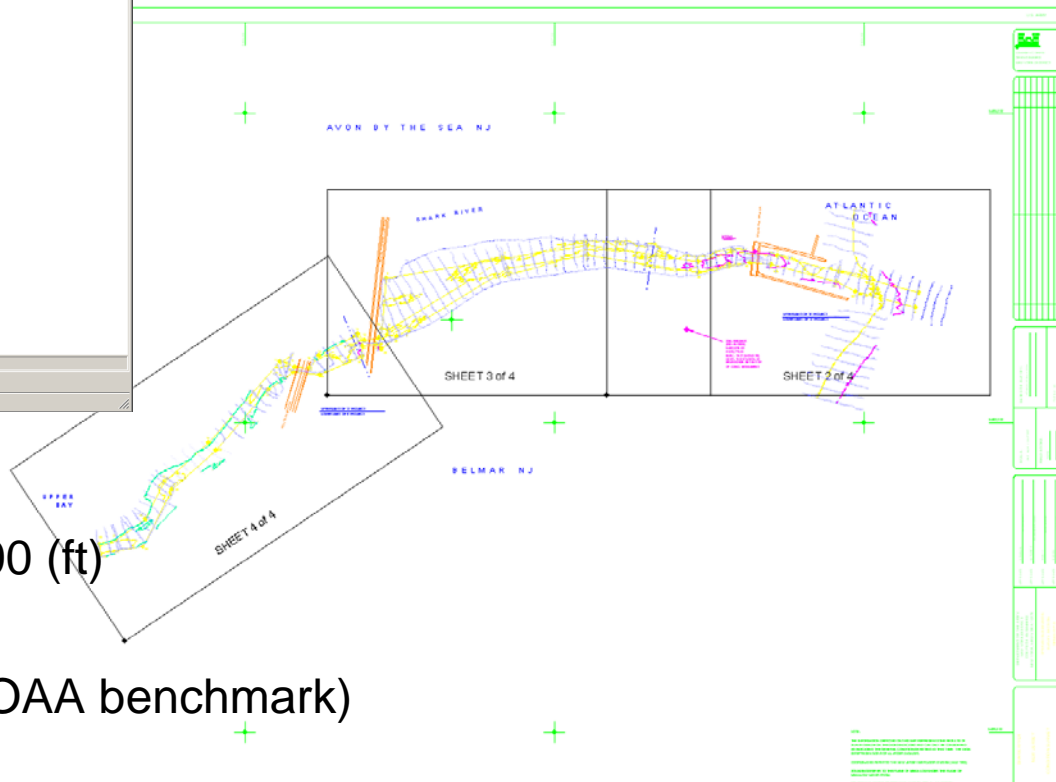


NAN Channel Surveys Extended in to Bay

CIRP



MLW → MSL
+ 2.76 ft (0.841 m)



Horizontal Datum:

State Plane NAD27 New Jersey 2900 (ft)

Vertical Datum:

MLW (ft) – COE Datum (not local NOAA benchmark)



Dataset Toolbox

Tools

- Math
 - Compare datasets
 - Data Calculator**
 - Angle convention
- Spatial
 - Smooth datasets
 - Geometry
 - Grid Spacing
- Temporal
 - Sample time steps
 - Merge datasets
- Conversion
 - Scalar to Vector
- Coastal
 - Wave Length and Celerity
 - Gravity Waves
- Modification
 - Map activity
 - Filter

Update Available Tools

Help...

Data Calculator

Data Sets

- 3364_0409_ft_MLW
 - d1. Z
 - d2. x location
 - d3. y location
 - d4. meters**

Add to Expression

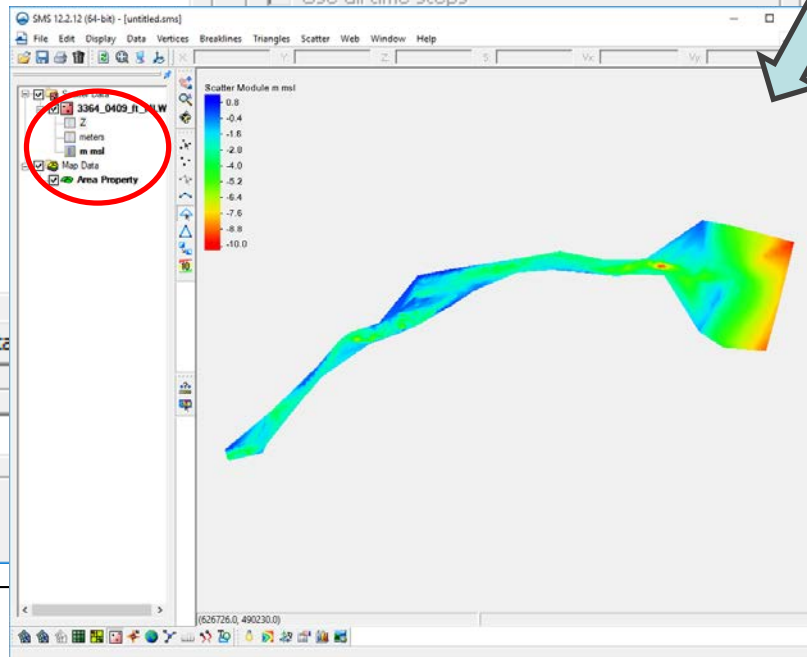
Data

Output dataset name: m msl

Time Steps

1. 0 00:00:00

Use all time steps

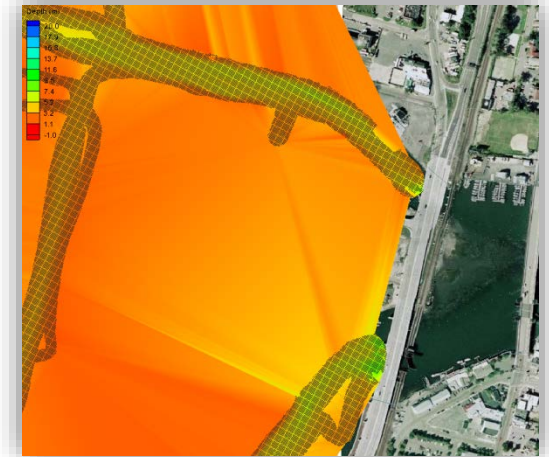




NJ DEP Channel Surveys

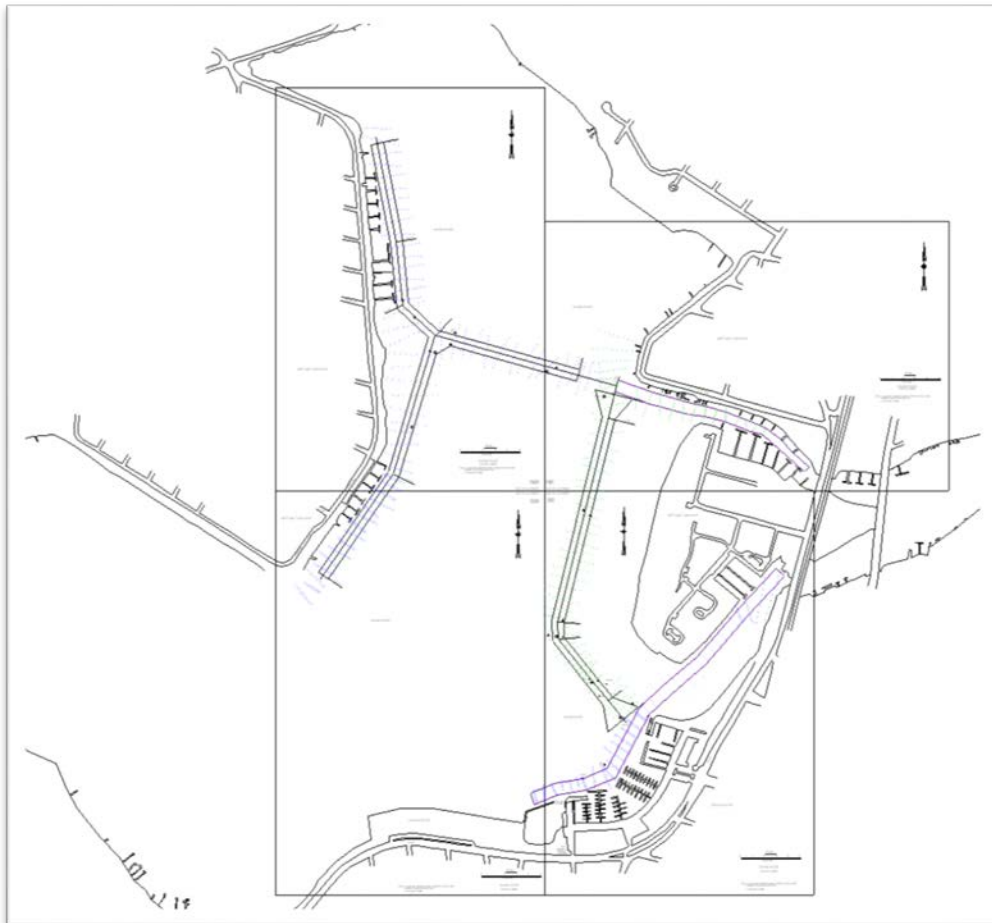
CIRP

June 2009
Survey



Provided conversion from local datum
to MSL:

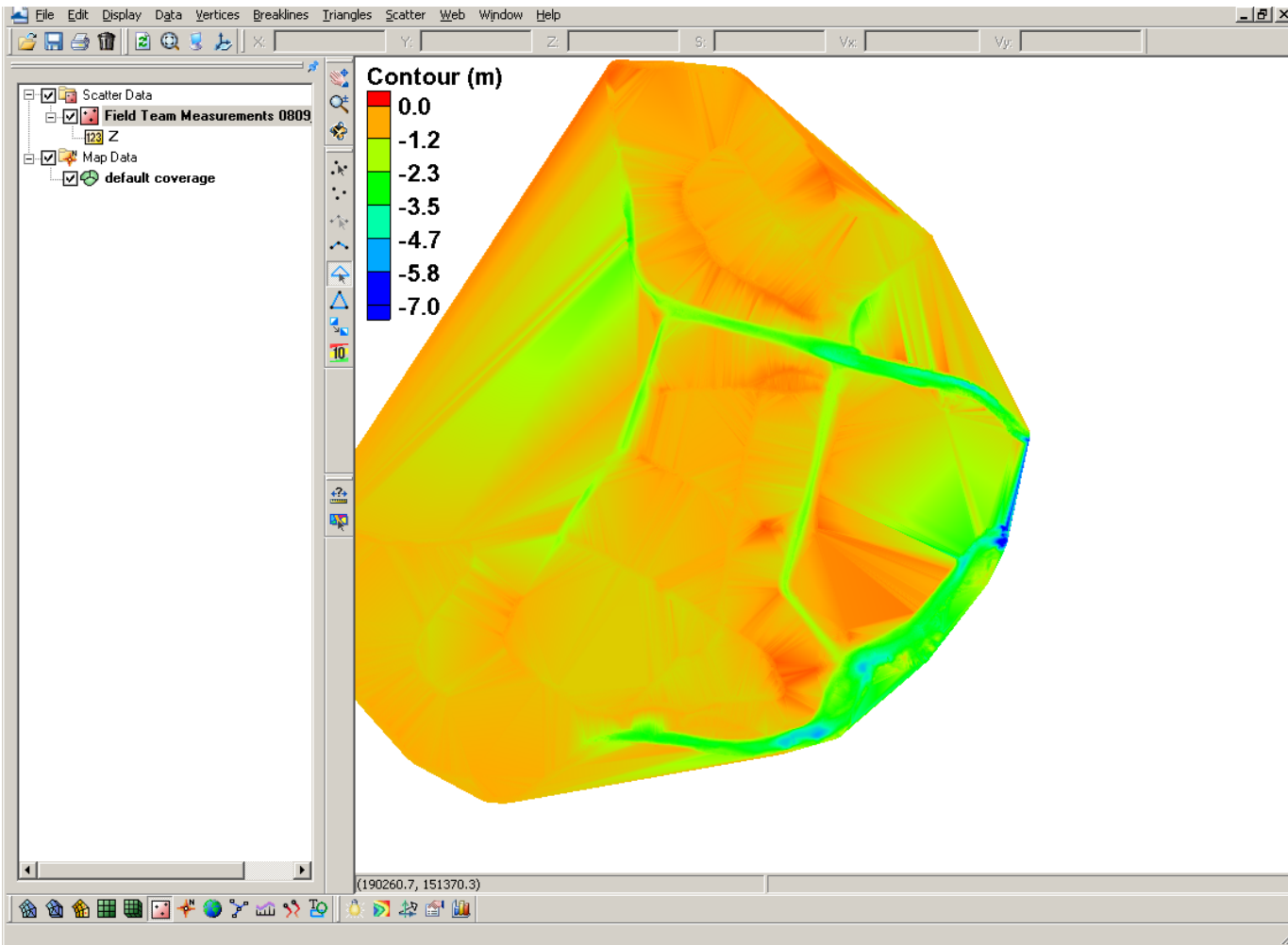
MLW \rightarrow MSL
+ 2.76 ft (0.841 m)



XYZ pulled out of drawing and
changed to ascii format



Field Data Collection – Multibeam Bay Bathymetry (August 2009)



Horizontal Datum:
State Plane
NAD83 New
Jersey 2900 (m)
Vertical Datum:
NAVD88 (m)



LIDAR

CIRP

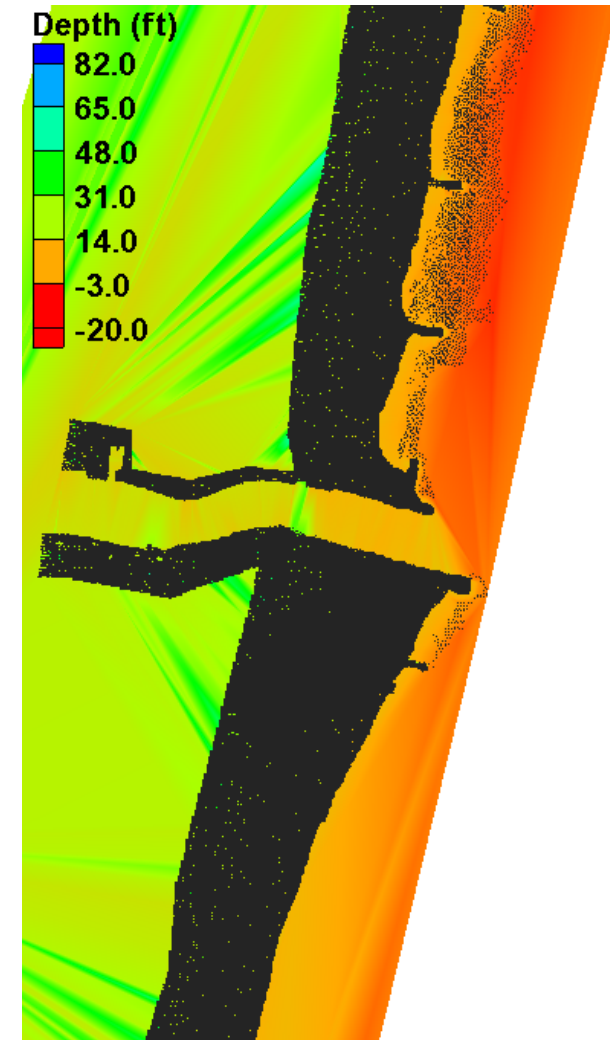
- Files are emailed in separate sections from the NOAA CSC Archive
 - Typically several to 10s of files that are 5 - 100 mb in size
- Compiling takes time
 - Points have been sampled/filtered and cropped to area of interest

Horizontal Datum:

State Plane NAD83 New Jersey 2900 (ft)

Vertical Datum:

NAVD88 (ft)





Coastal Relief Model (DTM/DEM)

CIRP

Bathymetry & Global Relief | ngdc.noaa.gov

NOAA NATIONAL GEOPHYSICAL DATA CENTER
NATIONAL OCEANOGRAPHIC AND ATMOSPHERIC ADMINISTRATION

NOAA > NESDIS > NGDC > MGGD > Marine Geology & Geophysics > Bathymetry & Relief

All MGG Coastal DEM Portal Fishing Global Lakes Multibeam NOS surveys

Bathymetry & Global Relief

Scientific stewardship, products, and services for ocean depth data and derived digital elevation models

Bathymetry (Ocean Depths)

- Bathymetric & Fishing Maps
- Great Lakes
- IHO Data Center for Digital Bathymetry (IHO DCDB)
- International Ocean Mapping Projects
- Multibeam Data
- NOS Hydrographic Survey Data
- Satellite-derived Data
- Trackline Data

Combined Bathymetry & Topography

- Coastal Relief & Tsunami Inundation
- Coastlines & Coastline Extractor
- Digital Elevation Model (DEM) Discovery Portal
- Global Relief (ETOPO1, ETOPO2, ETOPO5)

Topography (Land Elevations)

- All Topography
- Global Land 1-km Base Elevation Project (GLOBE)
- U.S. State images of 30-second Topographic Data
- Lidar Archive

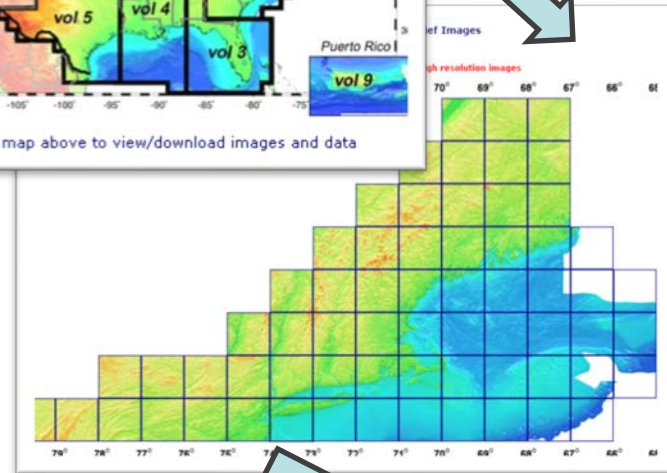
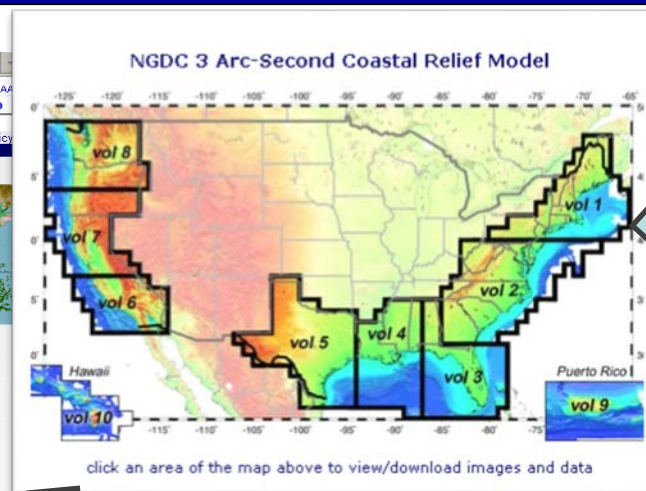
NGDC compiles, archives, and distributes bathymetric data from coastal and open ocean areas, including acting as the long-term archive for NOAA National Ocean Service (NOS) data collected in support of charting and navigation.

NGDC compiles the global ETOPO1 1-minute relief database, coastal relief models for US coastal areas, creates digital elevation models for tsunami inundation research, and stewards gridded topographic data from the GLOBE project.

NGDC participates in numerous international ocean mapping projects, and operates the International Hydrographic Organization (IHO) Data Center for Digital Bathymetry (IHO DCDB) on behalf of the member nations.

Questions: dem.info@noaa.gov

[NGDC Home](#) | [Contacts](#) | [Data](#) | [Disclaimers](#) | [Education](#) | [News](#) | [Privacy Policy](#) | [Site Map](#)



GEODAS Grid Translator - Design-a-Grid

Windows Macintosh UNIX-CE (Linux, OS/2, etc.) UNIX-BE (Sun, etc.)

Reset Submit Your Grid ID: (Create a clear identifier for Grid)

Grid Database:

Grid Area in degrees and minutes: Upper Latitude: Lower Latitude: Left Longitude: Right Longitude:

Grid Cell Size:

Number of Latitude Cells: Number of Longitude Cells:

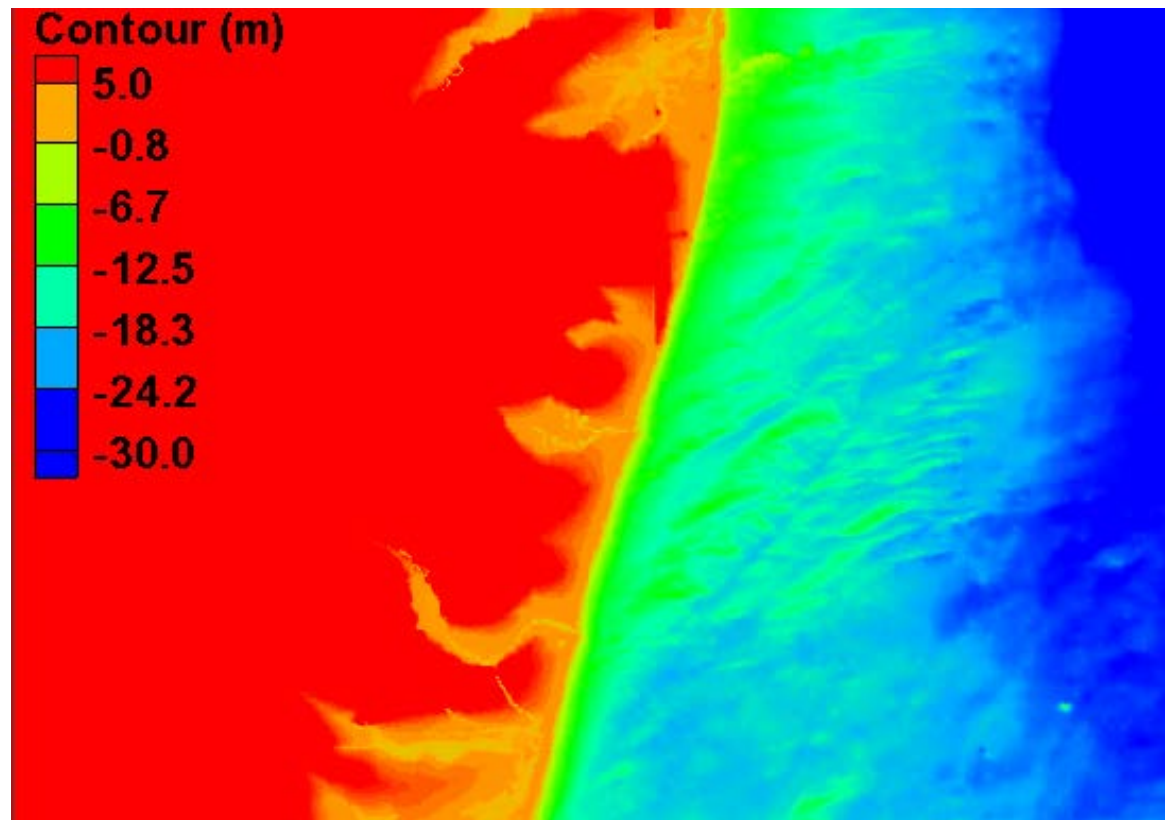
Grid Format: Output Grid Format: Binary Header Format ASCII Header Format XYZ (No,Lat,Depth) Output Grid Header: Space Tab Comma No Header Create Empty Grid Cells

Advanced menu fields

Generate a 3 sec
(pt/3rd second) grid



Coastal Relief Model



Horizontal Datum:

Geographic NAD83

Vertical Datum:

MSL (m) - Not accurate for shallow bathymetry (used for offshore)



Extra Bathymetry



- Convert shoreline shapefile in SMS

Horizontal Datum:

State Plane NAD83

New Jersey 2900 (ft)

- Added extra bay contour (set to -0.75 m)



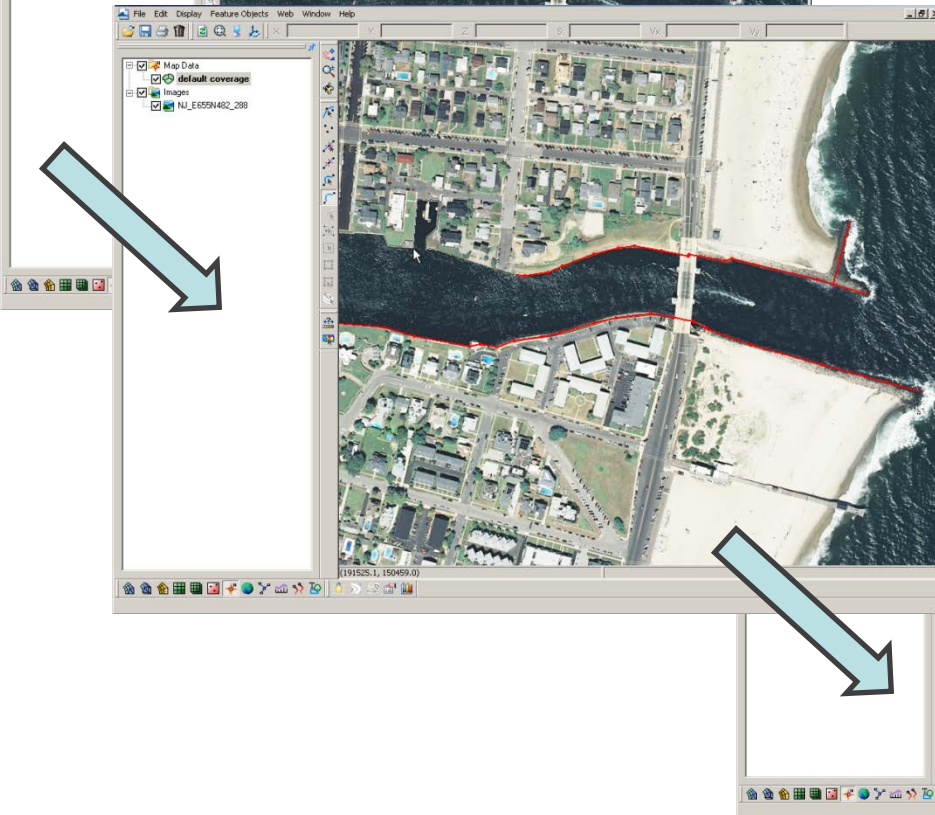


Create a Contour Polyline in the Map Module

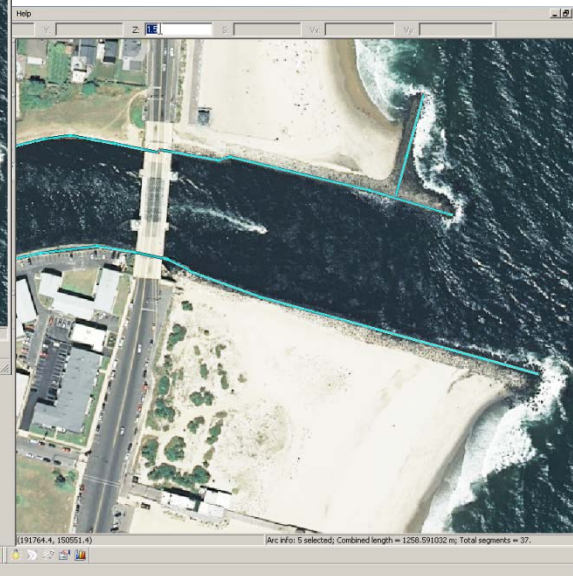
CIRP




Select Default Coverage under Map Data
Type → Generic → Mapping/Observation/Shoals



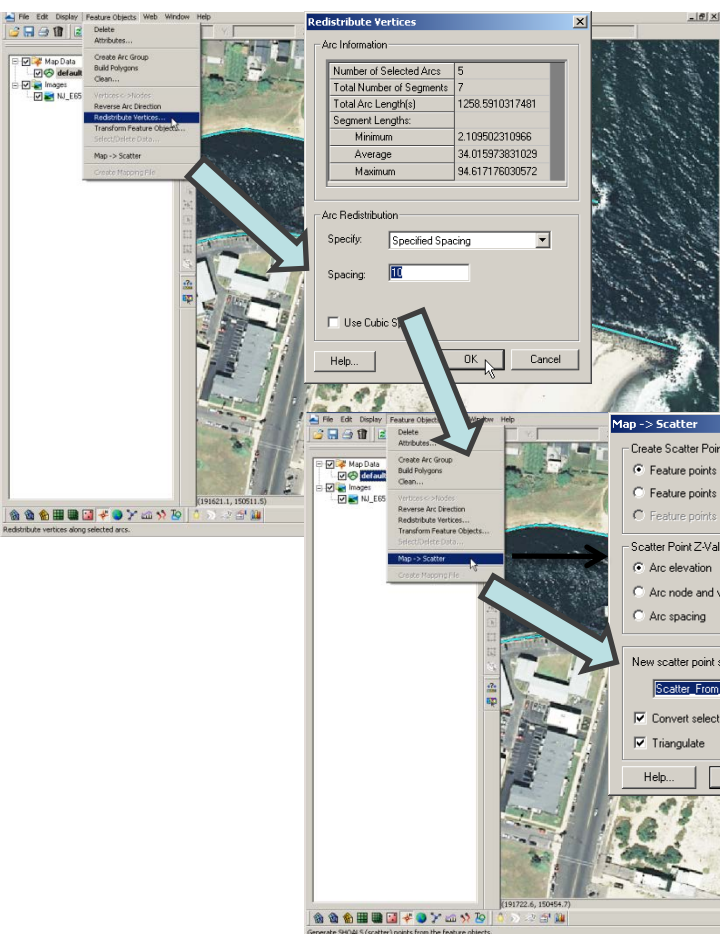
Draw arcs (polylines) feature
with  tool



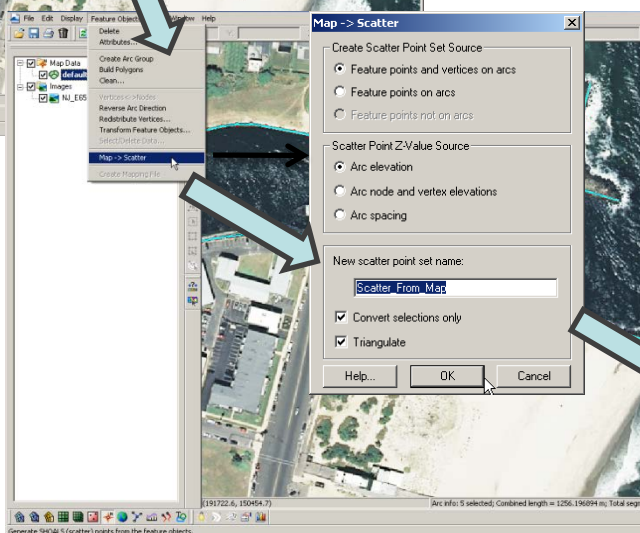
Select arcs 
and convert the z
elevation to the
desired contour
elevation



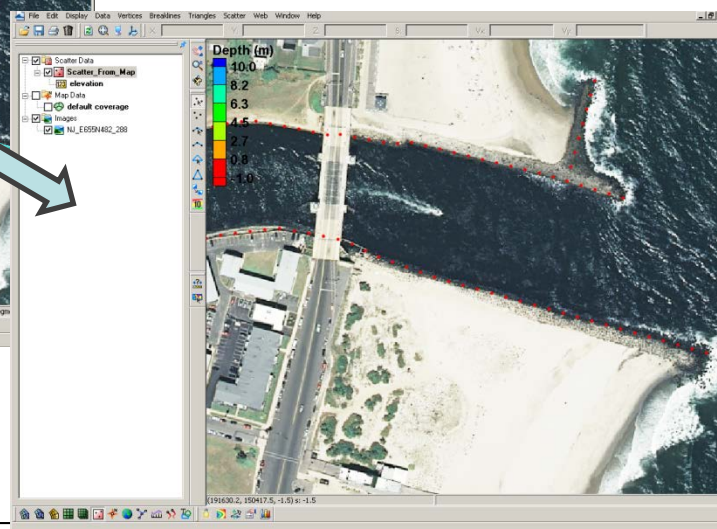
Create Scatterset Points from Map Data



Select arcs to redistribute the spacing of vertices
Feature Objects → Redistribute Vertices
Specify Spacing based on horizontal coordinate system units (metric in this case)



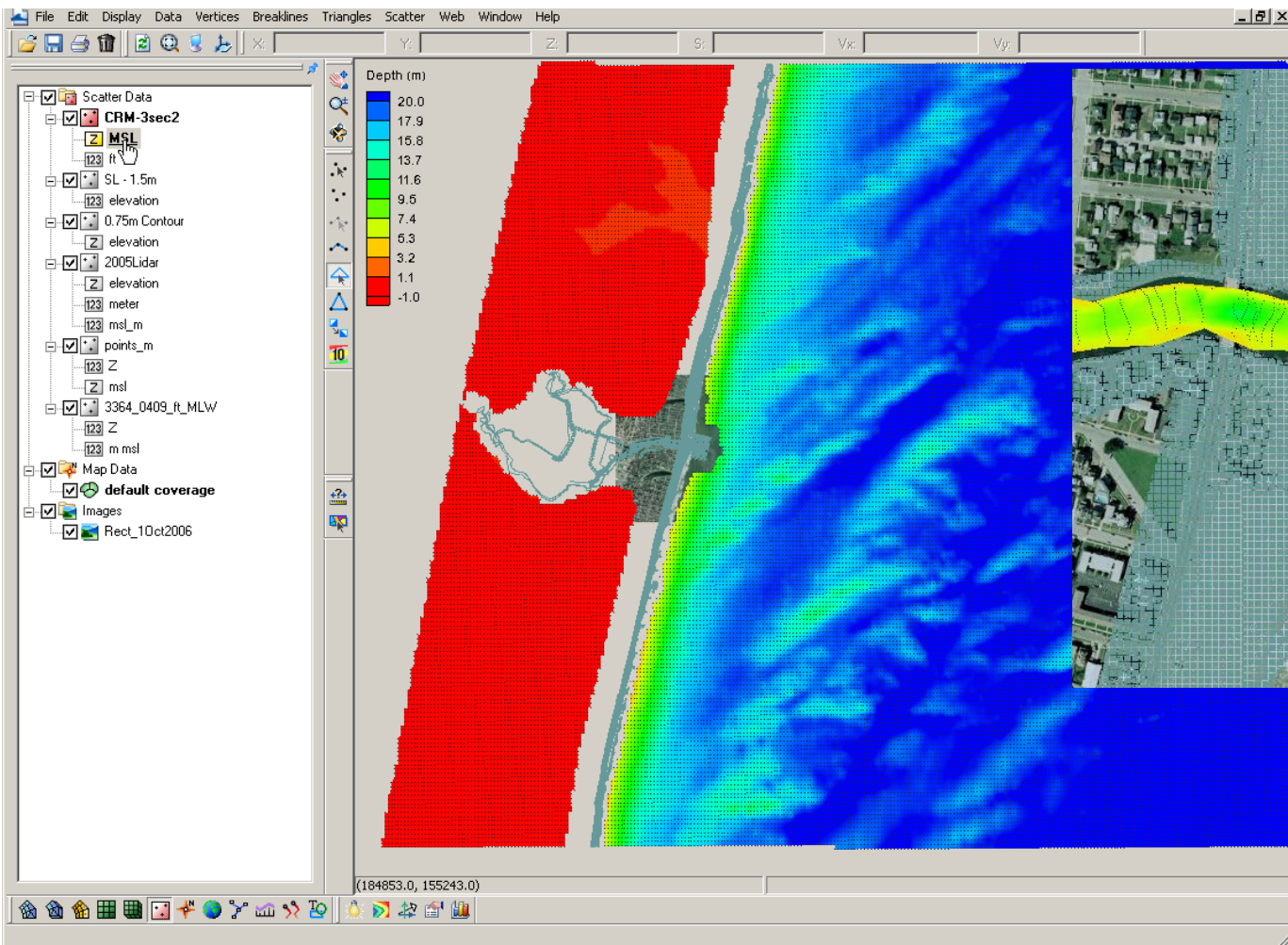
Feature Objects → Map>Scatter
Include Feature Pts and vertices
and the Arc Elevations





®

All Files Referenced to Same Horizontal and Vertical Datum



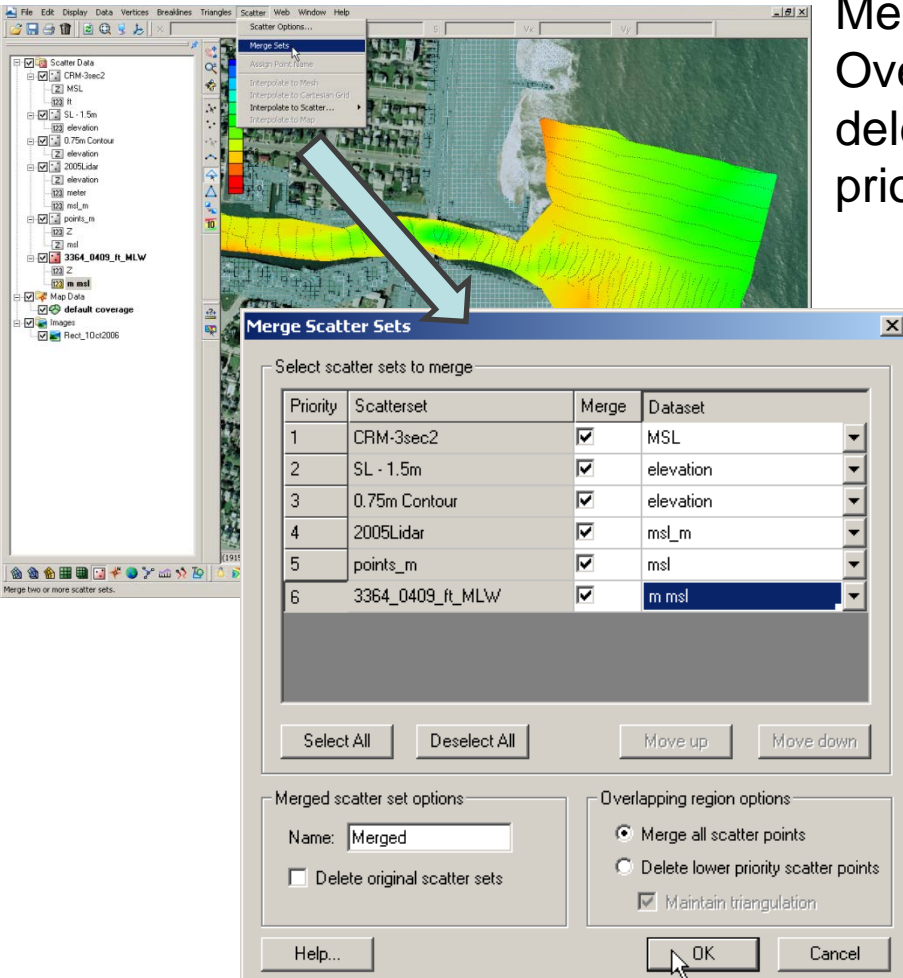
Delete unnecessary data points (check alignment and elevations in overlapping datasets)



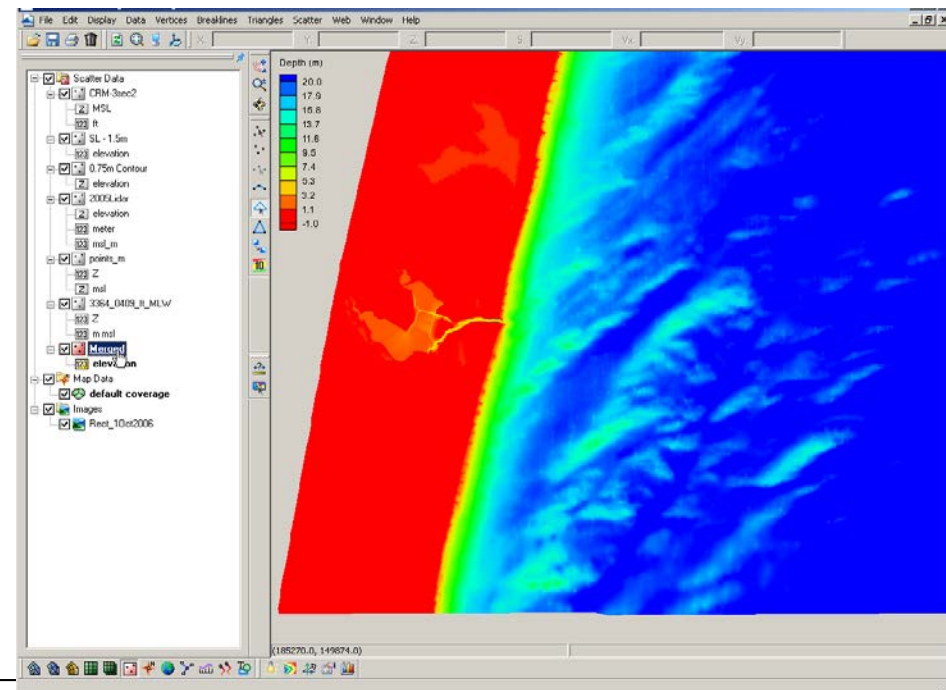
Merging Scattersets



Merging all scattersets will integrate all points. Overlapping areas of scattersets should either be deleted, or use a separate method of merging (by prioritizing using triangles).



Select the dataset





Questions?

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