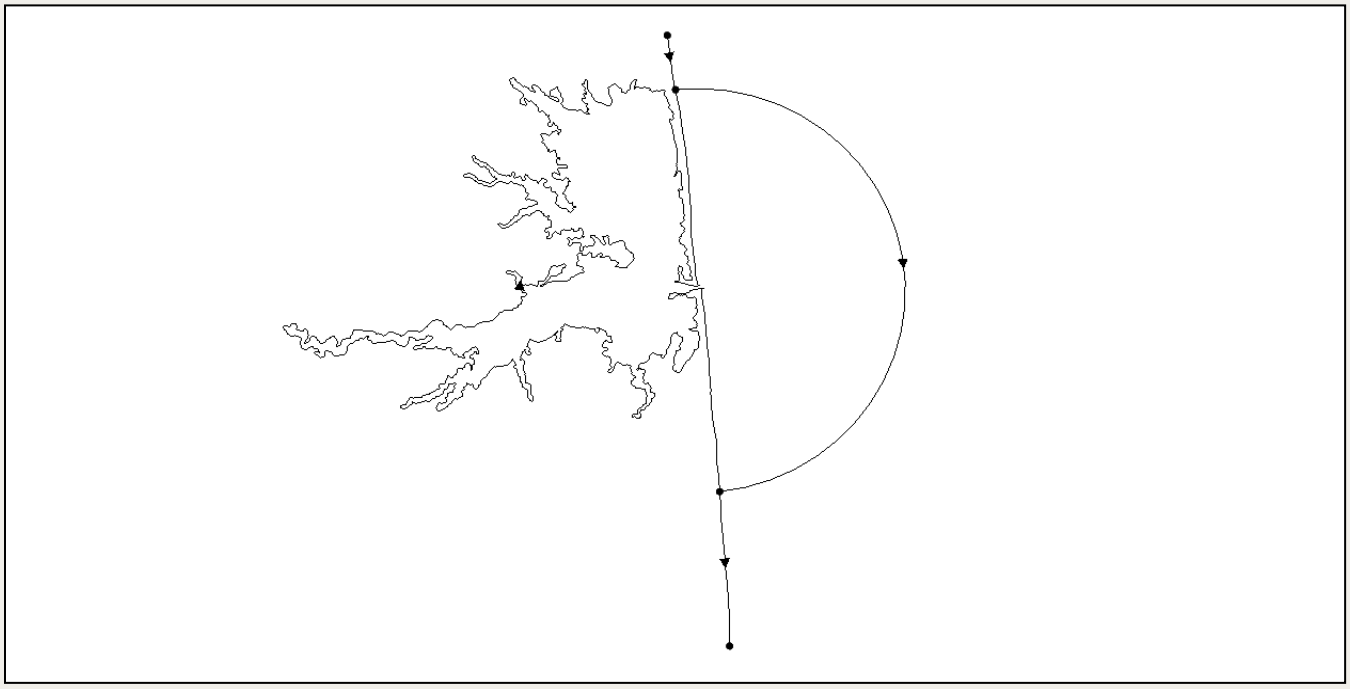
SMS 14.0 Tutorial

Simulation Domain



Objectives

This tutorial demonstrates how to generate a numeric model domain (polygon) for a coastal application.

Prerequisite Tutorials

- Overview
- Map Module
- Raster
- Background Data

Required Components

- SMS Core

Time

- 15–20 minutes

AQUAVEO™

1 Introduction

This exercise illustrates how to define a polygon which bounds the area for a numeric simulation. This polygon can be referred to as the domain. On the land side of a coastal model, this boundary is often defined by a coastline or line of maximum potential inundation in a flooding study.

This exercise extracts a coastline from a DEM, cleans up the coastline and creates the other boundaries of the simulation polygon.

This exercise utilizes data from the region around Indian River Inlet located on Delmarva Peninsula along the Maryland coast between Delaware Bay and Chesapeake Bay.

2 Getting Started

Start by importing a project file containing an existing mesh:

1. Launch the SMS application.
2. From the *Menu* bar, select the *File* | **Open…** menu item to bring up the *Open* dialog.
3. Navigate to the *Exercises/Indian River* folder.
4. From the *Files of type* drop-down menu, select "Project Files (*.sms)".
5. Select the "IR_background.sms" file.
6. Click the **Open** button to import the project and exit the *Open* dialog.

The initial project should appear similar to Figure 1.

 © Aquaveo 2026

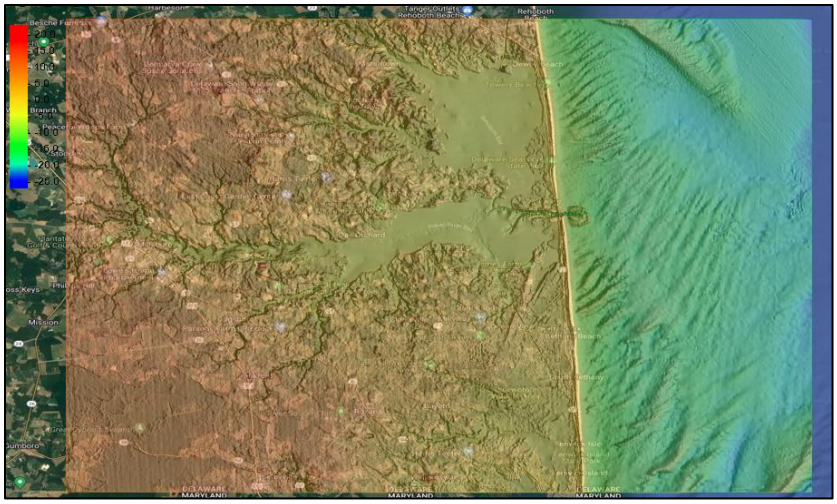


Figure 1: Initial Project

3 Extracting a Coastline

Coastline definitions are stored in *SMS* as GIS arcs or feature objects. They can be created in a number of ways. They may come from existing models, they may be digitized interactively from an aerial photo or topographic chart, they may be created from topographic surveys in *SMS*, or they may be extracted from coastline databases.

This exercise will illustrate the extraction of coastline data from a DEM. It will also illustrate how to edit coastlines and combine them with other features to define the simulation domain polygon.

A high-resolution DEM, obtained from NOAA, was included in the initial project. To extract a coastline from this DEM:

1. In the *Project Explorer,* under the "GIS Data" folder, turn off the "Google Hybrid" image checkbox to reduce clutter.
2. Right-click on the "IR_Inlet_DEM_2015.tif" image and select the *Convert To* | **Feature Contours at Elevation** context menu item. The *Contours from Single Raster Value* dialog opens.
3. Note: This tool can also be accessed directly from the toolbox.
4. For the *Input raster*, select the "GIS Data/IR_Inlet_DEM_2015.tif" drop-down menu item.
5. Set the *Contour Value* to "0.00".
6. For the *Output coverage* value, enter "MSL".
7. Click the **OK** button to run the tool and open the *Status* dialog.
8. Review the messages in the log and then click the **OK** button to close the *Status* dialog.
9. In the *Project Explorer,* under the "Map Data" folder, click on the new "MSL" coverage that was just created to make it active. This is shown in Figure 2.

© Aquaveo 2026

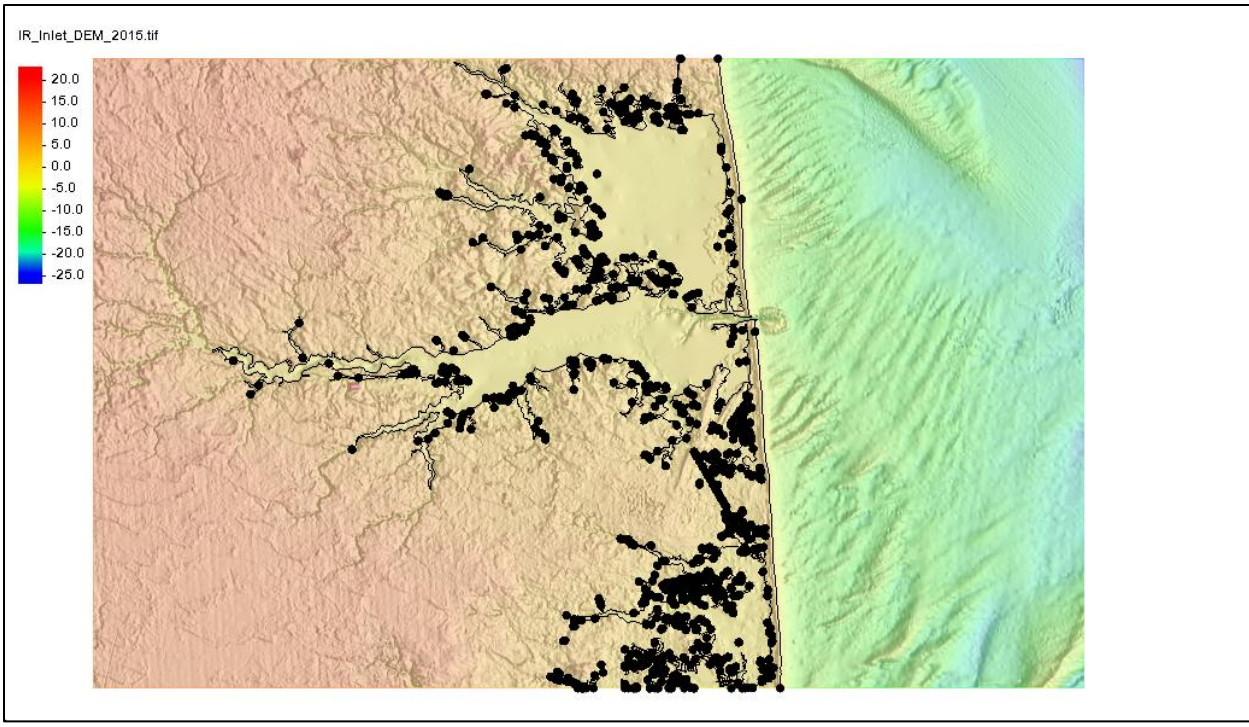


Figure 2: Extracted Coastline

SMS will create feature arcs along the 0.00-meter contour in the DEM. This will include the transition from negative to positive depths wherever they are including on the coast, in the bay, around islands in the bay and depressions upstream from the bay.

4 Cleaning the Coastline

Now that the coastline has been extracted from the DEM, we'll clean up the result and prepare them to be used as the coastline around the area of interest.

For this study, we are evaluating the circulation into and out of the Indian River Inlet. The extracted features include not only the principal coastline, but also the islands inside the bay and puddles or depressions landward of the bay. The islands may impact circulation patterns, but trying to represent their coastal shapes accurately can be a huge job. Their elevations will be applied to the resulting mesh, so for now we want to remove all the islands and puddles. In a real study, you would have to determine which islands to represent as land masses and leave those as holes in the domain.

We will use several tools to clean up the coastline.

4.1 Deleting the Islands and Puddles

To remove islands and puddles, we will select them and delete them. Follow the steps below to delete these arcs:

1. In the *Project Explorer,* on the new "MSL" coverage, right-click and select the **Duplicate** context menu item.
2. On the "MSL (2)" coverage, right-click and select the **Rename** context menu item and rename the coverage to "IR domain". This copy we will clean up.

 © Aquaveo 2026

3. Turn off the "MSL" coverage checkbox to simplify the display.
4. Select the "IR domain" coverage to make it active.
5. From the *Menu* bar, select *Display* | **Display Options…** to open the *Display Options* window.
6. From the list on the left, select the "Map" item.
7. Confirm that the *Point/Node* and *Arc* checkboxes are toggled on.
8. Click the **OK** button to close the *Display Options* dialog.

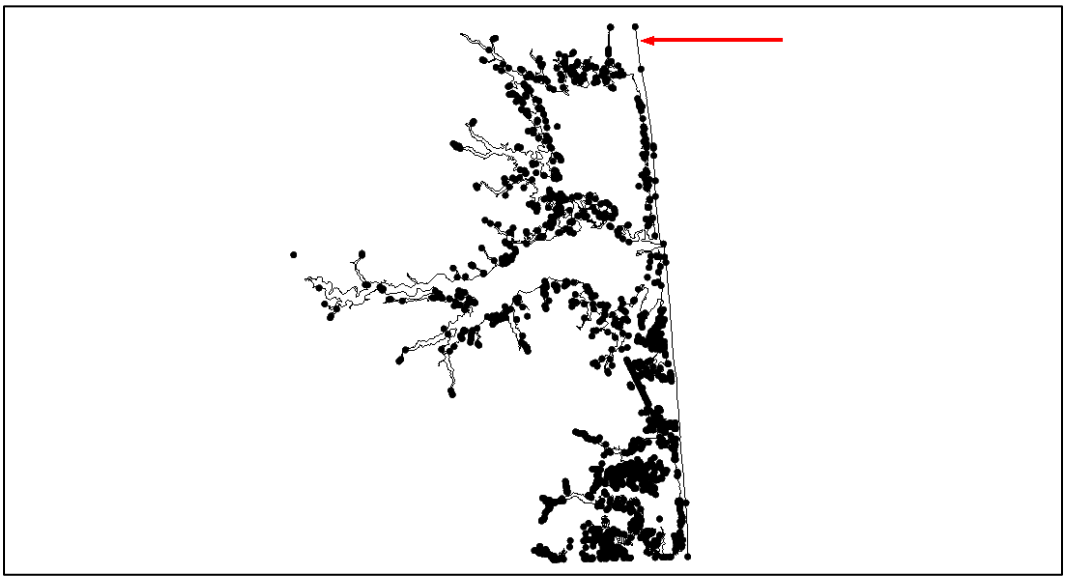


Figure 3: Selecting the Coastline

1. From the *Dynamic* Toolbar, select the **Select Feature Arc** tool,
2. In the *Graphics Window,* click on the north end of the coastline arc. This is the top, right arc as shown in Figure 3. The display will be updated to highlight this arc. It should go all the way around the bay and extend to the south end of the data.
3. In the *Graphics Window,* right-click anywhere and select the **Invert Selection** context menu item. Now all the arcs except the main coastline are selected.
4. From the *Keyboard*, press the **Delete** key to tell SMS to delete the selected arcs. A confirmation dialog will appear.
5. Click the **Yes** button to confirm the deletion.

This results in a single arc representing the coastline.

4.2 "Pruning" Narrow Inlet Branches

When generating a mesh, headlands that extend into the computational domain should be preserved since they can affect circulation in the model. However, small channels that extend inland do not carry enough flow to be of importance. To remove the narrow inlets, but maintain the headlands, we will use the "Prune" tool.

1. From the *Menu* bar, select the *Display* | **Display Options…** menu item to open the *Display Options* window.

© Aquaveo 2026

2. From the list on the left, select the *Map* item, if it isn't already selected.
3. In the options section on the right, toggle on the *Annotations* checkbox .
4. Next to the *Annotations* checkbox, click on the **Options…** button to open the *Arc Annotation Options* dialog.
5. In the *Direction* section, turn on the *Show arc direction arrow* checkbox.
6. Click the **OK** button to close the *Arc Annotation Options* dialog.
7. Click the **OK** button to close the *Display Options* dialog.
8. You will now see an arrowhead on the coastline arc denoting the direction. Zoom in to it discover which side of the arc represents "land". You will note that the land coastline goes from North to South so land is on the right.
9. From the *Dynamic Toolbar*, select the *Select Feature Arcs* tool to make it active.
10. In the *Graphics Window*, select the arc.
11. In the *Graphics Window*, right-click and select the **Prune arc(s)…** context menu item. The *Prune Arcs* dialog will appear.
12. Verify that the *Feature width type* option is set to "Constant".
13. Set the *Side to be pruned* option to "Right" (prune on the land side)
14. For the *Width* option, enter "100". The *Prune Arcs* dialog should now look similar to Figure 4.
15. Click the **OK** button to perform the prune operation. (Note: this may take a minute.)

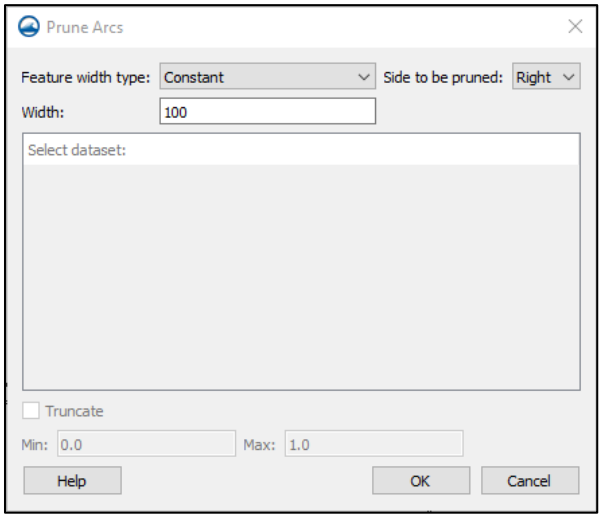


Figure 4: The Prune Arcs Dialog

You may want to zoom to different regions of the domain and toggle the "MSL" and "IR domain" coverages on and off to compare the two coverages to see what has been deleted and pruned. You can note islands and puddles that were deleted as well as narrow inlets. (You can also go into *Display Options* and enable the option to display inactive coverages so that both coverages can be displayed at the same time.)

Notes on pruning:

- The pruning tool does not function on single arcs that close in a loop. To apply pruning to a loop, split that arc into two.

© Aquaveo 2026

- The *Width* value is subjective. In this case we removed all inlets less than 100 meters wide.
- In addition to constant pruning, the pruning can be guided by a spacing function similar to scalar paving. Refer to the *Size Function* tutorial for information on how to create a scatter set for this purpose.

5 Defining the Domain Polygon

We will first finish defining the domain by creating a feature arc to enclose the region to be modeled. This consists of creating an arc that connects the two extreme ends of the coastline with a path out into the ocean.

ADCIRC does not require any specific boundary shape. You could create an arc to define the offshore edge of the domain manually using any shape. A semicircular or rectangular ocean section often makes sense, and SMS includes a tool to create these arcs. Figure 5 shows a circle of 10 km radius superimposed over the coastline extracted above. An arc that follows the seaward half of this circle would close the domain polygon and stay inside the extents of the DEM.

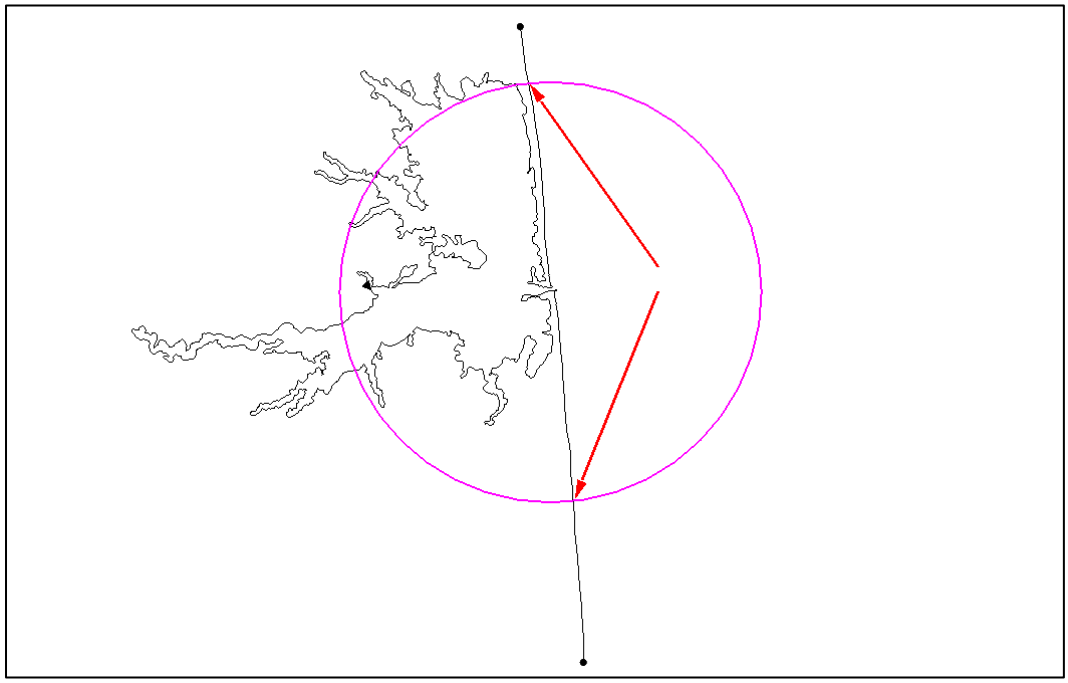


Figure 5: Circle with 10 km Radius Identifying Extreme Edges of the Coastline

To create a semi-circle:

1. In the *Project Explorer,* click on the "  IR domain" coverage to make it active.
2. From the *Dynamic Toolbar,* select the **Select Feature Vertex**  tool.
3. Iin the *Graphics Window,* select two vertices near where the displayed circle intersects the main coastline. This can be done by clicking on them while holding down the *Shift* key. Use Figure 5 as a guide but note that the specific location is not important.
4. Iin the *Graphics Window,* right-click anywhere and select the **Define Domain** context menu item from the menu to open the *Domain Options* dialog.

© Aquaveo 2026

5. In the *Domain* Type section, select the *Semi-circular* radio button option.
6. Click the **OK** button to generate the ocean boundary. The display in SMS should now look like Figure 6 below.

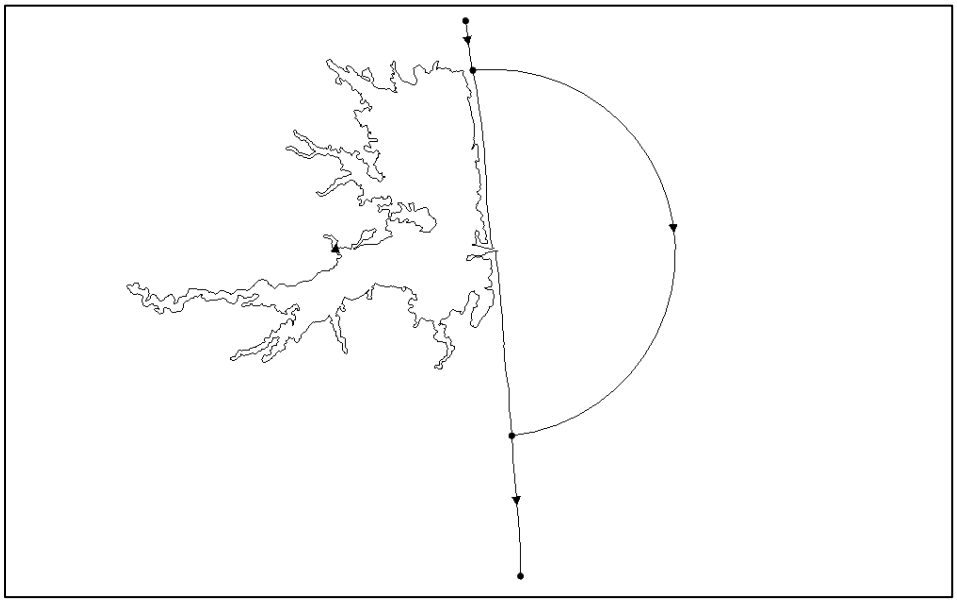


Figure 6: Model Domain With Ocean Boundary Feature Arc.

Notes:

- The semi-circle boundary is created on the left side of the selected arc. If the arc is oriented the other way, it can be reversed or the define domain option to use the other side is available.
- This coverage includes extensions of the coastline above and below the domain. These can be left alone or deleted based on individual preference.

6 Saving the Project

To save the project to this point:

1. From the *Menu* bar, select the *File* | **Save As...** menu item to open the *Save As* dialog.
2. Navigate to the Exercises/Indian River/work folder.
3. For the *File name,* enter "IR_domain.sms".
4. Click the **Save** button to save the file and close the *Save As* dialog.

© Aquaveo 2026

7 Conclusion

This concludes the Simulation Domain exercise. Several features have been demonstrated including:

- Arc extraction from DEM contours.
- Arc pruning.
- Arc selection and deletion.
- Arc creation using the *Create Domain* tool.
- Arc offsetting

If time permits, you may wish to try experimenting with:

- Extracting arcs at other contour values. A positive value would move the arc inland to allow for flooding. A negative value would move the arc seaward to simplify the hydraulics.
- Use other options/values for pruning. You may investigate pruning to the left instead of the right, using a larger or smaller pruning value, or using a spatially varied pruning value.
- Explore other options for domain creation. You could try a rectangle, or digitize in an ocean arc by hand.

© Aquaveo 2026