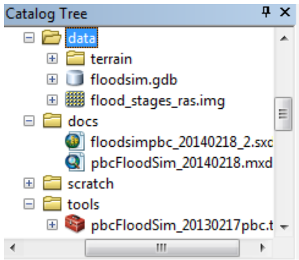
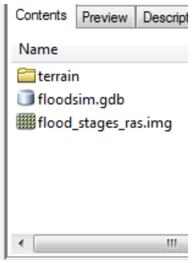
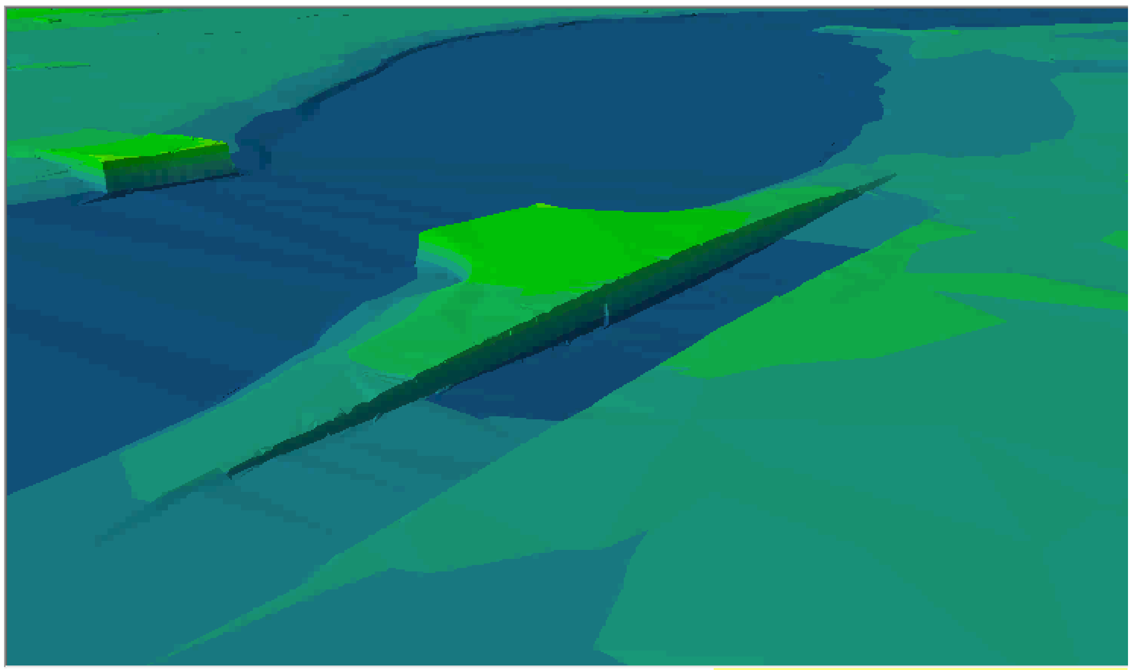
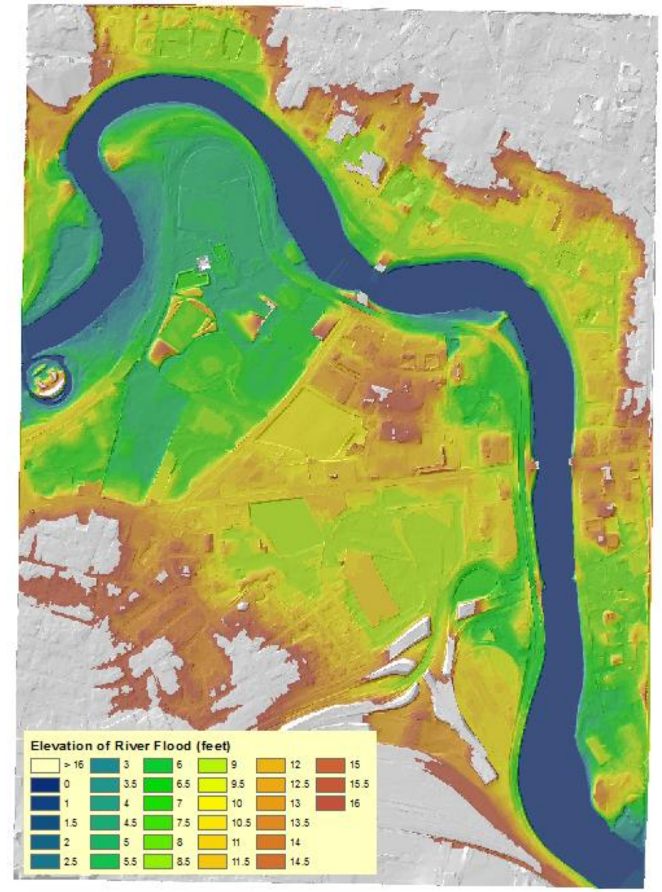
River Flood Simulation









Click to play video.

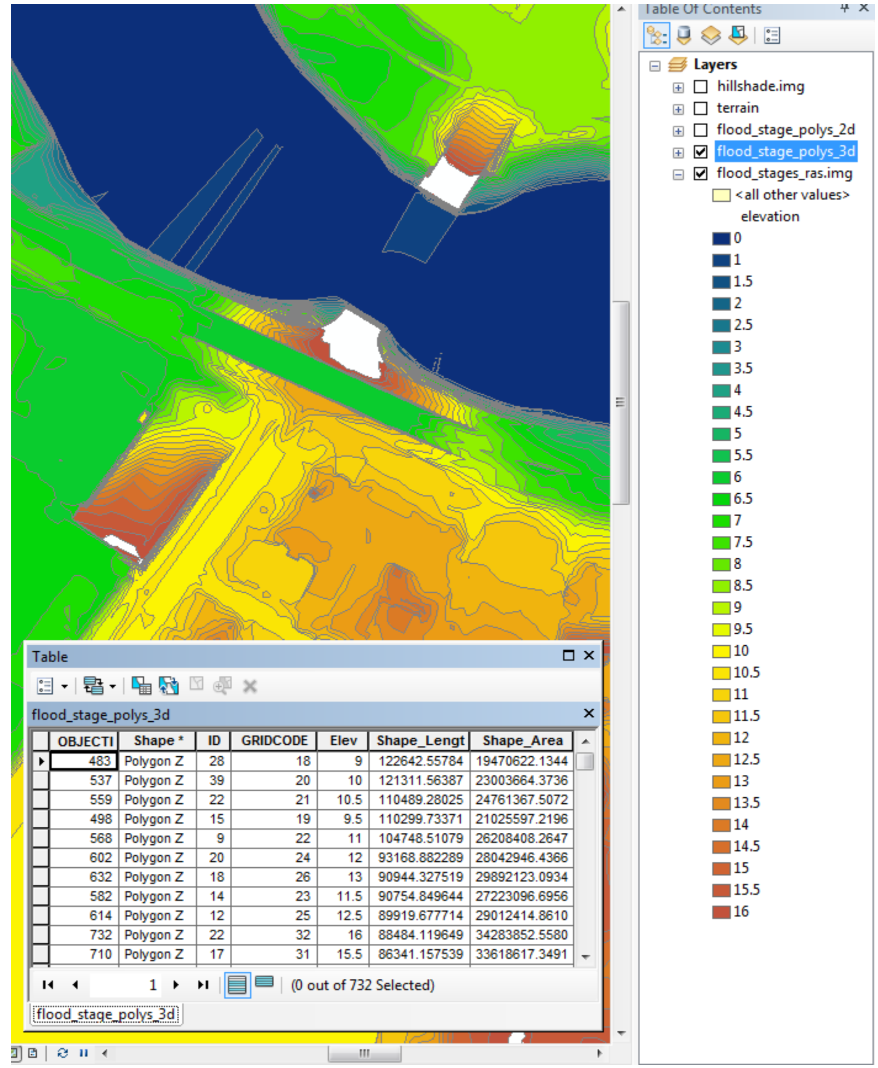
Flood Simulation Objective

Develop estimated flood stage polygons that estimate the extent of inundated areas as the Charles River rises in half-foot increments.

The source of water for this flood is assumed to be the river. Land area remains dry until connected to the river by the flood. Depressions are not filled until water rises above intervening landforms.

The attribute table for the polygon layer is shown on the right. The Elevatioon field denotes the height of the water at each flood stage.

2D and 3D feature classes were produced.



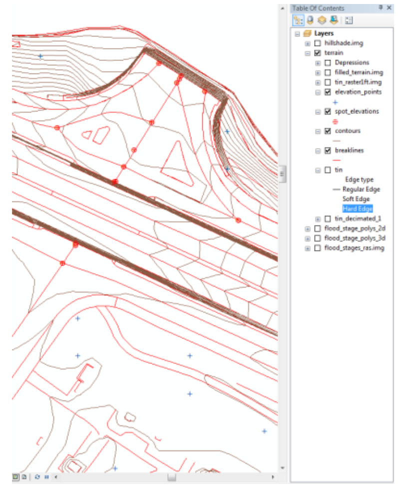
OBJECTI	Shape *	ID	GRIDCODE	Elev	Shape_Lengt	Shape_Area
483	Polygon Z	28	18	9	122642.55784	19470622.1344
537	Polygon Z	39	20	10	121311.56387	23003664.3736
559	Polygon Z	22	21	10.5	110489.28025	24761367.5072
498	Polygon Z	15	19	9.5	110299.73371	21025597.2196
568	Polygon Z	9	22	11	104748.51079	26208408.2647
602	Polygon Z	20	24	12	93168.882289	28042946.4366
632	Polygon Z	18	26	13	90944.327519	29892123.0934
582	Polygon Z	14	23	11.5	90754.849644	27223096.6956
614	Polygon Z	12	25	12.5	89919.677714	29012414.8610
732	Polygon Z	22	32	16	88484.119649	34283852.5580
710	Polygon Z	17	31	15.5	86341.157539	33618617.3491

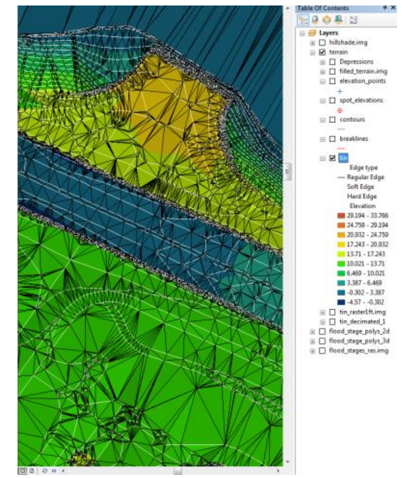
Surface Development

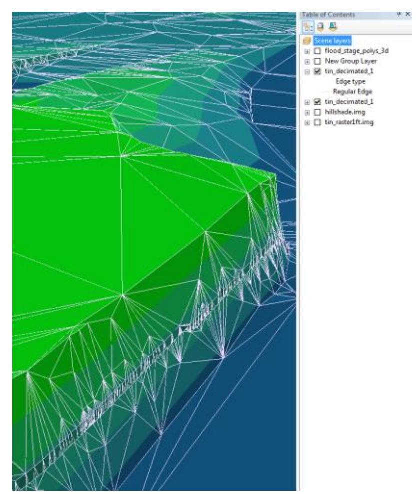
All of the estimations are based on a survey provided by the client. The data are based on a 2010 photogrametric survey conducted by InfoTech. According to their documentation, their elevations are based on the North American Vertical Datum of 1988.

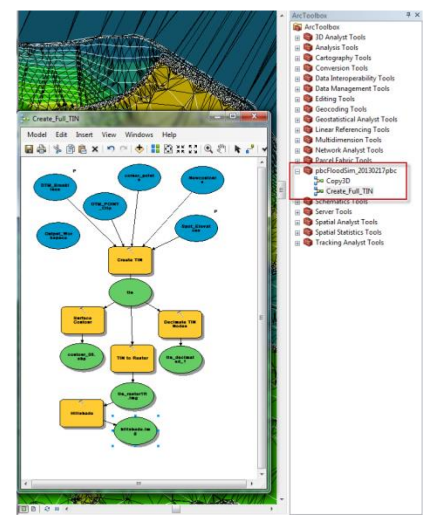
Masspoints, Spot Elevations Contours and Breaklines were intepolated using the ESRI CreateTIN tool. The TIN was converted to a raster with a 1 Foot cell resolution.

The procedure is recorded in the CreateFullTin model provided in the Tools Folder.







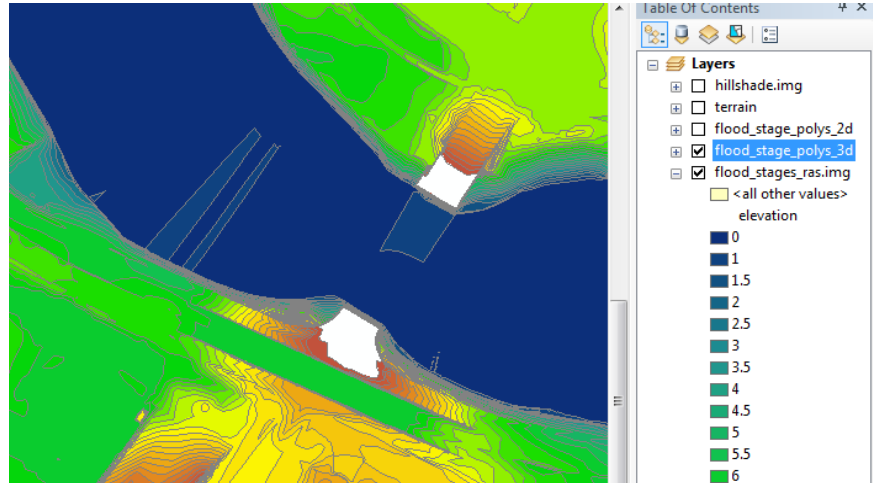


Flood Model

The model begins by locating the areas of the terrain surface that to not drain into the river. These areas do not flood until they are connected to the river by the flood.

Masspoints, Spot Elevations Contours and Breaklines were intepolated using the ESRI CreateTIN tool. The TIN was converted to a raster with a 1 Foot cell resolution.

The procedure is recorded in the CreateFullTin model provided in the Tools Folder.



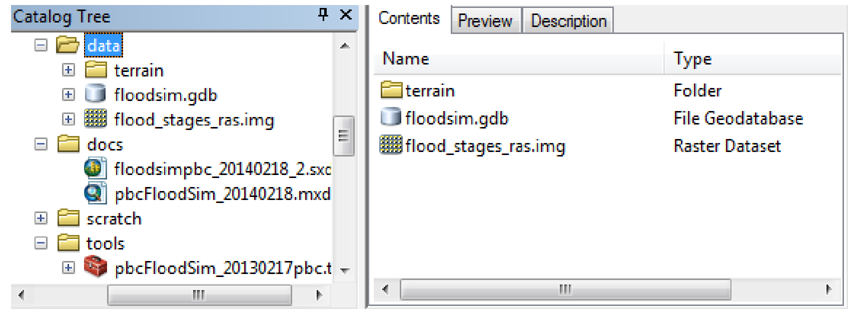

```
##Increment Flood Stage
for x in range(2, 33):

    ## Find area with elevations equal to or lower than current flood index
    print "Extracting elevation stage" + str(x) + "\n"
    arcpy.env.mask = ""
    elev_Exp = "VALUE <= " + str(x)
    elevMask = ExtractByAttributes(raster_dem, elev_Exp)
    #elevMask.save("G:\\current_projects\\geo\\boston_projects\\harvard\\floodsim_pbc\\scratch\\e

    ## Spread from River into the connected lower area
    print "Cost Diatance " + str(x) + "\n"
    arcpy.env.mask = elevMask
    cost = CreateConstantRaster(x, "INTEGER", 1,)
    floodMask = CostDistance(river_ras, cost)
    arcpy.env.mask = floodMask
    flood = CreateConstantRaster(x, "INTEGER", 1,)
    arcpy.env.mask = ""

    ## Save the current flood stage area to the stages raster
    print "Updated Stages Raster " + str(x) + "\n"
    stages_ras = CellStatistics([stages_ras, flood], "MINIMUM", "DATA")

    ## Convert the flood zone to a ploygon and write it to our polygon feature class.
    print "Raster to Poly " + str(x) + "\n"
    flood_stage_shp = "G:\\current_projects\\geo\\boston_projects\\harvard\\floodsim_pbc\\scratch
    arcpy.RasterToPolygon_conversion(flood, flood_stage_shp, "SIMPLIFY", "VALUE")
    arcpy.AddField_management(flood_stage_shp, "Elev", "DOUBLE", "", "", "","", "NULLABLE")
    el = x / 2.0
    arcpy.CalculateField_management(flood_stage_shp, "Elev", el)
```

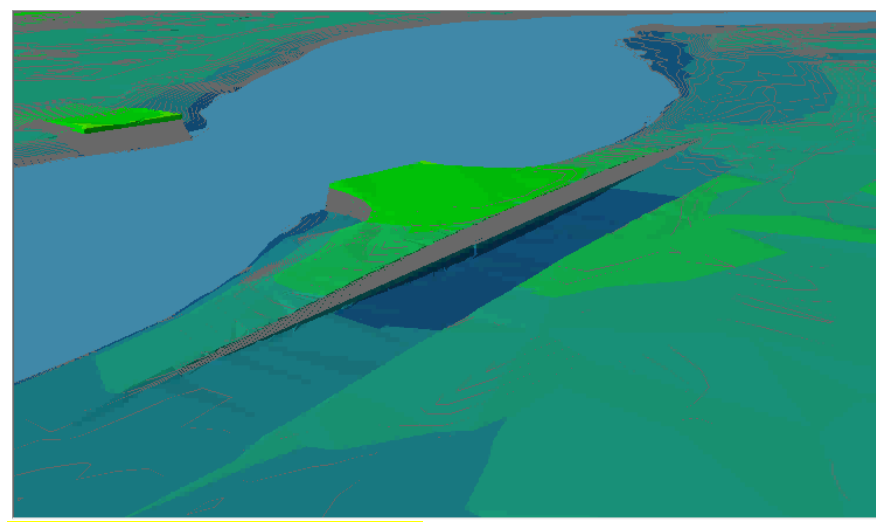
Products

The data folder includes a geodatabse with two feature classes holding the sequense of flood stage polygons. There are 32 polygons in this feature-class each of them covers the full extent of the flood at the given stage.

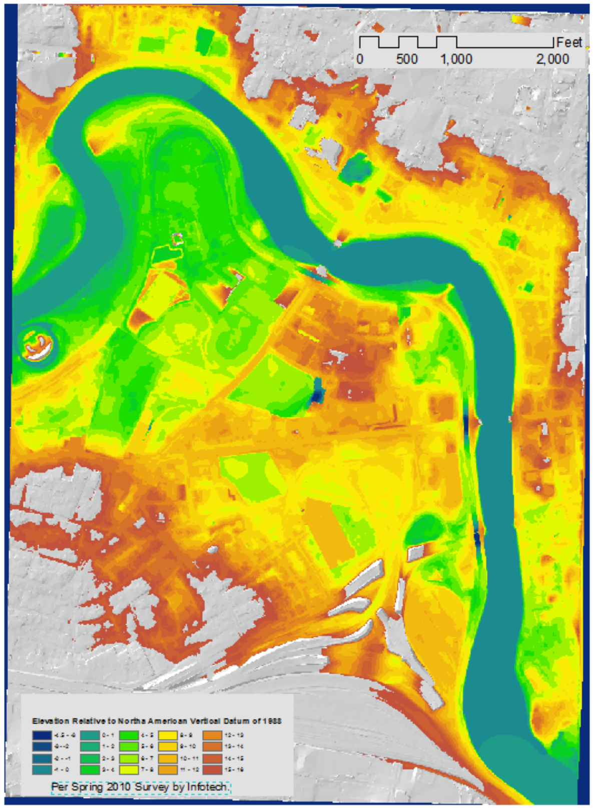
Because the river has an elevation of 1 foot, there is no flood stage for 0.5 feet. These polygons are saved as 2D and 3D features in the FloodSimpbc geodatabase. The geodatabase also includes each polygon as an individual feature class.

A raster that represents the vanguardof each flood stage in plan is also included since it is helpful for viewing in plan.

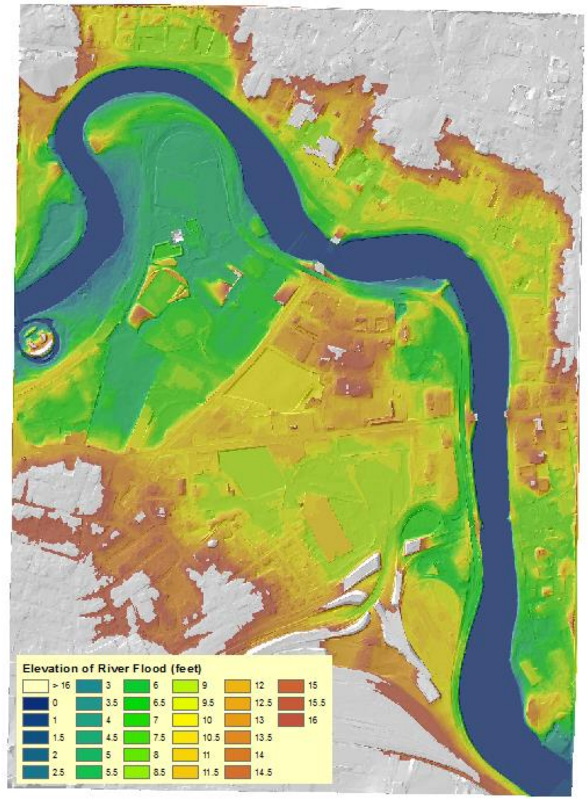




Click to play video!



Feet
0
500
1,000
2,000
Elevation Relative to Northa American Vertical Datum of 1988
-1 - 0
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9
9 - 10
10 - 11
11 - 12
12 - 13
13 - 14
14 - 15
15 - 16
Per Spring 2010 Survey by Infotech.



Elevation of River Flood (feet)
> 16
0
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
10.5
11
11.5
12
12.5
13
13.5
14
14.5
15
15.5
16

Feet
0
500
1,000
2,000
Depth of Local Depression Below Spillpoint (feet)
-2
-1
0
1
2
3
4
5
6
7
8
9
10
11
12
13