Water Modeling Solutions

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

VAHYDRO-GW: MAINTENANCE

Water Modeling Solutions

VAHydro-GW Maintenance/Improvements

- 1-2 year occurrence:
  - Pumping values updated
  - Measured heads updated
  - Recharge values updated
- 2-10 year occurrence:
  - Boundary conditions updated
  - Hydraulic parameters recalibrated
  - Updated geologic framework
- 10+ occurrence :
  - Model overhaul

Water Modeling Solutions

VAHydro-GW Maintenance/Improvements

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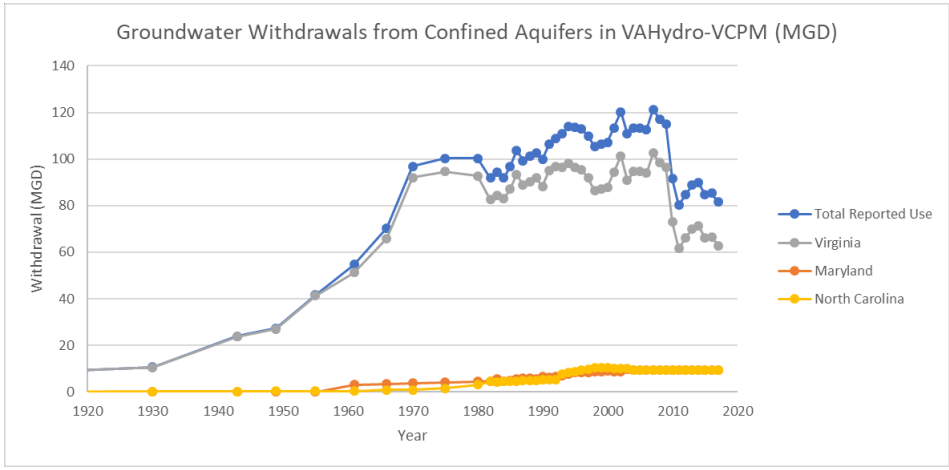

Water Modeling Solutions

VAHydro-GW Maintenance/Improvements

- 1-2 year occurrence:
  - Pumping values updated **- 2018**
  - Measured heads updated **– in progress**
  - Recharge values updated
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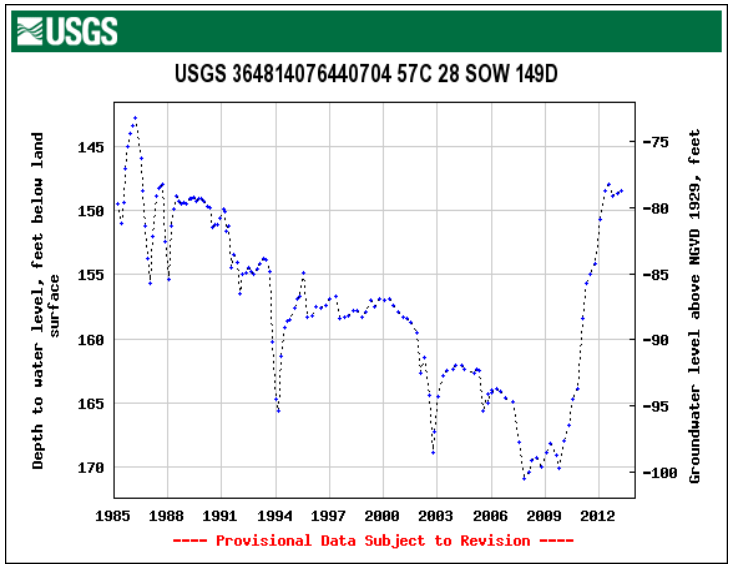

Water Modeling Solutions

VAHydro-GW Maintenance/Improvements

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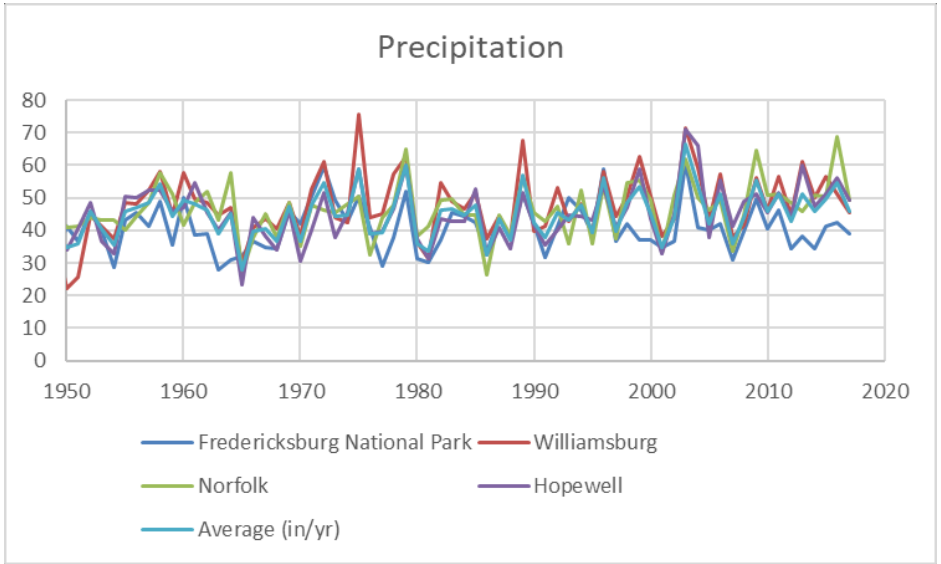

Water Modeling Solutions

VAHydro-GW Maintenance/Improvements

- 1-2 year occurrence:
  - Pumping values updated **- 2018**
  - Measured heads updated **– in progress**
  - Recharge values updated **– 2018**
- 2-10 year occurrence:
  - Boundary conditions updated **– upcoming**
  - Hydraulic parameters recalibrated
  - Updated geologic framework
- 10+ occurrence :
  - Model overhaul

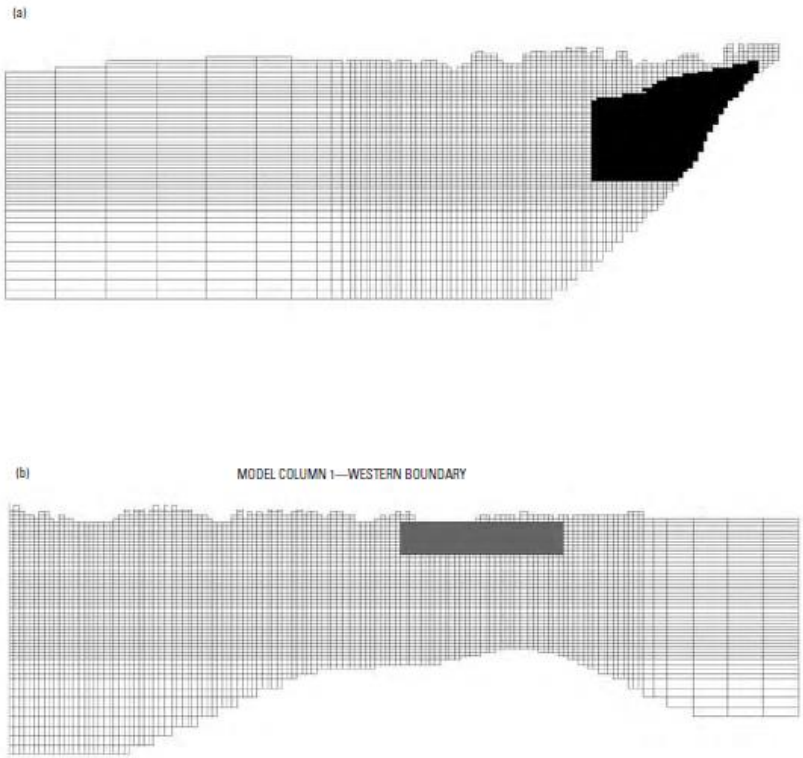

Figure 12. Finite-difference model grid showing cells designated for (a) time-varying specified flux to Maryland in row 1 and (b) constant specified flux from the Piedmont Province in columns 4–20.

Water Modeling Solutions

VAHydro-GW Maintenance/Improvements

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  - Measured heads updated **– in progress**
  - Recharge values updated **– 2018**
- 2-10 year occurrence:
  - Boundary conditions updated **– upcoming**
  - Hydraulic parameters recalibrated **– upcoming**
  - Updated geologic framework
- 10+ occurrence :
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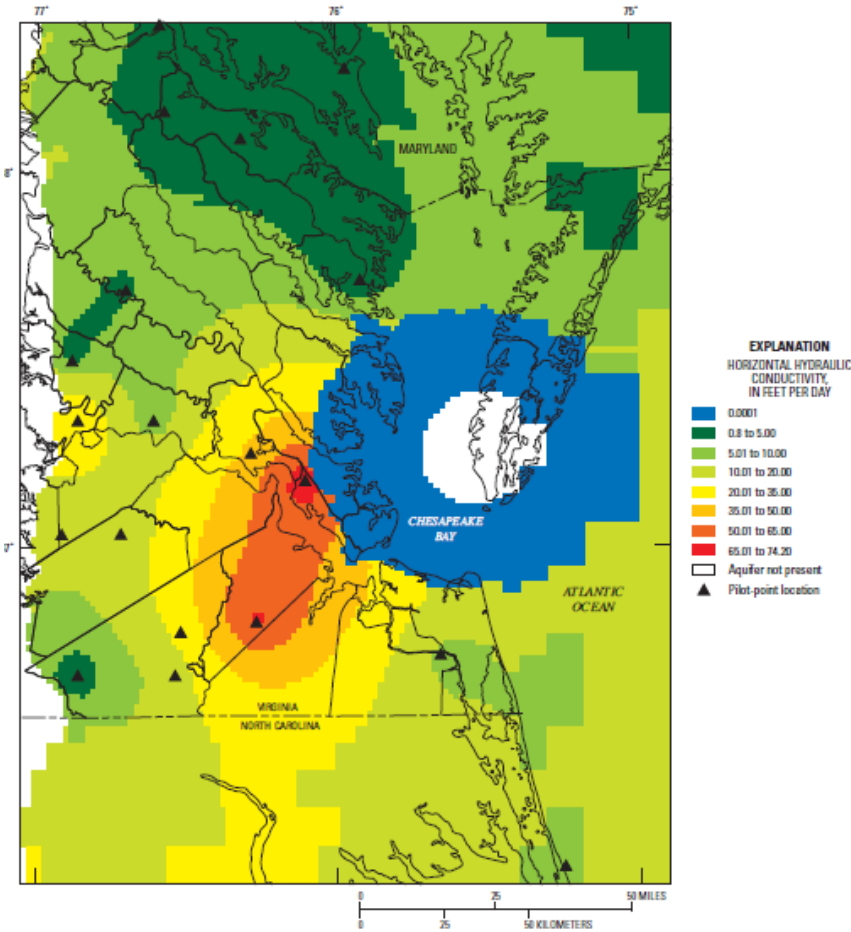

Figure 13. Pilot-point locations and simulated horizontal hydraulic conductivity at the top of the Potomac aquifer of the Virginia Coastal Plain.

Water Modeling Solutions

VAHydro-GW Maintenance/Improvements

- 1-2 year occurrence:
  - Pumping values updated **- 2018**
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  - Recharge values updated **– 2018**
- 2-10 year occurrence:
  - Boundary conditions updated **– upcoming**
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  - **Updated geologic framework – in progress**
- 10+ occurrence :
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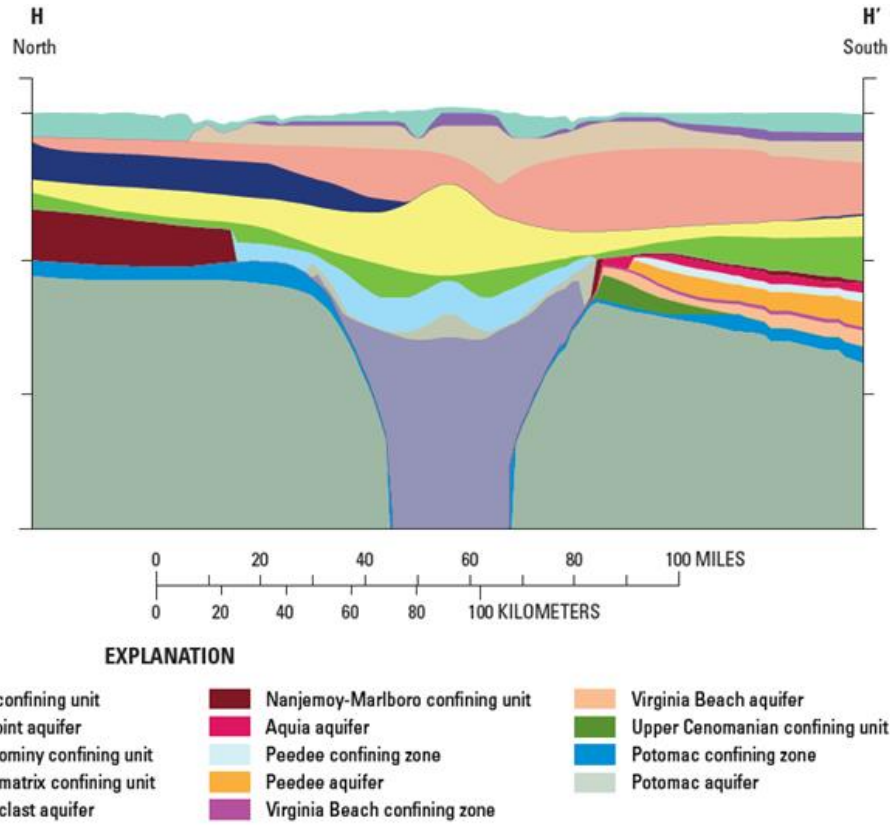


Water Modeling Solutions

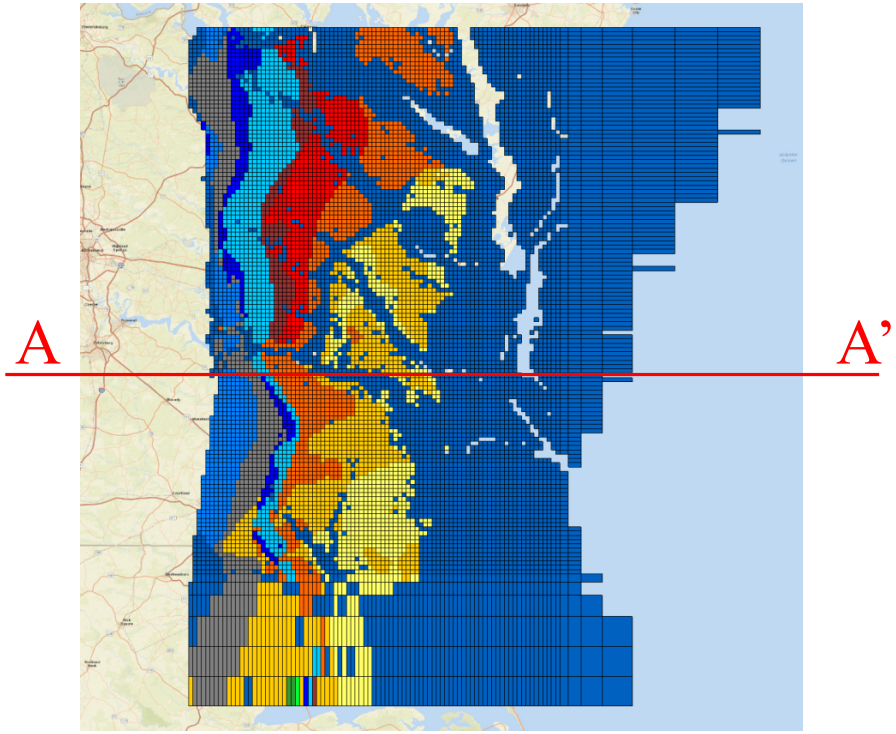
VAHydro-GW Geologic Framework

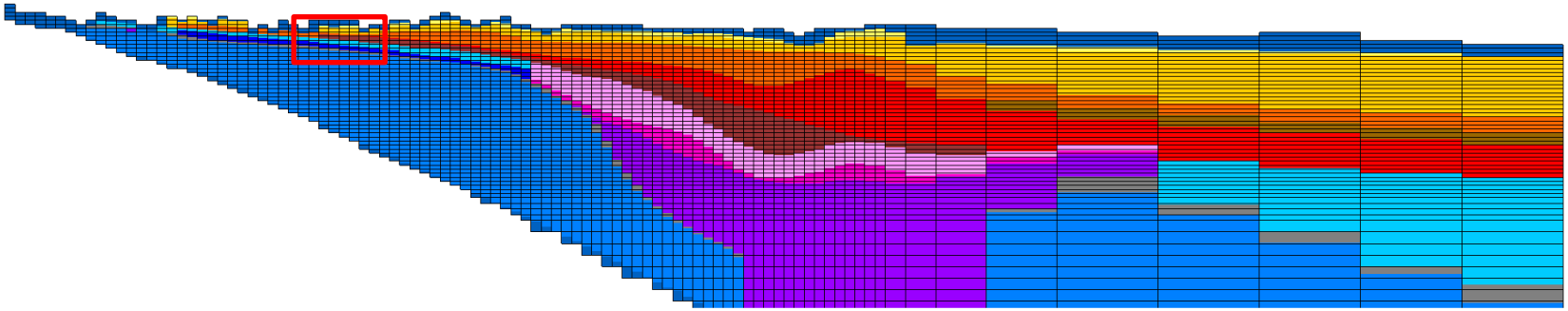
- MODEL BACKGROUND
  - 60-layer constant elevation.
  - 19 hydrogeologic units
  - HUF Package
    - 38 grid independent arrays

	Hydrogeologic Unit Name	Raster Name	HUF Array
1	Surficial Aquifer	m01_surf	SURF
2	Yorktown-Eastover Confining Unit	yorktown_cu	YTCZ
3	Yorktown-Eastover Aquifer	yorktown_aq	YEAQ
4	Saint Marys Confining Unit	saintmary_cu	SMCU
5	Saint Marys Aquifer	saintmary_aq	SMAQ
6	Calvert Confining Unit	calvert_cu	CACU
7	Piney Point Aquifer	pineypoint_aq	PPAQ
8	Chickahominy Confining Unit	chickah_cu	CHCU
9	Exmore Matrix Confining Unit	exmoremat_cu	XMCU
10	Exmore Clast Confining Unit	exmorecla_cu	XCAQ
11	Nanjemoy-Marlboro Confining Un.	nan_marb_cu	NMCU
12	Aquia Aquifer	aquia_aq	AQAQ
13	Peedee Confining Unit	peedee_cu	PDCU
14	Peedee Aquifer	peedee_aq	PDAQ
15	Virginia Beach Confining Zone	virgbeach_cu	VBCU
16	Virginia Beach Aquifer	virgbeach_aq	VBAQ
17	Upper Cenomanian Confining Unit	upperceno_cu	UCCU
18	Potomac Confining Zone	potomac_cz	POCZ
19	Potomac Aquifer	potomac_aq	POAQ
20	Basement Bedrock	basement	-

Water Modeling Solutions

VAHydro-GW Geologic Framework





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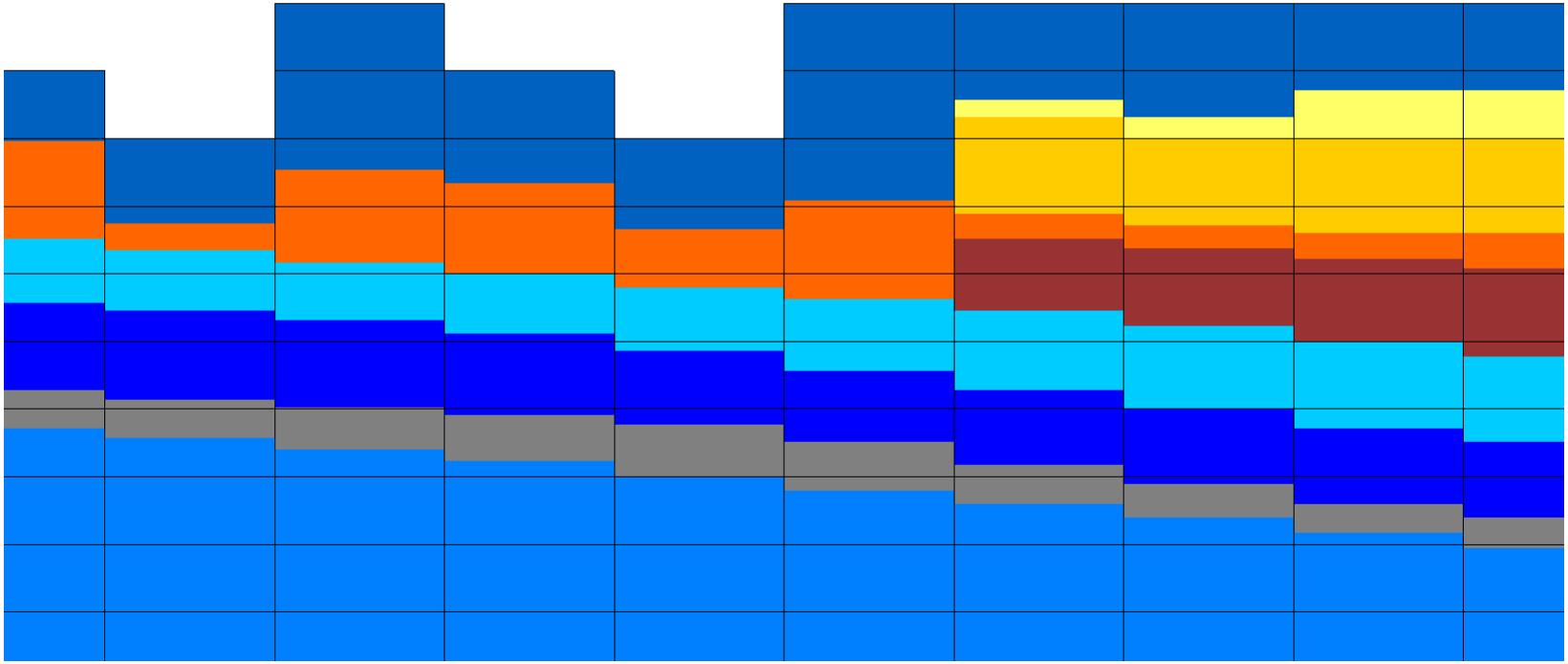
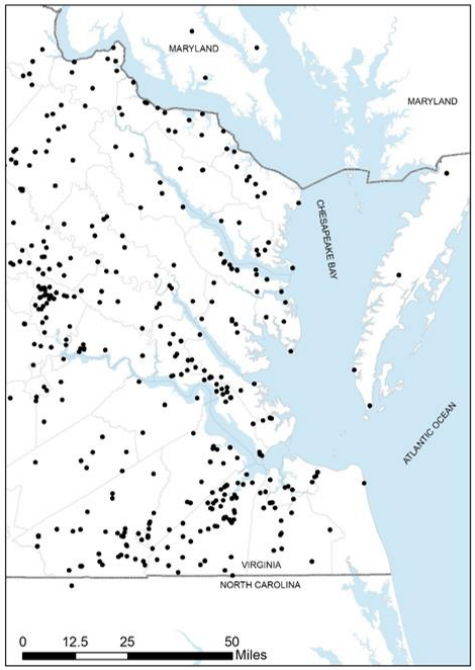
VAHydro-GW Geologic Framework

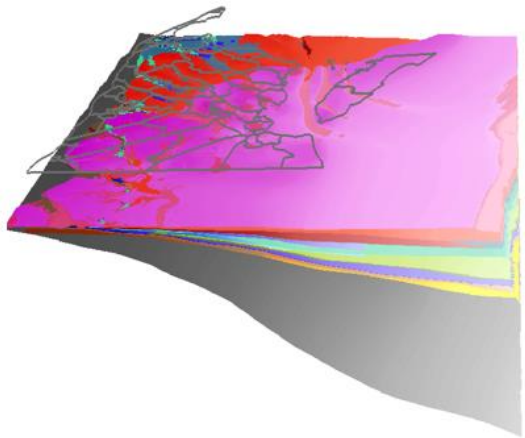
- Multiple hydrogeologic units in one cell.



Water Modeling Solutions

VAHydro-GW Geologic Framework





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- CHCU_THK.array
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- NMCU_THK.array
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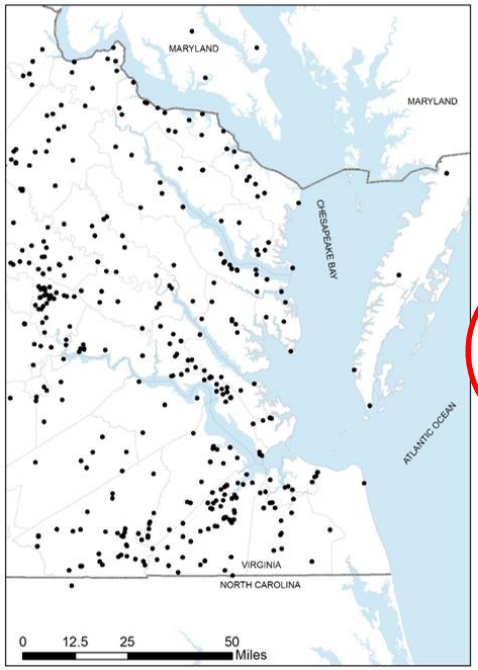
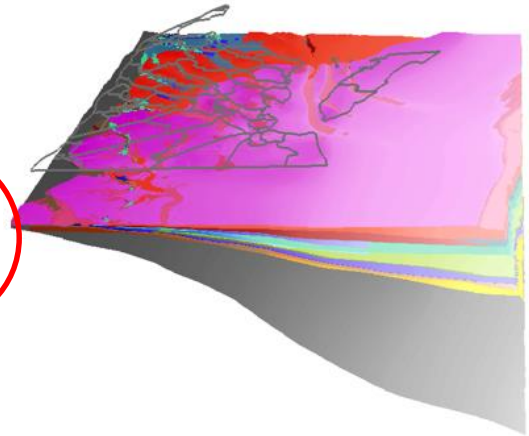
Water Modeling Solutions

VAHydro-GW Geologic Framework





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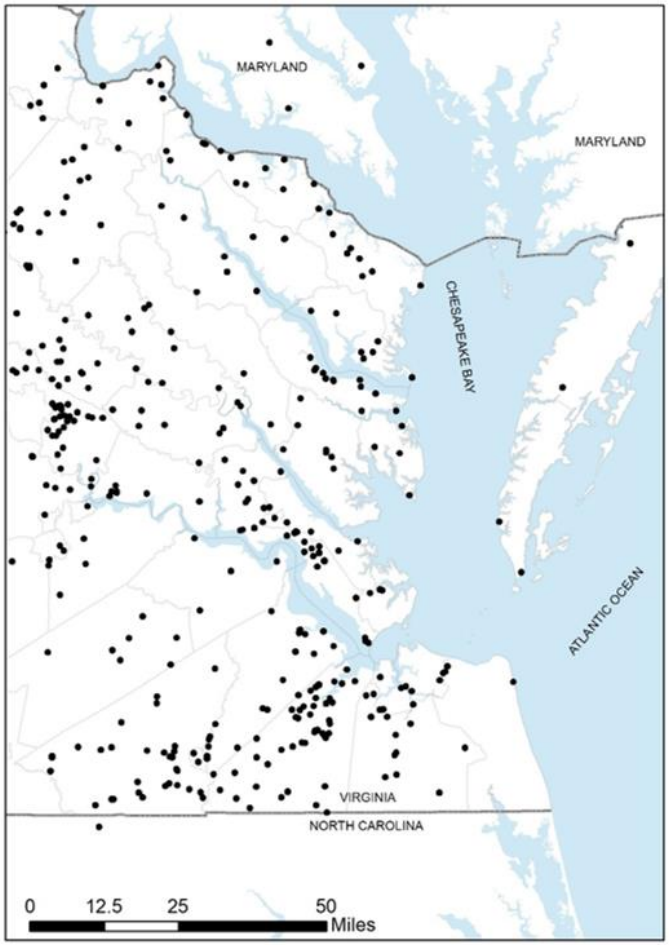
- YTCZ.array
- YTCZ_THK.array

Water Modeling Solutions

VAHydro-GW Geologic Framework

- Reproduce original rasters
  - **Borehole data**
  - Digitized contours
  - Surface/Bathymetry



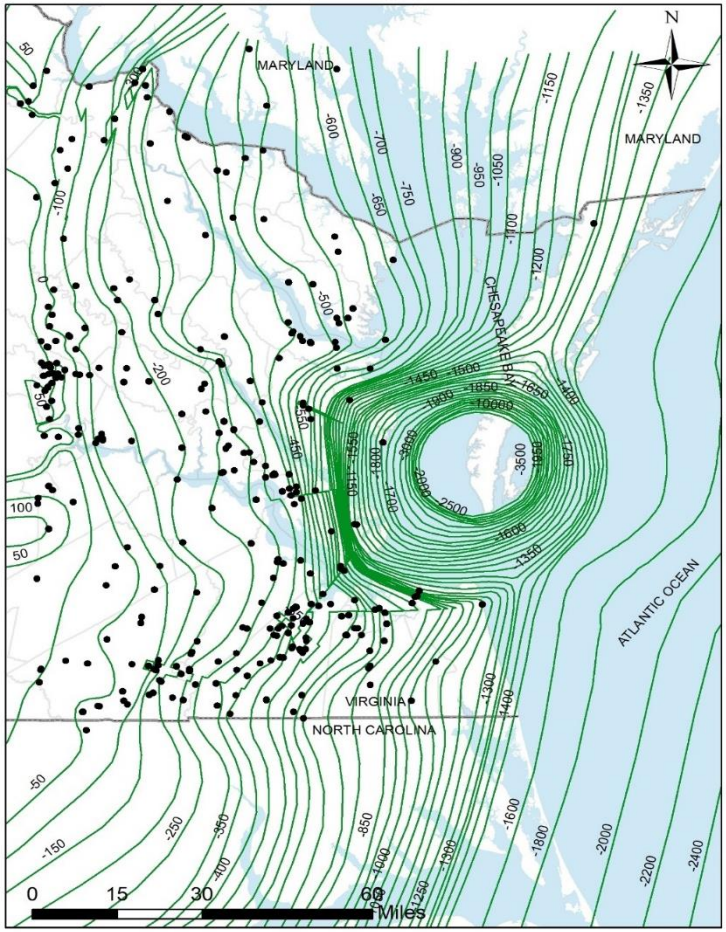
Legend

- YorktownCU - 125 Points
- YorktownAQ - 180 Points
- StMarysCU - 283 Points
- StMarysAQ - 39 Points
- CalvertCU - 260 Points
- PinePointAQ - 254 Points
- ChickahominyCU - 44 Points
- ExmoreMatrixCU -30 Points
- ExmoreClastCU - 18 Points
- NanjemoyCU - 270 Points
- AquiaAQ - 261 Points
- PeedeeCU - 4 Points
- PeedeeAQ - 4 Points
- VirginiaBeachCU - 33 Points
- VirginiaBeachAQ - 33 Points
- UpperCenoCU - 97 Points
- PotomacCU - 307 Points
- PotomacAQ - 309 Points
- Basement - 76 Points

Water Modeling Solutions

VAHydro-GW Geologic Framework

- Reproduce original rasters
  - Borehole data
  - **Digitized contours**
  - Surface/Bathymetry



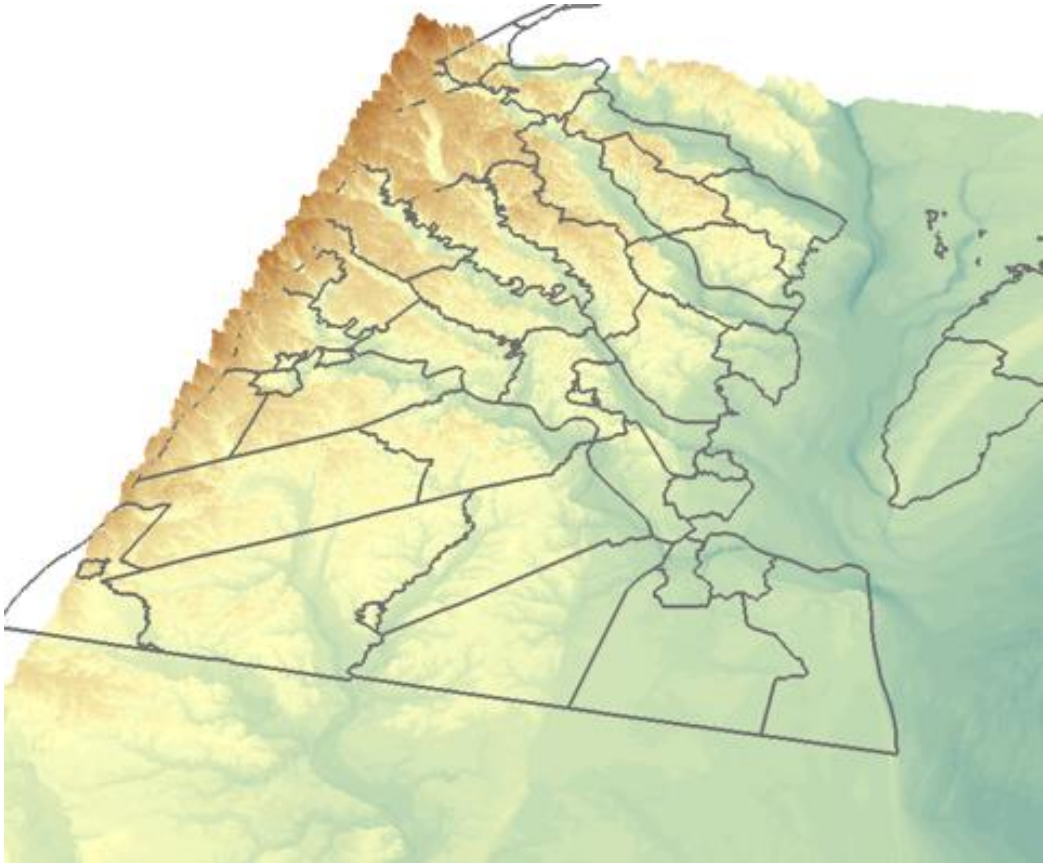
Legend

- PotomacAQ - 309 Points
- Potomac Aquifer Top Hand Digitized Contours

Water Modeling Solutions

VAHydro-GW Geologic Framework

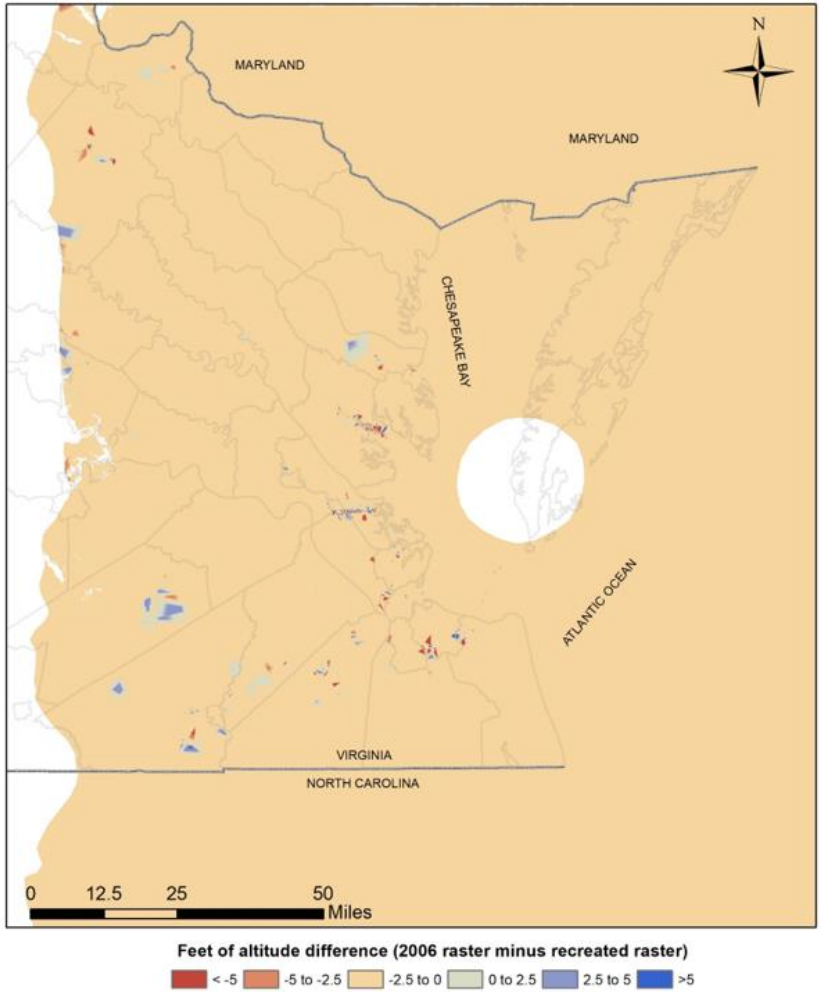
- Reproduce original rasters
  - Borehole data
  - Digitized contours
  - **Surface/Bathymetry**



Water Modeling Solutions

VAHydro-GW Geologic Framework

- Automated reproduction of original rasters
  - Points & contours -> TIN
  - TIN - > raster
  - Clip raster to originals
  - Adjust using incision surface
  - Adjust for interpolation below lower units
  - Add control points



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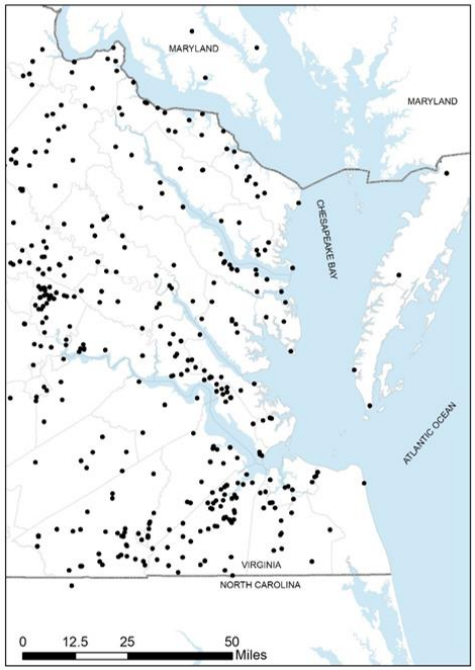

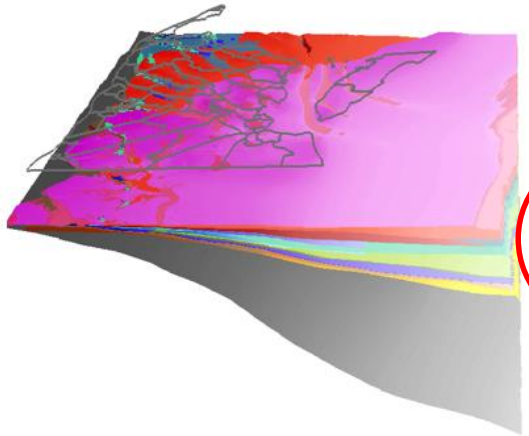

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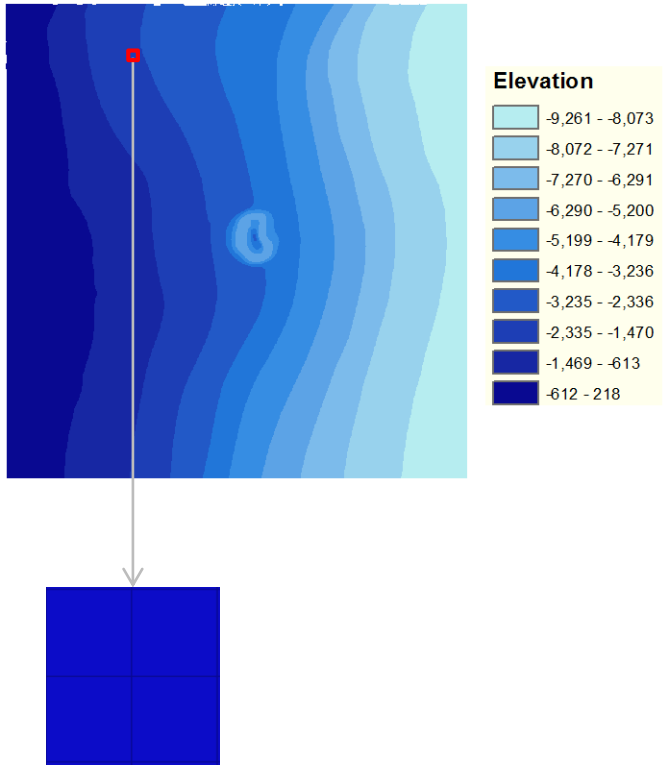
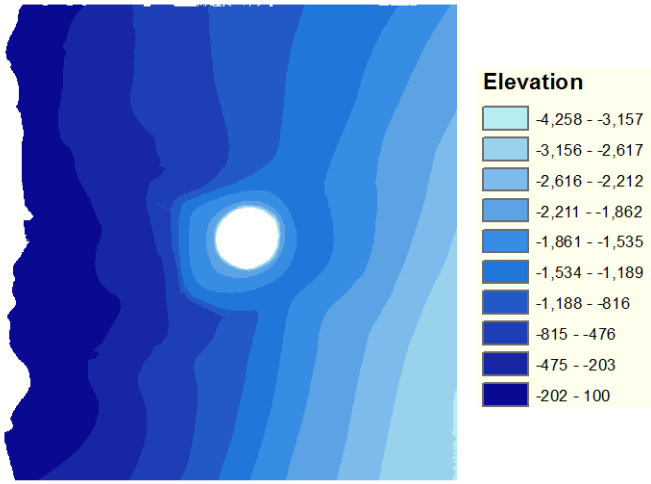
Water Modeling Solutions

VAHydro-GW Geologic Framework

- Basement Raster



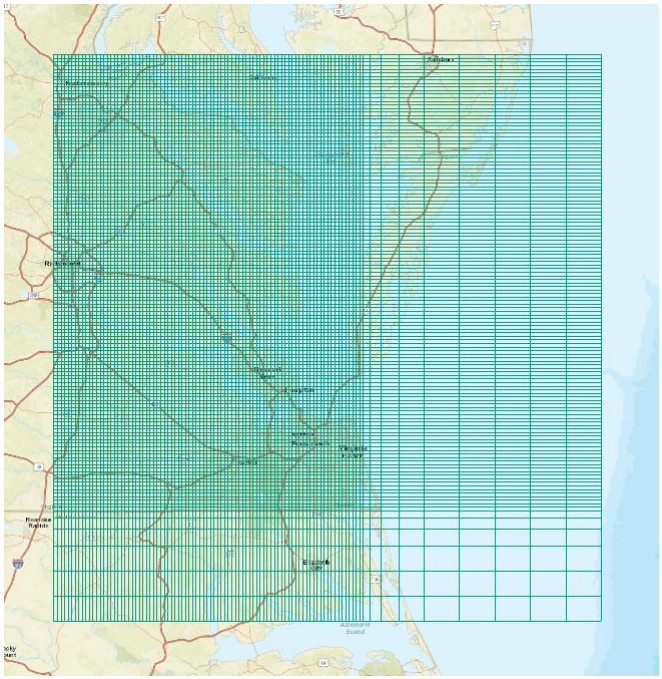
- Potomac Aquifer Raster



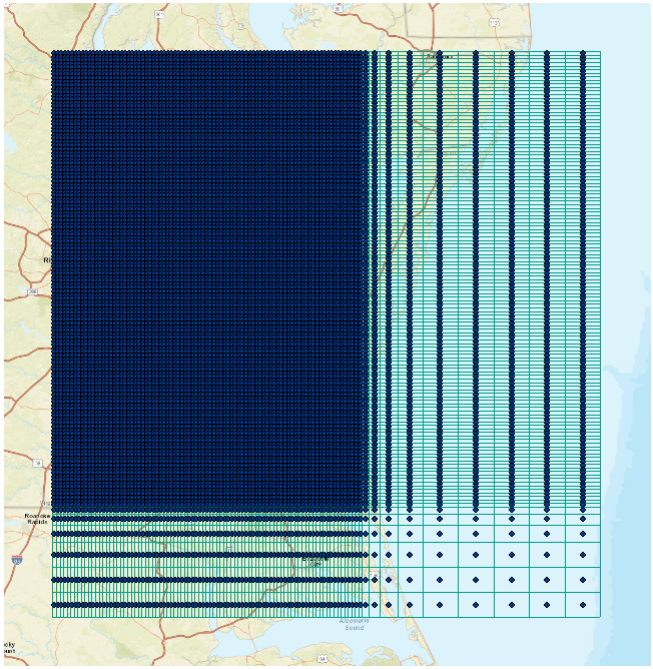
Water Modeling Solutions

VAHydro-GW Geologic Framework

- MODFLOW GRID

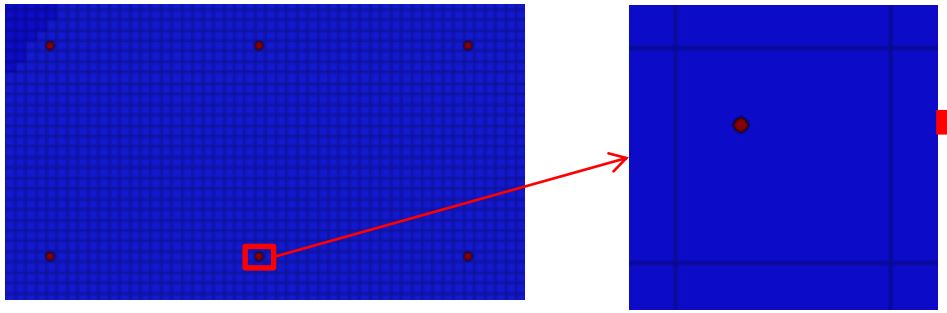


- Cell-Center Locations



VAHydro-GW Geologic Framework

- Use Python with GDAL (Geospatial Data Abstraction Library) to extract values from raster at Cell-Center Locations to MODFLOW HUF input files.



python™

GDAL

HUF POAQ Input File

PPAQ.array

56.	35.	13.	-17.	65.	55.	43.	127.	103.	90.	75.	-25.	-25.	-35.	-40.
0.	0.	0.	0.	0.	0.	-1.	-29.	-45.	-55.	-50.	-14.	-30.	-106.	-34.
-42.	-50.	-55.	-60.	-64.	-68.	-72.	-76.	-19.	-26.	-32.	-39.	-47.	-57.	-65.
-74.	-83.	-91.	-100.	-109.	-118.	-127.	-139.	-150.	-161.	-172.	-182.	-191.	-201.	-210.
-218.	-225.	-232.	-240.	-247.	-255.	-263.	-270.	-278.	-286.	-294.	-302.	-313.	-324.	-334.
-344.	-355.	-365.	-375.	-385.	-395.	-407.	-421.	-434.	-448.	-462.	-475.	-496.	-553.	-616.
-706.	-982.	-1078.	-1174.	-1228.	-1267.									
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-11.	-5.	-13.	0.	-11.	-25.	-50.	-41.	-35.	-28.	-21.	-13.	-21.	-38.	-116.
-45.	-52.	-57.	-62.	-67.	-71.	-75.	-15.	-21.	-28.	-35.	-42.	-49.	-56.	-64.
-71.	-79.	-88.	-96.	-105.	-116.	-127.	-139.	-150.	-161.	-172.	-183.	-193.	-204.	-213.
-221.	-228.	-235.	-242.	-249.	-257.	-265.	-273.	-281.	-289.	-297.	-306.	-317.	-327.	-337.
-348.	-358.	-368.	-378.	-388.	-398.	-412.	-426.	-439.	-453.	-467.	-482.	-507.	-558.	-621.
-710.	-988.	-1081.	-1177.	-1229.	-1268.									

HUF POAQ Thickness Input File

PPAQ_THK.array

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	61.	58.	55.	52.	48.	42.	49.
56.	68.	82.	93.	97.	98.	100.	98.	98.	98.	98.	98.	100.	101.	102.
102.	103.	103.	101.	100.	99.	99.	99.	98.	97.	96.	95.	93.	92.	91.
91.	90.	89.	88.	87.	85.	82.	77.	82.	87.	91.	96.	102.	98.	115.
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0.	0.	0.	0.	0.	0.	0.	63.	61.	58.	55.	52.	49.	52.	60.
69.	80.	90.	102.	104.	103.	102.	100.	99.	99.	98.	98.	99.	99.	101.
102.	101.	100.	99.	98.	97.	97.	97.	97.	96.	95.	93.	91.	90.	90.
88.	88.	87.	86.	85.	84.	79.	74.	80.	84.	89.	92.	94.	97.	114.
134.	0.	0.	0.	0.	0.									