PADEP DAM SAFETY'S PROBABLE MAXIMUM PRECIPITATION TOOL

INSTRUCTIONS AND APPLICATION IN ARCGIS



2. Right click on the zip file and choose the "extract all" option. Open the resulting file called the "PMP Evaluation Tool". View the contents of the file as shown below:

↓			
Home Share View			
↑ ↑ > PMP_Evaluation_Tool			
Name	~	Date modified	Туре
input		4/3/2019 11:03 AM	File folder
		6/12/2019 11:12 AM	File folder
Script		4/3/2019 11:04 AM	File folder

3. Obtain the shapefile for the watershed of the dam. One option is to use the USGS StreamStats website:

	https://streamstats.usgs.gov/ss/
StreamStats	× 📑

• For example, below the USGS StreamStats website is centered on Dehart Dam in Dauphin County, PA:



• USGS StreamStats can then be used to delineate the watershed for Dehart Dam:





Untitled - ArcMap	
File Edit View Bookmarks Insert S	election Geoprocessing Customize Wir
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i 🔍 🔍 🕎 🥝 X 🖞 🖓 🖛 🔶 🕅 - 🛙	+ Add Data
Table Of Contents	Add Basemap
%: 📮 🗇 📮 🗄	Add Data From ArcGIS Online

• Select the shape file (.shp) from the downloaded layers:

— =	Compressed Folder Tools	layers		
Home Share View	Extract			
	δ > Downloads > down	nload (3) > layers		
Name	Туре	Compressed size	Password Siz	ze Ratio
globalwatershed.dbf	DBF File	1 KB	No	1.KP
📄 globalwatershed.prj	PRJ File	1 KB	No	1 KB 16%
globalwatershed.shp	SHP File		INO	73 KB 31%
globalwatershed.shx	SHX File	1 KB	No	1 KB 47%
📄 globalwatershedpoint.db	f DBF File	1 KB	No	1 KB 83%
📄 globalwatershedpoint.prj	PRJ File	1 KB	No	1 KB 16%
📄 globalwatershedpoint.sh	p SHP File	1 KB	No	1 KB 68%
globalwatershedpoint.sh	K SHX File	1 KB	No	1 KB 62%

• The shape file will appear on the ArcGIS map as shown below:



• The downloaded shape can be renamed. In this example, it is renamed from "global watershed" to "Dehart Dam":



5. Use the "catalog" icon in ArcGIS to locate the "Gridded PMP Tool":
Catalog
🗢 - 🌩 💪 🏠 🐻 📰 - 🔛 😫 🗄
Location: 🖾 C:\Users\\Desktop\PMP_Evaluation_Tool
📧 🙀 Home - Documents\ArcGIS
🖃 🔂 Folder Connections
E C:\Users\
C:\Users\\Desktop\PMP_Evaluation_Tool
🗷 🔚 input
🗉 🛅 Output
🗆 🚞 Script
🗆 🚳 PA_PMP_Tool.tbx
💐 Gridded PMP Tool <

• Click on "Gridded PMP Tool" to start the tool. Then from the dropdown list, Dehart Dam is selected for the "Input basin outline shapefile":

🛐 Gridded PMP Tool	-		×	
Input basin outline shapefile or feature class		_	_ /	~
þehart Dam		-	2	
Location of "PMP_Evaluation_Tool" Folder				
C:\Users\Desktop\PMP_Evaluation_Tool			2	
Output Folder				
			2	
Local storm durations ***Basin area should be 100-sqmi or smaller for local storm PMP***	· (optional)		
01				
02				
			`	-
OK Cancel Environment	s 9	Show He	lp >>	

• Using the dropdown menu, a new output folder is created and called "Dehart Dam":

						^ 📮 ^
Look in: 🛛 🚞	Output		~ 全 🟠 🗔) 🏥 🛛 🖴	🔛 📑 🕻	s 🖆 👘
💼 Dehart Dan	n					- 3
	_					
Name:	Dehart Dam				Add	
Show of type:	Basic Types			~	Cancel	ī 🗌 🗸
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	Look in:	Look in: Cutput	Look in: Cutput	Look in: Output Cook in: Output Cook	Look in: Output	Look in: Output

• All Local storm durations, from 1 hour to 24 hours, are checked off for computation. (When scrolling down, note that the computations for general storms, tropical storms and temporal distributions are not normally needed for Pennsylvania Dam Safety.)

Dehart Dam Location of "PMP_Evaluation_Tool" Folder C: \Users \Desktop \PMP_Evaluation_Tool Output Folder C: \Users \Desktop \PMP_Evaluation_Tool \Output \Dehart Dam Local storm durations ****Basin area should be 100-sqmi or smaller for local storm PMF Image: Olimetric C: \Users 01 Image: Olimetric C: Olimetric:	P*** (optional)		63 63 63	
Location of "PMP_Evaluation_Tool' Folder C:\Users \Upesktop\PMP_Evaluation_Tool Output Folder C:\Users \Upesktop\PMP_Evaluation_Tool\Output\Dehart Dam Local storm durations ***Basin area should be 100-sqmi or smaller for local storm PMP 01 02	P*** (optional)		6	
C: \Users \Desktop \PMP_Evaluation_Tool Output Folder C: \Users Desktop \PMP_Evaluation_Tool \Output \Dehart Dam Local storm durations ***Basin area should be 100-sqmi or smaller for local storm PMA Image: Dot 1 01 Image: Dot 2 02	P*** (optional)	[[)	6	
Output Folder C:\Users \Desktop\PMP_Evaluation_Tool\Output\Dehart Dam Local storm durations ***Basin area should be 100-sqmi or smaller for local storm PMF O1 02	P*** (optional))	2	l
C: \Users \Desktop \PMP_Evaluation_Tool \Output \Dehart Dam Local storm durations ***Basin area should be 100-sqmi or smaller for local storm PMP 01 02	P*** (optional))	2	l
Local storm durations ****Basin area should be 100-sqmi or smaller for local storm PMI	P*** (optional))		
 ✓ 03 ✓ 04 ✓ 05 ✓ 06 ✓ 12 ✓ 24 				
				1

• Scroll down and complete the PMP tool input with the boxes checked as shown below. (Note that PADEP Dam Safety requires the determination of alternate temporal distributions as provided in a temporal distribution spread sheet):

	ler grid Cells		
Include sub-basin averages (op	tional)		
Sub-basin field (optional)			
			~
Include depth-duration chart out	tput		
Apply temporal distributions			

6. Click on OK and the PMP tool will compute the PMP depths and durations applicable specifically to the watershed of the dam. (This is

based on the transposition of historical storms to the watershed of a dam; historic storms are transposed only to regions of the state where the same storm could have occurred. The tool will then calculate the maximum precipitation depths for the storm durations that were checked.)

ecuting Gridded PMP Tool	Cancel
	<< Deta
Close this dialog when completed successfully	
Executing: Script22 "Dehart Dam" C:\Users\\Desktop\PMP_Evaluation_Tool "C:\Users\\Desktop\PMP_Evalu \Dehart Dam" 01;02;03;04;05;06;12;24 # # true # true # Start Time: Tue Jun 18 15:56:54 2019 Punning script_Script22	op uation_Tool\Output # true false
	PMP Evaluation Tool

 After the PMP tool completes the computations, the results can be obtained using the Arc-Map "Catalog" icon:



7. Using the ArcMap Catalog, find and open the "Local PMP Basin Average" file under the Output folder. The location of this file is shown below:



• The "Local PMP Basin Average" file provides an average of PMP rainfall depths and durations for all the points in the watershed that are analyzed by the PMP tool. (This data is used in the PADEP Dam Safety's PMP Distribution Spreadsheet.) The contents of the opened file are shown below:

	A	В	С	D	E	F	G	Н	I.	J
1 C	DID	STORM_TYPE	PMP_01	PMP_02	PMP_03	PMP_04	PMP_05	PMP_06	PMP_12	PMP_24
2	-1	Local	7.94	10.33	11.1	11.89	15.66	20.96	22.7	23.52

8. The PMP tool output also identifies the historic storms that were transposed to determine the PMP depth at each point and at each storm duration. (The identity of these storms is also required for DEP Dam Safety's PMP Distribution Spreadsheet.) Under the ArcMap Catalog, find the Local PMP Points file under the Output folder, and then drag it into the map area in Arc-Map:

Catalog	÷×
🗢 🕆 🏟 🔄 🔠 🕶 🖴 🗄	
ocation: 🖸 Local_PMP_Points_GlobalWatershed_21sqmi	~
🗄 🛜 Home - 💦 \Desktop	
E Folder Connections	
🗄 🔚 C:\Users\	
🗆 🚘 C:\Users\\Desktop\PMP_Evaluation_Tool	
🗄 🧰 input	
🖃 🧮 Output	
🖃 🚞 Dehart Dam	
🖃 🚞 Local	
표 🚞 CSV_GlobalWatershed_21sqmi	
🖃 🧊 PMP_GlobalWatershed_21sqmi.gdb	
🗄 🎆 L_01_GlobalWatershed_21sqmi	
🖽 🎆 L_02_GlobalWatershed_21sqmi	
🖽 🎆 L_03_GlobalWatershed_21sqmi	
🖽 🎆 L_04_GlobalWatershed_21sqmi	
🖽 🎆 L_05_GlobalWatershed_21sqmi	
🗄 🌉 L_06_GlobalWatershed_21sqmi	
🖽 🎆 L_12_GlobalWatershed_21sqmi	
🗄 🌉 L_24_GlobalWatershed_21sqmi	
Local_PMP_Basin_Average_21sqmi	
Local_PMP_Points_GlobalWatershed_21	sqmi 🥌
Image: A second se	hart.png

• On ArcMap, the "points file" appears as shown below:



 Under the Table of Contents, right click on "Local_PMP_Points" and then double click on the "Open Attribute Table":



• The "Attribute Table" shows the probable maximum inches of rainfall and the controlling storm at each point and each duration:

Local_PMP_Points_GlobalWatershed_21sqmi																							×
	OBJECTID *	Shape *	ld	POINT_X	POINT_Y	ELEV_FT	Grid_Id ZON	PMP_01	PMP_02	PMP_03	PMP_04	PMP_05	PMP_06	PMP_12	PMP_24	Storm ID 01-hour	Storm ID 02-hour	Storm ID 03-hour	Storm ID 04-hour	Storm ID 05-hour	Storm ID 06-hour	Storm ID 12-hour	Storm ID 24
	1	Point	13242	-76.75	40.45	1192.263672	13242	7.9	10.3	11	11.8	15.5	20.8	22.5	23.3 S	PAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
	2	Point	13243	-76.725	40.45	1192.403564	13243	7.9	10.3	11.1	11.9	15.6	20.9	22.6	23.5 SI	PAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
	1	Point	13244	-76.7	40.45	1032.348877	13244	8	10.3	11.1	11.9	15.7	21	22.7	23.6 S	PAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
	4	Point	13487	-76.75	40.475	1128.373291	13487	7.9	10.2	11	11.8	15.5	20.7	22.5	23.3 S	PAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
	6	Point	13488	-76.725	40.475	761.46051	13488	7.9	10.3	11.1	11.8	15.6	20.9	22.6	23.4 SI	PAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
	6	Point	13489	-76.7	40.475	930.819824	13489	7.9	10.3	11.1	11.9	15.7	21	22.7	23.5 S	PAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
	7	Point	13490	-76.675	40.475	1511.858398	13490	8	10.4	11.1	11.9	15.7	21	22.8	23.6 S	PAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
	8	Point	13491	-76.65	40.475	1176.516724	13491	8	10.4	11.2	11.9	15.7	21.1	22.8	23.6 SI	PAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
	S	Point	13736	-76.7	40.5	1058.337402	13736	7.9	10.3	11.1	11.9	15.6	20.9	22.6	23.5 SI	PAS_1406_1	SPAS_1406_1	SPAS_1408_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
	10	Point	13737	-76.675	40.5	950.053345	13737	7.9	10.3	11.1	11.9	15.7	21	22.7	23.5 S	PAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
	11	Point	13738	-76.65	40.5	833.442444	13738	8	10.4	11.1	11.9	15.7	21	22.8	23.6 S	PAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
	12	Point	13739	-76.625	40.5	1534.426392	13739	8	10.4	11.2	11.9	15.7	21	22.8	23.6 S	PAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
	13	Point	13740	-76.6	40.5	1079.002197	13740	8	10.4	11.2	11.9	15.7	21.1	22.8	23.6 SI	PAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
—	14	Point	13985	-76.65	40.525	1622.120728	13985	7.9	10.3	11.1	11.9	15.6	20.9	22.7	23.5 S	PAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
	15	Point	13986	-76.625	40.525	858.584961	13986	7.9	10.3	11.1	11.9	15.7	21	22.7	23.5 S	PAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
	16	Point	13987	-76.6	40.525	984.874939	13987												SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
	17	Point	13988	-76.575	40.525	1437.129395	13988	3 8	10.4	11.1	11.9	15.7	21	22.8	23.6 S	PAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
	18	Point	14232	-76.625	40.55	1551.087891	14232	3 7.9	10.3	11.1	11.8	15.6	20.9	22.6	23.4 S	PAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
P.	19	Point	14233	-76.6	40.55	1565.308105	14233	3 7.9	10.3	11.1	11.9	15.6	20.9	22.6	23.5 S	PAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
	20	Point	14234	-76.575	40.55	819.38562	14234	3 7.9	10.3	11.1	11.9	15.6	20.9	22.7	23.5 SI	PAS_1406_1	SPAS_1406_1	SPAS_1408_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
	21	Point	14235	-76.55	40.55	1421.792969	14235	3 7.9	10.3	11.1	11.9	15.7	21	22.7	23.5 S	PAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
	22	Point	14479	-76.6	40.575	1116.231201	14479	3 7.9	10.3	11	11.8	15.6	20.8	22.6	23.4 S	PAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
	23	Point	14480	-76.575	40.575	1226.696045	14480	3 7.9	10.3	11.1	11.8	15.6	20.9	22.6	23.4 S	PAS 1406 1	SPAS 1406 1	SPAS 1406 1	SPAS 1406 1	SPAS 1406 1	SPAS 1406 1	SPAS 1406 1	SPAS 1406 1

(enlarged box from the "Attribute Table" above

PMP_01	PMP_02	PMP_03	PMP_04	PMP_05	PMP_06	PMP_12	PMP_24	Storm ID 01-hour	Storm ID 02-hour	Storm ID 03-hour	
7.9	10.3	11	11.8	15.5	20.8	22.5	23.3	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	
7.9	10.3	11.1	11.9	15.6	20.9	22.6	23.5	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	
8	10.3	11.1	11.9	15.7	21	22.7	23.6	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	
7.9	10.2	11	11.8	15.5	20.7	22.5	23.3	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	
7.9	10.3	11.1	11.8	15.6	20.9	22.6	23.4	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	
7.9	10.3	11.1	11.9	15.7	21	22.7	23.5	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	
8	10.4	11.1	11.9	15.7	21	22.8	23.6	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	
8	10.4	11.2	11.9	15.7	21.1	22.8	23.6	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	
7.9	10.3	11.1	11.9	15.6	20.9	22.6	23.5	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	
7.9	10.3	11.1	11.9	15.7	21	22.7	23.5	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	
8	10.4	11.1	11.9	15.7	21	22.8	23.6	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	
8	10.4	11.2	11.9	15.7	21	22.8	23.6	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	

- Note that the Storm ID (for this example: SPAS_1406_1) is recorded for each point at each storm duration. (The IDs of the storms, which control the PMP depth at durations of 3, 6, 12, and 24 hours, are needed as input in DEP Dam Safety's PMP Distribution Spreadsheet. For some watersheds, there may be more than one controlling storm at the same duration for different points in the watershed.)
- Proceed to apply the PMP Tool data for a dam using <u>PADEP's</u> <u>Spreadsheet for Temporal Distribution of the PMP</u>.
- Both the spreadsheet and the associated guidance document can be downloaded from the DEP website. In addition to the guidance document, the spreadsheet includes basic instructions.