PTMApp-Desktop Version Release Notes and Known Problems
March 2019

Prioritize, Target, and Measure Application for Desktop (PTMApp-Desktop) Release Notes

The table below details release notes and version updates over time.

Version No.	Release Date	PTMApp-Desktop Tool Affected and Summary of Modifications	User Implications
1.0.61	10/2/15	1) Catchments and Loading a) Summarize Catchments and Loading – Calculation of the runoff volume was adjusted. b) Scaled Loads – Substantial changes within the "model" option were made. Also, tool now scales all data in tables output from Sediment, TP, and TN Channel Routing 2) BMP Suitability a) BMP Suitability – Field formats in the output polygons were made that that impacted calculations in Cost Analysis. 3) Benefits Analysis a) Estimate Load Reductions – An issue was resolved with routing load reductions to downstream resources. b) Treatment Trains – An issue with incorporating loads from different treatment groups was fixed. An optional function was added to allow treatment trains to operate with data that has been scaled by a "model" or "gauge" data. c) Attach to Catchments – A number of changes were made to the processing of this tool. Previous versions had errors in attaching treatment groups to the catchments. 4) Cost Analysis a) Cost Analysis - Field formatting issues were found with cost analysis processing that resulted in error. These issues have been resolved. Part of the resolution involved updating field formats in BMP Suitability.	For data that has already been processed on older versions of the toolbar, the PTMApp development team suggests re-running the following operations: 1. Runoff Volume and Peak Flow 2. Summarize Catchment Loadings 3. Scale Loads (if ran previously) 4. BMP Suitability 5. Reduction Ratio 6. Screen BMP 7. Reduction Efficiency 8. Estimate Load Reductions 9. Scale Load Reductions (if ran previously) 10. Treatment Trains (if ran previously) 11. Generate Benefits Table 12. Attach to Catchments 13. Cost analysis
1.0.62	10/26/15	1) BMP Suitability a) BMP Suitability – an update was made to remove the 3D analyst extension requirement.	Per the original intent, Users only need a spatial analyst extension to use PTMApp Desktop

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	1/25/16	1) Benefits Analysis a) Attach to Catchments – an update was made to fix an issue with aggregating information from BMP Suitability treatment groups to catchments. 2) Web Update a) Button added that packages PTMApp-Desktop data for use in PTMApp-Web. ***Note – due to the relationship class joins needed for this button, a Standard ArcGIS license is required. There is an optional parameter for a function for Eliminating Doughnut Holes from polygons. If this is checked then an Advanced ArcGIS license is required. This is the only tool that requires additional license beyond the Basic Spatial Analyst extension. 3) Generate Catchments – Handle objected fields with non-default names.	The updated to Attach to Catchments will impact the table_BA_BMP_All_Catchment and table_ca_bmp_costeff tables. The Web Update button will allow users to package data for upload to PTMApp-Web. Note, the PTMApp-Web administrator will still need to publish the data to the web application.
1.0.73	2/29/16	1) Cost Analysis a) The cost-effectiveness indecies are not calculated as $ per ton (sediment) and $ per pound (nutrients) instead of ton per $ and pound per $.	This update will impact table_ca_bmp_costeff tables.
1.0.76	4/15/16	1) Generate Catchments a) The buffer function in generate catchments was adjusted for the 10.2 version of PTMApp-Desktop. The 10.2 version had an error when running this function do to versioning issues between ArcGIS 10.2 and 10.3 2) Extract Data for Web a) This button was added to the 10.2 version of PTMApp-Desktop	This update will impact all outputs from Generate Catchments only on the 10.2 version of PTMApp-Desktop
2.0.21	5/22/17	1) PTMApp Toolbar – Tool wide updates a) Added compatibility for ArcMap Versions 10.4.x and 10.5.x. b) Added checks for schema, read, and write locks on all data layers at beginning of each tool. c) Version information is provided on all scripting error messages d) Error logs can now be emailed via the toolbar. e) The toolbar automatically processes in background processing. If 64-bit background processing is installed tools will run in this mode.	Added functionality through “lakes routing” to estimate mass loads into and leaving water bodies.

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		2) Ingest Data – Clip watershed a) Added options to choose cell size. All valid raster's will automatically resample to this raster size. b) Fixed issue with snap raster. c) Updated required layers clipped. d) Converts all 64-bit rasters to 32-bit floating point. 3) Catchments and Loading a) Generate Catchments - a 'Priority resource snap point' input was provided to allow the user to specify the snap distance when generating catchments and priority resource catchments. Additional guidance is provided in the PTMApp-Desktop User Guide on page 33. The default value was changed to 0. Also, fixed issue with p_res_catch_ID number generation. b) Build Lake Data button – added to allow the user to build the lake morphometry data needed to determine the sediment, TP, and TN retention ratio for each lake. Please see Workshop Session 1 Section 5.2.5 and Workshop Session 2 Section 4.12 for how to hydro-condition and build PTMApp-Desktop input data for lake routing. c) Lake Routing button – uses the sediment, TP, and TN retention ratios developed in Build Lake Data to estimate the water quality benefit provided by each lake. Guidance on running this button is provided in Workshop Session 2 Section 4.13. 4) Ranking a) Priority Resource Delivery – Fixed locking errors on VM machines. 5) BMP Suitability a) BMP Suitability – the NWI layer will now be ignored if no data in layer. 6) Benefits Analysis a) Reduction Efficiency – the 'table_treat' button was updated with more recent BMP removal efficiency statistics aggregated from the Water Environment Research Foundation (WERF) BMP database.	

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		b) Treatment Trains – Fixed issue with catchments overlapping priority resource catchments. c) Generate Tables button – an 'Apply Lakes: (optional)' check button was added to allow the user to apply the lake sediment, TP, and TN retention ratios 7) Cost Analysis – Adjusted default storage numbers 8) Extract for Web – Restrict name of web zip to 25 characters	
2.0.26	6/26/17	1) Catchments and Loadings a) Lake Routing button – code modifications to improve computational efficiency; approximate decrease in amount of time necessary to complete processing is 75% 2) Benefits Analysis a) Treatment Trains – code modifications to improve computational efficiency; approximate decrease in amount of time necessary to complete processing is 75%	Considerable reduction in the amount of computer processing time necessary to generated desktop products.
2.0.33	9/1/2017	1) Add BMP_total_cost field calculation within Cost Analysis tool. 2) Fix data lock check that occurs prior to error trap setup. 3) Fix square miles calculation in the 'Extract For Web' tool. 4) Summarize Catchment Loadings add warning if mn_rainfall layers have incompatible values. 5) Fix left over test tables checks Priority Resource and BMP Suitability tools	
2.1.38	10/18/2017	1) Input data error validation has been implemented. 2) Clip Watershed – Error trap handling coordinates out of bounds. 3) Clip Watershed – Layers with no clipping data within study area will no longer be created. 4) Clip Watershed – Added clip check for PLSS_Quarter_Quarter_Sections. 5) Generate Catchments – Alter functionality to avoid duplicate output catchment IDs. Also, added duplicates validation check. 6) Lake Routing – Restart processing at last completed priority resource catchment.	

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		7) Treatment Trains – Restart processing at last completed priority resource catchment 8) BMP Suitability – Added more messaging to limit the appearance of stalled processing. 9) Generate Benefits Tables - Add the 'theacres' field to all treatment groups. 10) Extract For Web – Add bypass to allow for processing web data when Treatment Trains or Cost Analysis tables do not exist.	
2.2.83	2/12/2018	1) Clip Watershed – Add clip for ssurgo_hsg. 2) Generate Catchments – Validate all p_res_pts are within study area. 3) Summarize Catchment Loadings – calculations for RO_vol_2yr and RO_vol_10yr attributes in table_catchment were corrected. 4) Catchments and Loading – Sediment, TP and TN Channel Routing – separate channel decay coefficient for TP and TN. 5) BMP Suitability – Completed review of NRCS Field Office Technical Guide and updated selection criteria to reflect recent changes. Added "dummy check" to ensure BMP area and drainage area are within practical limits. See the BMP Suitability Technical Memorandum for additional information. 6) Reduction Ratio – T_Volume calculation changed slightly for infiltration. 7) Treatment Trains – Minor performance improvements. 8) Treatment Trains – Fix bug in final loop of catchments outside p_res catchments. 9) Generate Benefits Tables – Temp memory optimization to handle large projects better. 10) Administrator – Added more detailed information to the error submission zip file. 11) Extract for Web – Fix issue with output zip files larger than 4GB. 12) Fix default environments settings to avoid random background processing errors.	
2.3.87	3/28/2018	1) Clip Watershed – Added validation of input geodatabase names. 2) Clip Watershed – lakes_route case-sensitivity fix	

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		3) Build Lakes – Now clears output fields if restarted. 4) Build Lakes – Added validating "Area_ac" field exists and contains no null values. 5) BMP Suitability – Fixed issue with nwi protection processing on large study areas. 6) Attach to Catchments – Fixed a merge error when no filtration layer exists.	
2.4.107	5/18/2018	1) SDR to Catchment Outlet – Workaround for Zonal Statistics crashing issue with large rasters on computers with less virtual memory. 2) Ingest ACPF – tool added to BMP Suitability module 3) Generate Catchments –catchmentraster now created in this tool instead of BMP Suitability 4) Reduction Ratio – Specify rainfall depth in [inches * 1000] 5) Reduction Ratio – allowed code to convert existing BMP polygon to BMP raster for estimating BMP benefits based on changes to land cover 6) Change default contact email to 'ptmapp@state.mn.us'	1) Ability to estimate water quality benefits of ACPF practices using PTMApp-Desktop 2) Patches provided for previous errors/issues. 3) PTMApp tickets now triaged through BWSR/MNIT staff
2.5.111	6/4/2018	1) Ingest ACPF – Fixed Estimated Load Reductions calculation issue with the protection treatment group. 2) Ingest ACPF – Change validation checks to not require all treatment groups when processing. 3) Sediment, TP, and TN Routing to the Catchment Outlet tools - fixed critical output parameter issue.	1) Patched issues for these tools.
2.6.122	7/30/2018	1) SDR to Catchment Outlet – Reverted zonal statistics conversion to integer for crashing on computers with less virtual memory. 2) Build Lakes – Now estimates drainage area to lake based on surface grids (fac_surf and fdr_surf) when available. 3) BMP Suitability – Fixed issue multi-part polygons found in different catchments. 4) Ingest ACPF – Split benefits processing of ACPF Nutrient Reduction Wetland (NRW) by group code. Wetland buffer run as filtration treatment group. Wetland ponded area run as storage treatment group.	1) SDR to Catchment Outlet on v. 2.4.107 or later may want to consider rerunning as sediment delivery ratio may be overestimated. 2) For users that ran BMP Suitability on v. 2.2.83 or later, a small minority of BMP features (< 3%) may have multipart polygons that span multiple catchments. Please

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		5) Ingest ACPF – Now saves out riparian polygons and Grass Waterways polygon. 6) Created Treatment Trains Preprocess tool. This tool clips out BMP by catchment and updates the benefits data. 7) Treatment Trains – Added validation check for null values in the input BMP. 8) Extract for Web – Added tables and fields required for the new Grant Report tool in PTMApp-Web. 9) License Key – Removed re-sizing feature of Register prompt, ensuring that the Register key appears on all machines.	see entry 10 below for additional information. 3) New Treatment Trains button, 'Treatment Trains Preprocess', now provides users ability to split BMPs from independent datasets (e.g. ACPF BMPs) based on catchment area for greater functionality in the Treatment Trains tool. 4) Other changes improve usability or patch minor bugs.
2.7.137	9/14/2018	1) Sediment, TP and TN Channel Routing – Channel routing equations updated to divide delta_tt by 24 (unit conversion) 2) Build Lakes – Divide delta_tt by 24 (unit conversion) 3) Ingest ACPF – T_volume calculation updated for Bioreactor, NRW, WASCOBBasin, and DrainageMgmt ACPF BMP types 4) Reduction Ratio - Adjusted CN_wtsh calculation for infiltration practices to capture mean CN in BMP's drainage area (previously only for BMP footprint) 5) Ingest ACPF –Adjusted CN_wtsh calculation for ACPF practices placed in infiltration treatment group (similar to #4) 6) Treatment Trains Preprocess - Adjusted CN_wtsh calc (similar to #4)	1) Channel routing was underestimating load delivery due to unit conversion (which has been updated in this version). Please see entry #11 in 'Known Problems' section below for additional information 2) Adjusted CN_wtsh calculation may result in different values for infiltration practices than previously generated. Same thing was changed in Ingest ACPF and Treatment Trains Preprocess
2.8.140	9/28/2018	1) Sediment, TP and TN Channel Routing – Channel routing sediment equation updated to not divide delta_tt by 24. Default TP and TN coefficients set to '0.4'. 2) Build Lakes Data – Separated TN/TP Channel Routing Coefficients to match functionality available in Sediment, TP, and TN Channel Routing 3) Lakes Routing – Validation check for null values in SQ2_10, PQ2_10, and NQ2_10	1) Final upgrade of channel routing, adjustment to Build Lakes Data to decouple TP and TN routing coefficients now gives user full functionality to set distinct values for TP and TN transport

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		4) Help – Provided a link to the PTMApp-Desktop Error Submission Instructions document to assist errors with providing data and information to address ticket requests 5) Help – Changed email to ptmapp@state.mn.us.	2) Additional changes either (1) are validation checks or (2) regard the Help prompt for submitting tickets.
2.9.167	1/31/2019	1) ArcMap 10.6 toolbar now supported 2) Generate Catchments – Code alterations to support 10.6 3) Reduction Ratio – Code alterations to support 10.6 4) Apply Parallel Processing Factor for parallelization of up to 4 cores on relevant hydrology tools. Only available in 32-bit mode for 10.6. 32-bit mode is no longer blocked for use. 5) Add validation check for ArcMap patches relevant to 10.5.1 and 10.6.1 6) BMP Suitability – Added bypass for generating Protection BMPs when lakes_route and NWI layers do not exist. 7) Extract for Web – Added validation for spaces in name. 8) Extract for Web – Update 1W1P watershed names and areas to be consistent with current names and areas. 9) Lake Routing - Added validation for SQ2_10, PQ2_10, NQ2_10 fields ranging between 0 to 1. 10) Pre-treatment trains tool – removed as process is now incorporated into Treatment Trains. Only relevant for practices from Ingest ACPF. 11) Treatment Trains- select BMPs within a catchment by catch_ID attribute instead of spatially. 12) Cost Analysis – Fix Cst_ fields to calculate based on BMP_tot_Cost 13) Added daisy chaining support for all tools. (Exception for Clip Watersheds and Extract for Web). 14) Modified tool GUIs to only display output data files (Exception for BMP Suitability and Ingest ACPF). 15) Ingest ACPF – Handle catch_ID of null values by assigning them to catchment with most overlapping spatial area. 16) BMP Suitability – Adjust expand command to avoid grabbing any major flow line.	1) A compatible toolbar is now available for ESRI ArcMap 10.6. Users are encouraged to use that version (should they have access to an ArcMap 10.6 license) as it includes performances improvements and additional functionality. Please see the section below ***Detailed Notes for the PTMApp-Desktop*** Release for more information on these improvements. 2) For users still accessing the ArcMap 10.5 toolbar, they will still see some performance improvements including faster processing for table writing and handling of temporary data. 3) Because of changes in 10.6, the user interface for certain tools is now different. This difference in interface is only different for tools automatically pulled by the toolbar. Users will see now difference in what information is asked (e.g. coefficients or user-

Version No.	Release Date	PTMApp-Desktop Tool Affected and Summary of Modifications	User Implications
		17) Table writing and copying optimization – 19 tools with varying degrees of processing performance improvement. This benefit is for both 10.5 and 10.6 toolbars.	provided inputs) as inputs for each tool. 4) Users can now "daisy chain" all tools. This allows users to set up runs of tools rather then setting up and running them individually only after a previous tool has completed processing.
2.10.174	3/21/2019	1) Reduction Ratio – Fix S_wtsh field calculation inaccuracies and all related downstream calculations within the infiltration processing 2) Reduction Ratio – Fix null issue 3) Treatment Trains – Fix null issue 4) Generate Catchments – StreamLink inaccuracy workaround to address larger-then-average catchments for very large watersheds.	1) User that generated and populated infiltration polygons in v.2.9.167 should consider re-generating them as benefits analysis gave inaccurate values based on artificially high potential abstraction (S_wtsh) estimates. 2) Catchments generated in v.2.9.167 for very large watersheds (i.e. HUC-8) were larger on average then 40 acres due to an error in ESRI's StreamLink tool. This has been fixed through a workaround in v. 2.10.XXX but users may want to consider re-generating catchments.

Detailed Notes for the PTMApp-Desktop 10.6 Release

Detailed below is a list of specific items related to the 10.6 release of PTMApp-Desktop toolbar.

1) Performance Improvement Expectations in 10.6

The 10.6 PTMApp-Desktop toolbar contains some significant performance improvements. The toolbar has 34 individual tools, and 24 of them (71%) will have varying degrees of performance improvements in ArcMap 10.6 (**Table 1**). These improvements were implemented by a combinations of code refactoring and technological advancements. Here are the main factors which led to these improvements:

- Parallel Processing implemented for raster calculations within the hydrology tools, including Flow Accumulation, Watershed, Fill, and Stream Link. *This improvement only works in 10.6 32-bit processing mode currently*.
- Redesign of the method used for calculating and populating tables. This includes combining multiple calculations into one insert/update cursor.
- Saving temporary products into temporary dictionaries instead of copying the data to disk.
- Removal of unnecessary copying of temporary data, where applicable.

Expected performance improvements will vary by project. However, the larger the project (larger total area, finer raster grid scale, etc.) the more users can expect improved performance. This will be most noticeable for projects with more resource points. A rough estimate of about a 50% improvement over your entire project can be expected. This is in comparison to the previous v.2.8.140 PTMApp-Desktop toolbar release in ArcMap v.10.5.

The relative improvement you can expect can vary from none to 99% depending on the tool. Below is the estimated breakdown of what you can expect. Your results will vary depending on the size of project and the computer hardware you are using. These estimates are provided for reference only. Please keep this in mind when running your data.

Please also note that, even with these improved processing speeds, the best way for a user to reduce their processing times is through their decisions in preparing their data. For example, choosing a grid scale appropriate for their expected use of the data or only choosing resource points which are absolutely necessary, still remain the best avenues for ensuring reasonable processing times.

Table 1. Performance improvements for the PTMApp-Desktop toolbar v.2.9 release in ESRI ArcMap v.10.6 versus the toolbar v.2.8.140 release in ArcMap v.10.5. Please note these improvements were estimated for example watersheds and may vary based on many factors.

Tool	Approx. Improvement	Notes
Ingest Data - Clip Watersheds	5%	
Ingest Data – Preprocessing data	None	
Catchments and Loading - Generate Catchments	25%	Assumes ESRI ArcMap v10.6 run in 32-bit mode with input/output rasters larger than 5000 x 5000 (cells)
Catchments and Loading - RUSLE Calculator	None	
Catchments and Loading - Travel Time	None	
Catchments and Loading - SDR to Catchment	None	
Catchments and Loading - Sediment Routing	90%	Assumes ESRI ArcMap v10.6 run in 32-bit mode with input/output rasters larger than 5000 x 5000 (cells)
Catchments and Loading - TP Loads	90%	Assumes ESRI ArcMap v10.6 run in 32-bit mode with input/output rasters larger than 5000 x 5000 (cells)
Catchments and Loading - TN Loads	90%	Assumes ESRI ArcMap v10.6 run in 32-bit mode with input/output rasters larger than 5000 x 5000 (cells)
Catchments and Loading - Runoff	90%	Assumes ESRI ArcMap v10.6 run in 32-bit mode with input/output rasters larger than 5000 x 5000 (cells)
Catchments and Loading - Summarize	40%	
Catchments and Loading - Channel Routing	80%	
Catchments and Loading - Scaled Loads	None	
Catchments and Loading - Build Lakes	50%	Assumes ESRI ArcMap v10.6 run in 32-bit mode with input/output rasters larger than 5000 x 5000 (cells)
Catchments and Loading - Lake Routing	15%	
Catchments and Loading - SPI - Calculator	None	
Ranking - SPI	10%	
Ranking - Leave Landscape	50%	
Ranking - Delivered	50%	
Ranking - Priority	99%	
Ranking - Custom Weighting	20%	
BMP Suitability - BMP Suitability	15%	
BMP Suitability - Excluded Areas	None	
BMP Suitability - Ingest ACPF	60%	
Benefits Analysis - Reduction Ratio	75%	Assumes ESRI ArcMap v10.6 run in 32-bit mode with input/output rasters larger than 5000 x 5000 (cells)
Benefits Analysis - Screen BMP	None	
Benefits Analysis - Reduction Efficiency	80%	
Benefits Analysis - ELR	30%	
Benefits Analysis - SLR	30%	
Benefits Analysis - Treatment Trains	15%	
Benefits Analysis - Generate Benefits	50%	
Benefits Analysis - Attach to Catchments	None	

Tool	Approx. Improvement	Notes
Cost Analysis	95%	
Extract for Web	None	

2) Recommendation for 32-bit/64-bit mode in ESRI ArcMap v.10.6

In previous versions of PTMApp-Desktop, we recommended exclusively using 64-bit background processing. However, in 10.6 the choice between 32-bit and 64-bit mode becomes a little more complicated.

In the current ESRI ArcMap 10.6 version, the new parallel processing functionality only works in 32-bit mode. But, all other tool operations run faster in 64-mode. Therefore, we recommend using either 32-bit or 64-bit mode based on aspects of your dataset:

- For projects with a study area of less than 5000 x 5000 raster cells use 64-bit background processing. This would be for all tools.
- For larger projects (i.e. input rasters are larger than 5000 x 5000 cells) use 64-bit background processing for most tools. The exceptions would be the 7 tools shown in **Table 2**, which will benefit significantly from parallel processing. Use 32-bit mode by turning off your background processing in ArcMap. This background processing feature can be toggled on or off before running each too. This can be done via Geoprocessing -> Geoprocessing Options -> Background Processing -> Enable (uncheck).
- The 32-bit mode can sometimes have memory limitations depending on computer hardware and other operations running on the machine. Therefore, if you receive an "Unable to allocate memory" error while running in 32-bit mode you will need to switch back to 64-bit.
- If you are daisy chaining tools together for processing they can only be chained together when running all in the same mode.

So, in summary, you should run PTMApp exclusively in 32-bit for smaller projects but, for larger projects, should consider toggling between 32-bit for tools in Table 2 and 64-bit for all other tools. This only applies to running the PTMApp-Desktop toolbar in ArcMap 10.6.

Table 2. Recommended tools to run only in 32-bit mode, as each will encounter faster runtimes through the application of parallel processing, which is currently only available in ESRI software in ArcMap v.10.6 running in 32-bit.

Tool
Catchments and Loading - Generate Catchments
Catchments and Loading - Sediment Routing
Catchments and Loading - TP Loads
Catchments and Loading - TN Loads
Catchments and Loading - Runoff
Catchments and Loading - Build Lakes
Benefits Analysis - Reduction Ratio

3) Potential differences in data generated in ESRI ArcMap v.10.6 vs previous versions

During testing, it was identified that changes made by ESRI to one hydrology tool, Stream Link, resulted in small changes to raster calculations that may accumulate moving downstream. These differences are effectively rounding errors, as raster data is saved to 6 significant digits. But when accumulating these differences across many thousands of cells it can impact the products derived from the Stream Link output.

For users creating data for the first time in v.10.6, this is not an issue. It is only an issue for users that wish to re-create data in v.10.6 to exactly match data from a previous version. In these cases, users should only notice differences when comparing data on major flowlines within large project areas.

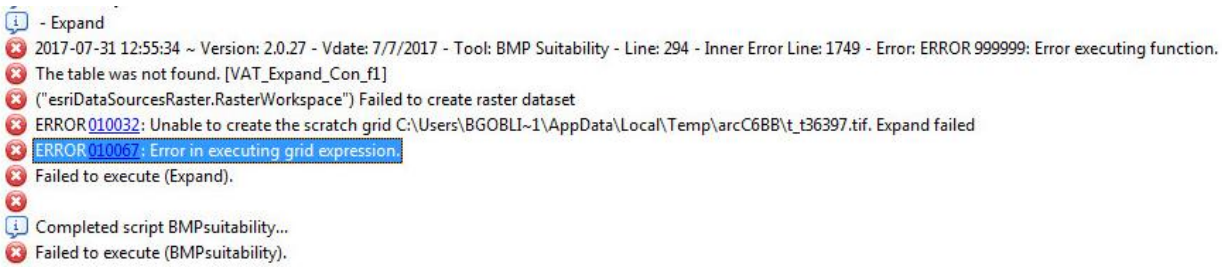
Similarly, catchment generation in v.10.6 along major flowlines may also differ. If a user needs to re-create data in v.10.6 and wishes to have the same catchments as data created in a previous version (10.5 or earlier), it is recommended they retain their previous catchment delineations and run the toolbar beginning with the first tool AFTER Generate Catchments, RUSLE Calculator.

PTMApp-Desktop Known Problems and Data Review

Detailed below is a list of known problems with the current PTMApp-Desktop toolbar. These issues pertain, predominantly, to how the toolbar saves data, accesses data, or interacts with ESRI ArcGIS software. For each problem, a screenshot of the generated error is shown (where available), along with a brief explanation of the cause of the error and a detailed description of the steps necessary to resolve the error. These problems (and their fixes) have been drawn largely from the help tickets provided by PTMApp users here: Ptma@tickets.assembla.com.

1) BMP Suitability error caused by the Expand tool

a. Example PTMApp toolbar error message:

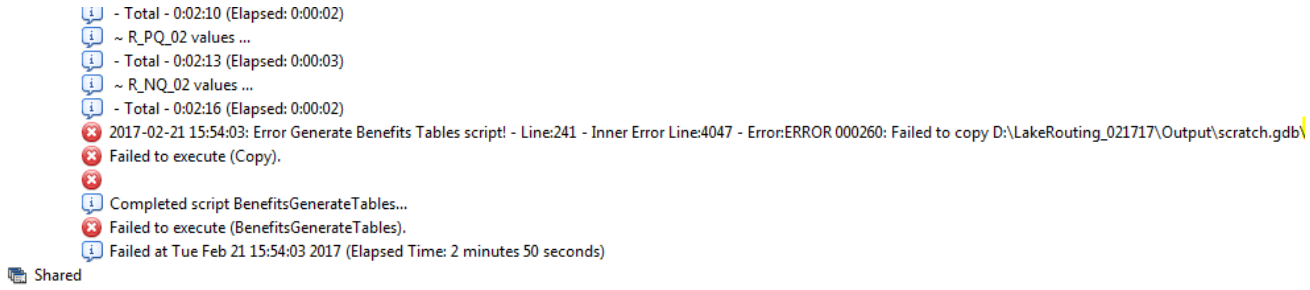


b. **Cause:** The above message is caused by a bug internal to the ESRI Expand tool and appears (to our knowledge) only in ArcGIS v10.5. This bug has been removed in newer versions.

c. **Fix:** Upgrade to ArcGIS v. 10.5.1 and download and install Service Pack 1. ***Please note then that you will not be able to run BMP Suitability in ArcGIS v. 10.5.***

2) Read/Write error when accessing/using data – can appear in any PTMApp tool

a. Example PTMApp toolbar error message:



b. **Cause:** Read/Write errors are typically caused when the toolbar looks to use, copy, and/or overwrite an existing feature class which is currently in use in the user's or another ArcGIS document.

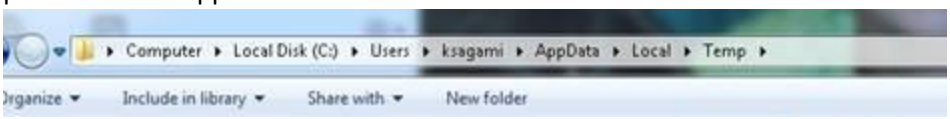
c. **Fix:** Remove the feature class from your ArcMap document and rerun the PTMApp button. If this does not clear the error, close the ArcMap document, open a new document, and rerun the PTMApp button. If this still does not clear the error, close the ArcMap document and open the folder or geodatabase the feature class resides in within Windows Explorer. If a lock still shows up in the geodatabase (and you're sure another user is not accessing the geodatabase) then manually delete the lock in Windows Explorer and rerun the PTMApp button in a new ArcMap document.

3) Read/Write error when saving data

a. **Cause:** Saving data to an external server can cause disruptions that can terminate internal processing within PTMApp.
b. **Fix:** To avoid this issue, we recommend saving data to an internal drive (e.g. local C-drive). This can be set in the PTMApp Administrative Settings tab following the guidance on pages 4-5 of PTMApp Workshop 2 or in the Environments settings of each PTMApp toolbar button.

4) Error Generated from Lack of Memory (common in BMP Suitability and other buttons)

a. Example PTMApp toolbar error message: N/A
b. Cause: GIS processing internal to PTMApp tools (e.g. zonal statistics and other operations on rasters) often creates a large number of intermediate products which are not saved to either the user's current workspace or the scratch workspace. These products are saved to a temporary (TEMP) folder often within the program files saved when the ESRSI ArcGIS software was downloaded.
c. **Fix:** To avoid this issue, first try clearing data from the TEMP folder and rerunning the particular PTMApp button. Below is a screenshot of where this data can be accessed:



If the process again fails, you may need to consider either (1) modifying your PTMApp inputs to reduce the size of the intermediate rasters or (2) adding additional local memory to your machine to create and store those intermediate products. Changes to PTMApp inputs could include either generating PTMApp inputs at a courser grid size (e.g. 5m or 10m instead of 3m) or splitting the project watershed into smaller watersheds. If you choose to add memory to your machine, you could, for example, add additional internal drive storage through an internal hard drive. We recommend adding at least 500 GB of generic storage to process most large watersheds (HUC-8 scale). Portable drives oftentimes do not work as suitable replacements for internal hard drives

as the USB connection can greatly slow communication time between the external hard drive and the PTMApp software, causing some ESRI operations to fail or not run to completion.

If/when you add the internal hard drive, please remember to modify the pathway of the TEMP folder to the new drive.

5) Catchments < 5 acres generated near priority resource points

a. **Example PTMApp toolbar error message:** This problem will not typically generate an error.
b. **Cause:** The Generate Catchments button will generate a priority resource catchment upstream of all areas flowing to a resource point. This button also mandates that all delineated catchments (those that average ~40 acres in size) fall completely within a priority resource catchment. These two rules can oftentimes lead to very small catchments delineated either upstream or downstream of a resource point. Sometimes these catchments can be as small as a few raster cells.
c. **Fix:** You can manually merge these small catchments with one adjacent catchment, but you should consider updating both the 'Catchment' feature class and 'Catchmentraster', which is a raster grid representing the location of catchments with cell values equal to the 'catch_id' in the Catchments feature class attribute table. Both of these data products can be found in the Processing geodatabase in your project's data output folder. If you choose to merge catchments, please ensure:
    i. The small catchment is merged within another catchment that's also contained within the same priority resource catchment. Priority resource catchments can be found in the 'p_res_catchment' feature class.
    ii. Any updates you make in the 'Catchment' feature class are reflected in 'Catchmentraster'. This may require manually changing raster cell values in Catchmentraster.
    iii. The pp_catchment (pour raster) data will need to be modified to accurately reflect the pours of the merged catchments. To test accuracy, re-delineate the catchments using the modified pp_catchment as the pour raster. The delineated raster can replace the "Catchmentraster" file and should match the merged catchments perfectly.

6) Duplicate catchment pour point values generated in pp_catchment

a. **Example PTMApp toolbar error message:** This problem will not generate an error.
b. **Cause:** Previous PTMApp-Desktop versions may not always create unique values for each catchment pour point. This can be checked by opening the 'pp_catchment' raster, and sorting the 'Count' attribute. If all values equal '1', then all catchments will have a single geometry for each catchment value (as shown in the 'Value' attribute in the table). If any values are greater than '1', then multiple catchment geometries may have

the same catch value, or 'catch_id'. This may cause loading and BMP results in one or more of the similar-numbered geometries to be missed, as these results can only be connected to a single catchment ID, or 'catch_id'. This will only be a problem for the geometries that have more than one catch_id, all other catchment ID's should have been assigned accurately.

c. **Fix:** Any PTMApp-Desktop v. 2.1.38 or later will have had this potential error addressed. Any data created in an earlier version, which had this issue occur, will need to be run on a newer version of the toolbar to be remedied.

7) Background Processing Error

a. Example PTMApp toolbar error message: "Background Processing has encountered a serious error and is unable to continue".

b. **Cause:** Computationally intensive tools such as Catchments and Loading > Lake Routing and Benefits Analysis > Treatment Trains may occasionally suffer a fatal error when processing very large areas, typically HUC-8 watershed sizes (> 500 sq-miles) and larger with fine raster grid sizes (e.g. 3m x 3m). Based on preliminary testing, the error occurs in all ArcGIS versions before 10.6 and occurs whether or not background processing is enabled (although it is more likely to occur when its enabled).

c. **Fix:** The most recent public release of the PTMApp toolbar has included additional internal checks and minor codes changes to avoid this error and better circumvent intermittent crashes. The most significant of these is an internal restart which now allows the user to restart a tool from the last resource point that was finished before the crash. The user doesn't need to "select" anything for this to occur. The toolbar will do this automatically.

Long-term, ESRI ArcGIS v.10.6 has included functionality that bypasses this error. Early tests on datasets that had previously generated this error have successfully avoided it. Future releases of the PTMApp toolbar in v.10.6 should all together avoid this issue.

8) Bug Fixed in Lake Routing for v. 2.2.83

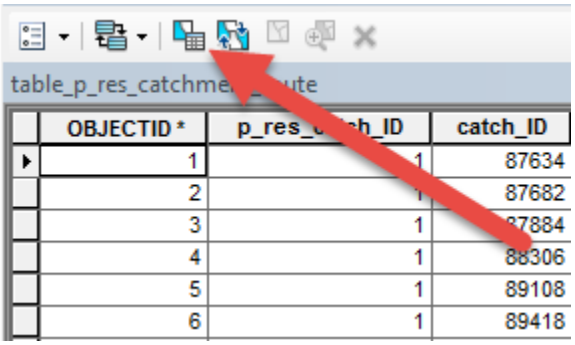
a. **Example PTMApp toolbar error message:** No error generated.

b. **Cause:** Beginning with PTMApp toolbar v. 2.1.38, functionality was added to the Catchments and Loading > Lake Routing button to allow the button to restart from the last-completed resource point. A bug was located in the code that caused rewrites of the 'bl' attribute values that save inputs to table_p_res_catchment_route before lake routing is run. You can see a list of these attributes in Table 11 of the Attribute Catalog on the PTMApp Documentation Website. This bug then led to miscalculation of loading values in that same table. An example is shown below for a given catchment draining to multiple resource points.

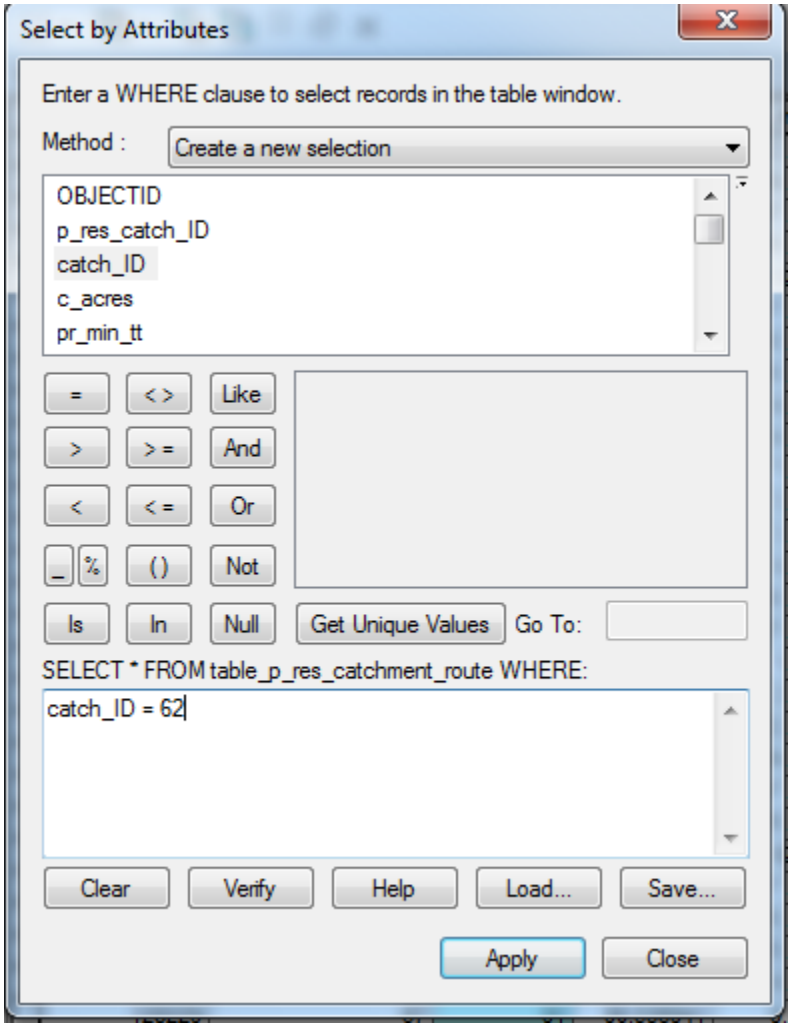
L_Sed_A	L_TP_A	L_TN_A	bl_c_sed_mass_fl_tons	bl_c_tn_mass_fl_lbs	bl_c_tp_mass_fl_lbs
1	1	1	19.45395	168.4415	2.087532
1	1	1	19.45395	168.4415	2.087532
1	1	1	19.15603	167.1467	2.061917
1	1	1	19.15603	167.1467	2.061917
0.364014	0.445548	0.603336	52.6244	277.037574	4.627821
0.364014	0.445548	0.603336	52.6244	277.037574	4.627821
0.358577	0.440216	0.598813	52.6244	277.037574	4.627821

The bl_c_sed_mass_fl_tons, bl_c_tn_mass_fl_lbs, and bl_c_tp_mass_fl_lbs, attributes should not vary for a given catchment.

You can check to see if your data has incorrect loading values due to this bug by opening the table_p_res_catchment_route table and clicking on 'Select by Attributes':



Select a catchment (via catch_id) that drains to at least one lake. In the screenshot below we're selecting the catchment with catch_ID = 62:



If, for this given catchment, you see more than one distinct value in either of the attributes noted above, then you may want to consider rerunning the data on the newest toolbar.

Please note, a PTMApp user would only experience this bug if Lake Routing was stopped and restarted during its run and the table_p_res_catchment_route was not deleted before the tool was rerun. In all other cases users would not have experienced this bug.

c. **Fix:** The most recent public release of the PTMApp toolbar (v. 2.2.83) has addressed and fixed this bug. If any Lake Routing was run on a dataset and table_p_res_catchment_route shows more than one distinct value for a given catchment (as outlined above), then you should consider rerunning on the newest version of the toolbar. To do so please:

1) Delete the 'table_p_res_catchment_route table' and 'lakes_route' feature class currently in your output Processing geodatabase**.**
2) Copy the 'lakes_route' feature class in your input Processing geodatabase to your Output Processing geodatabase.
3) Rerun the 'Sediment, TP and TN Channel Routing' button to re-create table_p_res_catchment_route.
4) Then re-run 'Build Lakes' and 'Lake Routing' to accurately populate the 'lakes_route' and 'table_p_res_catchment_route' attributes related to Lake Routing.

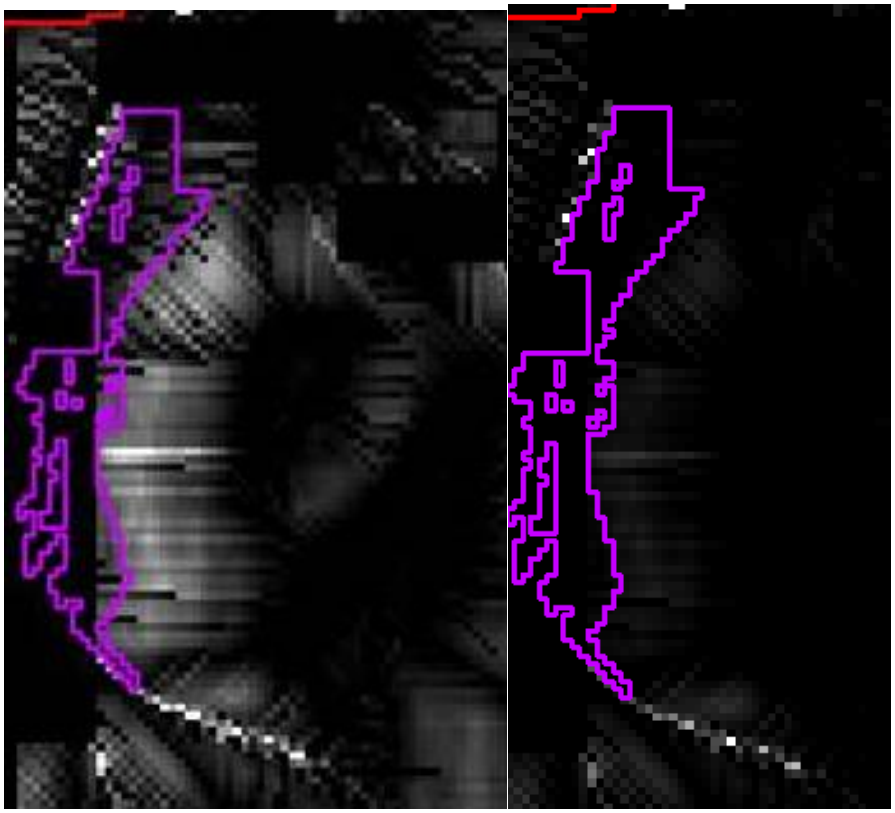
Note: If any 'AAProcess_...' files remain in your processing geodatabase after Lake Routing has run, please remove them before rerunning any PTMApp tools.

9) Treatment Trains reductions do not match individual BMP reductions

a. **Example PTMApp toolbar error message:** No error generated.
Cause: Sediment, TP, and TN load reductions calculated in Benefits Analysis, are estimated based on statistical BMP efficiencies applied to the largest flow accumulation cell in a given BMP polygon. This is performed because estimating load reductions for all flowpathways to the BMP requires delineating watersheds for each BMP and is oftentimes computationally prohibitive for the tens of thousands to hundreds of thousands of BMPs that are identified in BMP Suitability. As Treatment Trains is run on a subset of BMPs chosen by the user for implementation purposes, watersheds are delineated for each BMP and used to better estimate overall load reduction from the BMP and other BMPs it interacts with. The specific process Treatment Trains uses to estimate load reductions can be found in the Technical Memorandum on the PTMApp website.

This variation may result is different load reductions calculated in either Benefits Analysis or Treatment Trains for a given BMP. The difference is minimal for BMPs which deliver flow to one flowline (e.g. grassed waterway or depressional storage practice) but will be more significant for BMPs that may see more diffuse flow (e.g. filter strip).

This is shown visually in the figure below. The purple polygon is a filtration practice (specifically a filter strip) and the black-to-white grid is the 'sed_mass_fl' raster, which represents sediment delivery to the flowline (or catchment outlet). White cells mean high delivery while black cells mean low delivery. The figure on the left represents the grid before Treatment Trains was run while the figure on the right represent the grid after treatment trains was run. In this case we see all cells reduced which deliver flow to the BMP. When this BMP was run through Benefits Analysis, reductions would only have been registered for the flowline with the highest flow accumulation, likely the white one visible on the bottom of both figures.



10) Multi-part BMP polygons spanning multiple catchments

Note: This bug occurred only in PTMApp-Desktop toolbar versions 2.2.83 to 2.5.111.

Example PTMApp toolbar error message: No error generated.

Cause: A bug was identified and addressed within the process used to connect multi-part BMPs within the same treatment group on a flowline in the same catchment. For data run on versions 2.2.83 – 2.5.111 of the toolbar, the tool occasionally merged polygons into single features which were not in the same catchment, resulting in distinct BMP features that spanned multiple catchments and potentially resource catchments. Benefits estimated for these BMPs, such as load reduction or cost-effectiveness, would have only been estimated for one catchment, and would therefore have been incorrect.

This issue was not found to be widespread in tested data, and usually impacted < 1% of BMPs generated. Incidence of occurrence increased based on size of the watershed, so very large watersheds (e.g. HUC-8's and those > 1,000 sq-mi) may see occurences in up to 3% of BMPs.

A utility was developed to assist users in searching for BMPs which may be impacted by this bug. The utility will search for multipart polygons in each BMP feature class and will print a separate feature class to include any multipart polygons that span multiple catchments. This tool and guidance to run it is on the PTMApp Website's Theory and Documentation page. If, after running this utility, you do find multi-part polygons which span multiple catchments, you may wish to delete them or otherwise note them in your dataset. As this issue occurs in a vast minority of data generated (usually <1% of BMPs), you should not need to re-create or otherwise re-run your PTMApp-Desktop dataset.

11) Update to in-channel sediment, TP, and TN routing and load delivery to resource points

Example PTMApp toolbar error message: No error generated.

Cause: An issue was identified for data generated using PTMApp toolbar version 2.6.122 and prior (releases on or before July 30, 2018) relating to how PTMApp calculates sediment, total nitrogen (TN), and total phosphorus (TP) transport through channel networks. The equations used to estimate the fraction of load leaving the catchment outlet (or flowline) which reaches the priority resource point were underestimating the amount of mass that should have been reaching resource points. For small watersheds (e.g. HUC-12's) with short flow lengths and travel times to resource points, this issue is less significant, but for larger watersheds (e.g. HUC-8's) with longer flow lengths and travel times, it is more significant. This issue also affected any conservation practice benefit calculations measured at resource points but DID NOT affect load estimations at the catchment outlet or conservation practice benefits calculated at the catchment outlet.

A patch was developed to provide users an opportunity to update loads and BMP benefits measured at priority resource points. It is advised that any individual/group which created PTMApp data using a 2.6.122 version toolbar and prior and wishes to have updated loads and BMP benefit information run this patch.

The patch can be accessed on the PTMApp user documentation page by clicking on the 'ArcGIS Tool to Update Channel Loading' link:

https://ptmapp.bwsr.state.mn.us/User/Documentation

This link also includes a user guide to assist in running the patch.

Please also note that you will not need to re-run any tool in the toolbar to apply this patch. You only need to run the patch to update values in the PTMApp tables and features classes.

12) ESRI Bug in Zonal Statistics tool in 10.5.1

Example PTMApp toolbar error message: No error generated.

Cause: An issue was identified during a QAQC of PTMApp data while running the PTMApp Toolbar on a large project area approximately about 3 HUC 8s in size. ESRI states that incorrect statistics are produced when and 8 bit raster is used. The table below states which tools runs Zonal Statistics and Zonal Statistics as Table. The error in statistics was found in relation to Zonal Statistics but could possibly apply to the Zonal Statistics as Table also.

Tool	Zonal Statistics	Zonal Statistics as Table
Generate Catchments	X	
SDR to Catchment Outlet	X	
Runoff Volume and Peak Flow		X
Summarize Catchment Loadings		X
Scale Loads		X (model only)
Build Lakes Data	X	X
Lakes Routing	X	X
Custom Weighting		X
BMP Suitability	X	X
Ingest ACPF		X (looping)
Reduction Ratio		X
Estimate Load Reductions		X
Treatment Trains		X - 10 (looping)

Fix: Go to the link below on the ESRI Page with the Patches for 10.5.1. Install on the Machine before running PTMApp.

https://support.esri.com/en/download/7582

Please download and install the 2 patches in red below.

ArcGIS 10.5.1		Checksum (Md5)
ArcGIS Desktop Background Geoprocessing (64-bit)	ArcGIS-1051-BGDT-SAZST-Patch.msp	7AD849862CC008F978BCFEE4D786C442
ArcGIS Engine Background Geoprocessing (64-bit)	ArcGIS-1051-BGE-SAZST-Patch.msp	44C60466DA6A750BB9D3BE464C21E31F
ArcGIS Desktop	ArcGIS-1051-DT-SAZST-PatchB.msp	36C95A516F9239A30D10A1A6B5BB8D2C
ArcGIS Engine	ArcGIS-1051-E-SAZST-Patch.msp	369E26F2BBBF699AAEA7BEF34E19D6A1
ArcGIS Server	ArcGIS-1051-S-SAZST-Patch.msp	61D30C6AABF260C15BF046F4230A1164