User's Guide: **AgBufferBuilder: A Filter Strip Design Tool for GIS**

Version: 2.0

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Disclaimer: AgBufferBuilder 2.0 and associated documentation is supplied as-is with no warranty, explicit or implied. The program is provided as an educational and research tool. As with any model, the quality of results is highly dependent on the user's skill and ability to select input data and parameters that accurately represent the field site, to run GIS software, and to properly interpret the results.

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1. What is AgBufferBuilder 2.0?

AgBufferBuilder 2.0 is a computer program developed for use with ArcGIS (ESRI, Redlands, CA) to produce performance-based designs and assessments of vegetative filter strips around agricultural fields. A vegetative filter strip is a type of buffer used for trapping sediment and other pollutants carried in overland runoff from agricultural areas. The core model is based on relationships between buffer area ratio and trapping efficiency which account for pollutant type and site conditions. The relationships are based on a design storm of 61 mm in 1 hr producing runoff from an agricultural field to a well-established grass filter strip. In AgBufferBuilder 2.0, the core model is coupled with terrain analysis in the GIS to produce maps of designs and estimates of performance that can account for spatially non-uniform runoff from a field.

AgBufferBuilder 2.0 contains a design module and an assessment module. The design module produces a design for a filter strip that will achieve an approximately constant, user-selected level of pollutant trapping efficiency around an agricultural field. The assessment module estimates the whole-field pollutant trapping efficiency of a user-defined existing or hypothetical filter strip.

The core model is derived from the process-based Vegetative Filter Strip Model (VFSMOD ver. 2.x; Muñoz-Carpena and Parsons 2005). For a complete description of VFSMOD and its development, refer to the website http://abe.ufl.edu/carpena/vfsmod/. For a detailed description of the core model and its development, refer to Dosskey et al. (2011). For a detailed description of its coupling with terrain analysis and GIS in the AgBufferBuilder tool, refer to Dosskey et al. (2015).

2. How to Use AgBufferBuilder 2.0

AgBufferBuilder 2.0 runs with ArcGIS versions 10.0, 10.1, 10.3 and 10.4. Compatibility with other versions of ArcGIS has not been investigated. It is assumed that the user has the ArcGIS program loaded onto a computer having sufficient computing capability, network connectivity, and peripheral hardware for acquiring digital datasets, conducting the GIS operations, and displaying the results. It is further assumed that the user has training and experience working with ArcGIS and these system components.

To get started:
1. Download the zip file containing the appropriate AgBufferBuilder program from the website and extract the zip file to C:/.

2. Open the file **BufferBuilder_v2.0.mxd** in ArcGIS. The program will open as an ArcMap Project that contains the AgBufferBuilder toolbar. Be sure that you have also installed and enabled the Spatial Analyst and 3D Analyst extensions of ArcGIS.

3. Then, follow the step-by-step instructions provided in Appendix 6.5 of this guide.

AgBufferBuilder 2.0 will utilize a digital elevation model (DEM), a digital aerial orthophotograph, and some manually input information on soil conditions and design criteria for determining and mapping locations for filter vegetation around an agricultural field (design) and for producing estimates of performance of existing and hypothetical filter strips (assessment).

3. The Design Procedure

How to Conduct the Design Procedure. The design procedure will produce a design for a filter strip that will achieve an approximately constant, user-selected, level of pollutant trapping efficiency around an agricultural field. The design procedure uses two sets of tools: *"Clip & Project, Editing Tools"* and *"Buffer Builder Main"*. Using these tools, the major steps of the design process are (See also the Flow Chart in Appendix 6.3):

1. *Obtain DEM and aerial orthophotograph of the field site.* Reliable sources of DEMs and imagery include the USGS National Map (https://nationalmap.gov/) and the USDA-NRCS Geospatial Data Gateway (https://gdg.sc.egov.usda.gov/). Before using a DEM or orthophotograph, check the quality of the data for acceptable accuracy and resolution. Finer DEM grid sizes will produce more-precise results, but take longer to produce.

2. *Define the Area of Interest.* Using the *"Clip & Extract, Editing Tools"*, manually draw the <u>outside</u> margin of the agricultural field on the orthophotograph. The outside margin is the furthest that the filter strip will extend away from agricultural field and it defines the project area-of-interest (AOI). Typically, the outside margin will be located along a property line or roadside ditch, or along the upper bank of a stream, lakeshore, or wetland that will be protected with the filter strip. During execution of the Buffer Builder Main tool, the drawn field border (vector) will be converted into field border cells (raster).

3. *Input Site Conditions and Design Trapping Efficiency.* Open the "*Buffer Builder Main*" dialog box. Select from dropdown menus an average surface soil texture class (Appendix 6.1) and C-factor condition (Appendix 6.2) for the whole field. For C-factor, only two conditions are currently available and they represent seedbed stage for those two tillage/residue conditions. Future versions will allow users to input a value for C-factor, such as those that appear in Appendix 6.2. For rotation systems, the C-factor condition should reflect the one that produces the higher sediment load. Input the pollutant type number ("0" for sediment; "-1" for sediment-bound). Sediment-bound pollutants include nutrients and other chemicals in runoff that are bound to sediment particles. Finally, specify the level of trapping efficiency to be achieved by the design. Trapping Efficiency is the percentage of current runoff load from the AOI to be trapped by the filter strip.

4. *Run the Buffer Builder Main tool*. Click "OK". When the computations are completed, the computer monitor will show a map of the designed filter strip on the aerial photograph with contour lines shown. A map file is created that contains the field photograph, and

GIS layers for the border raster, contour vector, and designed filter strip raster. A spreadsheet file is created that contains input values and design statistics (see Appendix 6.6), including total area of the field (AOIAREA), total area of designed filter strip (BUFFERAREA), and the calculated whole field trapping efficiency of the designed filter strip (CAWATE1).

5. **NOTE:** The spreadsheet file contains four values for CAWATE (1-4). CAWATE1 is the value for the buffer as shown in the map output (i.e., cells shown filled with buffer). The value for CAWATE1 can be different (probably less) from the input-specified value for two reasons. The first reason has to do with rounding down minor fractions of buffer area requirement (< 0.5 cell). Cells that were rounded down are considered empty in the design and in the calculation of CAWATE1. The other CAWATE values (2-4) make different assumptions about rounding buffer area requirements to fill or not fill fractions of cells and are there for research purposes. The value for CAWATE3 assumes no rounding, should be very close to the specified input value under most circumstances, and can be used as a check on the internal calculation processes. The second reason is that contributing areas of some border cells may have severe site conditions that make a filter strip incapable of achieving the input-specified level of trapping efficiency and a lower value is assigned to those cells (see Step 2, below).

How the Design Procedure Works. The major operations executed by the Buffer Builder Main tool are:

1. *Calculate Terrain Attributes for Field Border Grid Cells.* The set of grid cells in the AOI that contribute runoff flow to each field border grid cell is determined by running the Flow Accumulation function. This function also determines the Flow Direction through each grid cell. Average Slope (in percent) of each contributing area is determined by dividing slope-weighted Flow Accumulation by the un-weighted Flow Accumulation. Then, Stream Power Index for each grid cell is calculated, where SPI = ln (Contributing Area x Average Slope).

2. *Determine Buffer Area Requirement for each Field Border Grid Cell.* For each grid cell in the field border, the appropriate equation that relates buffer area ratio to trapping efficiency is determined based on pollutant type and the average slope, soil texture, and C factor of its contributing area. The buffer area ratio that corresponds to the desired trapping efficiency is multiplied by the contributing area to that cell to determine the Buffer Area Requirement, i.e., number of grid cells that need to be filled with filter strip. If the desired trapping efficiency is greater than the upper limit that can be achieved under the existing site conditions, then the upper limit value is substituted for desired trapping efficiency with the result that the Buffer Area Requirement equals the entire contributing area for that border grid cell.

3. *Place Filter Strip in Grid Cells.* For each grid cell in the field border, the field border cell is filled first and, then, sequentially, cells in its contributing area that are closest to it and

up-gradient from it, based on flow direction, are filled until the total number of cells in its Buffer Area Requirement are filled. A higher value for Stream Power Index is used to break ties between cells of equal distance from a Field Border cell. This algorithm balances the need for filter to contact greater runoff load with the practical need to encourage compact field margin designs.

4. *Create a Map Project File and Data Spreadsheet.* The map file will contain the field photograph, and GIS layers for the border raster, contour vector, and designed filter strip raster. The data spreadsheet will contain input values and design statistics, including total area of the field (AOIAREA), total area of designed filter strip (BUFFERAREA), and the calculated whole field trapping efficiency of the designed filter strip (CAWATE1).

How to Apply the Design Results. The design results can be used by the landowner and conservation professional to guide where to install filter strip around the field. The spatial statistics, especially the total area of filter strip and trapping efficiency, can be used to compute various costs, incentives, and market values associated with the filter strip. If the modeled design is unacceptable to the landowner, it can still be used as a guide for placing filter strip around the field. In this case, the assessment procedure can be used to draw alternative designs and to estimate their pollutant trapping efficiencies. Keep in mind, however, that reducing the size of wider designed portions will reduce trapping efficiency of the filter strip and filling gaps between designed patches will increase the costs without adding much performance. Both of these modifications to the design will reduce cost-effectiveness of the filter strip.

Limitations of the Design Results. Design maps created by this procedure should be used cautiously, preferably after some form of field checking to ensure their validity, for several reasons:

- The DEM dataset may contain inaccuracies produced by conversion of contour maps to a digital grid structure, by land shaping and drainage modifications made after the original topographic data was collected, and by influential microtopography that is too subtle to be detected by the original topographic data.

- The design procedure assumes that no runoff flows into the AOI from areas outside of the AOI.

- The ArcGIS algorithm for determining flow direction and flow accumulation from the DEM (D8; Jenson and Domingue 1988) can also generate some inaccuracy (Tarboton 1997) which may translate into a degree of misalignment between the designed filter strip and actual runoff flow paths. Obvious misalignments between larger filter areas and topographic swales can be corrected during field layout.

- The design algorithm used for determining which cells to fill with the Buffer Area Requirement may not produce theoretical maximum trapping efficiency. The algorithm balances maximum trapping function (selecting cells receiving the greatest runoff flow) with practical farming geometry (by selecting cells nearer the field margin).

- The core model, which is a simplification of the process-based research model VFSMOD, has not, to date, been rigorously validated.

4. The Assessment Procedure

How to Conduct the Assessment Procedure. The assessment procedure will estimate the whole-field trapping efficiency of a user-defined filter strip. The user-defined filter strip may be an existing filter strip seen in the orthophotograph or a hypothetical one drawn on the photograph. The assessment procedure uses two sets of tools: "Clip & Project, Editing Tools" and "Buffer Builder Main". The major steps of the assessment process are (See also the Flow Chart in Appendix 6.4):

1. *Obtain DEM and aerial orthophotograph of the field site*. Reliable sources of DEMs and imagery include the USGS National Map (https://nationalmap.gov) and the USDA-NRCS Geospatial Data Gateway (https://gdg.sc.egov.usda.gov). Before using a DEM or orthophotograph, check the quality of the data for acceptable accuracy and resolution. Finer DEM grid sizes will produce more-precise results, but take longer to produce.

2. *Define the Area of Interest.* Using the "*Clip & Project, Editing Tools*", manually draw the outside margin of the agricultural field on the orthophotograph. The outside margin is the furthest that the filter strip will extend away from agricultural field and it defines the project area-of-interest (AOI). Typically, the outside margin will be located along a property line or roadside ditch, or along the upper bank of a stream, lakeshore, or wetland that will be protected with the filter strip. During execution of the "Buffer Builder Main" tool, the drawn field border (vector) will be converted into field border cells (raster).

3. *Define the Area of Filter Strip.* Using the "*Clip & Project, Editing Tools*", manually draw on the orthophotograph the area(s) that contain, or would contain, filter strip. Each filter strip polygon must have one side coincident with the outside margin of the AOI. Use the Zoom function of ArcMap to draw the polygons as accurately as possible. Snap together margins of filter strip polygons with the outside margin of the AOI. During execution of the "Buffer Builder Main" tool, the filter strip polygons (vector) will be converted into buffer cells (raster).

4. *Input Site Conditions.* Open the "*Buffer Builder Main*" tool. Select from dropdown menus an average surface soil texture class (Appendix 6.1) and C-factor condition (Appendix 6.2) for the whole field. For C-factor, only two conditions are presently available and they represent seedbed stage for those two tillage/residue conditions. Future versions will allow users to input a value for C-factor, such as those that appear in Appendix 6.2. For rotation systems, the C-factor condition should reflect the one that produces the higher sediment load. Input the pollutant type number ("0" for sediment; "-1" for sediment-bound). Sediment-bound pollutants include nutrients and other chemicals in runoff that are bound to sediment particles.

5. *Run the Buffer Builder Main tool.* Click "OK". When the computations are completed, the computer monitor will show a map of the filter strip polygon(s) on the aerial photograph with contour lines shown. A map file is created that contains the field photograph, and GIS layers for the border raster, contour vector, and filter strip raster. A spreadsheet file is created that contain input values and design statistics, including total area of the field (AOIAREA), total area of drawn filter strip (BUFFERAREA), and the calculated whole field trapping efficiency of the drawn filter strip (CAWATE1).

How the Assessment Procedure Works. The major operations executed by the assessment procedure are:

1. *Calculate Terrain Attributes for Field Border Grid Cells.* The set of grid cells in the AOI that contribute runoff flow to each field border grid cell is determined by running the Flow Accumulation function. This process also determines the Flow Direction through each grid cell. Average Slope (in percent) of each contributing area is determined by dividing slope-weighted Flow Accumulation by the un-weighted Flow Accumulation.

2. *Determine Buffer Area Ratio in the Contributing Area to each Field Border Cell.* For each grid cell in the field border, the total number of cells and the number of buffer-filled cells in its contributing area are counted. The appropriate equation that relates buffer area ratio to trapping efficiency is determined for each contributing area based on pollutant type and its average slope, soil texture, and C factor. The trapping efficiency associated with each field border cell is calculated and, finally, the contributing area weighted average trapping efficiency of all border cells is calculated.

3. *Create a Map Project File and Data Spreadsheet.* The map file will contain the field photograph, and GIS layers for the border raster, contour vector, and drawn filter strip raster. The data spreadsheet will contain input values and the assessment results.

How to Apply the Assessment Results. The results can be used by the landowner and conservation professional to estimate the performance of existing filter strips and of alternative filter strip designs. When combined with results for a designed filter strip, an informed comparison can be made of placement, size, and performance of various alternative designs. The spatial statistics can be used to compute various costs, incentives, and market values associated with each alternative design.

Limitations of the Assessment Results. Performance estimates provided by this procedure should be used cautiously for the following reasons:

• The DEM dataset may contain inaccuracies produced by conversion of contour maps to a digital grid structure, by land shaping and drainage modifications made after the original topographic data was collected, and by influential microtopography that is too subtle to be detected by the original topographic data.

• The ArcGIS algorithm for determining flow direction and flow accumulation from the DEM (D8; Jenson and Domingue 1988) can produce some inaccuracy (Tarboton 1997)

which can translates into misalignment between DEM-estimated flow paths and locations of existing or hypothetical filter strip.

- The calculation of trapping efficiency associated with each border cell does not consider variation in the location of buffer cells within a contributing area. It considers only the buffer area ratio for determining trapping efficiency and assumes that all buffer area is located for maximum contact with runoff flow. Consequently, in situations where existing or hypothetical buffer area is not ideally located, the calculated trapping efficiency may be overestimated.
- The design procedure assumes that no runoff flows into the AOI from areas outside of the AOI.
- The core model, which is a simplification of the process-based research model VFSMOD, has not, to date, been rigorously validated.

5. Program Tips, Tests, and Known Issues

Program Set-up
- The program .zip file must be extracted to C:/.
- ArcGIS extensions Spatial Analyst and 3D Analyst must be enabled.
- Background processing must be disabled in the Geoprocessing Options in ArcMap.
- A check mark must always be placed in box labeled "Create Buffer Assessment" in the Clip and Project Input Rasters dialog box.
- To run ONLY the design procedure, do NOT place a checkmark in the box labeled "Use Buffer Assessment" in the Buffer Builder Main tool dialog box.
- After each analysis, save project files to a personal folder and clear the program files.

Program Tests
- Opening the file **BufferBuilder_v2.0.mxd** should open an ArcMap project that contains the AgBufferBuilder toolbar.
- Conduct a quick design test by clicking on the "paperclip" icon to bring up the Clip and Project Input Rasters dialog box; place a checkmark in the box labeled "Create Buffer Assessment"; click "OK" at the bottom of the dialog box. Edit the field border polygon (AOI Mask Polygon shape file). Then, click the red "AgBB" icon to bring up the Buffer Builder Main tool dialog box; click "OK" at the bottom of the box. The program should produce and display an image of a designed filter as well as an output table containing statistics for that design. This test runs using prepared DEM and photograph files stored under "Field A" in the folder labeled Test Fields" and uses the default input site conditions and design criteria.
- For additional practice, a second set of prepared datasets are stored under "Field C" in the folder labeled "Test Fields".

Known Issues

- If only the assessment procedure is run, the result will display a blank screen. The user must manually load the GIS layers.
- In the output table "Buffer_Analysis.dbf", the value for CELLSIZE will always show "9" regardless of the value specified under "Output Cell Size" on the Clip and Project Input Rasters dialog box. The program will run according to the value specified for "Output Cell Size", but user will have to remember this value.

6. Appendices

Appendix 6.1: Soil texture class names and symbols found in soil surveys and the corresponding design model categories and input values. Class name modifiers such as gravelly, cobbly, channery, etc., are ignored for design model purposes. Soil texture information can be found in soil surveys obtained from the NRCS Web Soil Survey (https://websoilsurvey.nrcs.usda.gov/app/). In AgBufferBuilder 2.0, the default value is "0".

| Soil texture class name	Symbol	Model Category	Input value
Clay	C	Fine	0
Silty clay	SiC	Fine	0
Clay loam	CL	Fine	0
Silty clay loam	SiCL	Fine	0
Silt	Si	Fine	0
Sandy Clay	SC	Medium	1
Silt loam	SiL	Medium	1
Loam	L	Medium	1
Very fine sandy loam	VFSL	Medium	1
Fine sandy loam	FSL	Coarse	2
Sandy clay loam	SCL	Coarse	2
Loamy very fine sand	LVFS	Coarse	2
Sandy loam	SL	Coarse	2
Loamy fine sand	LFS	Coarse	2
Very fine sand	VFS	Coarse	2
Coarse sandy loam	CSL	Coarse	2
Fine sand	FS	Coarse	2
Sand	S	Coarse	2
Loamy coarse sand	LCS	Coarse	2
Coarse sand	CS	Coarse	2

Appendix 6.2: C-Factor values for different crop/tillage/residue conditions. These values were extracted from among more-extensive lists contained in Wischmeier and Smith (1978) (https://naldc.nal.usda.gov/download/CAT79706928/PDF). In AgBufferBuilder 2.0, the default is the seedbed stage for chisel or no-tillage after corn (0.15) with the alternative being disk plow tillage after corn (0.50).

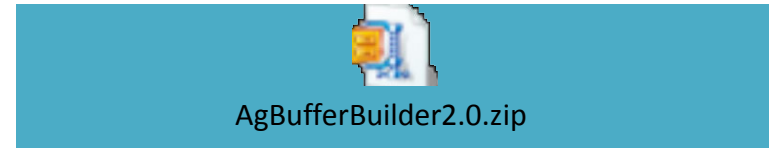| Cover type and management	Other characteristics	USLE C factor
Undisturbed forest land	45-70% canopy cover and 75-85% duff cover	0.002 – 0.004
Idle land: tall grass, weeds, short brush	75% canopy cover and 60% litter cover	0.03 – 0.07
Idle land: tall grass, weeds, short brush	25% canopy cover and 20% litter cover	0.17 – 0.20
Chisel or no-tillage after corn	Seedbed stage and 50% residue cover	0.13 – 0.17
Disk plow tillage after corn	Seedbed stage and 10% residue cover	0.45 – 0.52
Chisel tillage after soybeans	Seedbed stage	0.40 – 0.58
Moldboard plow tillage after soybeans	Seedbed stage	0.72 – 0.83

Appendix 6.3: Flow chart of the AgBufferBuilder 2.0 **design procedure**
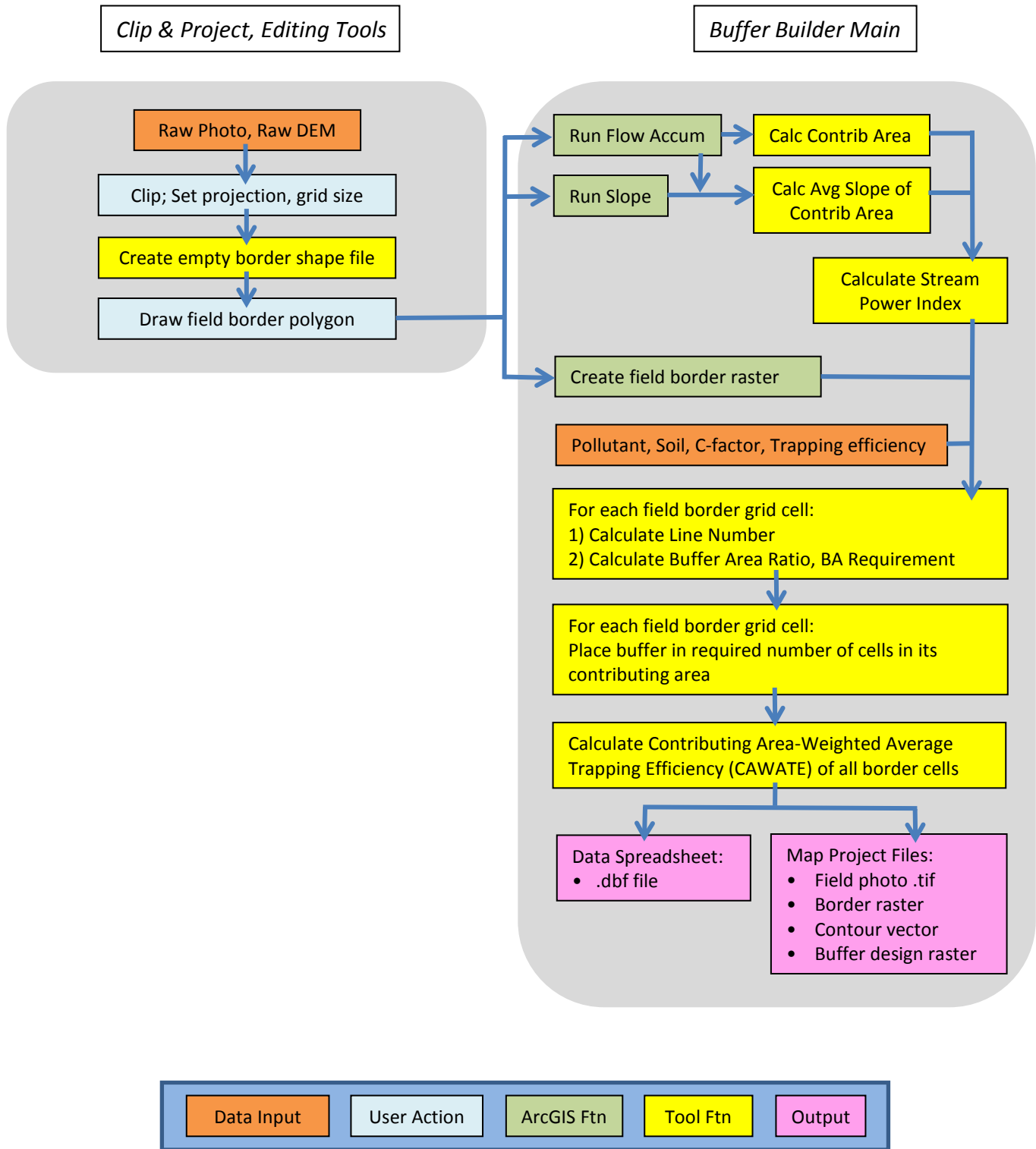
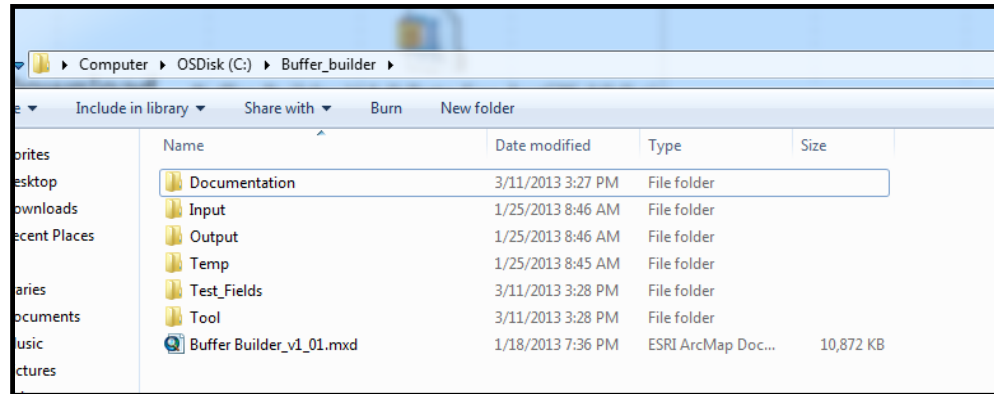**Appendix 6.4:** Flow chart of the AgBufferBuilder 2.0 **assessment procedure.**
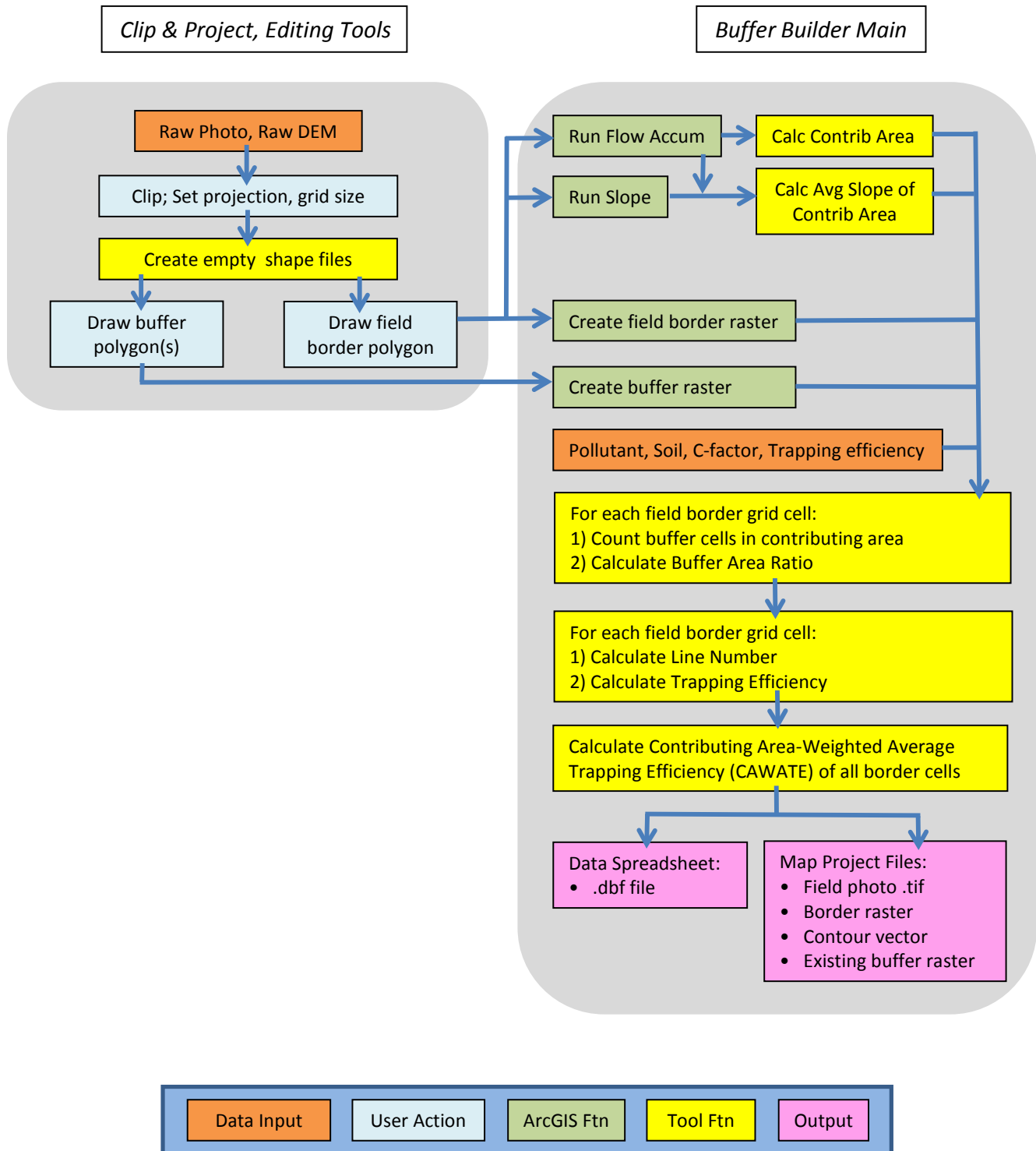
Appendix 6.5: Stepwise instructions for AgBufferBuilder 2.0 1. Download zip from AgBufferBuilder website:

AgBufferBuilder2.0.zip

2. Extract zip file to **C:/**

3. Open Buffer_Builder folder; contains the following folders:

Name	Date modified	Type	Size
Documentation	3/11/2013 3:27 PM	File folder	
Input	1/25/2013 8:46 AM	File folder	
Output	1/25/2013 8:46 AM	File folder	
Temp	1/25/2013 8:45 AM	File folder	
Test_Fields	3/11/2013 3:28 PM	File folder	
Tool	3/11/2013 3:28 PM	File folder	
Buffer Builder_v1_01.mxd	1/18/2013 7:36 PM	ESRI ArcMap Doc...	10,872 KB

Computer ▸ OSDisk (C:) ▸ Buffer_builder ▸

4. Open the **BufferBuilder_2.0.mxd**. This is an ArcMap Project that contains the Buffer Builder Toolbar. Be sure **Spatial Analyst and 3D Analyst Extensions** are active. You must also disable background geoprocessing. Go to Geoprocessing>Geoprocessing Options>Uncheck the Box next to "Enable" if it is.
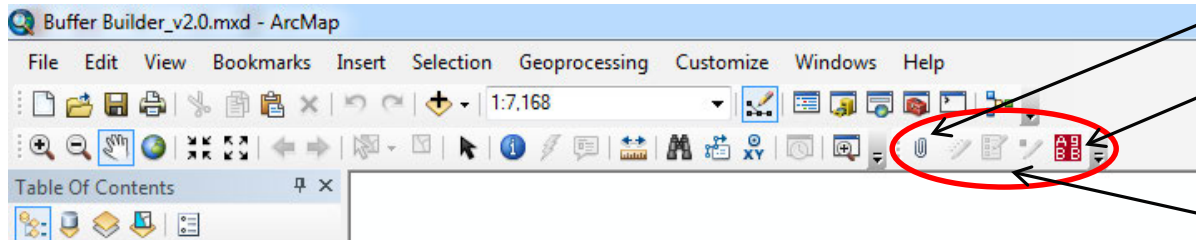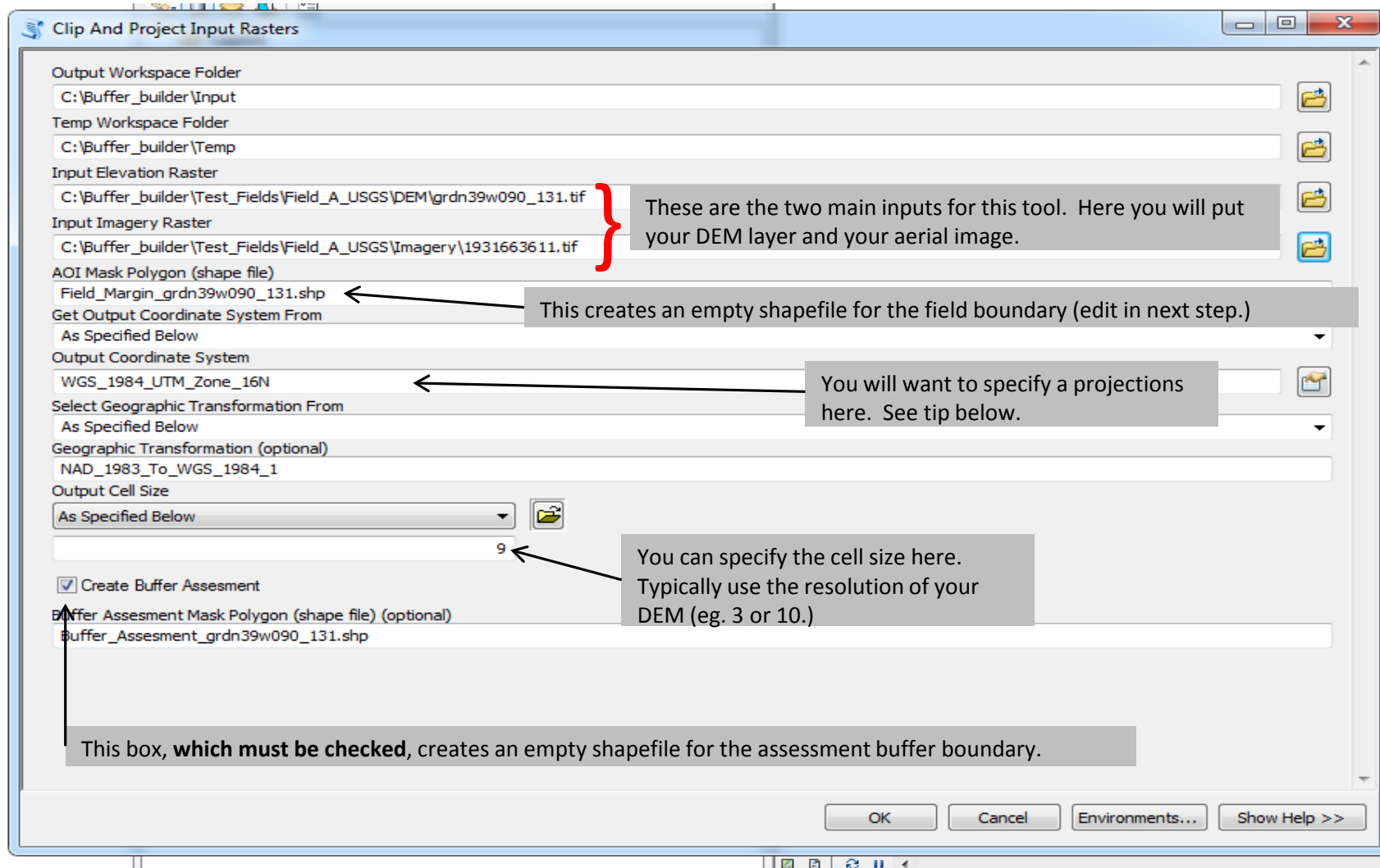
Clip and Project Input Rasters Tool (paper clip)

Buffer Builder Main Tool (AgBB)

Editing Tools—the 3 tools in the middle are used to edit the polygons created for (1) Field Boundary & (2) Assessment boundary Tools are: Start editing, create features, and stop editing

5. Click on the Clip and Project Input Rasters button (paper clip.) Opens this:

Clip And Project Input Rasters

Output Workspace Folder
`C:\Buffer_builder\Input`

Temp Workspace Folder
`C:\Buffer_builder\Temp`

Input Elevation Raster
`C:\Buffer_builder\Test_Fields\Field_A_USGS\DEM\grdn39w090_131.tif`

Input Imagery Raster
`C:\Buffer_builder\Test_Fields\Field_A_USGS\Imagery\1931663611.tif`

These are the two main inputs for this tool. Here you will put your DEM layer and your aerial image.

AOI Mask Polygon (shape file)
`Field_Margin_grdn39w090_131.shp`

This creates an empty shapefile for the field boundary (edit in next step.)

Get Output Coordinate System From
`As Specified Below`

Output Coordinate System
`WGS_1984_UTM_Zone_16N`

You will want to specify a projections here. See tip below.

Select Geographic Transformation From
`As Specified Below`

Geographic Transformation (optional)
`NAD_1983_To_WGS_1984_1`

Output Cell Size
`As Specified Below`

`9`

You can specify the cell size here. Typically use the resolution of your DEM (eg. 3 or 10.)

☑ Create Buffer Assesment

Buffer Assesment Mask Polygon (shape file) (optional)
`Buffer_Assesment_grdn39w090_131.shp`

This box, **which must be checked**, creates an empty shapefile for the assessment buffer boundary.

OK   Cancel   Environments...   Show Help >>

Pro Tips: *Use the "Fill" function in ArcToolbox>Spatial Analysis Tools>Hydrology on your DEM, prior to using AgBB, to remove sink errors and improve drainage mapping.
*While the clip and project tool is meant to clip your DEM and aerial photo together and project them to the same projection, it may be easier and more efficient to do this prior to using the AgBB tool, in another ArcMap project. Just be sure to select the appropriate projection in the AgBB Clip & Project tool.
*If you want to quickly make sure the tool is working, you can leave all defaults and click OK. This tool should run with the default data from the Test Fields folder.

6. After running Clip & Project Input Raster tool the following 4 layers are added to the
ArcMap Project:
Aerial Photo and DEM (clipped and reprojected), & empty shapefiles of Field Margin & Buffer Assessment
*The tool creates a new DEM which it uses for processing.
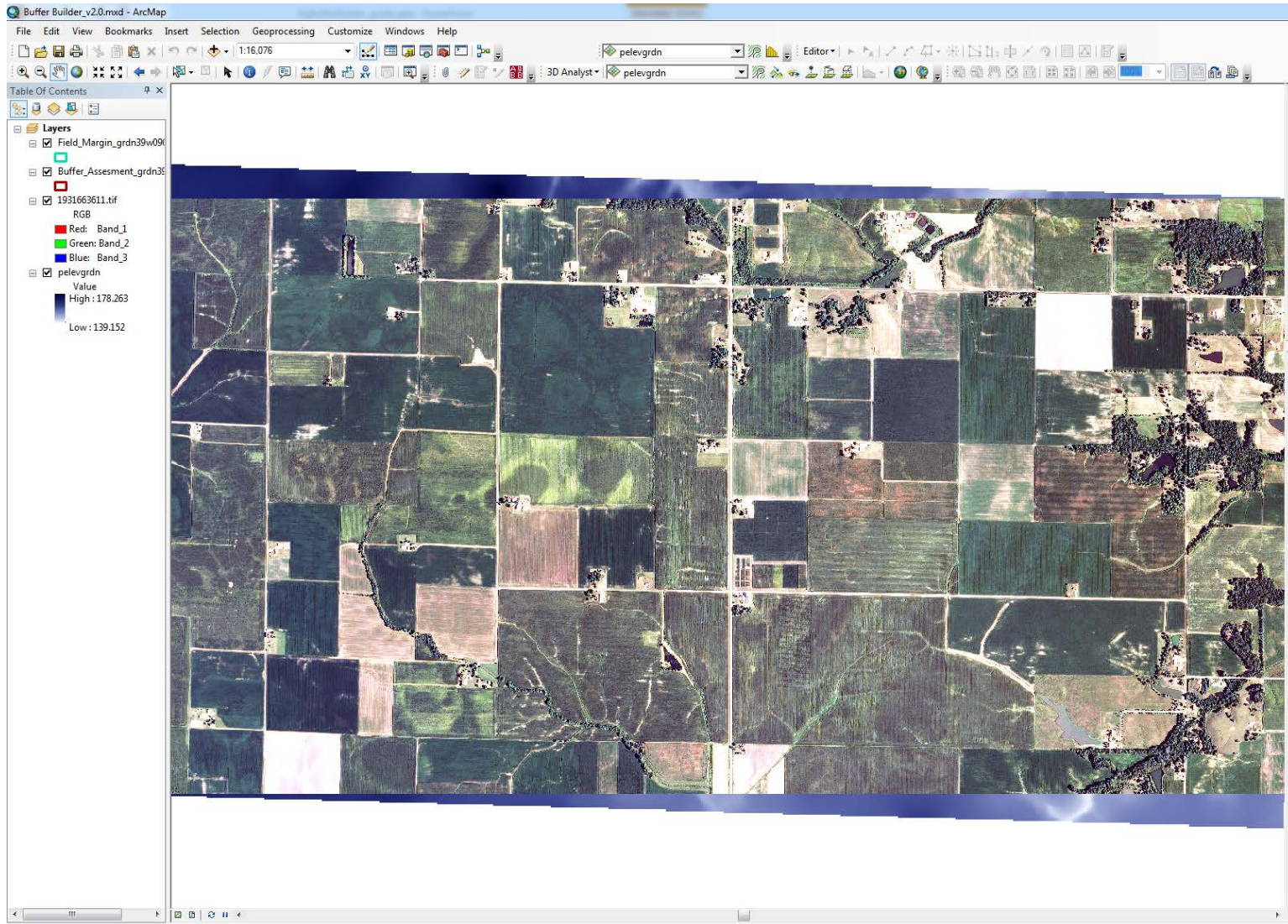
7. Now we must edit the shapefiles to add the boundary for the field and the assessment buffer. (Assessment buffer is optional.)

8. Click on the Start Editing tool (pencil) and be sure the Field Margin layer is active. Draw the field boundary polygon.

9. Do the same for the Buffer Assessment; be sure it is active and draw the polygon(s).

10. When finished, click on the Stop Editing tool (pencil with black square next to it.) Save edits.

Buffer Builder Toolbar
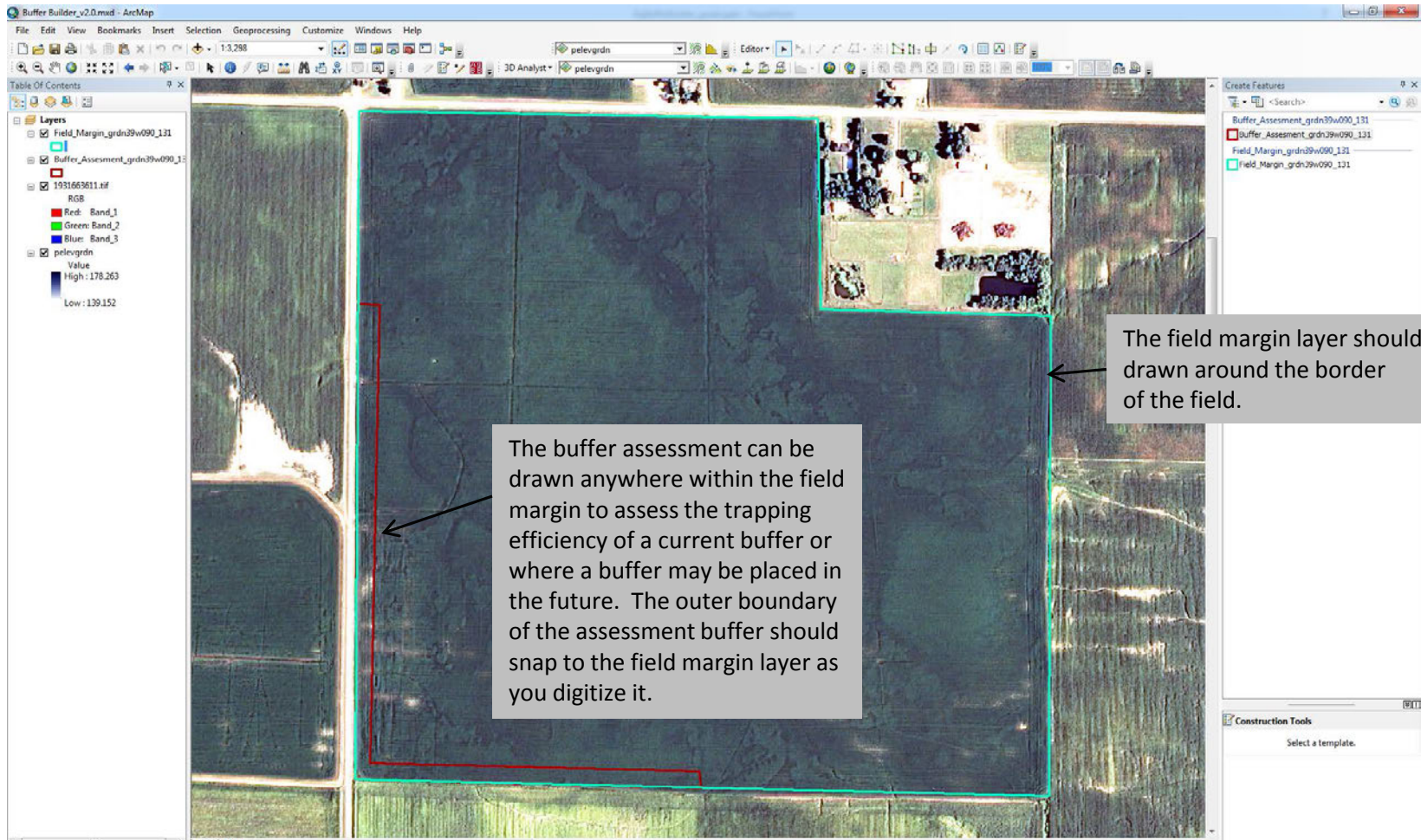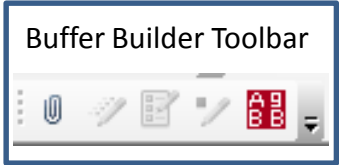
The field margin layer should be drawn around the border of the field.

The buffer assessment can be drawn anywhere within the field margin to assess the trapping efficiency of a current buffer or where a buffer may be placed in the future. The outer boundary of the assessment buffer should snap to the field margin layer as you digitize it.

Pro Tips: *You can use previously created field boundary or assessment boundary layers (which is useful when doing multiple scenarios with different Inputs on the same field.) Just be sure to remove the layers created by AgBB in the ArcMap table of contents, and when you add your own layers, be sure they are listed in the same order: Field Margin first, followed by Buffer Assessment.

11. Now we can run the Buffer Builder Main tool. The tool brings up this dialog box:
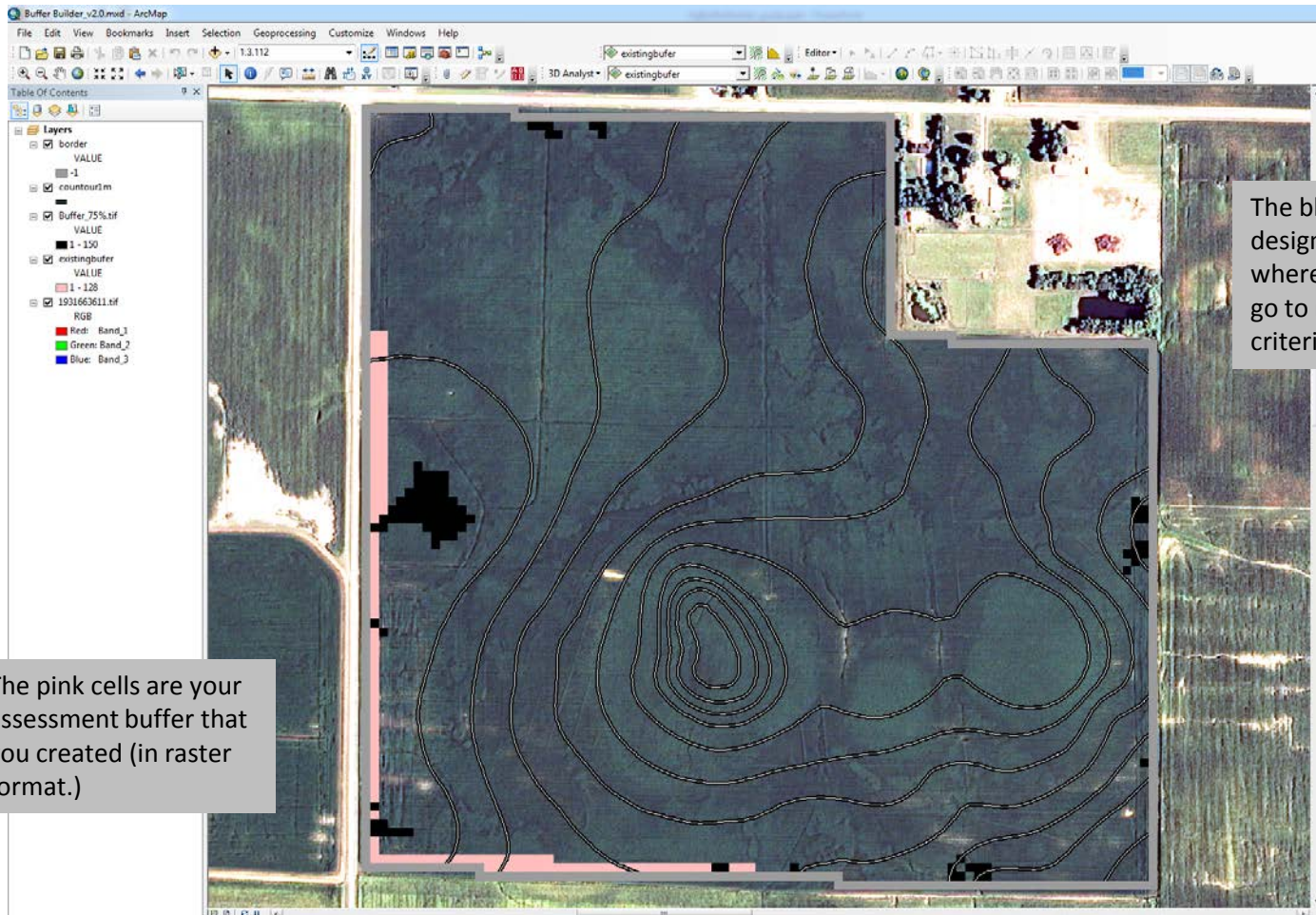
Buffer Builder Main

Output Workspace
C:\Buffer_builder\Output

Temp Workspace
C:\Buffer_builder\Temp

Imagery
C:\Buffer_builder\Test_Fields\Field_A_USGS\Imagery\1931663611.tif

Projected DEM
C:\Buffer_builder\Input\pelevgrdn.tif

> You will again have to change these inputs. The aerial image is the same as before. The DEM is the **new one** AgBB created located in: C:\Buffer_builder\Input\pelevXXXX

Field Margin Polygon
C:\Buffer_builder\Input\Field_Margin_grdn39w090_131.shp

Pollutant Type
sediment

Soil texture category of the surface soil_layer
Class - 0 (C, SiC, CL, SiCL, Si)

USLE C-Factor
No-till or chisel after corn leaving good residue cover

> These are the 3 inputs that you can change to meet your field criteria.

Trapping Efficiency
75
50   75

> Here you can change the trapping efficiency you want to achieve for the field buffer design. 50%-75% is the range.

Buffer Output Name
Buffer_75%

Elevation Countour Name
countour1m

Filed Border Name
border

☑ Use Buffer Assesmnet

> This can be checked if you created an assessment buffer; or left off if running the design tool only.

Assessment Buffer File
C:\Buffer_builder\Input\Buffer_Assesment_grdn39w090_131.shp

☑ Run Design Tool

Comment (optional)
Enter any comments

OK   Cancel   Environments...   Show Help >>

12. After Buffer Builder Main tool has run, this is the ouput map and there are 4 output layers:
    a. Border (field boundary, raster)
    b. Contour1m (1-meter contours; vector)
    c. Buffer_75% (Design buffer, raster)
    d. Existingbuffer (assessment buffer, raster)

The black cells are the design buffer area(s) where a buffer would go to meet the input criteria.

The pink cells are your assessment buffer that you created (in raster format.)

Pro Tips: *The Buffer Builder Main tool can take a long time to run. The time it takes depends on your DEM resolution and the area of your field, as well as your computer specs. Some results may take several hours.

13. The Output table (Buffer_analysis.dbf) is created but not automatically added to the map. It is located in the 'Tool' folder (see #3.)
14. Add table to the map and open.
15. You will then want to rename and save the map project and be sure all associated data is Included if you relocate the project.

Important information about the buffers are in the Output Table. For example, the trapping efficiency of your assessment buffer is here, as well as area.

Pro Tips: *Do not try and run the AgBufferBuilder tool again in the same project or within the same folders. When starting a new project, go back to step 2 to start with a fresh project and associated files. The program is very sensitive to file structure within ArcMap as well as associated data in the folders.

Appendix 6.6: Names, units, and definitions of parameters appearing in the output table <Buffer_Analysis.dbf>.

Parameter	Definition
OID	ArcGIS row designation in the output table. A design or an assessment will show only one row (OID = 0); both a design and an assessment will show two rows (OID = 0 and 1).
TIMESTAMP	Date and time of the analysis; Year, month, day, hr, min, sec
IMAGERY	Filename containing the aerial orthophotograph of the field area as specified in the "Buffer Builder Main" dialog box.
FLDMARGIN	Filename containing the field margin vector as specified in the "Buffer Builder Main" dialog box under "Field Margin Polygon".
POLLUTYPE	Type of pollutant to analyze for as selected in the "Buffer Builder Main" dialog box
SOILTEX	Soil texture category as selected in the "Buffer Builder Main" dialog box
CFACTOR	USLE C-factor as selected in the "Buffer Builder Main" dialog box
INTRAPEFF	Level of pollutant trapping efficiency to design a filter for, in percent, as specified in the "Buffer Builder Main" dialog box.
ELCOUNTOUR	Filename containing the contour lines of the field area. Contour interval is 1 m
AOI	Filename containing the raster of the assessed filter polygon for an assessment procedure, and, the DEM raster clipped to the field area for a design procedure.
AOISR	Coordinate system (i.e., projection) of the map project files
AOIEXTENT	Coordinates of the maximum extent of the AOI in cardinal directions
CELL SIZE	Raster grid dimensions = length of one side of a grid cell in meters
AOIAREA	Total area of grid cells in the AOI in acres
BUFFERAREA	Total area of grid cells containing filter strip in acres
CAWATE1	Contributing Area-Weighted Average Trapping Efficiency in percent = $(\sum_{n}^{1} Contributing\_area \times \%Trapping\_efficiency) \div AOIAREA$ where n is the number of field border grid cells through which runoff exits the AOI.
CAWATE2	(For research purposes)
CAWATE3	(For research purposes)
CAWATE4	(For research purposes)
ANALYSIS	Type of analysis (Design or Assessment) entered in the "Buffer Builder Main" dialog box
COMMENTS	User-supplied identifiers and notes entered in the "Buffer Builder Main" dialog box

Appendix 6.7: References

Dosskey, M.G., M.J. Helmers, and D.E. Eisenhauer. 2011. A Design Aid for Sizing Filter Strips Using Buffer Area Ratio. Journal of Soil Water Conservation 66(1):29-39. http://nac.unl.edu/documents/research/publications/2011filerBARdesignaid.pdf or http://www.jswconline.org/content/66/1/29.short

Dosskey, M.G., S. Neelakantan, T.G. Mueller, T. Kellerman, M.J. Helmers, and E. Rienzi. 2015. AgBufferBuilder: A geographic information system (GIS) tool for precision design and performance assessment of filter strips. Journal of Soil and Water Conservation 70(4):204-217. http://www.jswconline.org/content/70/4/209

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