Summary outline for processing CHaMP topographic data using CHaMP Toolbar version 5.02 or higher.

TIPS:

- Always turn off the ArcMap Editors (Vector or TIN) when finished editing layers before running any tool.
- If an error appears, make sure all input/output files and locations are listed correctly.
- Naming best practices for CHaMP:
  - **ONLY USE** underscores "_", letters and numbers in file names.
  - Do **NOT** start file or site names with a number.
- Save all of your work in the `C:\champbroker\organization\Crew\hitch\site\Topo` folder. If you must work outside of this folder, you will not be able to publish using the CHaMP Data Broker.
- QA Tools (Survey Checks, TIN and Validate Data) checks can be run at any time. ***We recommend running these tools after any editing sessions because doing so records information about the status of your data that could be helpful to troubleshoot problems later.***

GIS Setup:

1. Before opening ArcGIS, install CHaMP Topo Processing Toolbar from **http://champtools.northarrowresearch.com.**
2. Open ArcGIS, start a new map document (.mxd) and save it in the Topo folder listed above, using the following naming convention: `sitename_date_crew_total_station`
3. Turn on CHaMP Topo Processing, 3D Analyst, Editor, TIN Editing and Snapping toolbars (Customize/Toolbars).

GIS Processing - TOPO PROCESSING MENU:

New for 2015: The CHaMP Topo Toolbar now is *Project-Based* and uses a custom *Layer Manager* for organizing data inputs, outputs, and map layers. The Project will start automatically upon Creating a Survey GDB or Opening a Survey (Survey menu). Once the Project has been started, only a limited number of inputs are required by the tools.

STEP 1: CREATE SURVEY GDB

a. Under the "Survey" menu, select "Create Survey GDB" tool.
b. Specify output folder location, site name, watershed, stream name, projection system, visit ID, field season, organization, and survey crew.
c. If this is a first-time visit select "Initial visit" under "Visit Type" otherwise select "Repeat visit".

STEP 2: PROCESS TOTAL STATION INSTRUMENT FILE

a. Select Instrument model used for your survey.
b. For Nikon total station data, browse and select your raw instrument file exported from the instrument. For TopCon total station data, browse and select **both** the ".raw" and ".mjf" instrument files.
c. If your data has date information, select the appropriate dates on which the survey was performed (selecting multiple if necessary) under "Visit Date". You will be notified with a message if your data has no date information and you should ensure that the "No Data Information" option is selected.
d. Review the Survey Data "Total station instrument file" QAQC checks to note improvements to make in future surveys or fatal flaws in instrument files.

STEP 3: LOAD SURVEY DATA TO GDB

a. Under the "Topo Processing" menu, select the "Load Survey Data to Geodatabase" tool.
b. Specify the Inputs datasets (QAQC_RawPoints, in the Survey GDB), Code Field, Point number field, Breaklines, LiDAR points, Instrument Type, and Instrument Model.
c. The breakline datasets can found in the *.dxf file (exported separately from the total station).
d. Select Import Coordinate Type (this will most likely be "Assumed/Local" if this is an initial visit, and "Project" if a return visit).

STEP 4: COORDINATE TRANSFORMATION TOOL (FOR INITIAL VISITS ONLY, OTHERWISE SKIP TO STEP 5)

a. Use the Add Data button to add a base layer to the map (`C:\Base_Imagery or online maps like Bing or Google`).

b. Dialog Box 1:
   i. Specify Coordinate System. Load Benchmarks from Benchmarks.csv file or type them in the boxes (loading from .csv file preferred). Specify the Output workspace.
c. Dialog Box 2:
   i. Specify which three points are Benchmark 1, 2, and 3. "Attribute Field" should be "DESCRIPTION". Select an initial hinge point and rotation method.
d. Dialog Box 3:
   i. Cycle through each transformation and choose the best fit visually (roughly on the stream and in the same direction). Use the residual errors to guide your choice (should be as close to zero as possible).
   ii. Check the confirmation boxes, save and exit the transformation tool.

At this point, you can begin using the Validate Data Tool to look for errors in your data.

STEP 5: REVIEW ALL POINTS AND LINES. (manually, not using a tool). USE YOUR FIELD NOTES!
a. Open Error Points and Lines attribute table and repair codes, delete bad points, and assess issues.
b. Review points and lines to make sure they are coded properly (left/right banks, bars, islands, top/toe banks, etc.).
c. Edit Breaklines so they are connected where they need to be, and that Hard Breaklines do not cross.
   i. Use **Add Z Values to Breaklines** Tool (QA Menu) if changes are made to the breaklines.

STEP 6: CREATE SURVEY EXTENT POLYGON
a. Under the "Topo Processing" menu, select "Create Survey Extent Polygon".
b. Set the Tolerance (in meters). Use larger values (15-20) for larger sites (> 120m to 600m long) and smaller values (5 to 10) for smaller sites (< 120m long). Run the tool.
b. Rerun the tool if there are a significant amount of errors (lots of jagged edges, oversimplified edges or points grouped into separate polygons). Adjust the Tolerance as needed to produce a single, smooth polygon around all points.
c. Manually edit the Survey Extent polygon as needed (Editor Toolbar)
   i. Review Survey Extent polygon to make sure all points and lines are within extent of survey extent polygon
   ii. Check the cross-channel transects at top/bottom of site as polygons are often wider than extent of points.

STEP 7: CREATE A TOPO TIN FROM SURVEY POINTS
a. Run tool. A TIN will be added to the Table of Contents. TIN is NOT stored in Survey GDB, but is in the same folder.
b. Review TIN for cross channel dams, dams at end of surveys, bust/sink points. These often show up as shadowed areas or colors inconsistent with their surroundings (aka anomalies).
a. Review and repair all breaklines (look for crossed breaklines and elevation anomalies/odd triangulation features adjacent to breaklines).
b. Edit TIN by adding/deleting nodes (TIN editing Toolbar) or connecting TIN nodes as needed.

STEP 8: CONVERT A TOPO TIN TO DEM
a. Run tool. A DEM and Hillshade layer will be added to the Table of Contents. Both stored in Survey GDB.

STEP 9: DETREND A DEM TO REMOVE HILL SLOPE
a. Run tool. A Detrended DEM will be added to the Table of Contents. Stored in Survey GDB.

STEP 10: CREATE WETTED and BANKFULL POLYGONS (Tool Run Twice)
a. Browse and Select Detrended DEM in Survey GDB.
b. Creating wetted polygon: For Reference Points, browse to Edge_of_water points. Move slider to flood stream to best align with edge of water points. Save.
c. Creating bankfull polygon. For Reference Points, Browse to Topo_Points. Move slider to best align with Bankfull Points. Change Output Polygon to 'Bankfull' when saving.
d. Refresh and review Validation window for errors.

STEP 11: DIGITIZE CHANNEL UNIT POLYGONS
a. Run tool, then click on the Channel Units (Field) layer in the Table of Contents
b. Start a Vector Edit Session (Editor Toolbar). Use the Create Features window to select a Unit Number.
c. Roughly digitize the channel unit polygons LARGER than water surface extent polygon (in width across stream), but make sure they are DETAILED within the water surface polygon. Avoid overlapping polygons and gaps between units.
d. When done tracing a unit, double click OR right click/finish sketch. Stop Editing and Save when done with all units.

STEP 12: CREATE STREAM SURFACE TIN, DEM and WATER DEPTH

a. Run tool. Generates Water Surface TIN (WSETIN), DEM, and Water Depth raster, then clips the Channel Units to the Wetted polygon.
b. Review WSETIN for bust points (pyramids of color that look out of place). If found, edit Edge of Water Points and rerun tool. WSETIN should be a 'rainbow' of TIN color from upstream-downstream of site (water runs downhill).

STEP 14: GENERATE ERROR AND ASSOCIATED SURFACES

a. Run tool. Make sure that correct TIN and Channel Unit CSV files are specified.

STEP 14: CREATE A THALWEG

a. Run tool. Review thalweg to ensure it generally follows the field-collected thalweg (wg) points and that it passes close to in/out points. Wg points are NOT used in thalweg generation; thalweg line won't always intersect points.

STEP 15: CREATE A CENTERLINE (Tool Run Twice)

a. **The tool will be run 2 times, once for wetted and once for bankfull centerline.**
b. Click Generate Islands. Confirm qualifying islands in the map are red and all others grey. Use buttons to reassign qualifying status or reset to original state. (Note qualifying status here is only for centerline layout, not metrics).
c. Centerline should generally run down the center of each qualifying channel segment.
d. Centerlines may pass through non-qualifying islands, bars, boulders or other small dry patches.
e. Check centerline: do not skew at the ends of the survey.
    i. Ensure ends of survey do not skew or kink unnecessarily. If they do, manually edit the centerline (Editor toolbar).
    ii. Ensure ends of centerlines are inside water extent polygon.
f. Run tool a second time using Bankfull Extent Polygon and repeat steps b-e.
g. Refresh and review Validation window errors.

STEP 16: CREATE CROSS SECTIONS (Tool Run Twice)

a. **The tool will be run 2 times, once for wetted and once for bankfull cross sections.**
b. Run tool to create Wetted and Bankfull cross sections (toggle to relevant type). This may take a few minutes.
c. Review cross sections. Assign excessively long cross sections, or those not representative of typical channel width to Invalid (grey) status using +/- toggles.

GIS Processing - QA TOOLS and Finalize MENUs:

STEP 17: VALIDATE DATA (QA Tools Menu)

a. Refresh Validation window or run Validation Tool from QA Tools menu. Specify the topo TIN and water surface TIN. Click Refresh (green arrows).
b. Review all validation checks-green means good, warning means review, red means error and requires resolution.
c. Validation can be run and refreshed at any time during the process. This may be useful if you can't remember where you left off in a site's processing.

STEP 18: ADD A NOTE TO THE GEODATABASE (QA Tools Menu)

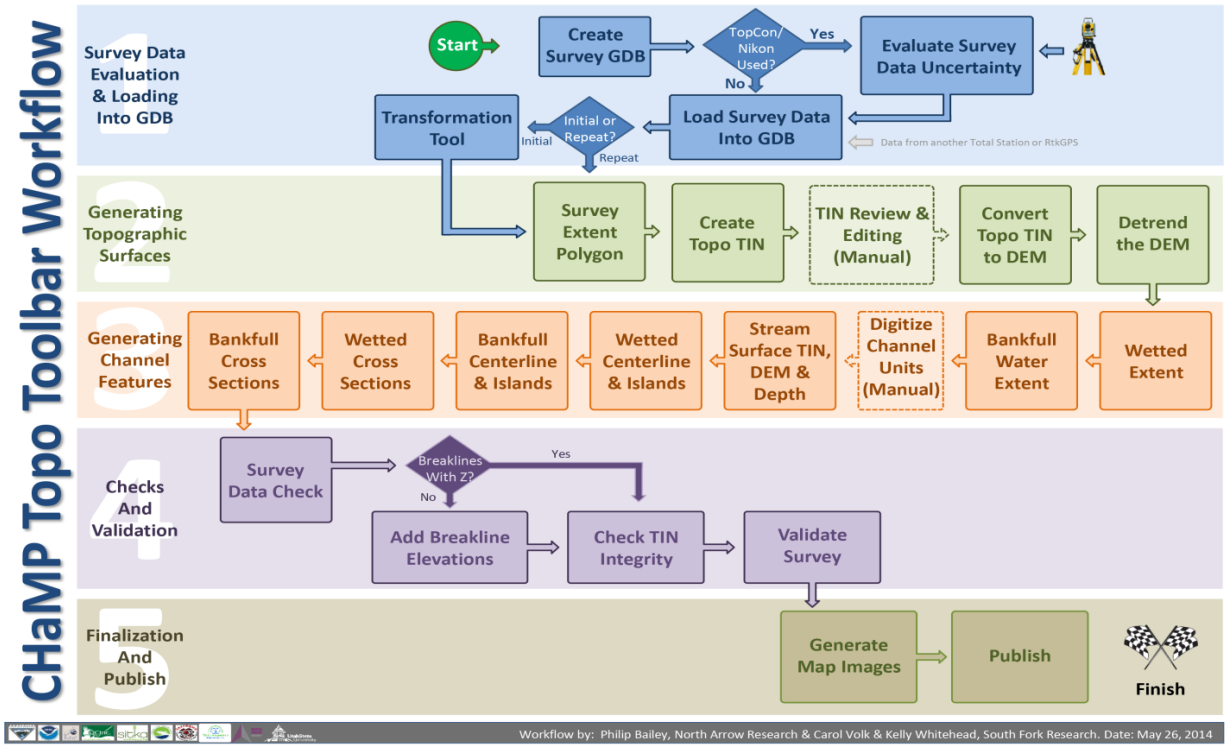
a. Use this tool to include a log entry about the survey or processing any time during the workflow.

STEP 19: GENERATE MAP IMAGES (Finalize Menu)

a. Run tool. Map images are 'quick' maps of topographic products that may be useful for later data review or sifting through sites. You can review these here: `C:\champbroker\organization\Crew\hitch\site\Topo`.

STEP 20: PUBLISH FINAL GEODATABASE (Finalize Menu)

a. Specify 'publish' if your data is error-free, or 'review' if there is a validation issue with your survey and another GIS analyst will review the data.
b. Specify all instrument survey files, any intermediate GIS files (i.e. .dxf or .shp), the Survey GDB, TIN and WSETIN.
c. The survey will now be available to the CHaMP Data Broker, as well as a zip folder located in the Topo folder for the site.
d. Survey processing is complete!


CHaMP Topo Toolbar Workflow
1
Survey Data Evaluation & Loading Into GDB
Start
Create Survey GDB
TopCon/ Nikon Used?
Yes
No
Evaluate Survey Data Uncertainty
Load Survey Data Into GDB
Data from another Total Station or RtkGPS
Initial or Repeat?
Initial
Repeat
Transformation Tool
2
Generating Topographic Surfaces
Survey Extent Polygon
Create Topo TIN
TIN Review & Editing (Manual)
Convert Topo TIN to DEM
Detrend the DEM
3
Generating Channel Features
Wetted Extent
Bankfull Water Extent
Digitize Channel Units (Manual)
Stream Surface TIN, DEM & Depth
Wetted Centerline & Islands
Bankfull Centerline & Islands
Wetted Cross Sections
Bankfull Cross Sections
4
Checks And Validation
Survey Data Check
Breaklines With Z?
Yes
No
Add Breakline Elevations
Check TIN Integrity
Validate Survey
5
Finalization And Publish
Generate Map Images
Publish
Finish
Workflow by: Philip Bailey, North Arrow Research & Carol Volk & Kelly Whitehead, South Fork Research. Date: May 26, 2014