Watershed and Stream Classification
for the Foothills Model Forest
Chisholm Fire
Delivery and Data Set Description
Watershed and Stream Classification

Chisholm / Dogrib Fires Research Initiative

Foothills Model Forest

Delivery Data Set Description

The intention of this document is to outline the deliverables and to provide a detailed description of coverage attribute tables created for the Foothills Model Forest client for Chisholm fire study area. The required activities and entities are outlined in the process documentation available as a separate document.

The Chisholm CDROM contains single line hydrography, hydrography polygons, watersheds and Digital Elevation Model (DEM) data as binary ARC/INFO coverages (line, polygon, and grid types) prepared within ARC/INFO 7.2 environment. An ArcView 3.2 project, for data overview, are also provided. The projection and datum is UTM Z11, NAD 83 with double precision accuracy maintained throughout all processes.

GISmo Solutions Ltd. completed this project using data provided by the Base Features Project, Resource Data Branch, Alberta Sustainable Resource Development.

The general information, including this data set description document, is located in the OVERVIEW sub-directory. This sub-directory also contains study area boundary, and an ArcView project file allowing for easy display of provided information.

Chisholm CDROM

The following directories and files are provided on the delivery CDROM:

BF_HYDRO, BF_UPDATES, CHS_ACCESS, CHS_DEM, CHS_HYDRO, CHS_WORK_COV, OVERVIEW

BF_HYDRO

This directory contains source hydrography data from the Base Features project. All data sets were provided as seamless coverages (E00) with unique BF-id identifiers

Chs_slnet A seamless SDE extracted set of SLNET data from RDB Data Distribution.

Chs_hydpoly Seamless SDE HYDROPOLYS data from Data Distribution.

Chs_hydpoly A seamless HYDROPOINTS data from Data Distribution.

info ARC/INFO directory required for binary data structures.
BF_UPDATE
This directory contains three coverages and a .dbf table that represent proposed changes to the Base Features information. The coverages contain elements that would be changed spatially (either added or modified arcs), while the table lists BF_IDS corresponding to arcs that would be deleted (replaced with modified arcs), flipped or reassigned PS-flow.

Chs_miscoded Coverage contains arcs that need corrections to ps-flow attribute.

Chs_flipped Coverage contains arc that require flow directionality flipped. (original data incorrectly directed upstream).

Chs_modif Coverage contains arc that require extension, trimming and possible additional flow directionality flipped.

Bf_edited.dbf Tables contain a list of BF_IDS that correspond at arcs requiring modifications (either change to ps-flow changed or directionality edit).

info ARC/INFO directory required for binary data structures.

CHS_ACCESS
This directory contains source access data from the Resource Data Data Distribution (Access Update project). All data sets were imported from provided export format coverages (E00).

Chs_cutlines Cutlines data
Chs_facil Facility points
Chs_hydcarto Annotation
Chs_pipes Pipelines
Chs_power Transmission lines.
Chs_rails Railways lines
Chs_roads Roads.
Chs_acc_poly Facility polygons.

CHS_DEM
This directory contains seamless source DEM coverage and some processed terrain information. DEM grid coverages were created using TOPOGRID and FILL ARC/INFO processes. Included here are contour coverages created for Quality Control (QC) before and after the utilization of TOPOGRID and FILL processes.

Specific files are as follows:

AFC_TOPO DEM for extended user study area. The extended area covers all 1:20K tiles (buffered by 300 M) overlapping study area processed through TOPOGRID and FILL to enforce a complete drainage. The required fill tolerance
was 6 M. Additional adjustment to Lesser Slave Lake was completed to enforce lake elevation at 577M. This DEM was used for watershed delineation. (AFC – Adjusted Filled Chisholm Topo)

**Flow_ac_lin** A flow accumulation lines grid indicating patterns of flow on **AFC_topo** (used in the QC process for validation of hydro network). Grid has a 25 m resolution and 50 cells threshold.

**AFC_hsh** A hillshade grid created from hydrologically adjusted surface with 35, 50 and 3 parameter values for sun location and vertical exaggeration.

**org_in_con_5** A 5m contour for source data. This data set demonstrates source DEM data errors.

**org_to_con_5** A 5m contour after initial **TOPOGRID** before adjusting streams directionality. This data set demonstrates some source hydro data errors.

**in_con_5** A 5m contour for corrected source data (after QC for proper terrain assembly).

**to_con_5** A 5m contour after **TOPOGRID** (QC for impact of stream network directional flows).

**Topo_contour_er.shp** A reference point for a location where stream flow needed to be adjusted (as org_in contours and org_to contours were significantly different)

**info** ARC/INFO directory required for binary data structures.

**CHS_HYDRO**

This directory contains a hydrography reaches and watersheds information requested by client. Both shape coverages: reachpoints and chs_reaches contain attributes requested by client. Watershed coverage (chs_wsd) corresponds to chs_reaches.

Specific files are as follows:

**Chs_segs** Flow segments designed for topological routes used for reaches aggregation. Individual gradients are compared and reaches are constructed by assigning an absreach attribute.

**Chs_reaches.shp** Shape line coverage of reaches. Note: A unique reach is represented by a single arc and may not be split by an in-flowing tributary. In a few specific cases there are more than one arc per reach (when ArcInfo limitations for maximum number of vertices are exceeded).

**Reachpointshp** Shape point coverage of reach downstream terminating points. A unique
Reach is represented by a single point and there are two (or more) points at the confluence.

**Chs_wsd_gr** Watershed drainage polygon coverage. Areas associated with individual arcs are corrected and edited for slivers following ARC/INFO GRID processes. To improve cartographic representation raster artifacts are “smoothed” by a spline and node snap processes (when corresponding Chs_wsd is created).

**Chs_wsd** Final watershed drainage polygon coverage. In addition to individual “atomic” polygons an UPSTREAM region class stores aggregated regions. Additional region classes ORD1, ORD2 … ORD8 represent subsets of regions corresponding to sub-basins of specific Strahler class.

**Info** ARC/INFO directory required for binary data structures.

**CHS_WORK_COV**
This directory contains a classified single line stream network, identity coverage (after intersection with polygons) and some working files and coverages.

Specific files are as follows:

- **Chs_buf** Extended study area, where hydrological adjustment to DEM is completed.
- **Csa_slnet** Chisholm Study Area single line attributed hydrography network
- **Cid_slnet** Single line hydrography network intersected with polygon information (identity process)
- **out_chs** 1:20K mapsheet neatlines used to create extended study area border
- **out_chis** An initial clipping polygon for study area (replaced by mask_500 derived out of watersheds later in the production).
- **Chs_lakes** Lakes polygon coverage for extended study area
- **Primary_forks.shp** Locations where a stream splits into two primary flows. Only one of these flows participates in drainage accumulation and region aggregation process.
- **Strahler.avl** ArcView Colour legend table for displaying Strahler classification
- **Topo_brks.shp** Locations where a topological break was created by software at:
  - Strahler class changes (Note: 1 into 3 inflow on the south edge does not create a break)
  - Crossing any polygon feature
  - At a confluence with a secondary flow of a higher order
  - As indicated by Hydropoints
info ARC/INFO directory required for binary data structures

OVERVIEW

This directory contains an outline of the study area, data documentation, and an ArcView 3.2 project for information display. The view comment fields (in view properties) provide additional information about the displayed data set.

Specific files are as follows:

**Mask_500** A mask shape polygon coverage (created from watershed coverage with a 500m buffer)

**Visio** Directory containing Data / Process Model documentation in VISIO / WORD format.

**Chisholm_data_des.doc** Microsoft WORD file, data description document.

**Strahler.avl** ArcView Colour legend table for displaying Strahler classification

**Chisholm.apr** An ArcView 3.2 project providing data overview.

The following views are provided in the **Chisholm.apr** project for client’s reference:

01 Overview.
Overview of Chisholm Fire study area.
02 **Source Data**
Source hydrography data. Corrections to Base Features source data set are provided as additional separate coverages. The Chs_buf polygon outlines the extent of corrections to the DEM.

03 **Strahler Classification**
Strahler classification is applied to primary and secondary flows
04 **Inflows**
A StartOrder attribute allows

to initialize Pembina River inflow

at Strahler Class 7 and Athabasca

River at Class 8

05 **Topological breaks**
Topological breaks are created at:

Strahler class changes (Note: 1 into 3 inflow on the south edge does not create a break)

Crossing any polygon feature

At a confluence with a secondary flow of a higher order

As indicated by Hydropoints
06 Segments and Reaches
Segments created on topological routes (primary flows only) are aggregated into reaches as per rules for gradient comparison. Topological break is never removed (Note: where a topological break is not present a full node topology is not enforced). Reachpoints with client attributes are created at a downstream node for every reach (so there are two of these at a confluence).

07 DEM data set.
View of the digital elevation model with mask.
Local modification to source DEM.
Review of original contours allows to see locations where contours were modified before used in the process. Several spikes, ridges in lakes etc were removed.

08 Flow Lines
There were no major discrepancies between flow accumulation lines and single line hydro flows. Minor cases as “A” are typical.
09 Reaches polygons and “Atomic”
Watershed polygons are created using ARC/INFO process that assigns a drainage area to individual arcs (reaches). The unique reach number “absreach” and the “grid-code” polygon attribute link the two data sets. Following the creation of watershed grids in raster domain, a corresponding polygon coverage is created and edited for accurate and pleasing cartographic representation. (Clean edited polygon cover with raster artifacts is provided as Chs_wsd_gr)

10 Watershed Upstream Regions
Region class Upstream in CHS_WSD stores upstream drainage areas for all reaches. Attention: Do not query or display the upstream layer !!!
Use selection tool to pick a region for a desired absreach number and convert it to a separate theme. There is only one upstream region per reach (even for reaches with multiple segments). Some regions may have "holes" if sub-areas are not connected to network.
11 Classification of regions for Strahler sub-basins

A “parent” attribute was added to reaches and regions to identify sub-basins of specific Strahler class. All regions of class 2 are available in the ORD2 region subclass.
DETAILED DESCRIPTION OF COVERAGE ATTRIBUTE TABLES

The following tables show all attributes for the final coverages for the Chisholm area. ARC/INFO topological attributes, maintained Base Features attributes, and new attributes added in our processes are identified for three coverages (with four corresponding feature attribute tables).

<table>
<thead>
<tr>
<th>Coverage</th>
<th>Attribute Table</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chs_hydropoint</td>
<td>Chs_hydropoint.pat</td>
<td>point attribute table</td>
</tr>
<tr>
<td>Chs_hydpoly</td>
<td>Chs_hydpoly.pat</td>
<td>polygon attribute table</td>
</tr>
<tr>
<td>Csa_slnet</td>
<td>Csa_slnet.aat</td>
<td>arc attribute table</td>
</tr>
<tr>
<td>Cid_slnet</td>
<td>Cid_slnet.aat</td>
<td>arc attribute table</td>
</tr>
<tr>
<td>Chs_segs</td>
<td>Chs_segs.aat</td>
<td>arc attribute table</td>
</tr>
<tr>
<td>Chs_reaches</td>
<td>Chs_reaches.dbf</td>
<td>shape arc attribute table</td>
</tr>
<tr>
<td>Reachpoints</td>
<td>Reachpoints.dbf</td>
<td>shape point attribute table</td>
</tr>
<tr>
<td>Chs_wsd</td>
<td>Chs_wsd.pat</td>
<td>polygon attribute table</td>
</tr>
<tr>
<td>Chswsd.upstream</td>
<td></td>
<td>UPSTREAM region class attribute table</td>
</tr>
</tbody>
</table>

**CHS_HYDPOINT.PAT**

<table>
<thead>
<tr>
<th>NAME</th>
<th>ITEM DEFINITION</th>
<th>ITEM DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>AREA</td>
<td>8 18 F 5</td>
<td>Polygon area in coverage units. Set to 0 for point features.</td>
</tr>
<tr>
<td>PERIMETER</td>
<td>8 18 F 5</td>
<td>Perimeter in coverage units. Set to 0 for point features.</td>
</tr>
<tr>
<td>CHS_HYDPOINT#</td>
<td>4 5 B</td>
<td>Polygon internal sequence number (record number).</td>
</tr>
<tr>
<td>CHS_HYDPOINT-ID</td>
<td>4 5 B</td>
<td>Polygon feature identification.</td>
</tr>
<tr>
<td>FEATURE-CODE</td>
<td>10 10 C</td>
<td>Base Features Project Attributes (BFA)</td>
</tr>
<tr>
<td>FEATURE-TYPE</td>
<td>30 30 C</td>
<td>BFA</td>
</tr>
<tr>
<td>NAME</td>
<td>80 80 C</td>
<td>BFA</td>
</tr>
<tr>
<td>SOURCE</td>
<td>6 6 C</td>
<td>BFA -</td>
</tr>
<tr>
<td>CAPTURE_DATE</td>
<td>8 10 D</td>
<td>BFA -</td>
</tr>
<tr>
<td>BF_ID</td>
<td></td>
<td>BFA</td>
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**CHS_HYDPOLY.PAT**

<table>
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<tbody>
<tr>
<td>AREA</td>
<td>8 18 F 5</td>
<td>Polygon area in coverage units. Set to 0 for point features.</td>
</tr>
<tr>
<td>PERIMETER</td>
<td>8 18 F 5</td>
<td>Perimeter in coverage units. Set to 0 for point features.</td>
</tr>
<tr>
<td>CHS_HYDPOLY#</td>
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<td>Polygon internal sequence number (record number).</td>
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<td>Polygon feature identification.</td>
</tr>
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<td>30 30 C</td>
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</tr>
<tr>
<td>NAME</td>
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<td>BFA</td>
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<tr>
<td>SBFLAG</td>
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<td>BFA</td>
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<tr>
<td>BF_ID</td>
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<td>BFA</td>
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### CSA_SLNET.AAT

<table>
<thead>
<tr>
<th>NAME</th>
<th>ITEM DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>FNODE#</td>
<td>From-node sequence number.</td>
</tr>
<tr>
<td>TNODE#</td>
<td>To-node sequence number.</td>
</tr>
<tr>
<td>LPOLY#</td>
<td>Left polygon sequence number.</td>
</tr>
<tr>
<td>RPOLY#</td>
<td>Right polygon sequence number.</td>
</tr>
<tr>
<td>LENGTH</td>
<td>Length in coverage units.</td>
</tr>
<tr>
<td>CSA_SLNET#</td>
<td>Arc internal sequence number (record number).</td>
</tr>
<tr>
<td>CSA_SLNET-ID</td>
<td>Arc feature identification.</td>
</tr>
<tr>
<td>FEATURE_CODE</td>
<td>BFA !!! Features were unsplit based on whether or not it is a lake.</td>
</tr>
<tr>
<td>FEATURE_TYPE</td>
<td>BFA !!! These attributes represent lakes or one of the feature code / type attributes for unsplit streams.</td>
</tr>
<tr>
<td>NAME</td>
<td>-</td>
</tr>
<tr>
<td>SOURCE</td>
<td>-</td>
</tr>
<tr>
<td>CAPTURE_DATE</td>
<td>-</td>
</tr>
<tr>
<td>PS-FLOW</td>
<td>BFA !! Even if sin has only primary flows (based on SEC_SEG) original P and S values exist here.</td>
</tr>
<tr>
<td>SECSEG</td>
<td>Secondary Segment flag &quot;P&quot;, &quot;S&quot;. If BF data was not changed in the QC process it corresponds to PS-FLOW attribute</td>
</tr>
<tr>
<td>STARTORDER</td>
<td>Attribute controlling classification for external inflows</td>
</tr>
<tr>
<td>STRORDER</td>
<td>Strahler class (1 - 6 in this set).</td>
</tr>
<tr>
<td>BF_EDIT_FL</td>
<td>Flag from correction process values 1 - 8 as described below 1. Miscoded PS, 2. Connectivity (this flag indicated &quot;pour&quot; point). Some are left open, many were modified by snap nodes or added segments. 3. (Delete) does not exist on final set. 4. Flipped arc. 5. Added. These segments are broken at lake border, but not fully attributed. 6. (Added from DEM, client approved). 7. Gap created. 8. Dogleg (zinger corrected).</td>
</tr>
<tr>
<td>EDIT_DET</td>
<td>Edit detail – description corresponding to BF_EDIT_FL</td>
</tr>
<tr>
<td>ERRORS</td>
<td>Error messages from initial route creation (name and P/S errors)</td>
</tr>
<tr>
<td>STARTLENGTH</td>
<td>Attribute allows for adjusting route construction priority on inflowing streams</td>
</tr>
<tr>
<td>SEG_NO</td>
<td>Sequential upstream segment number (route design attribute)</td>
</tr>
<tr>
<td>HI_ORD</td>
<td>Highest Strahler order (route design attribute)</td>
</tr>
<tr>
<td>DOM_NU</td>
<td>Route ID (route design attribute)</td>
</tr>
<tr>
<td>DOM_ID</td>
<td>Route ID of corresponding primary route (route design att. on S flow)</td>
</tr>
<tr>
<td>NEWROUTFLAG</td>
<td>New Route required flag (route design attribute)</td>
</tr>
</tbody>
</table>

### CID_SLNET.AAT

<table>
<thead>
<tr>
<th>NAME</th>
<th>ITEM DESCRIPTION</th>
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<tr>
<td>TNODE#</td>
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</tr>
<tr>
<td>LPOLY#</td>
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<tr>
<td>Field</td>
<td>Format</td>
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<td>--------------------</td>
<td>--------</td>
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<tr>
<td>RPOLY#</td>
<td>4 5 B</td>
</tr>
<tr>
<td>LENGTH</td>
<td>8 18 F5</td>
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<tr>
<td>CID_SLNET#</td>
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<tr>
<td>CID_SLNET-ID</td>
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<td>CSA_SLNET#</td>
<td>4 5 B</td>
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<td>CSA_SLNET-ID</td>
<td>4 5 B</td>
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<td>FEATURE_CODE</td>
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<tr>
<td>FEATURE_TYPE</td>
<td>30 30 C</td>
</tr>
<tr>
<td>NAME</td>
<td>80 80 C</td>
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<tr>
<td>SOURCE</td>
<td>6 6 C</td>
</tr>
<tr>
<td>CAPTURE_DATE</td>
<td>8 10 D</td>
</tr>
<tr>
<td>PS-FLOW</td>
<td>1 1 C</td>
</tr>
<tr>
<td>SEC_SEG</td>
<td>1 1 C</td>
</tr>
<tr>
<td>STARTORDER</td>
<td>2 6 B</td>
</tr>
<tr>
<td>STRORDER</td>
<td>2 6 B</td>
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<td>BF_EDIT_FL</td>
<td>1 1 I</td>
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<td>EDIT_DET</td>
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<td>4 6 B</td>
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<tr>
<td>HI_ORD</td>
<td>4 6 B</td>
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<td>4 6 B</td>
</tr>
<tr>
<td>DOM_ID</td>
<td>4 6 B</td>
</tr>
<tr>
<td>NEWROUTFLAG</td>
<td>2 1 B</td>
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<tr>
<td>CHS_HYDPOLYCP#</td>
<td>4 5 B</td>
</tr>
<tr>
<td>AREA</td>
<td>8 18 F5</td>
</tr>
<tr>
<td>PERIMETER</td>
<td>8 18 F5</td>
</tr>
<tr>
<td>CHS_HYDROPOLYCP-ID</td>
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</tr>
<tr>
<td>SBFLAG</td>
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</tr>
<tr>
<td>POLY_FEAT</td>
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</tr>
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<td>RECNO</td>
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### CHS_SEGS.AAT

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<th>ITEM DEFINITION</th>
<th>ITEM DESCRIPTION</th>
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</thead>
<tbody>
<tr>
<td>FNODE#</td>
<td>4 5 B</td>
<td>From-node sequence number.</td>
</tr>
<tr>
<td>TNODE#</td>
<td>4 5 B</td>
<td>To-node sequence number.</td>
</tr>
<tr>
<td>LPOLY#</td>
<td>4 5 B</td>
<td>Left polygon sequence number.</td>
</tr>
<tr>
<td>RPOLY#</td>
<td>4 5 B</td>
<td>Right polygon sequence number.</td>
</tr>
<tr>
<td>LENGTH</td>
<td>4 12 F5</td>
<td>Length in coverage units.</td>
</tr>
<tr>
<td>CHS_SEGS#</td>
<td>4 5 B</td>
<td>Arc internal sequence number (record number).</td>
</tr>
<tr>
<td>ROUID</td>
<td>4 4 B</td>
<td>Route ID identifier.</td>
</tr>
<tr>
<td>FROM</td>
<td>4 7 F4</td>
<td>Start point along the route.</td>
</tr>
<tr>
<td>TO</td>
<td>4 7 F4</td>
<td>Stop point along the route.</td>
</tr>
<tr>
<td>FR-SPOT</td>
<td>8 12 F3</td>
<td>Elevation reading at start point.</td>
</tr>
<tr>
<td>TO-SPOT</td>
<td>8 12 F3</td>
<td>Elevation reading at stop point.</td>
</tr>
<tr>
<td>GRAD-SG</td>
<td>8 12 F3</td>
<td>Gradient for the segment.</td>
</tr>
<tr>
<td>GRAD</td>
<td>8 12 F3</td>
<td>Gradient for the segment.</td>
</tr>
<tr>
<td>ABSREACH</td>
<td>2 5 B</td>
<td>Unique reach identifier.</td>
</tr>
<tr>
<td>CURREACH</td>
<td>2 5 B</td>
<td>Unique reach identifier with in unique route.</td>
</tr>
<tr>
<td>CLASS</td>
<td>2 2 B</td>
<td>Specifies class based on which aggregation was made.</td>
</tr>
<tr>
<td>FROMREACH</td>
<td>8 10 F3</td>
<td>Starting point along the route for the aggregated reach.</td>
</tr>
<tr>
<td>TOREACH</td>
<td>8 10 F3</td>
<td>Ending point along the route for the aggregated reach.</td>
</tr>
<tr>
<td>GRADREACH</td>
<td>8 10 F3</td>
<td>Gradient for the aggregated reach.</td>
</tr>
</tbody>
</table>

### CHS_REACHES.DBF

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<thead>
<tr>
<th>NAME</th>
<th>ITEM DEFINITION</th>
<th>ITEM DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
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<td>4 5 B</td>
<td>From-node sequence number.</td>
</tr>
<tr>
<td>TNODE#</td>
<td>4 5 B</td>
<td>To-node sequence number.</td>
</tr>
<tr>
<td>LPOLY#</td>
<td>4 5 B</td>
<td>Left polygon sequence number.</td>
</tr>
<tr>
<td>RPOLY#</td>
<td>4 5 B</td>
<td>Right polygon sequence number.</td>
</tr>
<tr>
<td>LENGTH</td>
<td>8 18 F5</td>
<td>Length in coverage units.</td>
</tr>
<tr>
<td>CHS_REACHES#</td>
<td>4 5 B</td>
<td>Arc internal sequence number (record number).</td>
</tr>
<tr>
<td>CHS_REACHES-ID</td>
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<td>Arc feature identification.</td>
</tr>
<tr>
<td>ABSREACH</td>
<td>4 6 B</td>
<td>Unique reach identifier.</td>
</tr>
<tr>
<td>IGNORESEG</td>
<td>1 1 C</td>
<td>Flag to help identify last arc for the reach.</td>
</tr>
<tr>
<td>DOWNELEV</td>
<td>10 3 DOUBLE</td>
<td>Elevation at the downstream node.</td>
</tr>
<tr>
<td>UPELEV</td>
<td>10 3 DOUBLE</td>
<td>Elevation at the upstream node.</td>
</tr>
<tr>
<td>RISE</td>
<td>10 3 DOUBLE</td>
<td>Rise( Upstream Elevation – Downstream elevation).</td>
</tr>
<tr>
<td>STRLNDIST</td>
<td>10 3 DOUBLE</td>
<td>Strait line distance from beginning to end.</td>
</tr>
<tr>
<td>VALLEYS LP</td>
<td>10 3 DOUBLE</td>
<td>Valley Slope.</td>
</tr>
<tr>
<td>CHANLEN</td>
<td>10 3 DOUBLE</td>
<td>Length of the channel.</td>
</tr>
<tr>
<td>CHANSLP</td>
<td>10 3 DOUBLE</td>
<td>Channel Slope.</td>
</tr>
<tr>
<td>SINUOSITY</td>
<td>10 3 DOUBLE</td>
<td>Sinuosity.</td>
</tr>
<tr>
<td>LOCDRAIN A</td>
<td>10 3 DOUBLE</td>
<td>Local drainage area.</td>
</tr>
<tr>
<td>TOTDRAIN A</td>
<td>10 3 DOUBLE</td>
<td>Total drainage area.</td>
</tr>
<tr>
<td>PARENT</td>
<td>4 5 B</td>
<td>Flag calculated for reaches that are parent reaches for sub-basins of specific Strahler class. (1,2…8)</td>
</tr>
</tbody>
</table>
### REACHPOINTS.DBF

<table>
<thead>
<tr>
<th>NAME</th>
<th>ITEM DEFINITION</th>
<th>ITEM DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>5 0 INTEGER</td>
<td>Unique point identifier.</td>
</tr>
<tr>
<td>DOWNLEV</td>
<td>10 3 DOUBLE</td>
<td>Elevation at the downstream node.</td>
</tr>
<tr>
<td>UPELEV</td>
<td>10 3 DOUBLE</td>
<td>Elevation at the upstream node.</td>
</tr>
<tr>
<td>RISE</td>
<td>10 3 DOUBLE</td>
<td>Rise( Upstream Elevation – Downstream elevation).</td>
</tr>
<tr>
<td>STRLNDIST</td>
<td>10 3 DOUBLE</td>
<td>Strait line distance from beginning to end.</td>
</tr>
<tr>
<td>VALLEYSLP</td>
<td>10 3 DOUBLE</td>
<td>Valley Slope.</td>
</tr>
<tr>
<td>CHANLEN</td>
<td>10 3 DOUBLE</td>
<td>Length of the channel.</td>
</tr>
<tr>
<td>CHANSLP</td>
<td>10 3 DOUBLE</td>
<td>Channel Slope.</td>
</tr>
<tr>
<td>SINUOSITY</td>
<td>10 3 DOUBLE</td>
<td>Sinuosity.</td>
</tr>
<tr>
<td>LOCDRAIN</td>
<td>10 3 DOUBLE</td>
<td>Local drainage area.</td>
</tr>
<tr>
<td>TOTDRAIN</td>
<td>10 3 DOUBLE</td>
<td>Total drainage area.</td>
</tr>
</tbody>
</table>

### CHS_WSD.PAT

<table>
<thead>
<tr>
<th>NAME</th>
<th>ITEM DEFINITION</th>
<th>ITEM DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>AREA</td>
<td>8 18 F 5</td>
<td>Polygon area in coverage units. Set to 0 for point features.</td>
</tr>
<tr>
<td>PERIMETER</td>
<td>8 18 F 5</td>
<td>Perimeter in coverage units. Set to 0 for point features.</td>
</tr>
<tr>
<td>CHS_WSD#</td>
<td>4 5 B</td>
<td>Polygon internal sequence number (record number).</td>
</tr>
<tr>
<td>CHS_WSD-ID</td>
<td>4 5 B</td>
<td>Polygon feature identification.</td>
</tr>
<tr>
<td>GRID-CODE</td>
<td>4 8 B</td>
<td>Corresponds to reaches ABSREACH attribute.</td>
</tr>
</tbody>
</table>

### CHS_WSD.UPSTREAM

<table>
<thead>
<tr>
<th>NAME</th>
<th>ITEM DEFINITION</th>
<th>ITEM DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>AREA</td>
<td>8 18 F 5</td>
<td>Polygon area in coverage units. Set to 0 for point features.</td>
</tr>
<tr>
<td>PERIMETER</td>
<td>8 18 F 5</td>
<td>Perimeter in coverage units. Set to 0 for point features.</td>
</tr>
<tr>
<td>UPSTREAM#</td>
<td>4 5 B</td>
<td>Polygon internal sequence number (record number).</td>
</tr>
<tr>
<td>UPSTREAM-ID</td>
<td>4 5 B</td>
<td>Polygon feature identification.</td>
</tr>
<tr>
<td>ABSREACH</td>
<td>4 6 B</td>
<td>Reach identifier</td>
</tr>
<tr>
<td>PARENT</td>
<td>4 5 B</td>
<td>Parent flag calculated for regions that correspond to parent reaches for sub-basins of specific strahler class.</td>
</tr>
</tbody>
</table>
Information on reach aggregation for Chisholm area

Chisholm area used the aggregation rules option table 2 containing number of gradient classes (for segments), min max class segment gradient, % change parameter for aggregation.

Agg_rule_2.tab

9  Number of segment classes
-90 0 0  min, max class gradient , % change parameter
0 1 0.5
1 2 1.0
2 3 1.5
3 4 1.5
4 6 2.0
6 10 3.0
10 20 5.0
20 90 10.0

After reading the option table an Avenue script assigns abs_reach (and reach_grad) attribute as per rules.

Reach summary tool was applied to all reaches and to a selected group of reaches with length > 60m. An external ASCII summary option table 2 was used. Summary option table contains number of target reach classes, min max class reach gradient and class name attributes.

Summ_par_2.tab

10  Number of reach classes
-90.0 0.0 -1  min max Class
0.0 1.0 1
1.0 2.0 2
2.0 3.0 3
3.0 4.0 4
4.0 6.0 5
6.0 10.0 6
10.0 20.0 7
20.0 40.0 8
40.0 90.0 9

An Avenue script applies reach classification and displays statistics ie. count, min, max, average length, average gradient for each reach class.
## Results

### All Reaches

<table>
<thead>
<tr>
<th>Class</th>
<th>Count</th>
<th>Min Length</th>
<th>Max Length</th>
<th>Avg Length</th>
<th>Avg Grad</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>396</td>
<td>16.1</td>
<td>15023.4</td>
<td>459.4</td>
<td>-0.7</td>
</tr>
<tr>
<td>2</td>
<td>7127</td>
<td>0.6</td>
<td>52585.4</td>
<td>505.0</td>
<td>0.5</td>
</tr>
<tr>
<td>3</td>
<td>4651</td>
<td>4.5</td>
<td>31448.0</td>
<td>339.5</td>
<td>1.5</td>
</tr>
<tr>
<td>4</td>
<td>2892</td>
<td>6.4</td>
<td>27669.2</td>
<td>304.2</td>
<td>2.5</td>
</tr>
<tr>
<td>5</td>
<td>2553</td>
<td>6.8</td>
<td>4892.8</td>
<td>252.7</td>
<td>3.5</td>
</tr>
<tr>
<td>6</td>
<td>3097</td>
<td>6.5</td>
<td>8121.3</td>
<td>248.9</td>
<td>5.0</td>
</tr>
<tr>
<td>7</td>
<td>2188</td>
<td>6.9</td>
<td>2138.7</td>
<td>201.1</td>
<td>7.7</td>
</tr>
<tr>
<td>8</td>
<td>1024</td>
<td>8.1</td>
<td>3593.2</td>
<td>189.2</td>
<td>13.2</td>
</tr>
<tr>
<td>9</td>
<td>90</td>
<td>14.7</td>
<td>820.1</td>
<td>175.8</td>
<td>25.4</td>
</tr>
</tbody>
</table>

Total: 24018

### Over 60m length

<table>
<thead>
<tr>
<th>Class</th>
<th>Count</th>
<th>Min Length</th>
<th>Max Length</th>
<th>Avg Length</th>
<th>Avg Grad</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>248</td>
<td>63.7</td>
<td>14991.1</td>
<td>406.5</td>
<td>-0.4</td>
</tr>
<tr>
<td>2</td>
<td>6529</td>
<td>60.0</td>
<td>52585.4</td>
<td>546.5</td>
<td>0.5</td>
</tr>
<tr>
<td>3</td>
<td>4523</td>
<td>60.0</td>
<td>31448.0</td>
<td>352.1</td>
<td>1.5</td>
</tr>
<tr>
<td>4</td>
<td>2831</td>
<td>60.2</td>
<td>27669.2</td>
<td>314.2</td>
<td>2.5</td>
</tr>
<tr>
<td>5</td>
<td>2511</td>
<td>60.0</td>
<td>4892.8</td>
<td>261.4</td>
<td>3.5</td>
</tr>
<tr>
<td>6</td>
<td>3058</td>
<td>60.1</td>
<td>8121.3</td>
<td>253.0</td>
<td>5.0</td>
</tr>
<tr>
<td>7</td>
<td>2157</td>
<td>60.0</td>
<td>6308.0</td>
<td>208.9</td>
<td>7.7</td>
</tr>
<tr>
<td>8</td>
<td>1019</td>
<td>63.3</td>
<td>3593.2</td>
<td>192.2</td>
<td>13.2</td>
</tr>
<tr>
<td>9</td>
<td>88</td>
<td>65.7</td>
<td>842.6</td>
<td>181.1</td>
<td>25.1</td>
</tr>
</tbody>
</table>

Total: 22964

**Note:** The elevation data accuracy and the calculated slope attributes for the reaches shorter than 60m may be misleading. Such short reaches could have both start and end elevation assigned from either value and gradient / slope attribute set to 0. Most of these short reaches were created due to the topological constraints such as crossing a lake, or connecting network segment in the double line river, and even adjusted DEM will not support precise reading of elevation data for these.