Channelization

Data Sources and Management. Natural stream channels tend to meander from side to side as the stream carves its path downslope, and the measure of the meandering characteristics of a stream is called sinuosity (Mueller 1968). Channelization, which reduces sinuosity, is the process of straightening, widening or deepening stream channels to increase water conveyance and provide anthropogenic services (i.e., flood protection, navigation, drainage to facilitate agriculture and development; Emerson 1971, Gillette 1972, Brooker 1985).

To estimate stream channelization in the study area, we used both the NHD flowline and waterbody datasets and selected flowline features with feature types of Stream-River and Artificial-Path (U.S. Geological Survey, et al. n.d. *a*, U.S. Geological Survey et al. n.d. *b*.). Artificial paths are theoretical flow network connections intended to track the flow of water when a stream encounters another waterbody (i.e., when a dam on a stream forms a reservoir), as such paths typically flow through the center of a waterbody and connect to the stream feature on the downstream side. Within the NHD dataset there are features classified as artificial paths which do not encounter a waterbody feature but rather follow the path of a stream, as a Stream-River feature does. For example, within the study area, the Pearl River (Lower Pearl watershed) is almost entirely classified as Artificial-Path rather than Stream-River. This apparent misclassification makes it necessary to include, in the channelization analysis, any artificial paths that are not within waterbodies (NHD waterbody dataset).

We calculated a sinuosity index for each feature by dividing the length of each stream segment feature by the straight-line distance between its endpoints, or

$$\text{Channel length}_{(m)} / \text{Valley length}_{(m)}.$$

Following Mueller (1968), the lowest sinuosity values (near 1.0) indicate a straight stream segment that has potentially been channelized. As stream sinuosity increases, these values increase greater than one. Stream segment features within each watershed were then filtered based on their sinuosity values, with features holding a sinuosity less than 1.02 and a length greater than 200 m considered as potentially channelized. We included the length requirement (200 m) because the high resolution NHD dataset is digitized at a 1:24,000 scale, which leads to the coarse appearance of smaller features and, consequently, less accurate reflection of the shape of small stream segments. For example, at this scale a 200 m stream feature appears less than one cm long. After applying the filter, each potentially channelized location was visually examined with National Aerial Imagery

Program (NAIP) imagery to make final determination of whether channelization has occurred, and, based on this visual inspection, the associated NHD features were classified as either channelized or un-channelized in the NHD waterbody dataset. (Table 1). Upon visual inspection, many of these channelized segments look like canals however this analysis is based on features that are designated as streams by the U.S.G.S. There could be discrepancies in the NHD dataset leading to canals being categorized as streams or it could be that the level of channelization is so severe that the channels appear completely artificial.

Table 1

Total Stream Segments (#)	Filtered Segments (#)	Channelized Segments (#)
323,186	38,563	22,221

Data Analysis. We calculated a channelization index to determine a ratio of channelized to un-channelized stream length within each watershed. To do this, we used the NHD high-resolution flowline dataset, which was updated to contain the channelization classification. The channelization index was calculated as,

$$\sum(\text{channelized streams})_{(m)} \,/\, \sum(\text{all streams})_{(m)}.$$

References

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Mueller, Jerry E. 1968, An Introduction to the Hydraulic and Topographic Sinuosity Indexes, Annals of the Association of American Geogrphers, vol 58, no. 2 (June, 1968), Taylor and Francis, Ltd.

U.S. Geological Survey, U.S. Environmental Protection Agency, USDA Forest Service, and other Federal, State and local partners n.d. a., NHDFlowline, U.S. Geological Survey, Reston Virginia <ftp://nhdftp.usgs.gov/DataSets/Staged/States/FileGDB/HighResolution/>.

U.S. Geological Survey, U.S. Environmental Protection Agency, USDA Forest Service, and other Federal, State and local partners n.d. b., NHDWaterbody, U.S. Geological Survey, Reston Virginia <ftp://nhdftp.usgs.gov/DataSets/Staged/States/FileGDB/HighResolution/>.