

## **Watershed Assessment Approach:** **FluvialGeomorph (FG) Assessment of the Papillion Creek Basin**

*Impact Statement: Development of a basin-wide assessment approach focusing on physical geomorphic channel and watershed characteristics provides USACE planners with the ability to identify critical locations to target Natural and Nature-Based Features (NNBF) restoration.*

The USACE Omaha District (NWO) and the USACE-ERDC Coastal and Hydraulics Laboratory (CHL) partnered with the Papio-Missouri River Natural Resource District (NRD) to assess stream channel degradation on the Papillion Creek Watershed. The Papillion Creek Watershed is located to the northwest, west, and southwest of downtown Omaha, Nebraska, and has rapidly developing urban areas (Figure 1). The goals of the study were to: (1) assess the level of stream degradation that has occurred since the streams were originally classified by USACE and the US Geological Survey (USGS) in the 1990s; and (2) develop a comprehensive strategy document that identifies level of stream degradation, determines which assets are at greatest risk (i.e., bridges, utilities, residential and commercial development, and ecosystem), assesses appropriate locations for Natural and Nature-Based Features (NNBF) applications, develops restoration matrix, and identifies priority construction projects.

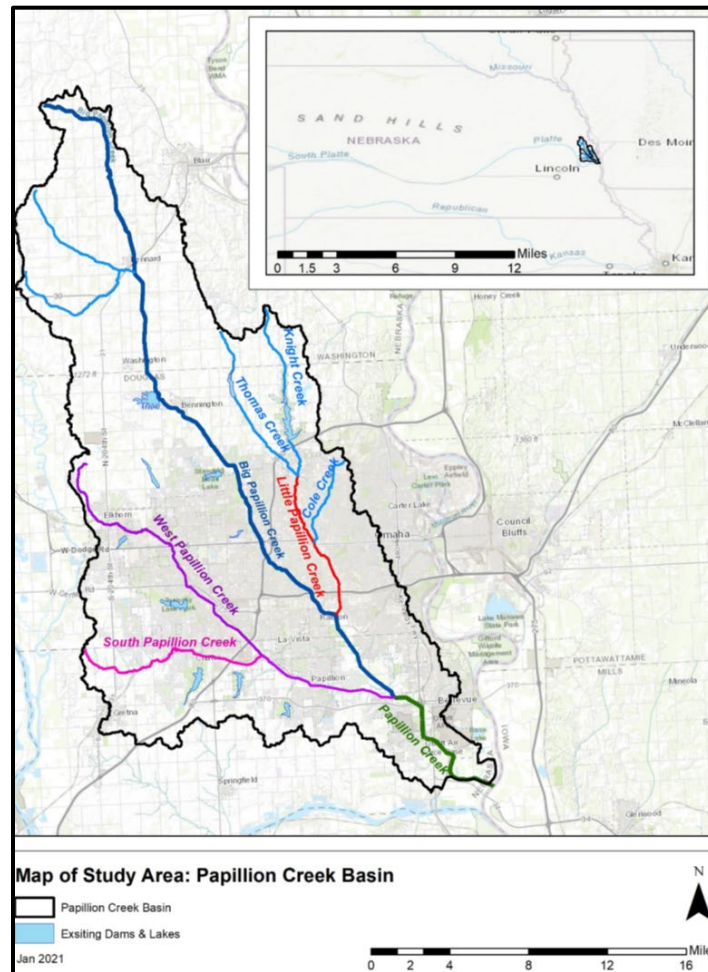


Figure 1. Papillion Creek Watershed Study location map.

FluvialGeomorph (FG) is an ERDC-CHL developed rapid watershed assessment toolkit to assess stream channel stability (Figure 2). FG uses existing high-resolution terrain data such as Light Detection and Ranging (LiDAR) or other available data sets to measure and compare channel morphology. Channel morphology is then mapped and compared against representative stable channel dimensions (empirical relationships) to identify locations within the watershed where channel instability exists. Assessments are completed on a single data set or multiple years of data, depending on the availability of data. Geomorphic mapping and the associated metrics provide a basis to identify and assess priority locations within the watershed for further data collection and study or concentrated restoration. The study included the Big Papio, Little Papio, West Papio, South Papio, Hell, Thomas, and Cole Creeks (shown in Figure 1). Site specific NNBF restoration matrices were developed for West Papio, South Papio, and Cole Creeks. An example NNBF restoration matrix is illustrated in Figure 3. An example section of channel erosion is illustrated for South Papillion Creek in Figure 4. The completed Papillion Creek Watershed study was provided to the NRD in November 2022.

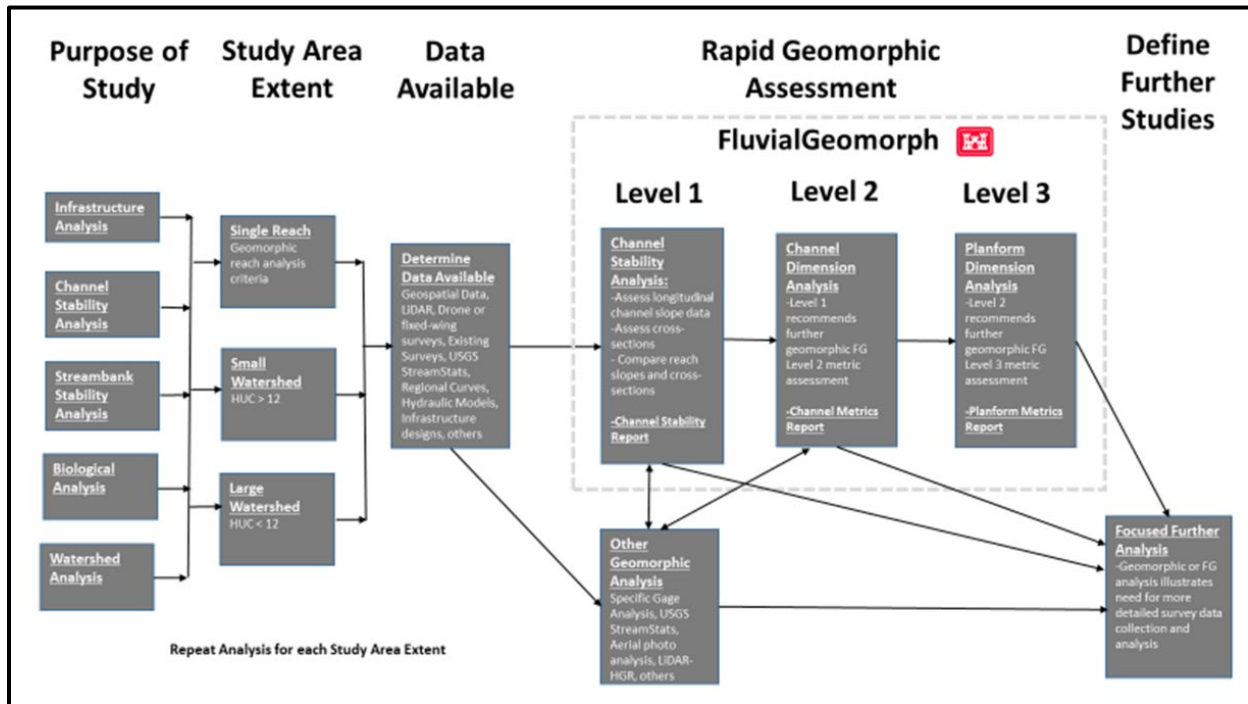


Figure 2. FluvialGeomorph (FG) workflow.

Alternative	Planning Objectives?		Planning Constraints			Screening Result
	Meets Purpose and Need	Sustainable	Technically Feasible	Includes beneficial environmental opportunities	Level of structural bank protection	
Alt 1 - No Action	No	No	NA	No	NA	<b>Does not meet the need of the project</b>
Alt 2 – Steel Sheet Pile Wall	Yes	Minimal maintenance	Yes	No, no vegetation components and unnatural in appearance	Total	<b>Not environmentally beneficial, likely not the least cost alternative</b>
Alt 3 – Retaining Wall	Yes	Minimal to moderate maintenance	Yes	No, no vegetation components	Partial to Total	<b>Environmentally beneficial, Not least cost alternative</b>
Alt 4 – Riprap Blanket w/Toe	Yes	Minimal to moderate maintenance	Yes	Yes, vegetation component above blanket	Partial	<b>Environmentally beneficial, not least cost alternative</b>
Alt 5 – NNBF LPSTP/LFSTP w/bioengineering	Yes	Minimal to moderate maintenance	Yes	Yes, potential to incorporate vegetation and contribute to viewshed aesthetic value	Partial: up to half bank height based on final design	<b>Environmentally beneficial, likely a component of least cost alternative.</b>
Alt 6 – Full Bank Rock Wall	Yes	Minimal to moderate maintenance	Yes	Yes, majority of wall covered with topsoil and vegetation contributing to viewshed aesthetic value	Total	<b>Environmentally beneficial, not least cost, but long life with minimal maintenance</b>
Alt 7 – NNBF Grade Control Structure	Yes	Minimal to moderate maintenance	Yes	Yes, stone facing; potential to incorporate vegetation and contribute to viewshed aesthetic value	Partial: provided limited toe protection, does prevent channel deepening & widening	<b>Environmentally beneficial, likely a component of least cost plan</b>
Alt 8 – Buyouts	Yes	Moderate to significant maintenance	Yes	No	NA	<b>Environmentally and economically unacceptable</b>

Figure 3. FluvialGeomorph (FG), Cole Creek NNBF restoration matrix table.



Figure 4. South Papillion Creek, downstream of Giles Road Culverts.

The development of FluvialGeomorph (FG) is being used to assess and develop a systematic watershed assessment approach. POC: Chris Haring [christopher.p.haring@usace.army.mil](mailto:christopher.p.haring@usace.army.mil)