The Geospatial Study of Catchment Area of Swa Creek Dam, Bago Region

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Abstract

Topography of the catchment area of a creek needs to be considered as it has a significant influence on the flooding characteristics. Swa Creek Dam and its surrounding area located in Bago Region is selected as the study area as the dam failed in 2018 and 85 villages were flooded, blocked Yangon-Mandalay Highway Road and forced more than 63,000 people from their homes. The objectives of the paper are to study the topographic feature of the area of the dam and its surrounding and to examine the catchment area of Swa dam by using Google Earth Pro and Arc GIS. Primary data are recorded from Google Earth Pro. Raster interpolation is generated by using IDW method. Then, it is contouring from raster surface to create DEM of Swa Creek Dam and its surrounding Area. Hydrology analysis is based on DEM to calculate the catchment area of the dam. Finally, topography and catchment area are the important factors to occur flooding and collapse Swa Creek Dam. East and Southeastern parts, the location of Pyay and Yedashe Townships, of Swa Dam are the flat land areas which are the flooded areas in the rainy season of the year.

Keywords: Swa Creek Dam, DEM, IDW, topography, catchment area

Introduction

A water catchment (commonly referred to as a "watershed") is an area of land where all water flows to a single stream, river, lake or even ocean. [1]

Swa Creek Dam is located on the western bank of Swa Creek in Yedashe Township, Bago Region. The area of the dam is 18.86 Sq.km .

Catchment areas are located in low lying area where water from the rivers and streams flow into a basin or a dam or a water body. The sources of water for the dam are from rainwater and tributaries of Swa Creek. Catchment area may flow their water into the lower parts of the basin areas or into lowland settlement areas. The largest basin area of the study area is 146.78 sq.km.

A. The Significance of Catchment Areas

Catchment basins provide water for irrigation, to a large number of people and animals, which is essential to their survival. Drainage basins are also habitual for both plants and animals. Similarly, the sediments deposited along river basins are alluvial and good for agriculture. River basins are used for hydro-electric power.

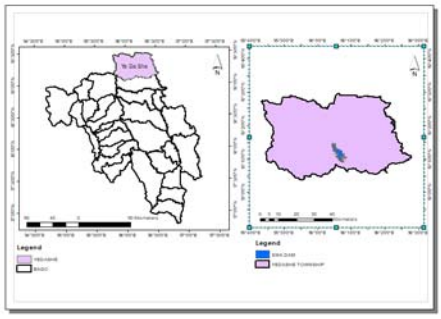

Figure (1). Location Map of Swa Dam in Yedashe Township, Bago Region

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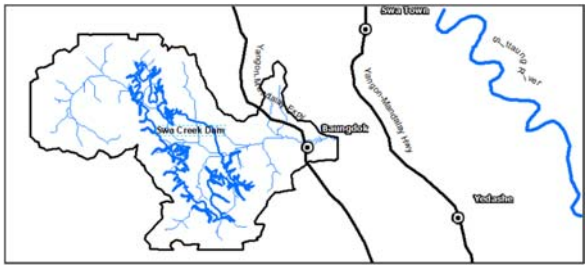

Figure (2). Swa Creek Dam and the Surrounding Area in Yedashe Township, Bago Region
Note: The largest basin of Swa Creek and its flow accumulation are highlighted by polygon and stream network respectively.

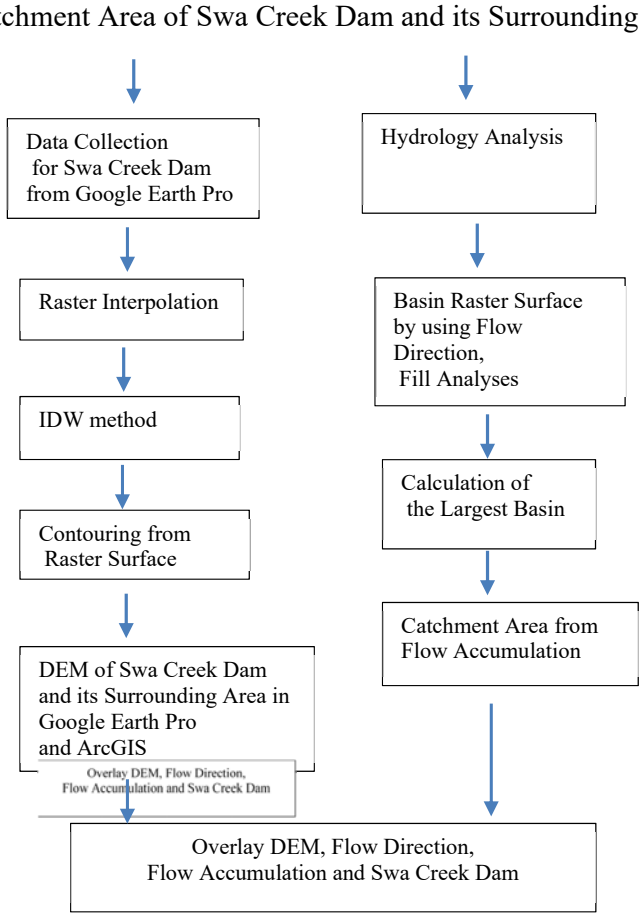

Figure (3). Study Design for the Topography and Catchment Area of Swa Creek Dam and its surrounding Area

B. Objectives

The objectives of the paper are to study the topographic feature of the area of the dam and its surrounding and to examine the catchment area of the dam by using Google Earth Pro and Arc GIS.

C. Sources of Data and Methodology

To construct Digital Elevation Model and to draw Swa Creek Dam and its surrounding area, primary data are recorded from Google Earth Pro. DEM is generated by IDW method to examine the topography of the basin area. Hydrology analysis is done to know the flow accumulation and the catchment area of the dam. Finally, map showing countouring and catchment area of Swa Creek Dam and its surrounding area is produced.

Result and Discussion

A. Topographic feature of the area of the dam and its surrounding

1) Raster Interpolation and Raster Surface

To get DEM map, at first elevation of the study area is collected from Google Earth Pro. Then, the elevation data are exported and generated by GPS visualizer. Finally, Inverse distance weighted (IDW) interpolation technique is used to get interpolated surface by using a set of sample points recorded in Google Earth.

These interpolated surfaces are controlled by limiting the input points. To get enough surfaces, it is necessary to have the area which is wider than the study area where the prediction is being made, and then estimate them from the calculation.

We can specify the number of points to use directly, or specify a fixed radius within which points will be included in the interpolation. [2]

Next step is to draw contour lines by connecting locations of equal value in a raster dataset that represent continuous phenomena such as elevation. The line features connect cells of a constant value in the input. The distribution of the contour lines indicates the elevation changes and the lower and higher places within the study area so that the researcher can identify the flooding area.

Figure 4 and 5 show an input elevation dataset and the output contour dataset. The areas where the contours are closer together indicate the higher locations, the location of Swa Creek Dam. They correspond with the areas of higher elevation (in black on the input elevation dataset). Pyay and Yedashe townships are situated in the lower locations, the northeastern and southeastern parts of the Dam. They are the flood-prone areas of August 2018 food (Plate 1).

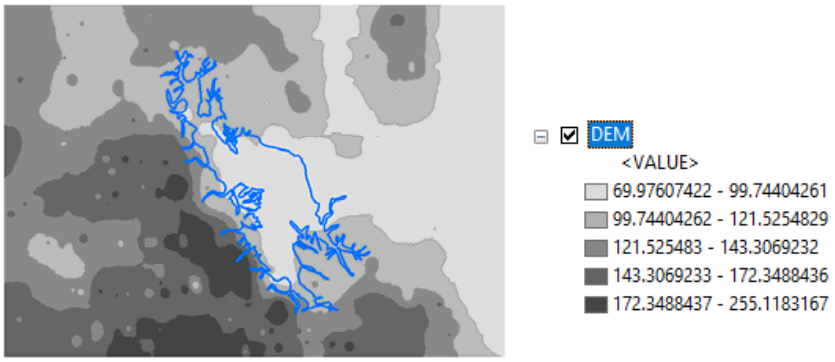

Figure (4). Digital Elevation Modep of Swa Creek Dam and its Surrounding Area

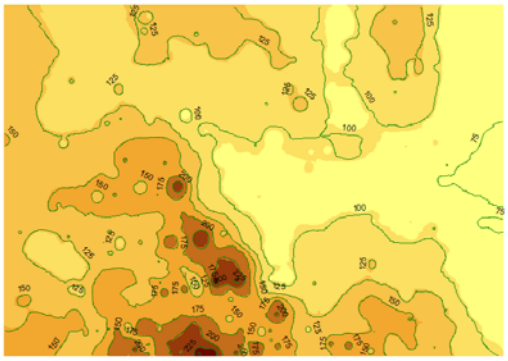

Figure (5). Land Slope of Swa Creek Dam and its Surrounding Area

Plate (1). Flood Area in Yedashe Township (Source: Photo taken in August 2018)

B. Catchment area of the dam

Hydrology analysis is done on the basis of the raster DEM map. Hydrologic characteristics of a surface determine the direction of flow from every cell in the raster. This is clculted with the flow direction tool. The procedure to draw catchment area of Swa Creek Dam is shown in Figure 3.

At first, basin raster surface is calculated by using flow direction which find all sets of connected cells and fill analyses to delineate the drainage basin. All cells in the raster will belong to a basin. And then, the largest basin is calculated among other basins. There are 7 basins in Swa Creek Dam area.

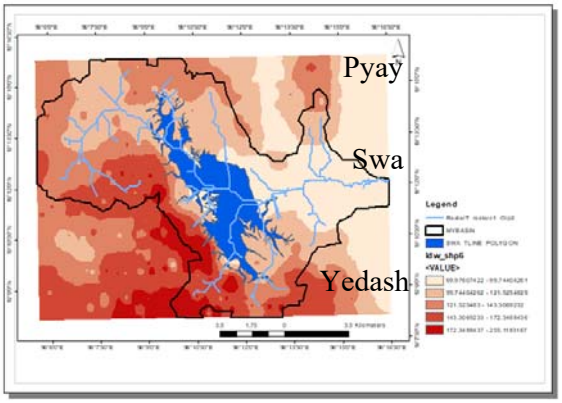

Figure (6). Overlay map of DEM, Flow Direction, Flow Accumulation and Swa Creek Dam

The flow accumulation tool is used to calculate flow pattern. “The results of Flow Accumulation can be used to create a stream network by applying a threshold value to select cells with a high accumulated flow”. [4] All cells in raster surface flow into each downslope

cell in the output raster. In figure 6, map shows the direction of travel from the largest basin to its surrounding area especially to the lowest area such as Pyay and Yedashe townships.

C. *The study of catchment areas of Swa Creek and Dam*

The study area, Swa Creek Dam, is located in Bago Region. The breached dam was built across the Swa creek in 2004.

It receives heavy rainfall. The western and northern parts of the Dam are located above 200 ft and the east and southeastern parts are below 100 ft. The size of the basin area is about 100 ft. The western and northern parts are higher than the eastern and southeastern parts (Figure 6). Thus in the rainy season the villages in Yedashe Township, which is located in the lower part of the dam, are flooded every year (Plate 1).

In August 2018, the bride over the Swa creek was damaged after flooding at the Yagnon-Mandalay highway in Swa Township. Many 85 villages were flooded after the dam failed. Unleashing waters blocked a major highway and forced more than 63,000 people from their homes and submerging a section of highway. After the spillway of an irrigation dam bursted in Swar creek in central Myanmar, sending a torrent of water through villages and the nearby towns of Swar and Yedashe. Traffic between Myanmar's major cities of Yangon and Mandalay and the capital, Naypyitaw, was disrupted after the flooding damaged a bridge on the highway linking the cities.

Similar situation is found in South-east Asia; collapse of a hydroelectric dam in neighbouring Laos displaced thousands of people and killed at least 27.

Conclusion

This paper is concerned with the study of catchment area of the dam and the effect of the dam on its surrounding areas. The study area, Swa Creek Dam is located in central Myanmar. It is especially used for irrigation agriculture. The sources of water for the dam are Swa Creek and rainwater. However, in rainy season the areas near and/or the lower parts of the dam may be flood-prone areas. Contours are also a useful surface representation, because they allow simultaneously visualizing flat and steep areas (distance between contours) and ridges and valleys (converging and diverging polylines). Thus, DEM map and contour map is drawn based on the elevation points from Google Earth and generated by using IDW method. Flow direction, flow accumulation and catchment area of the basin are produced from hydrology analysis by using Arc Map. Swa Creek Dam is constructed for irrigation agriculture. The lower part of the dam and its surrounding areas, however, are flood-prone and damaged areas because of the heavy rainfall and not having mitigation work for local people. Therefore, in August 2018 flood, many villages and many properties are lost in the impact of the dam collapse.

References

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