First and Last Name

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GEOG 300, F12

TA: Jane Doe

CT#1 due MM/DD/YYYY

Question CT#1-3

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**Flood or Drought: The argument for forecast based reservoir operations.**

***Interpretation (56)***

Reservoirs impact water supply for billions of people around the globe. Freshwater is stored in reservoirs during times that are seasonally wet to be used during the drier periods. Antiquated operations can leave a reservoir prone to flood or drought (Huang & Hsieh, 2015, paragraph 1). New management strategies have been developed and applied successfully, and should be implemented by reservoirs facing these risks (Ngo et al., 2008, p. 457).

***Analysis (400)***

Access to freshwater is essential to daily life. Reservoirs provide this need to communities living in areas subject to drought conditions. One-sixth of the world’s population is dependent on snowmelt, and much of this snowmelt is controlled downstream by a reservoir (Makin et al., 2015, paragraph 30). Optimal operation is the key to providing enough water to the surrounding populace without reaching the capacity and overtopping, creating a flood.

Reservoirs have historically been operated using rule curves developed by the US Army Corps of Engineers. “A rule curve is the compilation of operating criteria, guidelines, and specifications that govern the storage and release rates of a reservoir,” (Ralph et al., 2009, p. 1287). To meet objectives such as flood control and water storage the rule curve prescribes release rates allowed during certain seasons. Rule curves are developed based on information from historical floods.

There are issues associated with basing current reservoir operations off historical floods. Many of these historical flows come from only a small snapshot in time, such as a ten-year period, and are simply not representative of the long term hydrologic cycle. Another problem is that that historical meteorological patterns do not depict present patterns. With climate change comes uncertainty. Extreme weather is being seen more frequently on both ends of the spectrum (high and low precipitation). Operating according to these rules based on middle ground values can prove to be ineffective. The last setback of operating based on a rule curve, is that these values have already been set, and only account for seasonal changes (Makin et al., 2015, paragraph 2). It does not look at individual events. When events are as extreme as those seen by the breaching of Oroville Dam in February of 2017, the rule curve was not simply not enough guidance to operate under the extreme conditions, which ultimately lead to dam failure.

Applications such as MIKE11 have been proposed as tools for better management strategies rather than simple rule curve operation. This model uses real time watershed monitoring and modern weather and water forecasting to help water managers selectively release or retain water from reservoirs in a manner that reflects forecasted conditions. MIKE11 follows adaptive management principles for continual improvement of reservoir operations using mathematical algorithms and forecasts (Ngo et al., 2008, p. 460). Current reservoir manuals utilize gross estimates of flood potential to establish reservoir storage and release requirements. They do not account for changing conditions in the watershed (Ngo et al., 2008, p. 463).

***Evaluation (29)***

Weather prediction is still inaccurate. Ngo et al. and Ralph et al. assume forecasts are accurate, but it is important to realize that these predictive measures are not always correct.

***Inference (30)***

Reservoir operation guidelines are a problem that have faced local communities, globally, from the inception of reservoir development. This ultimately can determine water supply, and the prosperity of these communities.

***Explanation (34)***

Current reservoir operating techniques are unsustainable for the uncertain future we face. With better prediction, we can operate with precision and accuracy, leading to a more stable source of freshwater for billions of people.

***Literature Cited***

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