Lessons about Geomorphic Reclamation from Sediment Yield Quantification and Erosion Modeling Studies[1]

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Abstract: The UN State of World Population 2014 report predicts global population will increase to 11 billion by 2100. Increases in land-disturbing activities like mining that can accelerate erosion and sediment yield will accompany that population growth. Geomorphic land reclamation has gained widespread acceptance as a means to mitigate erosion and sediment yield increases associated with that growth and to better satisfy other reclamation criteria like freedom from maintenance and providing an ecologically-integrated landscape that functions and appears similar to the surrounding undisturbed land. Recently completed studies have quantified sediment yield from geomorphically-reclaimed mined lands and have verified that the reclaimed lands can provide sediment yields similar to natural, un-disturbed adjacent lands, but also give insight into key design and construction considerations that can cause the reclamation to miss this performance target. Improper geomorphic design inputs and construction grading practices in a geomorphically reclaimed sub-watershed in Spain caused sediment yield that initially was 385% greater than those in a correctly designed and constructed contiguous sub-watershed until erosional processes resolved these errors and produced sediment yields of 18.4 t ha^{-1} yr^{-1} that further decreased to 4.02 t ha^{-1} yr^{-1} when vegetation established, values that caused no on-site or off-site degradation of the environment (Zapico et al., 2018). Computer modeling of an Australian geomorphic reclamation using SIBERIA indicated that correcting design input and construction errors would reduce modeled sediment yield by 41% from 23.4 t ha^{-1} $yr^{-1}$to 13.9 t ha^{-1} yr^{-1} (Hancock et al., 2019). Measured sediment yield in a U.S. study showed that correctly designed and constructed geomorphic reclamation at a moderately-vegetated site matched the native site sediment yield (11.0 t ha^{-1} yr^{-1}) and the well-vegetated geomorphic reclamation site had 19% less sediment yield (9.0 t ha^{-1} yr^{-1}) than the native site over the 403-day period that represented the 2013 water year (Bugosh and Epp, 2019). These studies indicate that it is essential to use proper design inputs and methods, as well as ensuring construction adheres to the design, to make a geomorphic reclamation project that performs as expected.[3]

Additional key words: Siberia.

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3. Work reported here was conducted near: 32^{O} 20’ 00.40” S, 150^{O} 56’ 25.21” E (Australia); 40^{O} 39’ 20.77” N, 2^{O} 02’ 21.02” W (Spain); and 36^{O} 59’ 04.64” N, 108^{O} 08’ 26.47” N (U.S.A.).