GEOMORPHIC ASSESSMENT OF THE SAND TRANSPORT FOR THE MODIFIED PROJECT PALEN SOLAR ELECTRIC GENERATING SYSTEM

Progress Report – June 6, 2013

Task 2: Geomorphic Assessment of Sand Dune Morphology (including patterns of sand transport and deposition) for the Modified Project using the Numerical Model of Sand Transport Developed by PWA for the Approved Project

DRI has evaluated the PWA sand transport model and successfully reproduced the patterns of sand transport corresponding to the Collison et al. (2010) report. Based on this experience, we have made an initial model run using the outline of the modified project (Fig 1). The effects of the revised project boundary on sand transport appear to be confined to the Zone II sand transport zone on the east side of the project; and a limited area in Zone III north of the project. This initial run does not take into account the changes made to the perimeter of the project (fence vs. wall), nor the array itself.

Evaluation of the PWA sand transport model

The PWA model is a very simple model that moves sand from cell to cell based on rules that are determined by a wind regime derived from a weather station (Blythe Airport, CA), which is situated approximately 38 miles ESE of the site of the PSEGS. The wind directions and therefore the directions of sand transport are rotated to accommodate local conditions as a result of the topographic steering of winds.

The extent to which the modeled wind regime is representative of the PSEGS site is not clear. Collison et al. (2010) apparently used the potential sand transport directions based on the study of Muhs et al. (2003). We have recalculated the potential sand transport directions and magnitudes for the same weather station based on the record of hourly wind speed and direction for the period January 1, 2001 – December 31, 2012, obtained from the Western Regional Climate Center http://raws.dri.edu/cgi-bin/rawMAIN.pl?caKBLH

The wind data were processed using the model of Fryberger (1979), modified to use wind speed in meters/second (Bullard, 1997; Fryberger, 1979) to calculate potential sand transport (or drift potential (DP)). A threshold wind speed for sand transport of 7 m/sec was used. The resulting potential sand transport pattern is very similar to that in (Muhs et al., 2003). There is a clearly bimodal wind regime with two main directional sectors (N-NNW – 34.37% of annual total DP; and SSE-WSW – 59.75% of annual DP. Seasonally, the northerly sector dominates in the winter months, whereas the southwest sector dominates in the spring and summer. The strongest winds and a significant proportion of annual potential sand transport

(DP) occurs in the spring (March – May), accounting for 42% of annual DP. Importantly, winds in this period are dominantly from the SSW-WSW sector, giving rise to sand transport towards the northeast at this time of year.

The existing model runs used a distribution of wind and sand transport direction based on field observations of transport directions in the winter months (Kenney, 2010). These may not be representative of the peak sand transport months in the spring.

DRI will be conducting a sensitivity analysis to determine the influence of changing wind directions on patterns of sand transport during the spring months, in relation to the revised boundary for the PSEGS. We will modify the rules for sand transport in the PWA model to account for a greater proportion of southwest winds.

The PWA model assumed that sand transport would cease at the project boundary – which was defined by a solid wall. The revised PSEGS project boundary is proposed to be defined by a chain-link fence, which will have a very different effect on wind flow and sand transport. Sand may pass through the fence and winds will be affected by the heliostat array. It will also be necessary to revise the PWA model to take account of the new arrangement of the solar array and the heliostats.

Next steps

Revise PWA model to take account of seasonal changes in wind directions and sand transport patterns

Revise PWA model to incorporate permeable barrier around project area and interaction between wind, sand, and heliostat arrays.

References

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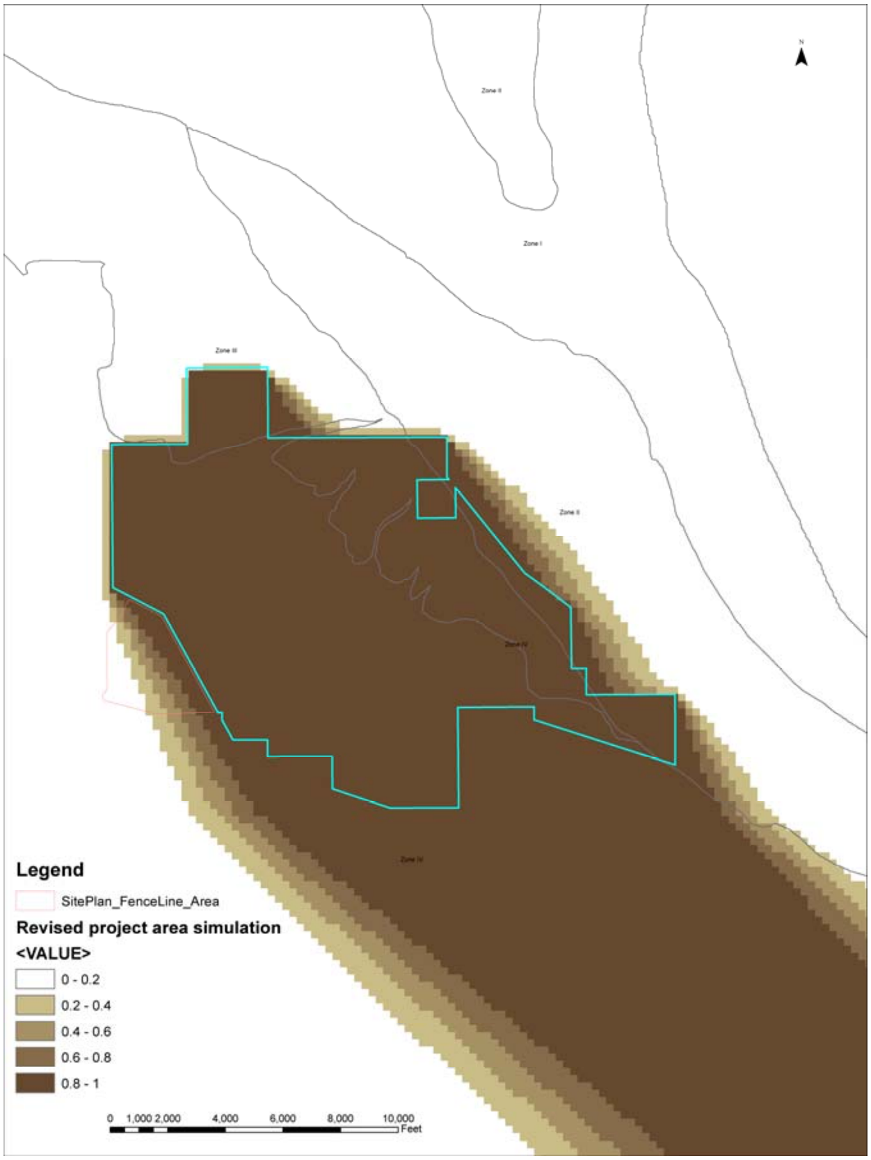

Fig 1. Preliminary sand transport analysis using PWA model and new PSEGS project outline.