APPLIED ENGINEERING AND GEOLOGY, INC.

Engineers • Environmental Assessors • Geologists

578 E Street, Lincoln, California 95648

916.645.6014 Telephone

www.aegEngineers.com

SEDIMENT AND EROSION ASSESSMENT REPORT

SACRAMENTO VALLEY WATER QUALITY COALITION

ORDER R5-2014-0030

Prepared for:

Bruce Houdesheldt, Director of Regulatory Affairs

NORTHERN CALIFORNIA WATER ASSOCIATION

455 Capitol Mall, Suite 335

Sacramento, California 95814

DRAFT

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1.0 INTRODUCTION

Applied Engineering and Geology, Inc. (AEG) has prepared this Sediment and Erosion Assessment Report (Report) for the Sacramento Valley Water Quality Coalition (SVWQC) at the request of the Northern California Water Association (NCWA). The SVWQC coverage area is shown in **Figure 1**.

As required by R5-2014-0030, the Waste Discharge Requirements General Order (General Order) for Growers in the Sacramento River Watershed, the SVWQC as the third party representing growers within the Sacramento River Watershed, is required to provide an assessment report that identifies the areas susceptible to erosion and the discharge of sediment that could impact receiving water. This Sediment and Erosion Assessment Report indicates the areas within the SVWQC region where growers will be required to complete Sediment and Erosion Control Plans (SECPs). In addition, owners and operators of irrigated agriculture lands complete and certify Farm Evaluations that include a list of sediment and erosion control practices used to mitigate the potential of discharges during irrigation season.

The combination of the documentation of widely accepted Natural Resources Conservation District (NRCS) management practices used by owners and operators of irrigated agriculture operations in the Sacramento Valley to mitigate erosion of sediment and this Sediment and Erosion Control Assessment Report, will allow the Coalition to identify and focus efforts to address erosion issues.

2.0 BACKGROUND

Agricultural fields may be susceptible to erosion from both irrigation practices and storm water runoff. The potential for erosion and movement of soil to surface waters depends on a series of factors including:

- Soil erodibility
- Rainfall
- Slope
- Vegetative cover
- Presence/absence of management practices to prevent the generation of sediment, or capture the sediment prior to entering surface waters (e.g. pressurized irrigation, use of PAM [polyacrylamide], sediment detention basins)

AEG evaluated the potential for sediment erosion in the SVWQC coverage area based on the risk of soil mobilization due to either storm or irrigation water runoff. Erosion can result from two processes, soil mobilized by storm water runoff and soil mobilized by irrigation practices. Essentially, any flowing water can mobilize surface soils and, depending on the slope of the ground, the soil can be transported to surface waters. Flood, sprinkler, and furrow irrigation are irrigation practices that have the highest potential to mobilize sediment whereas pressurized irrigation (drip and microsprinklers) have the least potential to mobilize sediment.

Storm water falling on fields can also mobilize soil in agricultural fields and result in the movement of soil to surface waters. The greater the slope and soil erodability, the more likely a field will have sediment runoff during rain events. All these factors must be considered together since a field with furrow irrigation or with a high slope does not necessarily mean that there is an erosion issue. There are management practices available to prevent sediment runoff (such as vegetative cover) and/or capture runoff before it enters a downstream waterbody (sediment detention basin).

Given very steep slopes and sufficient rainfall, even bedrock will eventually erode resulting in sediment deposition in surface streams. In fact, some erosion is normal and even in relatively pristine watersheds, surface waters normally carry some sediment as they move downstream. If a sediment source is eliminated, the natural energy of the stream will begin to excise the channel as the stream robs its banks of sediment. Despite the tendency to carry some sediment load, streams are often subject to anthropogenically generated sediment loads which result in impairment of their assigned beneficial uses. This is the fundamental reason sediment and erosion assessments are performed. (Ref E – East, Page 5)

3.0 METHODOLOGY

AEG was directed by the NCWA to use the Revised Universal Soil Loss Equation (RUSLE), as presented in the California State Water Resources Control Board's (State Board) Construction General Permit (Construction General Permit) (Ref C – California, Page 27), as the basis for assessing the potential for sediment erosion. This method was chosen as it has previously been accepted by the California Central Valley Regional Water Quality Control Board.

The equation shown below is the RUSLE, as presented in the Construction General Permit:

$$A = R * K * LS * C * P \quad \text{(Eq. 3.1)}$$

Where:

- A = rate of sheet and rill erosion
- R = rainfall-runoff erosivity factor
- K = soil erodibility factor
- LS = length-slope factor
- C = cover factor (erosion controls)
- P = management operations and support practices (sediment controls)

Per the Construction General Permit, C and P factors are given values of one (1.0) to simulate bare ground conditions (Ref C – California, Page 27).

It should be noted, the above approach is very conservative, as it assumes bare ground conditions exist year round and no soil protection measures have been implemented. Both of these assumptions are unlikely to match the actual conditions/practices of commercial agricultural land. Conditions shown in Figures 6, 7, and 9 reflect bare ground conditions, rather than irrigation or storm season runoff from common irrigated agricultural operations.

A general description of the steps AEG used to calculate the rate of erosion is as follows:

- Download data files for R, K, and LS from the State Board;
- Convert R data into an area based format (convert contour lines into polygons);
- Convert data into a format compatible with GIS spatial analysis tools (polygon to raster conversion); and,
- Perform RUSLE algebraic calculations using R, K, and LS data to produce rate of erosion data (multiply three sets of regional data using GIS software).

Units were not included in the R, K, and LS data files, and AEG found no unit references for the K and LS values obtained from the State Board. The Construction General Order does show that when the State Board's input data is used, the rate of erosion output will be in tons per acre. As AEG has performed the RUSLE calculations using a time period of one year, the units for rate of erosion (A) are tons per acre per year (tons/ac/yr). (Ref C – California, Page 219 of PDF File)

3.1 Input Data Used

AEG used R, K, and LS data files from the State Board as the inputs for RUSLE (Ref B - California). These data files contain information for all of California.

The R data required several additional operations before it could be used in the calculation of the rate of erosion. The preparation of the R data is discussed in **Section 3.2**.

The K and LS data was received by AEG in a polygon format (for GIS). To use this data for computations, AEG converted the polygon data into raster data. This raster data was then used as the K and LS input data for the RUSLE computations. **Figures 2** and **3** show maps of the K and LS raster data.

3.2 Process Used to Incorporate Rainfall-Runoff Erosivity Factor (R) Data

The R data files contained data for both isoerodent data and erosivity index data. As these erosion calculations were performed for a time period of one year, the erosivity index value of 100%, or one (1.0), is used. Therefore, only the isoerodent portion of the R data is a variable in these calculations.

The R data files AEG obtained from the State Board included isoerodent contour lines for California, but no data features that covered areas of California (such as the polygons in the K and LS data files). The isoerodent contour lines are shown on **Figure 4**. Since contour lines cannot be used as inputs for the calculations, AEG created isoerodent polygons by tracing the isoerodent contour lines and assigning each polygon the average numerical value of the two boundary contour lines. Additionally, topographic peak polygons were assigned the numerical value of the contour line surrounding the peak, and the polygons with an unspecified boundary value along the California/Nevada boundary were assigned a value of half the contour interval of the contour line in California.

Once these isoerodent polygons were created, they were converted to raster data to be used as an input to the RUSLE computations, as with the K and LS data. **Figure 5** shows a map of the isoerodent raster data.

4.0 RESULTS

Once the R, K, and LS data had been converted to a raster format, the RUSLE calculations were performed to produce rate of erosion output data for Northern California in tons/ac/yr (see **Figure 6**).

Figure 7 shows the rate of erosion output data for a region, provided to AEG by the NCWA, at below or above the low/high risk break of 5 tons/ac/yr set by the State. Low risk areas are shown in green and high risk areas are shown in red. Please note, the region shown on **Figure 7** does not include all of the SVWQC coverage area, as portions of the Pit River and Goose Lake sub-watersheds are not included.

Figures 8 and **9** show the SVWQC member parcel locations and the rate of erosion output data for these member parcel locations below or above the low/high risk break of 5 tons/ac/yr, respectively. Low risk areas are shown in green and high risk areas are shown in red.

5.0 DISCUSSION

As shown on **Figure 7**, a large portion of the Sacramento Valley is classified as low risk for erosion based on the above analysis. Those areas within the Sacramento Valley that are classified as high risk for erosion are generally large waterways (ex. Sacramento River) and the Sutter Buttes (largely due to their topography). Additionally, the majority of the eastern half of the Pit River sub-watershed is classified as low risk.

As shown on **Figure 9**, the majority of the SVWQC member parcels are located in low risk of erosion areas based on the above analysis. Those member parcels located in high risk of erosion areas are generally located near Clear Lake, Red Bluff, Redding, and along the large waterways in the Sacramento Valley. In the Sierra Foothills, the Pope Valley of Napa, and Lake County the agricultural acreage is a small percentage of the land use. For instance, out of the 230,972 acres of land that drain into Lake Berryessa, in Napa County' Putah Creek Watershed only 1.5% (3,461 acres) of the land is in drip irrigated agriculture. The remainder is natural and has trees, chaparral, and duff (Ref A – Bruce).

In these areas, most if not all vineyards use drip irrigation. In addition, all vineyards on slopes of 5% or greater in Napa County are required to have cover crops during rain period as part of the County Erosion Control Plan requirements. In Lake County, grading permits include conditions to protect the local watershed from runoff pollution through the implementation of Best Management Practices (BMPs) in accordance with an Erosion Control Plan.

6.0 NEXT STEPS

The risk to receiving waters from each parcel will be determined by use of the responses provided by individual growers to questions on the Sacramento Valley Water Quality Coalition (Coalition) Farm Evaluation Report (FEP). During the spring of 2015, members are completing their FEP for all of their parcels. Responses to Question 3 in Part A – Whole Farm Evaluation, asks "Does your farm have the potential to discharge sediment to off-farm surface waters?" and documentation of irrigation and cultural management practices for sediment and erosion control in Part D of the FEP will determine if a parcel located in an area already identified as having the potential to discharge more than 5 tons/acre/year will pose a risk for discharge of sediment.

Once this Sediment and Erosion Assessment has been approved by the Central Valley Regional Water Quality Control Board (Regional Board), the SVWQC will contact members located in the areas classified as having high erosion risk and request those members prepare sediment and erosion control plans.

APPENDIX A

Figure

Figure 1 - SVWQC Coverage Area (Ref C – California, Page 60 of the PDF File)

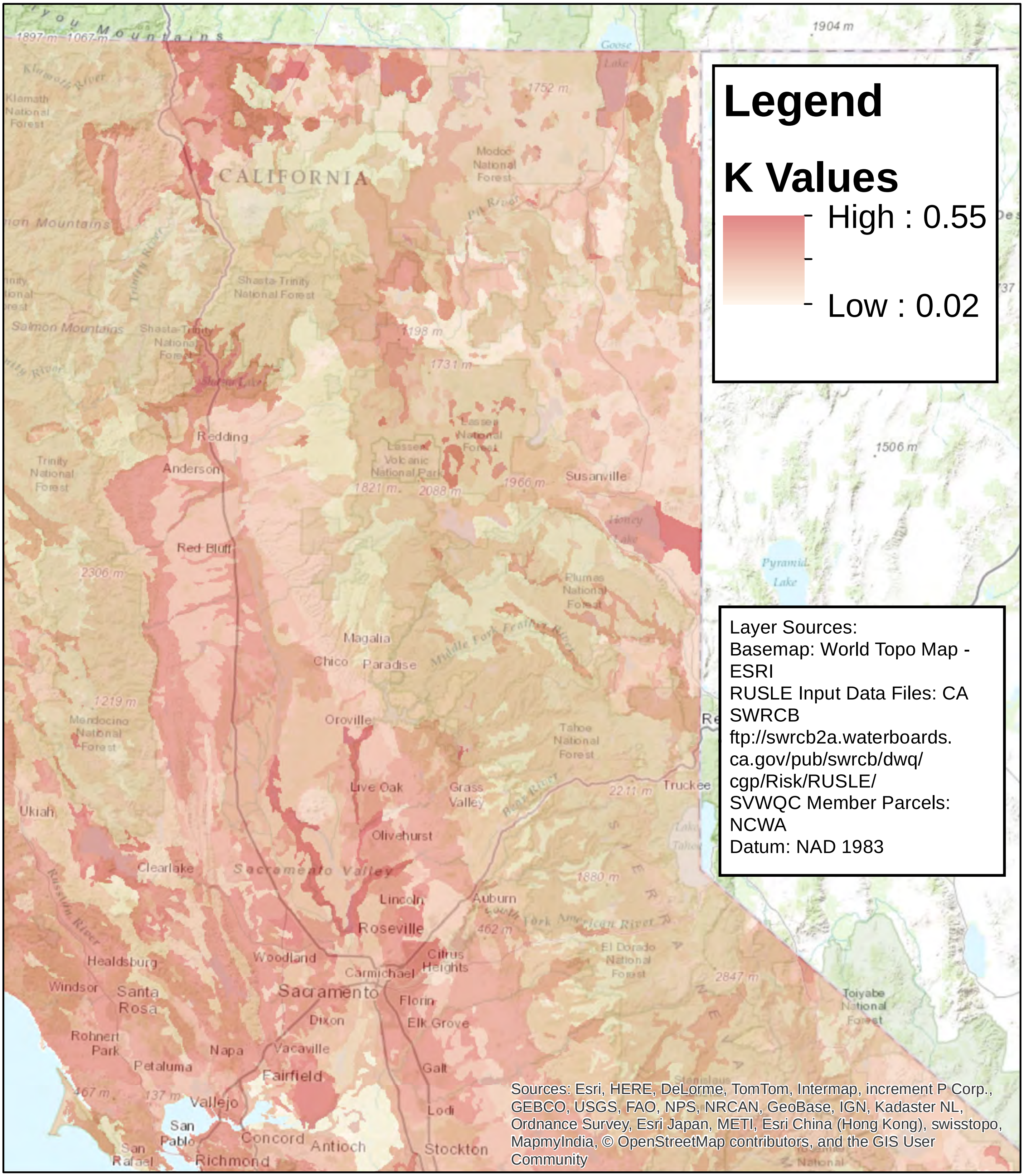

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Figure 2

0 10 20 40 60 80 Miles

N

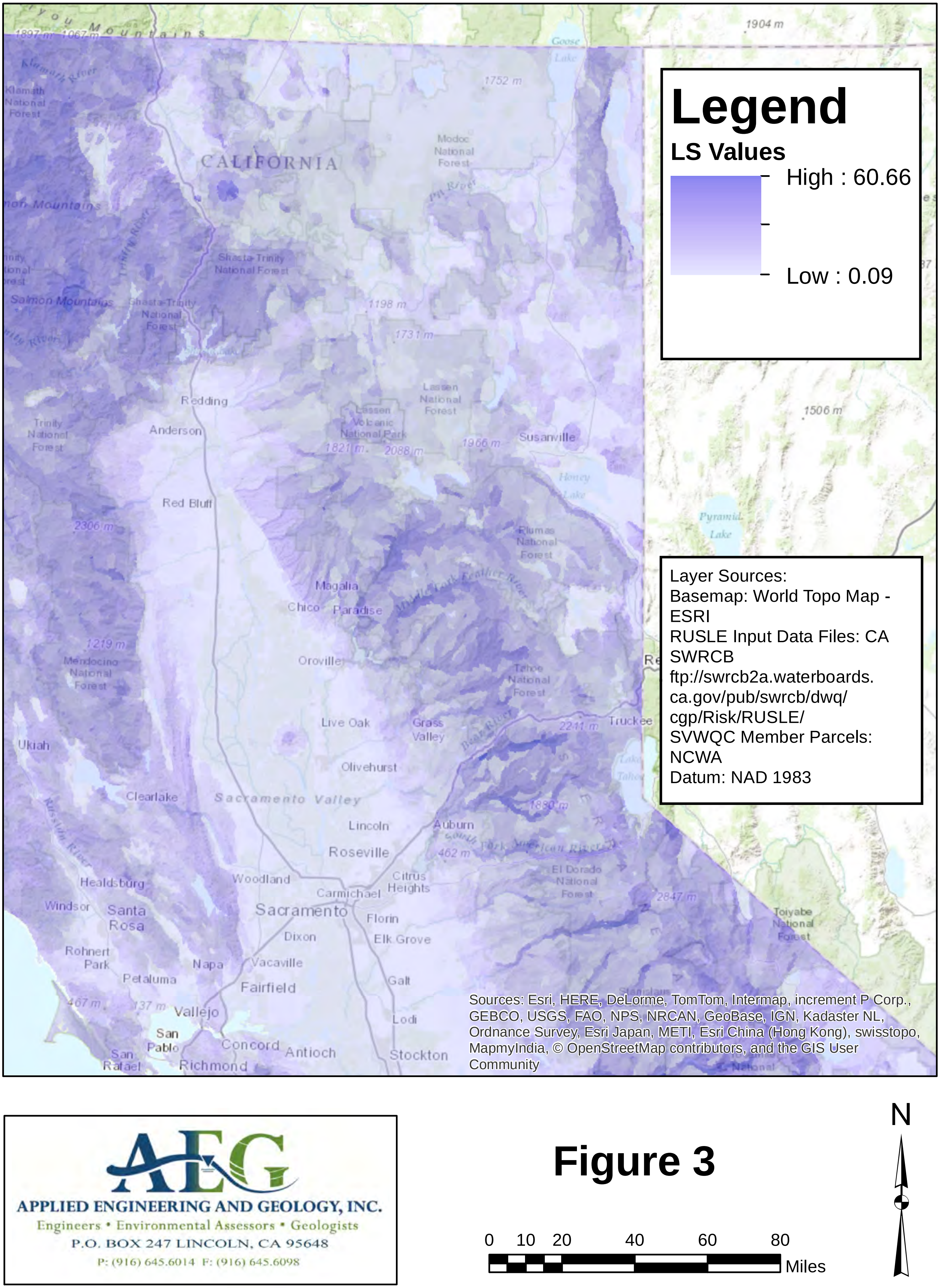

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Figure 3

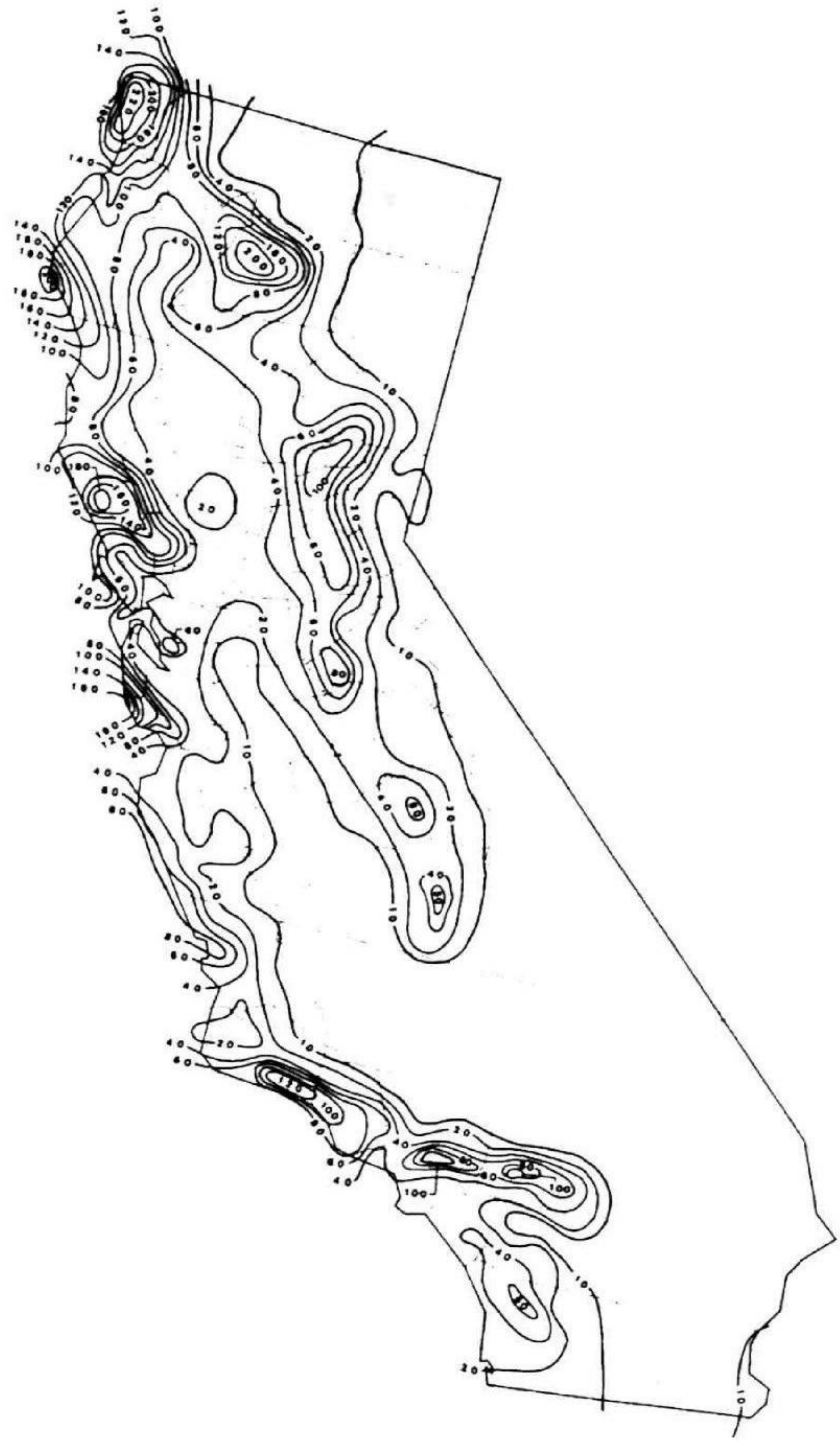

Figure 4 - Isoerodent Map of California (Ref G – United, Page 7)

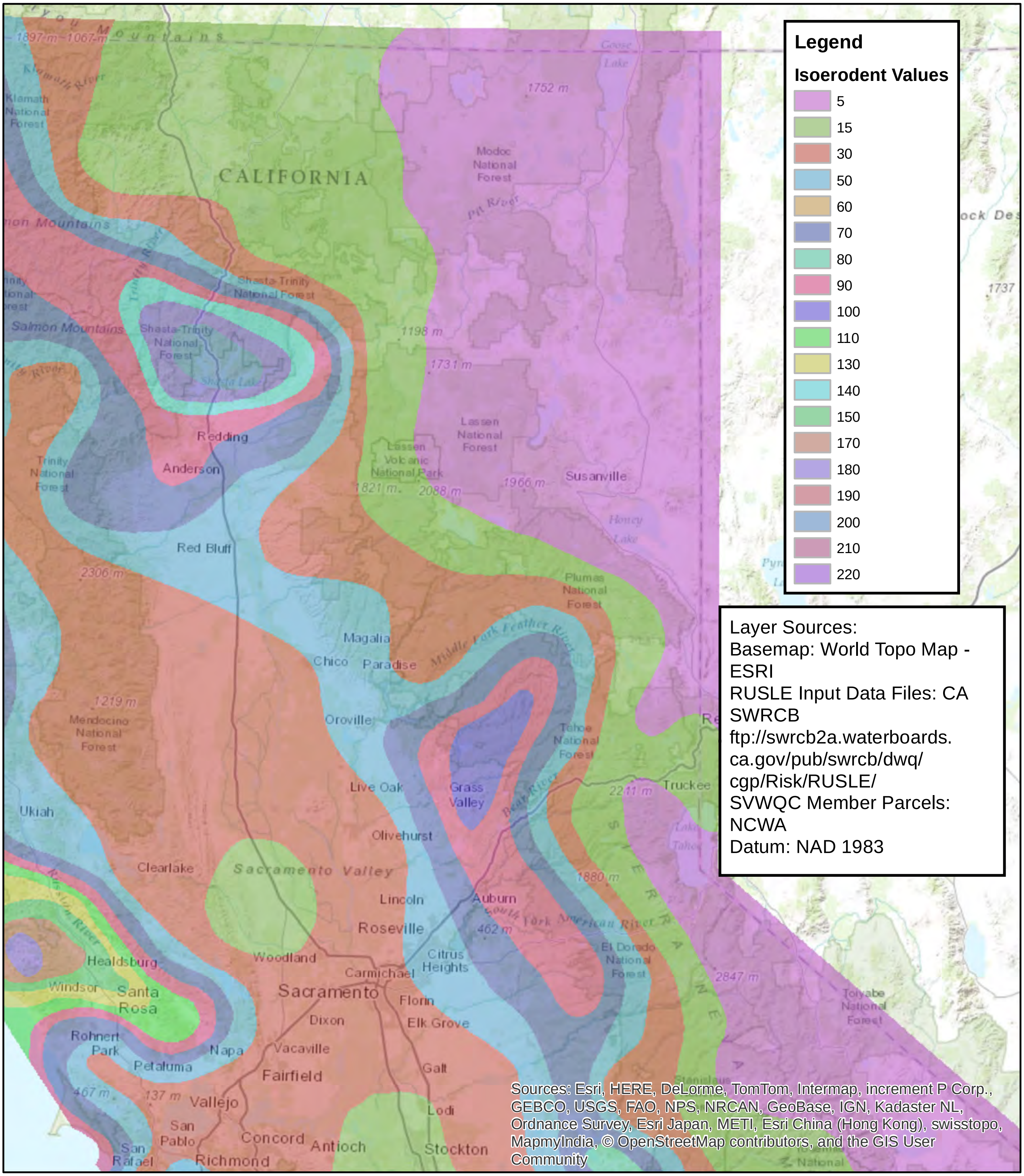

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Figure 5

0 10 20 40 60 80 Miles

N

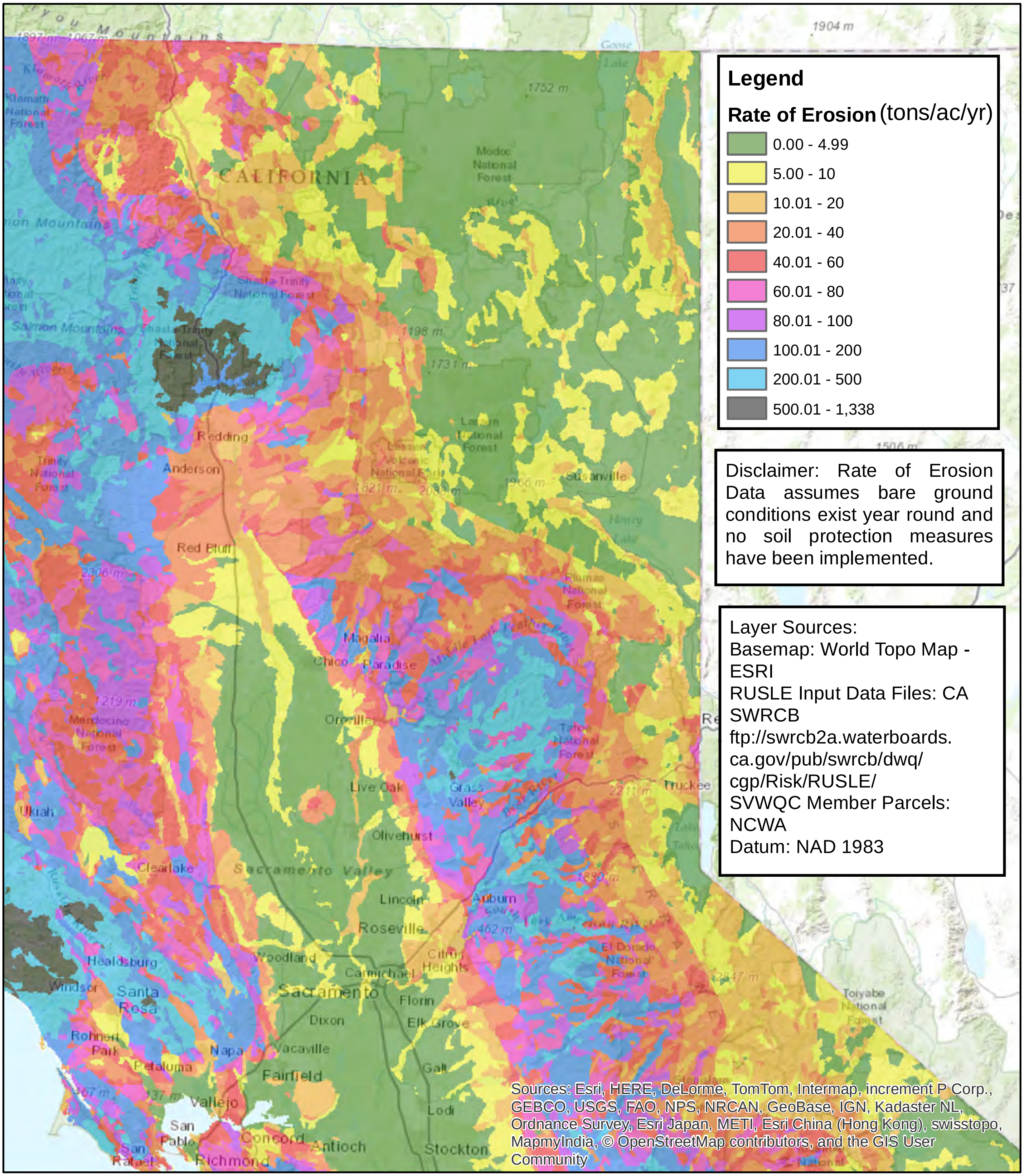

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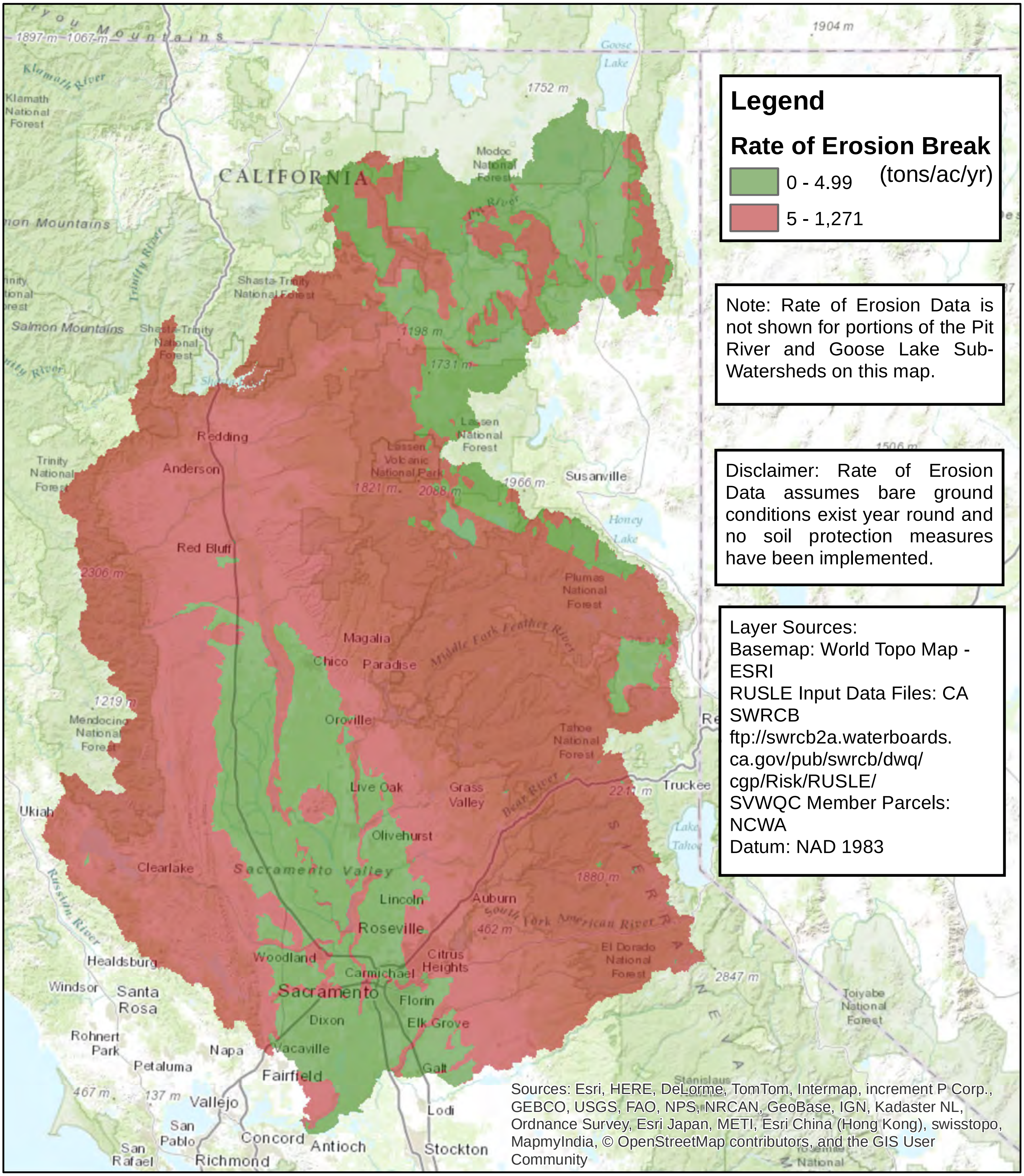
Figure 6

0 10 20 40 60 80 Miles

N



0 10 20 40 60 80 Miles

N

Figure 7

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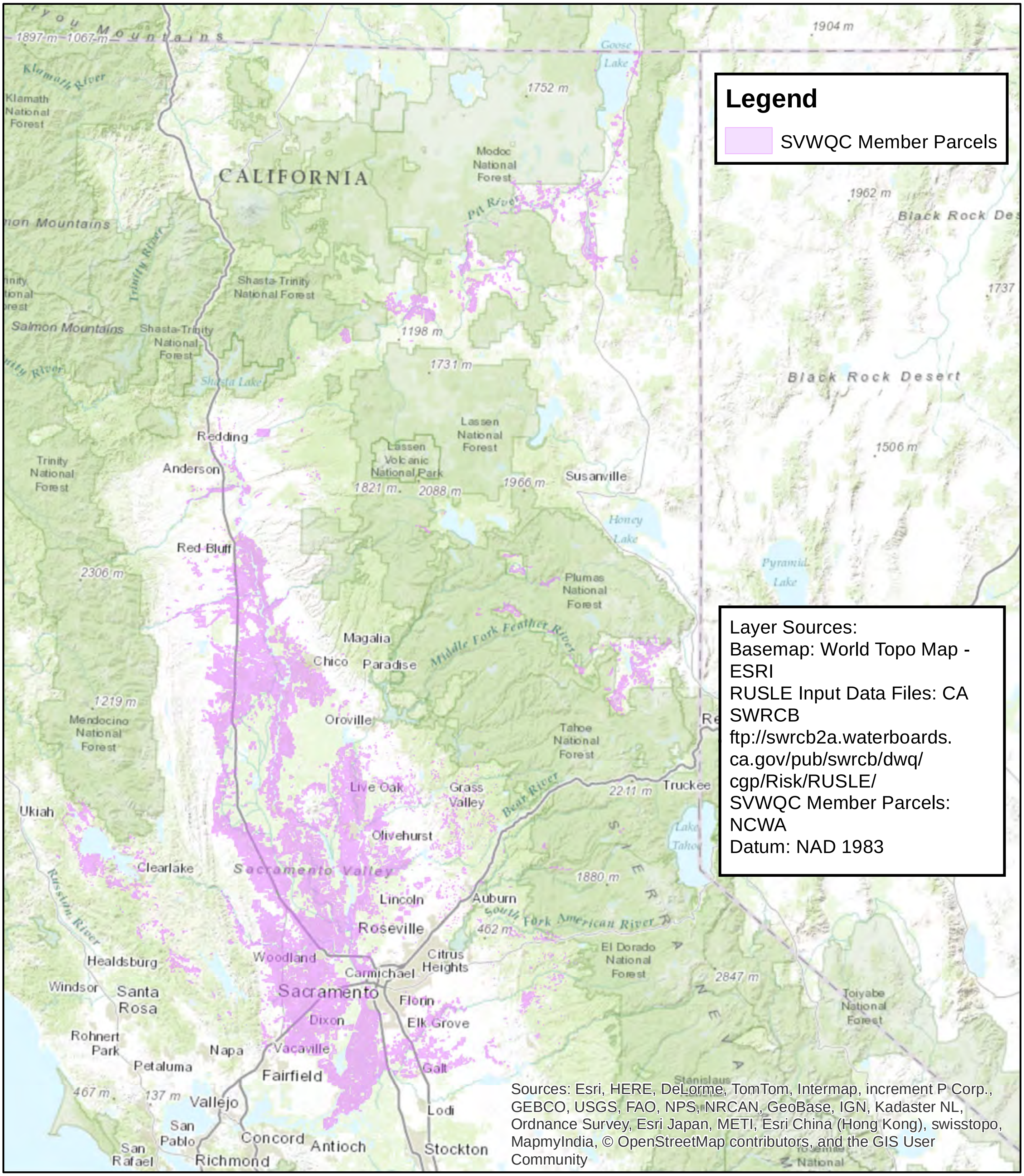

Figure 8

0 10 20 40 60 80 Miles

N

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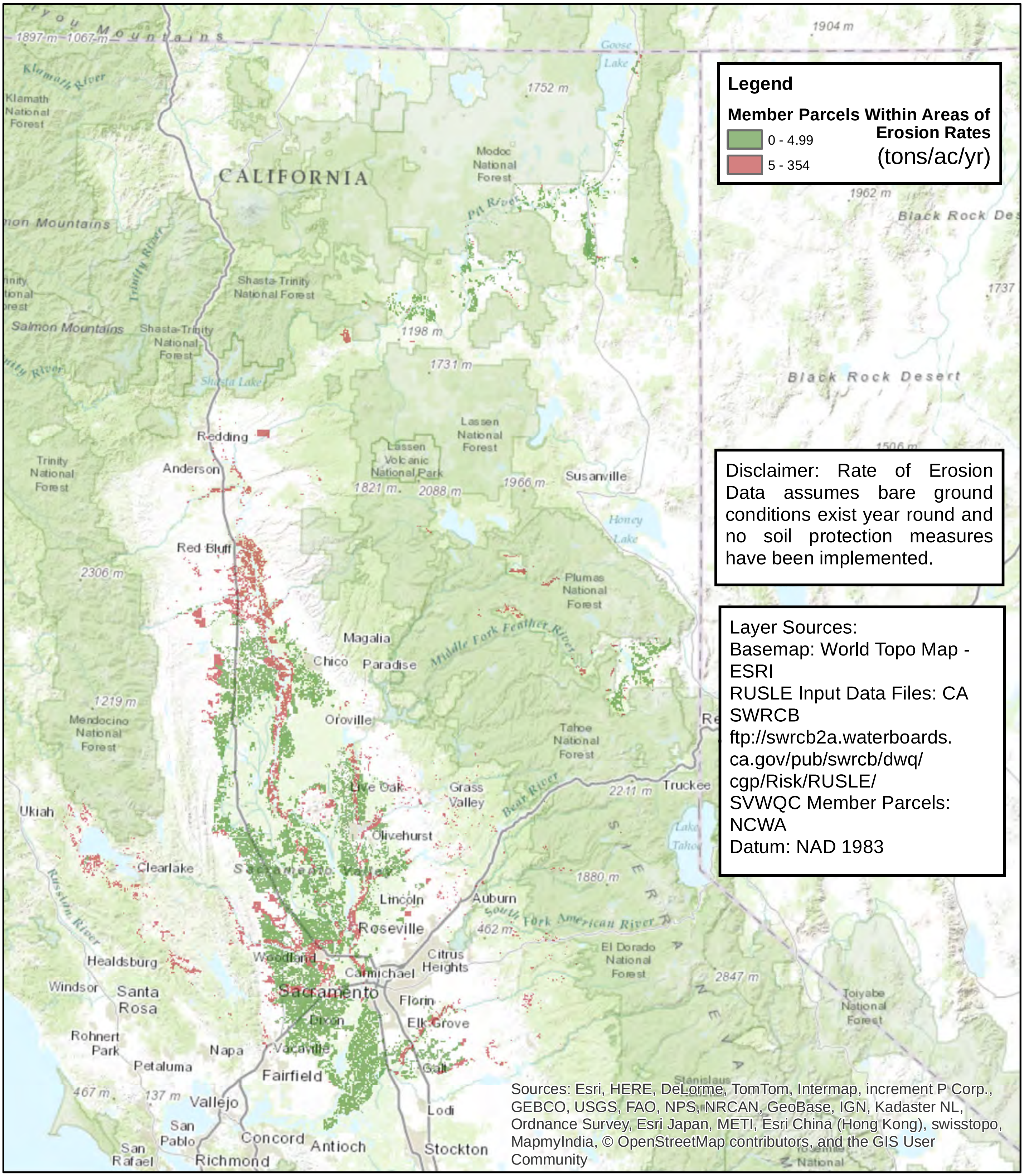

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Figure 9

0 10 20 40 60 80 Miles

N

APPENDIX B

References

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C. California State Water Resources Control Board. Construction General Permit Fact Sheet, 2009-0009-DWQ amended by 2010-0014-DWQ & 2012-0006-DWQ.

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G. Steve Maricle. SVWQC Drainages Shapefile Larry Walker Associates, Email, March 28, 2014, Recipient: Bruce Houdesheldt. (source for regional coverage data)

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