



## Science Plan Summary Sheet

### Science Plan

We used three independent sources of geodetic information to evaluate the tectonic contribution to sea level rise: tide gage analyses, benchmark analyses, and Global Positioning Systems (GPS) analysis. We use tide gage data (Relative Sea Level, RSL), compared with a Regional Sea-Level (ReSL) rate, to estimate Vertical Land Motion (VLM) rates.

- **Tide Gage Analyses:** We deployed tide gages at 2 historic tide gage locations (Hookton Slough, Mad River Slough). We analyzed data collected by Towill Surveying, Mapping and GIS Services for the U.S. Army Corps of Engineers at 2 historic tide gage locations (Fields Landing, Samoa). We analyzed water level data from 3 tide gage sites (North Spit, Crescent City, Trinidad). We installed a stilling basin at a 3<sup>rd</sup> historic tide gage location (Chevron Dock) and plan on installing a gage there soon. Tide gage data span from the 1970's through 2016.
- **Benchmark Analyses:** We analyzed historic first order benchmark survey data from the National Oceanic and Atmospheric Administration (NOAA) Central Library archives for surveys conducted in 1931, 1944, 1967, and 1988. Earlier surveys had systematic error, so we only used a comparison between the 1967 and 1988 surveys.
- **GPS Analyses:** We analyzed GPS data from the USGS for continuous GPS sites in the northern CA region. GPS data span from around 2000 through 2016.

We will be providing GIS data products summarizing the geodetic observations listed above.

### Summary Statement

We present the local sea level observations, along with the VLM, for some of the tide gage sites below. A more comprehensive summary is available in our reports to the USFWS published online. There is a northeast-southwest gradient of vertical land motion that is most likely the result of elastic deformation of the North America plate as imparted by seismogenic coupling along the Cascadia subduction zone megathrust fault. We will be conducting numerical modeling of the crust to evaluate sources of the spatial variation of these VLM rates.

Our observations are summarized in **Table 1** and **Figure 1**. Based upon our analyses of VLM, Crescent City is currently rising at 3.25 mm/yr and Hookton Slough is currently subsiding at 3.56 mm/yr (**Table 1**). **Figure 1** shows benchmark, tide gage, and GPS locations and their VLM rates for Humboldt Bay. The inset shows the region including Humboldt and Del Norte counties. Red represents subsidence and green represents uplift.

**Table 1. Summary of sea level rise and vertical land motion estimates for Humboldt Bay tide stations.**

Tide Station (TS)	SLR and VLM Rates (mm/yr)			
	ReSL	RSL	TS - CC	VLM
Crescent City (CC)	2.28	-0.97		3.25
North Spit (NS)	2.28	4.61	5.58	-2.33
Mad River Slough (MRS)	2.28	3.39	4.36	-1.11
Samoa (SO)	2.28	2.53	3.50	-0.25
Fields Landing (FL)	2.28	3.76	4.73	-1.48
Hookton Slough (HS)	2.28	5.84	6.81	-3.56

<sup>1</sup>ReSL = regional sea level, RSL = relative sea level, and VLM = vertical land motion.

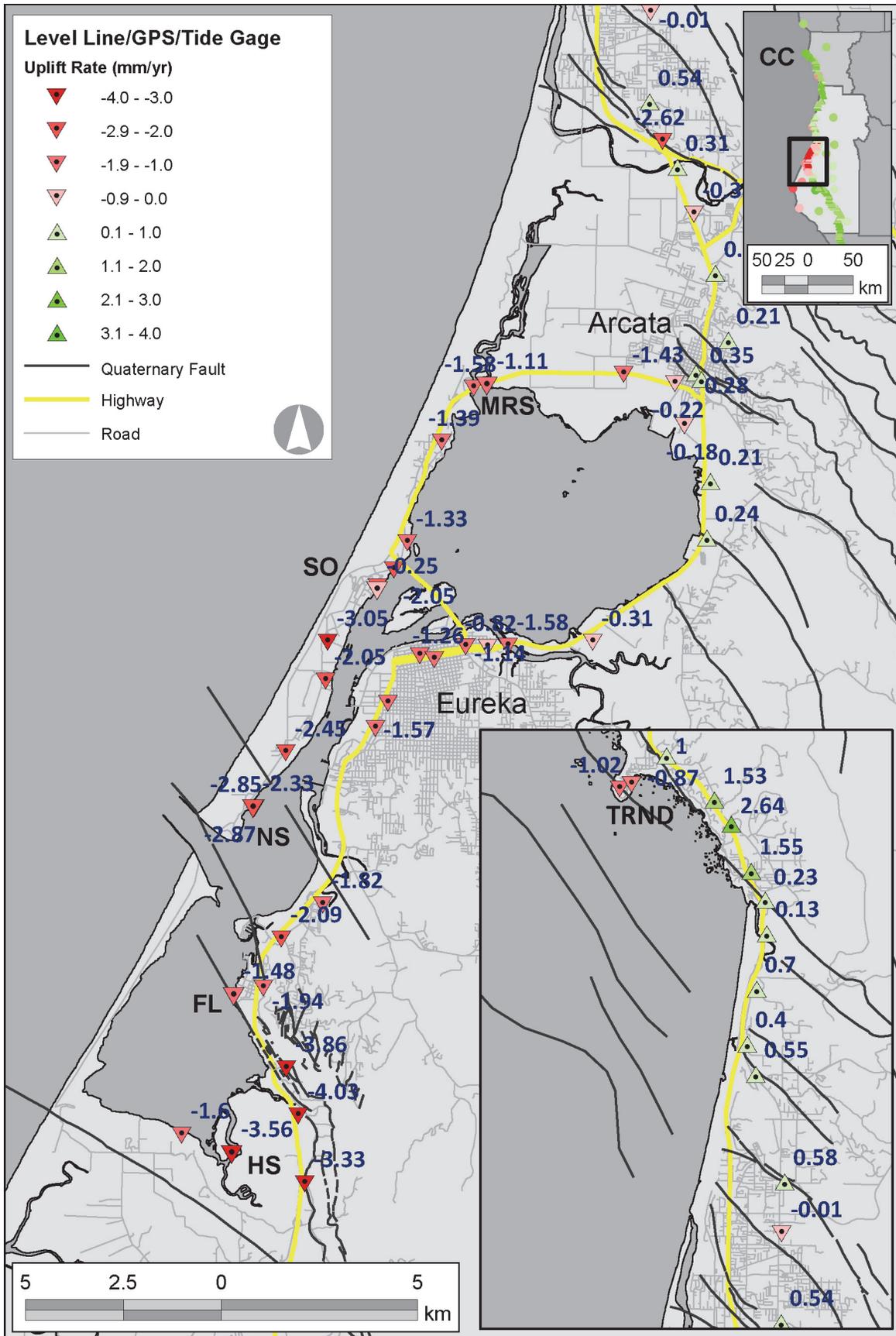


Figure 1. Summary of vertical land-level change in the Humboldt Bay region.