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OPENING AND CLOSING STATUS OF THE BIG SUR RIVER MOUTH, MONTEREY COUNTY, CA

Based on Photographic Interpretation during Selected Years, 1972-2010

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Digitized aerial photographs of the Big Sur River mouth from the California Coastal Records Project and Google Earth were examined to determine whether the lagoon outlet was open with surface water flowing into the Pacific Ocean. A total of 14 years and sixteen images were available; the status of the lagoon could be determined in 14 of the images; and the lagoon was open in all photos except October 2004. Review of the daily discharge records at USGS Gage 11143000 shows that lagoon outlet was usually open, when the 7-day long discharge at the USGS gage was greater than 8 to 12 cfs, but in one case, October 2004, the mouth was closed when discharge at the gage ranged from 10-12 cfs.

Introduction – Aquatic biologist, David H. Dettman, assembled and interpreted the status of the Big Sur River mouth and the Lagoon outlet by assembling and examining historical aerial photographs of the Lagoon. Two sources of photos were reviewed, including oblique view photos from the California Coastal Record Project (CCRP) and overhead imagery from Google Earth, Google, Inc.^{1,2}

Purpose and Method – The purpose of reviewing the photos was to develop an understanding of the geomorphic conditions and channel configuration at the outlet, and if possible determine whether the opened/closed status of the outlet was related to hydrologic conditions, preceding the photo dates.

Each digital image was carefully examined at full size, 1:1 format, by selecting this option with photo viewing software (Olympus Master 2) or the browser supplied by websites at CCRP or Google Earth. The condition of the mouth, open or closed was noted by looking for the presence of watered channel across the sand berm.

The historical mean daily discharge record at the USGS Gage No. 11143000, near Big Sur, CA was used to index freshwater inflows on the image date and time, and during the 7-day long period preceding the photo date.³ In several cases, especially for the earlier photos, only months were provided in the photographic record and in 1972 only the photo year was provided. In these cases the range of mean daily flows for the photo month were used to index the flow conditions

Results and Interpretation of Photos – Sixteen images were available for interpretation, covering selected years between 1972 and 2010. (**Table 1**) The detail and orientation of the outlet in two photos, 1987[**Photo 4**] and 1994[**Photo 7**], were not discernable due to low resolution or out-of-view and could not be used to definitively determine status of the outlet. In the remaining 14 photos the geographic details of a wetted outlet channel, or water flowing along the northern bedrock headland were clearly visible, or not.

The lagoon was open in all of the photos except October 2004. Review of the daily discharge records at USGS Gage 11143000 showed that lagoon outlet was usually open, when 7-day long discharge at the USGS gage was greater than 8 to 12 cfs, but on October 11, 2004, the mouth was closed when discharge at the gage ranged from 10-12 cfs. Based on this photographic interpretation, I estimate that flows ranging above ~10 to 15 cfs are needed to maintain an open channel outlet with consistent flow between the Lagoon and the Pacific Ocean.

¹ Source of Digital photos from the California Coastal Records Project: Copyright (C) 2002-2011 Kenneth & Gabrielle Adelman, California Coastal Records Project, www.Californiacoastline.org

² Source of Digital photos from Google Earth: Google EarthPro Imagery, © 2011 Google

³ Streamflow measurements for USGS Gage No 11143010, Big Sur River at Andrew Molera State Park, near Big Sur, CA are available at: http://waterdata.usgs.gov/ca/nwis/measurements?site_no=11143010&agency_cd=USGS

Photographic log – A printed log of the digital photos is shown as a reference for viewing. (**Photo 1 – Photo 16**) If desired, additional details can be seen in most of the photos by zooming into the photos at higher resolution on the CCRP and Google websites.

Table 1: Status of the river mouth at the Big Sur River Lagoon on selected dates, months and years during the period from 1972 to 2010, based on review of digital aerial photographs and imagery.⁴

Year	Date	Time	Ocean Level ⁵	Status River Mouth	Quality Photo	Streamflow (cfs) ⁶	Streamflow Range (cfs) ⁷	Notes
1972	unk	--	--	Open	Good		19-45	Range of March-April mean daily flow
1979	4/30	14:24	3.30	Open	Good	99	99-134	Channel shows recent lateral scour & deposition
1986	4/2		Very Low	Open	Excel	228	228-391	
1987	June		High	UNK	Poor		14-18	Range of June mean daily flow
1989	Jan		Very Low	Open	Fair		19-96	Range of January mean daily flow
1993	Apr		Very Low	Open	Excel		75-144	Range of April mean daily flow
1994	5/12		High	Open/Closed?	Poor	22	22-30	
2002	6/7	9/2	High	Open	Fair	27	27-33	
2004	10/11	13:35	2.25	Closed	Excel	12	12-12	
2005	10/28	13:56	3.69	Open	Good	20	18-21	Outflow channel below sill readily seen Sill of lagoon outflow is not visible, but flow into ocean over beach clearly seen
2007	7/29		Low	Open	Good	8.0	8.0-8.5	
2008	9/23	13:42	3.50	Open	Excel	11	10-11	
2009	5/24			Open	Fair			View of outflow channel below sill partially obscured by shadows, late PM photo
2010	9/23	13:07	4.13	Open	Excel	14	14-15	
	9/24	13:07	4.13	Open	Excel	25	24-25	

⁴ Source of digital imagery: Photos for 1972, 1979, 1986, 1987, 1989, 1993, 2002(Sept), 2004, 2005, 2008, & 2010 from California Coastal Records Project, Copyright (C) 2002-2011 Kenneth & Gabrielle Adelman, California Coastal Records Project, www.Californiacoastline.org. Photos for 1994, 2002 (June), 2007, and 2009 from Google EarthPro, Google, Inc., CA.

⁵ Tidal level based on photo date/time stamp, or if possible, rated as high, mid, low, or very as inferred by comparison of ocean level to rocky headlands and beach conditions on images. Ocean level from Tidal Gage No. 9413450 at Monterey, CA http://tidesandcurrents.noaa.gov/data_menu.shtml?stn=9413450 [Monterey, CA&type=Tide Data](http://monterey.ca.gov/TideData)

⁶ For photos with date/time stamp the streamflow is the mean daily discharge at USGS Gage No. 11143000 for photo date.

⁷ For photos with date/time stamp the streamflow is the range of mean daily discharge at USGS Gage No. 11143000 for seven days previous to photo date.



Photo 1: Big Sur Lagoon and River mouth, 1972, date unknown, but probably late March or April, based on green grass on hill slopes.

Source: Copyright (C) 2002-2011 Kenneth & Gabrielle Adelman, California Coastal Records Project, www.Californiacoastline.org

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Photo 2: Big Sur Lagoon and River mouth, April 30, 1979. Source: Copyright (C) 2002-2011 Kenneth & Gabrielle Adelman, California Coastal Records Project, www.Californiacoastline.org

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Photo 3: Big Sur Lagoon and River mouth, April 2, 1986. Source: Copyright (C) 2002-2011 Kenneth & Gabrielle Adelman, California Coastal Records Project, www.Californiacoastline.org

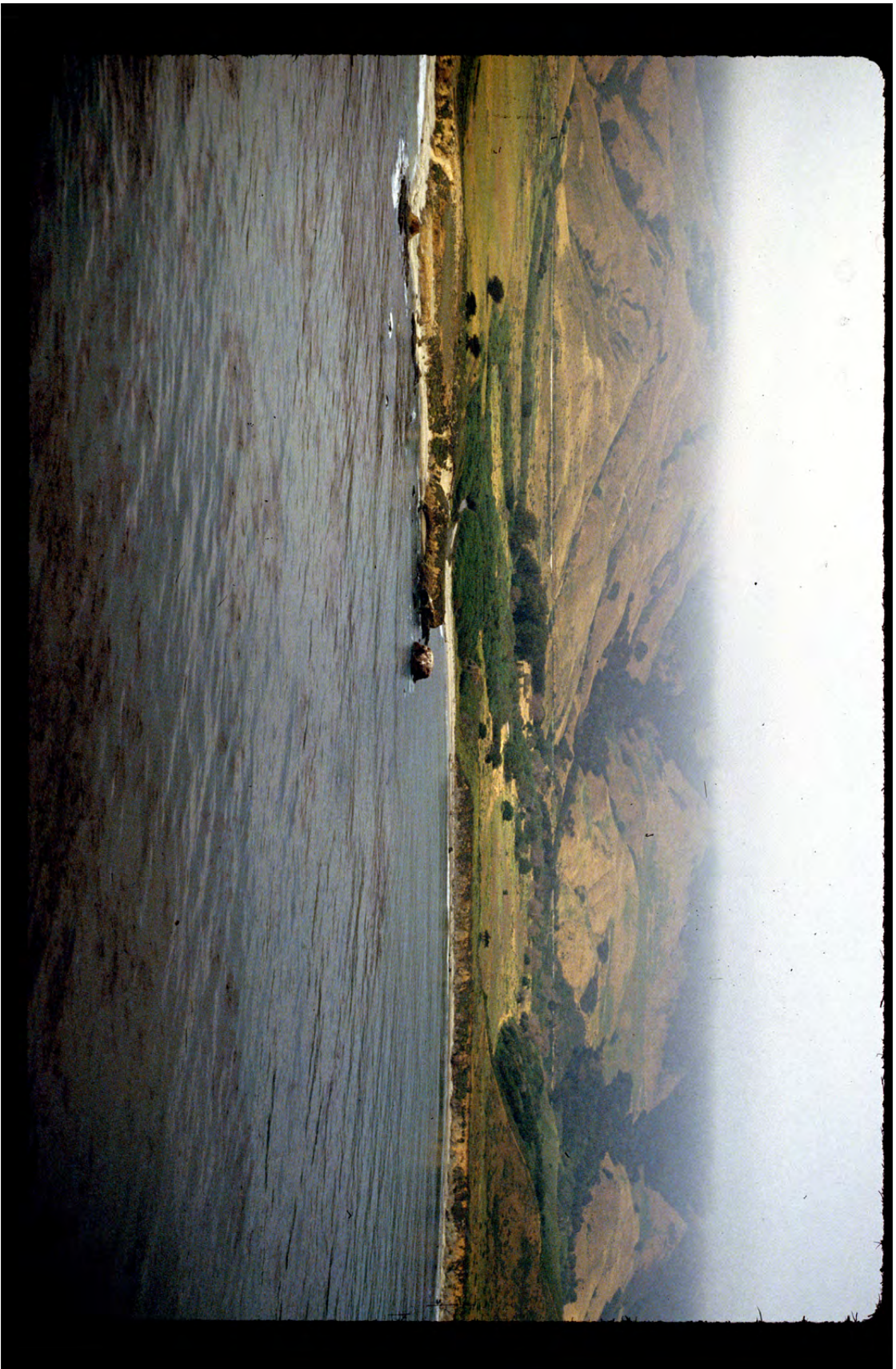


Photo 4: Big Sur Lagoon and River mouth, June 1987. Source: Copyright (C) 2002-2011 Kenneth & Gabrielle Adelman, California Coastal Records Project, www.Californiacoastline.org

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Photo 5: Big Sur Lagoon and River mouth, June 1989. Source: Copyright (C) 2002-2011 Kenneth & Gabrielle Adelman, California Coastal Records Project, www.Californiacoastline.org

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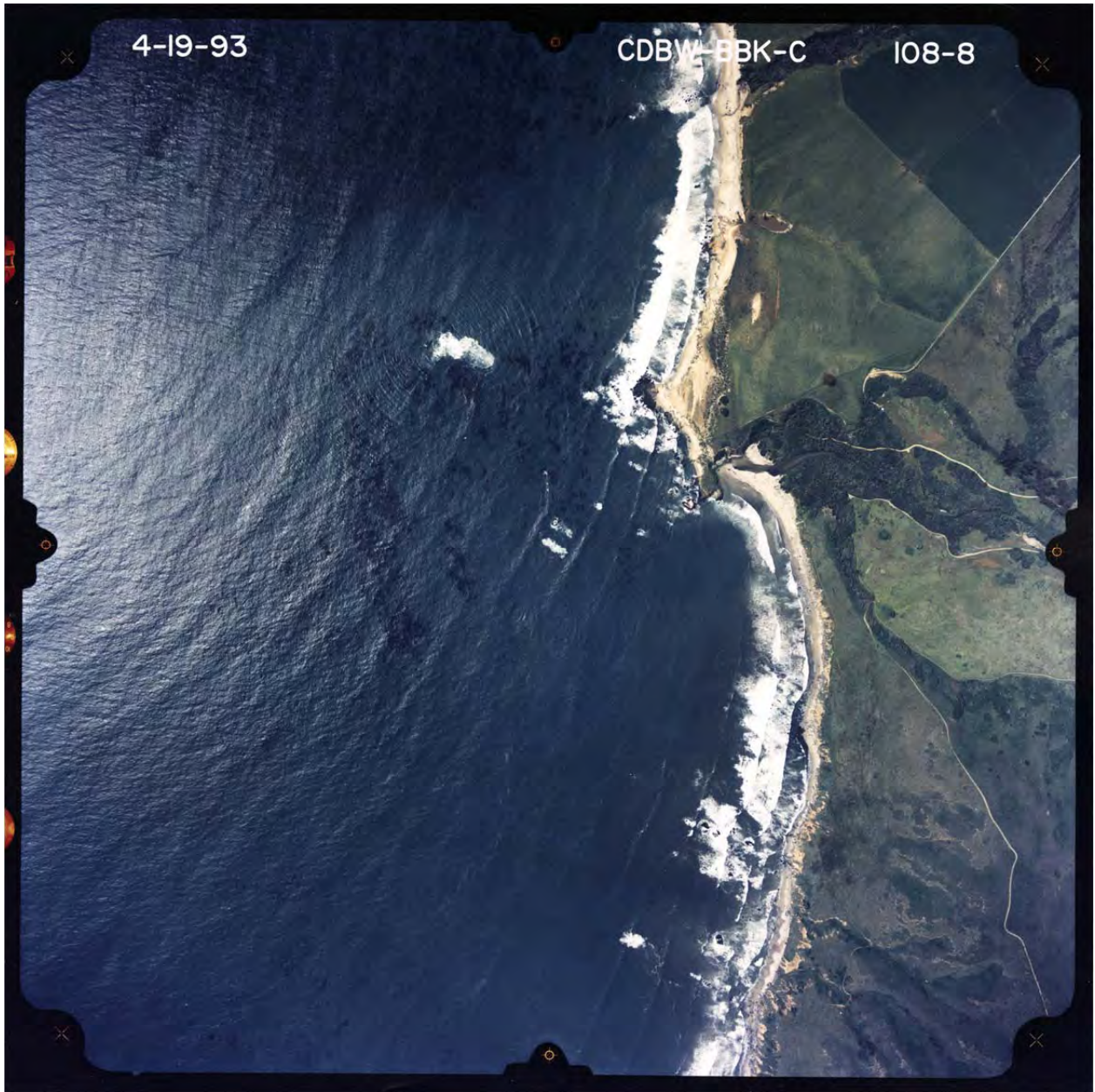


Photo 6: Big Sur Lagoon and River mouth, April 1993. Source: Copyright (C) 2002-2011 Kenneth & Gabrielle Adelman, California Coastal Records Project, www.Californiacoastline.org



Photo 7: Big Sur Lagoon and River mouth, May 12, 1994. Source: Google EarthPro Imagery, © 2011Google

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Photo 8: Big Sur Lagoon and River mouth, June 7, 2002. Source: Google EarthPro Imagery, © 2011 Google

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Photo 9: Big Sur Lagoon and River mouth, September 2, 2002 @ 10:24 hours. Source: Copyright (C) 2002-2011 Kenneth & Gabrielle Adelman, California Coastal Records Project, www.Californiacoastline.org

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Photo 10: Big Sur Lagoon and River mouth, October 11, 2004 @ 13:35 hours. Source: Copyright (C) 2002-2011 Kenneth & Gabrielle Adelman, California Coastal Records Project, www.Californiacoastline.org

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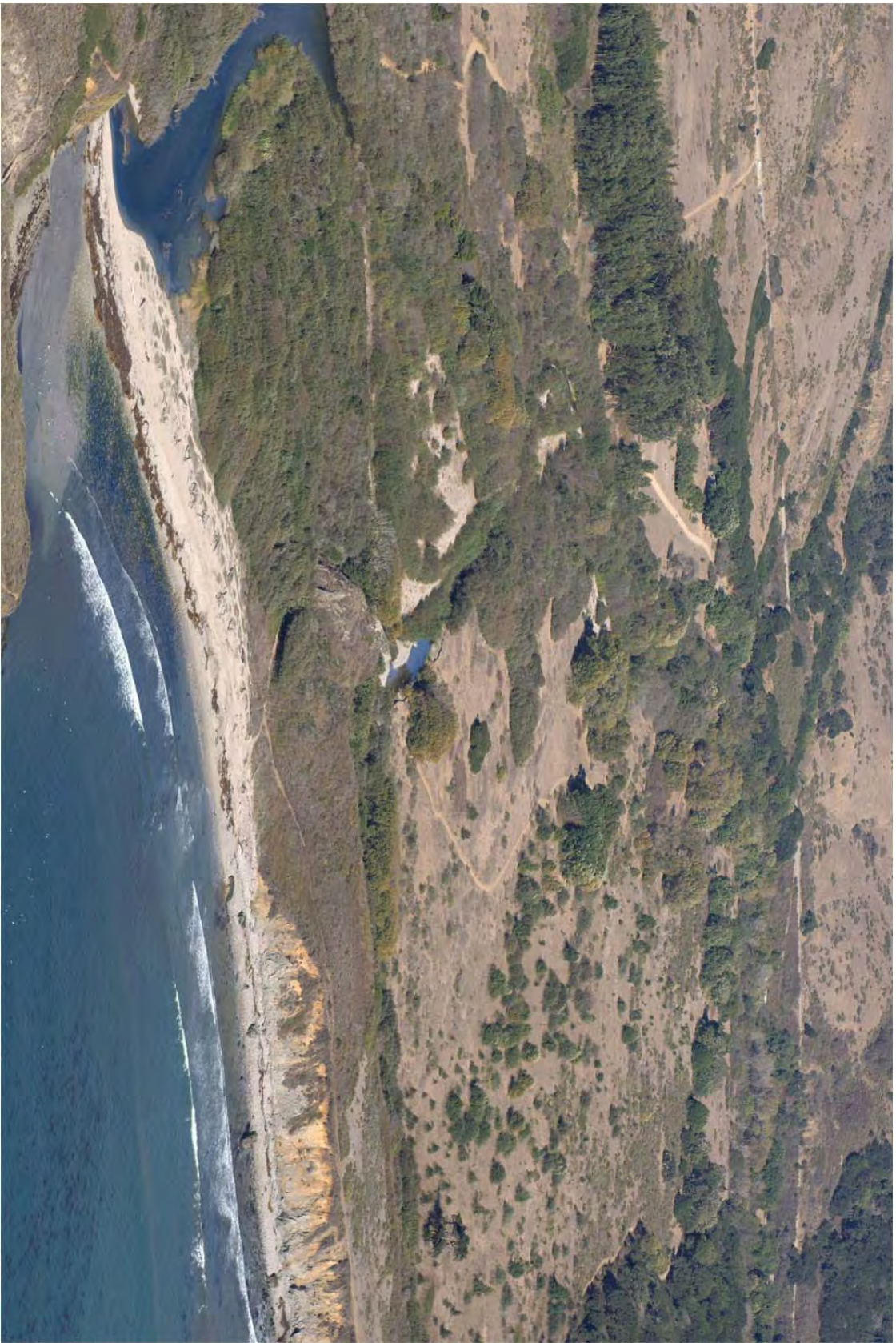


Photo 11: Big Sur Lagoon and River mouth, October 28, 2005 @ 13:56 hours. Source: Copyright (C) 2002-2011 Kenneth & Gabrielle Adelman, California Coastal Records Project, www.Californiaoastline.org

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Photo 12: Big Sur Lagoon and River mouth, July 27, 2007. Source: Google EarthPro Imagery, © 2011 Google

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Photo 13: Big Sur Lagoon and River mouth, September 23, 2008 @ 13:42 hours. Source: Copyright (C) 2002-2011 Kenneth & Gabrielle Adelman, California Coastal Records Project, www.Californiacoastline.org

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Photo 14: Big Sur Lagoon and River mouth, May 24, 2009. Source: Google EarthPro Imagery, © 2011 Google

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Photo 15: Big Sur Lagoon and River mouth, September 29, 2009. Source: Google EarthPro Imagery, © 2011 Google

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Photo 16: Big Sur Lagoon and River mouth, September 24, 2010 @ 13:07 hours. Source: Copyright (C) 2002-2011 Kenneth & Gabrielle Adelman, California Coastal Records Project, www.Californiacoastline.org

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