Delineation of Coastal Boundaries Using Tidal Data

Roman Institutes of Justinian
500 AD

Thus, the following things are by natural law common to all -- the air, running water, the sea, and consequently the sea-shore.

Anglo/American Common Law

The coastal boundary is the average of daily high tides (mean high water)

Lord Mathew Hale
17th Century

"*ordinary tides ... which happen between the full and change of the moon"*

Attorney General v. Chambers
1854

"*the average of the medium tides in each quarter of a lunar evolution ... gives the limit ... to the rights of the Crown on the seashore*"

Borax Consolidated v.City of Los Angeles

... to ascertain the mean high tide line with requisite certainty in fixing the boundary of valuable tidelands… an average of 18.6 years should be determined as near as possible.

Roman Institutes of Justinian
500 AD

"The sea-shore extends to the limit of the highest tide in time of storm or winter… Again, the public use of the sea-shore, as of the sea itself, is part of the law of nations; consequently every one is free to build a shelter upon it for purposes of retreat, as well as to dry his nets and haul them up from the sea. But they cannot be said to belong to any one as private property, but rather are subject to the same law as the sea itself, with the soil or sand which lies beneath it.

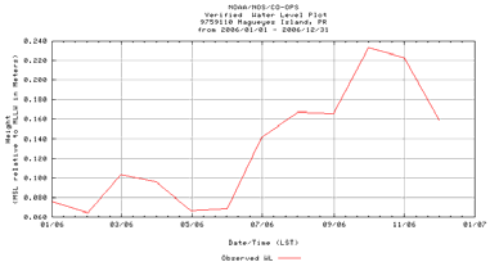
Las Siete Partidas
13th Century AD

- *… e todo aquel lugar es llamado ribera de la mar quanto se cubre el agua de ella, quanto mas crece en todo el año, quier en tiempo del ….(Partida 3, Title 28, Law 4)*

Borax Consolidated v.City of Los Angeles

- *By the civil law, the shore extends as far as the highest waves reach in winter, but by the common law, the shore is confined to the flux and reflux of the sea at ordinary tides*

Annual Sea Level Cycle
Magueyes Island, Puerto Rico



Puerto Rico

"la línea de la pleamar máxima viva equinoccial"

Costa Rica

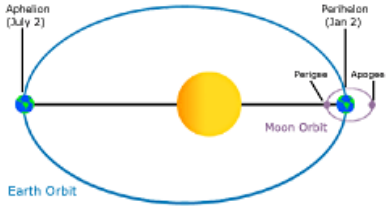
"50 metros apartir de la línea de pleamar ordinaria"

Differences in Legal Definitions

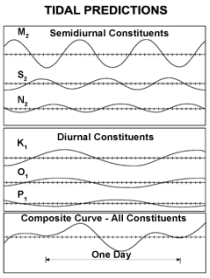
Anglo/American common law limits the public domain to the average daily reach of the tides, the civil law expands the public domain to the maximum reach of the waters.

Tidal Bulges Caused by the Moon

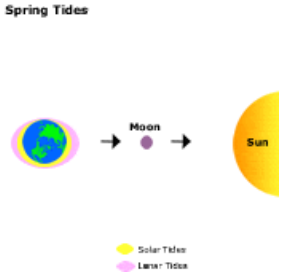
Elliptical Orbit of the Moon



Tidal Constituents



Spring Tides



Tide Predictions

$h = Ho + Sum\{fH\ cos[at + (Vo+u) - K]\}$

where

h = height of tide at any time t

Ho = mean height of water level above datum of prediction

H = mean amplitude of any constituent A

f = factor for reducing mean amplitude H to prediction year

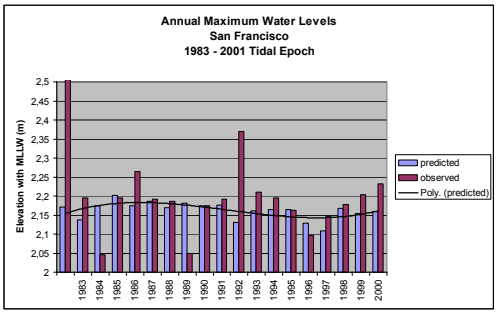
a = speed of constituent A

t = time reckoned from some initial epoch

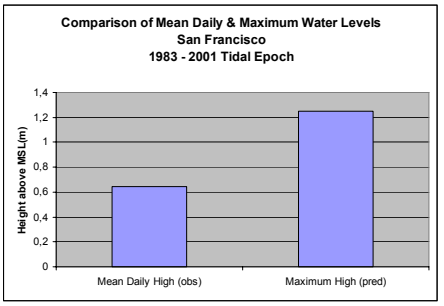
$(Vo+u)$ = value of equilibrium argument of A when t =0

K = epoch of constituent A

Prediction of Maximum High Water



Comparison of Mean & Maximum High Waters



Conclusions

Despite the differences in legal definitions, coastal boundaries in jurisdictions under both the Anglo/American common law or the Roman civil law can be delineated with appropriate analysis of tidal data . . .