CALMAC Study ID CPU0035.01
Volume 9 of 15
Appendix H

Embedded Energy in Water Studies
Study 1: Statewide and Regional Water-Energy Relationship

Prepared by
GEI Consultants/Navigant Consulting, Inc.

Prepared for the
California Public Utilities Commission
Energy Division

Managed by
California Institute for Energy and Environment

August 31, 2010

Appendix H Surface Storage and Groundwater Limits

Local surface water and groundwater are balancing supplies in the model. They are used to provide additional water to meet the balance of demand not fulfilled by all other water supplies including wholesale supplies. The model uses three values to govern the use of these supplies within each region: 1) an upper limit for local surface water supply available for use in each hydrologic region, 2) a historic average ratio between groundwater use and local surface water use in each region, and 3) user-defined increase in local surface supply. This section discusses the three, their sources, and how they are used in scenario analysis.

H.1 Upper Limit for Local Surface Water Supply

The Study team estimates an upper limit for total local surface water supply to simulate the constrained capacity that local reservoirs have to serve a region. This value is calculated using historic data from the Regional Water Balances and only accounts for surface water supply used to meet the following demands: urban, agricultural, instream, managed wetlands, and required delta outflow. Wild and Scenic uses are not accounted for as these flows are uncontrolled and are not being considered in this model.

$$\begin{aligned} &Historic\ Local\ Surface\ Supply \\ &\quad = Local\ Deliveries - Environmental\ Wild\ and\ Scenic \\ &\quad + Return\ Flow\ from\ Carryover\ Storage + Reuse\ of\ Surface\ Water \\ &\quad + Inflow\ Drainage\ from\ other\ HRs \end{aligned}$$

The upper limit is calculated in each water year type from 1998-2005 in each region and then averaged over the period to produce value for each region. The upper limit is calculated by adding historic supplies from (as defined by the water balances) Local Deliveries, Return Flow from Carryover Storage, Reuse of Surface Water, and Inflow Drainage from other Hydrologic Regions and subtracting historic demand by Wild and Scenic Rivers. The remainder is that local surface water which meets urban, agricultural and select environmental water demands. The historic averages calculated for each hydrologic region are summarized in Table 1.

.

Table 1: Calculated Upper Limit for Local Surface Water

Region	Local Surface Water Limit (TAF)
NC	2,119
SF	867
CC	79
SC	366
SR	13,862
SJ	4,735
TL	2,322
NL	444
SL	171
CR	306

H.1.1 Groundwater to Surface Water Ratio

The historic ratio of groundwater to surface water is used to split the total balancing supply between groundwater and surface water. The ratio is calculated in each region for each year type and then used to develop an average for each region. The total surface water supply used for this calculation follows the same method as the surface water upper limit calculation. The total groundwater supply used in this calculation is obtained from the Regional Water Balances, and it is denoted as "Total Groundwater Withdrawal." The historic average ratio for each hydrologic region is summarized in Table 2.

Table 2: Ratio of Surface Water to Groundwater Use

	Surface Water	Groundwater
NC	86%	14%
SF	81%	19%
CC	7%	93%
SC	18%	82%
SR	84%	16%
SJ	64%	36%
TL	30%	70%
NL	75%	25%
SL	29%	71%
CR	42%	58%

H.1.2 User-Defined Increase in Local Surface Supply

Users can define increases in local surface supply available in each hydrologic region. These inputs are added to the existing upper limit for local surface water supply to simulate additional construction of surface storage in each region. The Study Team collected information on the existing storage capacity in each region to use as a guide for scenario inputs. Current storage capacities were obtained from DWR's Draft Regional Water Balances for the Draft 2010

California Water Plan. Storage capacities are summarized in Table 3 along with data representing a 2% increase in storage used in scenario analysis.

Table 3: Total Surface Water Storage Capacity

Region	Total Available Surface Storage (TAF)	2% Increase in Storage
NC	3,780	76
SF	746	15
CC	1,227	25
SC	2,259	45
SR	16,146	323
SJ	11,477	230
TL	2,046	41
NL	1,181	24
SL	459	9
CR	620	12

H.1.3 Lower Limit for Groundwater Supply in Select Regions

The model uses a lower limit for groundwater pumping in two regions to better reflect actual operations; these two regions are the South Coast (SC) and San Francisco (SF) Regions. Historic data on total groundwater pumping in each region was obtained from the regional water balances. This data is presented in Table 4.

Table 4: Historic Groundwater Pumping (TAF)

	SC	SF
1998	1,632	38
1999	1,693	221
2000	1,873	139
2001	1,862	220
2002	1,768	268
2003	1,461	279
2004	1,476	252
2005	1,237	245
Historic Minimum	1,237	38
Minimum Used in Model	1,000	38

The minimum groundwater pumping amount for SF was set using the historic minimum of 38 TAF which occurred in 1998. The historic minimum for the South Coast was 1,237 TAF occurring in 2005. However, the Study Team estimates this is not representative of the true minimum and estimates the true minimum to be approximately 1,000 TAF.