Addressing Hydrologic Variability In Complex Water Management Systems

Floodplain Management Association
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Water Management of the Past Focused on Challenges

CA Water Plan (1957)
California’s Central Valley landscape is still predominately agricultural in character.

Hydrologic Variability Considerations

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Total Precipitable Water (mm)
Hydrologic Variability Considerations: American River Example

American River at Fair Oaks

Folsom Reservoir Begins Operation

Source: Sacramento and San Joaquin Comprehensive Study
Importance of Sierra Nevada Range in CA Water Management

Figure ES-1 Cross-Section Showing Elevations along 40° North

Average Annual Precipitation in California
(With Shaded Relief)

Precipitation in Inches
- 180.1 - 200.0
- 140.1 - 160.0
- 120.1 - 140.0
- 100.1 - 120.0
- 80.1 - 100.0
- 70.1 - 80.0
- 60.1 - 70.0
- 50.1 - 60.0
- 40.1 - 50.0
- 30.1 - 40.0
- 30.0 - 35.0
- 25.1 - 30.0
- 20.1 - 25.0
- 15.1 - 20.0
- 10.1 - 15.0
- 5.1 - 10.0
- < 5.0

Modified from the National Atlas
How Temperature Increases Influence Storm Runoff Volumes

CONCEPT GRAPHIC

Existing Rain / Snow Trends

Future Rain / Snow Trends
How Sea Level Rise Influences System Outflow

Estimates of Future Sea Level Rise in California

<table>
<thead>
<tr>
<th>Year</th>
<th>Low</th>
<th>Mean</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>2030</td>
<td>4.3 cm</td>
<td>14.4 cm</td>
<td>29.7 cm</td>
</tr>
<tr>
<td>2050</td>
<td>12.3 cm</td>
<td>28.0 cm</td>
<td>60.8 cm</td>
</tr>
<tr>
<td>2062*</td>
<td>18.5 cm (0.61 ft.)</td>
<td>38.8 cm (1.27 ft.)</td>
<td>83.1 cm (2.73 ft.)</td>
</tr>
<tr>
<td>2100</td>
<td>42.4 cm</td>
<td>91.9 cm</td>
<td>166.4 cm</td>
</tr>
</tbody>
</table>

(Source: NRC, 2012)

Using Plans to Support Implementation


Houbolt was a voice in the wilderness in advocating for a cost efficient approach to safely deliver humans from the earth to the moon (and back again).

Plans are worthless, planning is everything.
– President Dwight D. Eisenhower
Managing for Different Hydrologic Conditions

Because river flows vary over days, seasons, and years, the actions we employ to manage these flows are different.

Source: The importance of water reform in the Murray-Darling Basin. (2011)
Flow-Frequency Only Provides a Limited Perspective
We Need Different Tools to Address Different Objectives
Our understanding of the water management system in the Central Valley is still in its infancy.

In Australia, it took a drought of record (the Millennium Drought) and a series of equally devastating floods to rethink and reshape Australian water management.

Australia recognized 3 distinct conditions of environmental needs for hydrologic events.

It is important to understand how our water management system responds to different environmental / hydrologic conditions and how our responses to these conditions interact.

We need a portfolio of tools and ways of looking at broad system response and the interactions between different ways we manage flood waters.
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