

Understanding Groundwater in the Napa Basin

Thomas Harter

**Robert M. Hagan Endowed Chair for Water Management and Policy
UC Davis**

ThHarter@ucdavis.edu

<http://groundwater.ucdavis.edu/SGMA>













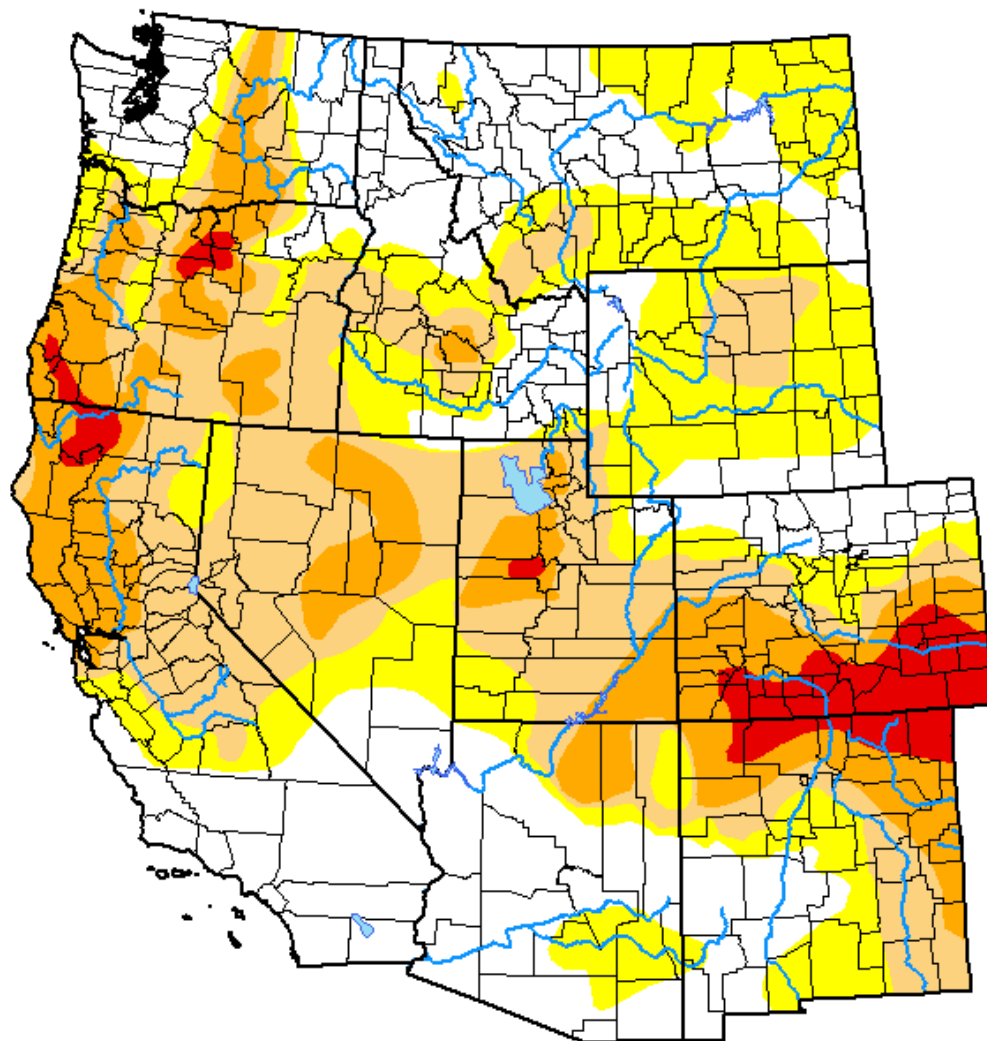












U.S. Drought Monitor West

June 9, 2020
(Released Thursday, Jun. 11, 2020)
Valid 8 a.m. EDT



Intensity:

| | |
|---|------------------------|
|  | None |
|  | D0 Abnormally Dry |
|  | D1 Moderate Drought |
|  | D2 Severe Drought |
|  | D3 Extreme Drought |
|  | D4 Exceptional Drought |

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>

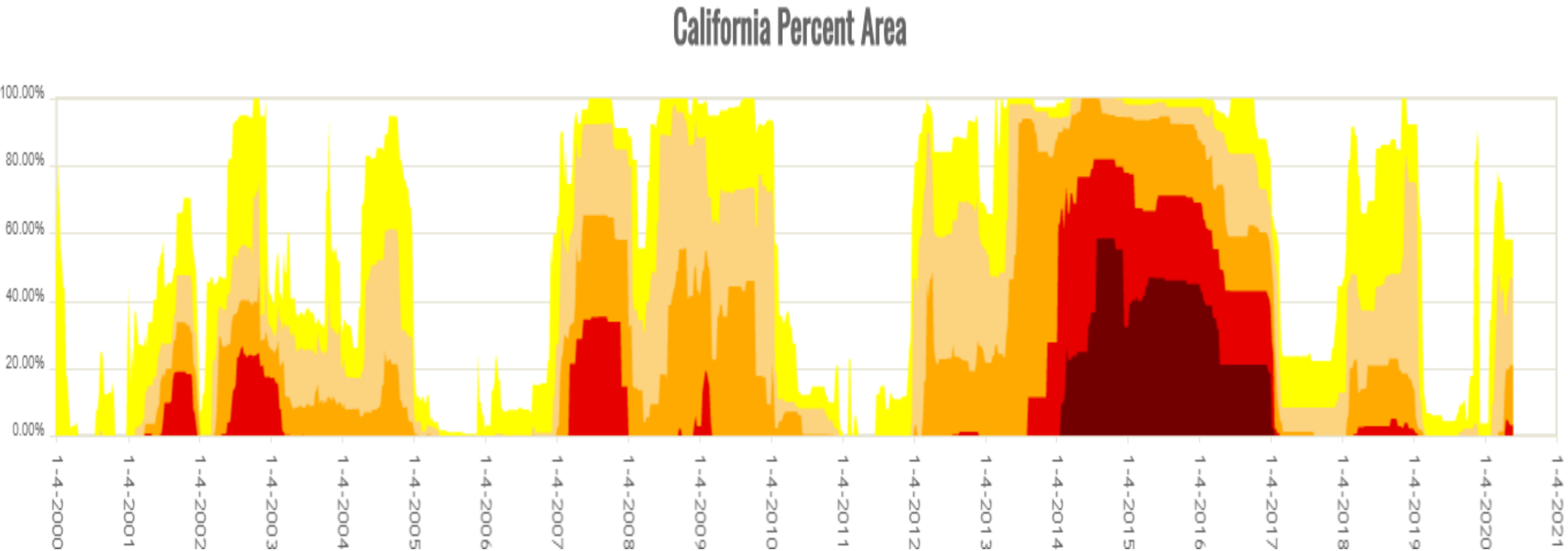
Author:

Brad Pugh
CPC/NOAA

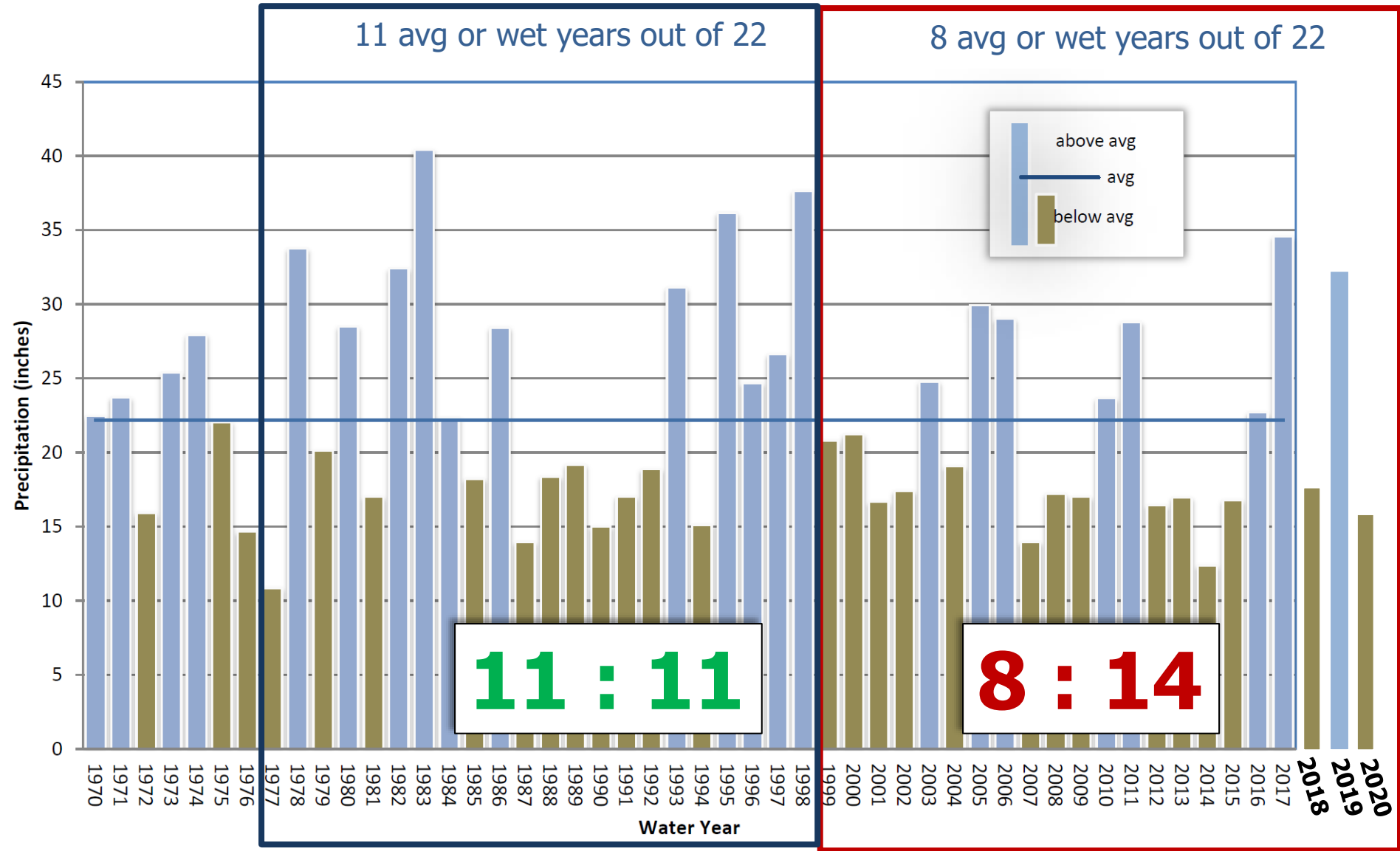


droughtmonitor.unl.edu

20 Year History of Percent Drought Area in California



An Unofficial "Groundwater Drought Score"



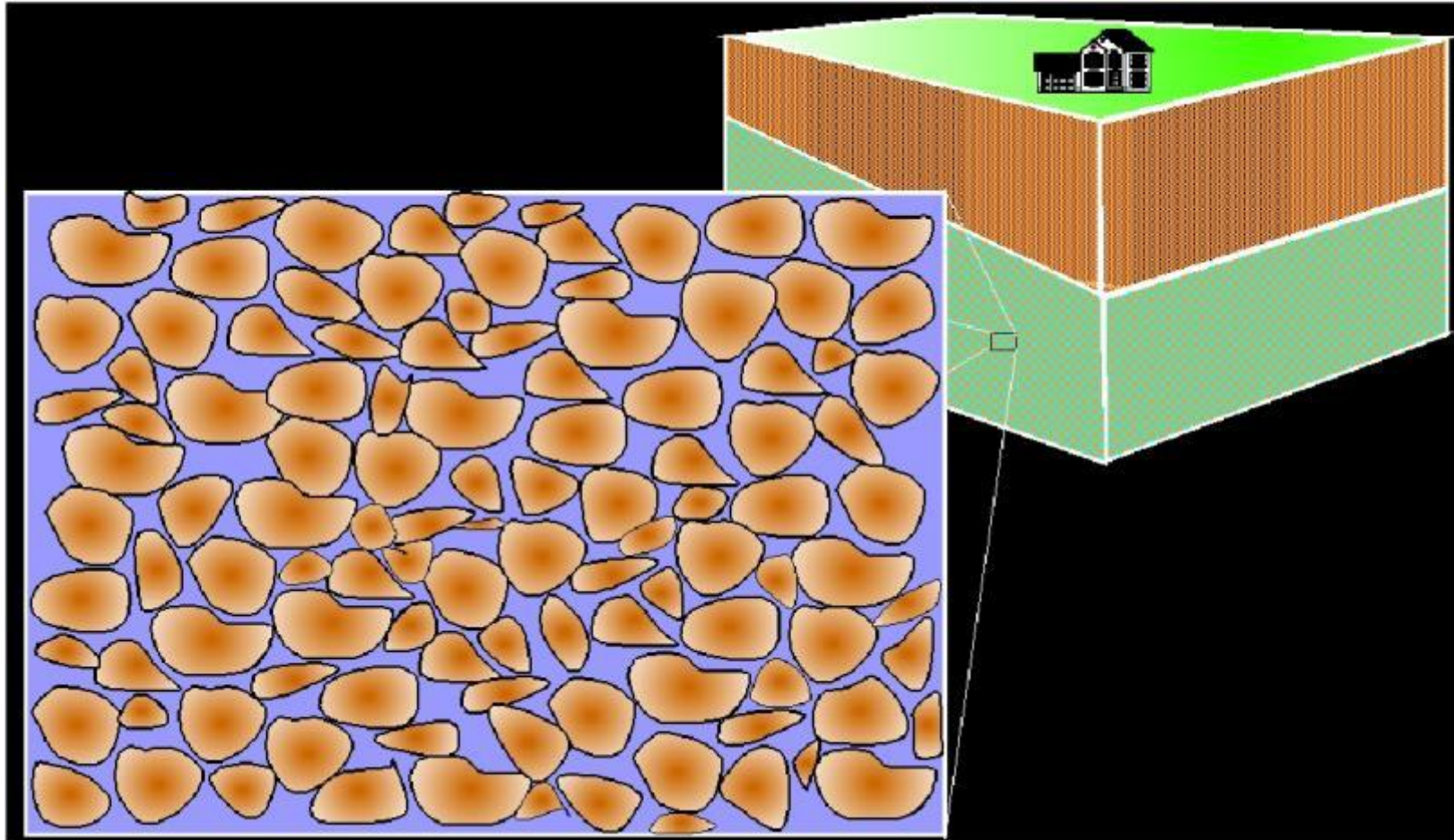
Harter and Brewster, California Water Blog, April 9, 2018; Data from DWR, 2017

<https://californiawaterblog.com/2018/04/08/groundwater-recovery-in-california-still-behind-the-curve/>

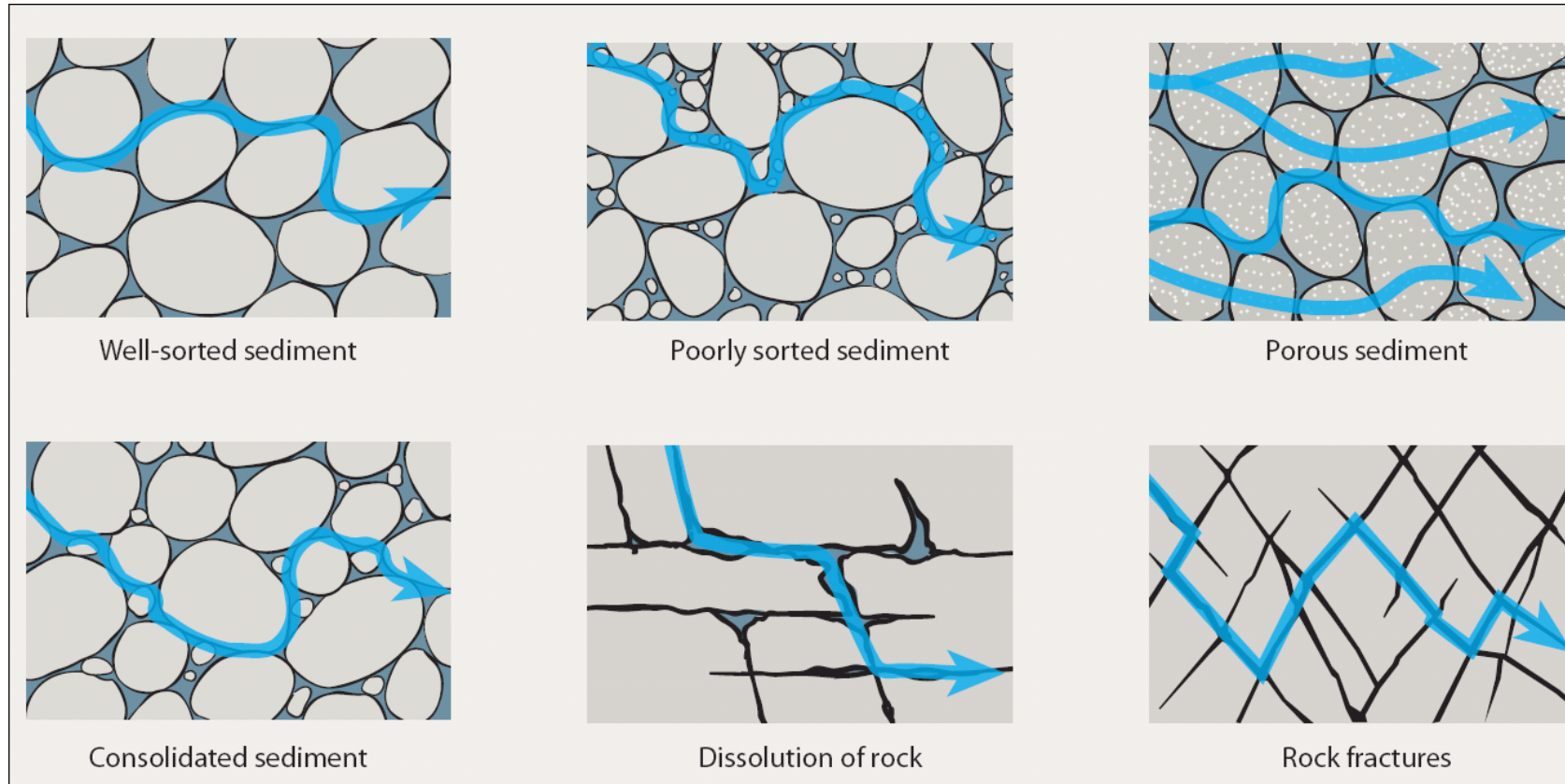
What is Groundwater?

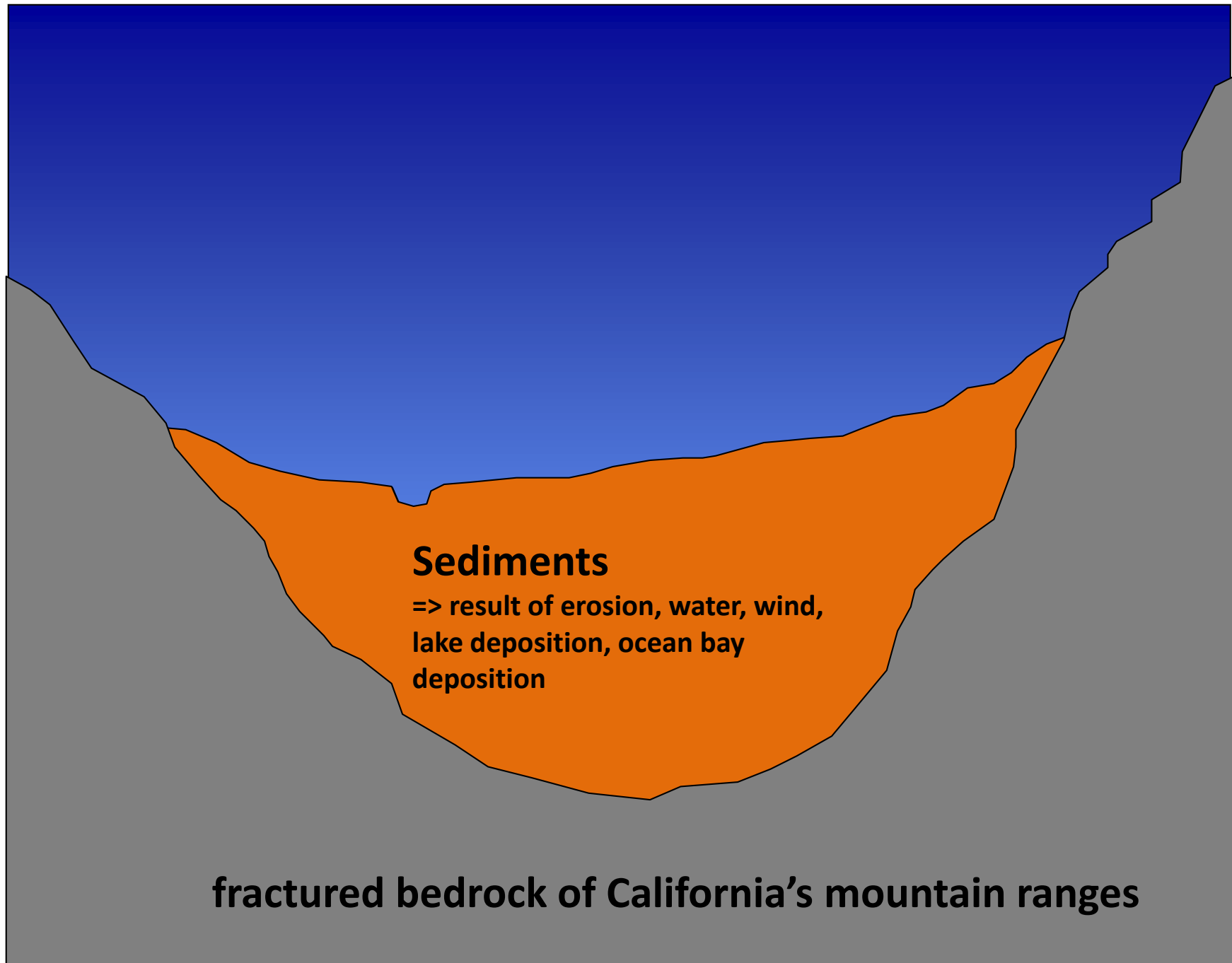
- An underground lake?
- A network of underground rivers?
- A network of pipelike water arteries?
- A giant sponge?

Groundwater = Water completely filling
Pores/Fractures



Groundwater in Different Sediments and Rocks

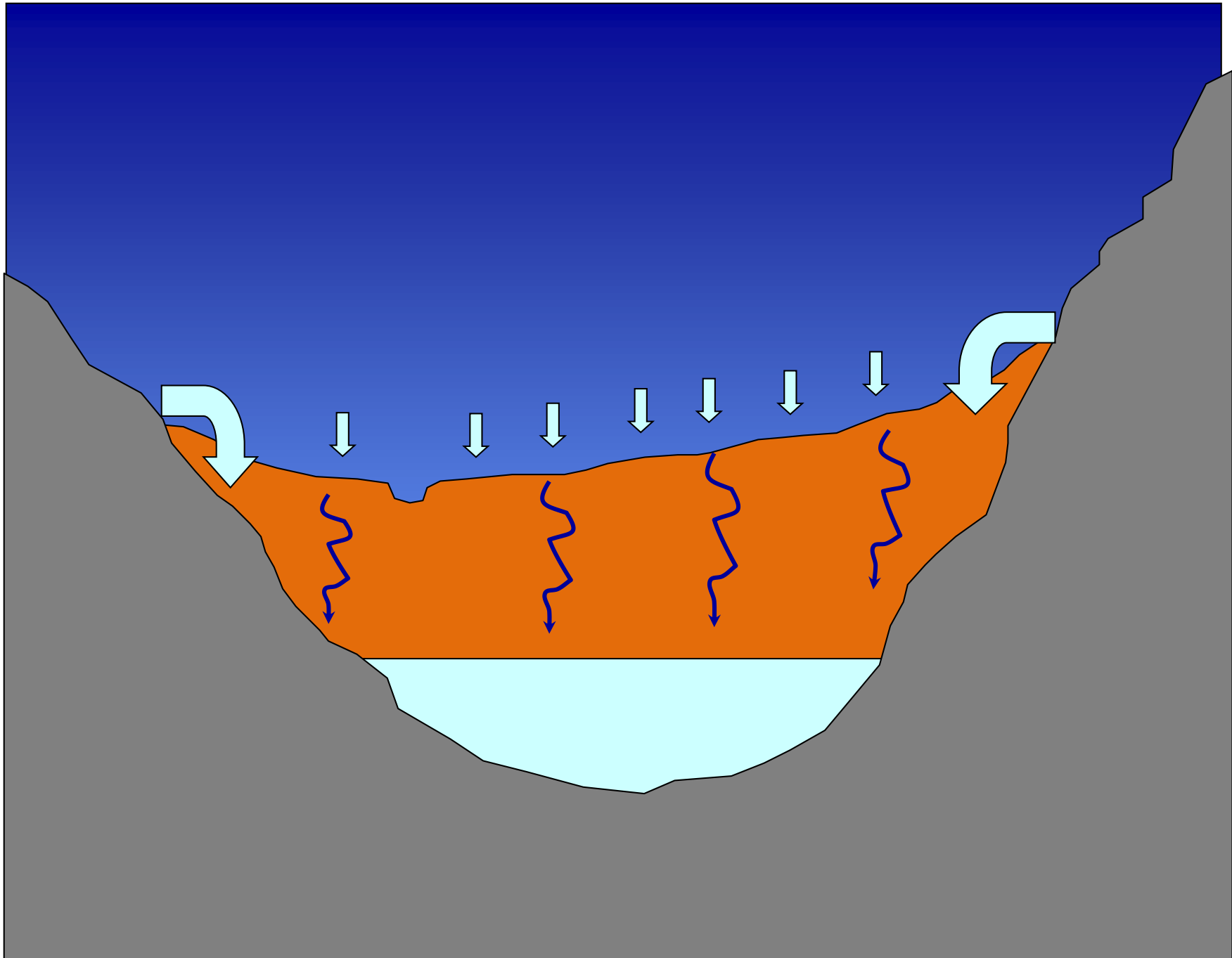


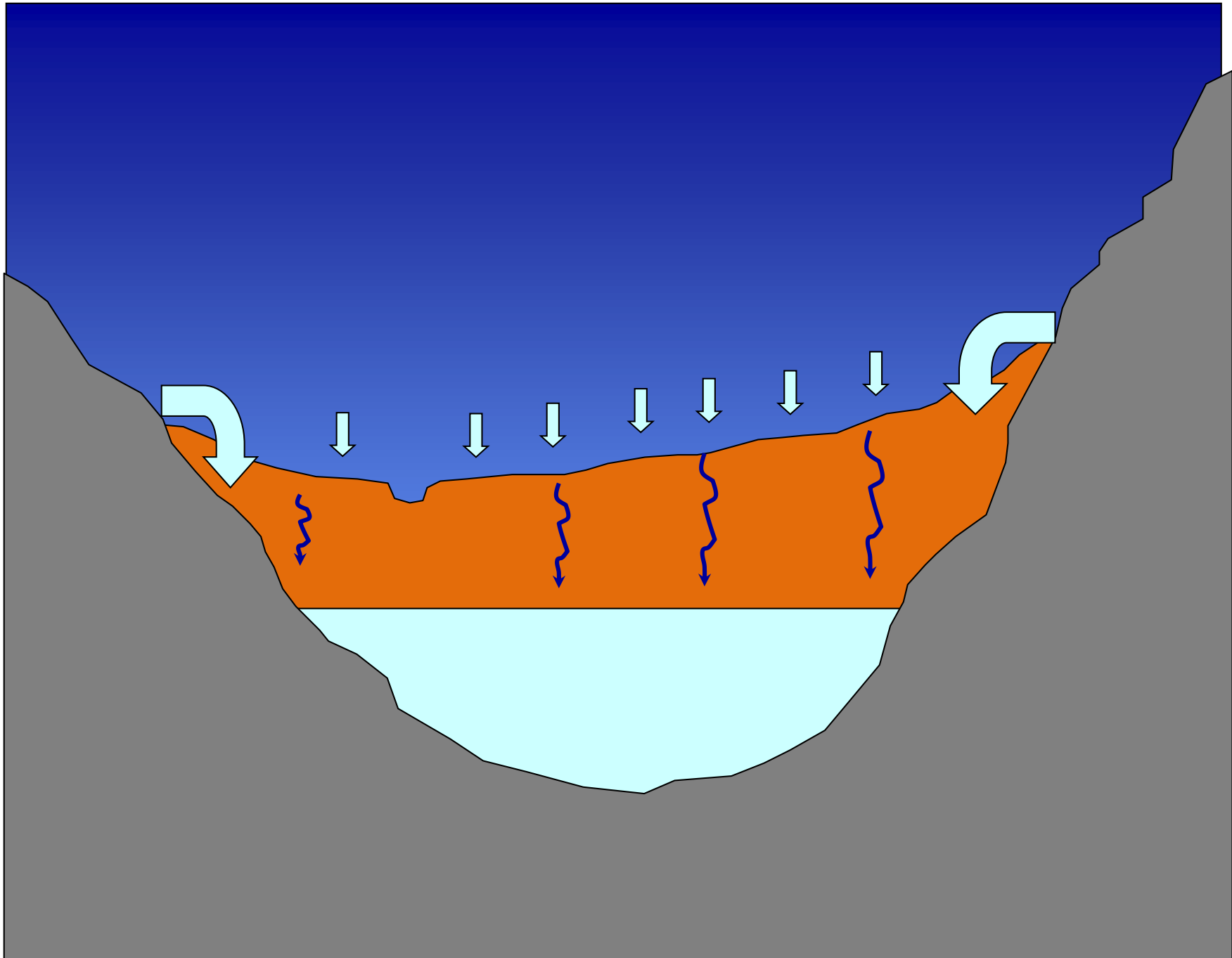


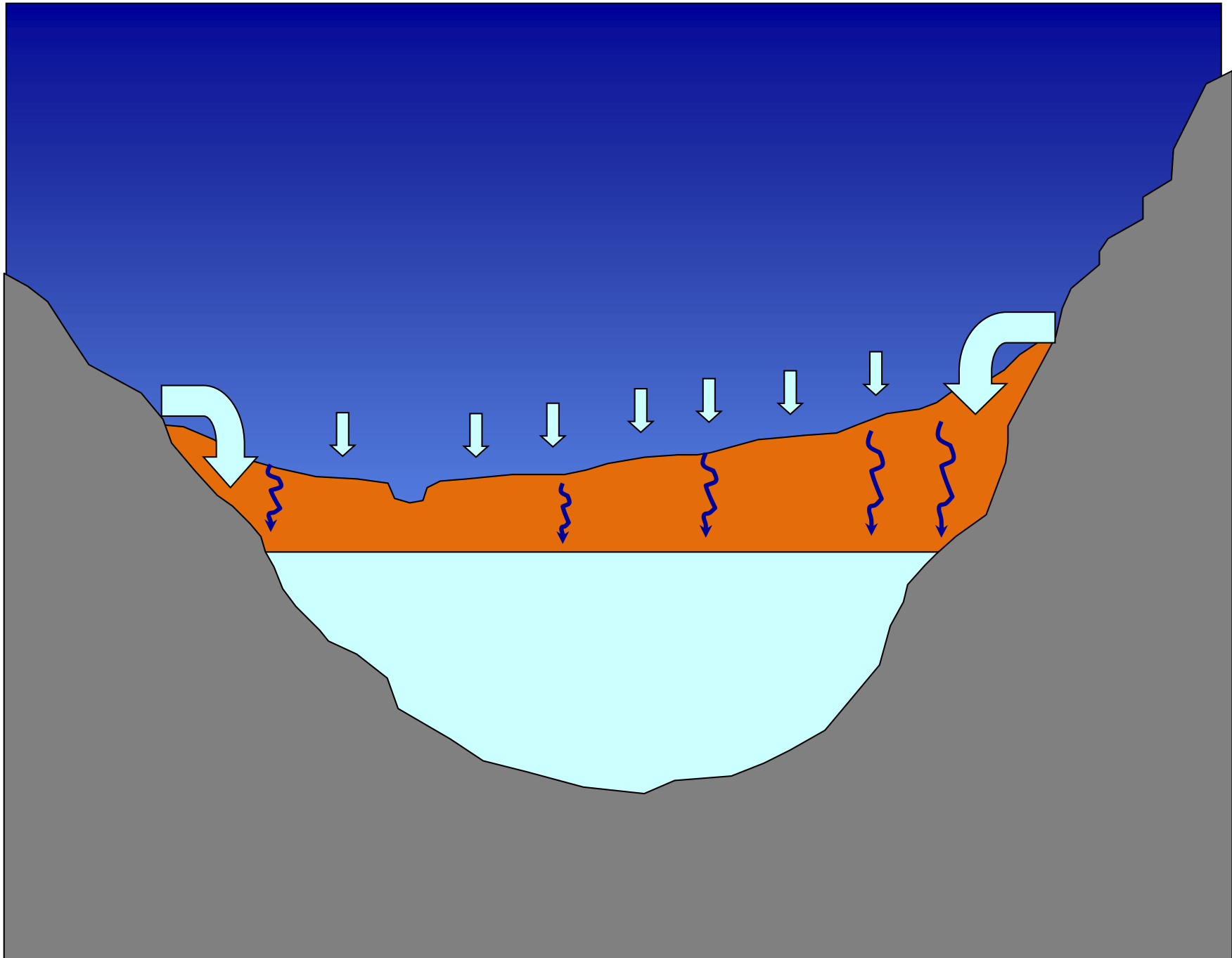
Sediments

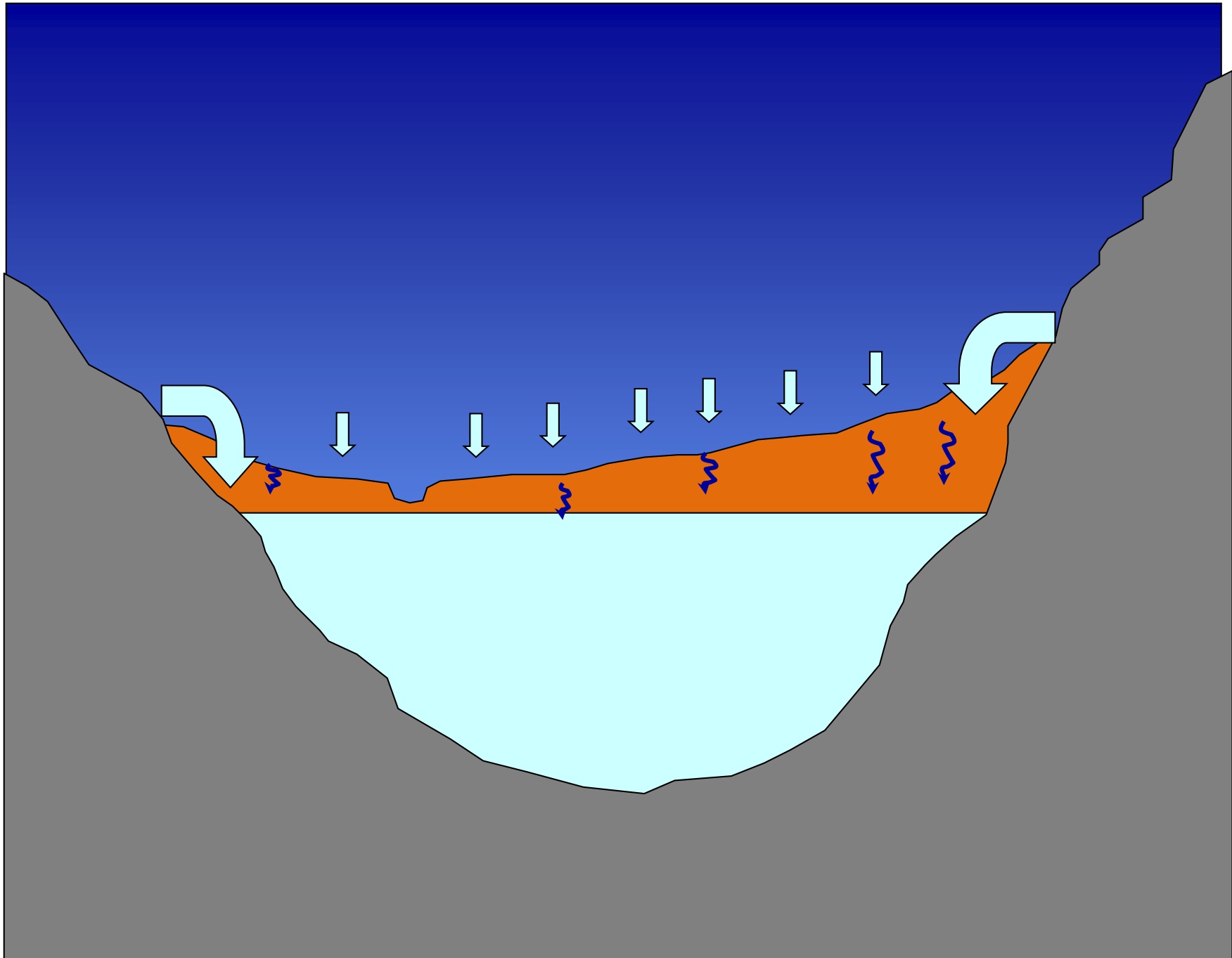
=> result of erosion, water, wind,
lake deposition, ocean bay
deposition

fractured bedrock of California's mountain ranges



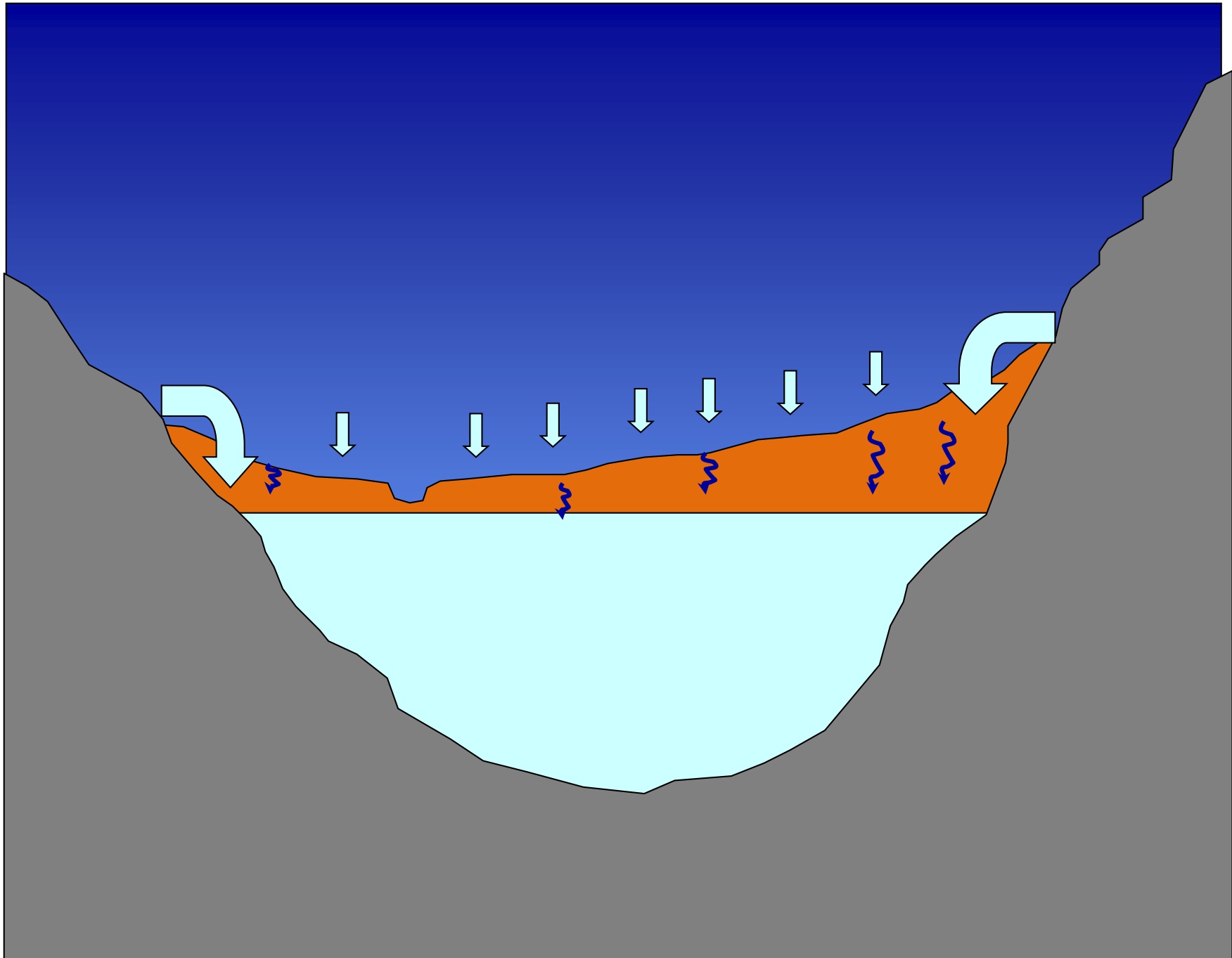


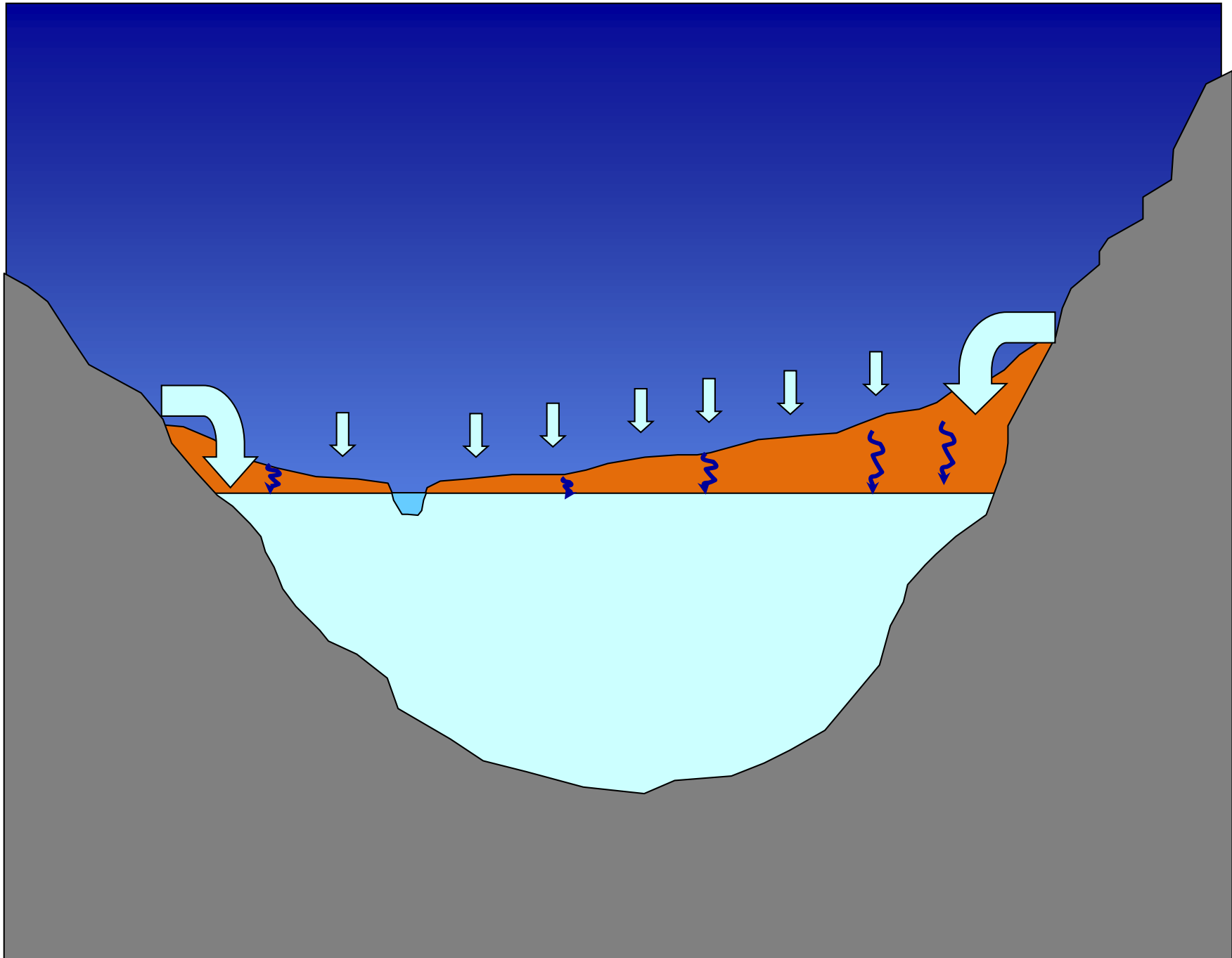


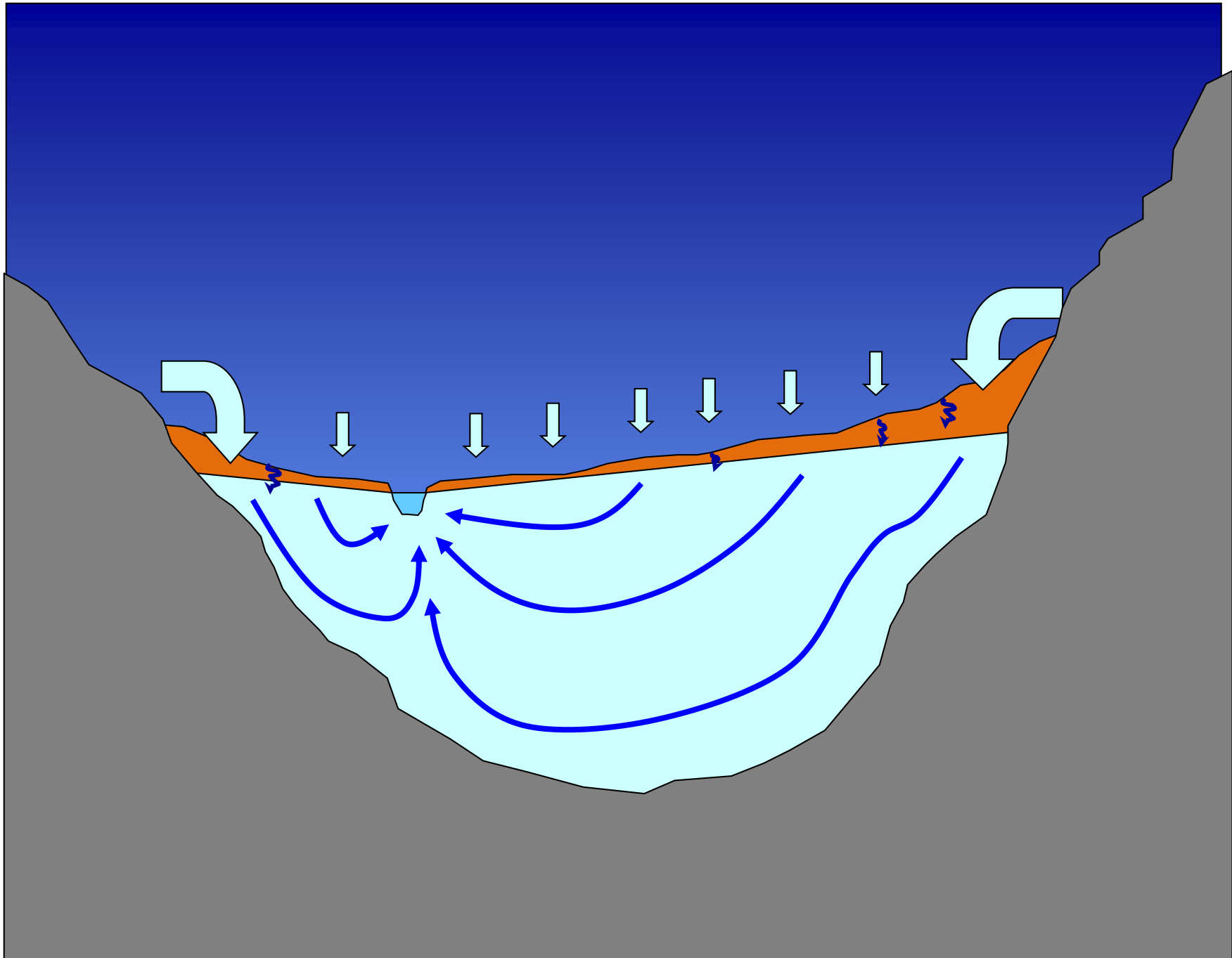


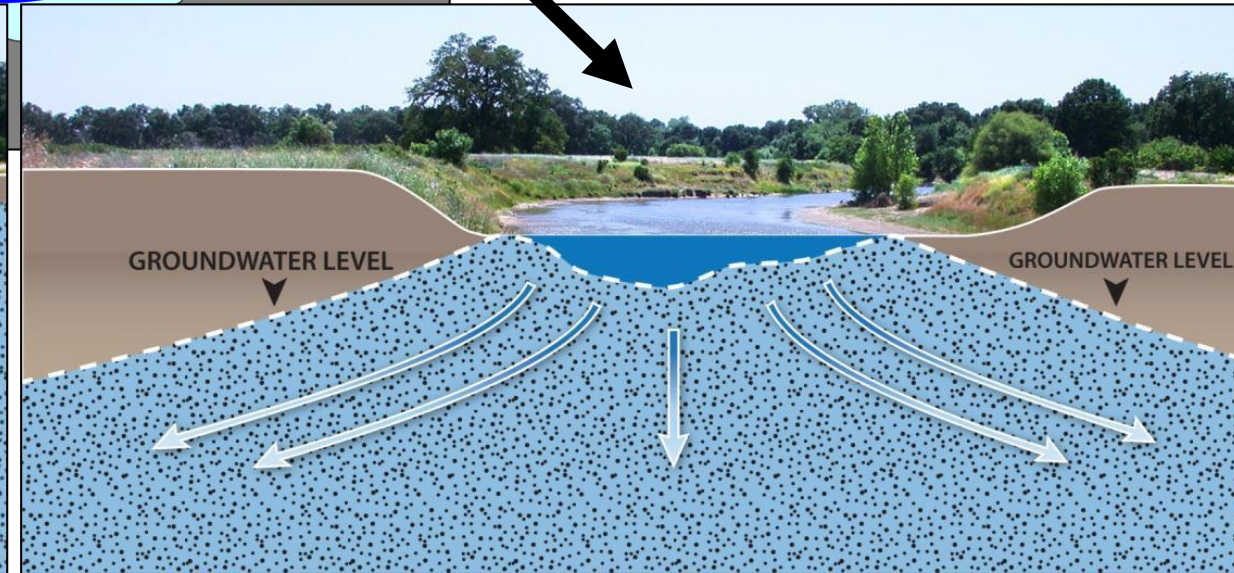
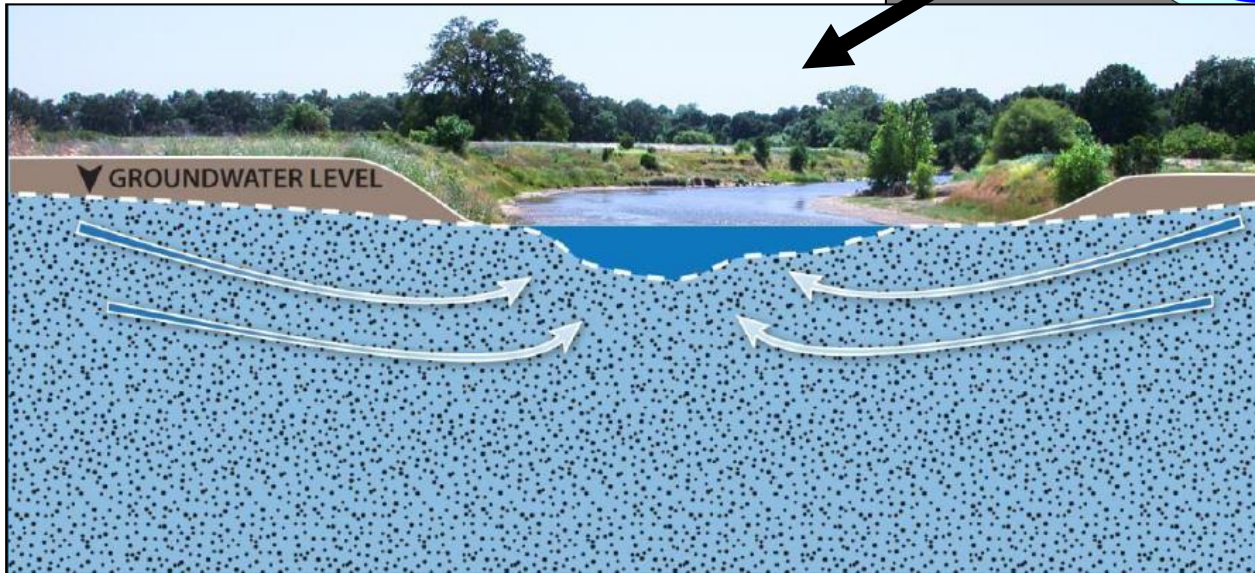
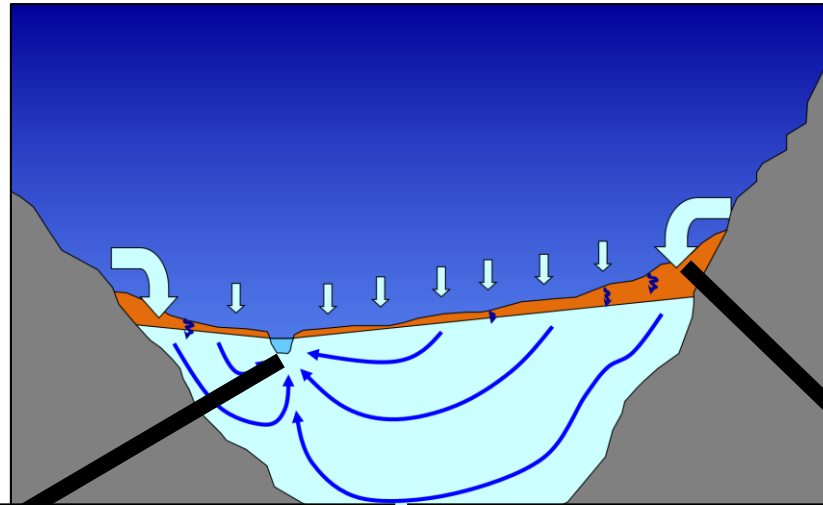






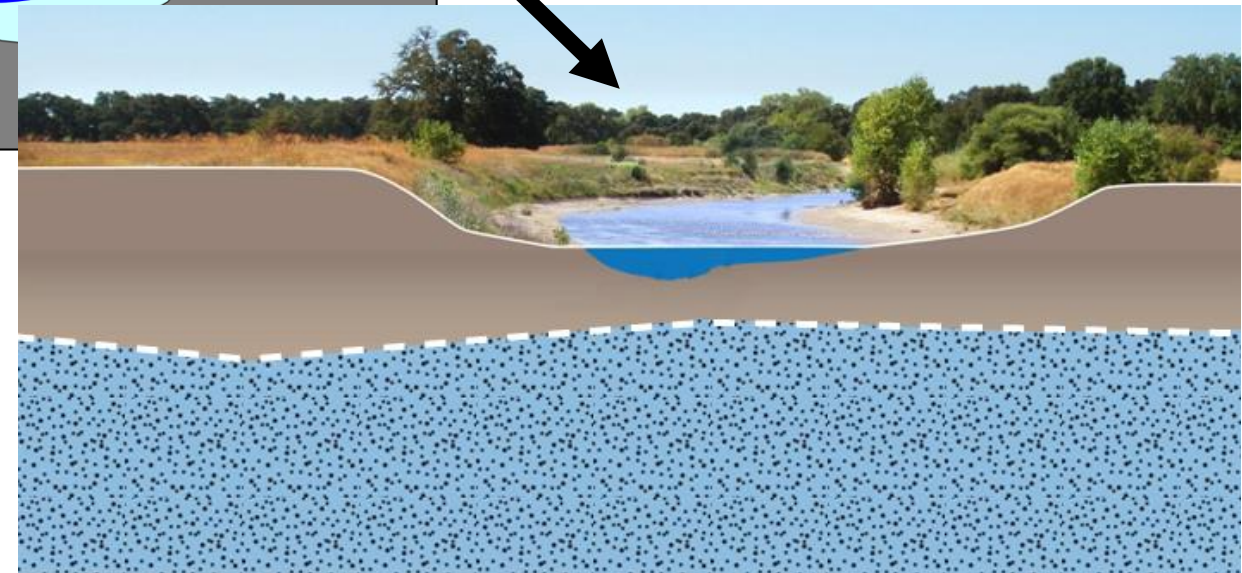
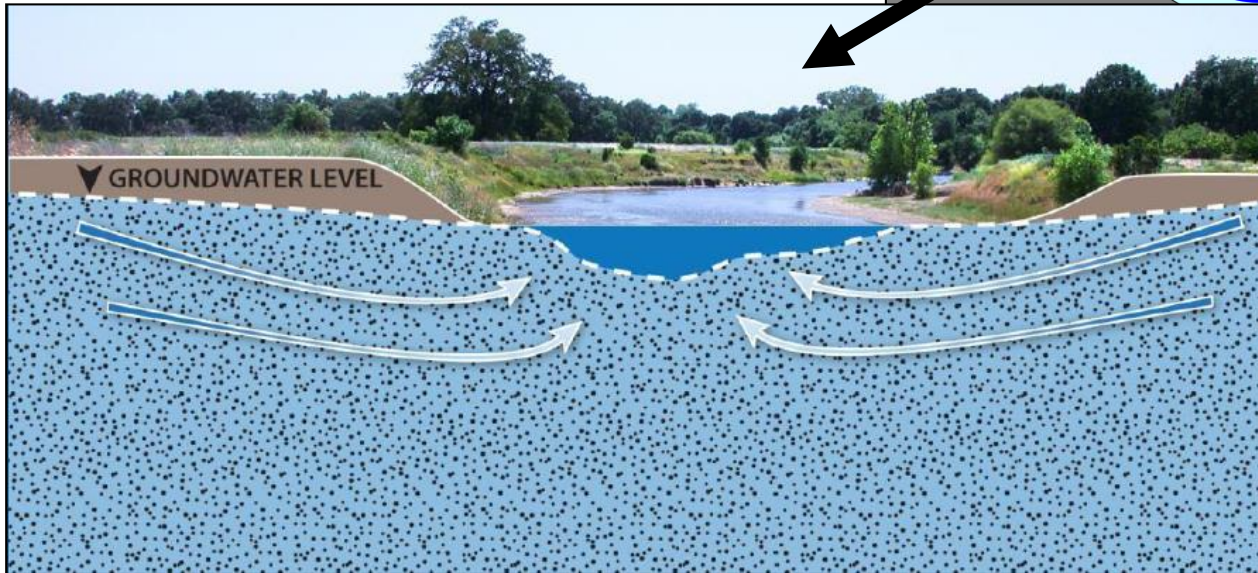
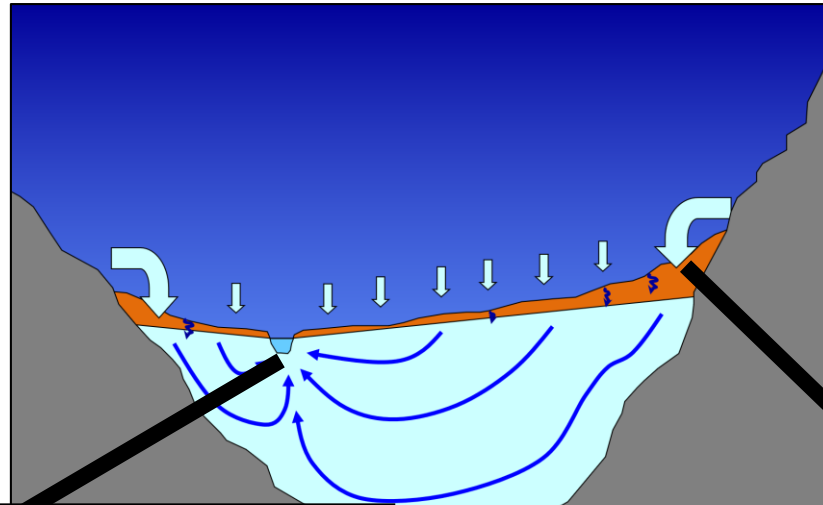






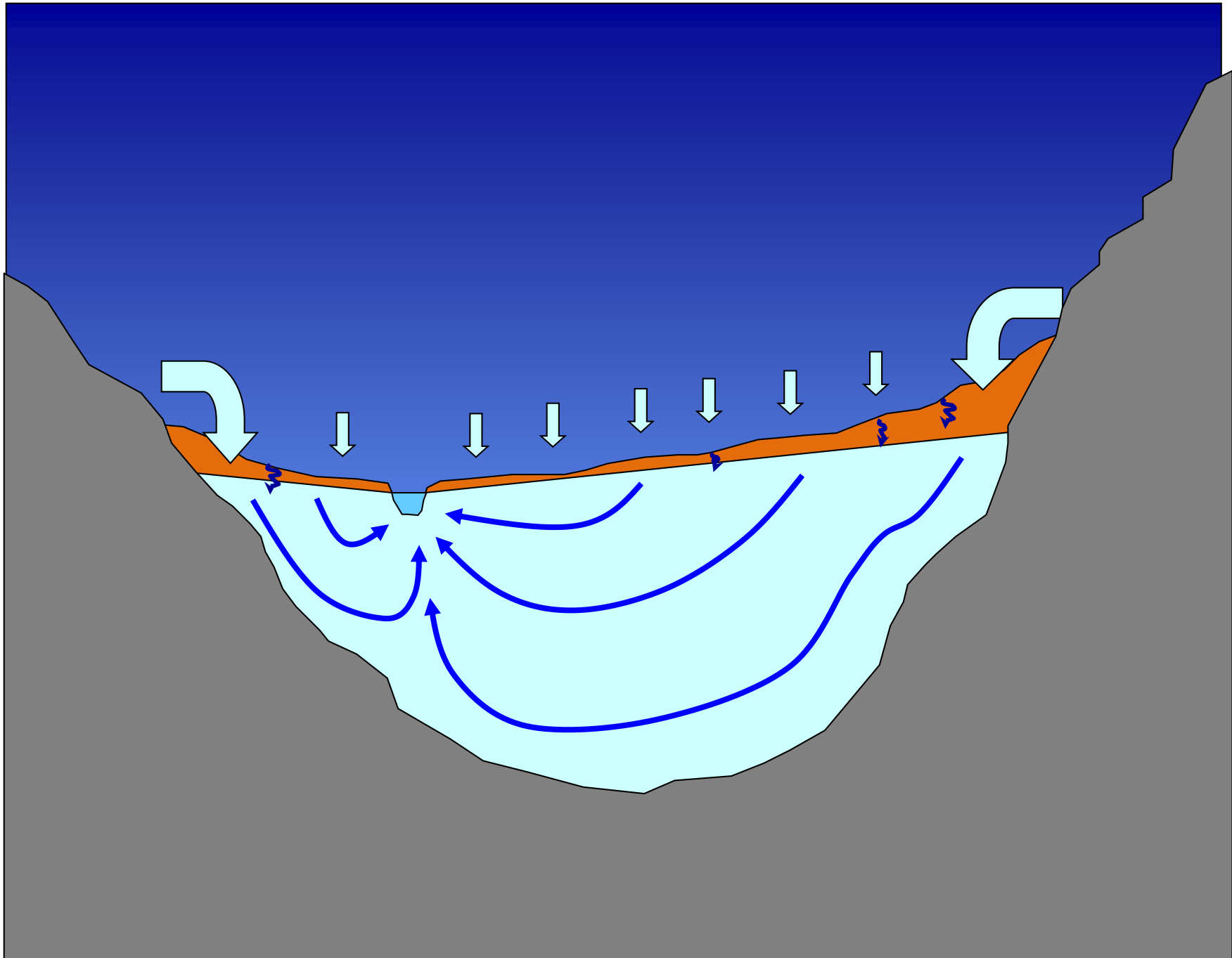
**Gaining Stream:
Groundwater Provides Baseflow to Stream**

**Losing Stream:
Stream Recharges Groundwater**



**Gaining Stream:
Groundwater Provides Baseflow to Stream**

**Disconnected Stream:
Stream Recharges Groundwater**

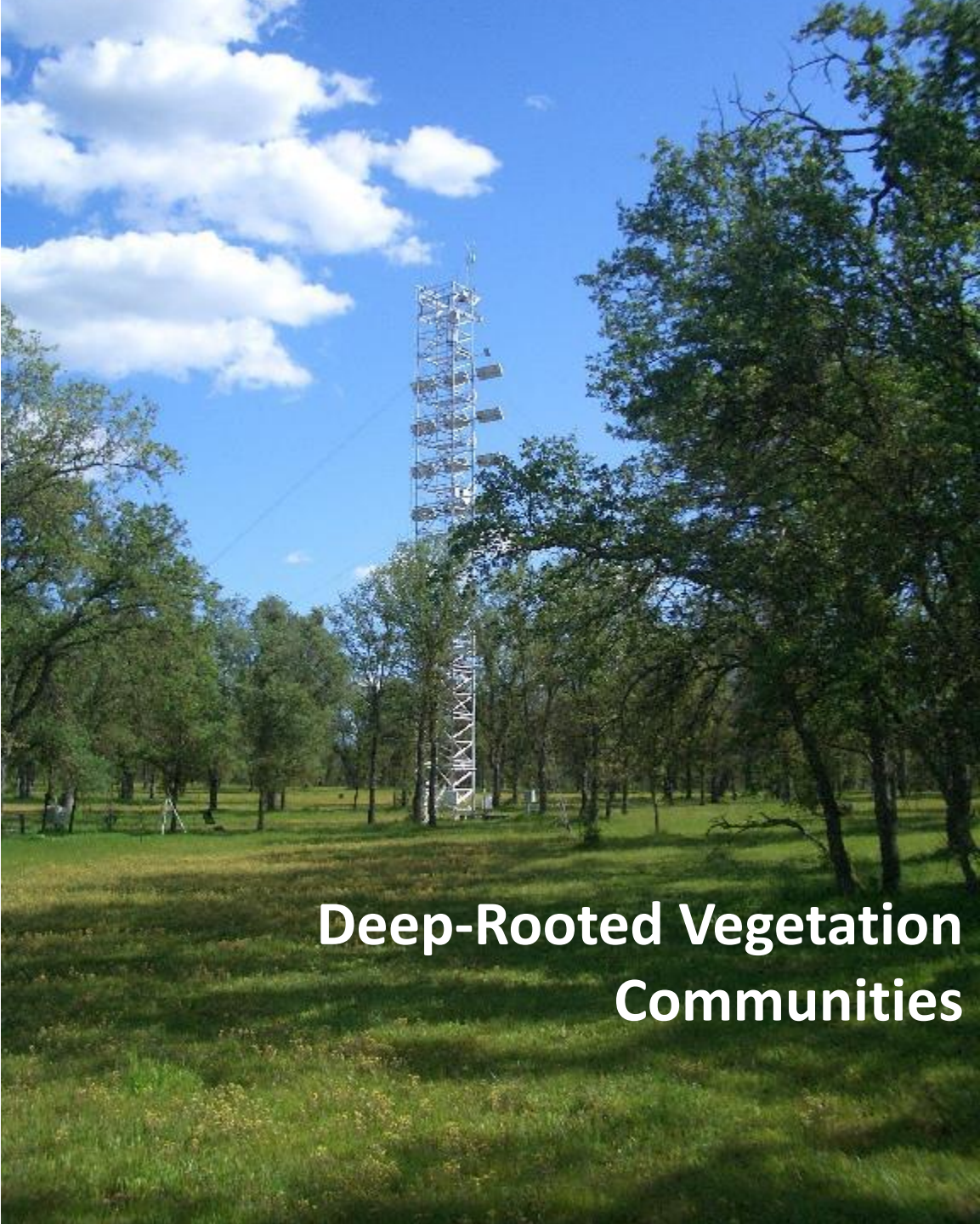


Riparian Vegetation

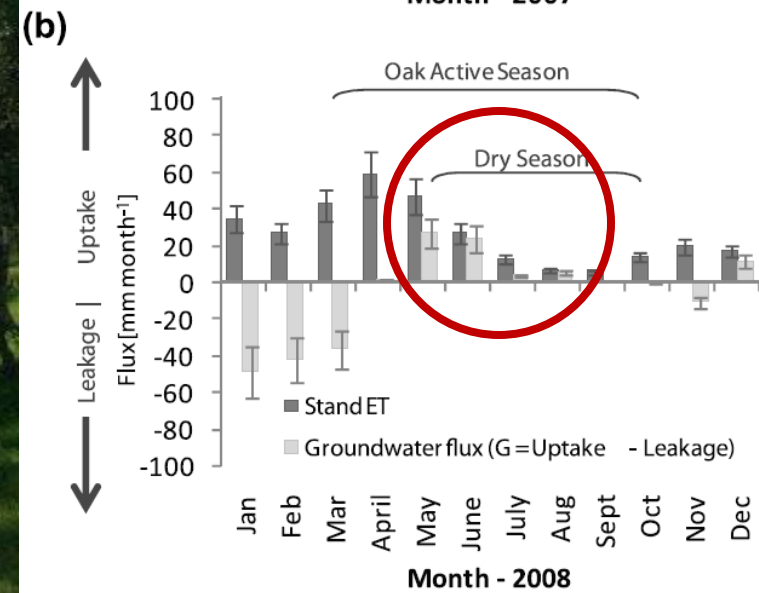
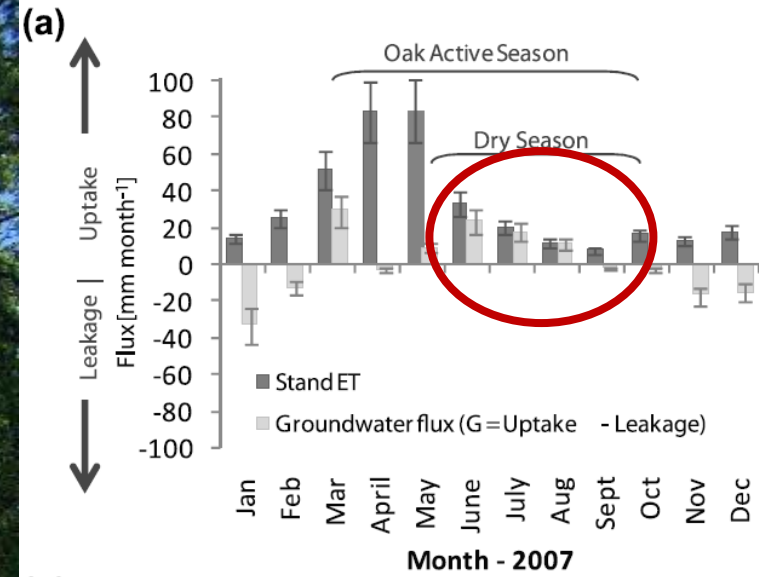


Springs and Seeps



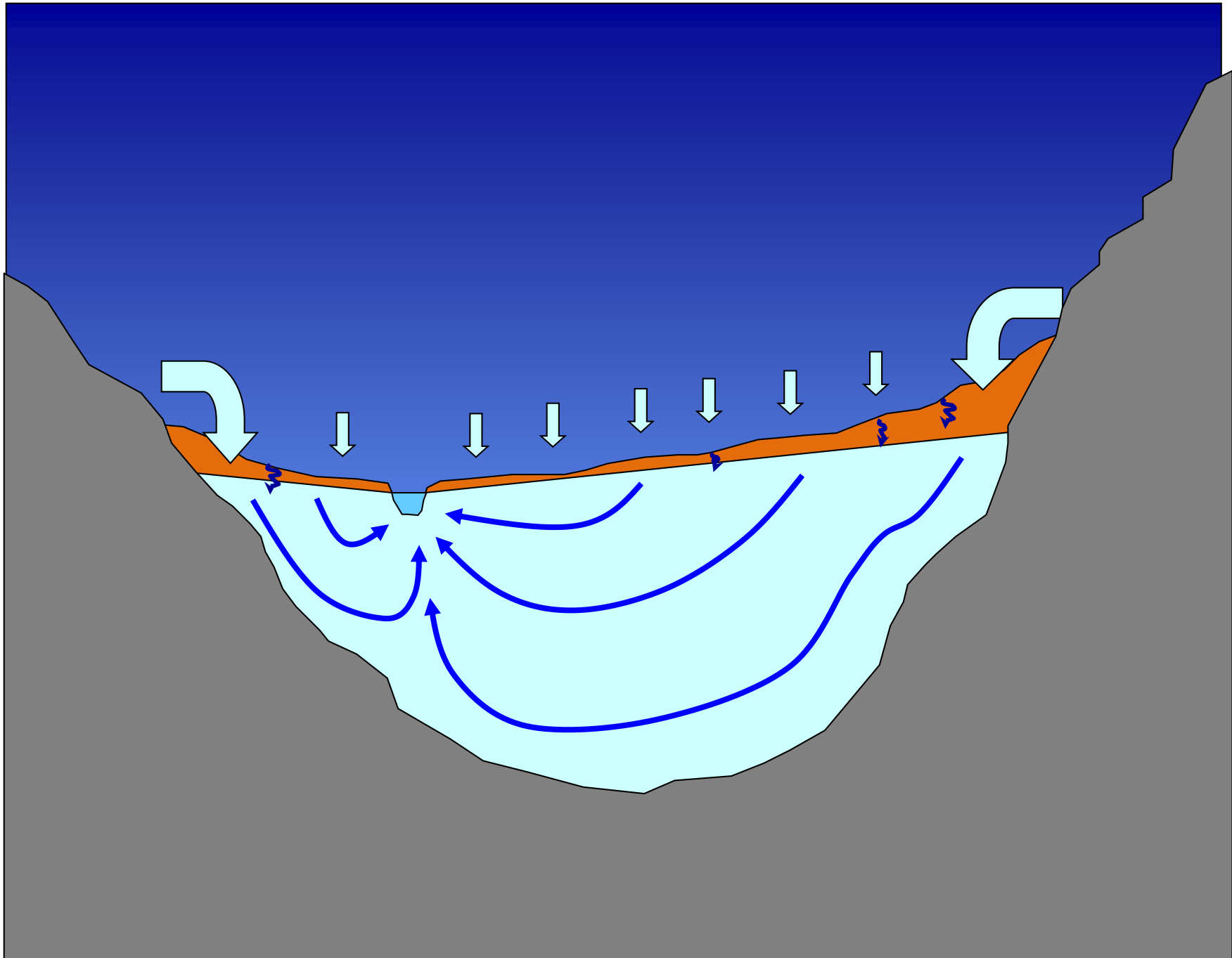


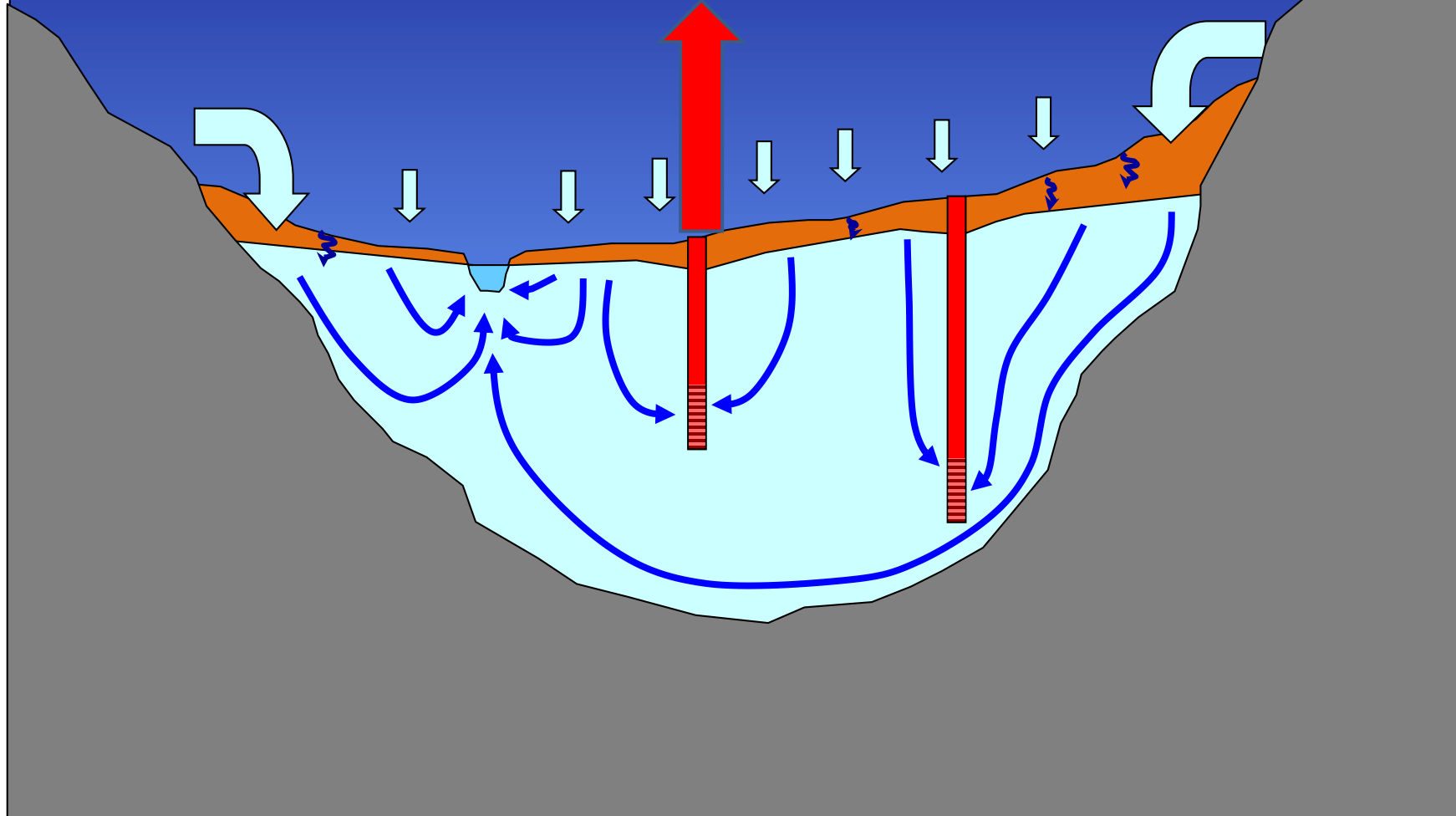
Deep-Rooted Vegetation Communities

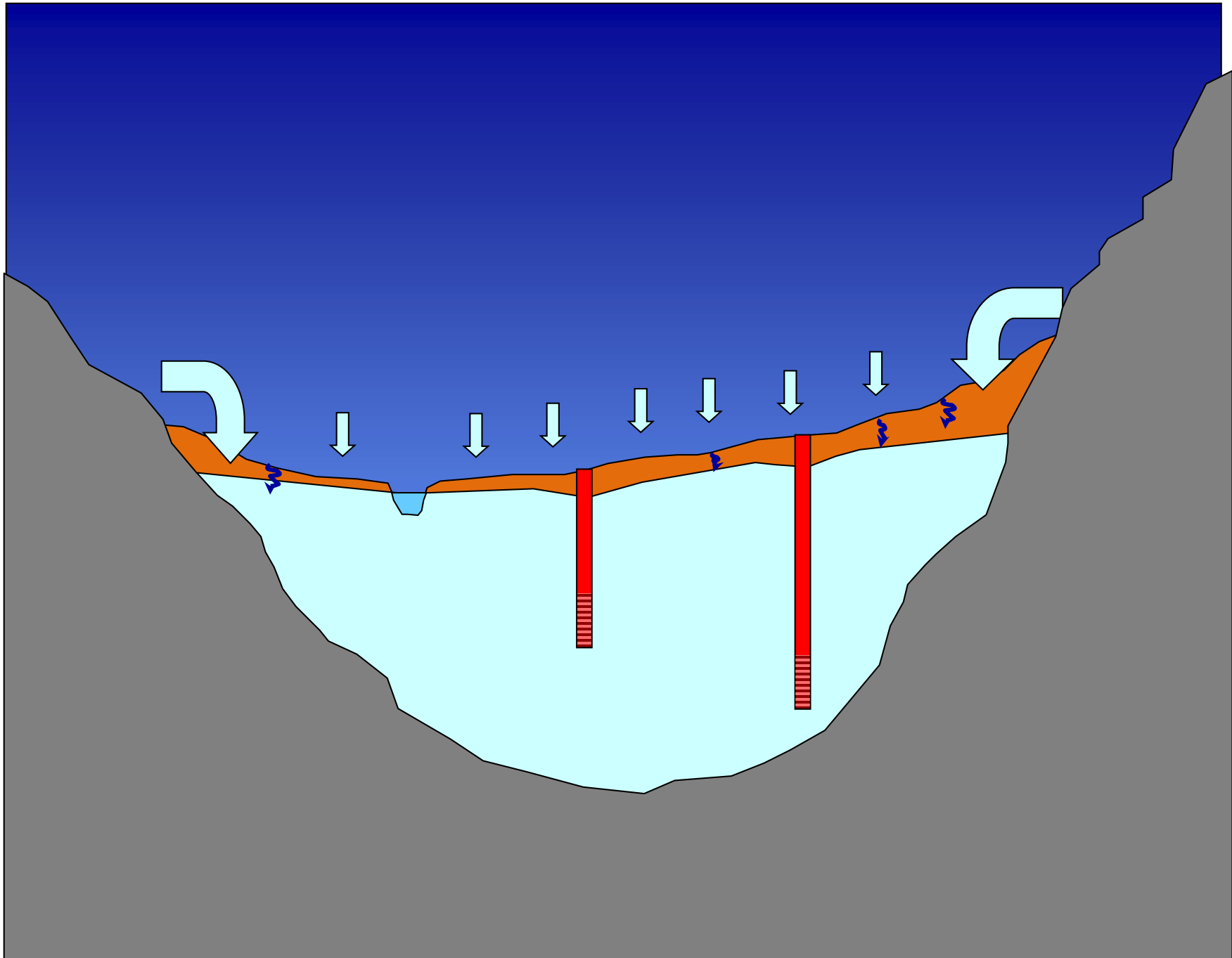


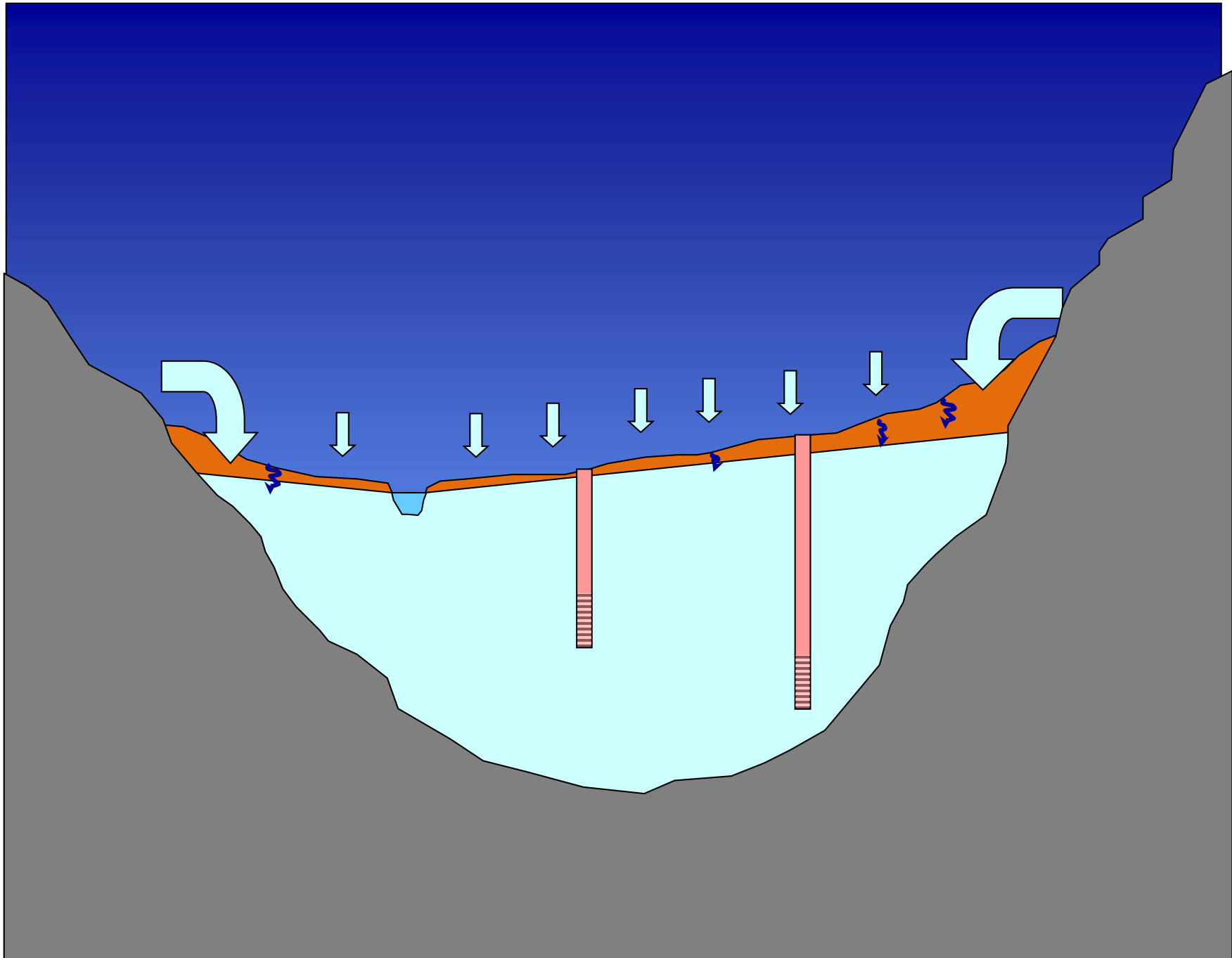


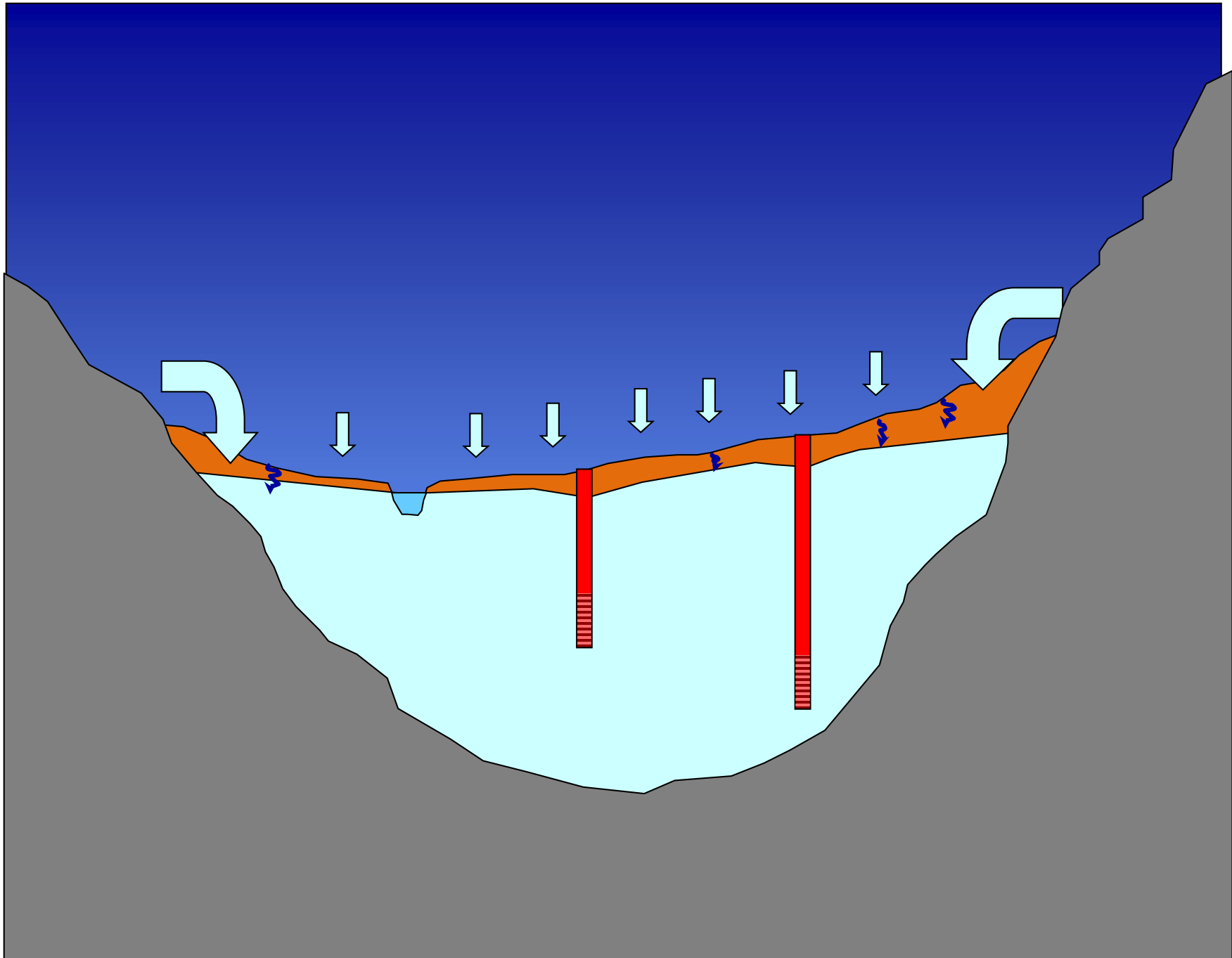
Vernal Pools

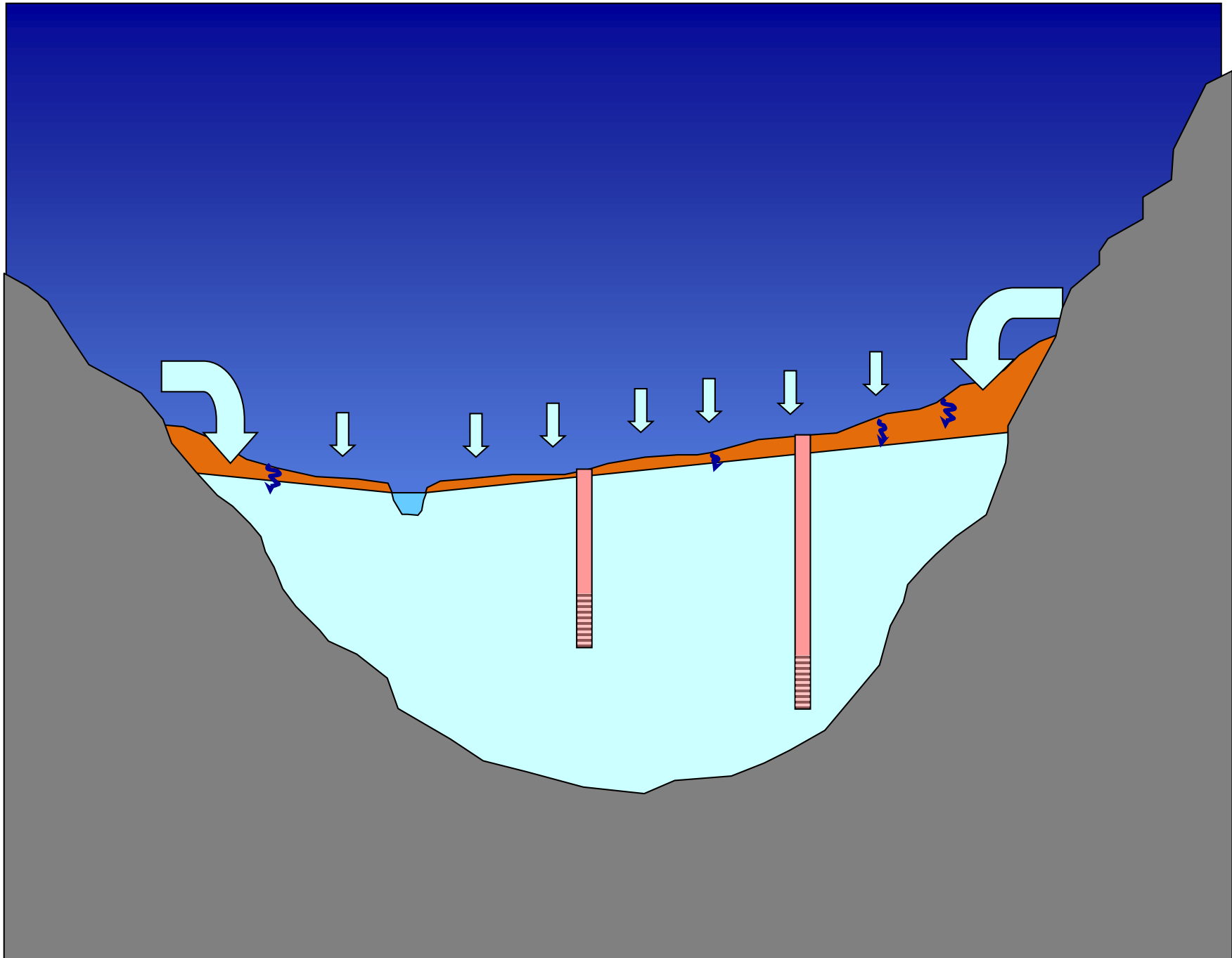


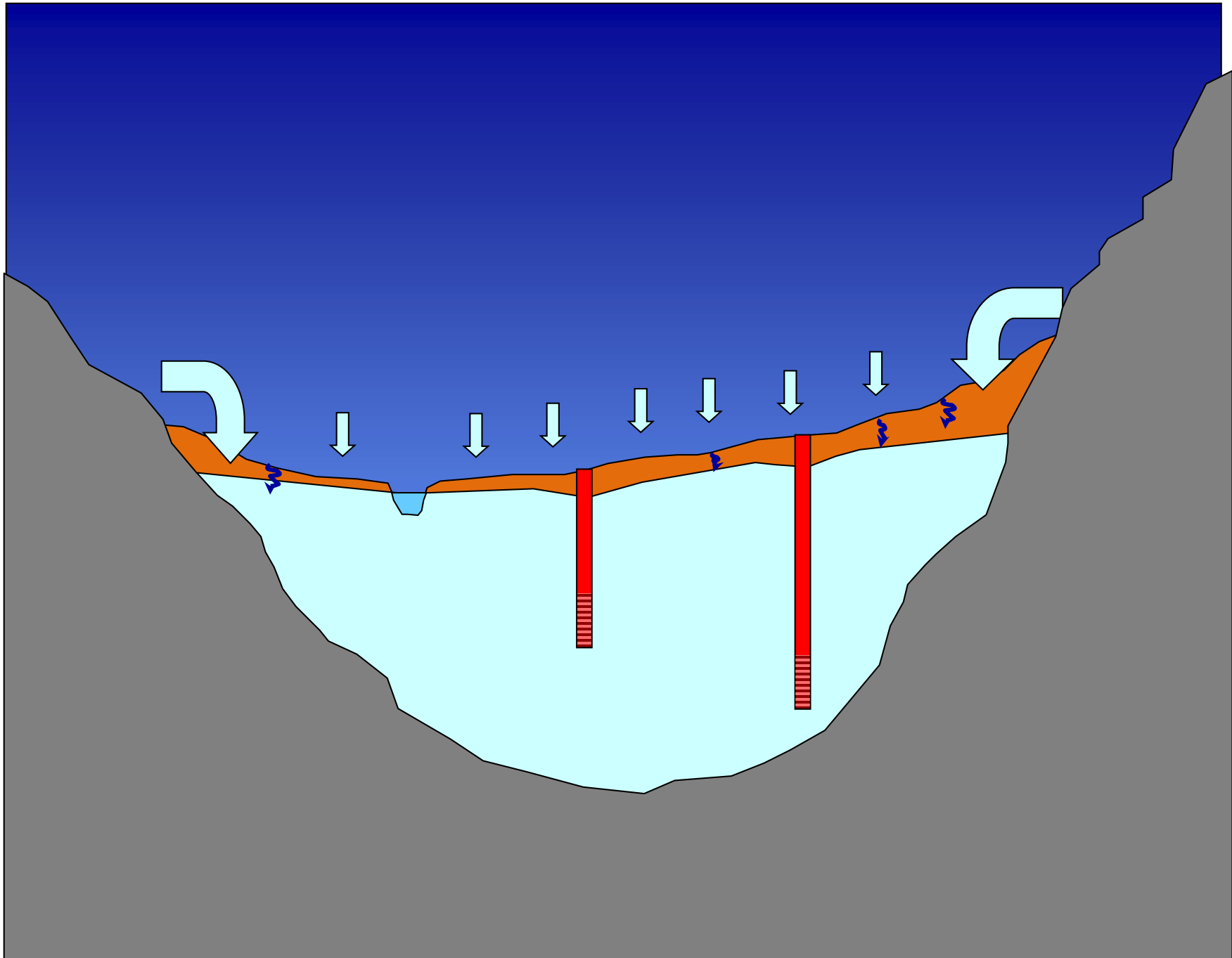


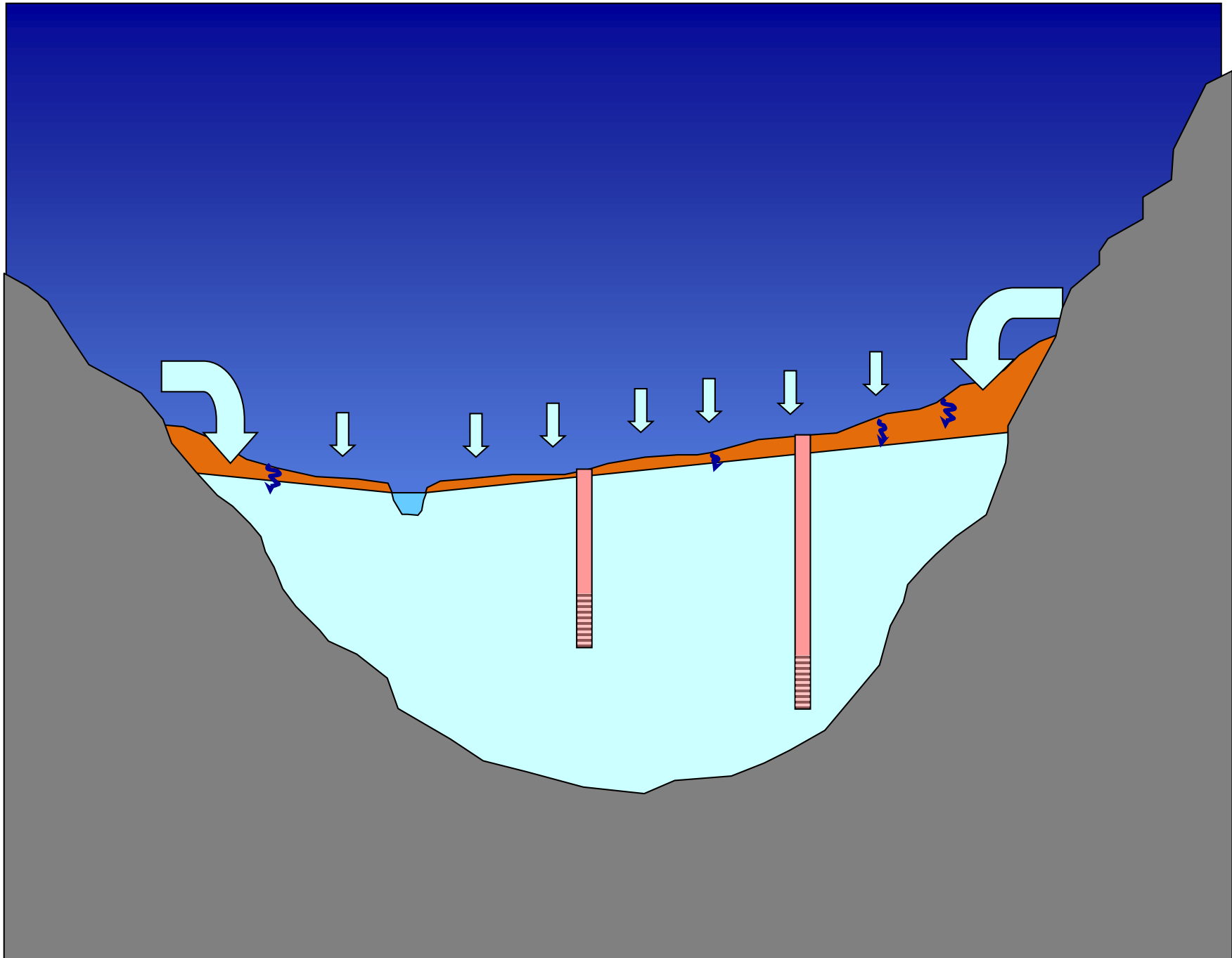


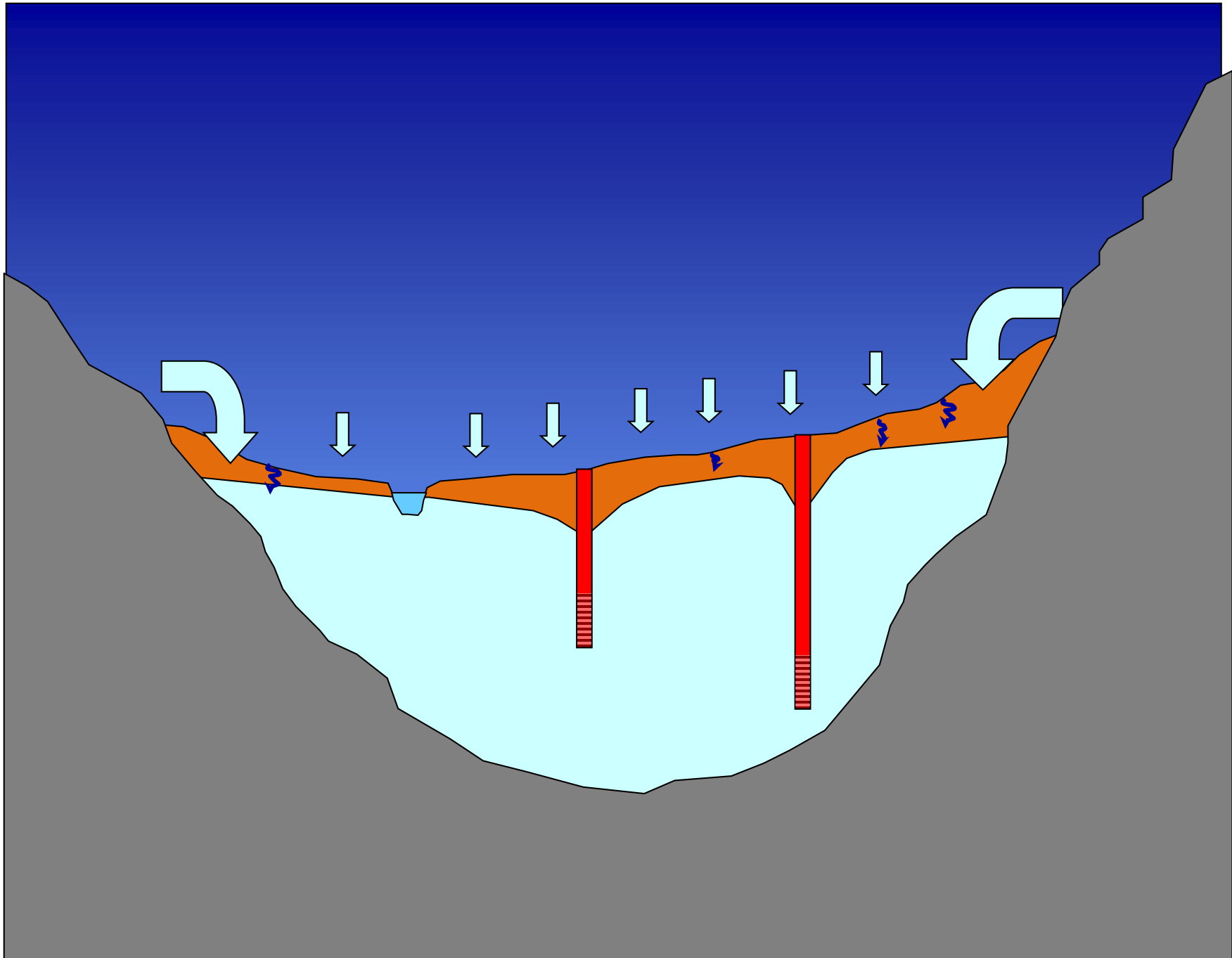




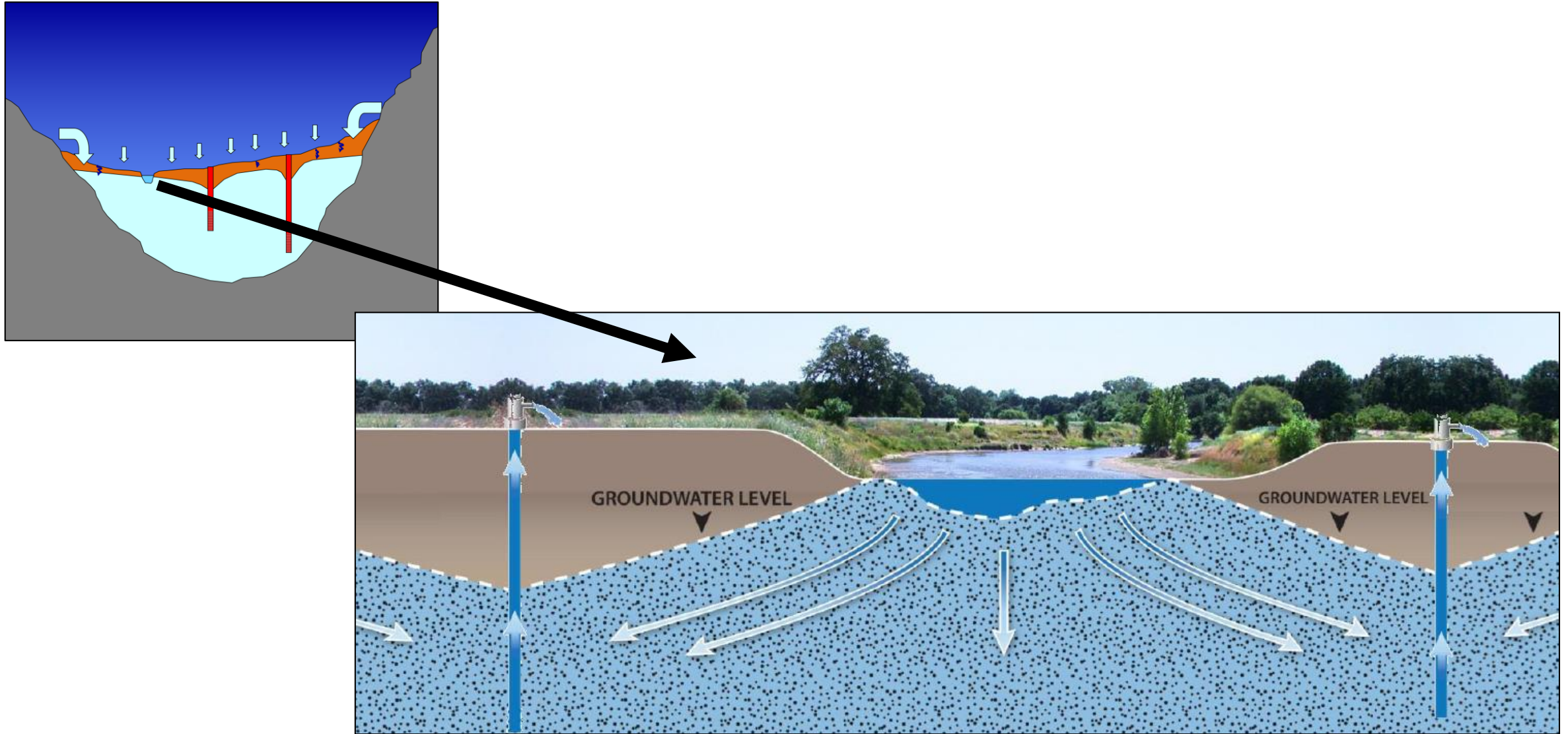


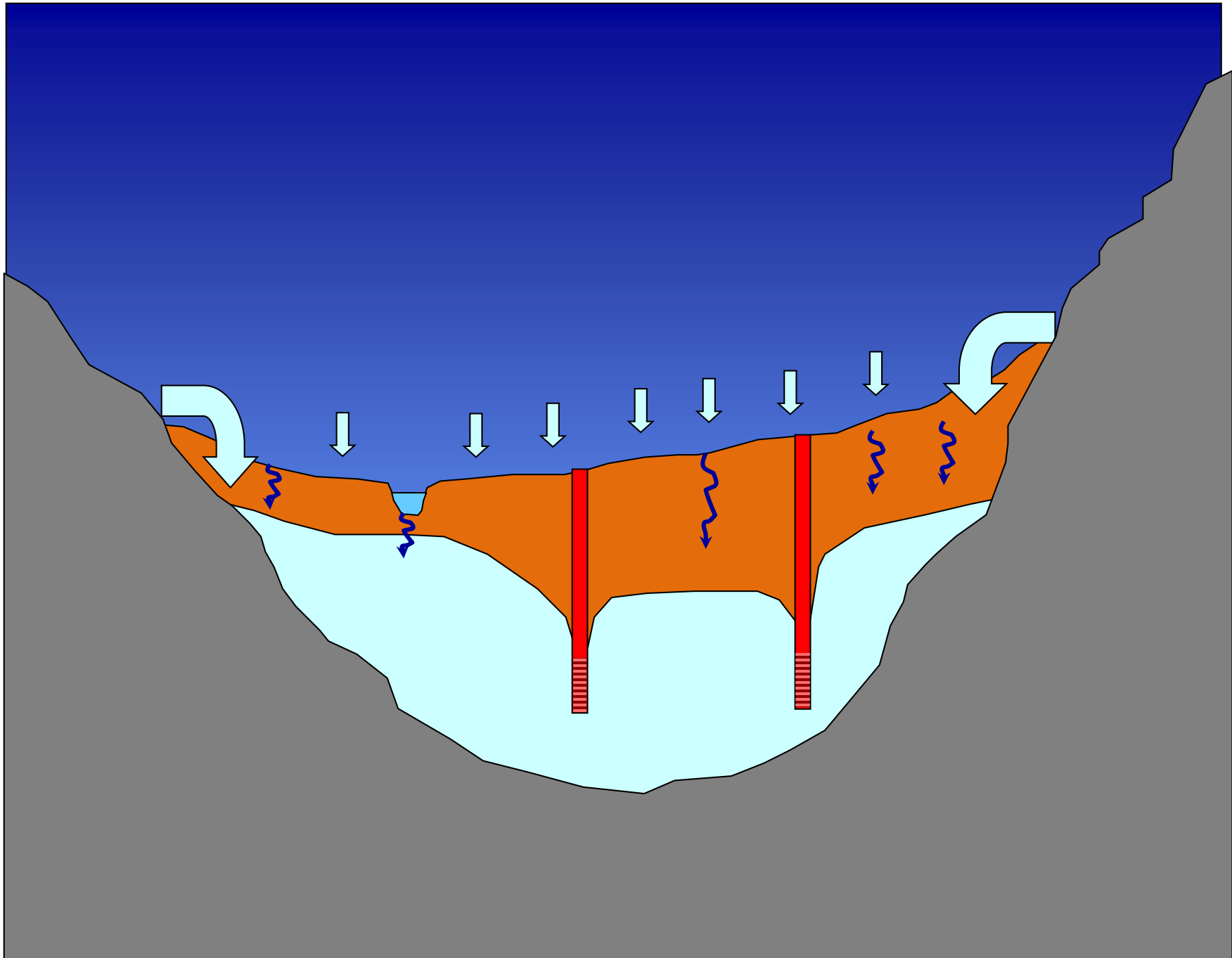


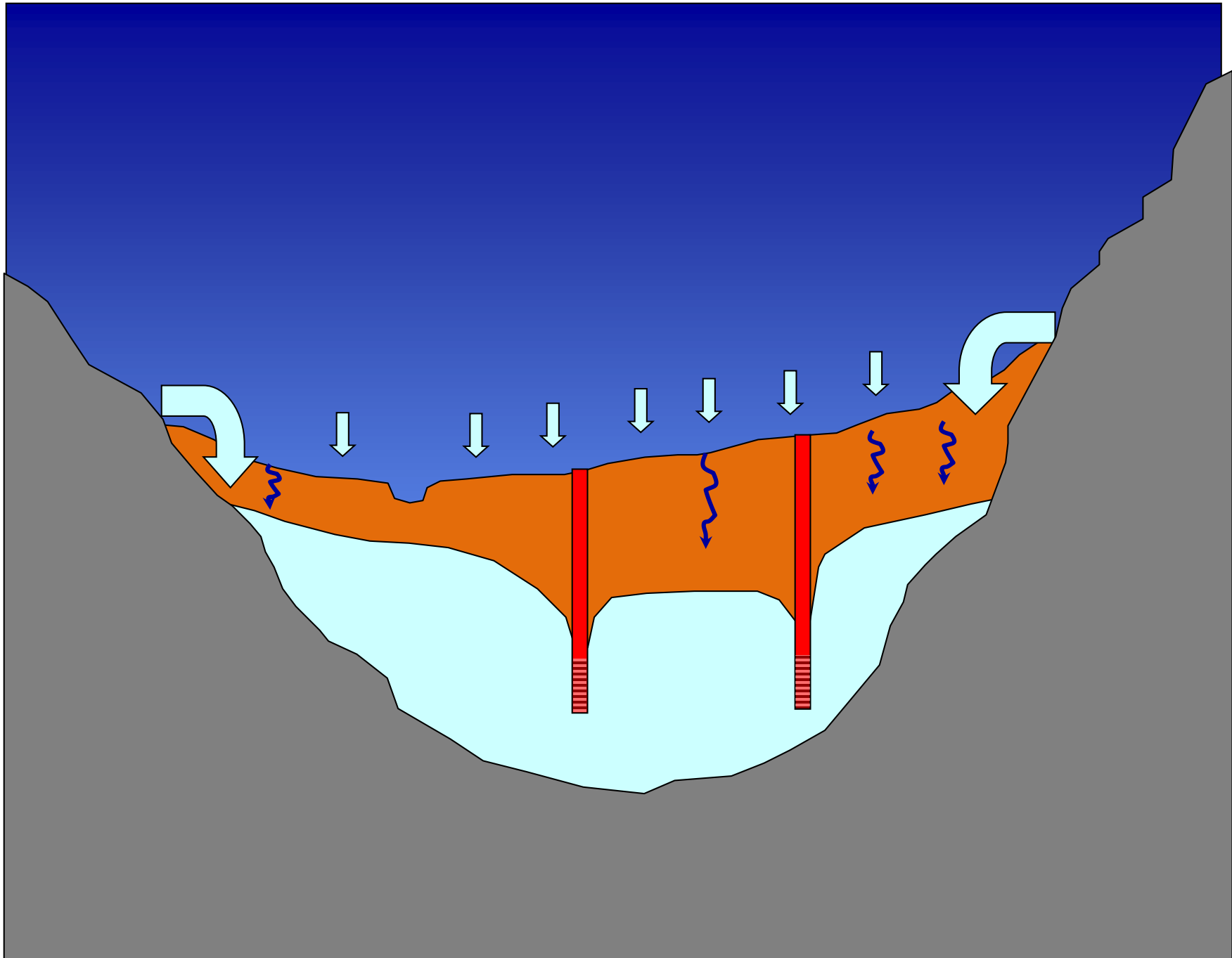




Streamflow Depletion from Groundwater Pumping

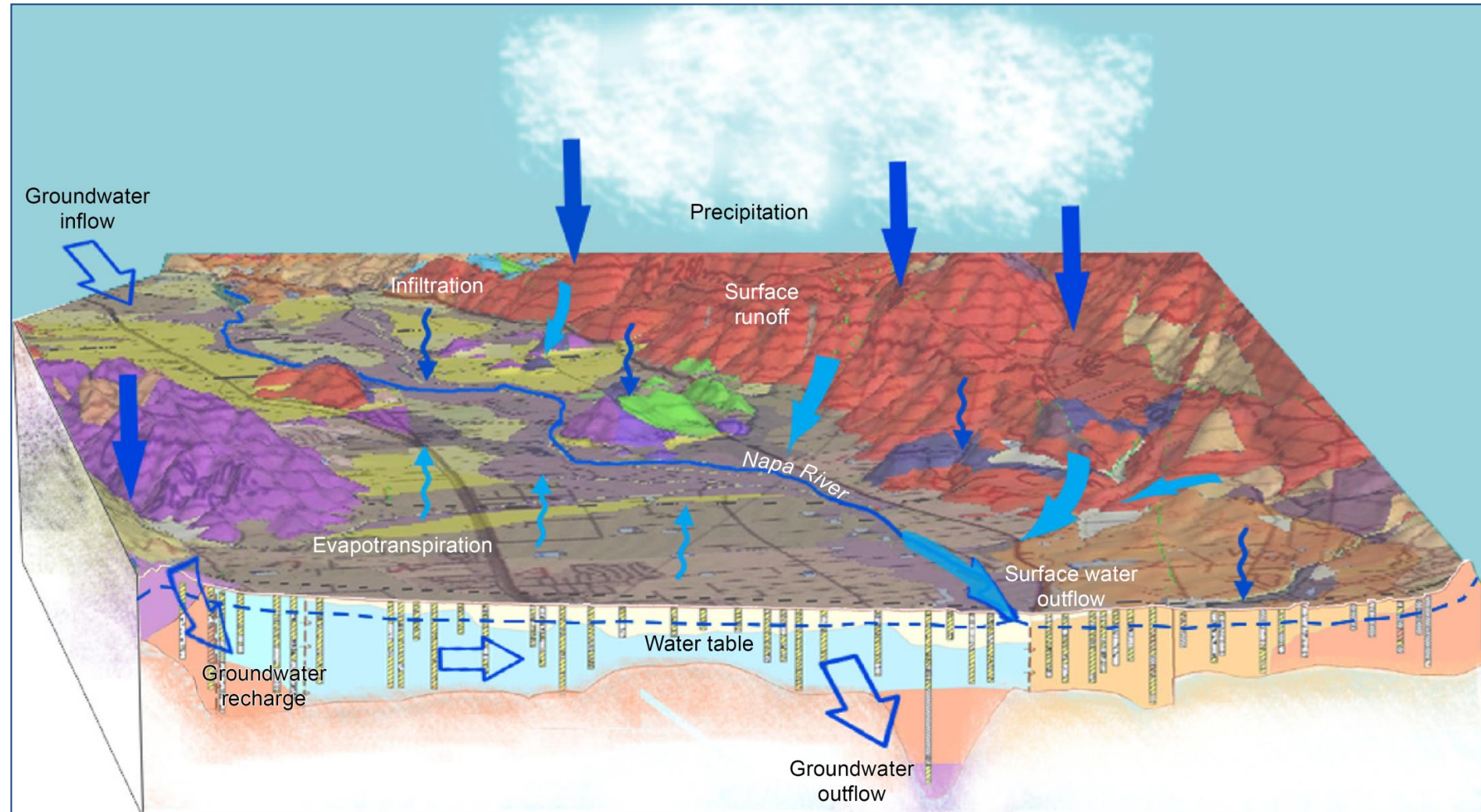






Napa Valley Conceptual Hydrogeologic Model

- Groundwater occurs in all four primary formations
- Precipitation and streambed infiltration primary source of groundwater recharge
- Primary groundwater discharge:
 - Pumping
 - ET
 - Baseflow
- Napa River interconnected with groundwater



GROUNDWATER LEVEL MONITORING, 2019

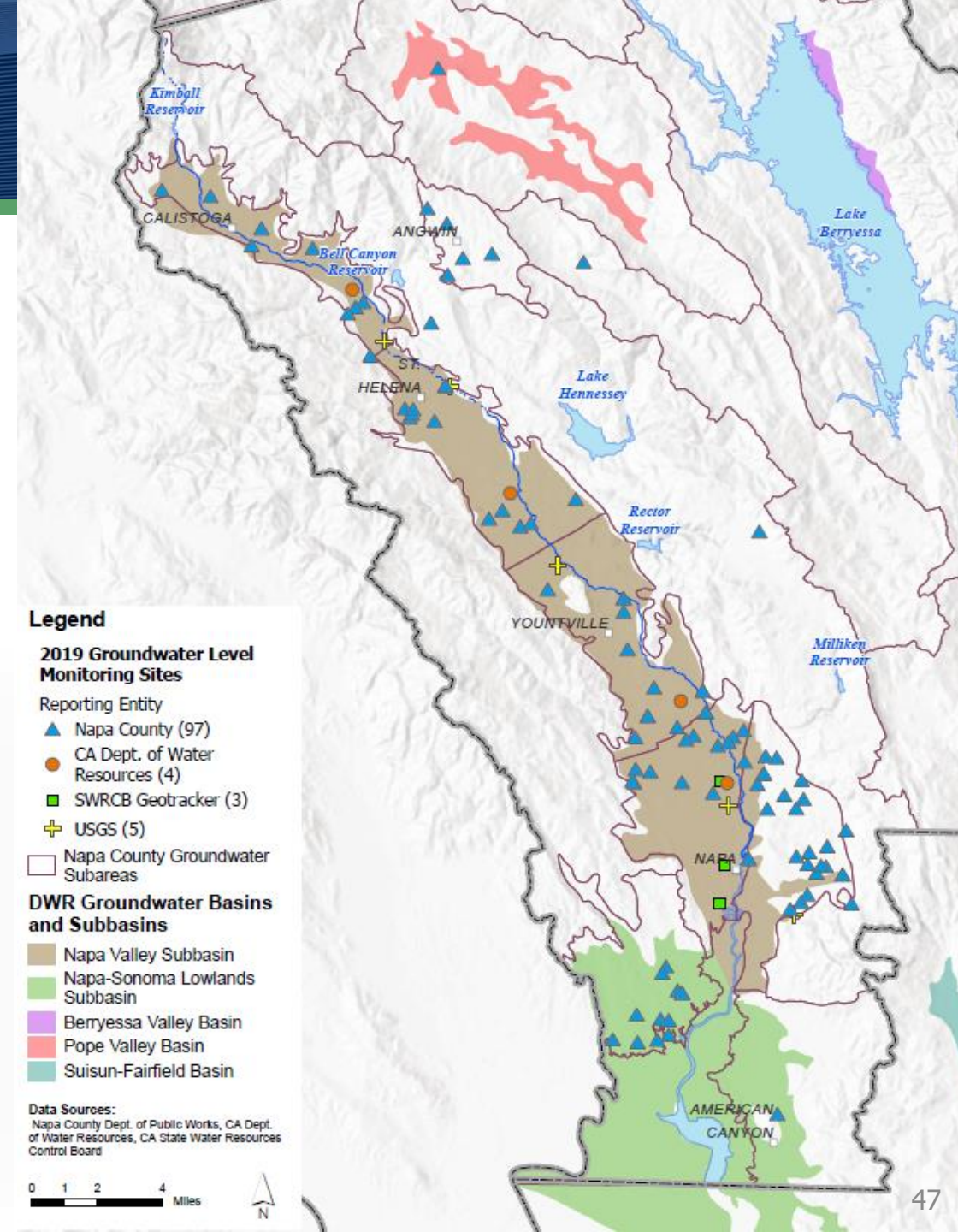
▲ Napa Co., 97 (including 10 SW/GW)

● DWR, 4

■ SWRCB GeoTracker, 3

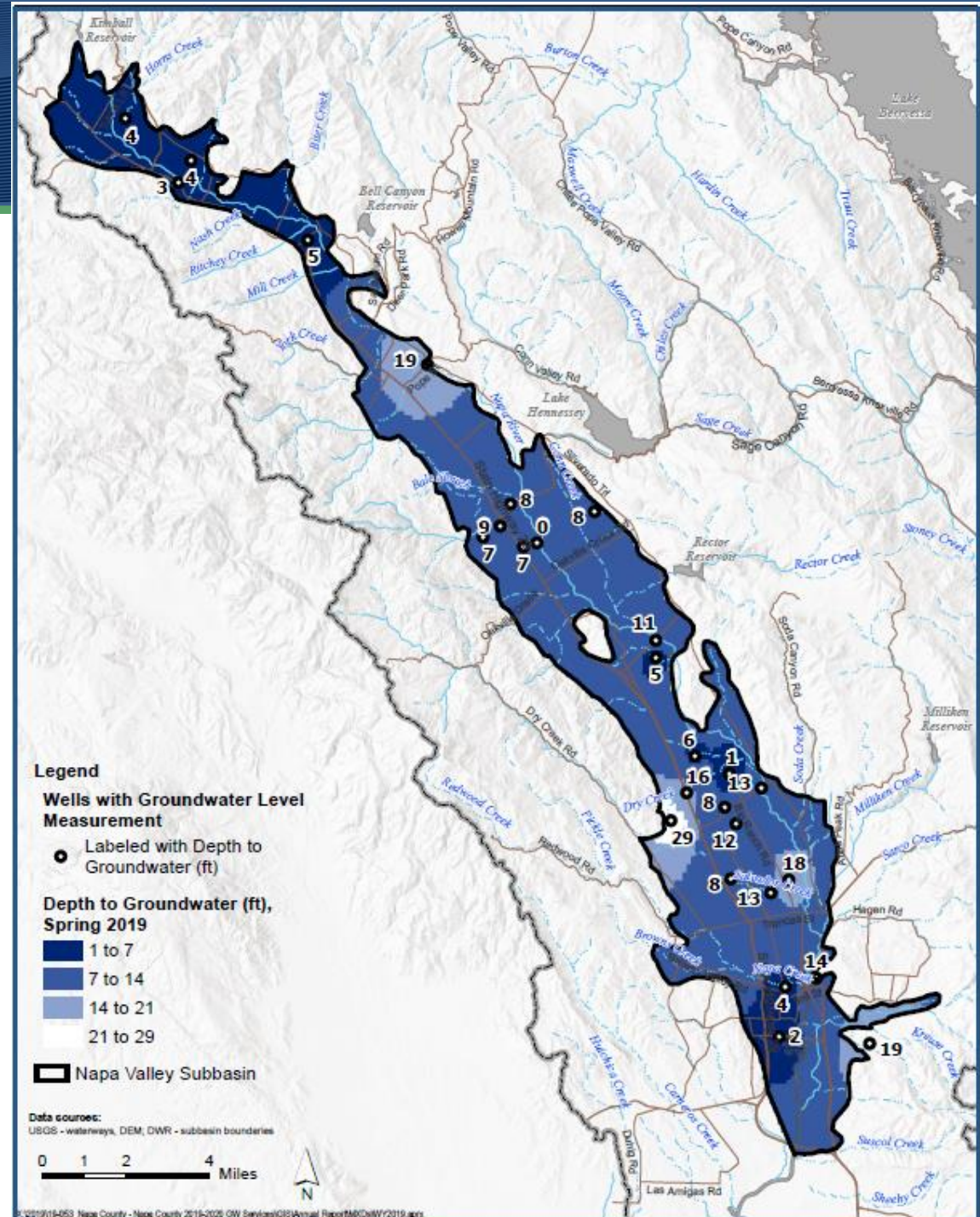
+ USGS, 5

Total = 109



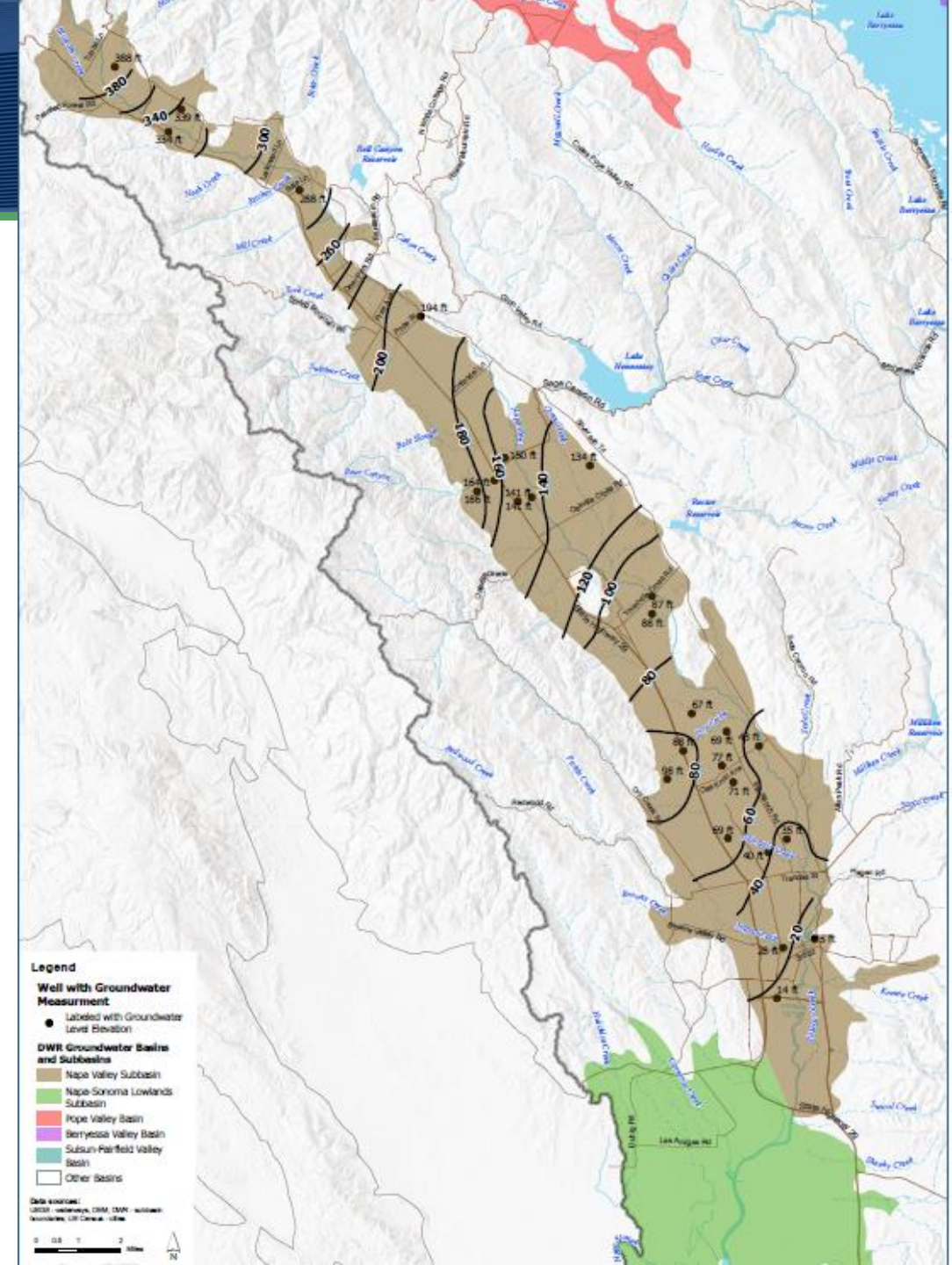
DEPTH TO GROUNDWATER

- Very Shallow Depth to Groundwater

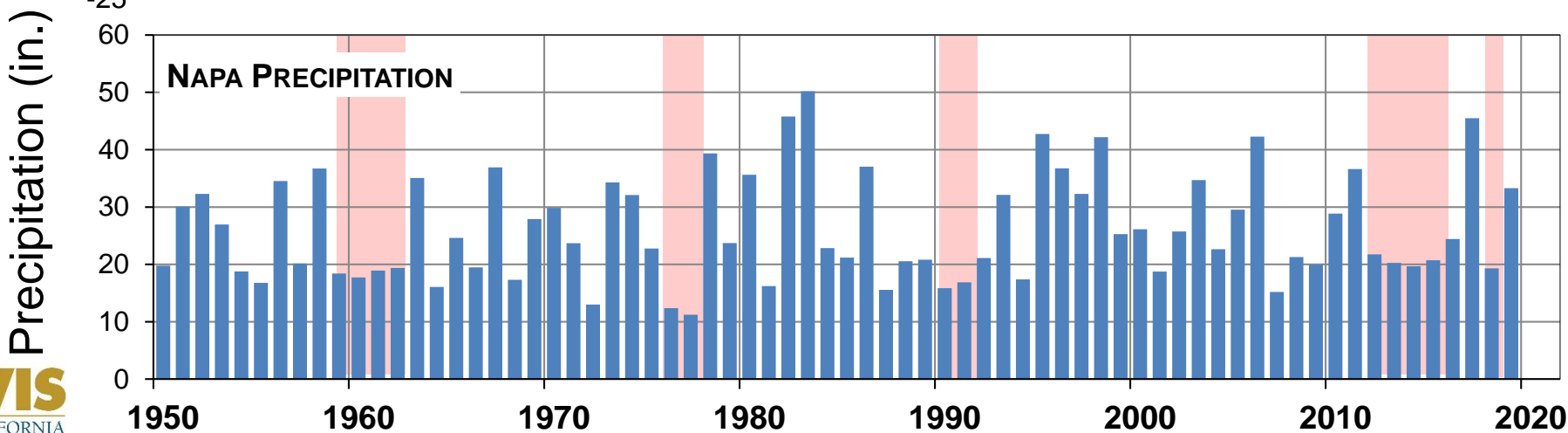
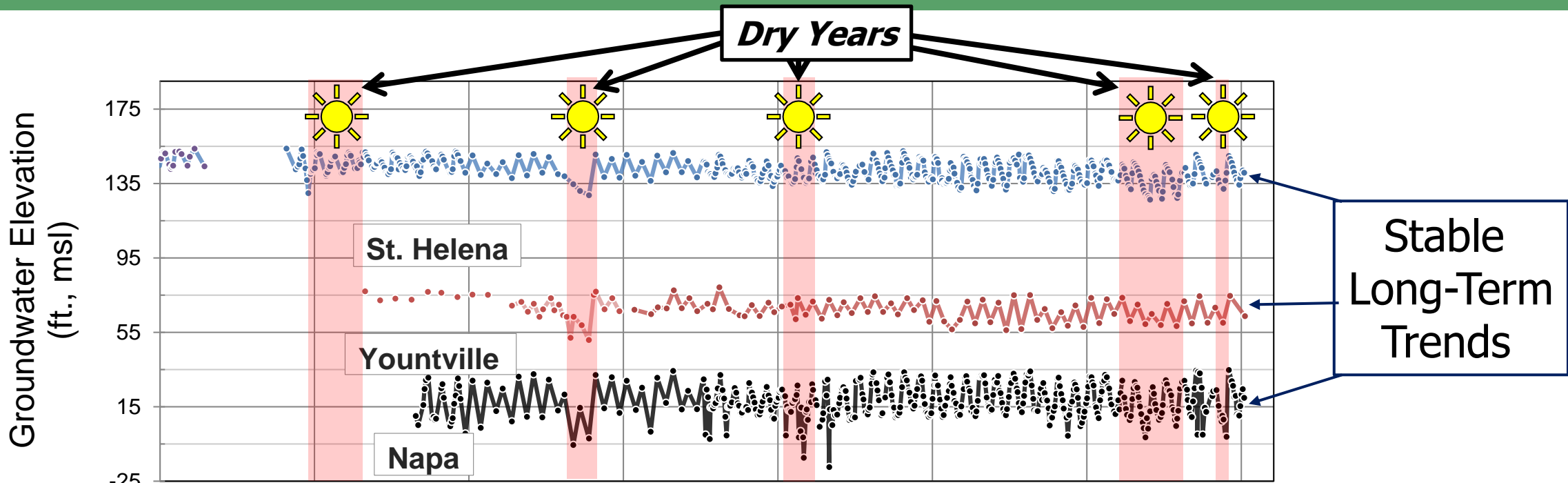


GROUNDWATER FLOW DIRECTIONS

Spring 2019



GROUNDWATER CONDITIONS: NAPA VALLEY SUBBASIN

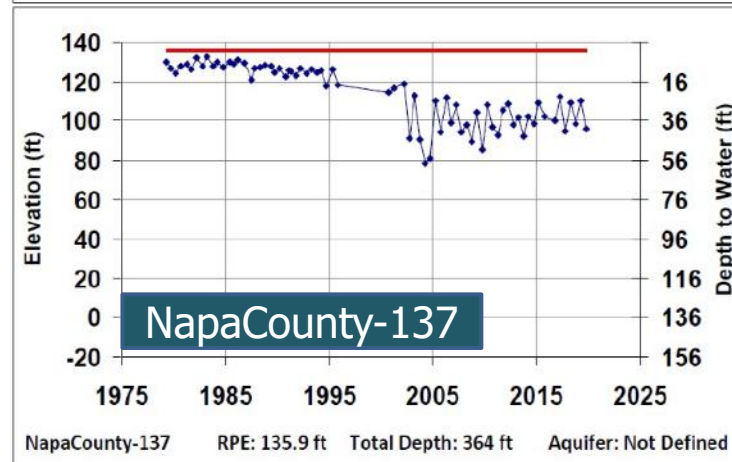
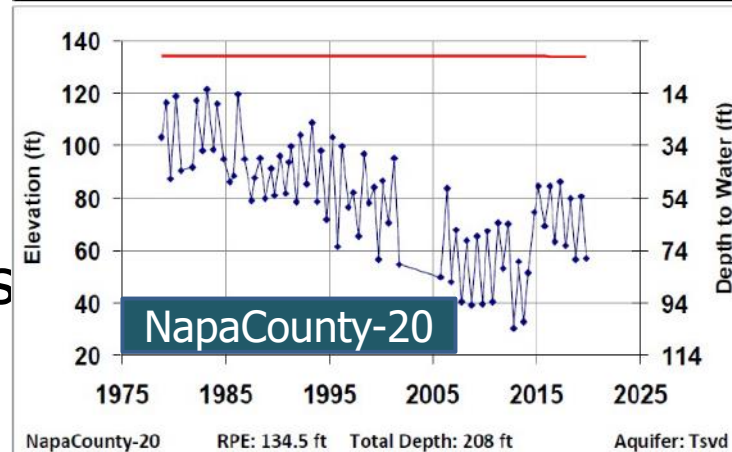
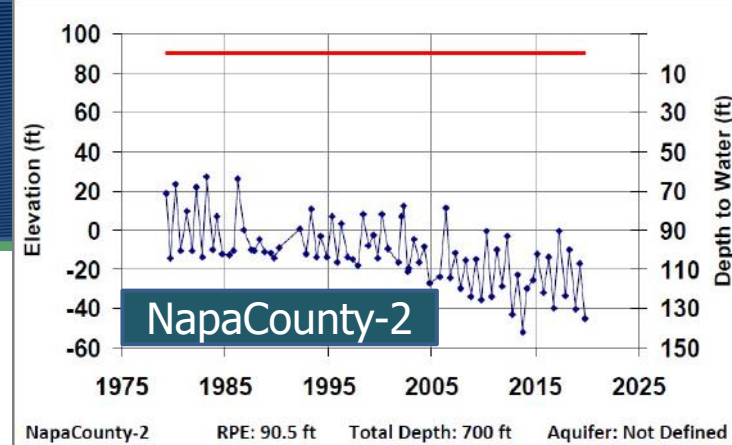


**Median Annual
Total
Precipitation:
23.27 in.**

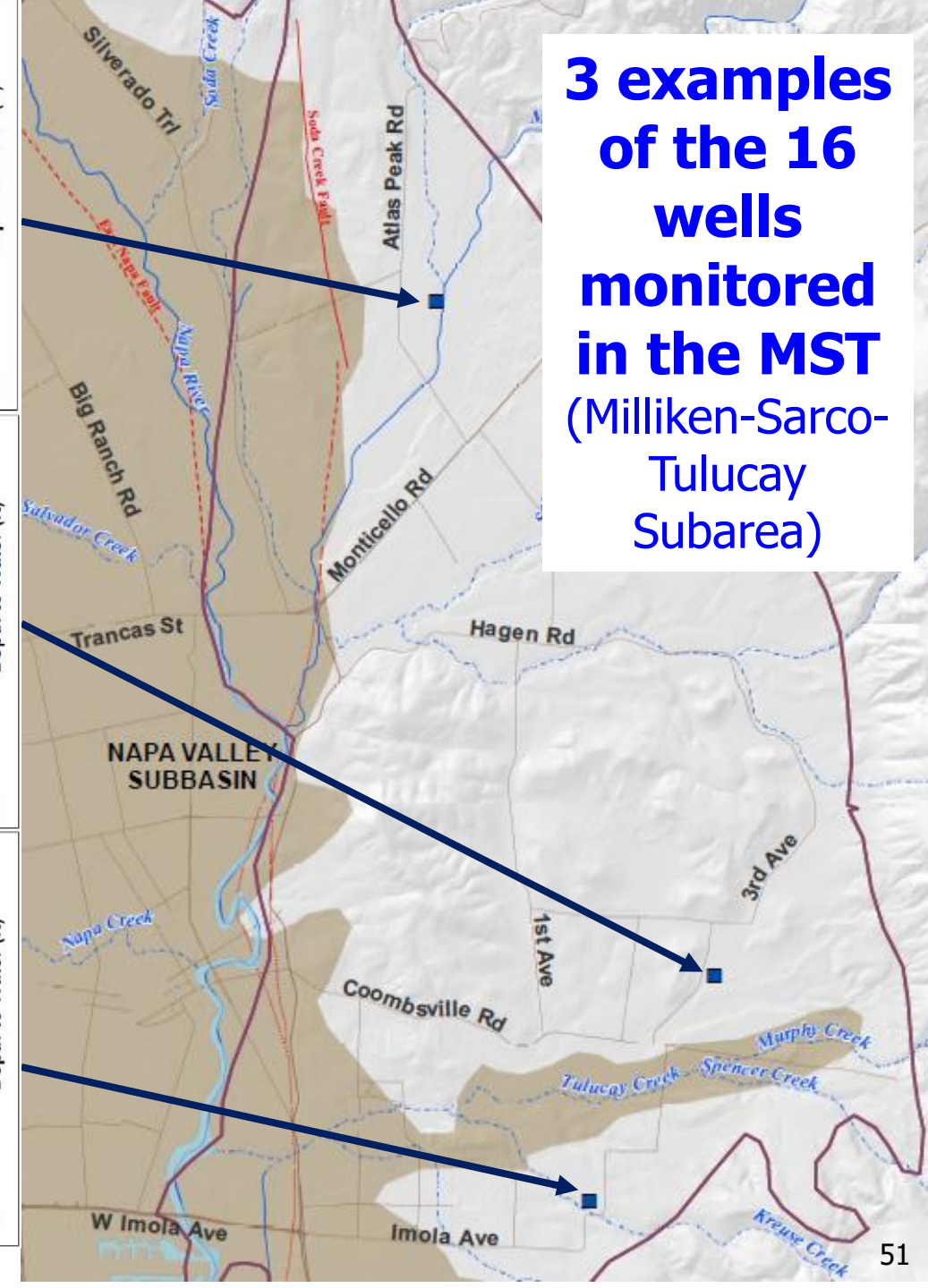
**2019 (Wet)=
33.29 in.**

MST Hydrographs

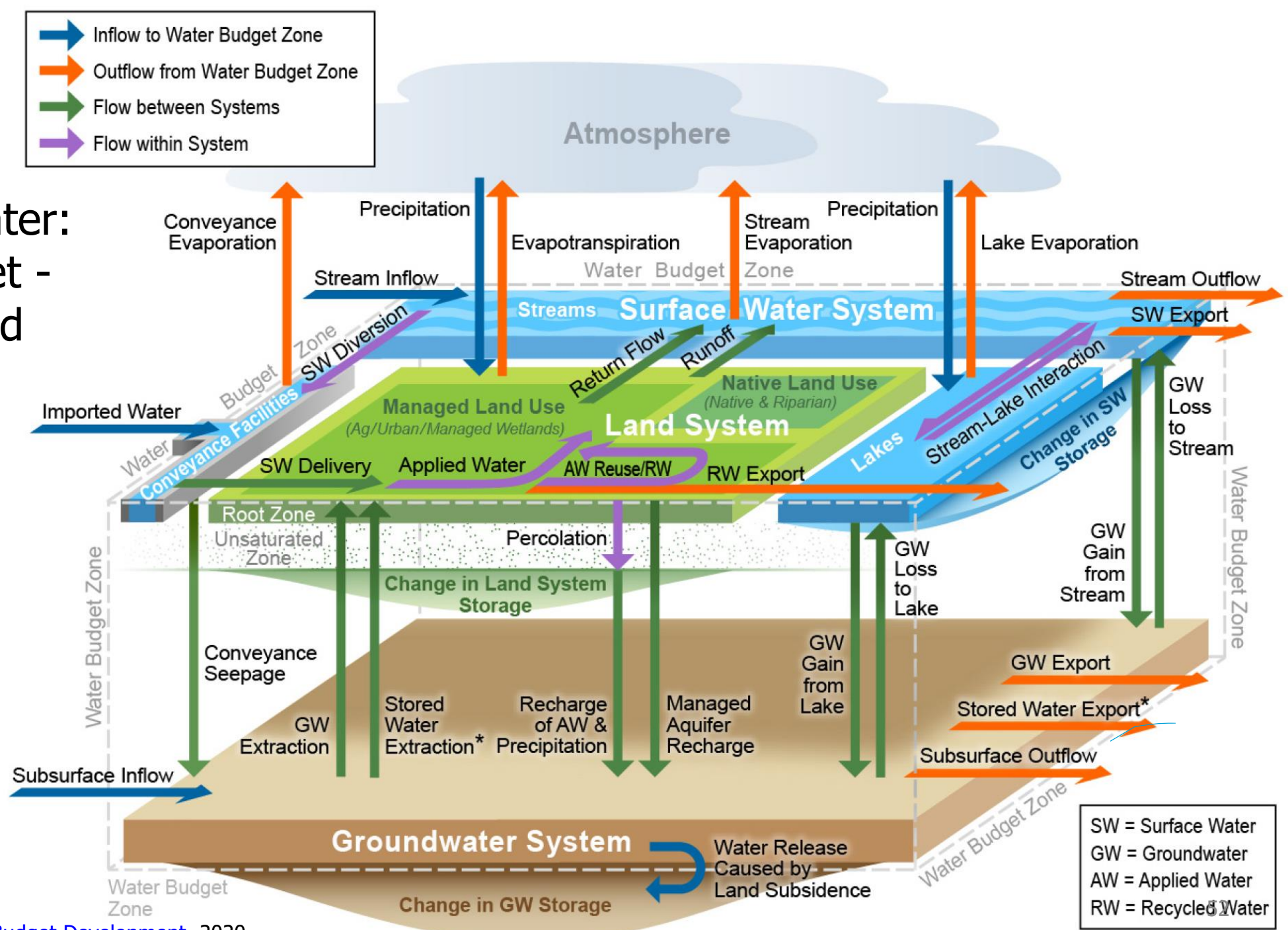
- Monitoring data available for about four decades
- Recognized historical declines
- Stable groundwater levels since about 2009
- Some monitoring wells show recent increase in groundwater levels



**3 examples
of the 16
wells
monitored
in the MST
(Milliken-Sarco-
Tulucay
Subarea)**



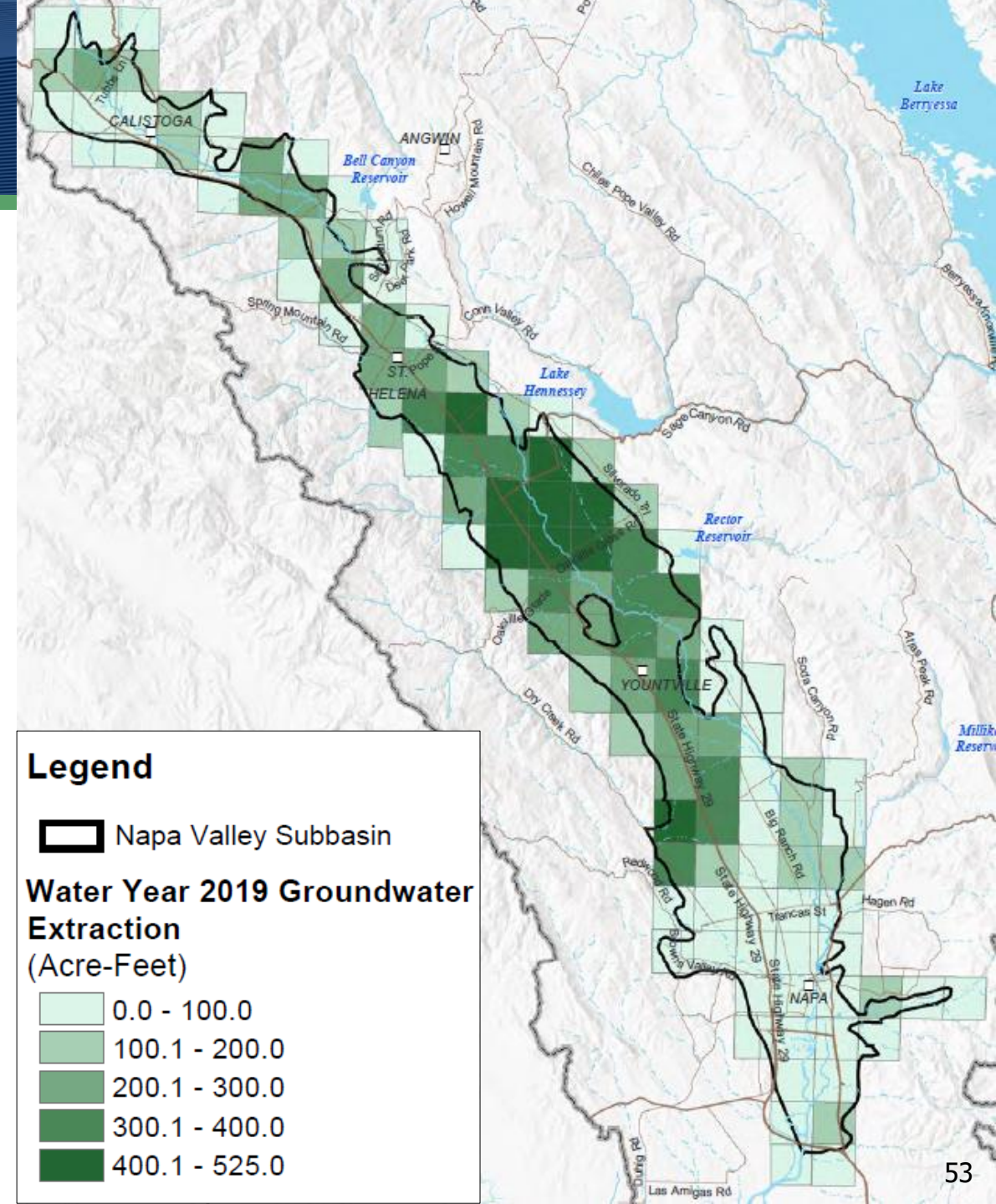
Accounting for Water: The Water Budget - Components and Fluxes



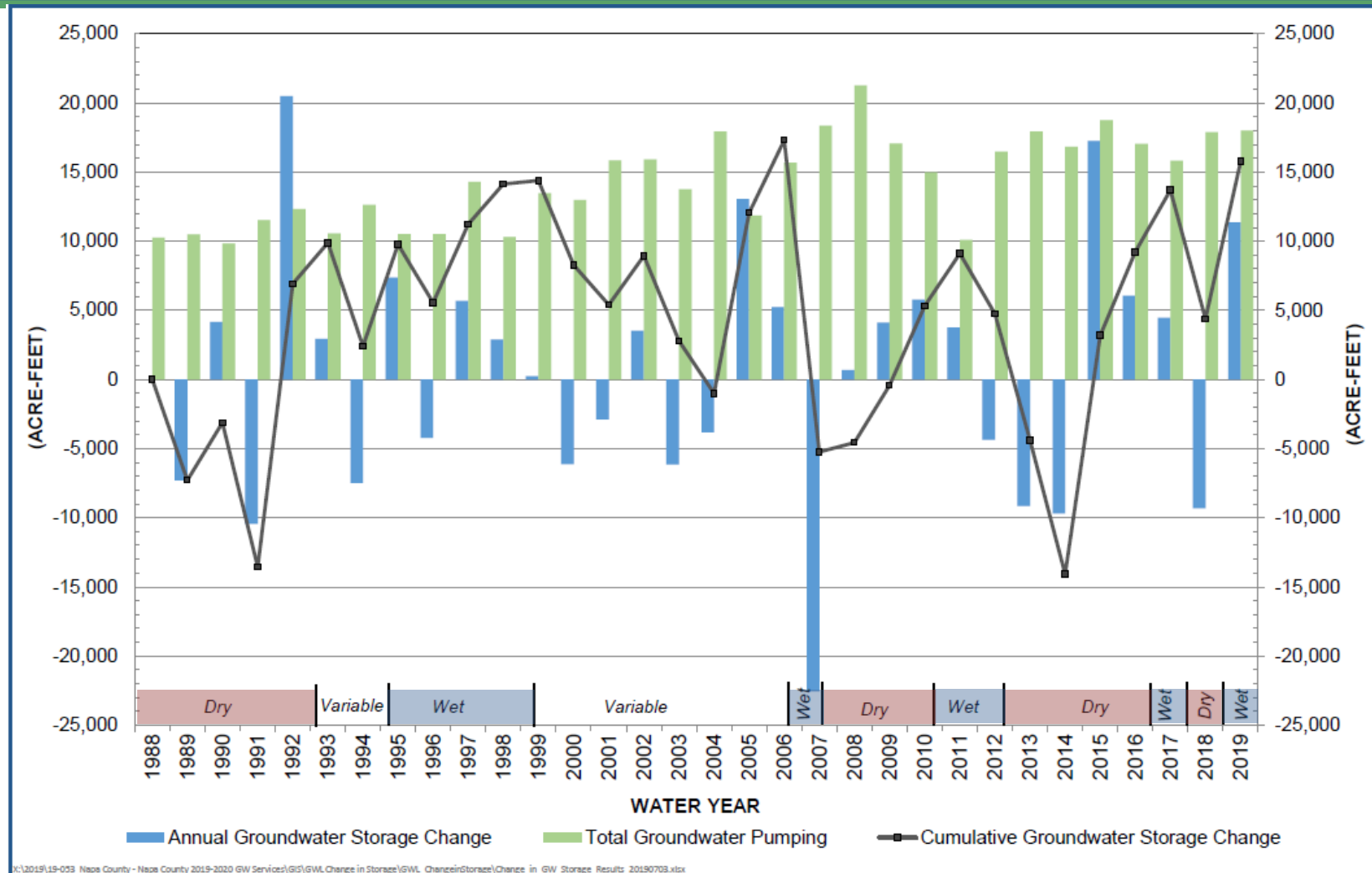
Groundwater Pumping, 2019 (Acre-feet)

| | Acre-feet |
|----------------------------|-----------|
| Ag (vines and other) | 12,656 |
| Municipal | 261 |
| Unincorporated Domestic | 357 |
| Unincorporated Landscaping | 3,442 |
| Unincorporated Wineries | 1,233 |

TOTAL = 17,949 Acre-feet



GROUNDWATER STORAGE CHANGES: WATER YEARS 1988-2019



Summary of Groundwater Pumping and Change in Groundwater Storage

| Description | (Acre Feet) |
|---|------------------|
| 2019 Groundwater Pumping | 17,949 |
| Avg. Annual Landscape Recharge (1988-2015) | 69,000 |
| Sustainable Yield (Estimated Range) | 17,000 to 20,000 |
| 2019: Annual Storage Change | +11,374 |
| 1988-2019: Cumulative Annual Storage Change | +15,762 |

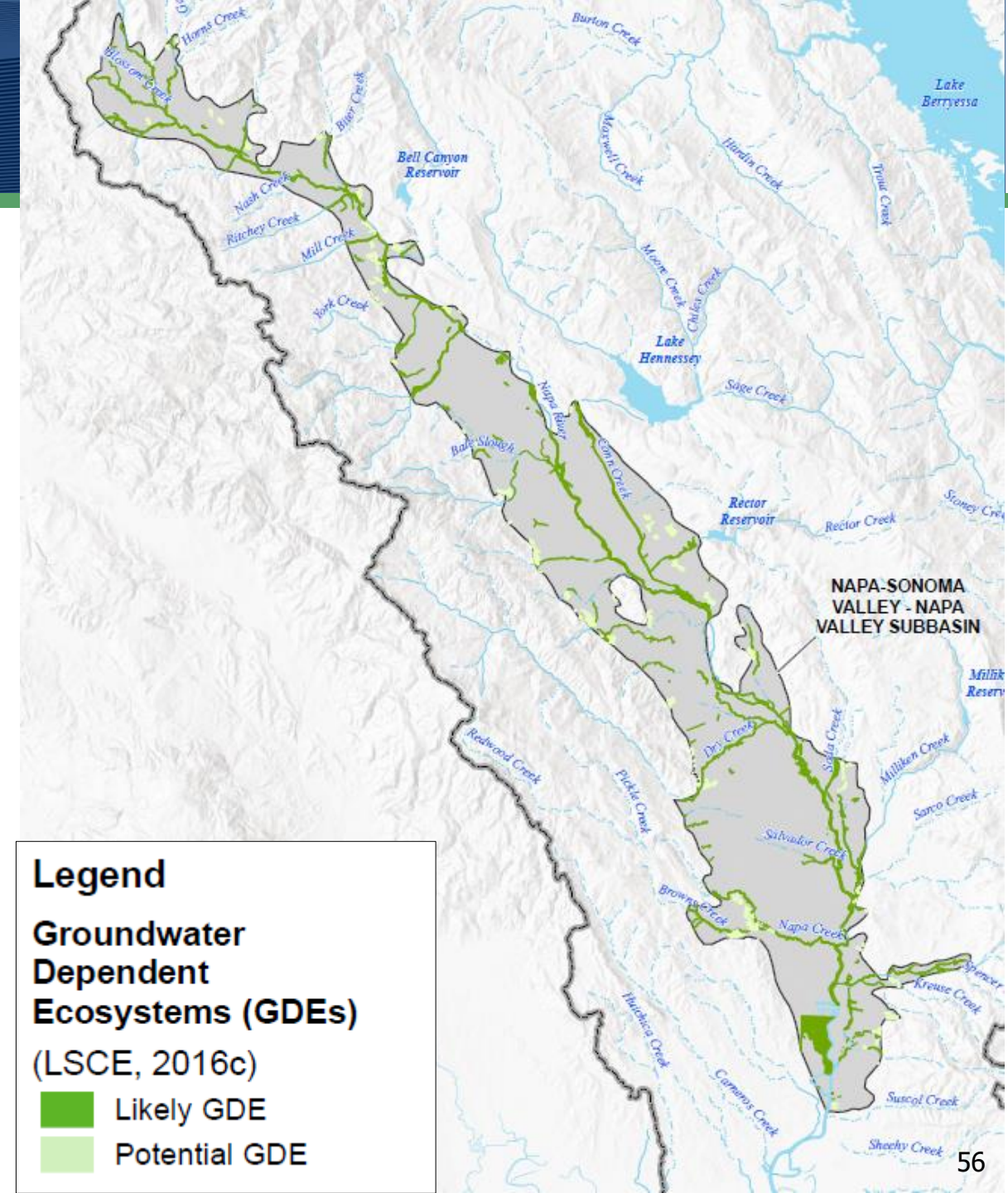
Excerpt Napa SGMA Sustainability Goal (2016):

*.....[Everyone] in the county will integrate stewardship principles and measures in groundwater development, use, and management to protect economic, environmental, and social benefits and **maintain groundwater sustainability indefinitely without causing undesirable results**, including unacceptable economic, environmental, or social consequences.*

Groundwater Dependent Ecosystems Water Use, 2019 (Acre-feet)

- GDEs are an important groundwater user and component of the water budget
- GDE Acreage: 2,663 acres

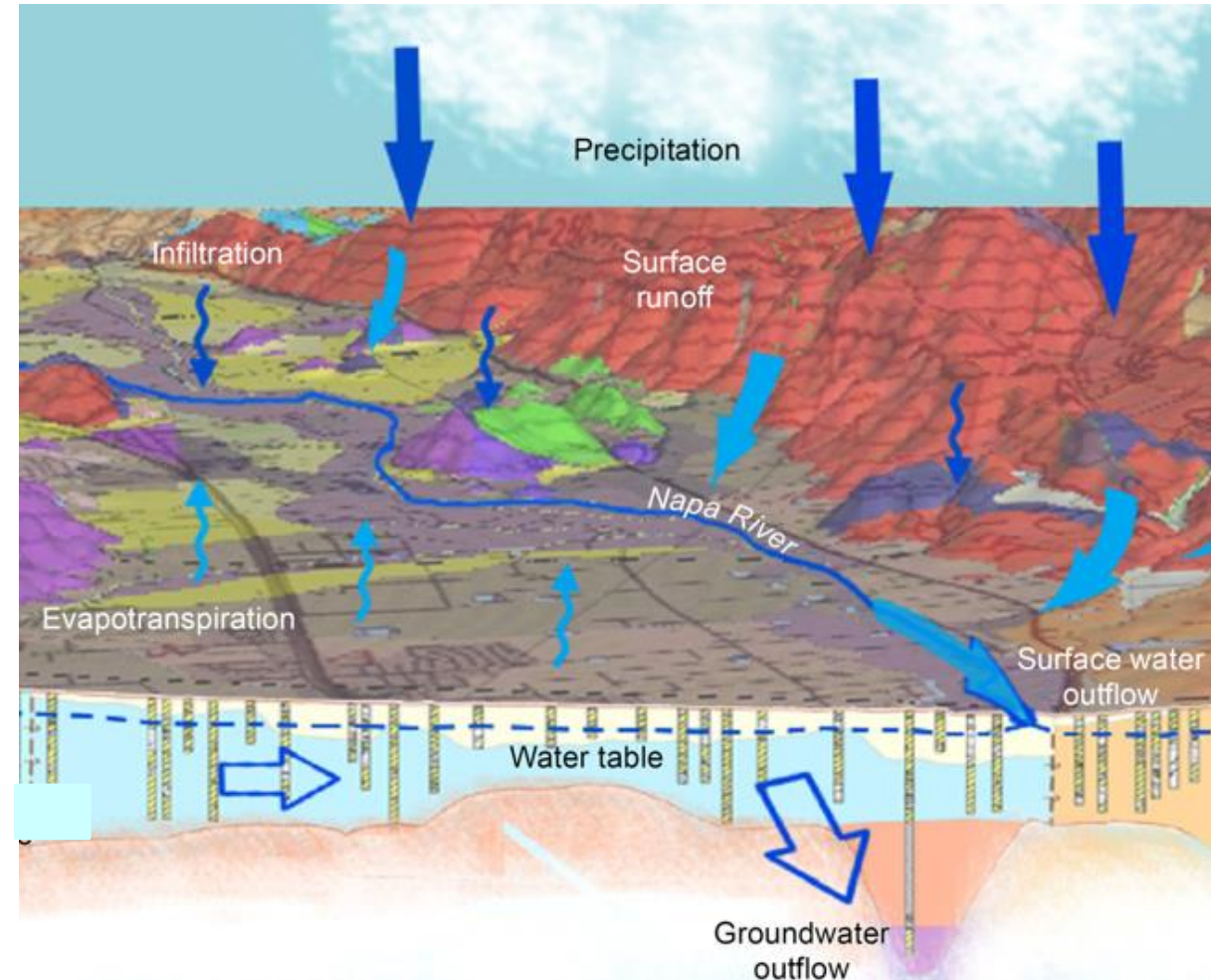
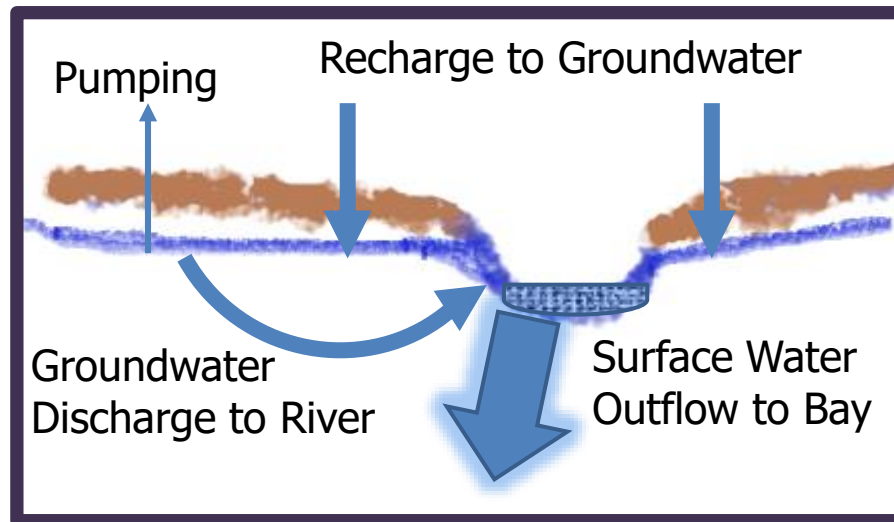
TOTAL= 4,924 Acre-feet



FUTURE STRATEGIES FOR SUSTAINABILITY & RESILIENCY

- Avg. Recharge to Groundwater (69,000 AF/yr)
- Pumping Dry Year (18,000 Af/yr)
- Avg. Discharge from Napa River to San Pablo Bay (176,000 AF/yr)

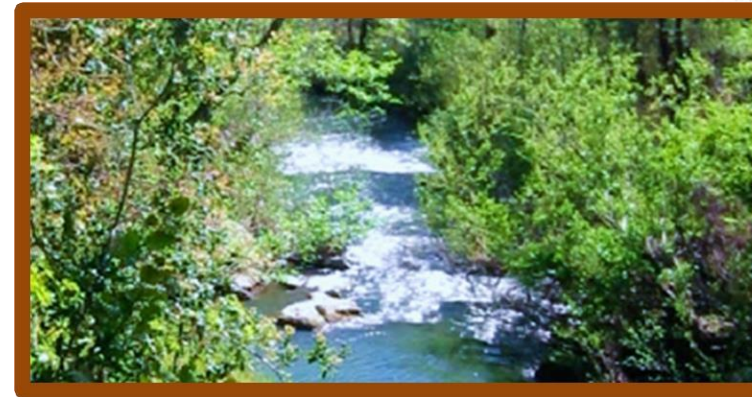
How can we utilize the natural/contemporary landscape to retain more water in the basin?



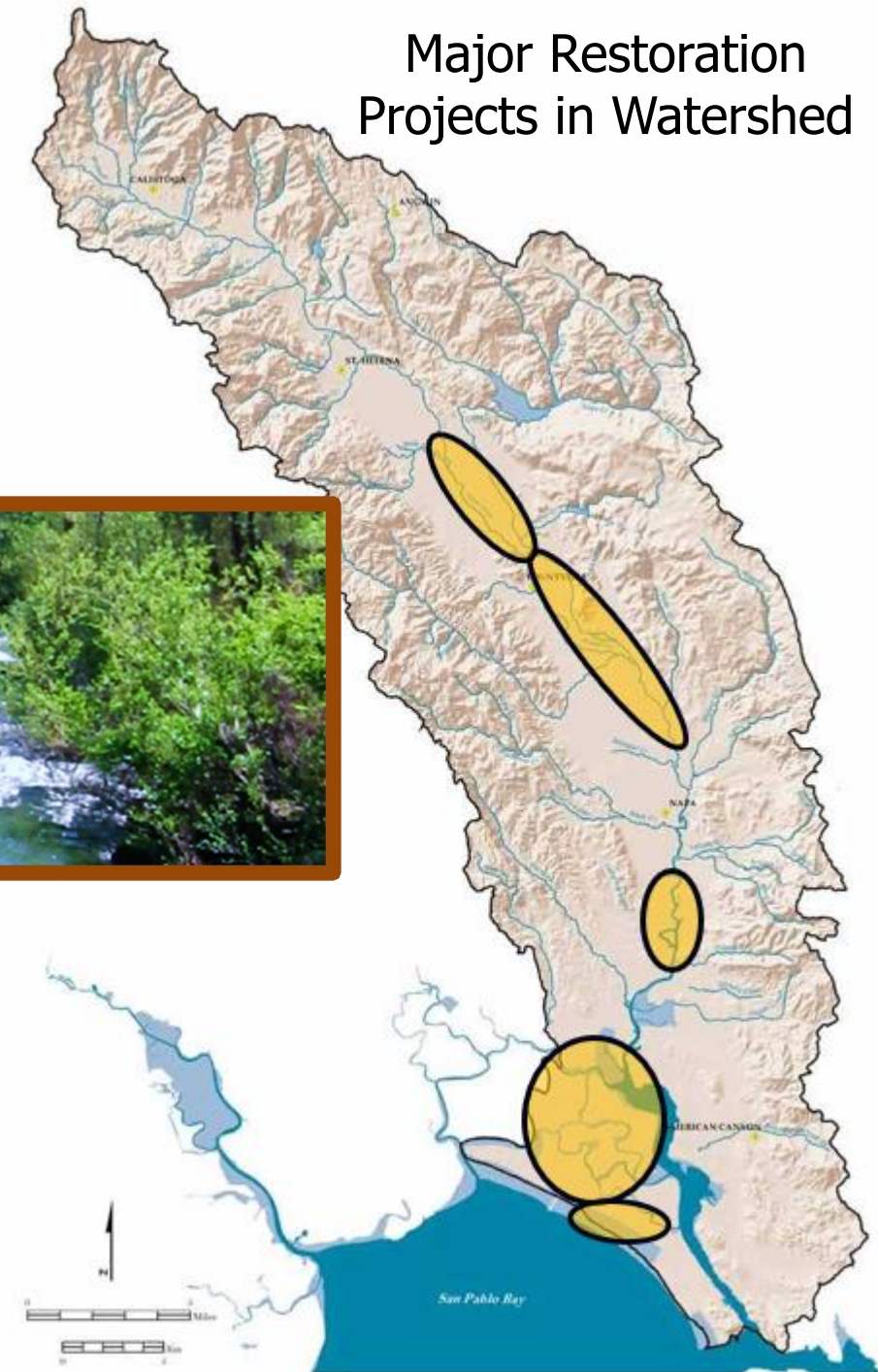
NAPA VALLEY RESILIENCY: ENHANCING GROUNDWATER RECHARGE & RESILIENCY

- Napa Valley landscape: significant change over the past two centuries
- "...the valley's **ecological health and resilience** could be greatly enhanced..."
- "**enhancing groundwater recharge**;
- enabling the natural capabilities of streams and wetlands to **retain surface water**;
- identifying, preserving, and expanding strongly perennial wetlands and stream reaches;
-and increasing the connectivity of habitats are **all part of designing a more complex, robust and resilient landscape.**"

(Robin Grossinger, 2012; *Napa Valley Historical Ecology Atlas*)



Major Restoration Projects in Watershed





- <http://groundaternitrate.ucdavis.edu>
- <http://ag-groundwater.org>
- Contact Dr. Thomas Harter at ThHarter@ucdavis.edu