Mendocino Groundwater 2021 Update

March 29, 2021

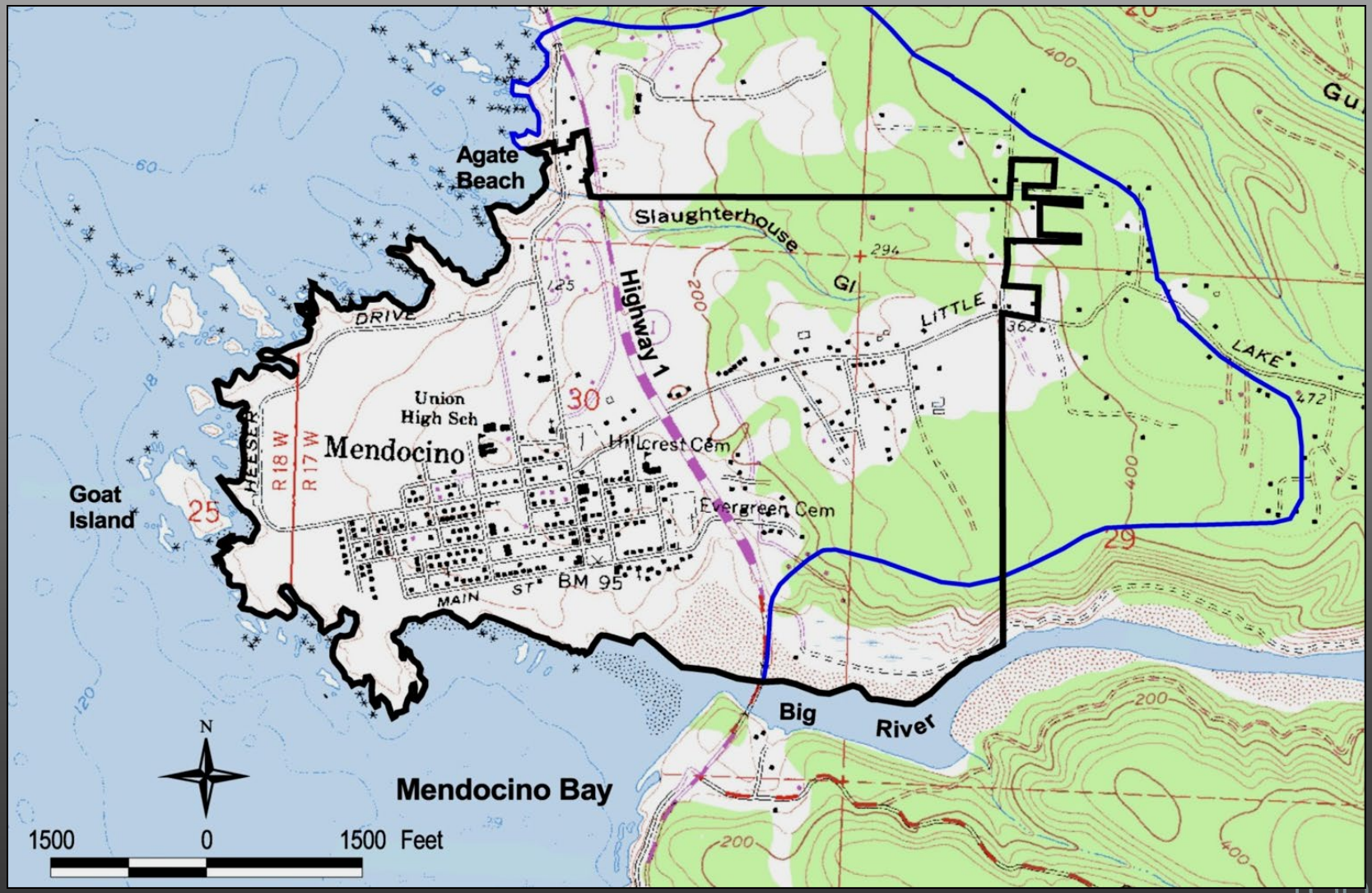
Overview

- Mendocino Water Supply
- Water Shortage Contingency Plan
- Mendocino Groundwater Balance
- Water Conservation Effectiveness
- WY2021 Drought Outlook

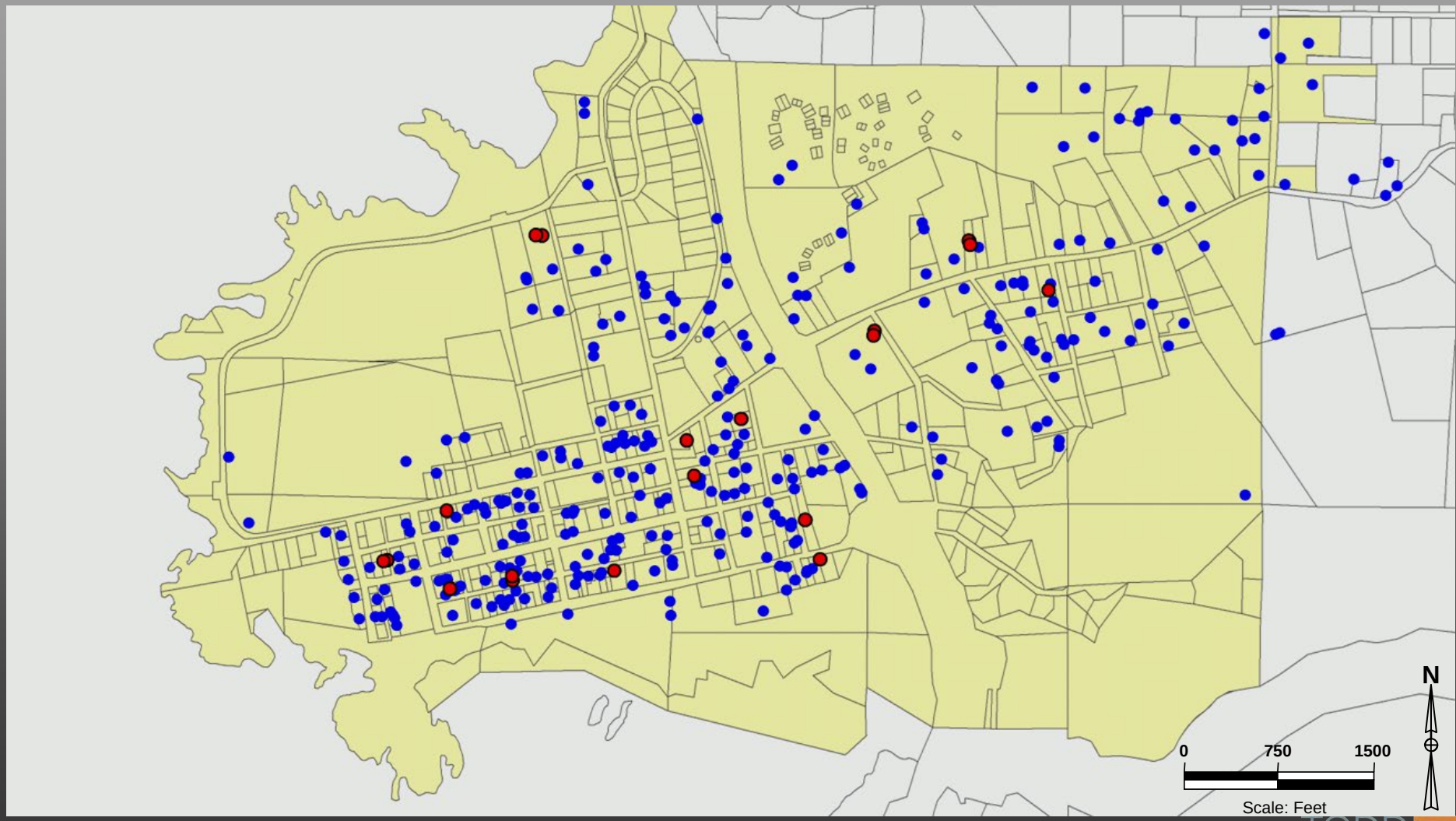
Mendocino Water Supply

TODD GROUNDWATER

Mendocino City Community Services District

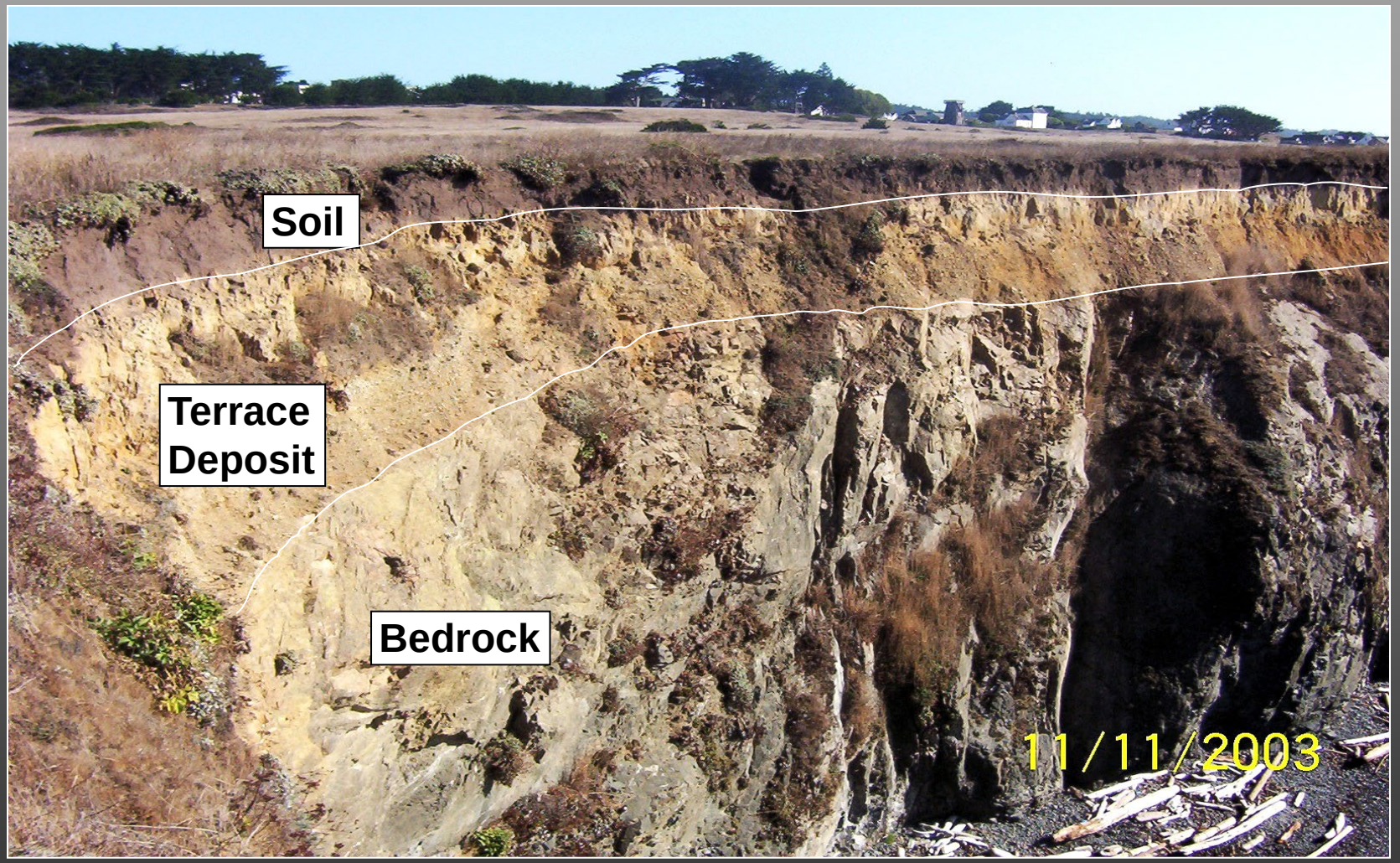


Water supply is derived from individual, privately-owned wells



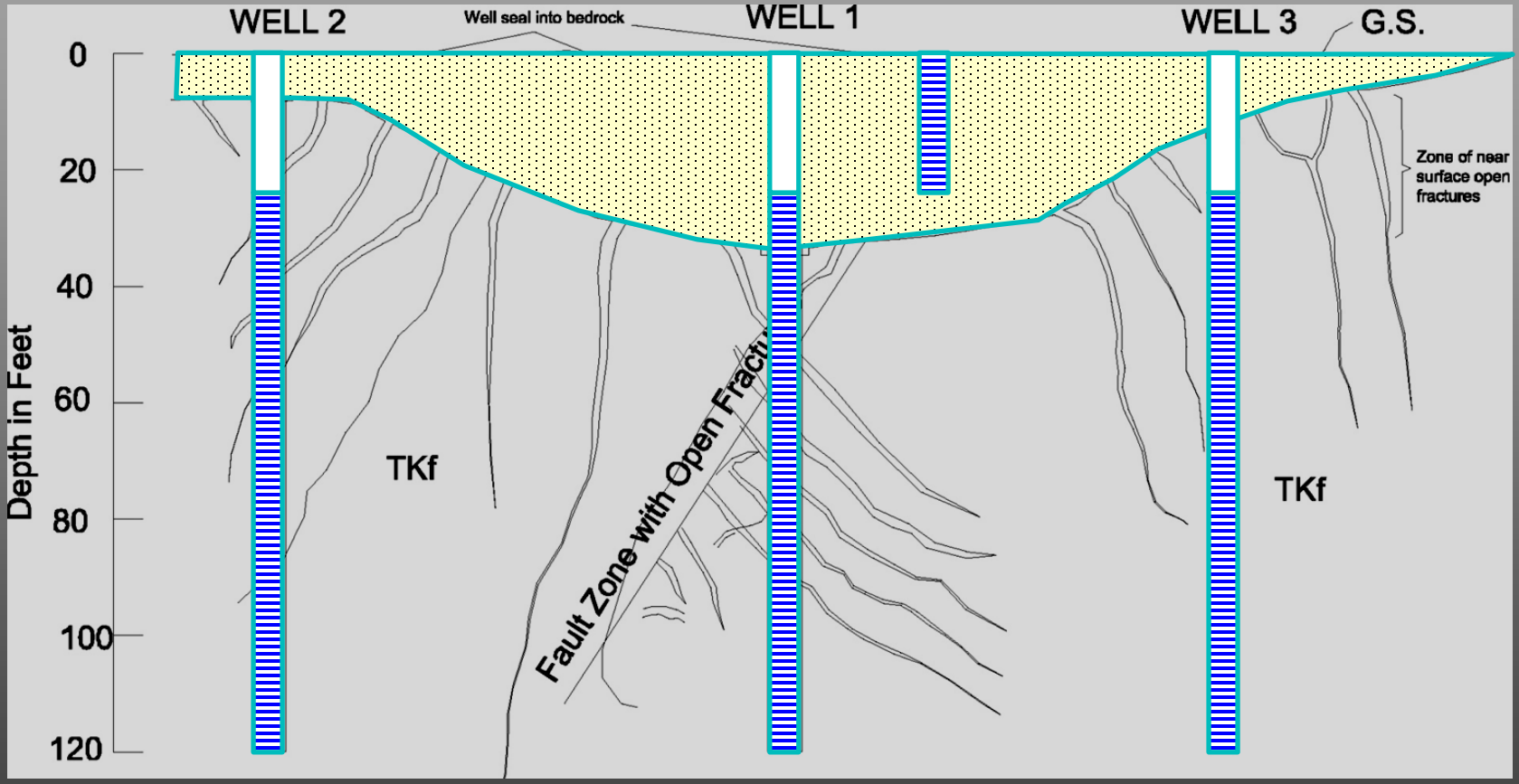
TODD GROUNDWATER

Mendocino Headlands Aquifer is Thin Sand Layer Overlying Fractured Rock



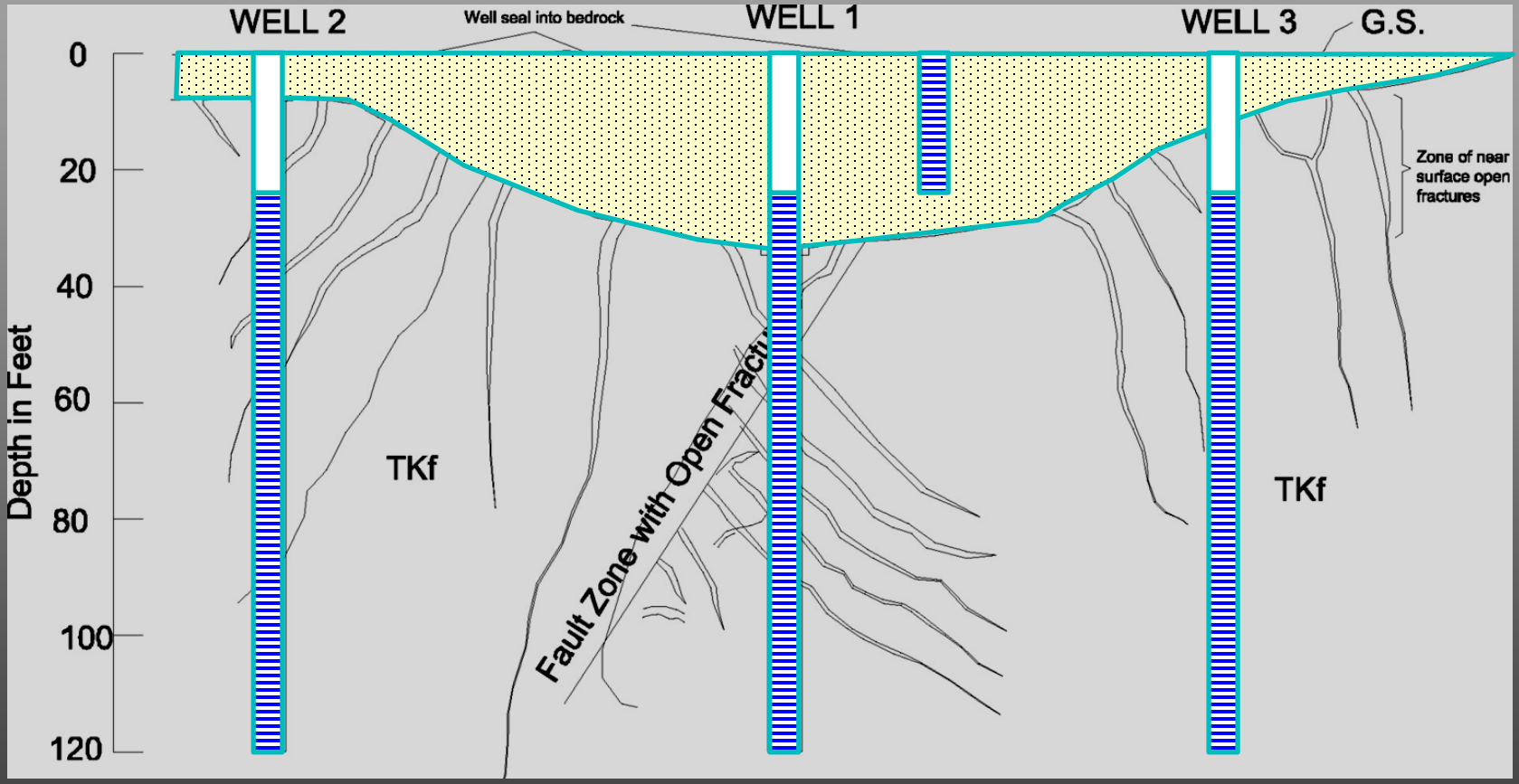
TODD GROUNDWATER

Wells Pump from Shallow Terraces and Deep Fractured Bedrock



Source: DWR (1985)

Water in Terrace Deposits Pressurizes the Fractured Bedrock Aquifer System



Source: DWR (1985)

Which Wells are Most Vulnerable

- 2014 Well Survey
  - 292 responses for 72% response rate
  - 28 dry wells reported (10% of respondents)
- Shallow (<35 feet deep) were most vulnerable
  - 57% of all reported dry wells were shallow wells
  - 33% of shallow wells were dry
- Vulnerable Areas
  - Downtown
    - 78% of reported dry wells
    - 97% of imported water was for downtown area
  - East of Highway 1
    - 19% of reported dry wells

Water Shortage Contingency Plan

TODD GROUNDWATER

The 1976-77 Drought Triggered Change in County Water Policy for Coastal Areas

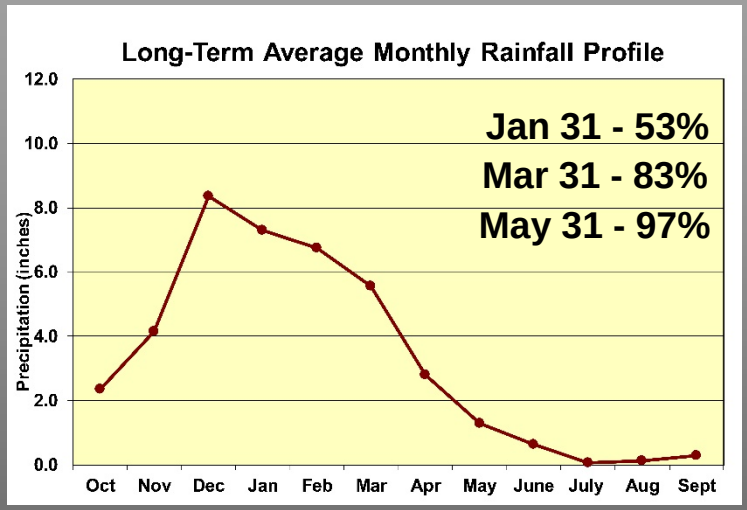
- **1976-77 Drought**
  - Two-Year period with about 50% of total rainfall
  - Severe water shortages along Mendocino Coast
  - Led to policy changes by County
- **California Dept. of Water Resources (DWR)**
  - Mendocino County Coastal Groundwater Study (1982)
  - Town of Mendocino Groundwater Study (1985)
- **Mendocino County**
  - Review of DWR Reports (1987)
  - General Plan and Coastal Element Updates
    - Verify summer water supply
  - Mendocino Coastal Groundwater Development Guidelines (1989)

MCCSD Developed Water Shortage Contingency Plan

- **Precipitation is only water source**
  - Both amount and timing are important
  - Spring groundwater levels are not necessarily a good indicator of summer conditions
- **Aquifer is quick to respond to changes**
  - Groundwater levels can recover in one season
  - Multi-year droughts compound effects
- **Develop criteria to forecast drought**
  - Defined as percentage of allotment, not past water use
  - Define criteria based on precipitation
  - Identify early so conservation can be effective
  - Provide measures to evaluate recovery

Drought Criteria

- **Rainfall as Early Indicator**
  - Total rainfall since October 1
  - Spring rainfall since February 1
  - Three evaluation dates
    - January 31, March 31, May 31
- **Summer and Fall Assessment**
  - Groundwater Levels and Rainfall
  - Three evaluation dates
    - August 31, November 30, December 31
- **Multi-Year Drought**
  - If previous year a Stage 2 or 3 drought,
  - Then modify to next most severe stage

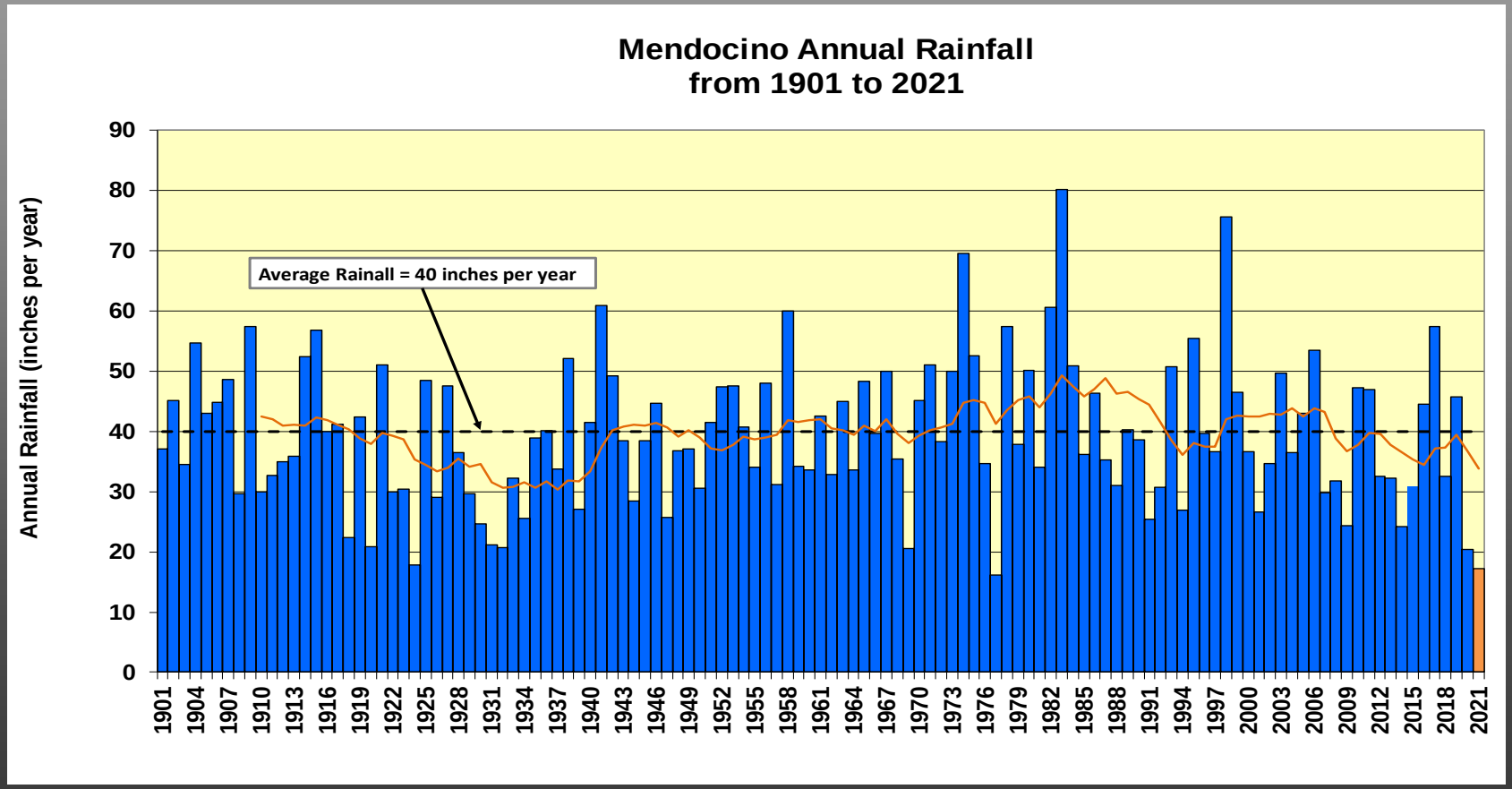


Mendocino Groundwater Balance

TODD GROUNDWATER

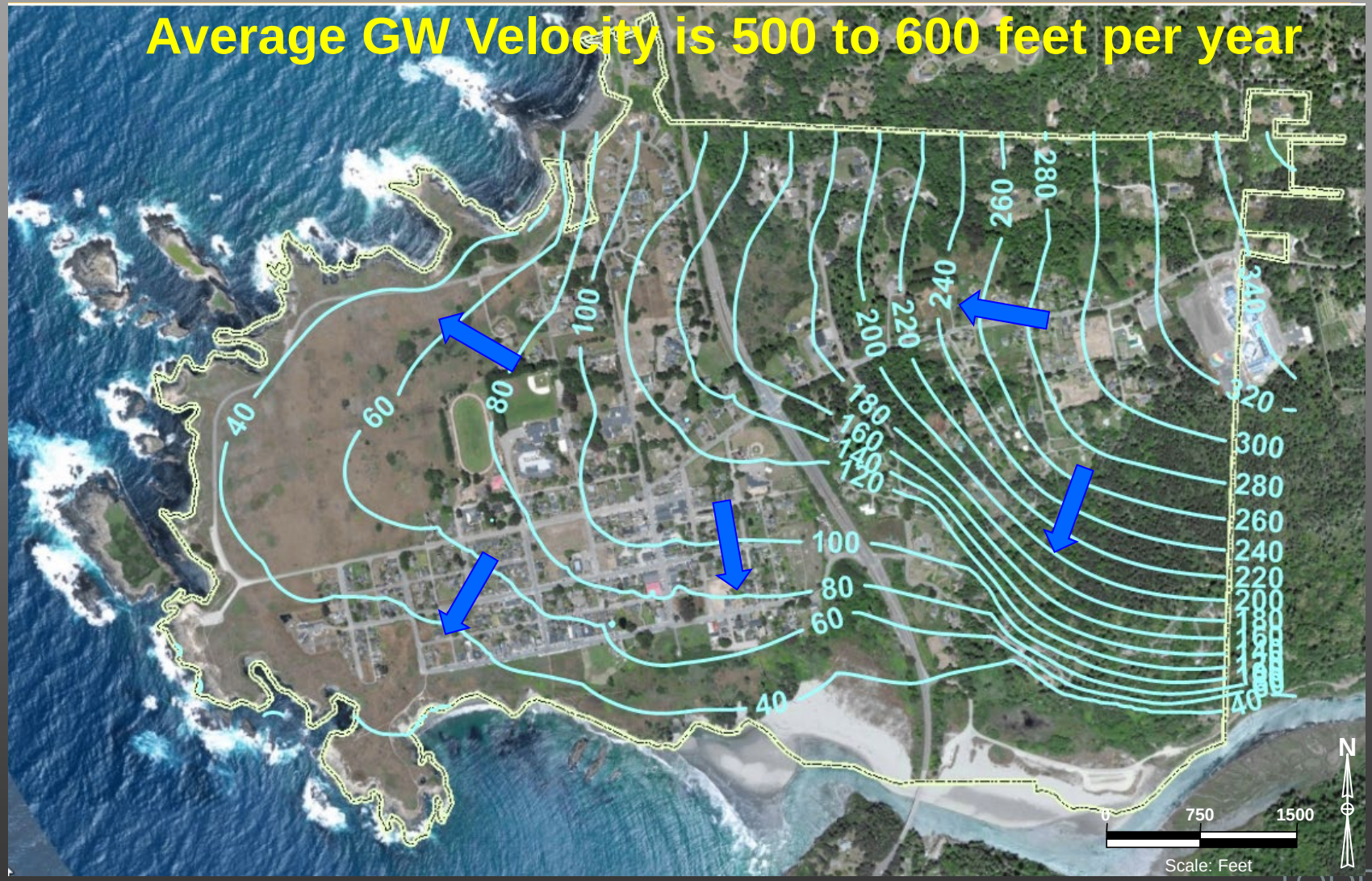
Precipitation is Primary Source of Mendocino Water Supply

- Recent Extended Drought Period Shows Pattern Similar to 1920-1935 Drought Period

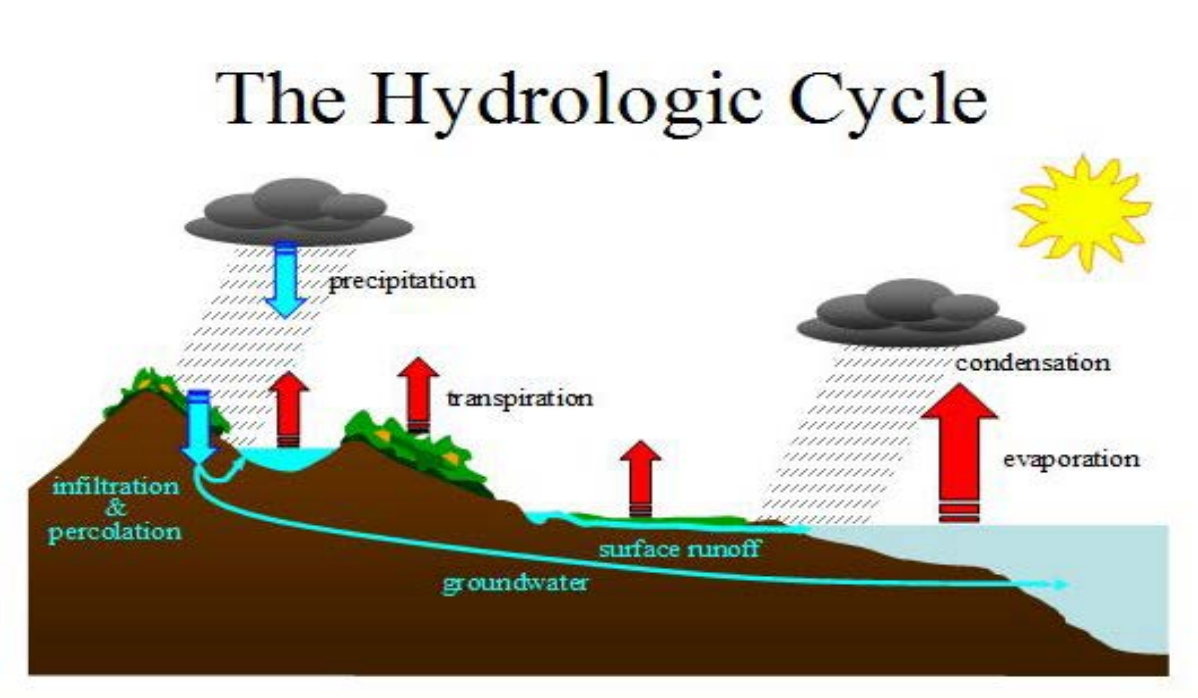


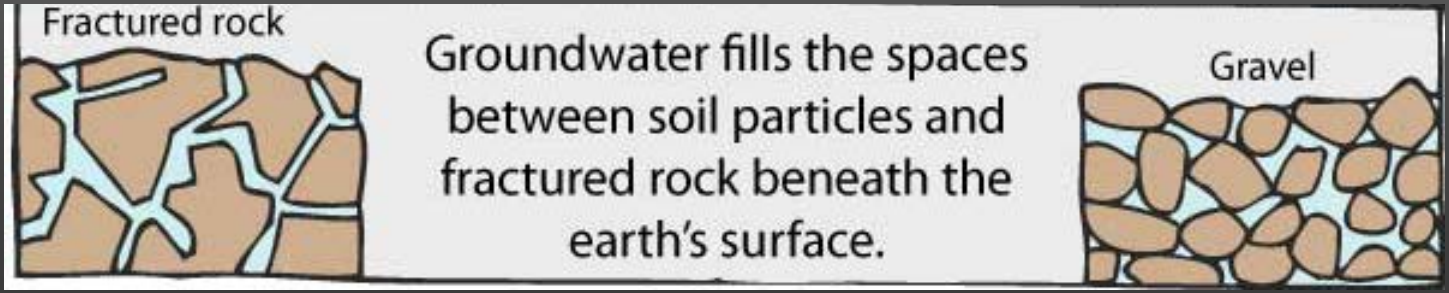
TODD GROUNDWATER

Groundwater Flows towards Springs and Creeks

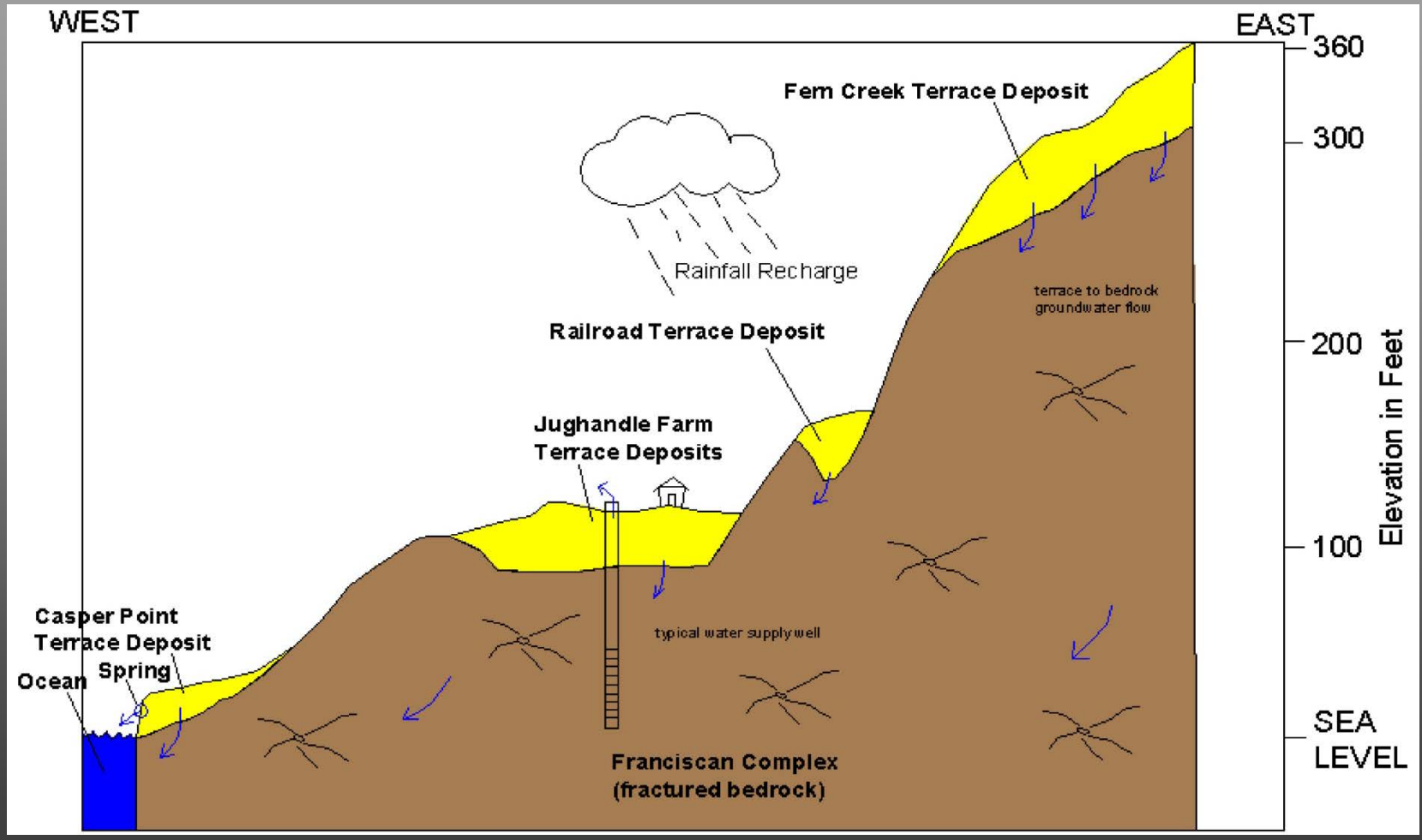


Groundwater is Derived from Rain and Discharges to the Ocean

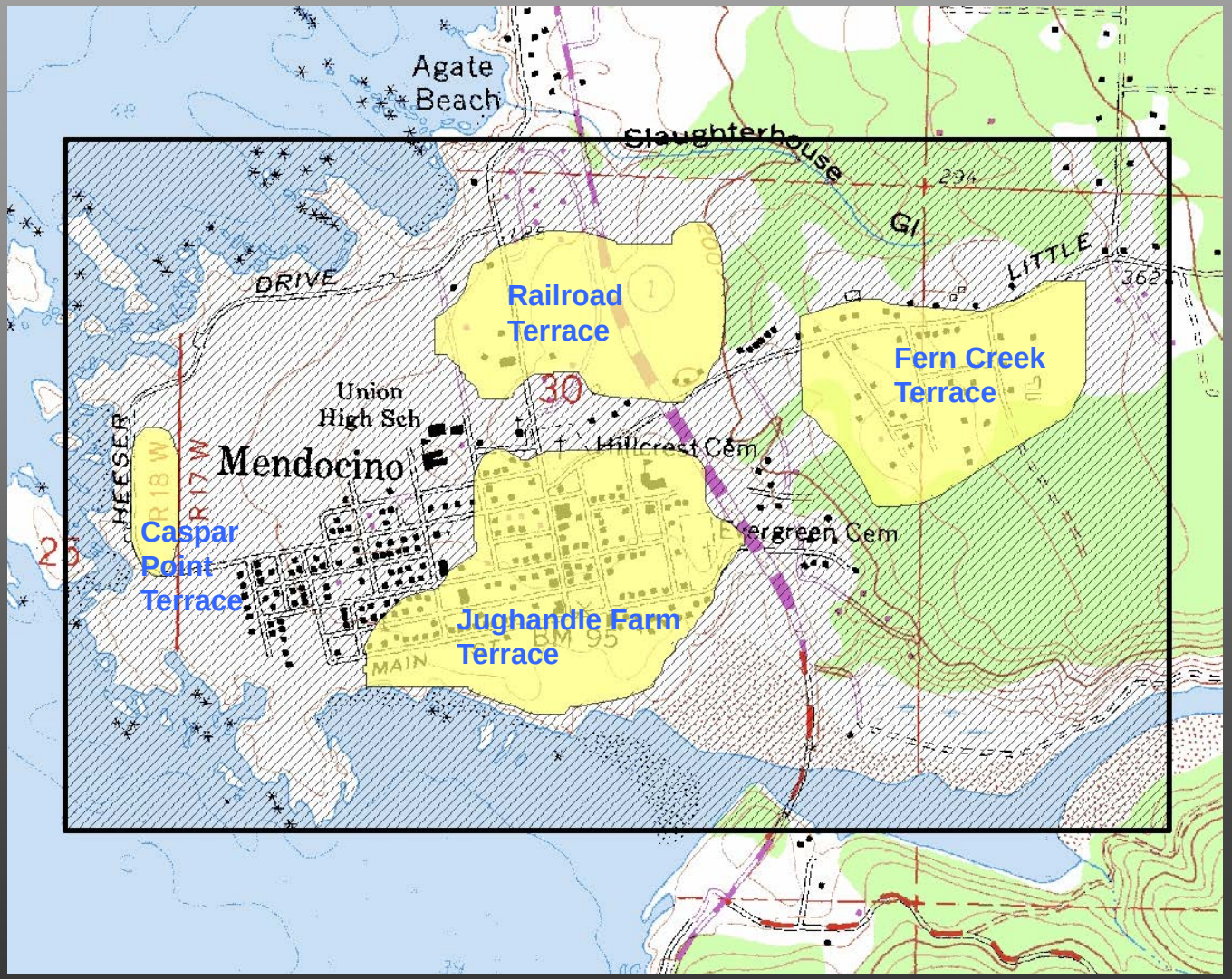




Sandy Terrace Deposits Recharge the Fractured Bedrock



Perennially Saturated Terrace Deposits are Key to Mendocino Water Supply



Primary Outflow is Natural Seepage to ET, Springs and Creeks

Groundwater Model is a Planning Tool for Assessing Water Supply

- Change in recharge from precipitation controls system
  - Natural seepage, ET and Storage Change vary with precipitation recharge
- Current pumping is about 6% of total groundwater outflow
  - Earlier pumping rates were about 18% of pumping

	INFLOW (acre-ft)			OUTFLOW (acre-ft)				
Water Year	Ground water Recharge	Ground water Inflow	Total Inflow	Natural Seepage	ET	Pumping Wells	Total Outflow	Change in Storage
2015	850	16	866	645	147	63	855	11
2016	1,213	16	1,229	801	258	68	1,127	102
2017	1,547	16	1,563	1,065	373	73	1,511	53
2018	1,001	16	1,017	744	249	71	1,064	-47
2019	1,384	16	1,400	910	352	71	1,334	67
2020	641	16	657	615	144	64	823	-166
Average	1,106	16	1,122	797	254	68	1,119	3
Percent of Total	99%	1%		71%	23%	6%		

Water Conservation Effectiveness

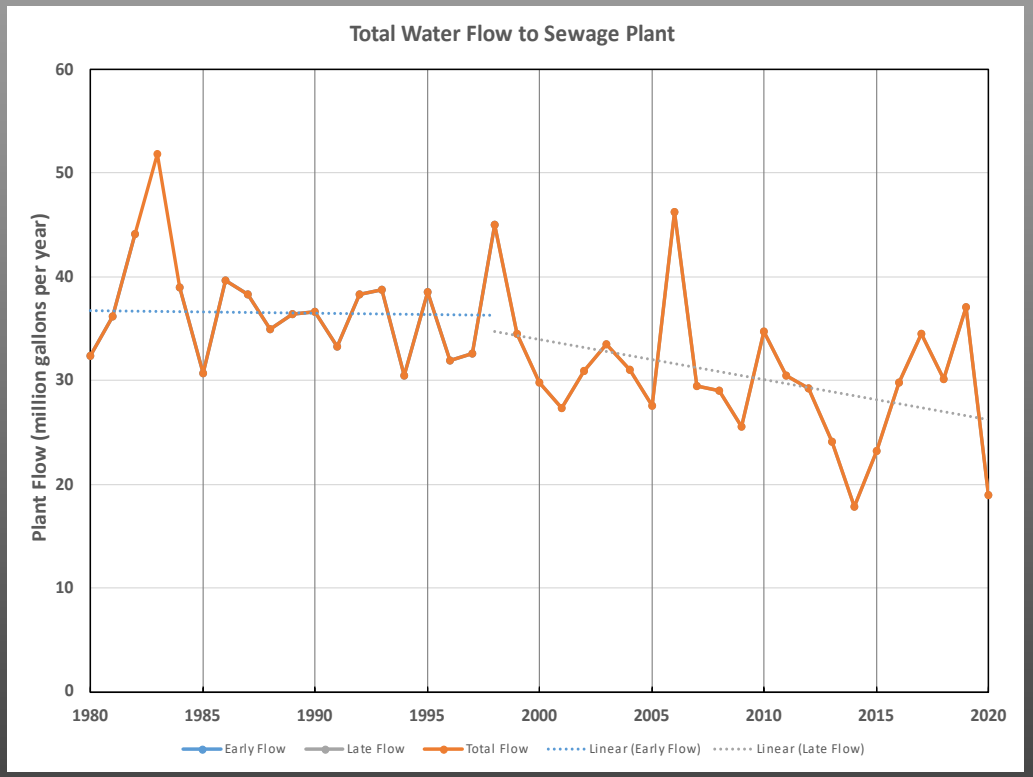
TODD GROUNDWATER

Metered Well Data Indicate Current Pumping Well Below Allotments

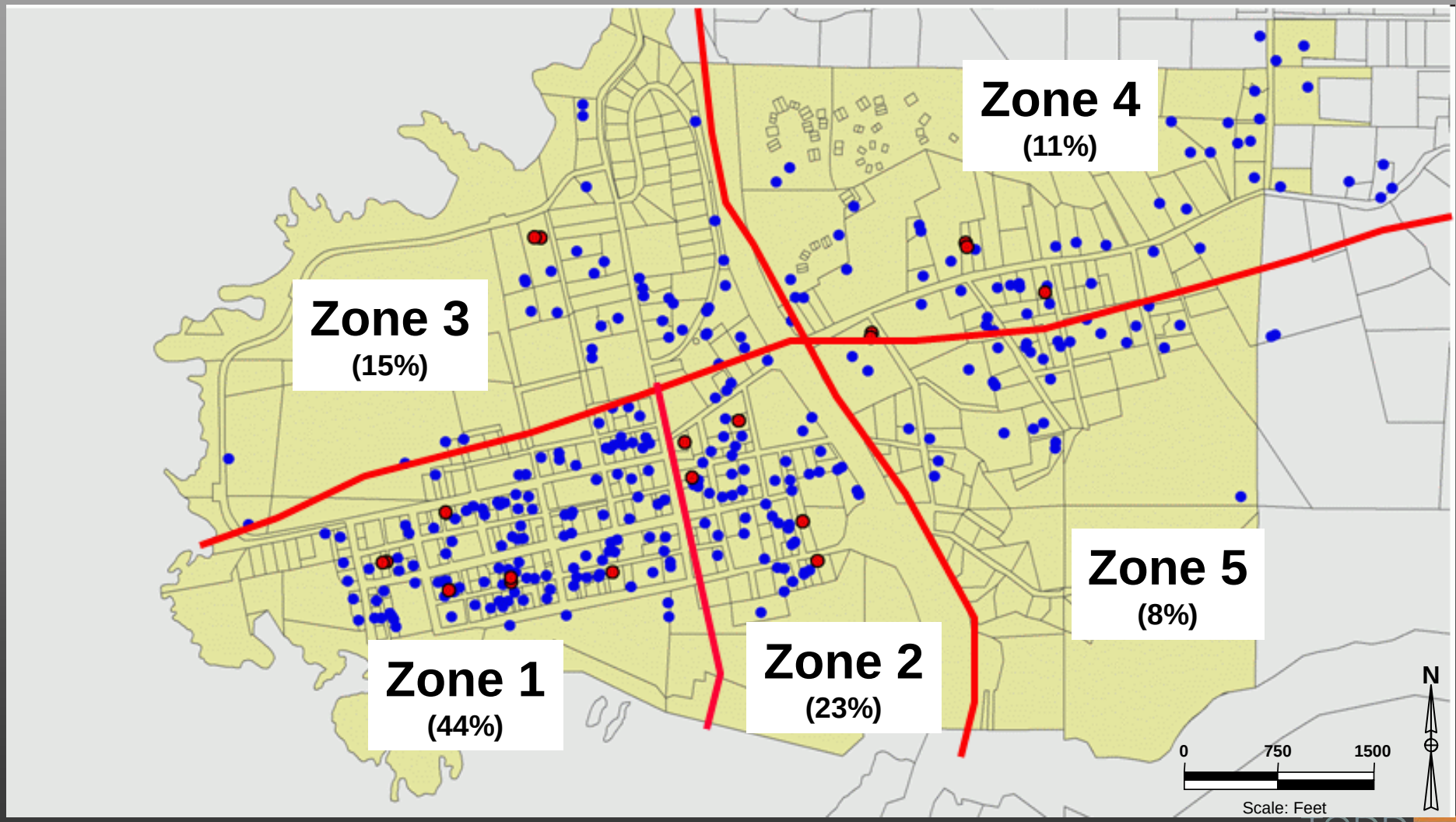
- **Metered Pumping Data**
  - Total reported pumping in WY2015-2020 is about 65 to 75 AFY
  - Community-wide water use about 30% to 40% of allotments
  - Average water use is about 50 gallons per day per person
- **Changes Attributed to Water Conservation**
  - Metering shown statewide to reduce water use
  - Permanent changes and repairs in water use
  - Reductions in outdoor water use
  - Repair of leaks
- **Changes are Consistent with Statewide Trends**

Sewage Plant Inflow Data Confirms Decrease in Indoor Water Use

- Declining Plant Flows
  - Consistent Flow Rate in 1980s and 1990s
  - Declining Flow Rate appears to start in 2000
  - Current Flow Rate about 30% to 40% lower
- Represents Reduction in Indoor Water Use
  - Permanent and discretionary water conservation
  - Assume outdoor use has declined at a similar rate or more
- Plant Data Noisy
  - Groundwater inflows to system



Distribution of Metered Pumping Is Same as Allotment Distribution



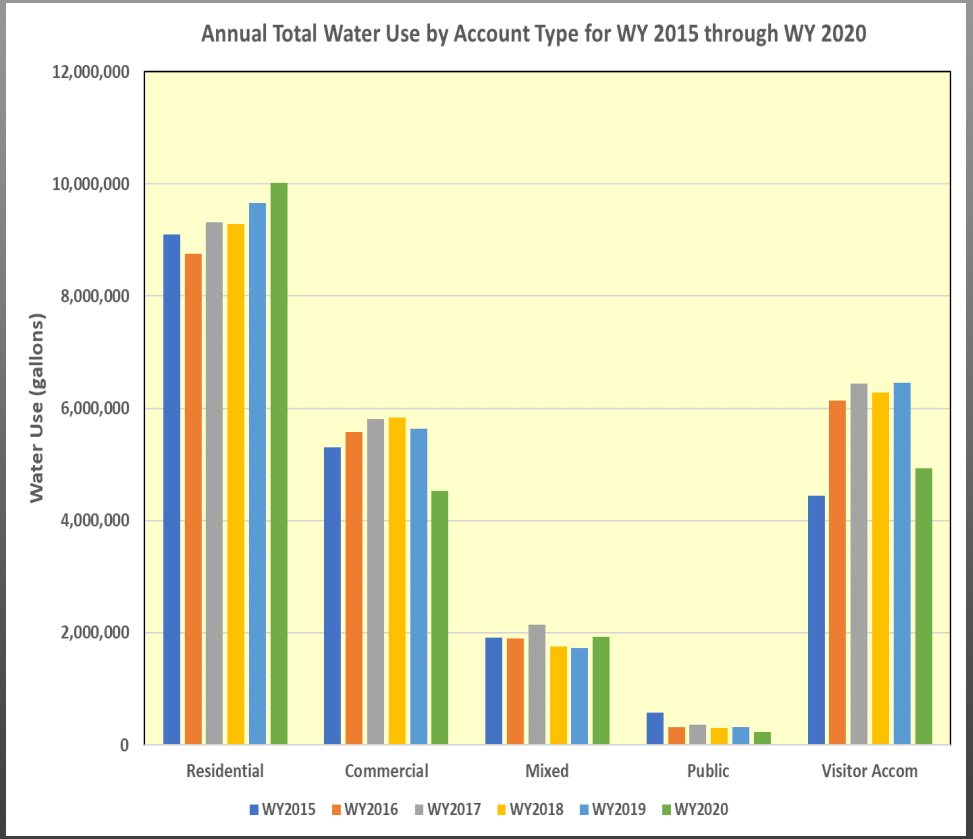
TODD GROUNDWATER

WSCP Stages are Based on Pumping Allotments

- Metered Pumping Relative to WSCP Drought Stage
  - 90% of accounts use less than 60% of Allotment for year
  - 80% of accounts use less than 60% of Allotment in Summer
  - 92% of accounts use less than 80% of Allotment in Summer
  - 4% of accounts use their full Allotment in Summer or don't report pumping
- For MCCSD water users, no changes required if water use already below WSCP Stage requirement
- WSCP Stages are Based on Pumping Allotments
  - Prior to metering, pumping estimated as percent of allotment
  - WSCP used 1990s water use with reductions during droughts
  - Considered to be permanent changes in water uses

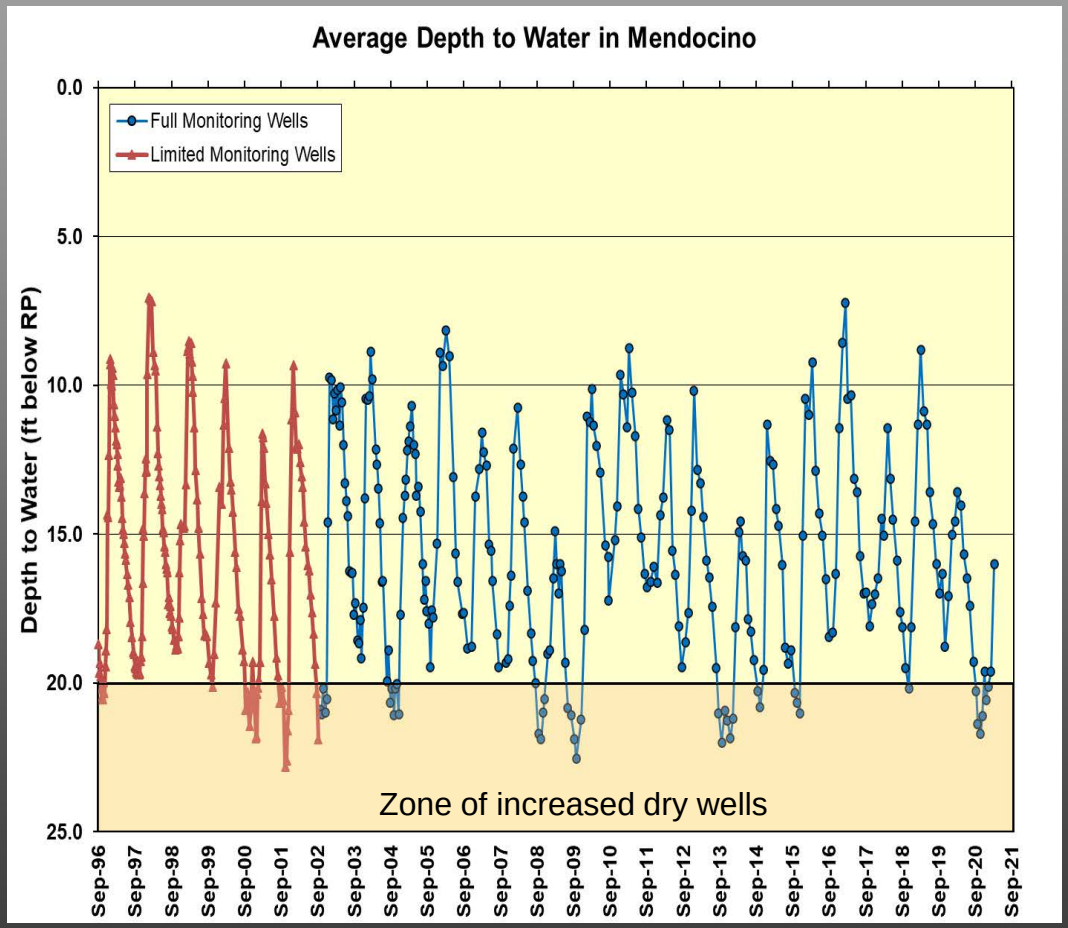
Recent Water Use Trends

- During WY2020
  - Commercial and Visitor Accom water use declined 10% to 20%
  - Residential water use increased about 5%
  - Others had minor change
- Drought Response
  - Customers are staying within allotment requirements
  - WY2020 response likely affected by pandemic issues



Average Depth to Groundwater is an Indicator of Potential Issues

- Average Depth to Water (DTW) is from all District monitor wells
  - Highest water levels occur in March and April
  - Lowest water levels occur in late Summer
- When average DTW drops below 20 feet, see increased occurrence of dry or impacted wells
  - Extent is affected by depth and duration of low water levels

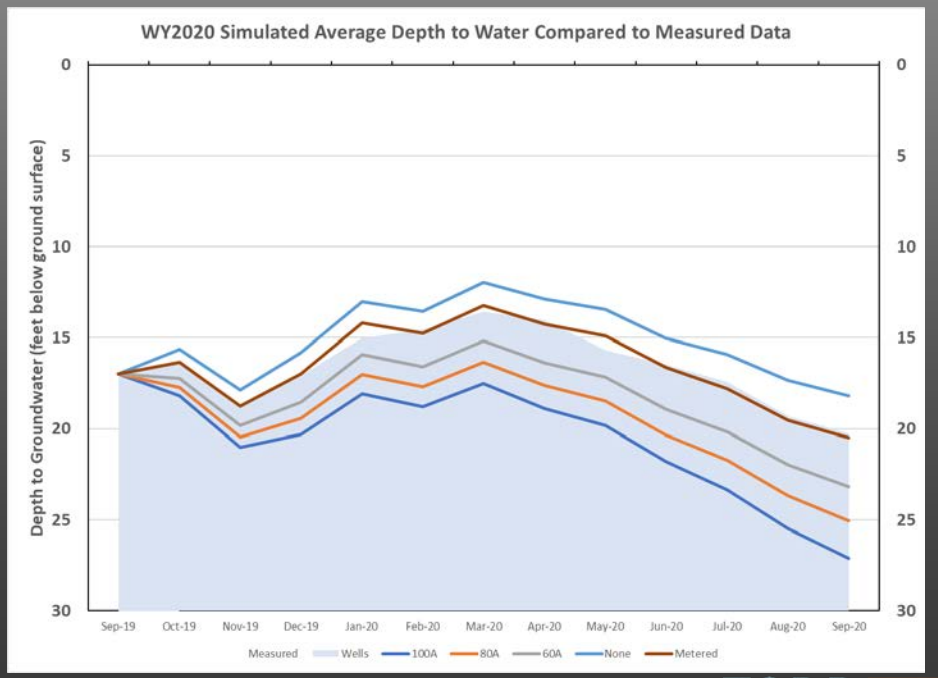


TODD GROUNDWATER

Use Groundwater Model to Test Effectiveness of Water Conservation

- **Change in Average Depth to Water**
  - GW levels 5 feet lower for Full Allotment Pumping
  - GW levels 2 feet lower for 60% of Allotment Pumping
  - Actual pumping helped keep water levels out of problem zone
- **Change in Water Budget**
  - Natural outflows and Storage change in response to pumping
  - Current pumping saves about 50% of water in storage for following year
- **For every gallon conserved, a half gallon carries over to next year**

	INFLOW (acre-ft)			OUTFLOW (acre-ft)				
Water Year	Ground water Recharge	Ground water Inflow	Total Inflow	Natural Seepage	ET	Pumping Wells	Total Outflow	Change in Storage
2020 Metered	641	16	657	615	144	64	823	-166
2020 100%	641	16	657	558	119	222	899	-242
2020 80%	641	16	657	572	125	178	875	-218
2020 60%	641	16	657	588	132	133	853	-196
2020 33%	641	16	657	609	143	73	826	-168
No Pumping	641	16	657	638	158	0	795	-138



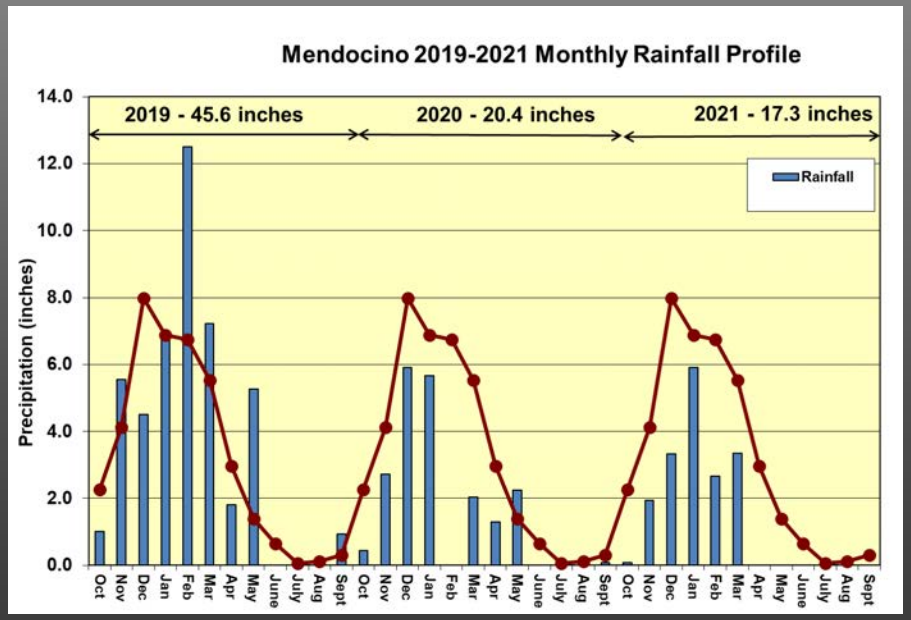
TODD GROUNDWATER

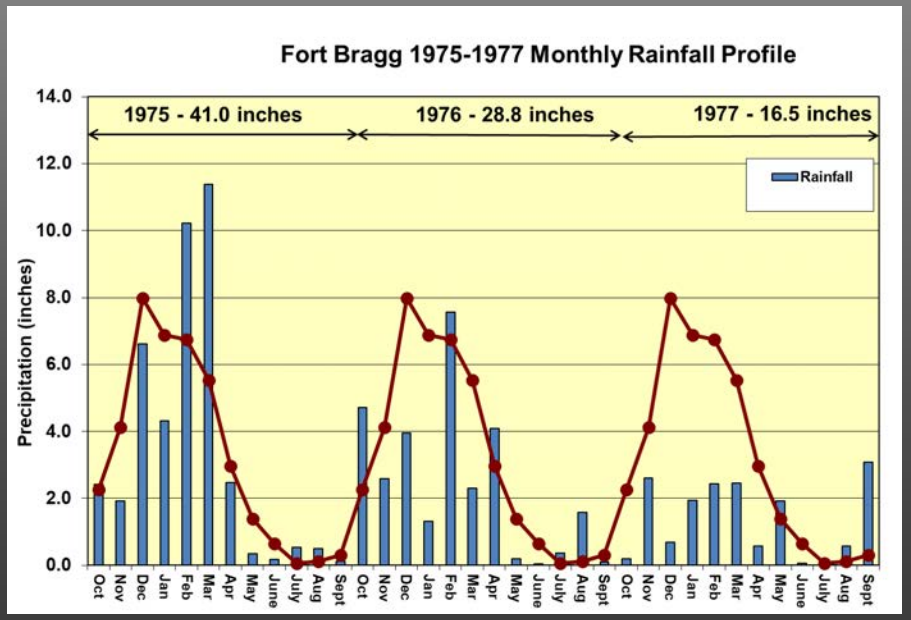
WY2021 Drought Outlook

TODD GROUNDWATER

2020-21 Drought is Similar in Magnitude as 1976-77 Drought

- 2020-2021 is lining up to be historic two-year drought
- Comparable to 1976-1977 drought
- 2021 rainfall is higher than 1977, so that will help





TODD GROUNDWATER

WY2021 Spring Rainfall Probability

- Total WY2021 Rain to Date is 17.3 inches
  - Spring rain to date is 6.0 inches
- Probability based on Rainfall over Past 30 Years
  - Average April/May rain in 4.5 inches
  - Median April/May rain is 3.7 inches
  - Maximum April/May rain is 10.85 inches

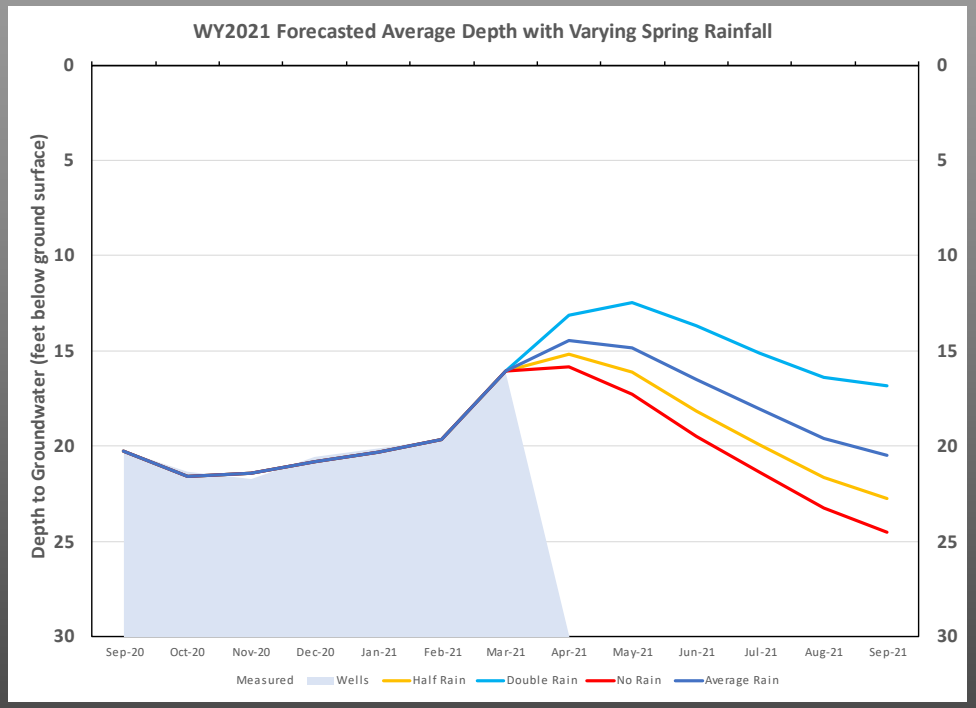
Rain requirements to Change Drought Stage

Water Shortage Stage	April/May Rain Requirement	Probability from past 30 Years
Stage 1	>11.7”	0% (0)
Stage 2	6.7” to 11.7”	30% (9)
Stage 3	4.0” to 6.7”	17% (5)
Stage 4	<4.0”	53% (16)

TODD GROUNDWATER

Use Groundwater Model to Forecast Potential WY2021 Conditions

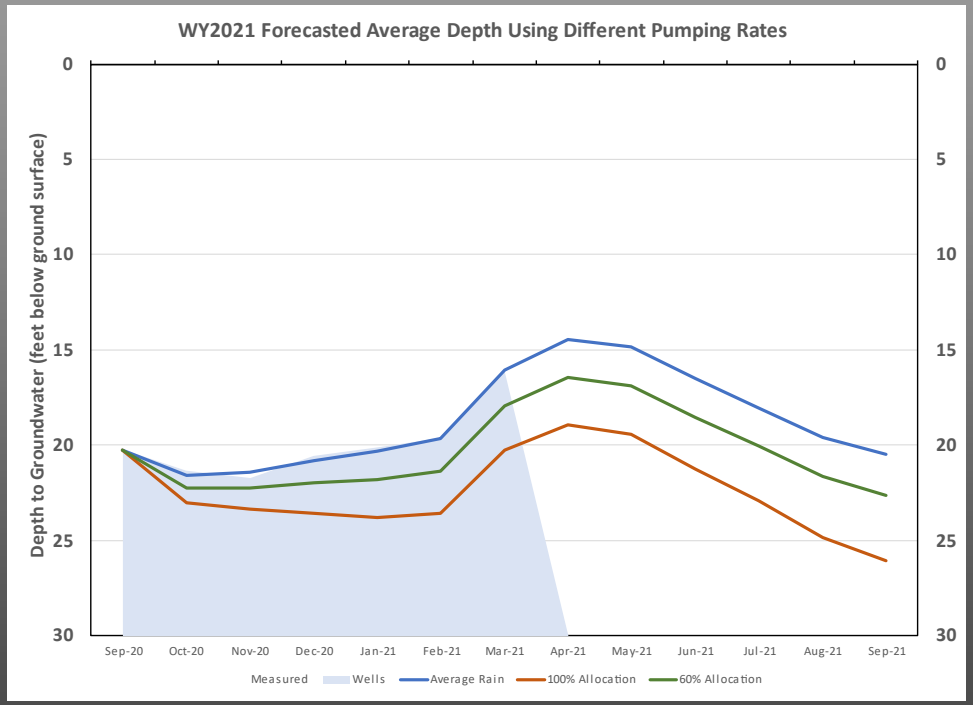
- **Vary Precipitation Rate**
  - Use October-March data
  - Project April-September rain as average, half average, double average, and no additional rain
  - Use WY2020 Pumping rates
- **Scenario Results**
  - Average or above Spring rain will improve conditions
  - Average to Above Average rain may keep Average DTW above 20 feet
  - Below average rain may lead to Average DTW below 20 feet by June to July



TODD GROUNDWATER

Use Groundwater Model to Assess Water Conservation for WY2021

- **Vary Pumping Rate**
  - WY2020 metered pumping
  - 60% Allocation pumping
  - 100% Allocation pumping
  - Use average rainfall
- **60% Allocation Pumping**
  - Average DTW below 20 feet for 7 months
  - Maximum DTW is 23 feet
- **100% Allocation Pumping**
  - Average DTW below 20 feet for 10 months
  - Maximum DTW is 26 feet
  - This may represent the 1977 condition that resulted in severe water shortages



TODD GROUNDWATER

WY2021 Outlook

- WY2021 looks to be a challenging historic drought year with likely continued issues with dry wells
- Community has implemented water conservation measures that have significantly reduced water use
- Current water conservation is anticipated to help sustain higher groundwater levels during WY2021
- Even so, many wells will likely continue to be impacted during WY2021


Questions