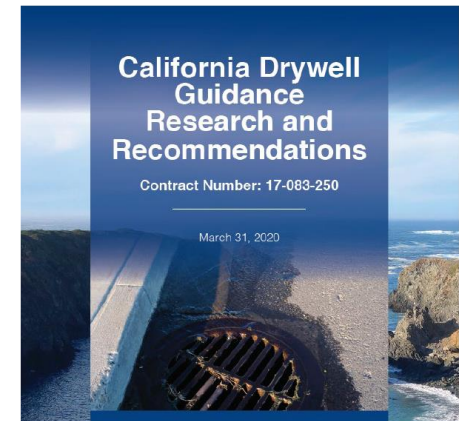


Dry Wells or Groundwater Recharge Enhancement Features

TWD Board Meeting
March 18, 2026

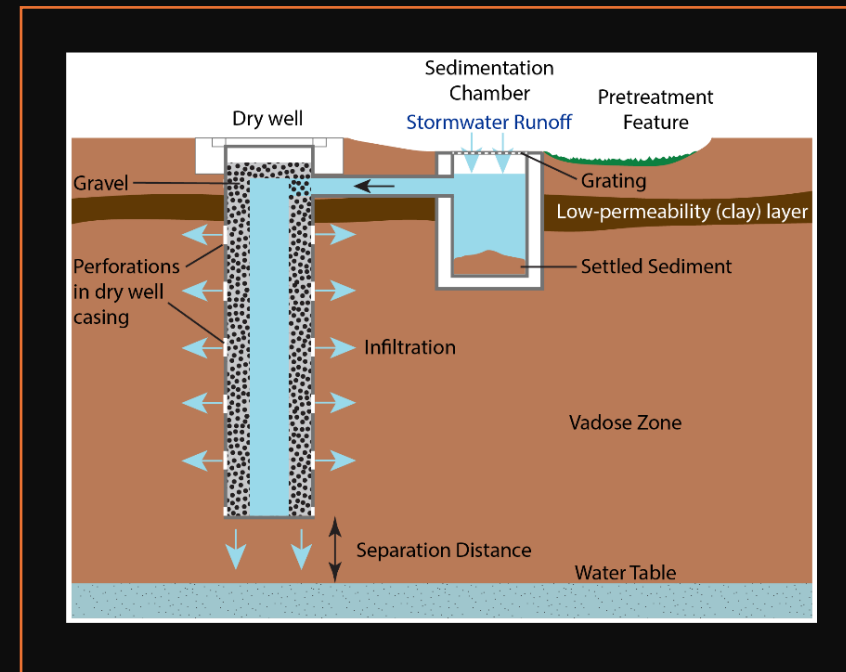


Prepared by
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Prepared for
California Water Resources Control Board
1001 I Street
Sacramento, California
95814

Overview – Dry Wells


- Dry wells are gravity-fed excavated pits lined with perforated casing.
- Constructed to penetrate low permeability layers to allow fluids to enter more permeable layers.
- A dry well is considered a Class V Underground Injection Control (UIC) by US EPA if deeper than it is wide.
- Class V UIC wells must be registered with the US EPA and only inject uncontaminated storm-water.
- California Guidelines for Dry Wells for Stormwater developed in 2020 by Geosyntec
- Geosyntec has installed numerous dry wells for stormwater in Los Angeles.



Groundwater Recharge Enhancement Features - GREF

| Recharge Feature | How It Works | Best Conditions | Advantages | Limitations | California Notes |
|-------------------------------|--|--|----------------------------------|--------------------------------------|--------------------------------|
| Infiltration/Spreading Basins | Water spread in basins to infiltrate vadose zone | High-permeability soils, large land area | Low cost, soil-aquifer treatment | Needs large area, clogging | Widespread in Central Valley |
| Detention Basins | Temporary stormwater storage for slow infiltration | Urban edges, storm capture | Flood control + recharge | Low infiltration unless combined | Used in DWR flood projects |
| Flood-MAR | Diverts floodwater to fields/floodplains | Ag land, floodplains | Huge volumes possible | Seasonal, crop disruption | Used during atmospheric rivers |
| Dry Wells | Vertical wells infiltrate below low-perm soils | Urban areas or tight soils | Small footprint, year-round | Requires pretreatment | Pilots in Northern CA |
| ASR/ASTR Wells | Inject treated water to aquifer | Urban/deep aquifers | Recoverable storage | High cost, high water quality needed | Used in Regional Water Bank |
| Infiltration Trenches | Gravel trenches infiltrate shallow soil | Small sites <5 acres | Cost-effective small scale | Clogging, pretreat needed | Used in UID retrofits |
| Reverse Tile Drains | Subsurface perforated pipes recharge below root zone | Ag areas with low-perm soils | No land lost, no evap | Needs conveyance | Pilots in Dunnigan/Butte |

Why Use a GREF

1. Depth to permeable soils make infiltration basin cost prohibitive
 2. There is limited space
 3. Want to recharge water below root-zones
 4. Reduces Flooding and Surface Water Pooling
 5. Reduce Load on Municipal Stormwater Systems
 6. Improve Water Quality Through Natural Filtration
- 

Initial Data Needs

Geology/Hydrogeology

- Stratigraphy – where are the permeable and impermeable layers and can recharge water make it to the groundwater?
- Infiltration Rates – How fast does water move down?
- Depth to groundwater – Is there enough capacity (unsaturated material) for the recharge water?
- Aquifer Type – Can aquifer accept the water?

Available Space

- How much land do I have to work with?
- What are obstacles to construction?

What is the Recharge Water Source

- Treated/Untreated?
- How will you get water to GREF – Conveyance?
- When is it available – How much?

Water Quality

- Chemistry and sediment load of source water
- Existing Groundwater Quality

Permitting

Initial Sources for Assessment

SGMA Data Viewer (<https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#gwlevels>)

- Basin Characterization Folder
- Water Quality
- Water Levels
- Geologic Logs

GeoTracker (<https://geotracker.waterboards.ca.gov/>)

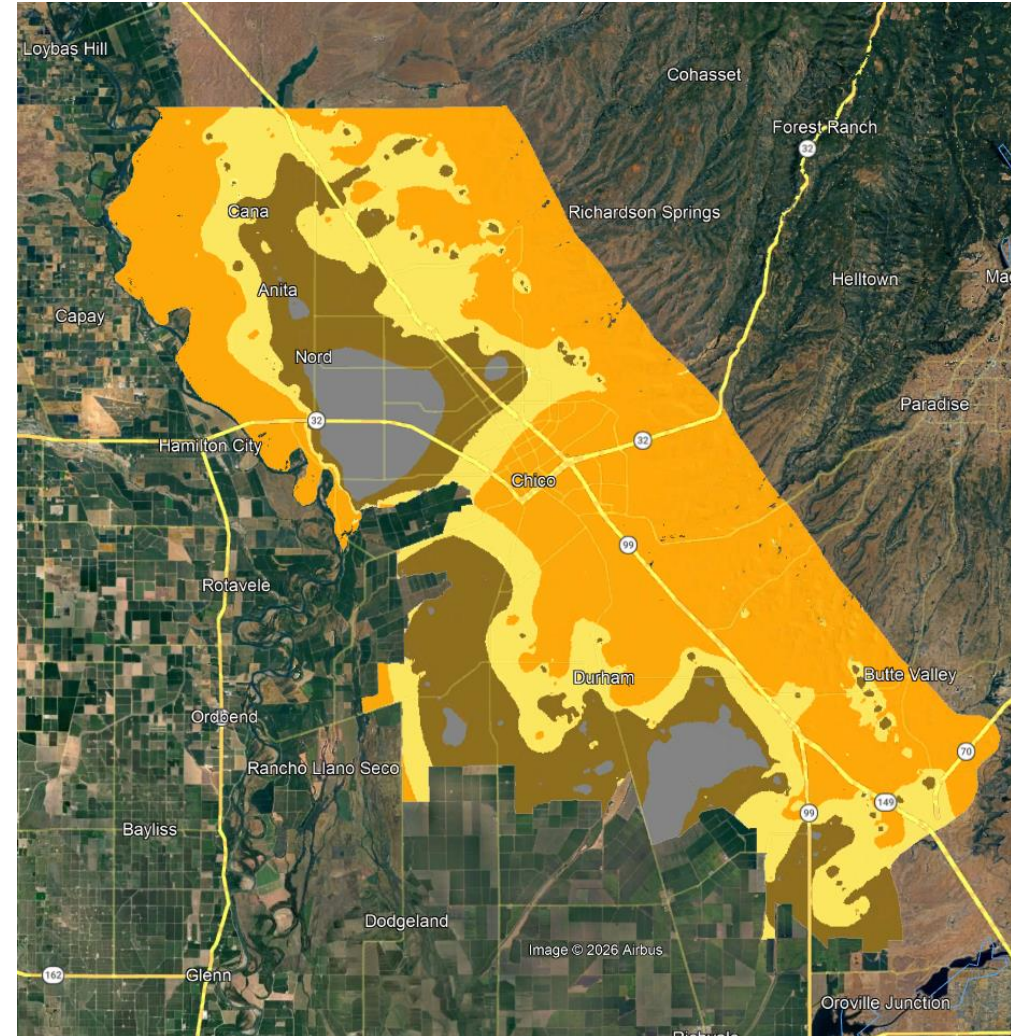
- Environmental Sites with Reports
- Water Quality

Vina GSA Groundwater Recharge Project

- Model of Vina Subbasin AEM data
- Numerous tTEM investigations

Initial Field Work

- tTEM
- Permeability Testing
- Water Quality
- Monitoring Well
- Water Level Monitoring



Considerations

Poor Soil

- Low permeability down to groundwater – cannot get the water there

To much Sediment or Contaminants

- High treatment costs
- High permitting and monitoring costs

Poor Aquifer Material

- No capacity to accept water

Shallow Groundwater

- No room for the water

Source Water to Far Away

- High conveyance costs

Who Owns the Water

Examples

City of Stockton Delta Water Treatment Plant

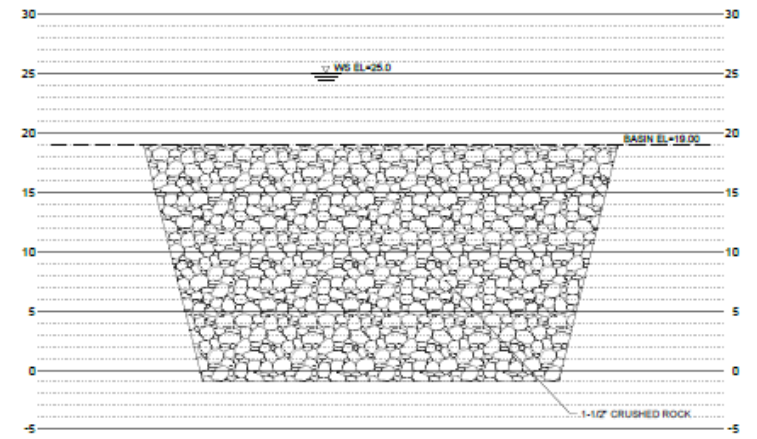
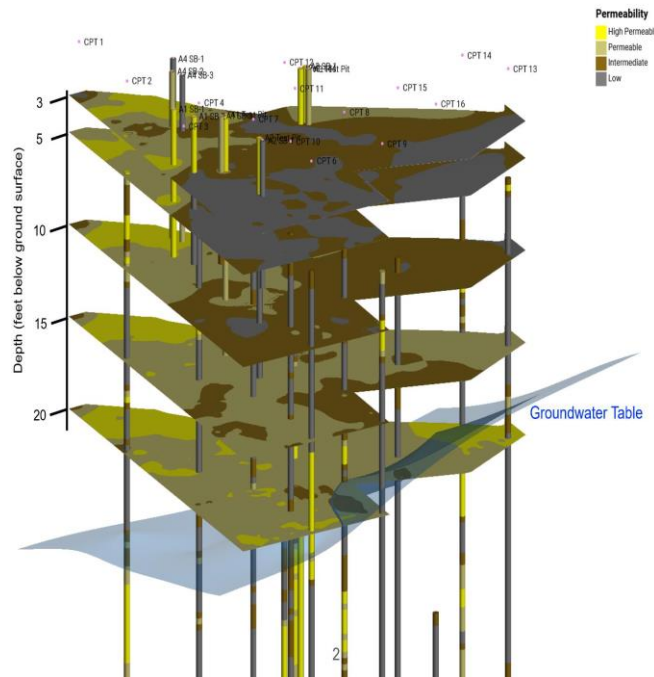
- Dry Wells a.k.a GREF

Stormwater Infiltration Drywells

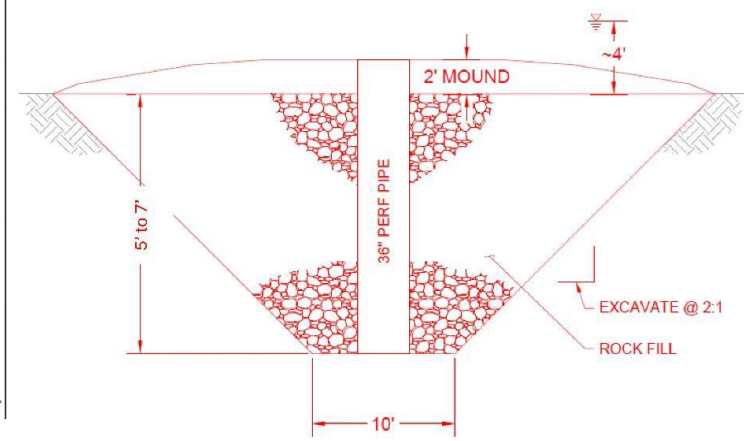
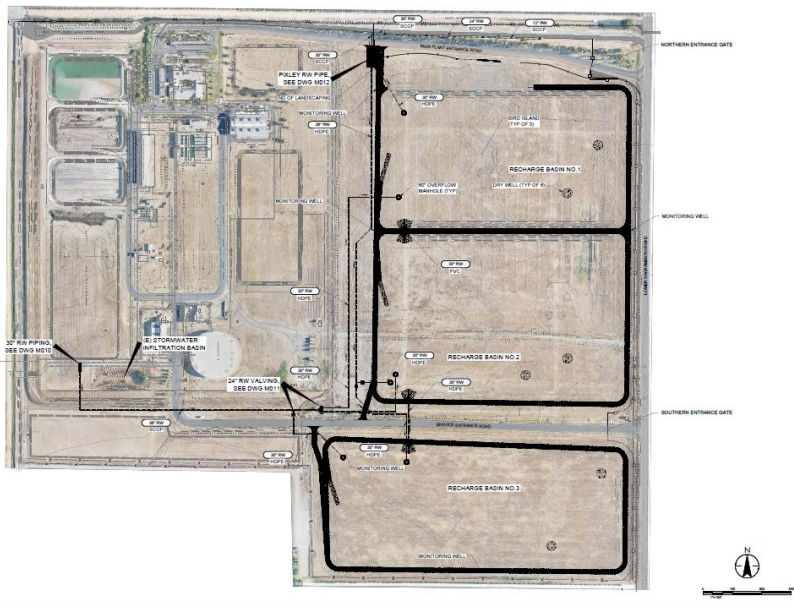
Vina GSA Groundwater Recharge Project

- Reverse Tile Drain

City of Stockton Delta Water Treatment Plant Groundwater Recharge Basins



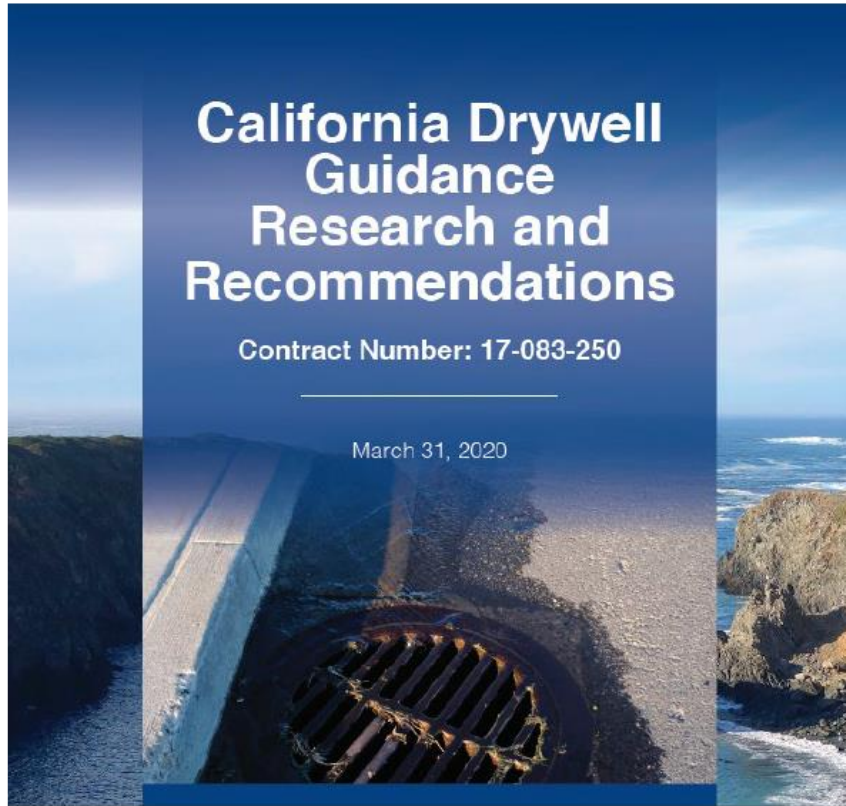
DRY WELL - DETAIL
SCALE: NOT TO SCALE



Excavated Groundwater Recharge Enhancement



Stormwater Infiltration Drywells



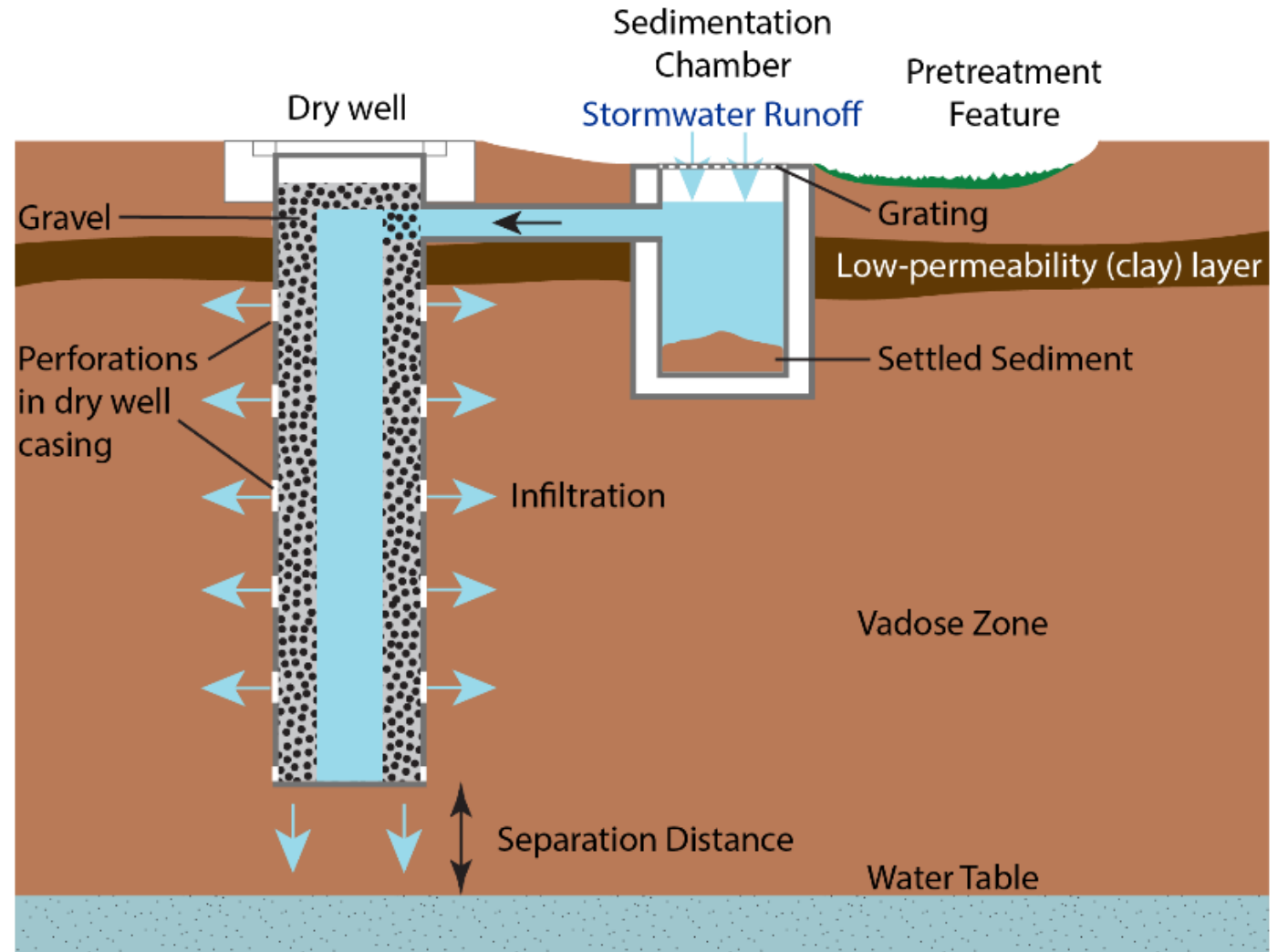
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Vina GSA Groundwater Recharge Project Reverse Tile Drain Pilot Test

Two Tests

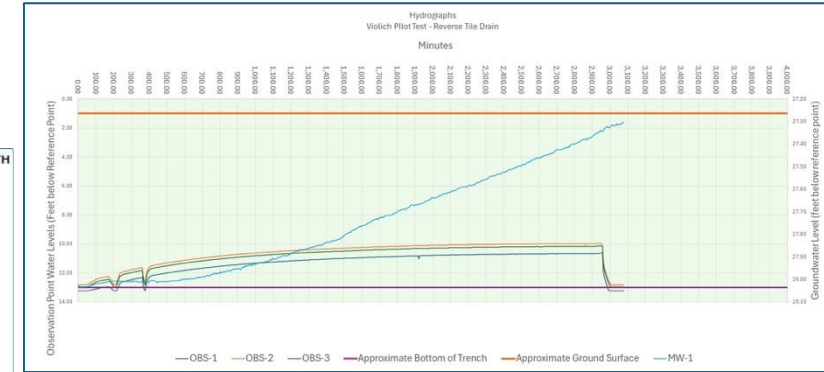
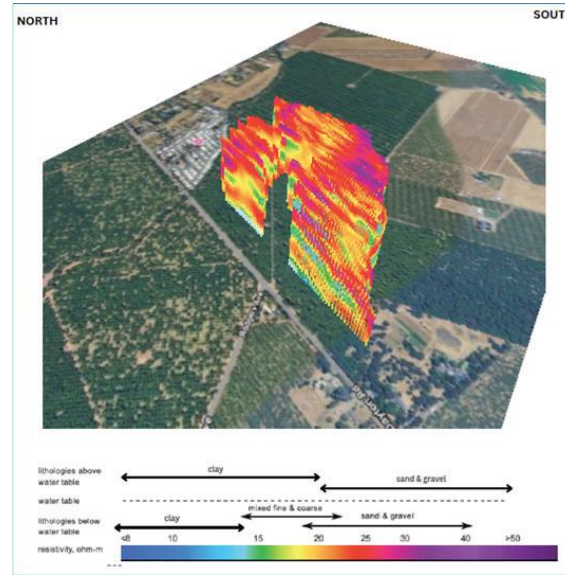
- Using water from existing on-site irrigation well
- Two FloodMAR Events
 - Done in conjunction with infiltration basin

Results

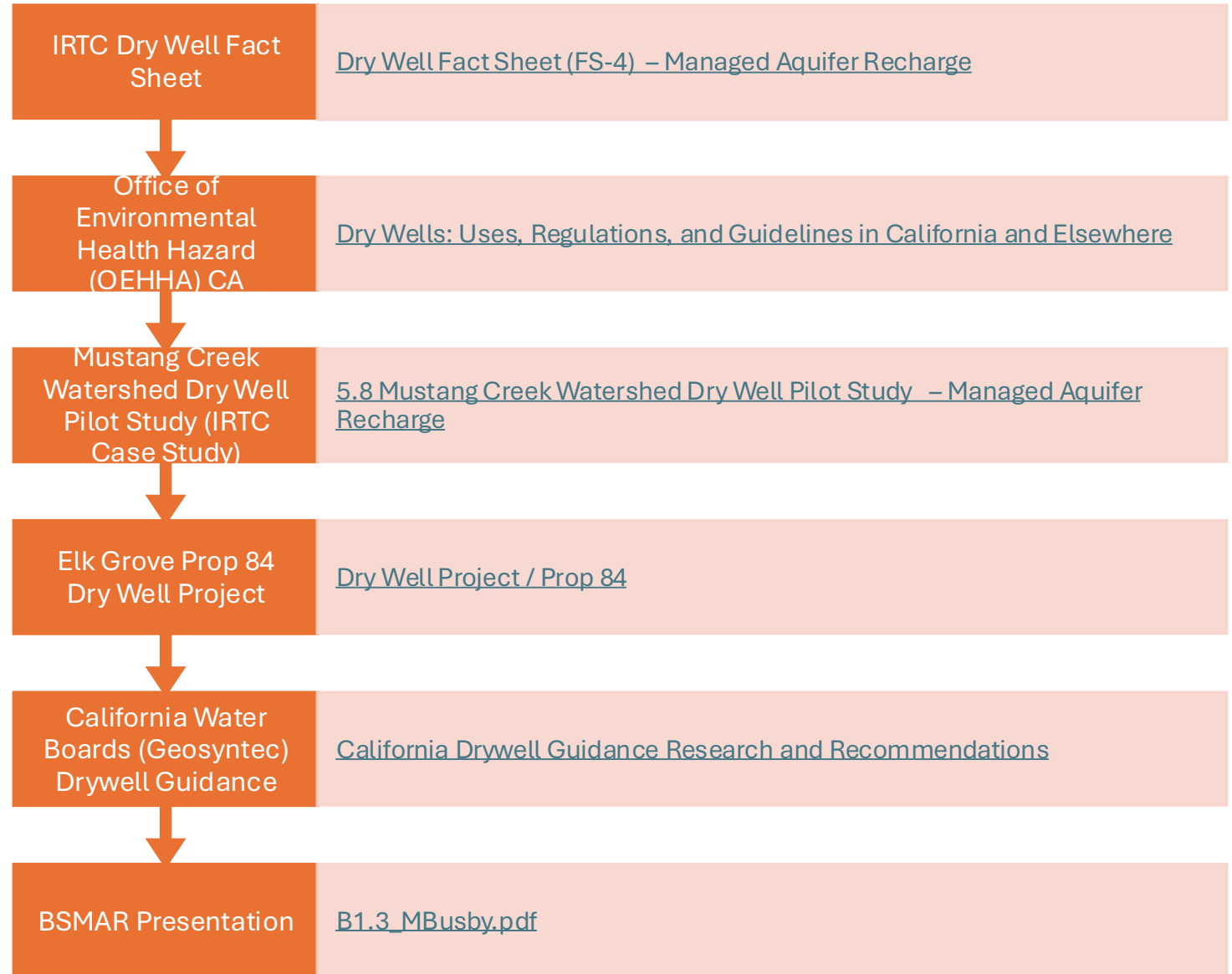
- High infiltration rates – 40 to 90 feet per day
- Full scale could do 20 acre-feet/day

Considerations

- Sediment load
- Water quality



Other Information



Thank You

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