

Groundwater Recharge

in Eastern San Joaquin County, California
resulting from the ...



Farmington
Groundwater Recharge Program



for
Toward Sustainable Groundwater in Agriculture – An
International Conference Linking Science and Policy
15-17 June 2010
San Francisco, California

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Stockton East Water District






Stockton East Water District

- Established in 1948
- Mission: Management of the Eastern San Joaquin Groundwater Basin and providing supplemental water supplies
- Provides surface water for agricultural and urban use
- Agriculture is the largest sector of the economy exceeding \$2.1B in 2008
- Local sponsor for Farmington Groundwater Recharge







Regional Setting

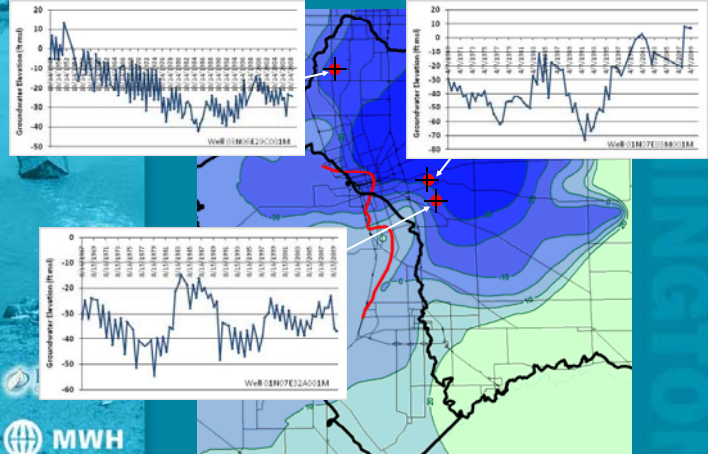




Local Setting



Pacific Ocean ← S.F. Bay ← Central Valley ← Sierra Nevada

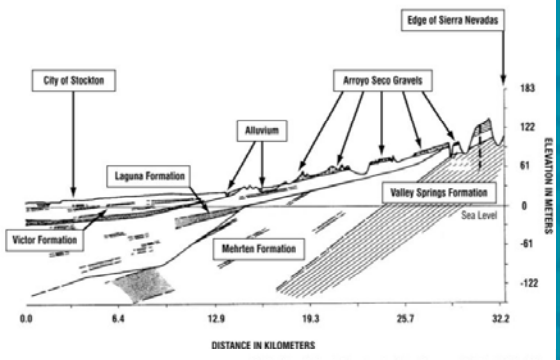
Hydrogeologic Setting





Department of Water Resources Groundwater Elevation Data (Spring 2009)

Geologic Cross Section



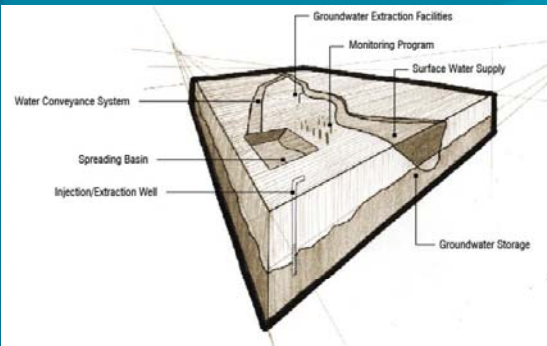
Modified from California Department of Water Resources Bulletin 11.8-3, 1974

Introduction

Conjunctive Use - "The use of groundwater and surface water in combination to maximize yield of both"

Farmington Groundwater Recharge Program - Is a classic conjunctive use project in an agricultural region of the Central Valley, California.



Program Overview

- Program Funds (30 Million Dollars)
- Program Partners
 - Stockton East Water District (25% Cost Share)
 - United States Army Corps of Engineers (75% Cost Share)
 - Other local participants (In-Kind Services)
- Uses existing water supplies
- New facilities include enlarged diversions, conveyance and recharge facilities
- Project Design Capacity – 1,785 cfs (50 m³/s)
- Total Acreage Required for Recharge 7,000 acres (2,600 hectare)



What are the Goals of the Program?

- Replenish Groundwater
 - Raise groundwater table
 - Reduce pump lift; lower pump costs
 - Provide drought protection
- Protect Groundwater Quality
 - Reduce saline water intrusion
- Provide Ecosystem Benefits
 - Seasonal habitat along Pacific Flyway
 - Temporary shallow-water bird habitat
- Build Water Conveyance System Improvements

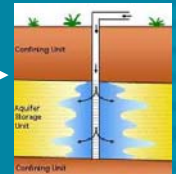


Program Recharge Techniques



← Excavated Pit

→ Injection Wells



← Surface Water In Lieu of Groundwater

Program Recharge Techniques

Flooded Field →



← Spreading Basin



What are Ridges and Furrows?

- Wave washing maximizes periods between maintenance
- Furrows collect fine grain sediments
- Ridges allow continued surface area for recharge
- Easy to construct



SEWD Facility

- Spreading Basin Facility
- 3 Basins = 60 Acres or 0.24 km²
- Built In 2002
- Total Groundwater Recharged = ~ 30,000 AF or 3.75 x 10⁷ m³



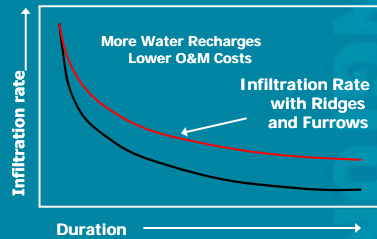
Monitoring Program

Data Monitored to Calculate Infiltration Rates and Trends

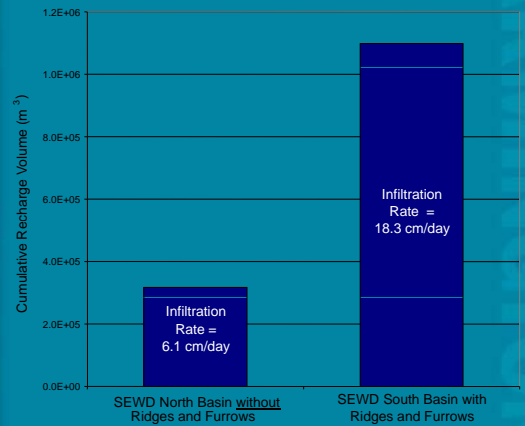
- Water Inflow (Weirs, Flow gauges)
 - Basin Height (Staff Gauges)
 - Precipitation (Weather station)
 - Evapotranspiration (Weather station)
- ### Monitoring of Groundwater Response to Recharge
- Monitoring Wells
 - Groundwater Elevation
 - Groundwater Quality

Why use this technique?

- Reasons for Infiltration Rate Decrease
 - Soil Compaction
 - Turbidity Solids Load, Source Water and/or Basin Erosion
 - Water Chemistry (sodium Absorption Ratio)
 - Precipitation
 - Biological Plant/Algae
- Traditional Remedy
 - Discing
 - Ripping
 - Scraping



Results



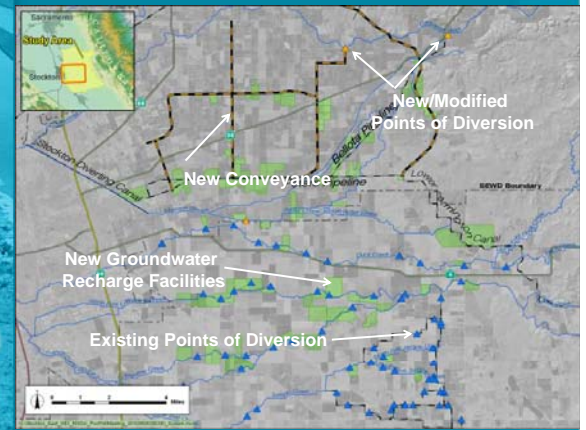
Comparison of Results

Recharge Basin	East	North	South
Wetted Size (m ²)	76,890	60,703	56,656
Maximum Basin Depth (m)	3.7	0.9	0.9
Ridges and Furrows Present (Y/N)	Partially, 48,562 (m ²) contained ridges and furrows, 28,328 (m ²) did not contain ridges and furrows	No	Yes
Average Infiltration Rate (cm/day)	15.2	6.1	18.3
Cumulative Infiltration Volume (m ³)	1.4 x 10 ⁶	3.2 x 10 ⁵	1.1 x 10 ⁶

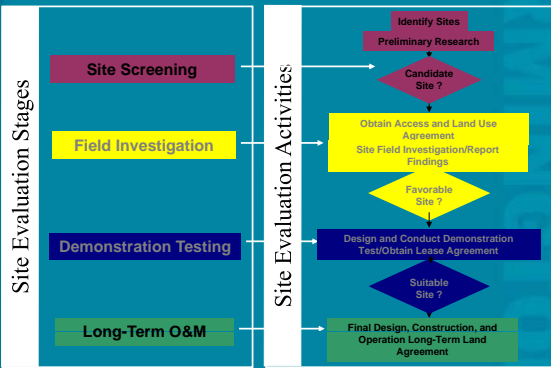
Duration of Infiltration Test Summary - 12/17/03 to 4/11/04



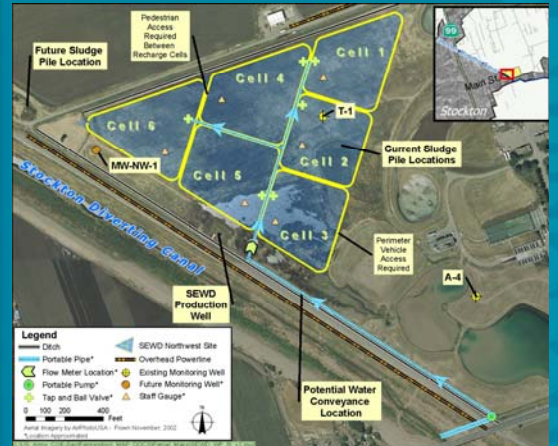
Farmington Program Facilities



Process for Site Selection/Evaluation



Program Recharge Techniques



Conclusions / Key Consequences

- Surface recharge of flood flows mitigate the critically overdrafted groundwater basin and sustain agriculture in the region
- Proven process established for developing recharge projects while protecting the environment
- Groundwater recharge is a beneficial use of the flood flows and SEWD has applied for water rights

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