Waste Discharge Requirements: What does it mean to the grower?



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California Rice

an industry changes...

ILRP Rice Specific Coalition 2003



Applying Learning

Irrigated Lands Program



California Rice

Advancing into the WDR

CRC used same successful principles

- Surface water started with the Rice Pesticides Program and Irrigated Lands Regulatory Program
- -Ground water starts with Ground Water Assessment Report to summarize existing data specific to rice
 - Includes newly developed data from UC Davis through the Rice Research Board
 - Provides the scientific basis for a rice-specific WDR through the conceptual model



Groundwater Assessment



Groundwater Assessment



Develop technical analysis to support long-term monitoring and implementation recommendations

Approach

-Evaluate field and soil environment

-Assess historic groundwater quality data

-Evaluate vulnerability





ABSTRACT

Rice is farmed on approximately

500,000 acres in the Sacramento Valley. A rice-specific Conceptual Site Model (CSM) was developed to frame a groundwater assessment report (GAR) to analyze the potential for rice farming to impact local groundwater quality. A rice-specific CSM is valuable in the context of Sacramento Valley groundwater management because rice farming occupies such significant acreage overlying major groundwater basins. The main components of the

rice-specific CSM are the physical-chemical conditions and dynamics pertaining to flooded fields and root zones, water and pollutant sources and sinks, and potential transformations and pathways for migration of water and pollutants. The CSM describes characteristics specific to rice farming, including soil types, water management and its influence on soil conditions, and then relates these to underlying groundwater quality.

The groundwater quality analysis relied on readily available sources of information regarding root zone geochemistry, and nutrient, pesticides, and general parameter concentrations in the shallow groundwater, and deep groundwater underlying the rice fields. In addition, the fate of applied nitrogen fertilizers, and sources and fate of salinity were evaluated

The assessment was performed on

behaf of the California Rice Commission Coalition (CRC), a statutory organization representing about 2,500 rice farmers and handlers, which manages the only commodity specific water quality coalition with representation specifically for rice in the Sacramento Valley. The GRA is required by the Central Valley Regional Water Quality Control Board's (RWQCB) Long-Term Irrigated Lands Regulatory Program (LTILRP). The LTILRP adds groundwater monitoring and reporting requirements to the ongoing surface water monitoring portion of the program. A rice-specific Monitoring and Reporting Plan (MRP) will be developed for the CRC, based on the findings of the GAR.

specific CSM and provides an overview of data collected for this effort. A preliminary discussion of results pertaining to nitrate transformation processes in the rice root zone, and nitrate concentrations in the shallow and deep groundwater is also provided.

DATA SETS

Data from historical and current monitoring networks were reviewed to determine which were applicable to this analysis and to identify significant gaps in monitoring of groundwater quality in the Sacramento Valley's rice-growing region. Well networks were chosen based on the following features: • Location of wells in proximity to rice farmland • Availability of well construction information • Availability of well construction information • Availability of information on sampling depth • Range of chemical constituents monitored • Peer-review and publication of results The following data sets were reviewed for groundwater quality and intrate concentrations: USGS Rice Wells, Shallow Domestic Wells, USGS GAMEWells.

lassifications) were also reviewed, as well as results of root zone tudies.

Assessment of Nitrate Concentrations in Groundwater Underlying Rice Farming Areas of the Sacramento Valley

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RICE-SPECIFIC CONCEPTUAL SITE MODEL

The CSM is a framework for analyzing data related to subsurface hydrology and pollutant transport. It helps describe and analyze connections of rice fields to the broader environment. The CSM embodies interrelated processes and potential transport pathways. Independent lines of evidence can be developed to assess risk of groundwater quality degradation by rice farming.







th, and adaptive management.

SUMMARY OF FINDINGS

Figure 4: Maximum Observed NO2+NO3-N Concentrations in the Three USGS Datasets

Ultimately, the CSM can be used as a tool to design tar



Figure 5: NRCS Soil Drainage Classifications in Rice Growing Areas of the Sacramento Valley



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 Water and nutrient management in rice farming: The flooding of rice fields creates reducing soil conditions that maintain nitrogen in the ammonium (not nitrate) form.

 Rice-specific conceptual site model: The large, contiguous acreage farmed continuously in rice, combined with the uniqueness of rice farming practices, support a rice-specific approach to erroundwater quality management.

 Rice soils: Sacramento Valley soils on which rice is grown are usually composed of tight clays and have very low verical hydraulic conductivity, limiting downward movement of applied materials to very low rates, regardless of their concentration in soil pore water.

 Local hydrogeology: Local geology includes old marine deposits and volcanic rocks, that are sources of naturally occurring salinity and common elements (e.g. Fe, Mn).

 Shallow groundwater quality: Nitrate was not detected in any USGS Rice Well at a level exceeding the MCL. The quality of this shallow groundwater suggests that there is no evidence of nitrate contamination from the rice lands that are represented by these wells. Most of the USGS Rice Wells had TDS concentrations below

1,000 mg/L (the upper limit SMCL for TDS).



NITRATE IN RICE ROOT ZONES

Porewater concentrations (about 1.2x those shown for soils) are all below the MCL, and those at the base of

the profile are near zero

REFERENCES

Linquist, Bruce, Chris van Kessel, Jim Hill, Randall Mutters, Chris Greer, and Luis Espino. 2011. Improving fertilizer guidelines for California's changing rice climate. (Annual Report to the Rice Research Board). UC-ANR (University of California Agriculture and Natural Resources). 2010. Rice Nutrient Management in California. UC-ANR Publication 3516, 136 pp. USGS (U. S. Geological Survey). 2001a. Shallow Ground-Water Quality Beneath Rice Areas in the Sacramento Valley, California, 1997. Water-Resources Investigations Report 01-4000. National Water-Quality Assessment Program. USGS (U. S. Geological Survey). 2001b. Ground-Water Quality in the Southeastern Sacramento Valley Aquifer,

California, 1996. Water-Resources Investigations Report 01-4125. USGS (U.S. Geological Survey). 2008. Ground-Water Quality Data in the Middle Sacramento Valley Study Unit, 2006 – Results from the California GAMA Program. U.S. Geological Survey Data Series 385, 100 p.

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Rice Lands

- Groundwater quality generally high
- Contiguous blocks of continuous rice
- Relatively consistent farming practices since about 1982





SWRCB Initial Vulnerability Areas and DPR Groundwater Protection Areas

Rice Within SWRCB Initial Vulnerability Areas and DPR Groundwater Protection Areas



Runoff or Leaching

California Rice

50,000 acres or 10% of total rice acres is grown on initial HVAs and GPAs



Rice within Initial SWRCB HVA
 Rice within DPR Leaching and Leaching or Runoff GPA
 County Boundary
 Groundwater Basins







Note: Figure from the Rice-Specific Groundwater Assessment Report, Figure 2-2.

Groundwater Data Quality Analysis



Collected & Analyzed Existing Groundwater Quality Data

Key Features of Selected Datasets

- Proximity to rice
- Range of constituents
- Range of depths: shallow, medium, and deep groundwater
- Documented, peerreviewed, or published



Compared Groundwater Quality Results*

- Nutrients (nitrate , phosphorus, potassium, sulfur, zinc, iron)
- Salinity (TDS, specific conductance)
- Pesticides registered for use on rice
- Metals and non-metals

*Compared to drinking water standards and other triggers



Evaluated Well Networks

Shallow and Deep Well Networks Overlying the Initial HVAs and GPAs in Rice Fields

Legend

Stallow Domestic Wells Rice within Initial SWRCB HVA Rice within DPR Leaching and Leaching or Runoff GPA **USGS Rice Wells** Active Monitoring Well County Boundary Abandoned Monitoring Well Groundwater Basins USGS Well Networks USGS GAMA Wells Grid Well and Rice Initial HVAs VCalifornia Rice Elow Path Well

Nitrate Results for All Well Networks

Legend

USGS Rice Wells

- <5 mg/L NO2+ NO3-N</p>
- 5 mg/L 10 mg/L NO2+ NO3-N
 Shallow Domestic Wells
- 8 < 5 mg/L NO2+NO3-N
- 5 mg/L 10 mg/L NO2+NO3-N
- > 10 ma/L NO2+NO3-N

GAMA Wells

- <5 mg/L NO2+ NO3-N</p>
- 5 mg/L 10 mg/L NO2+ NO3-N
- >10 mg/L NO2+ NO3-N



- Rice Lands (DWR)
- Groundwater Basins





Review of DPR Groundwater Protection Program

- Review of DPR technical approach
- DPR Groundwater
 Database
 - Incorporates statewide pesticide monitoring
 - DPR, CDPH, USGS

Legend



- DPR Well Inventory Database
- Well Sampled for Pesticides Registered for Use on Rice





Data Sources: Groundwater Basins, Rice Crop (California DWR 2010); Basemap, County (ESRI 2011), DPR (2011). Datum is NAD83

Groundwater Assessment Summary





Multiple lines of evidence

Low risk

- *—Nitrate in USGS Rice Wells below the MCL*
- —No confirmed detections of pesticides registered for use on rice
- Analysis forms basis for Trend Monitoring Program

Major Rice-Specific WDR Features

GW & SW monitoring Farm evaluations & management practices Rice lands Ongoing coordination with DPR Rice-specific N management tool (CRC) initiative)



CRC Due Dates for Reports

California Rice

Report	Date	Updates
Submittal of templates for Farm Evaluation and Nitrogen Management Plan	November 30, 2014	As needed
Groundwater Trend Monitoring Work Plan	October 1, 2014	As needed
Farm Evaluation Management Practice Summary	July 31, 2015	Every three years
Annual Monitoring Report	December 31	Annually

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Farm Evaluation Template

ID rice acres and crop grown in rotationLocation of farm

- ID and track management practices implemented on farm
- ID where water leaves property
- In-service and abandoned wells
- Acknowledgement by Grower of landowner notification

fornia Rice

Nitrogen Management Plan Template

- Developed in consultation with others
- Soil & plant tissue testing
- Nitrogen application rates
- Nitrogen application timing
- Consideration of organic N fertilizer
- Consideration of irrigation water N levels



Grower Due Dates for Reports

California Rice

Report	Date	Update
Notification of Landowner	As part of Farm Evaluation	Initial notification and when change in ownership for rice land
Farm Evaluation	March 1, 2015	Annually
Nitrogen Management Plan	March 1, 2016	Annually
Nitrogen Management Plan Summary Report	If identified within a high vulnerability area triggered by nitrates	Specified in GWQMP
Mitigation Monitoring Report	By October 1st when mitigation measures are implemented	Annually

Three Items for Rice Growers

Report	Date	Update
Notification of Landowner	As part of Farm Evaluation	Initial notification and when change in ownership for rice land
Farm Evaluation	March 1, 2015	Annually
Nitrogen Management Plan	March 1, 2016	Annually



Discussion/Questions?

