



North Fork Kings
Groundwater Sustainability Agency

Groundwater Sustainability Plan (GSP) Status Report

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Provost & Pritchard Consulting Group**

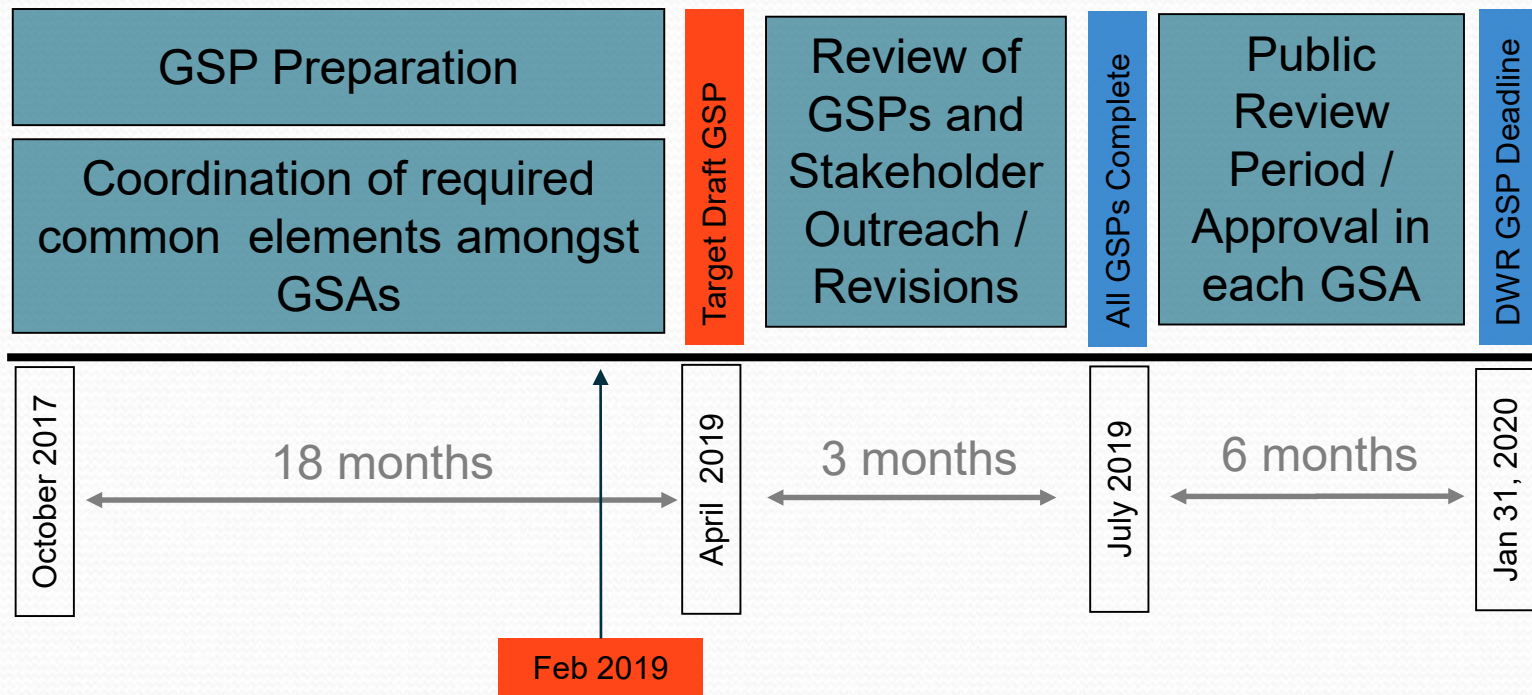
BOARD OF DIRECTORS MEETING

FEBRUARY 27, 2019

RIVERDALE COMMUNITY EDUCATION CENTER

Presentation Overview

1. Schedule
2. GSP Development Update
3. Kings Subbasin Coordination Update
4. Achieving Sustainability
 - Potential Projects
 - Management Actions
 - Undesirable Results
5. Projects Submitted for Grant Funding
6. Land Subsidence
7. Water Budget



GSP Preparation and Coordination Timeline

GSP Development Update

GSP Section	Current Status	Future Work
2- Plan Area	Draft Complete – comments incorporated	Draft Provided to Board of Directors
3.1 - Hydrogeologic Conceptual Model	Internal Draft Complete – submitted to Technical Advisory Group	Incorporate comments and submit draft to Board of Directors
3.2 – Historical GW Conditions	In Progress – nearing completion	Complete draft, then provide to TAG and RCAC for review in early March
3.3 – Water Budget	In Progress – historical WB nearly complete, working on current and future water budgets	Complete draft, then provide to TAG and RCAC for review in March
4 - Sustainable Management Criteria	In Progress, developing criteria for water levels as proxy for determining sustainability	Develop criteria, define undesirable results, set measurable objectives and minimum thresholds by early April
5 – Monitoring Network	In Progress - data gaps identified, initiating chapter development	Complete draft, then provide to TAG and RCAC for review in March
6 – Projects and Management Actions	In Progress – identifying potential projects and management actions	Complete draft, then provide to TAG and RCAC for review in March
7 – Plan Implementation	Not Initiated	Early April target date for submittal to TAG and RCAC

GSP Development Proposed Schedule

North Fork Kings GSA GSP Development Proposed Schedule		
Admin Draft of GSP	Board Meeting	4/24/19
NFKGSA Stakeholder Review		
Coordination with other Kings Subbasin GSAs		
Coordination with adjacent subbasins/GSAs		
Consider and incorporate comments into GSP		
Public Review		
Authorize Release of Public Review Draft	Board Meeting	7/24/19
90-day Public Review Period		
Public Hearing, receive comments on GSP	Board Meeting	10/23/19
Finalize and Submit GSP		
Consider and incorporate comments into GSP		
Special Board Meeting (tentative), review comments	Board Meeting	12/11/19
Consider and incorporate comments into GSP		
Board Adopt Final GSP	Board Meeting	1/22/20
Submit GSP to DWR	Prior to	1/31/20

Kings Subbasin Coordination Task Orders

All GSAs within Kings Subbasin working together to estimate current overdraft responsibility among GSAs and coordinate activities:

Task 1 - project coordination and meetings

Task 2 - groundwater conditions

Task 3 - estimation of groundwater storage (unconfined)

Task 4 - groundwater flow estimates

Task 5 - confined aquifer boundary flow estimate

Task 6 - data management system

Task 7 - water budget

Task 8 - DWR Technical Support Services Coordination

Task 9 - Coordination Agreement Assistance

Task 10 - Water Level Sustainable Management Criteria Coordination

Sustainability & Sustainable Yield

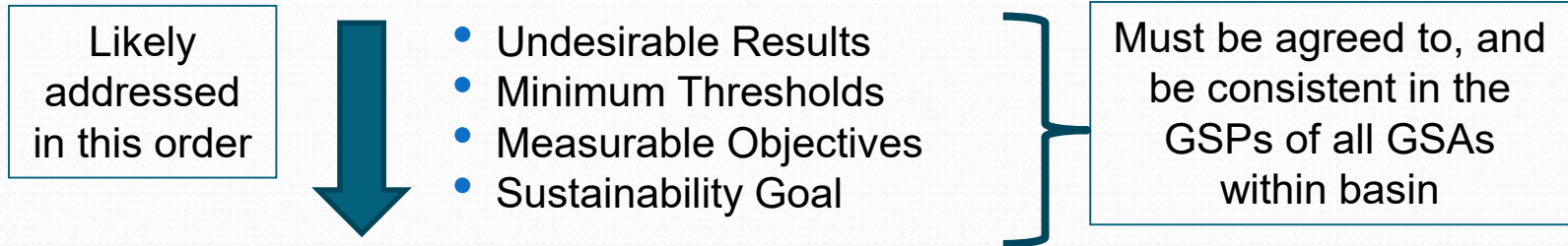
- *SGMA does not incorporate sustainable yield estimates directly into sustainable management criteria. Basin-wide pumping within the sustainable yield estimate is neither a measure of, nor proof of, sustainability. Sustainability under SGMA is only demonstrated by avoiding undesirable results for the six sustainability indicators.*
- DWR cares about results of pumpage, not necessarily amount of pumpage
- Will need to monitor pumpage and sustainability criteria
- Sustainable yield will be estimated to satisfy sustainability criteria
- Sustainable yield may need to be modified in future (5-year intervals)
 - Only an estimate; some uncertainties
 - Changes over time

Sustainable Management Criteria

- Sustainability indicators



- Significant & Unreasonable – defined using the following:



Achieving Sustainability

- Preliminary estimate of groundwater overdraft for NFKGSA is approximately 50,000 AF/yr, but historical water budget indicates a higher overdraft number
- Overdraft and declining groundwater levels directly relate to potential impacts for all sustainability indicators
- There are basically only two ways to achieve sustainability and eliminate overdraft:
 - Increase water supply - primarily through project development
 - Reduce water demand – primarily through management actions
- Increasing water supply will be the emphasis, but there are hurdles:
 - Availability and frequency of additional water – likely Kings River floodwater – for groundwater recharge or direct use
 - Water rights – all Kings River water is allocated per established schedule
 - Physical constraints – soils conducive for recharge, distribution system, etc.

Projects

- Preliminary project list contains recharge projects that would yield an estimated annual average of approx. 34,000 AF/yr based on historic floodwater availability
- Additional projects have been envisioned but not identified because additional information is needed, such as:
 - Locating restrictive clay layers to better define potential recharge areas
 - Potential yield and cost of newer technologies, such as reverse flow tile system
- The amount of overdraft that can't be overcome with increasing the water supply will need to be overcome with management actions that reduce water demand
- Demand reduction through management actions will likely need to be initiated within 5 - 10 years if project development isn't progressing as needed
- Several projects have been submitted for grant funding

Potential Management Actions

- Management Actions are programs and policies that will aid the GSA in achieving sustainability primarily through water demand reduction measures and improving data monitoring
- A suite of potential management actions will be presented in the GSP that could be implemented at the GSA level or landowner level
- GSA may not want to dictate management actions at the landowner level, what works for one landowner may not work for another and economic impacts must be considered
- Need to establish the criteria and response to exceedances of minimum thresholds and undesirable results

Undesirable Results

- Undesirable results occur when conditions related to any of the six sustainability indicators become significant and unreasonable
- Undesirable results will be used by DWR to determine whether the sustainability goal has been achieved within the basin
- Undesirable results will be defined by minimum threshold exceedances – at a single monitoring site, multiple sites, portion of basin, entire basin
- GSP must include a description for each undesirable result and define when an undesirable result is triggered
- Descriptions of undesirable results are to be coordinated with other GSAs within a basin

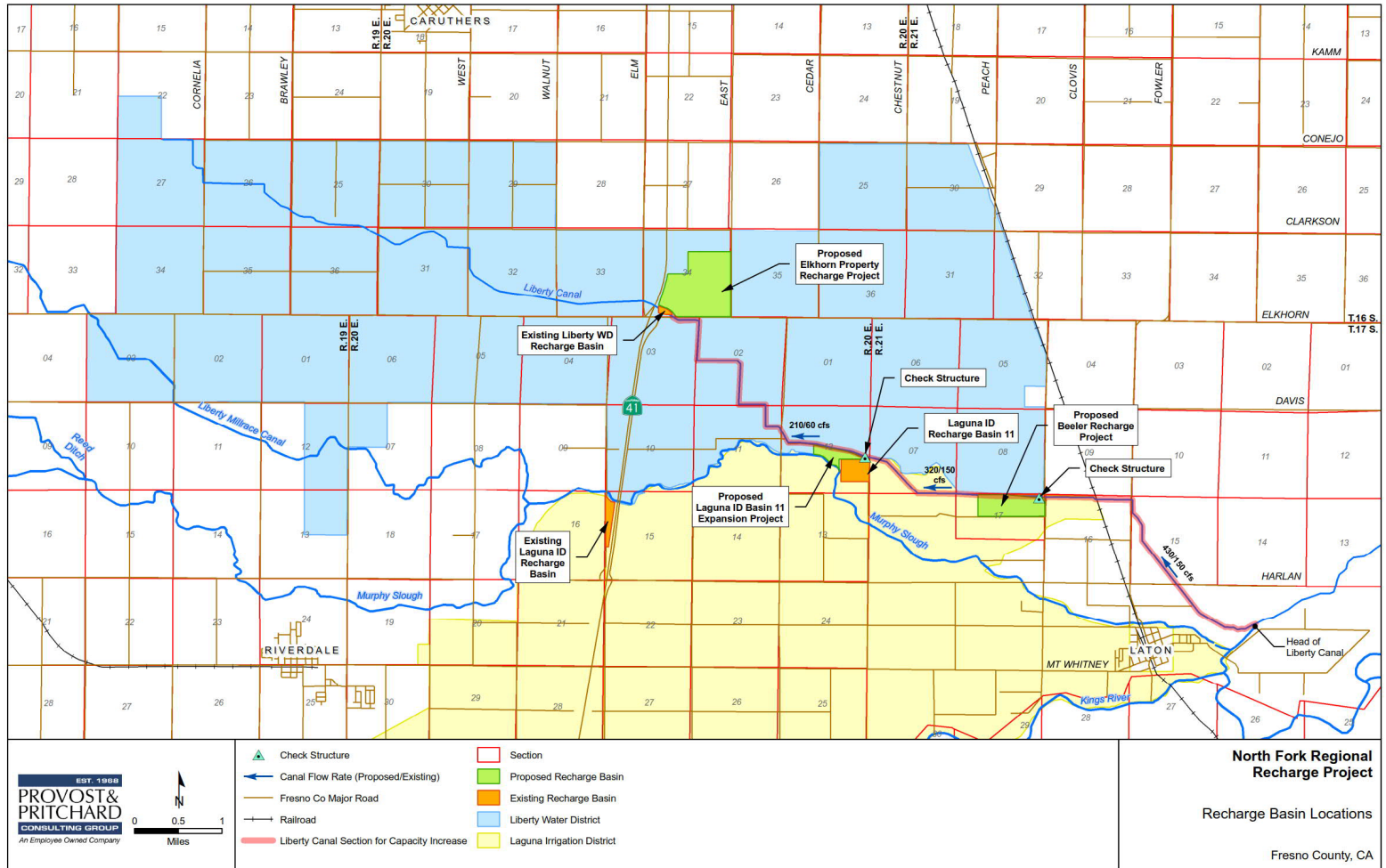
Prop 1 IRWM Implementation Grant – Round 1

- Round 1 of Integrated Regional Water Management (IRWM) Implementation Grant funding from Proposition 1 will be awarded this summer by DWR
- Current solicitation is a combined total of \$12.7 million for the Tulare Lake Funding Area
- Kings Basin Water Authority (KBWA) is one of potentially seven IRWM groups that could compete for this funding

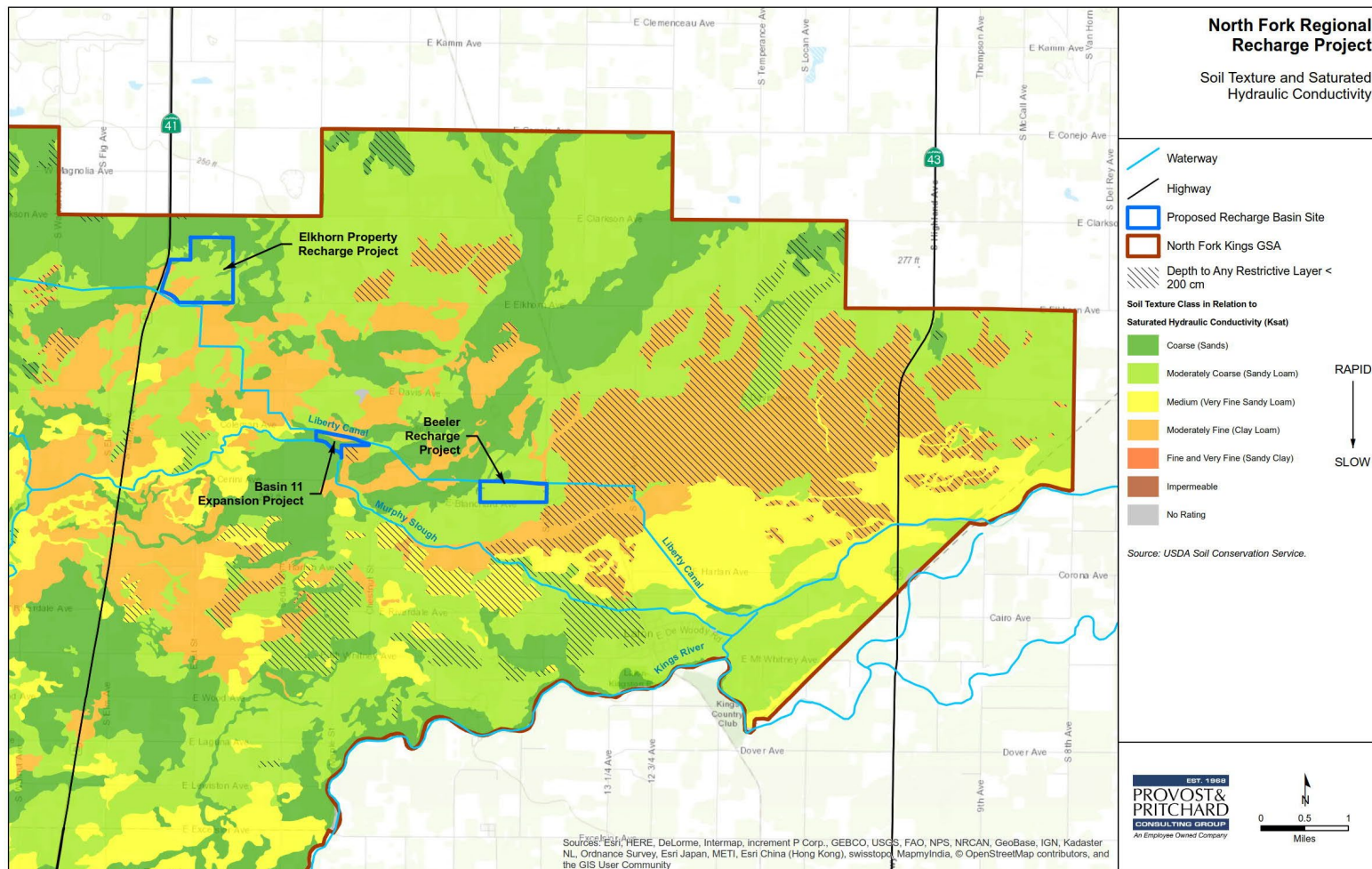
Prop 1 IRWM Implementation Grant – Round 1

- KBWA asked for project pre-applications to be submitted on Friday 2/22/19
- Pre-applications will be independently scored by Project Review Panelists
- KBWA intent is to select one or more projects with a total request of not less than \$2M, then prepare final application to DWR
- Cost share is required unless receive DAC waiver, and funding plan required
- North Fork Kings GSA submitted a project called North Fork Regional Recharge Project, largely still conceptual in nature
- Laguna Irrigation District submitted conveyance portion of Laton North Recharge Project, much further along in development

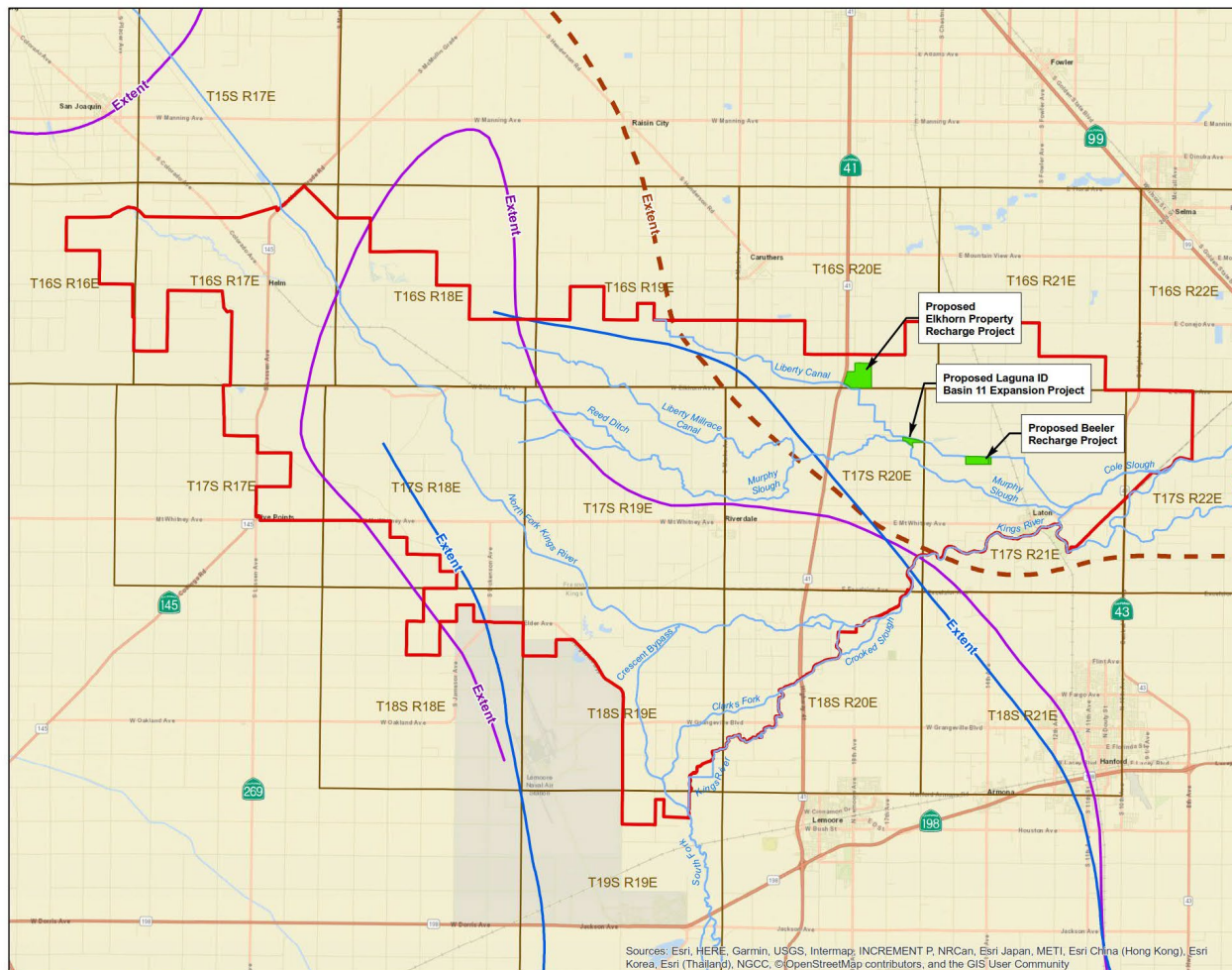
North Fork Regional Recharge Project – combines 3 projects on IRWM list



Surface soils appear conducive for recharge – excavation will increase infiltration rate



Recharge
would occur
outside clay
layer extents

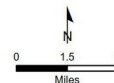


North Fork Regional Recharge Project

Extent of Subsurface Clay Layers

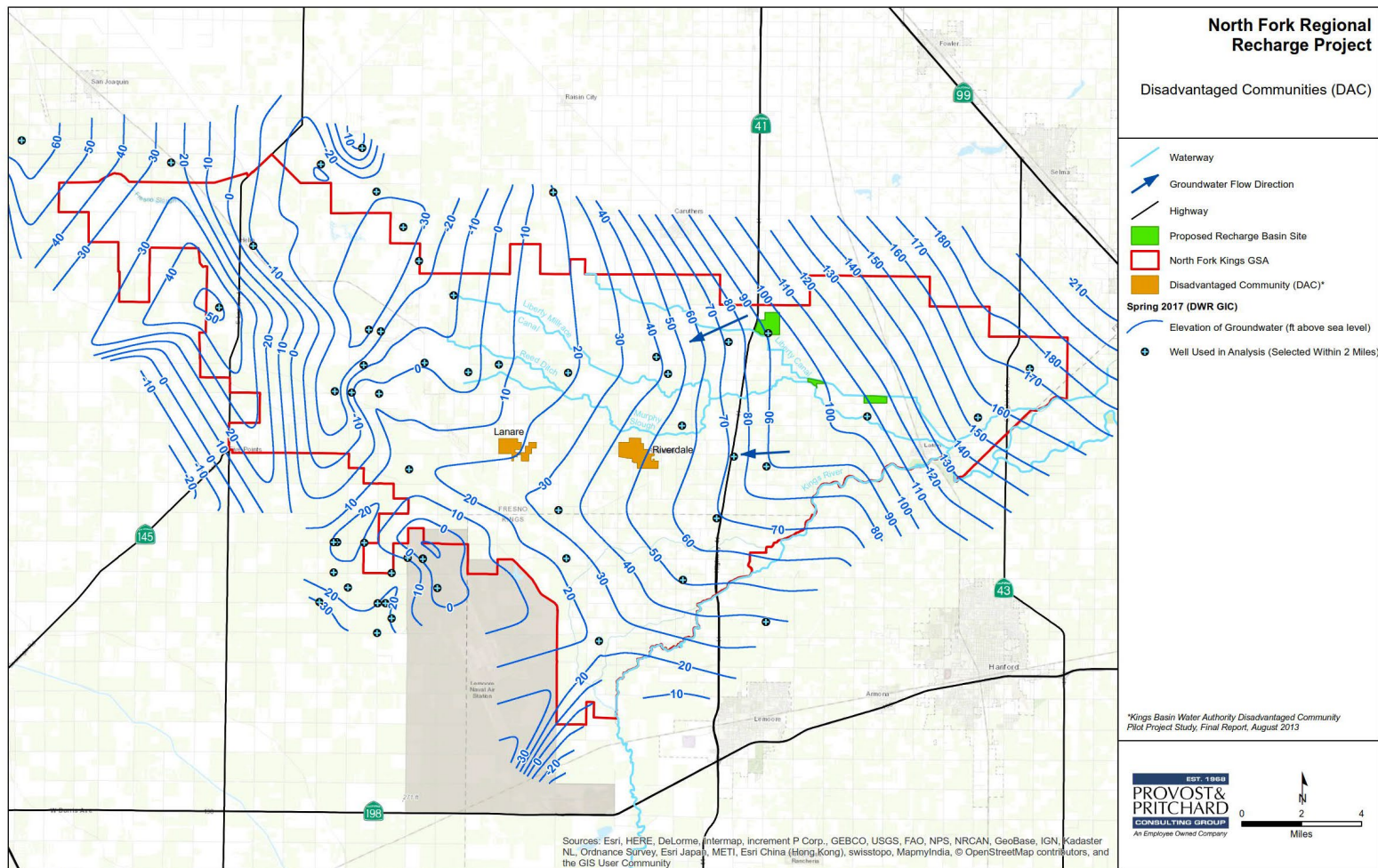
- A-Clay Extent (1999-H)
- C-Clay Extent (1999-H)
- - - E-Clay Eastern Extent (Page and LeBlanc 1969, modified by KDSA)
- Proposed Recharge Basin Site
- North Fork Kings GSA
- Township/Range

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Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, ©OpenStreetMap contributors, and the GIS User Community


Recharged water would flow under clay layers toward DACs and benefit majority of GSA area




Conceptual layout of Elkhorn recharge facility – utilize temporary berms until proposed excavation occurs as part of Highway 41 expansion project



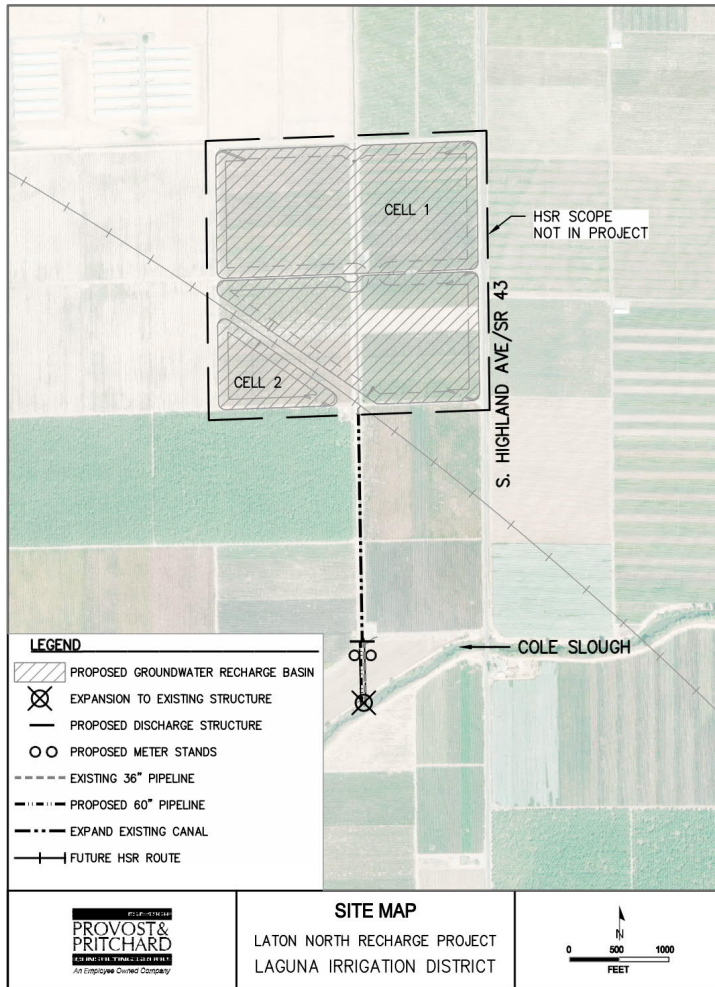
North Fork Regional Recharge Project is very expensive based on preliminary estimate used for pre-application, but project should be one of the top priorities for NFKGSA

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NORTH FORK REGIONAL PROJECT SUMMARY OF PRELIMINARY ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST		
2/21/2019		
NFRFP components:		
1) Elkhorn Property Recharge Project and Liberty Canal Improvements 2) Basin 11 Expansion Project 3) Beeler Recharge Project		
Assume loan repayment term of 30 years at 5% annual interest rate		
	Work or Material	Estimated Cost
		Item Total
Phase 1	Elkhorn Basin - Property, Site Improvements, Structures, Monitor Wells	\$ 7,817,000
	Liberty Canal Improvements, Easements	\$ 7,014,000
	General Conditions	\$ 1,048,000
	Non-Contract Costs	\$ 2,746,000
	Project Contingency	\$ 4,656,000
	Subtotal	\$ 23,281,000
Estimated Annual Project Yield: 11,400 acre-foot		
Annualized Cost: \$1,514,500		
^{1/} Average Annual Cost per Acre-Foot: \$ 133		
Phase 2	Basin 11 Expansion - Property, Site Improvements, Structures, Monitor Wells	\$ 2,890,000
	General Conditions	\$ 220,000
	Non-Contract Costs	\$ 531,000
	Project Contingency	\$ 910,000
	Subtotal	\$ 4,551,000
Estimated Annual Project Yield: 1,260 acre-foot		
Annualized Cost: \$296,000		
^{1/} Average Annual Cost per Acre-Foot: \$ 235		

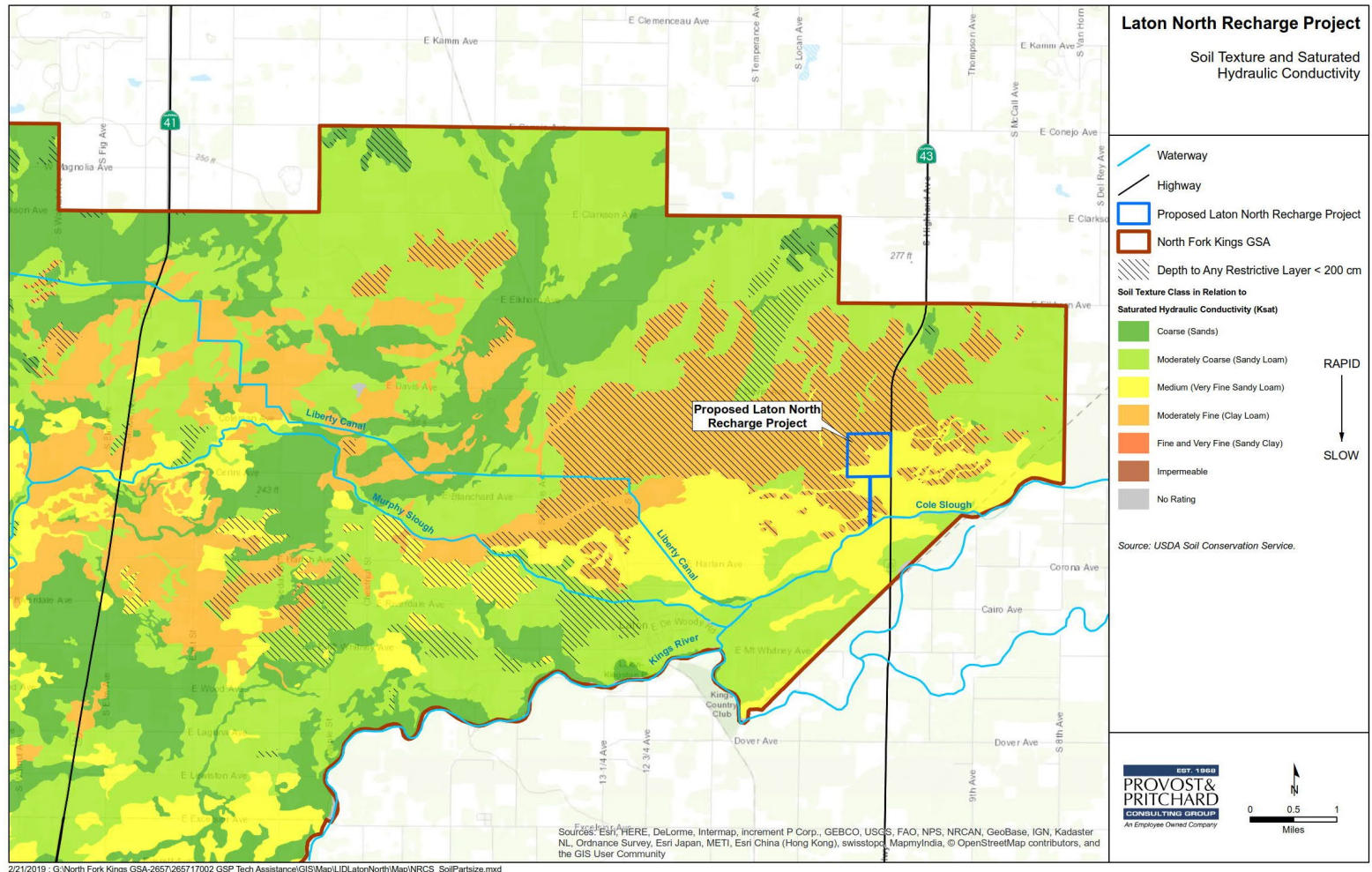
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Assume loan repayment term of 30 years at 5% annual interest rate		
	Work or Material	Estimated Cost
		Item Total
Phase 3	Beeler Recharge Project - Property, Site Improvements, Structures, Monitor Wells	\$ 6,233,000
	General Conditions	\$ 382,000
	Non-Contract Costs	\$ 928,000
	Project Contingency	\$ 1,886,000
	Subtotal	\$ 9,429,000
Estimated Annual Project Yield: 2,500 acre-foot		
Annualized Cost: \$613,400		
^{1/} Average Annual Cost per Acre-Foot: \$ 245		
Overall Project		
Phase 1	Elkhorn Property Recharge Project and Liberty Canal Improvements	\$ 23,281,000
Phase 2	Basin 11 Expansion Project	\$ 4,551,000
Phase 3	Beeler Recharge Project	\$ 9,429,000
	Total	\$ 37,261,000
Estimated Annual Project Yield: 15,160 acre-foot		
Annualized Cost: \$2,423,900		
^{1/} Blended Average Annual Cost per Acre-Foot: \$ 160		
^{1/} Based on water being available on average 40 days per year		

Another project that was submitted for funding was the conveyance portion of the Laton North Recharge Project being pursued by Laguna ID

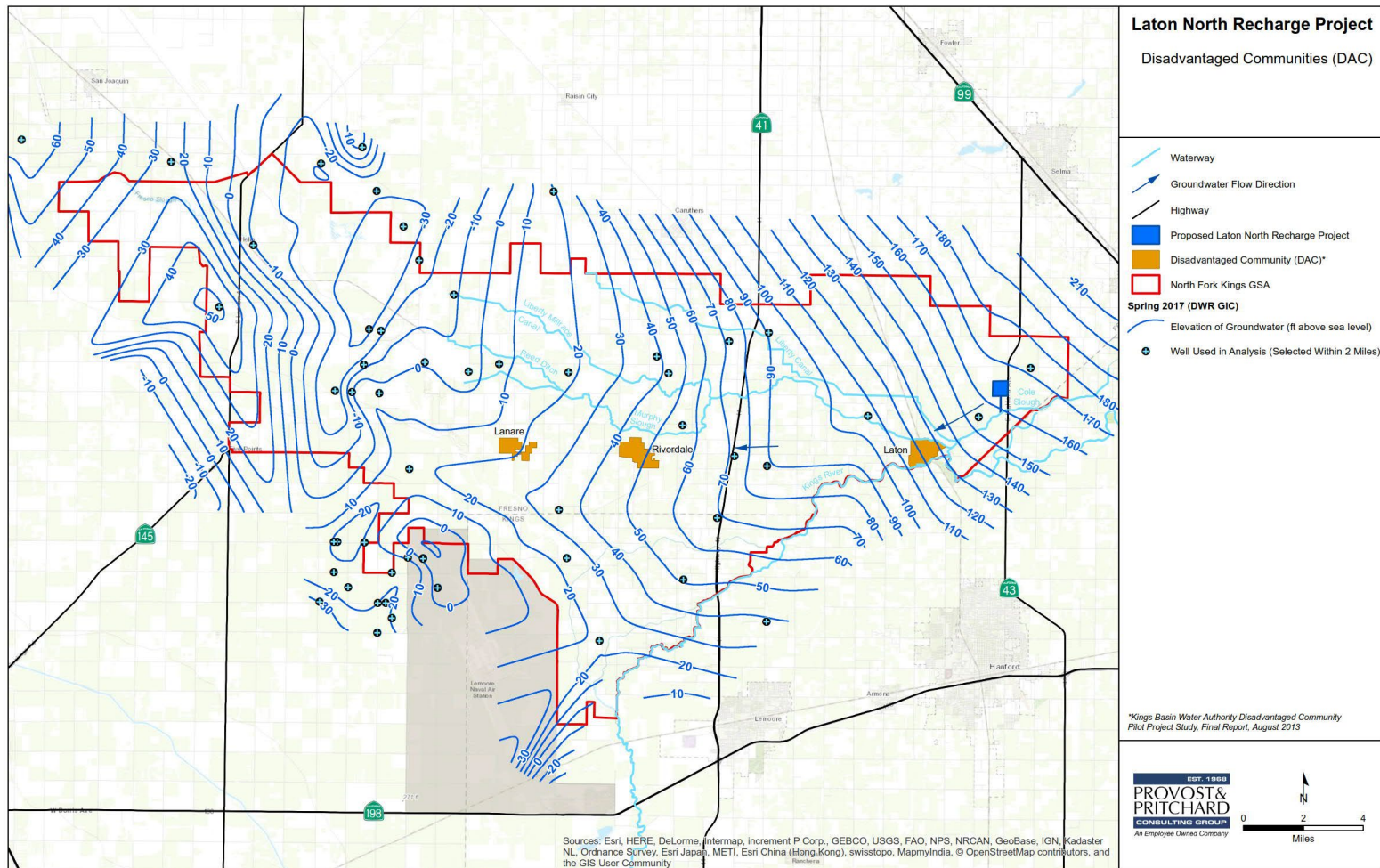
- Recharge basin to be excavated by High Speed Rail project
- Construction of conveyance system submitted for grant funding
- Gross acreage = $150 \pm$ acres
- Storage volume = $2,800 \pm$ AF
- Estimated average annual recharge = $5,000 \pm$ AF



Laton North Recharge Project
surface soils
conductive for
recharge – but
basin
proposed to
be excavated
by HSR



Laton North Recharge Project would benefit DACs



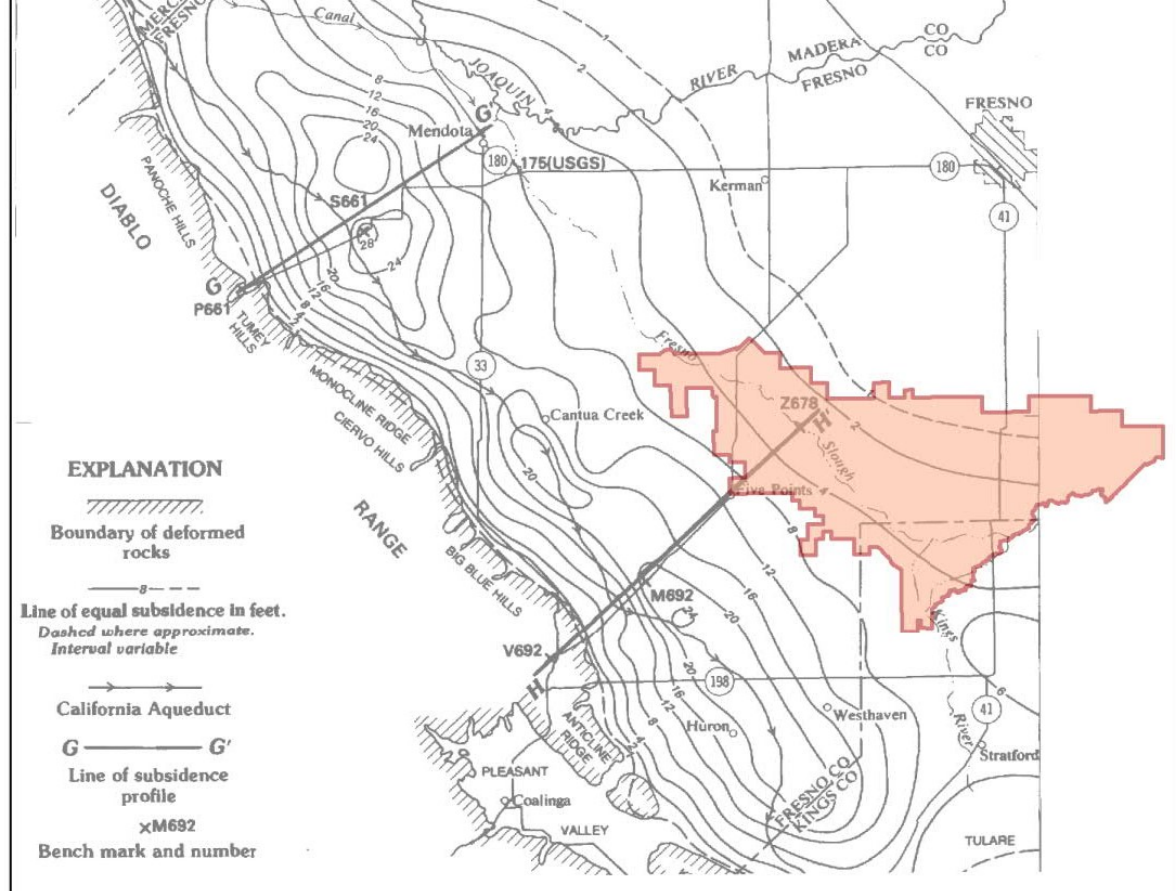
Submitted KBWA IRWMP Pre-Applications – Round 1

Agency	Project Title	Grant Amount Requested	Total Project Cost
Fresno Irrigation District	Fresno Irrigation District Wagner Recharge Basin	\$2,136,000	\$4,276,780
North Fork Kings GSA	North Fork Regional Recharge Project	\$10,250,000	\$37,512,000
Consolidated Irrigation District	Adams and Academy Basin	\$2,414,060	\$4,130,088
Kings River Conservation District	McMullin On-Farm Flood Capture Project, Phase 2B	\$3,011,000	\$7,232,000
County of Fresno	Fresno County Domestic Well Destruction and Water Sampling Program	\$515,100	\$515,100
City of Reedley	City of Reedley Storm Water Basin	\$2,170,455	\$2,170,455
City of Selma	Storm Drain, Storage and Recharge Project	\$2,175,000	\$2,415,000
Laguna Irrigation District	Laton North Recharge Project	\$450,000	\$911,000
Fresno Metro. Flood Control District	Basin CF – Stormwater Recharge and Flood Control Protection Project	\$1,072,036	\$1,072,036
Fresno Metro. Flood Control District	Basin SS – Stormwater Recharge and Flood Control Protection Project	\$1,040,033	\$1,040,033
Fresno Metro. Flood Control District	Basin CE – Stormwater Recharge and Flood Control Protection Project	\$1,265,909	\$1,265,909
	Total =	\$26,499,593	\$62,540,401

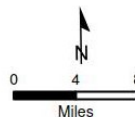
Land Subsidence

- Land Subsidence is one of the Sustainability Indicators and must be considered in GSP
- *“Significant and unreasonable land subsidence that substantially interferes with surface land uses”*
- Subsidence is occurring in southwestern portion of NFKGSA
- KRCD is monitoring specific sites
- DWR and USBR has been assessing regional subsidence utilizing satellite data
- Subsidence has occurred over time but increased during recent drought

Historical Land Subsidence



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Legend

North Fork Kings GSA

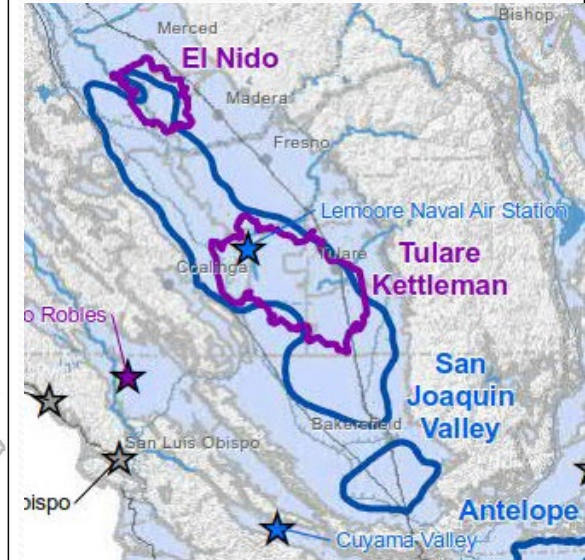
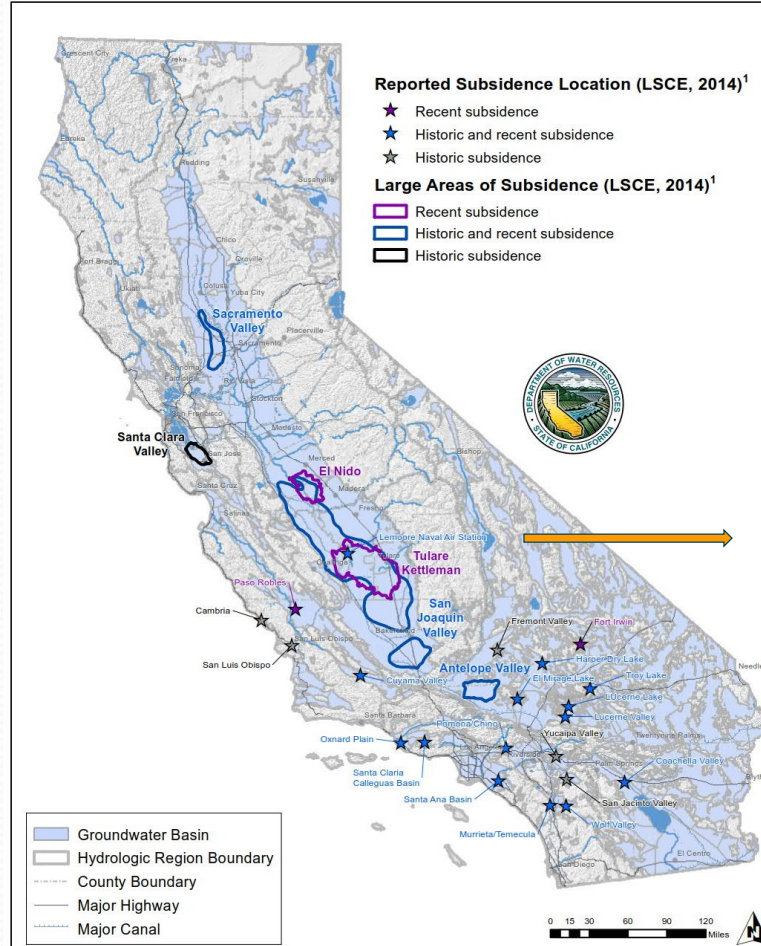
Source: USGS PP 437-I, 1984, Land Subsidence in the San Joaquin Valley, California, as of 1980

North Fork Kings GSA

Land Subsidence from 1926 to 1972

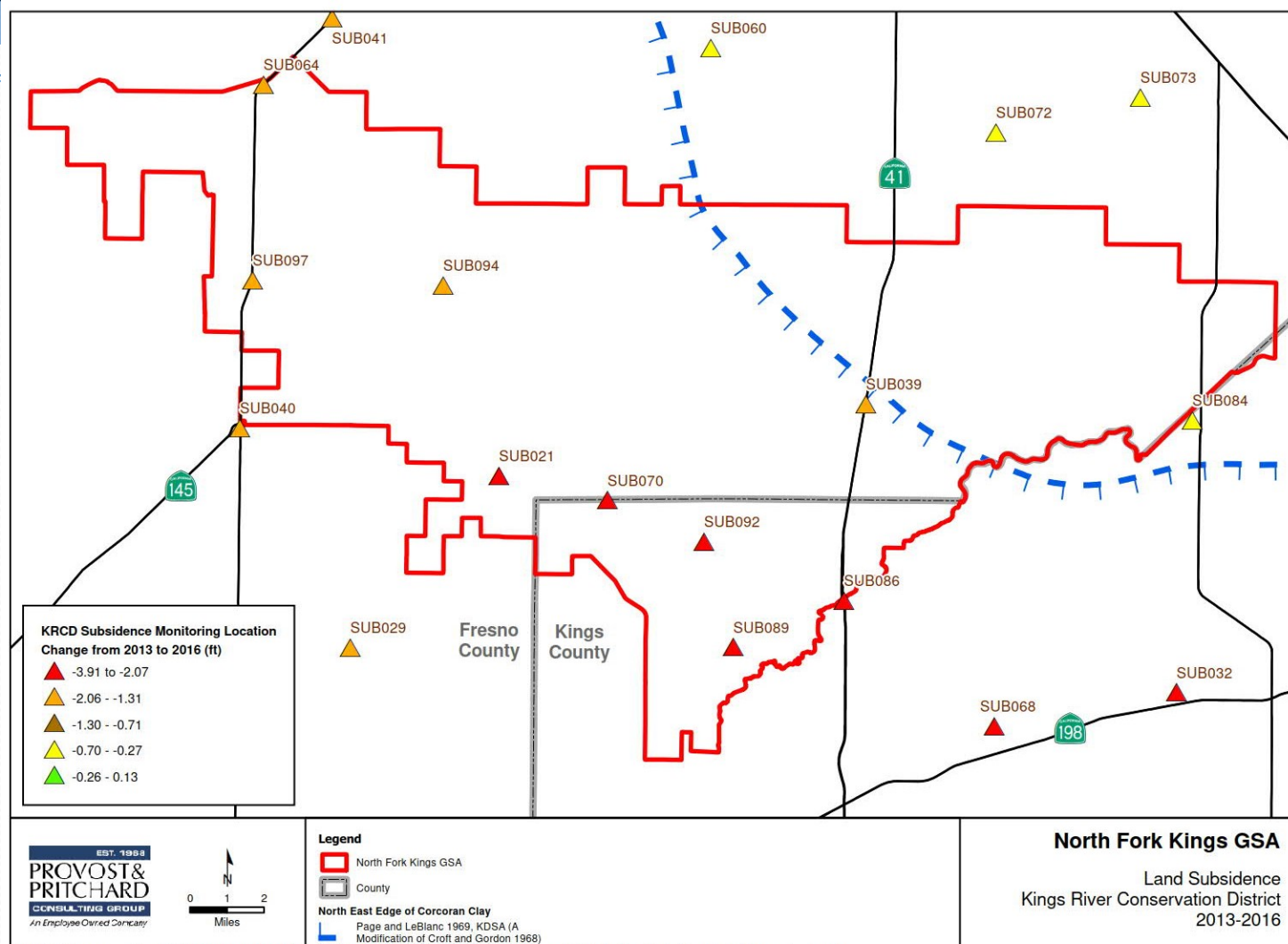
DWR Report regarding Land Subsidence in California - 2014

FIGURE 3
Land Subsidence from Groundwater Use in California
LSCE, Borchers and Carpenter, 2014¹

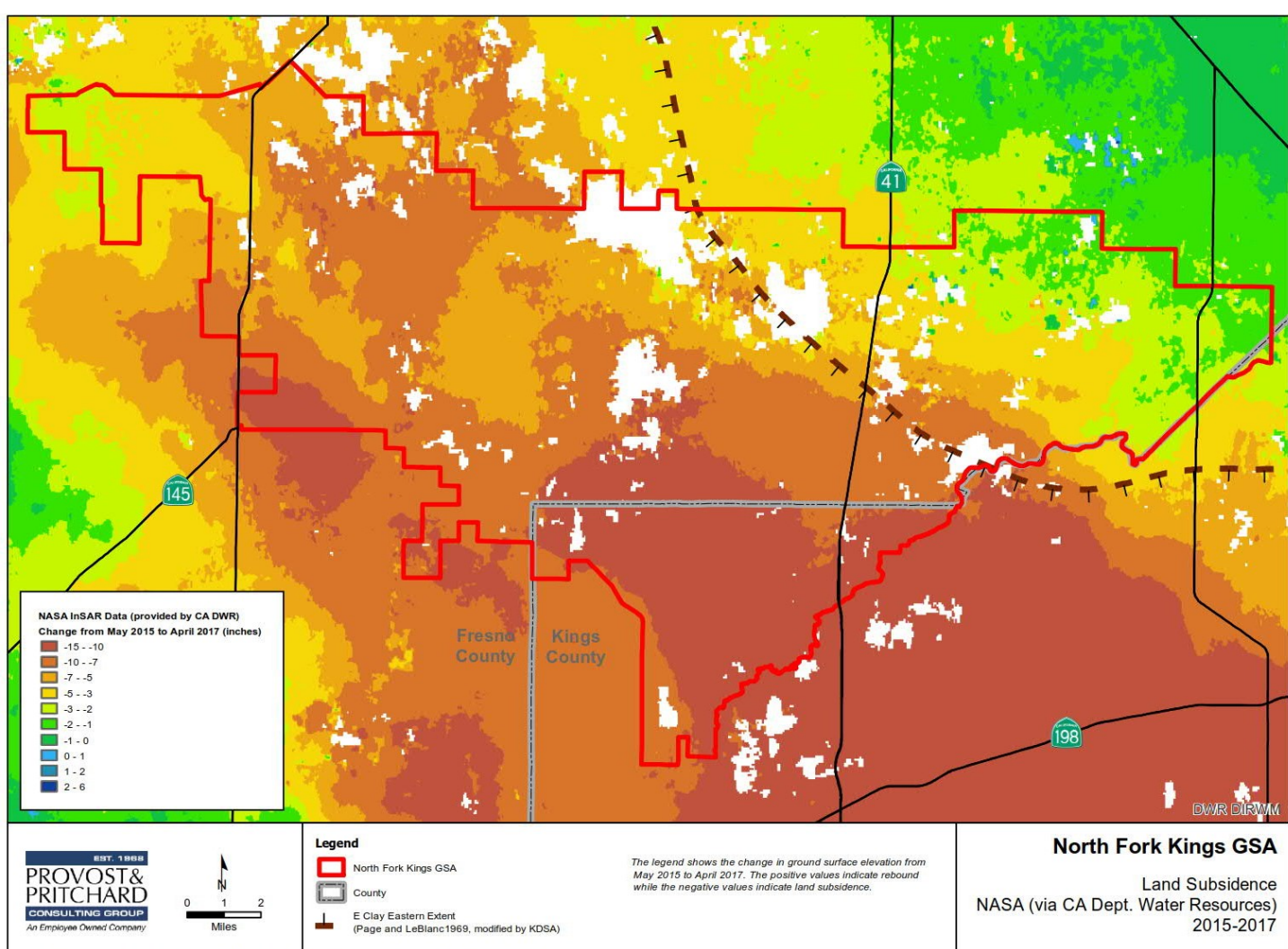


¹Land Subsidence data modified from LSCE, Borchers and Carpenter, 2014.

KRCD Land Subsidence Monitoring 2013 - 2016

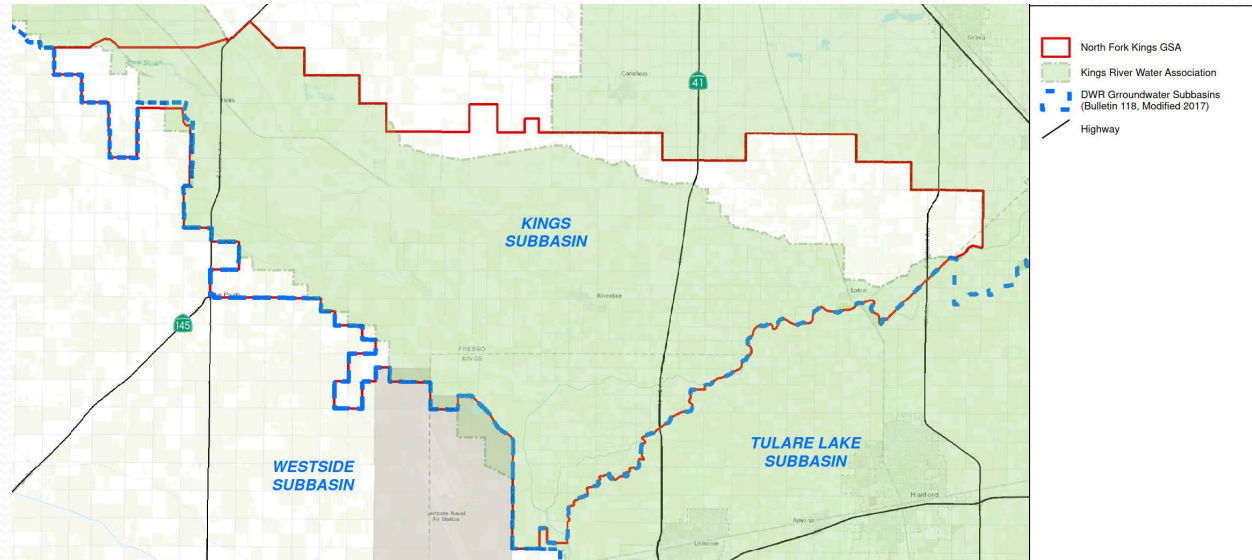


DWR – NASA Satellite monitoring of land subsidence May '15 – April '17



Water Budget

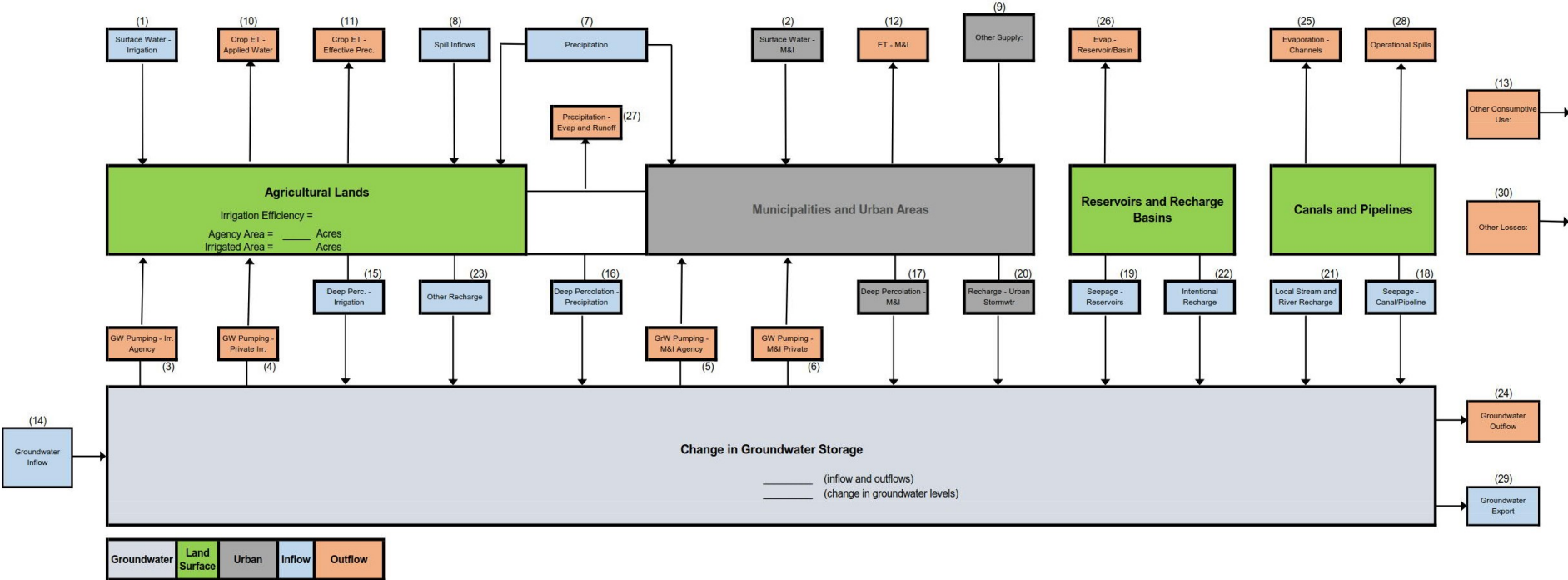
- Water budget is required to be prepared as part of GSP
- Water demand not met by surface water or precipitation is met by groundwater pumping
- Surface water supply within NFKGSA almost exclusively Kings River
- Approximately 22% of NFKGSA area is outside Kings River service area



Water Budget Components

- Summarize all water sources (inputs) and water uses (outputs)
 - Inputs: Surface water, precipitation, groundwater pumping (estimate), groundwater inflow
 - Outputs: Irrigation, municipal, residential, industrial, groundwater outflow
- Calculate change in groundwater storage = Inputs – Outputs
 - Water into groundwater system minus water out of groundwater system
- Historical, Current and Future Water Budgets are required by SGMA
- Future simulations are required to estimate impact on groundwater

NORTH FORK KINGS GSA **WATER BUDGET DIAGRAM** PERIOD OF RECORD = 1997 - 2011



Historical Water Budget – simplified version

Need to add confidence
intervals (error %) to
components

Closure term likely
groundwater inflow

North Fork Kings GSA

GSA Historical Water Budget

Water Budget - Average Annual Values

Period of Record: Oct. 1996 - Sep. 2011

(all units in acre-feet)

Simplified water budget

Concept: groundwater pumping and recharge is all internal and shows up in storage change

Description		Irrigation Eff. Symbol	80% Volume (AF)	Source
Inflows				
1) Surface Water for Irrigation and Recharge		Qirr	175,300	Measured
2) Surface Water for M&I and Recharge		Qmi	0	Measured
8) Spill Inflows		Si	0	Calculated
9) Other Supply - Kings River seepage		Os	47,000	Calculated
14) Groundwater Inflow - unconfined		GWi	16,300	Calculated
Groundwater Inflow - confined		GWi	0	Closure term
16) Deep Percolation of Precipitation		PRCp	8,200	Calculated
Total Inflows			246,800	
Outflows				
Consumptive Use				
10) Evapotranspiration met by Applied Water		ETc	327,100	Calculated
12) Evapotranspiration of M&I		ETmi	2,000	Calculated
13) Other Consumptive Use - dairy		Od	3,600	Calculated
24) Groundwater Outflow - unconfined		GWo	0	Estimated
Groundwater Outflow - confined		GWo	10,000	Estimated
25) Evaporation - Channels		Ech	1,100	Calculated
26) Evaporation - Reservoirs & Recharge Basins		Er	0	Calculated
28) Operational Spills		S	0	Measured
29) Groundwater - Export		GE	0	Measured
30) Other Losses:		OI	0	
Nonrecoverable Subtotal			343,800	
Method 1				
Estimated Annual Change in Groundwater Storage			(97,000)	
Inflows		246,800		Calculated
Outflows		(343,800)		
Method 2				
Calculated Annual Change in Groundwater Storage			(59,000)	
Unconfined Aquifer		(49,000)		Measured
Confined Aquifer (Subsidence)		(10,000)		Estimated



Questions?