



North Fork Kings
Groundwater Sustainability Agency

GROUNDWATER SUSTAINABILITY PLAN (GSP) STATUS REPORT

Kevin Johansen
Provost & Pritchard Consulting Group

BOARD OF DIRECTORS STUDY SESSION

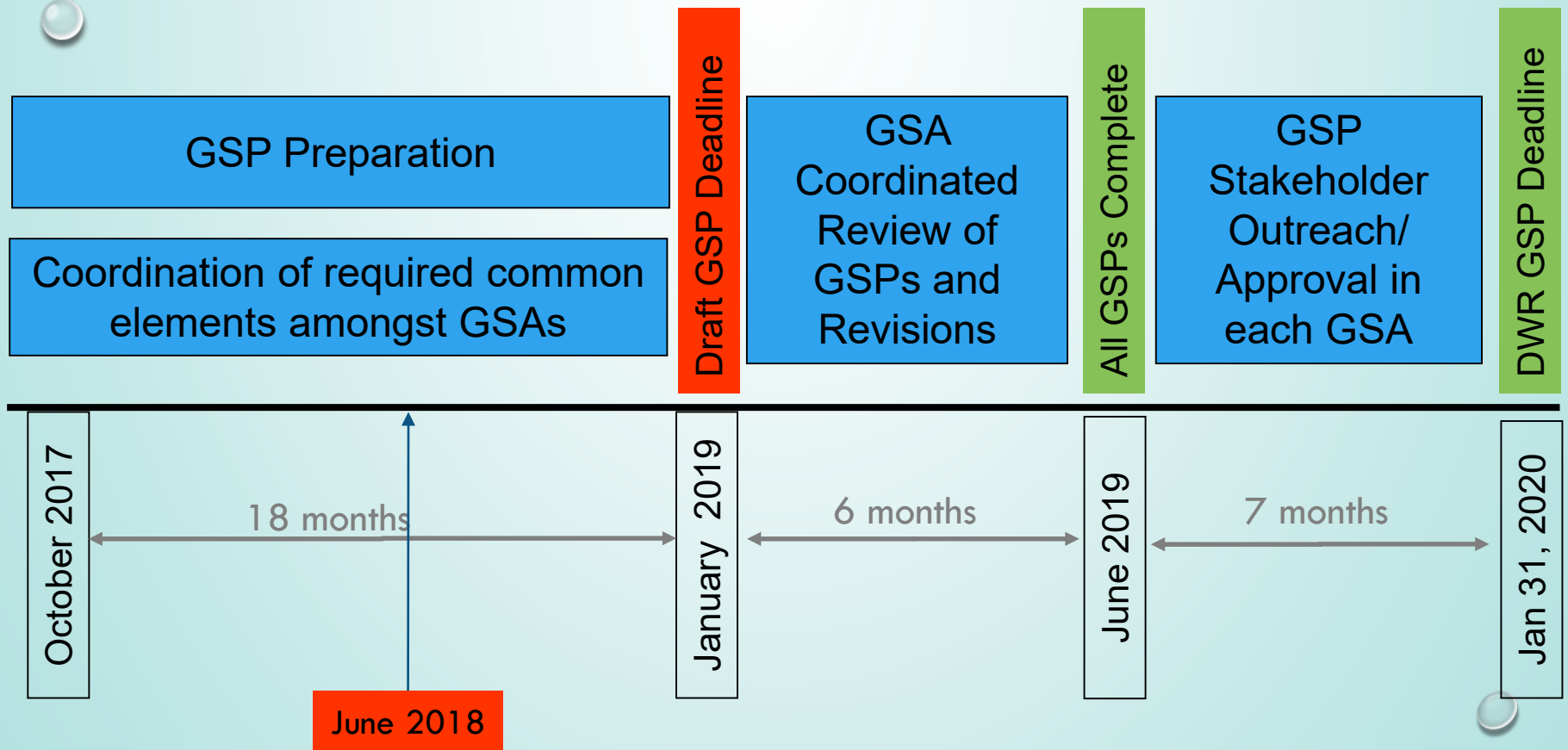
JUNE 27, 2018

RIVERDALE MEMORIAL HALL

PRESENTATION OVERVIEW

1. SCHEDULE / TIMELINE
2. KINGS SUBBASIN COORDINATION
 - UNCONFINED AQUIFER STORAGE CHANGE
 - GROUNDWATER BOUNDARY FLOW
 - WATER BUDGET ALTERNATIVE
 - ALTERNATIVES FOR APPORTIONMENT OF RESPONSIBILITY
3. WATER BUDGET
4. GSP DEVELOPMENT UPDATE
5. SUSTAINABLE MANAGEMENT CRITERIA
6. PRELIMINARY WATER QUALITY CHARACTERIZATION
7. MANAGEMENT AREA CONSIDERATIONS
8. FUTURE WORK & NEXT STEPS

SCHEDULE / TIMELINE



GSP PREPARATION AND COORDINATION TIMELINE

PRELIMINARY OUTREACH AND COORDINATION SCHEDULE

Prepare GSP and
Coordination Agreement

Circulation & Review Draft
GSP and Coordination
Agreement

Public Review
and Adoption

Plan adoption
and
implementation

Key Documents and Deadlines

Jun.-Jul. Public Draft GSP

NFKGSA GSP JAN 2020

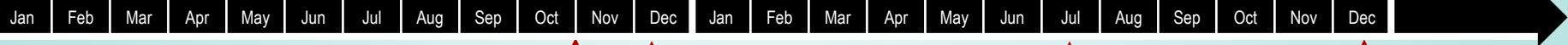
Dec. Final Draft GSP

Aug. Public Comment Report

2018

2019

2020



Anticipated Key Public Meetings and Hearings

Dec. Board Technical Workshop

Jul. Public Meeting for
Public Draft GSP

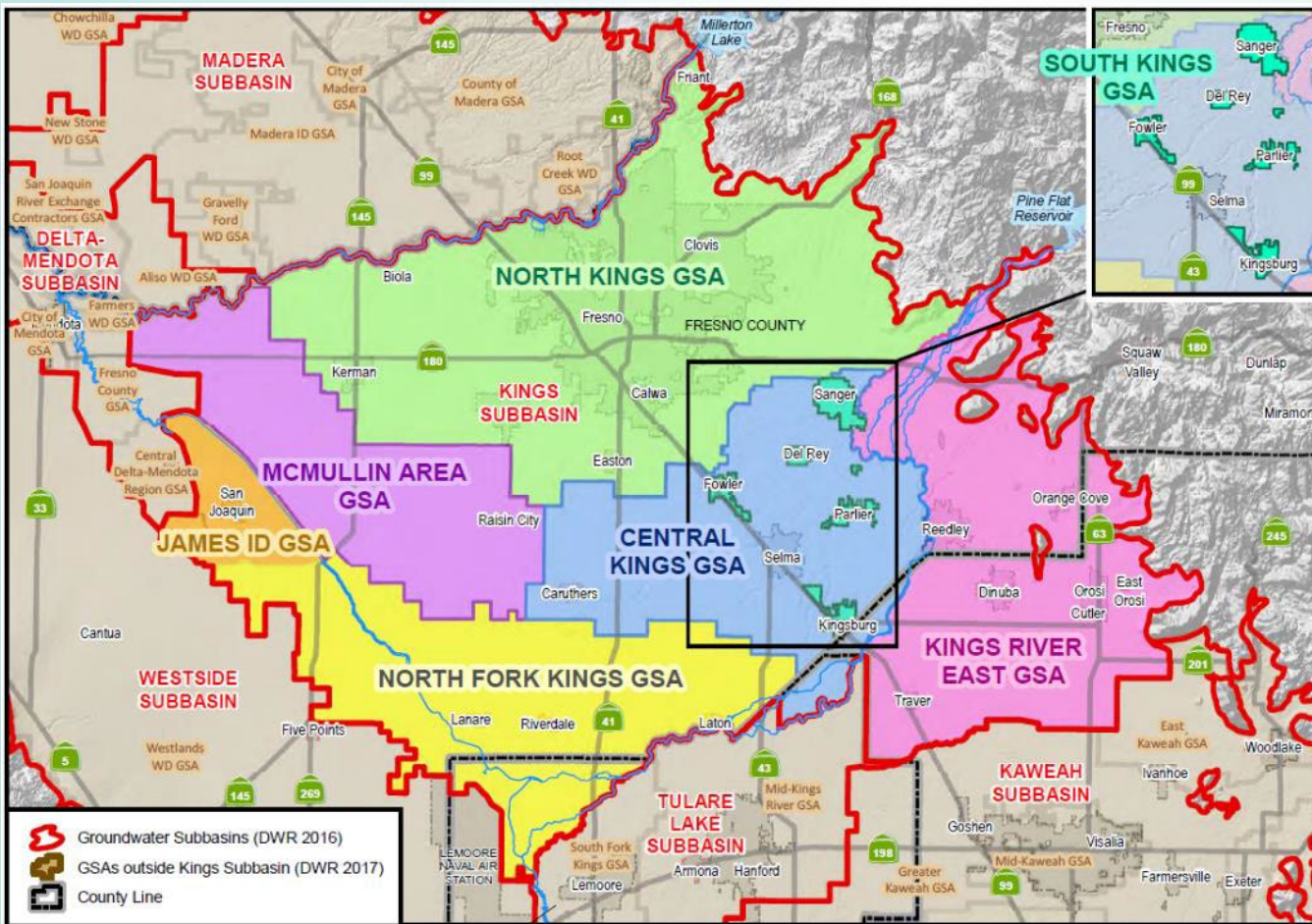
Dec. Public Hearing for
Final Draft GSP

Nov. Sustainable Management Criteria Public Meetings

The background is a light teal color with a subtle gradient. In the corners, there are several realistic-looking water droplets of various sizes, some with highlights and shadows, giving a fresh and clean aesthetic.

KINGS SUBBASIN COORDINATION

KINGS SUB BASIN



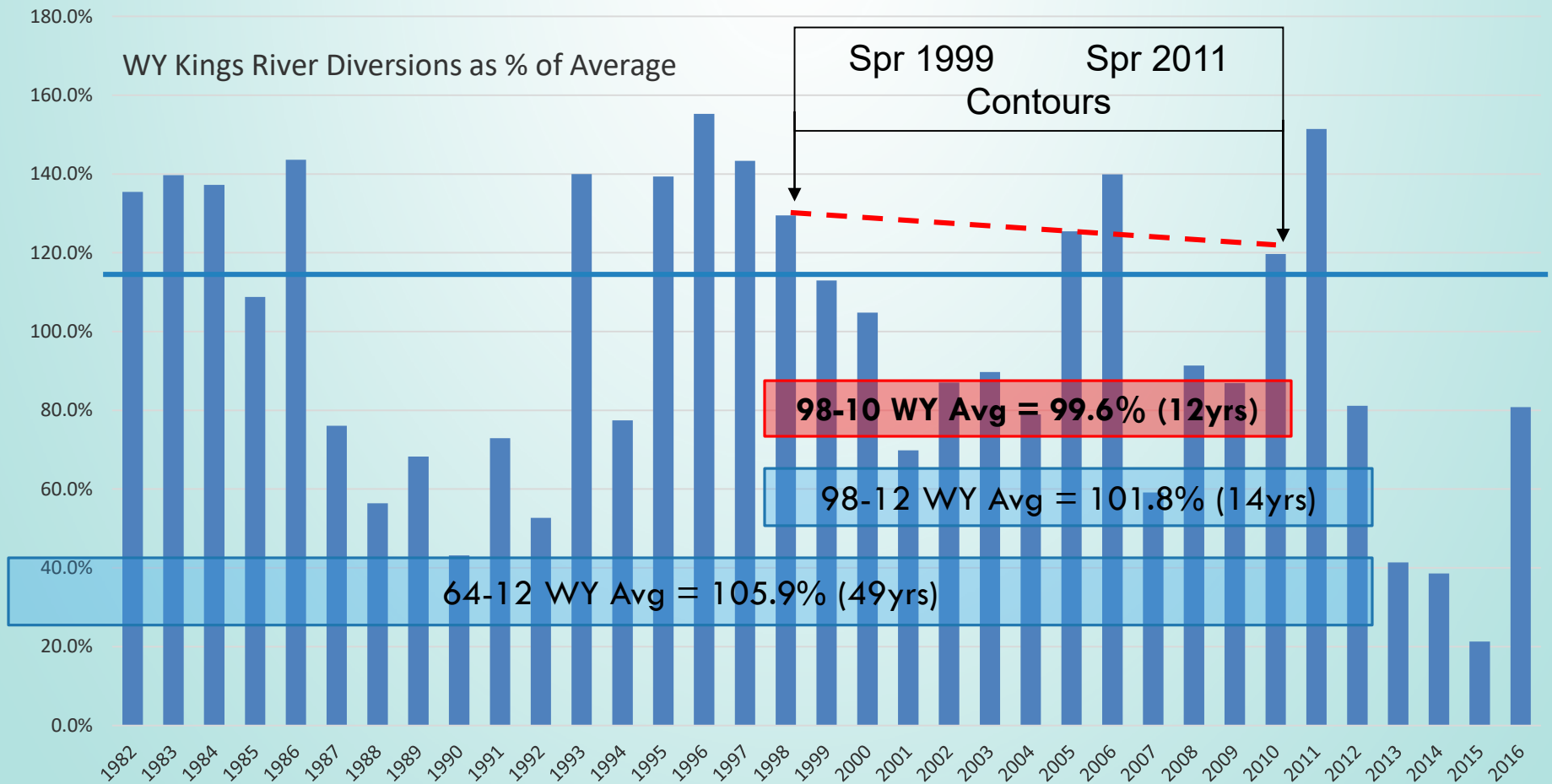
- ▶ 7 GSAS WITHIN KINGS SUB BASIN
- ▶ EACH GSA IS PREPARING IT'S OWN GSP
- ▶ EACH GSA MUST COORDINATE WITH OTHER GSAs IN SUB BASIN ON GSP
- ▶ ENTIRE SUB BASIN MUST BE SUSTAINABLE BY 2040

The Kings Subbasin is considered “High Priority” and “Critically Overdrafted”

KINGS COORDINATION GROUP EFFORTS (ON-GOING)

- 7 KINGS GSAs MEET TWICE A MONTH AT FRESNO IRRIGATION DISTRICT'S OFFICE
- VARIOUS TECHNICAL MEMORANDUMS PREPARED AND ARE BEING UPDATED
- OVERDRAFT ESTIMATION FOR EACH GSA (ON-GOING, NEARING COMPLETION)
 - CHANGE IN GROUNDWATER STORAGE BEING REVISED
 - GROUNDWATER FLOWS – INTERNAL BETWEEN GSAs AND EXTERNAL TO ADJACENT SUBBASINS BEING REVISED
- EVALUATED KINGS RIVER SURFACE WATER DIVERSIONS INTO KINGS SUBBASIN, SELECTED WY 1998-2010 AS RECENT “TYPICAL” PERIOD

STORAGE CHANGE BASIS PERIOD



KINGS BASIN COORDINATION UPDATE


- INITIAL TASKS FOCUSED ON GROUNDWATER STORAGE CHANGE
- GOAL TO REACH AGREEMENT ON INITIAL ESTIMATES OF AMOUNT OF OVERDRAFT TO BE CORRECTED, AND RESPONSIBILITY BY GSA
- MOA FOR DISPUTE RESOLUTION AND GRANT FUNDING ADOPTED OR BEING ADOPTED BY EACH GSA
- GRANT FUNDING CONTRACT – NFKGSA WILL CONTRACT WITH DWR AND HAVE SUB-AGREEMENTS WITH OTHER GSAs
 - MATCH WAIVER APPROVED
 - ELIGIBLE COSTS BACK TO JULY 2017
- CONSIDERING NEW COORDINATED TASKS
 - CONFINED AQUIFER BOUNDARY FLOWS
 - DATA MANAGEMENT SYSTEM
 - WATER BUDGET

KINGS BASIN COORDINATION TASK ORDERS

- KINGS COORDINATED EFFORT IS TRYING TO ESTIMATE CURRENT OVERDRAFT WITHIN KINGS SUB BASIN AND ASSIGN RESPONSIBILITY AMONG GSAs
 - 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 FOR APPROVAL
 - TASK 6 - DATA MANAGEMENT SYSTEM FOR APPROVAL
 - TASK 7 - WATER BUDGET FOR APPROVAL



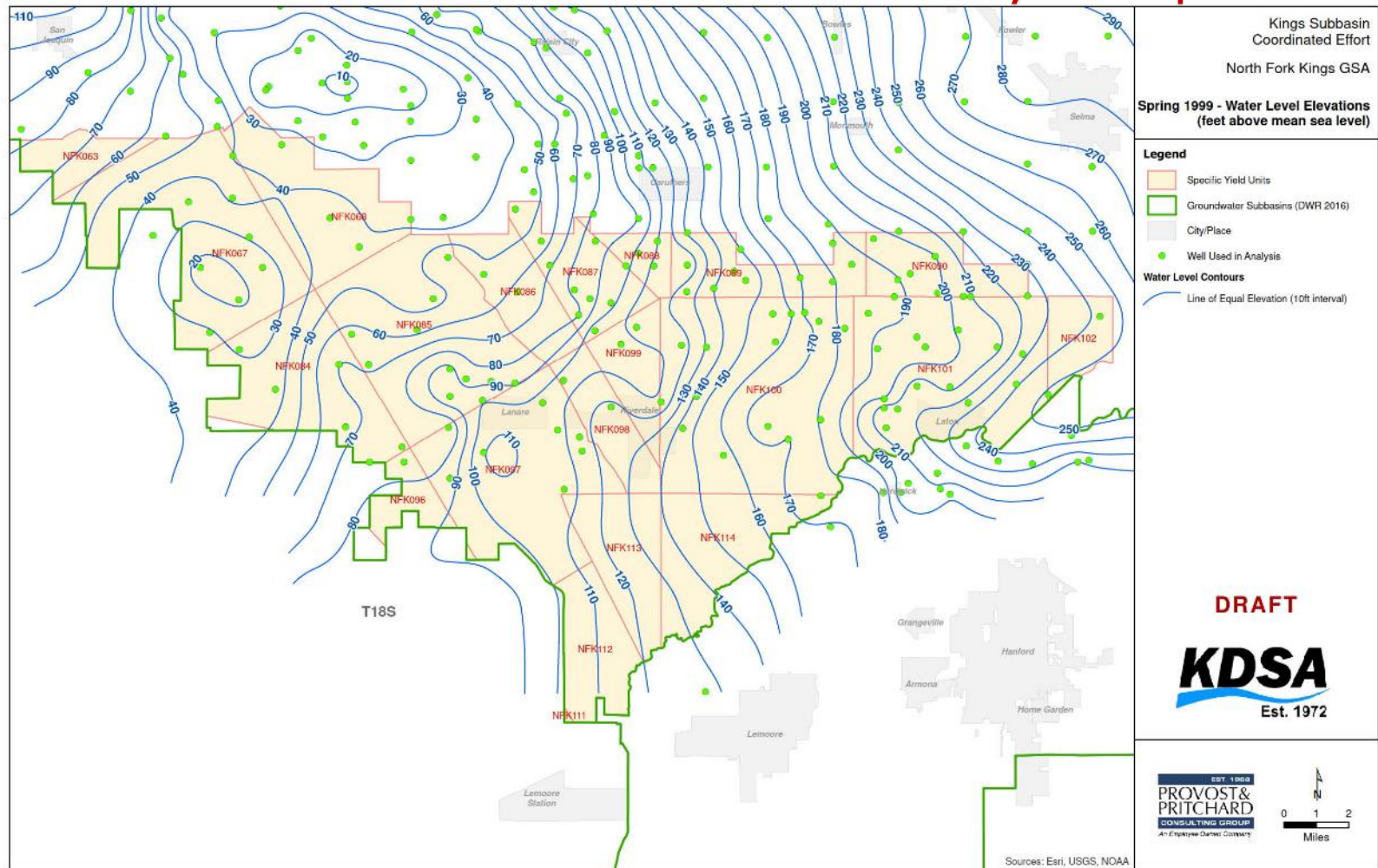
KINGS BASIN COORDINATION UPDATE

- EVALUATED 5 METHODOLOGY ALTERNATIVES AND ITERATIONS
 - REGARDLESS OF METHOD, FOCUS OF GROUP HAS BEEN ON DISCUSSION OF HISTORY OF GROUNDWATER FLOWS AND IMPACTS
 - SEEKING AGREEMENT AMONG GSAs ON METHODOLOGY, ACKNOWLEDGING THE NUMBERS WILL CHANGE
- 

UNCONFINED AQUIFER STORAGE CHANGE

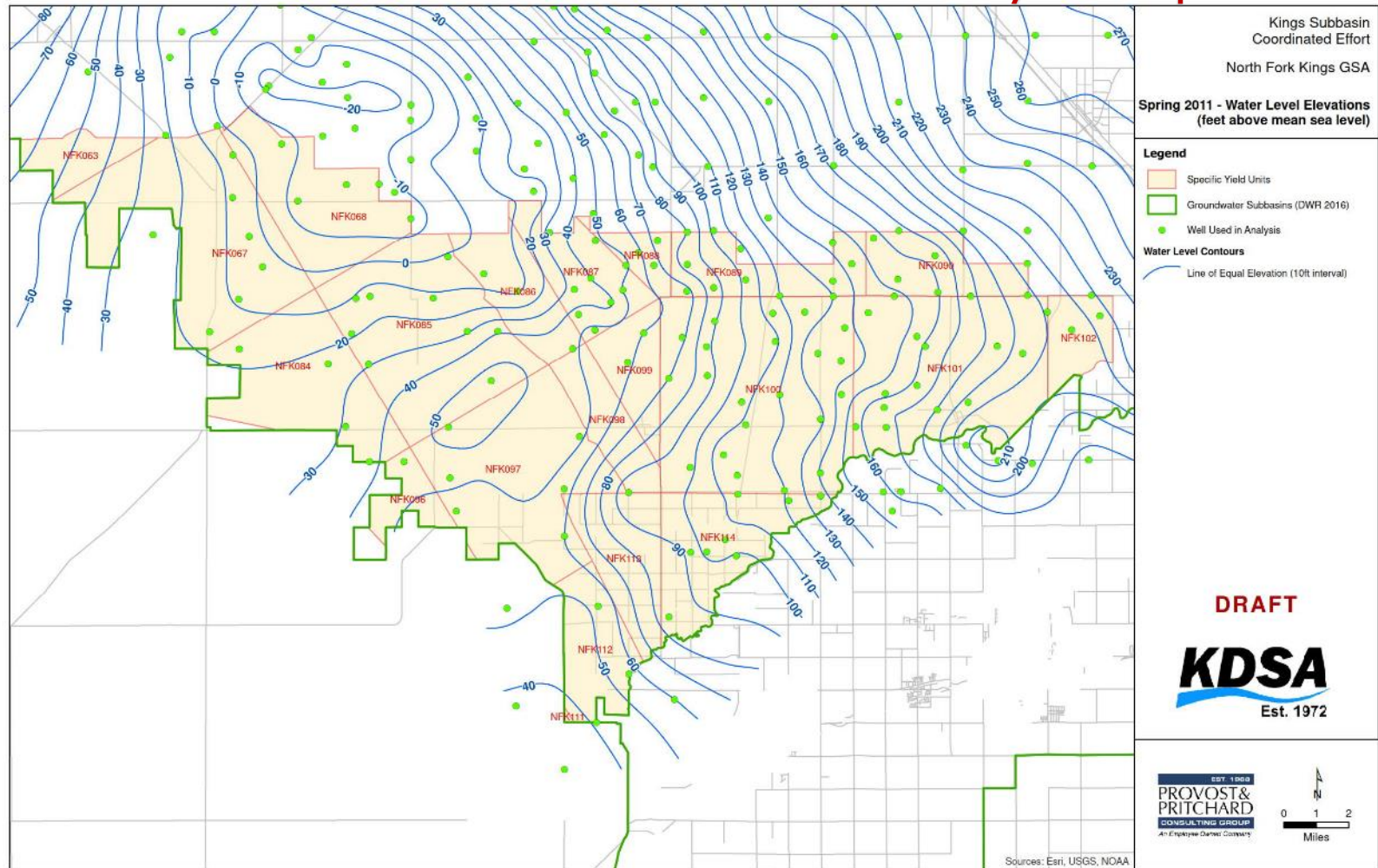
GROUNDWATER ELEVATION CONTOURS SPRING 1999 UNCONFINED AQUIFER

Preliminary – Subject to Change

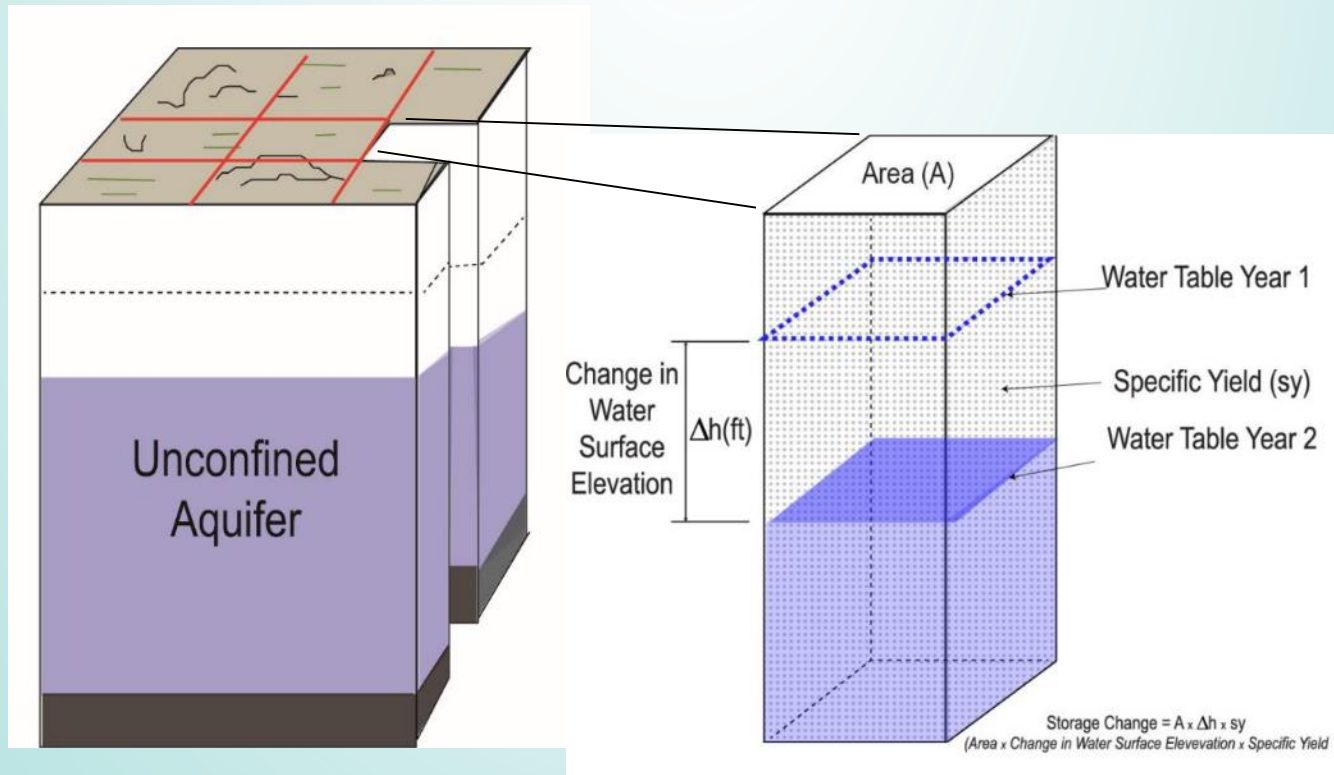


GROUNDWATER ELEVATION CONTOURS SPRING 2011 UNCONFINED AQUIFER

Preliminary – Subject to Change

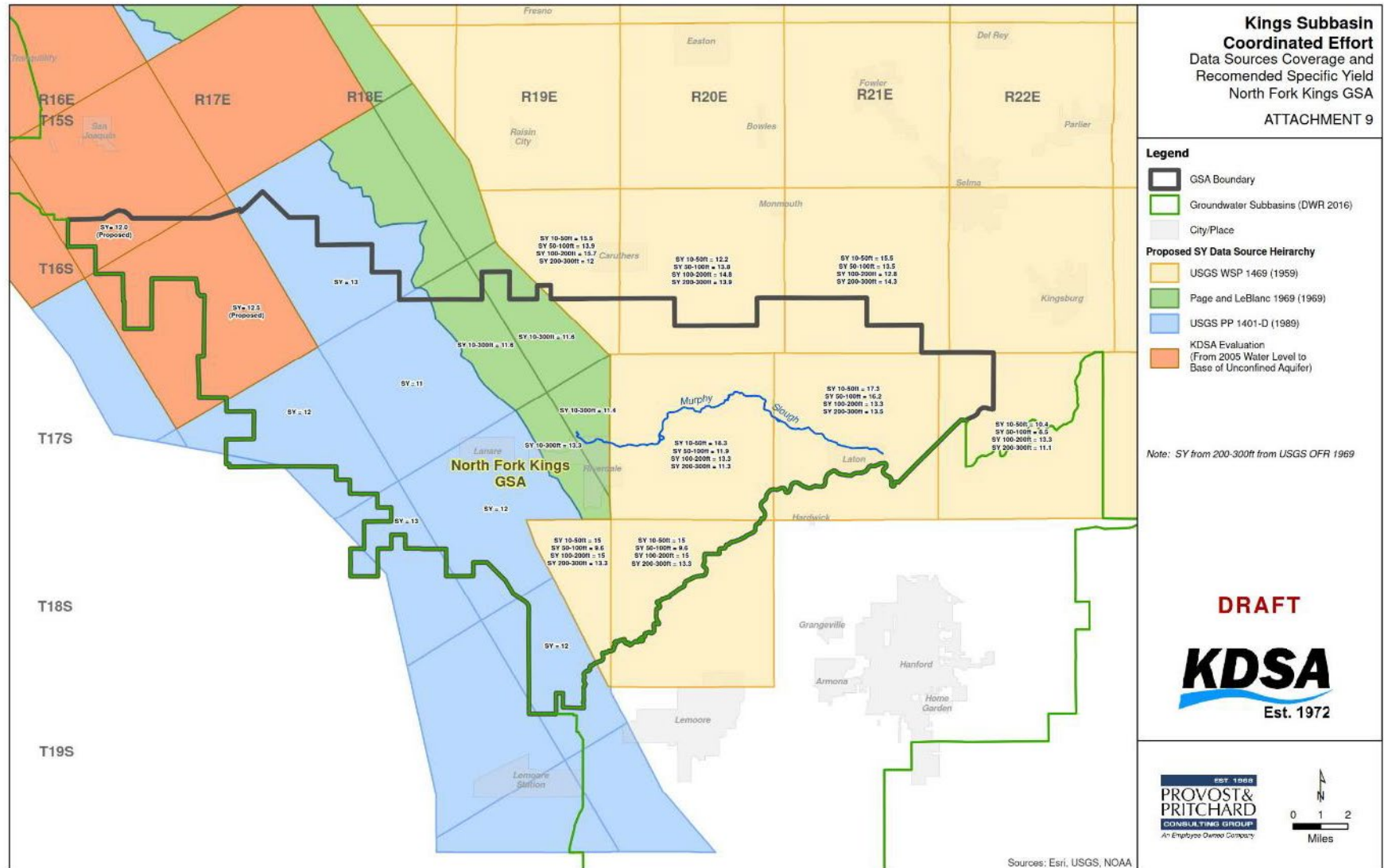


ESTIMATE OF GROUNDWATER STORAGE



SPECIFIC YIELD VALUES UNCONFINED AQUIFER STORAGE CHANGE

Preliminary – Subject to Change



Preliminary – Subject to Change

ESTIMATE OF NFKGSA UNCONFINED AQUIFER GROUNDWATER STORAGE CHANGE 1999-2011

Revised 1-25-2018

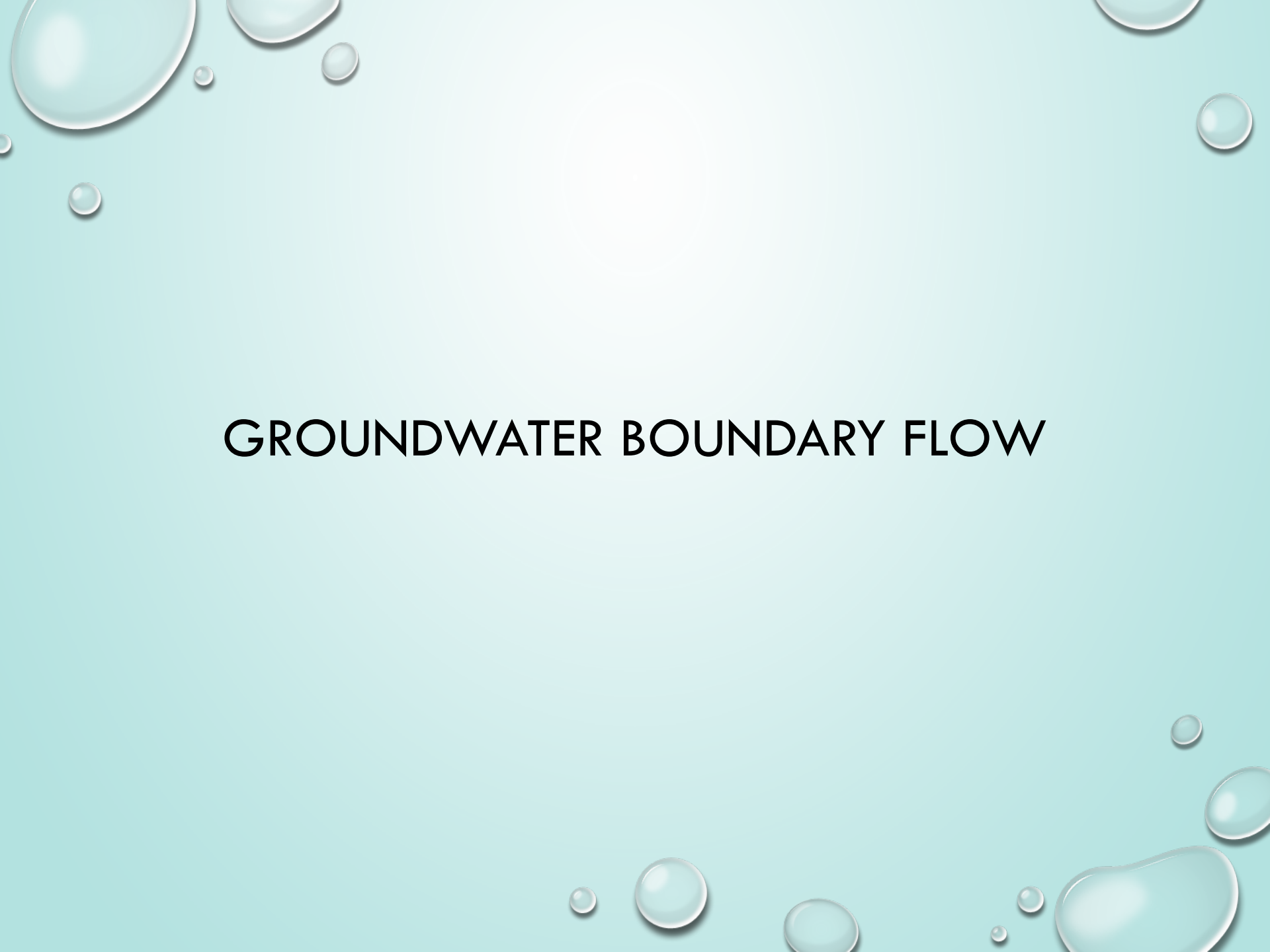
North Fork Kings GSA											
SY Unit	SY Source	SY10to50	SY50to100	SY100to200	SY200to300	Acres	1999 DTW Ave	1999 AF	2011 DTW Ave	2011 AF	AF Change
NFK063	KDSA	0.12	0.12	0.12	0.120	2,773	110.6	63,024	132.5	55,743	-7,281
NFK067	KDSA	0.125	0.125	0.125	0.125	16,262	150.9	303,093	170.6	262,943	-40,149
NFK068	USGS PP 1401-D	0.13	0.13	0.13	0.130	9,547	150.9	185,112	198.7	125,704	-59,408
NFK084	USGS PP 1401-D	0.12	0.12	0.12	0.120	11,019	151.7	196,054	177.0	162,648	-33,406
NFK085	USGS PP 1401-D	0.11	0.11	0.11	0.110	16,075	136.2	289,617	175.5	220,091	-69,526
NFK086	Page and LeBlanc 1969	0.116	0.116	0.116	0.116	5,237	150.8	90,611	194.3	64,187	-26,425
NFK087	Page and LeBlanc 1969	0.116	0.116	0.116	0.116	5,523	142.1	101,142	185.6	73,284	-27,858
NFK088	USGS WSP 1469	0.155	0.139	0.157	0.120	1,891	128.2	43,919	171.2	31,149	-12,769
NFK089	USGS WSP 1469	0.122	0.138	0.148	0.139	5,778	91.1	172,915	134.1	136,664	-36,251
NFK090	USGS WSP 1469	0.155	0.135	0.128	0.143	5,117	60.2	166,312	93.8	143,133	-23,180
NFK096	USGS PP 1401-D	0.13	0.13	0.13	0.130	2,375	119.4	55,779	161.6	42,724	-13,054
NFK097	USGS PP 1401-D	0.12	0.12	0.12	0.120	15,060	106.5	349,636	159.0	254,836	-94,799
NFK098	Page and LeBlanc 1969	0.133	0.133	0.133	0.133	4,082	100.2	108,500	153.3	79,672	-28,827
NFK099	Page and LeBlanc 1969	0.114	0.114	0.114	0.114	3,876	111.0	83,501	159.1	62,273	-21,228
NFK100	USGS WSP 1469	0.183	0.119	0.133	0.113	22,931	76.2	629,511	124.3	490,298	-139,213
NFK101	USGS WSP 1469	0.173	0.162	0.133	0.135	17,049	43.7	613,178	81.3	508,282	-104,896
NFK102	USGS WSP 1469	0.104	0.085	0.133	0.111	3,194	32.3	97,543	66.7	87,111	-10,433
NFK111	USGS PP 1401-D	0.08	0.08	0.08	0.080	46	0.0	1,106	180.4	441	-665
NFK112	USGS PP 1401-D	0.12	0.12	0.12	0.120	5,393	104.6	126,438	163.8	88,179	-38,260
NFK113	USGS WSP 1469	0.15	0.096	0.15	0.133	6,112	96.0	175,350	140.5	135,853	-39,498
NFK114	USGS WSP 1469	0.15	0.096	0.15	0.133	8,485	82.0	254,765	129.1	203,087	-51,679

Sum of Change (1999-2011) = -878,803
 Number of Years = 12
 Average Change Per Year = -73,234

Preliminary – Subject to Change

UNCONFINED AQUIFER STORAGE CHANGE SPRING 1999 TO SPRING 2011

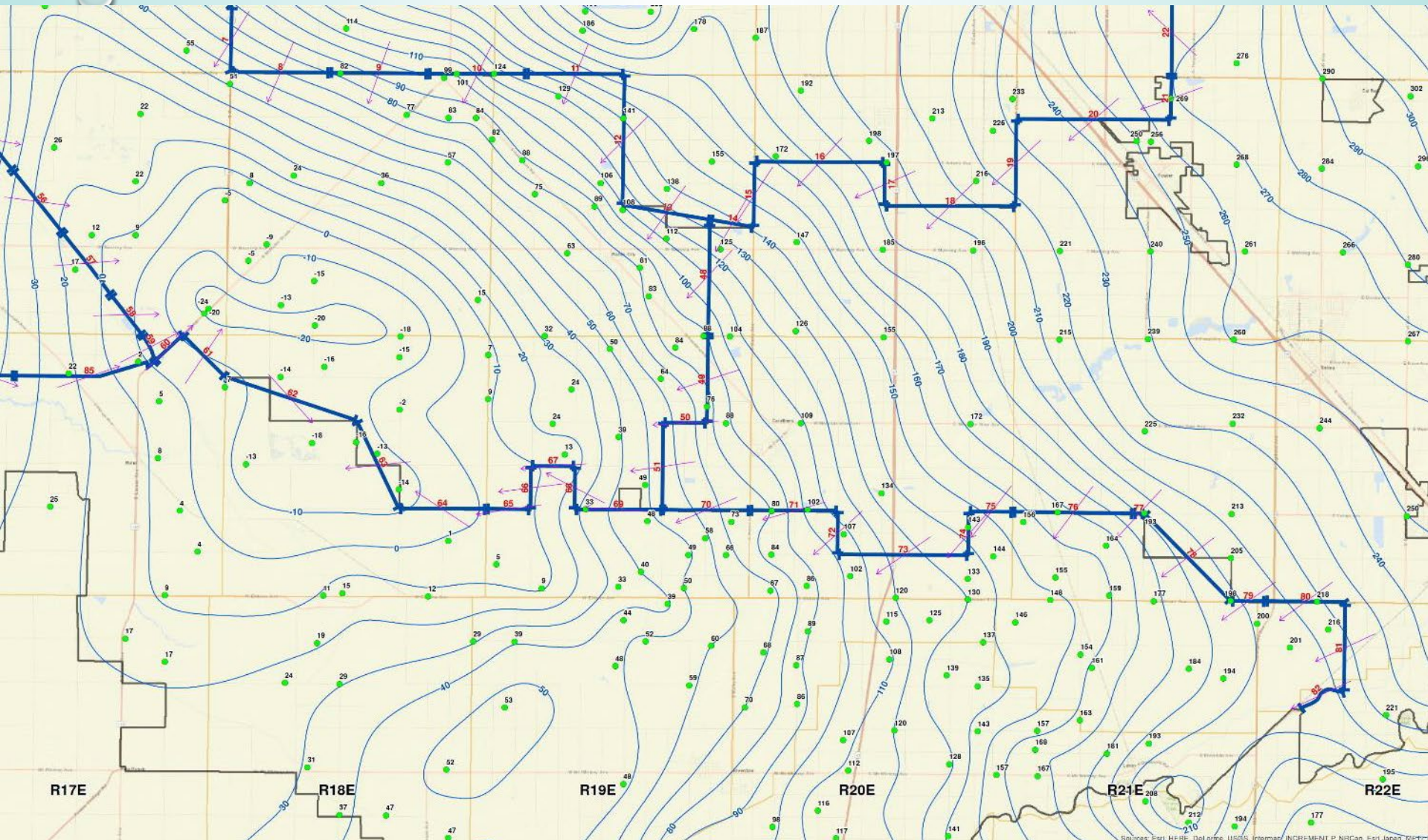
GSA	Spring 1999 to 2011 Storage Change (AF)
North Kings	38,000
Central & South Kings	45,000
Kings River East	18,000
North Fork Kings	73,000
McMullin	24,000
James	8,000
Total =	206,000

The background is a solid teal color. It is decorated with several realistic water droplets of various sizes. These droplets are primarily located in the top-left, top-right, and bottom-right corners, with a few smaller ones scattered elsewhere. Each droplet has a highlight on its upper-left side and a soft shadow on its lower-right side, giving them a three-dimensional appearance.

GROUNDWATER BOUNDARY FLOW

Preliminary – Subject to Change

BOUNDARY FLOW EXAMPLE - SPRING 2011



BOUNDARY FLOW ESTIMATES

Kings Subbasin Groundwater Flow (Unconfined) Estimation

(Table for Tech Memo 5)

3-16-18 Draft - Storage Change and Boundary Flow numbers will change as contours are being revised.

GSA	Neighboring GSA	1925		1962		1999		2011	
		Internal	External	Internal	External	Internal	External	Internal	External
North Fork Kings		11,930	1,000	15,000	-8,000	10,000	-3,200	21,400	-4,000
	Central/South Kings	8,000		10,000		16,000		20,000	
	McMullin	4,000		5,000		-10,000		1,000	
	James	-70		0		4,000		400	
	Westlands WD		700		0		500		1,000
	South Fork Kings GSA		-400		-2,000		300		-1,000
	Mid Kings River GSA		700		-6,000		-4,000		-4,000

Notes: 1) Values are acre-feet. Positive means inflow from neighboring GSA. Negative value means outflow to neighboring GSA.

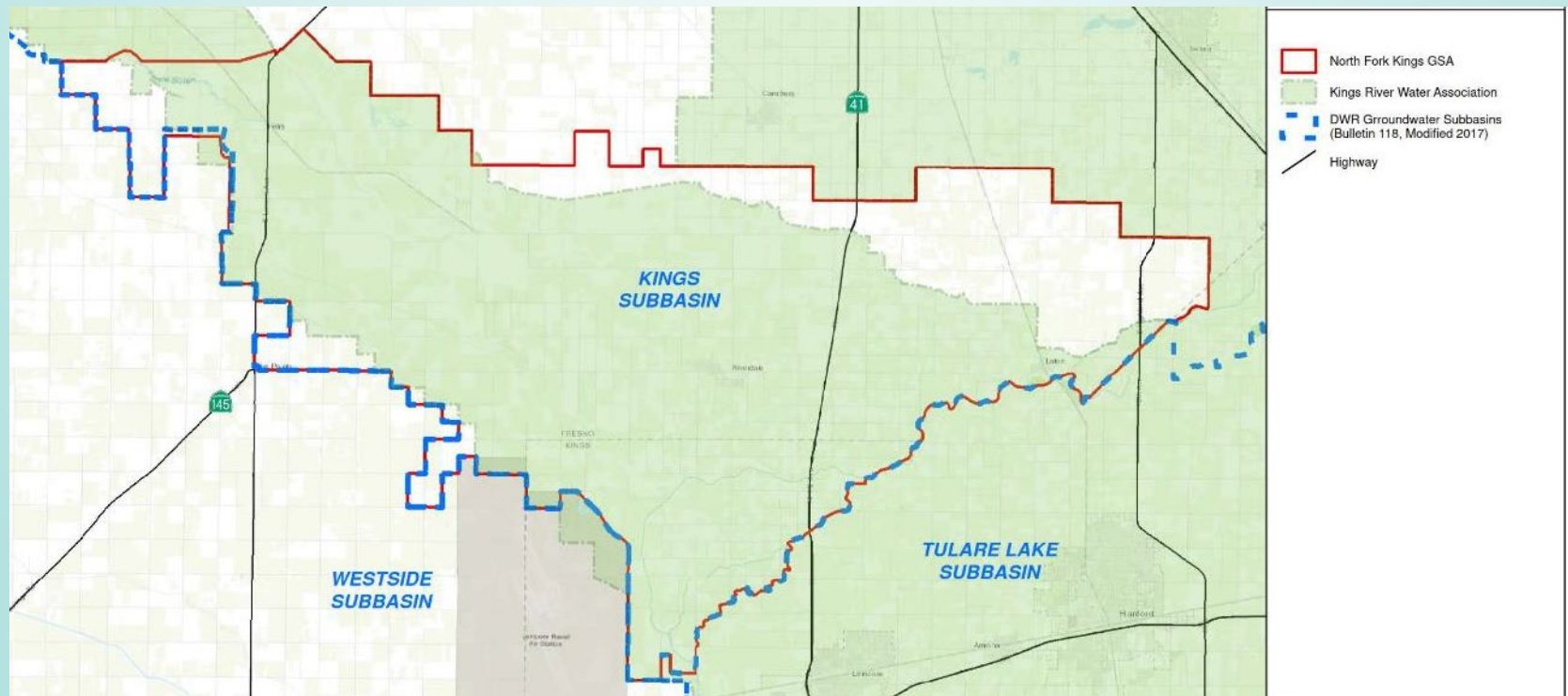
2) Values estimated from contours included in Tech Memo 4 dated 1-24-18.

The background is a light blue gradient. In the top-left and bottom-right corners, there are several realistic water droplets of various sizes. These droplets have highlights and shadows, giving them a three-dimensional appearance. The text is centered in the middle of the page.

WATER BUDGET ALTERNATIVE

CONCEPTUAL WATER BUDGET ALTERNATIVE

- WATER BUDGET CONCEPT FOR ALLOCATING OVERDRAFT RESPONSIBILITY
- WATER DEMAND NOT MET BY SURFACE WATER OR PRECIPITATION MUST BE MET BY GROUNDWATER PUMPING
- SURFACE WATER SUPPLY WITHIN NFKGSA ALMOST EXCLUSIVELY KINGS RIVER
- APPROXIMATELY 22% OF NFKGSA AREA IS OUTSIDE KINGS RIVER SERVICE AREA



KINGS RIVER SURFACE WATER SUPPLY

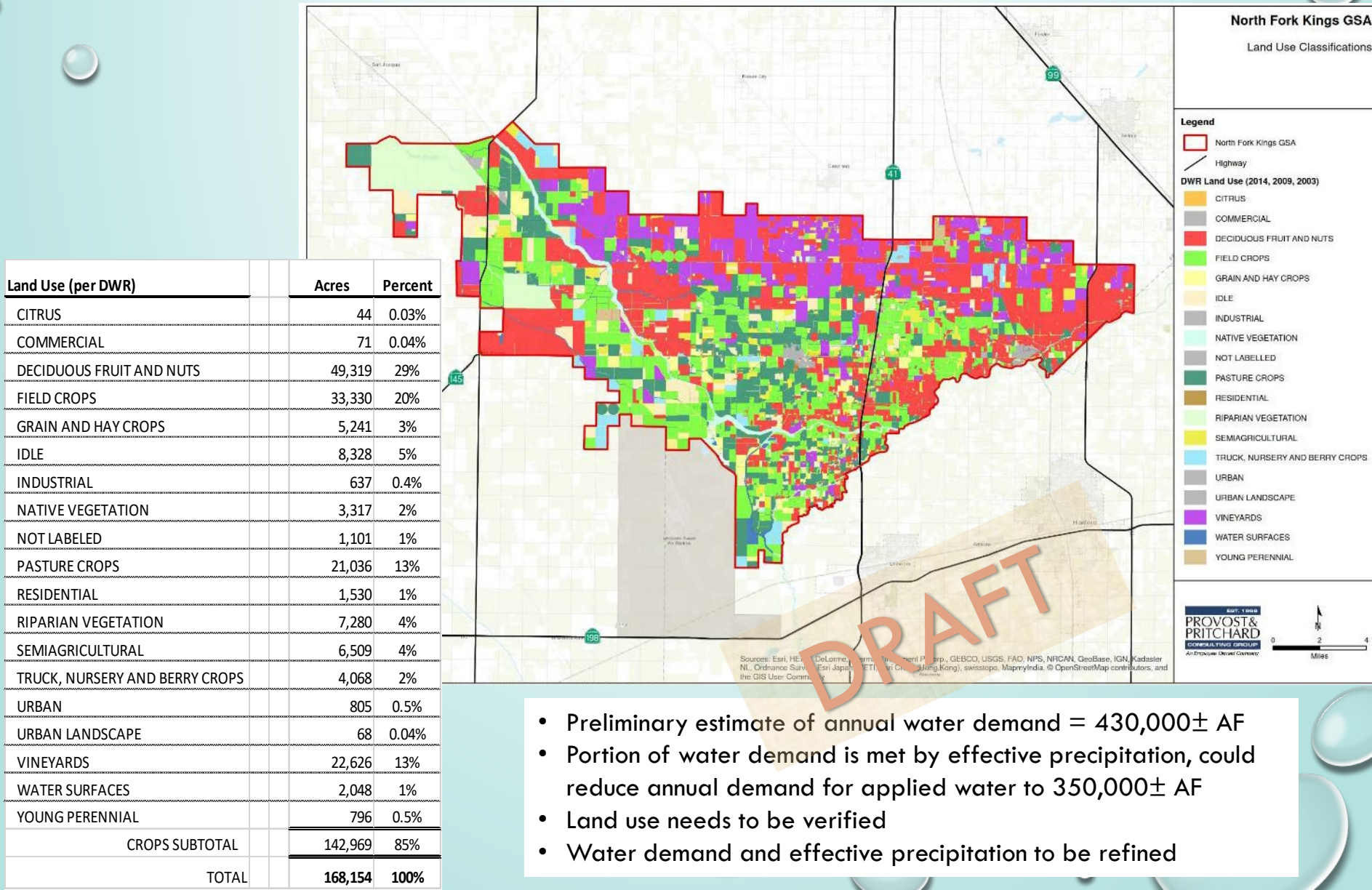
Kings River Headgate Diversions

NORTH FORK KINGS GSA

	Coordinated Kings period			WY 2010 - 2011
	High	Low	Average	
	WY 1997	WY 2006	WY 1997/98	
	- 1998	- 2007	- 2009/10	
Burrel Ditch Company	4,860	1,785	5,485	11,732
Clark's Fork Recl District	2,337	801	1,406	2,388
Crescent Canal Company	31,777	3,429	14,157	38,178
Laguna Irrigation District	75,124	15,285	47,579	96,959
Liberty Canal Company	15,701	595	6,157	15,383
Murphy Slough Association	118,028	14,860	51,278	119,436
Stinson Canal & Irrigation Co.	26,097	3,916	10,728	59,671
Upper San Jose Water Company	2,914	436	2,302	3,810
Total	276,838	41,107	139,091	347,557
% Water Year	186%	41%		198%

All data through 2009 from KRWA Watermaster Reports. Other data from KRWA website.

NORTH FORK KINGS GSA LAND USE - 2014



- Preliminary estimate of annual water demand = 430,000± AF
- Portion of water demand is met by effective precipitation, could reduce annual demand for applied water to 350,000± AF
- Land use needs to be verified
- Water demand and effective precipitation to be refined

CALCULATED WATER DEMAND

KINGS GSA - PRELIMINARY CALCULATED WATER DEMAND

DRAFT 4/06/18

Land Use General	Land Use Detail	ITRC avg Zone 12/16 ETc	Annual Demand (ft/ac)	North Fork Kings GSA	
				Acres	Demand w/o Effec precip (AF)
PASTURE CROPS	ALFALFA AND ALFALFA MIXTURES	3.93	3.93	19,429.1	76,364
DECIDUOUS FRUIT AND NUTS	ALMONDS	3.38	3.38	18,800.8	63,461
DECIDUOUS FRUIT AND NUTS	APPLES	3.42	3.42	207.1	708
DECIDUOUS FRUIT AND NUTS	APRICOTS	3.34	3.34	6.5	22
FIELD CROPS	BEANS	2.25	2.25	3.0	7
TRUCK, NURSERY AND BERRY CROPS	BEANS (GREEN)	1.69	1.69	-	-
TRUCK, NURSERY AND BERRY CROPS	BUSH BERRIES	1.69	1.69	0.4	1
TRUCK, NURSERY AND BERRY CROPS	CABBAGE	1.69	1.69	0.1	0
TRUCK, NURSERY AND BERRY CROPS	CARROTS	1.69	1.69	3.0	5
DECIDUOUS FRUIT AND NUTS	CHERRIES	3.42	3.42	488.3	1,670
CITRUS	CITRUS	3.36	3.36	9.8	33
///	///				
VINEYARDS	VINEYARDS	2.44	2.44	862.0	2,102
DECIDUOUS FRUIT AND NUTS	WALNUTS	3.77	3.77	5,920.8	22,324
WATER SURFACES	WATER SURFACES		3.00	2,062.4	6,187
GRAIN AND HAY CROPS	WHEAT	1.66	1.66	3,244.0	5,378
YOUNG PERENNIAL	YOUNG PERENNIALS	2.71	2.71	796.1	2,160
		Total		168,186.6	431,005
Assumed Effective Precipitation		3.5	in/ac/yr		49,054
Estimated Net Demand of Applied Water (AF)					381,951
Estimated Net Demand per acre					2.27

Notes: DWR Land Use 2014 primarily. Supplemented with DWR Land Use 2009 and/or 2003 where 2014 data missing.

ITRC water balance data is average for CIMIS Zone 12 and Zone 16, typical year, surface irrigated

The background is a light blue gradient with several realistic water droplets of various sizes scattered around the edges. The droplets have highlights and shadows, giving them a three-dimensional appearance.

ALTERNATIVES CONSIDERED FOR APPORTIONMENT OF STORAGE CHANGE

ALTERNATIVES 1 & 2

Column #	1	2	3
	Alt 1		Alt 2
Methodology	Equal Distribution		Storage Change Only
GSA	Acreage	Total Basin Storage Change 99-11 (206k) divided by Total Basin Acreage (981k) multiplied by GSA Acreage (AF)	Storage Change Estimation (99-11) from TM4 (AF)
Central/South	160,870	33,762	45,000
James	29,051	6,097	8,000
Kings River East	191,126	40,112	18,000
McMullin	120,580	25,307	24,000
North Fork	168,187	35,298	73,000
North Kings	311,728	65,424	38,000
Total	981,542	206,000	206,000

Notes:

- Alternatives 1 and 2 not agreeable because of lack of identification of cause/contribution
- Doesn't account for groundwater flow

ALTERNATIVES 3 & 4

Column #	4	5	6	7	8	9
	Alt 3			Alt 4		
Methodology	Storage Change +/- Boundary Flows			Storage Change +/- Difference between Historic and Boundary Flows		
Column Calculation			3+4+5			3+4+5-7-8
GSA	Average of 1999 and 2011 Internal Boundary Flows ¹ (AF)	Average of 1999 and 2011 External Boundary Flows ¹ (AF)	Total w/Average of 1999 and 2011 Ext Flows (AF)	1925 Internal Boundary Flows ¹ (AF)	1925 External Boundary Flows ¹ (AF)	99-11 Storage Change less difference between Avg of 1999 & 2011 and 1925 Boundary Flows (AF)
Central/South	-23,450	-8,000	13,550	-8,000	50	21,500
James	-34,200	2,400	-23,800	2,070	0	-25,870
Kings River East	-500	-3,650	13,850	-1,000	2,300	12,550
McMullin	110,000	450	134,450	13,000	-1,900	123,350
North Fork	15,700	-3,600	85,100	11,930	1,000	72,170
North Kings	-67,550	-3,300	-32,850	-18,000	0	-14,850
Total		-15,700	190,300		1,450	188,850

Notes:

- Average boundary flows for each year during period (99-11) likely to be used rather than just bookends
- Alt 3 ignores historic flow patterns
- Alt 4 concern is what historic year is correct to use, may use average of more recent years like 1962-64

ALTERNATIVE 5

Column #	13	14	15	16	17	18
	Alt 5					
Methodology	% of Basin Net Demand less Surface Water delivered into GSA					
Column Calculation		13 ÷ 1		13-15	Column 16	Column 3
GSA	Assumed Net Demand assuming 3.5in/yr Effective Precip ² (AF)	Net Demand per acre (AF)	Total Surface Water Deliveries ² (AF)	Net Demand less Surface Water (AF)	% of Basin Net Demand less Surface Water (%)	% of Basin Net Demand less SW x Basin Storage Change (AF)
Central/South	338,676	2.11	250,434	88,242	10.43%	21,495
James	68,336	2.35	33,844	34,492	4.08%	8,402
Kings River East	429,504	2.25	239,837	189,667	22.43%	46,202
McMullin	283,983	2.36	1,710	282,273	33.38%	68,760
North Fork	381,951	2.27	139,253	242,697	28.70%	59,120
North Kings	488,393	1.57	480,098	8,295	0.98%	2,021
Total			1,145,175	845,667	100.00%	206,000

Notes:

- Alt 5 ignores impacts of geographic proximity to rivers/recharge
- Generalized water budget approach still leads to debate over change in groundwater flows, plus numbers will be different than in detailed water budgets for each GSA

ALTERNATIVES SUMMARY

- EVALUATED 5 METHODOLOGY ALTERNATIVES AND ITERATIONS
- GENERAL CONSENSUS SEEMS TO BE NARROWING IN ON ALTERNATIVE 4 AS METHOD FOR APPORTIONING RESPONSIBILITY
 - STORAGE CHANGE +/- AVERAGE BOUNDARY FLOWS WITH RECOGNITION OF HISTORIC BOUNDARY FLOW
 - SEEKING AGREEMENT ON METHODOLOGY ACKNOWLEDGING THE NUMBERS WILL CHANGE
 - GSAs NEED TO AGREE TO METHODOLOGY, SOME WAITING FOR CONFINED BOUNDARY FLOW ESTIMATE

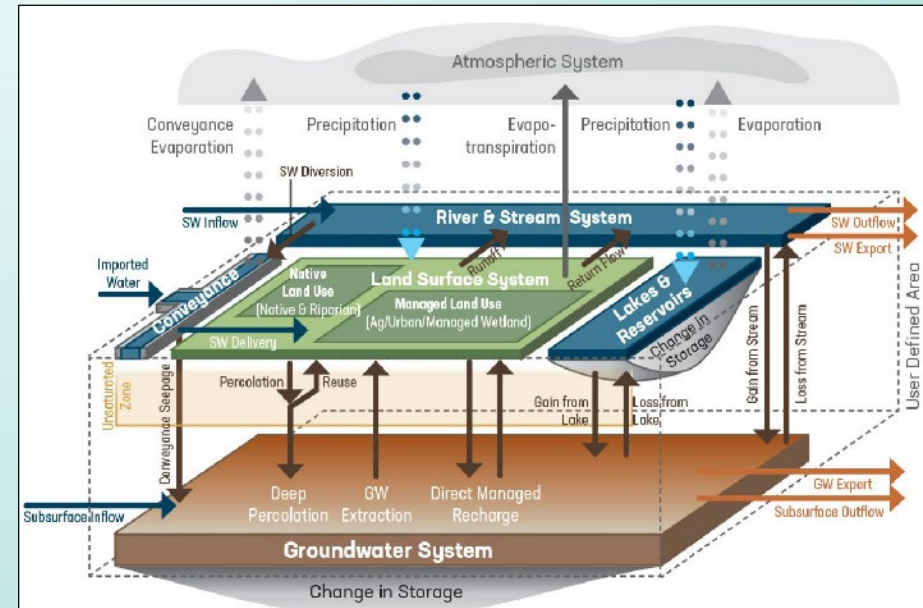
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DETAILED WATER BUDGET

WATER BUDGET

REGIONAL COMPONENT (KINGS BASIN – TASK 7)

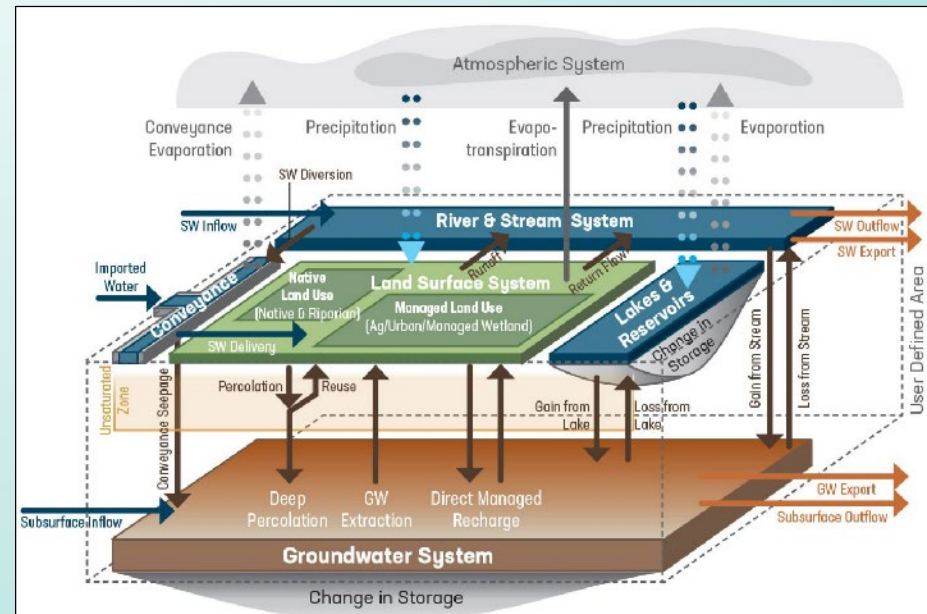
- COMPARISON OF WATER BUDGET METHODS MEMORANDUM
 - ANALYTICAL MODEL (SPREADSHEET)
 - EXISTING KINGS BASIN MODEL
 - OTHER NUMERICAL MODEL
- ESTABLISH COMMON CRITERIA / ASSUMPTIONS
- COORDINATION WITH DWR
 - MEETINGS
 - VERIFICATION OF REQUIREMENTS



WATER BUDGET

LOCAL COMPONENT (NORTH FORK KINGS GSA)

- **DATA COLLECTION**
 - **SPREADSHEET FORM**
 - **AGENCIES PROVIDE SOME DATA, P&P COLLECTS SOME DATA**
 - **P&P WILL COLLECT, ORGANIZE, REVIEW**
- WATER BUDGET ANALYSIS
- WATER BUDGET CALIBRATION
- FUTURE SIMULATIONS
- WATER BUDGET REPORT



WATER BUDGET COMPONENTS

- SUMMARIZE ALL WATER SOURCES AND USES
 - SOURCES: SURFACE WATER, PRECIPITATION, GROUNDWATER (ESTIMATE)
 - USES: IRRIGATION, MUNICIPAL, RESIDENTIAL, INDUSTRIAL
- SUMMARIZE HYDROLOGICAL INTERACTIONS
 - LAND SURFACE: GROUNDWATER INTERACTIONS
 - GROUNDWATER PUMPING, DEEP PERCOLATION, INTENTIONAL RECHARGE, RIVER/CANAL SEEPAGE
 - LAND SURFACE: ATMOSPHERE INTERACTIONS
 - PRECIPITATION, EVAPORATION, EVAPOTRANSPIRATION
- CALCULATE CHANGE IN GROUNDWATER STORAGE
 - WATER INTO GROUNDWATER SYSTEM MINUS WATER OUT OF GROUNDWATER SYSTEM

The background is a light blue gradient with a subtle radial effect, being lighter in the center. It is decorated with several realistic water droplets of various sizes, some with highlights and shadows, scattered around the edges.

GSP DEVELOPMENT

GSP DEVELOPMENT UPDATE

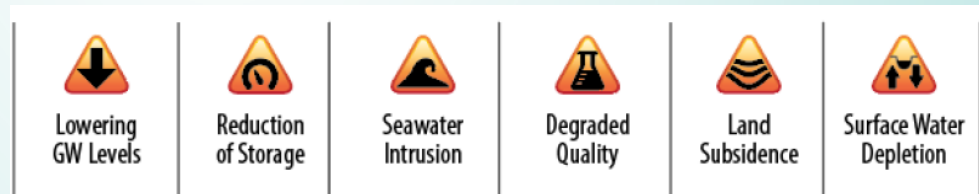
GSP Section	Current Status	Future Work
2- Plan Area	Internal Draft Complete.	Provide to Technical Workgroup for review, then to Board of Directors.
3.1 - Hydrogeologic Conceptual Model	Internal Draft Complete.	Provide to Technical Workgroup for review, then to Board of Directors.
3.2 – GW Conditions	In Progress.	Complete draft, then provide to Technical Workgroup for review.
3.3 – Water Budget	Researching water budget options	Start in July 2018
4 - Sustainable Management Criteria	Outline of Requirements, Draft criteria for water levels	Develop criteria, define undesirable results, set minimum thresholds and measurable objectives
5 – Monitoring Network	In Progress – work focusing on existing well network and aquifers being monitored.	Complete draft, then provide to Technical Workgroup for review.
6 – Projects and Actions	Not Initiated	Summer/Fall 2018
7 – Plan Implementation	Not Initiated	Late 2018

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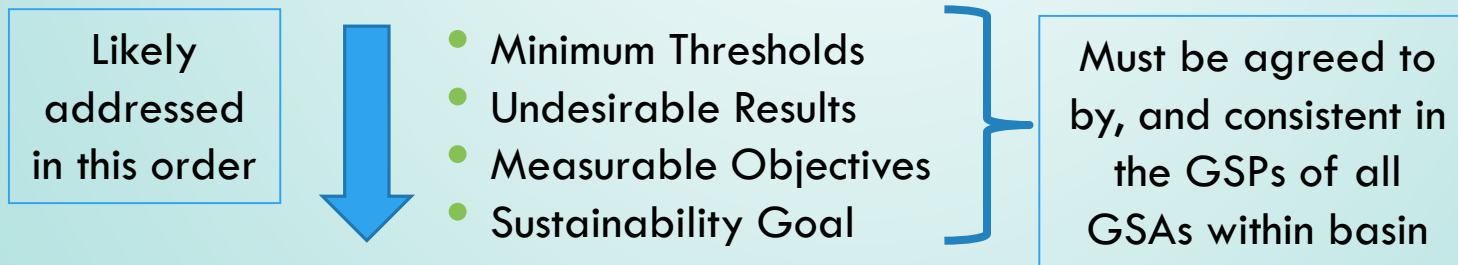
SUSTAINABLE MANAGEMENT CRITERIA

SUSTAINABLE MANAGEMENT CRITERIA

- SUSTAINABILITY INDICATORS









- SIGNIFICANT & UNREASONABLE – DEFINED USING THE FOLLOWING:



SUSTAINABILITY INDICATORS

This is what is monitored

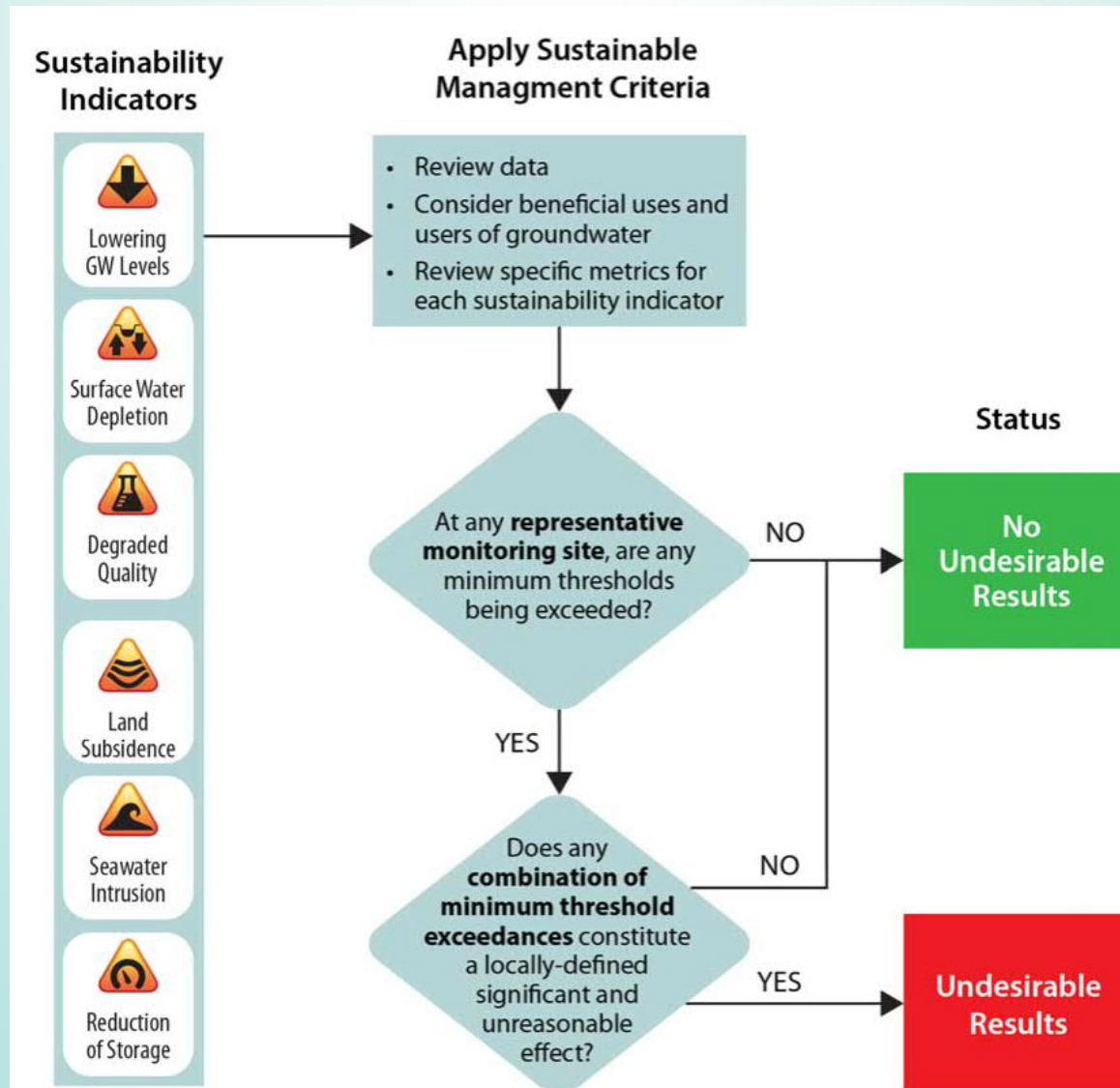


Sustainability Indicators	 Lowering GW Levels	 Reduction of Storage	 Seawater Intrusion	 Degraded Quality	 Land Subsidence	 Surface Water Depletion
Metric(s) Defined in GSP Regulations	<ul style="list-style-type: none"> Groundwater Elevation 	<ul style="list-style-type: none"> Total Volume 	<ul style="list-style-type: none"> Chloride concentration isocontour 	<ul style="list-style-type: none"> Migration of Plumes Number of supply wells Volume Location of isocontour 	<ul style="list-style-type: none"> Rate and Extent of Land Subsidence 	<ul style="list-style-type: none"> Volume or rate of surface water depletion
Undesirable Result (Significant & Unreasonable)	Chronic Lowering indicating significant & unreasonable depletion	Reduction of GW Storage	Seawater Intrusion	Degraded Water Quality, Migration of Contaminati on Plumes	Subsidence that interferes with surface land uses	Depletions that impact beneficial uses of surface water

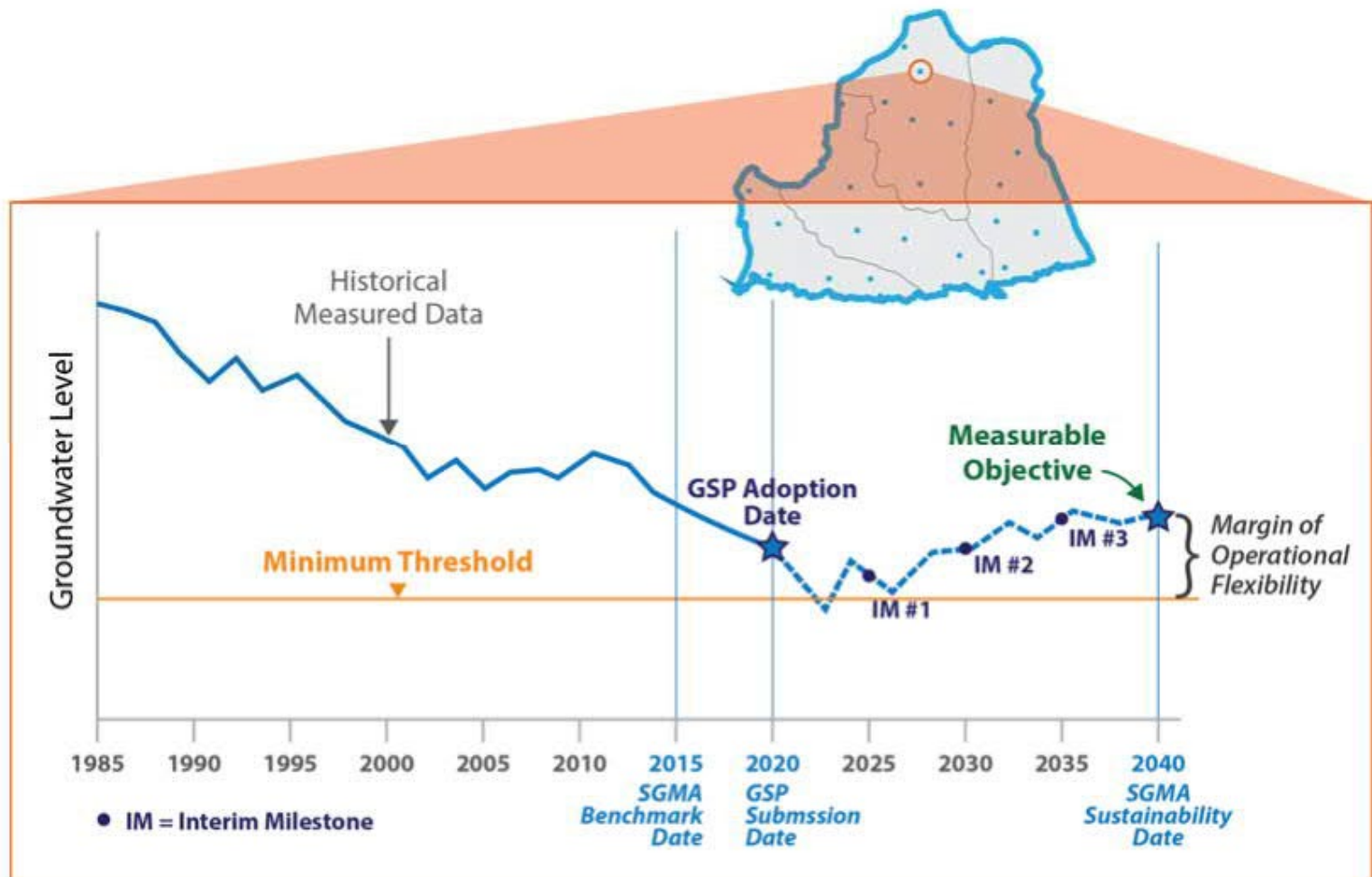
All Undesirable Results
Based on Exceeding Minimum Threshold



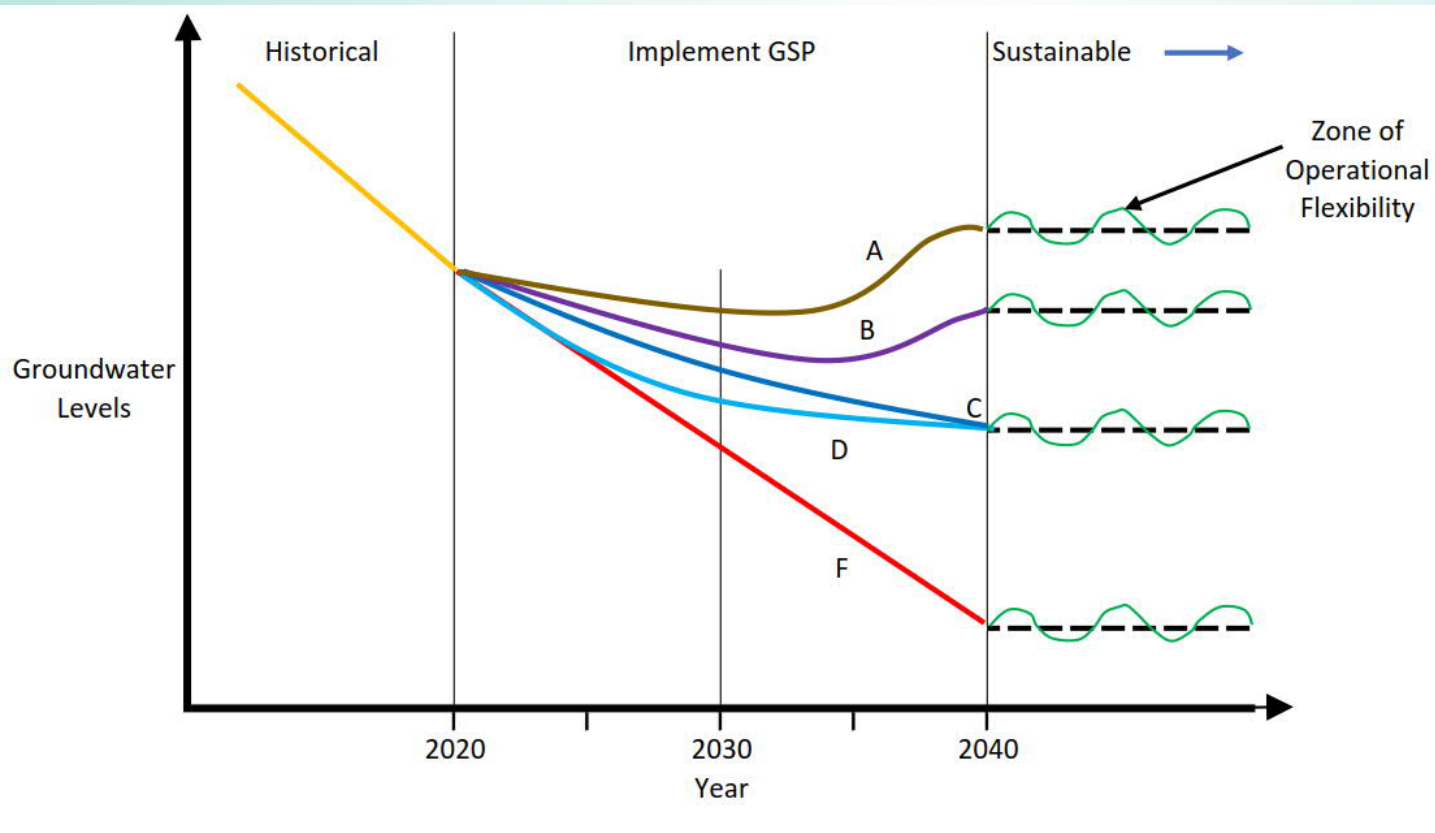
RELATIONSHIP BETWEEN SUSTAINABILITY INDICATORS AND UNDESIRABLE RESULTS



MINIMUM THRESHOLDS, INTERIM MILESTONES AND MEASURABLE OBJECTIVES

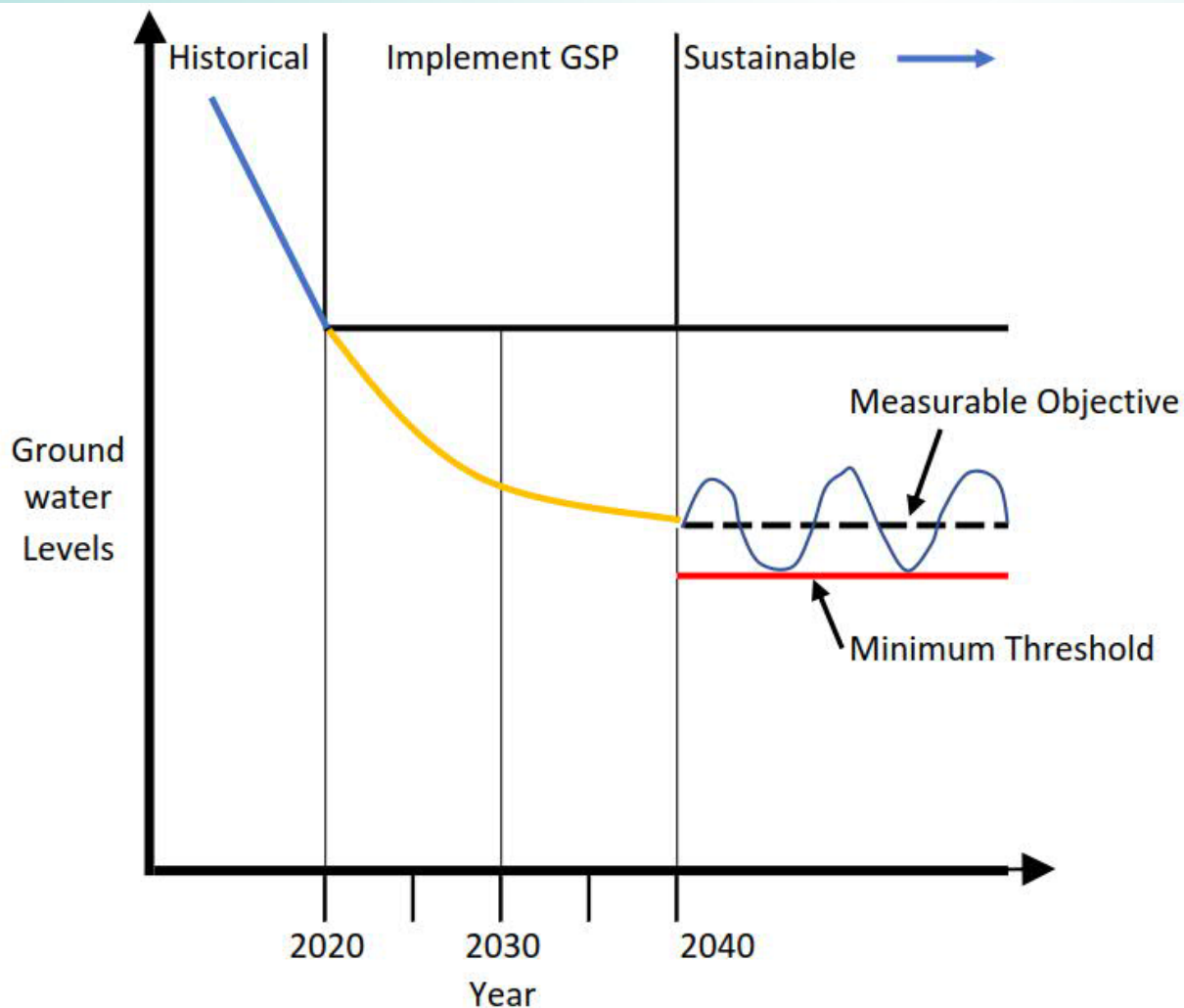


PATHS TO SUSTAINABLE GROUNDWATER LEVELS



- A & B: IS RECOVERY REALISTIC GOAL?
- C & D: RECOMMENDED
- F: DWR WILL NOT LIKELY APPROVE

MEASURABLE OBJECTIVES & MINIMUM THRESHOLDS

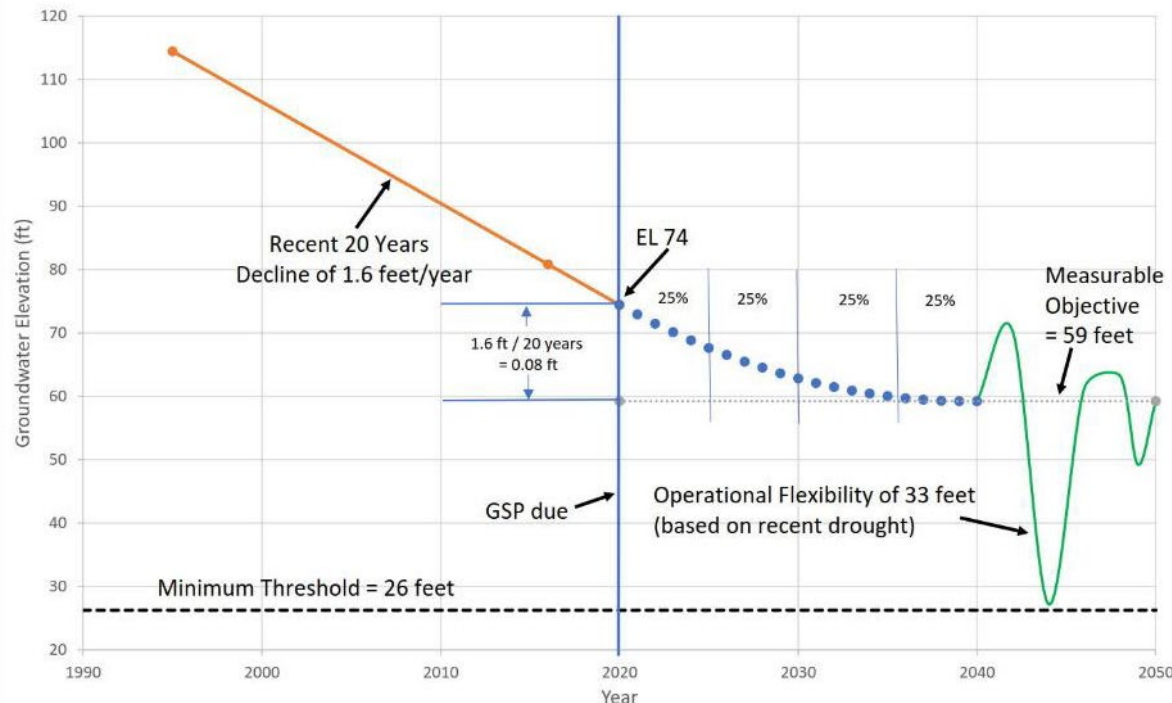


- **Measurable Objective:** Must maintain this level, on average, over long-term.
- **Minimum threshold:** Lowest level allowed; based on droughts, conjunctive use, etc.

Example for Illustrative Purposes Only

ALTERNATIVE C – CONSTANT MITIGATION

Groundwater Level - Sustainability Criteria
Alternative 1 - Constant Mitigation
(25% improvement every 5 years)

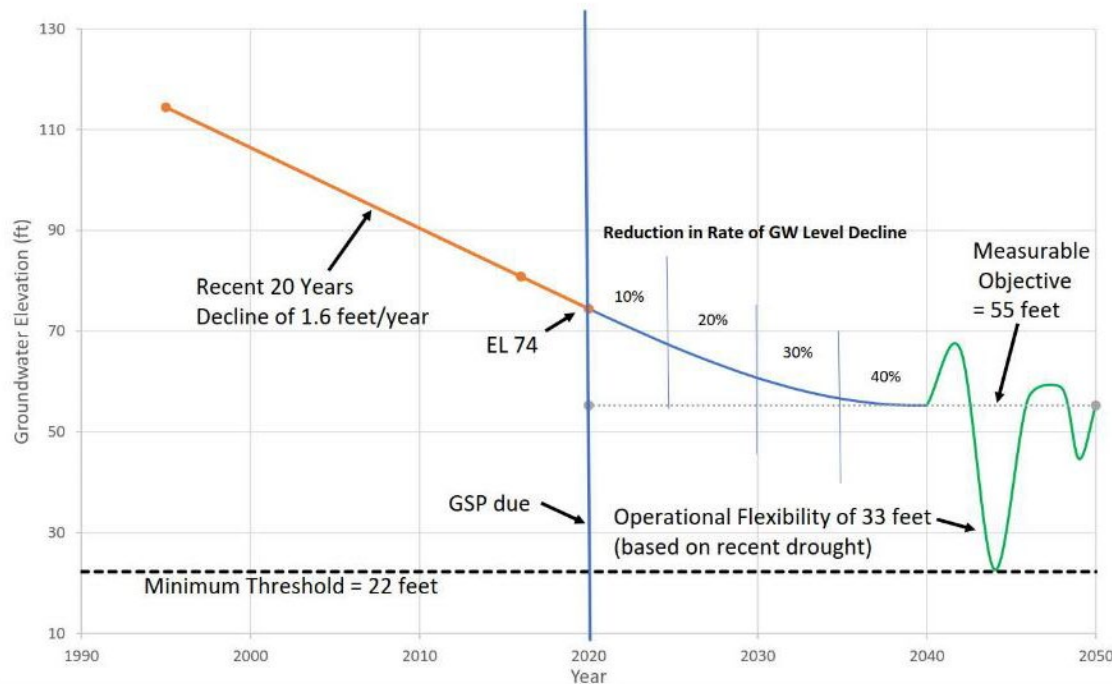


- CONSTANT MITIGATION
LIKELY ACCEPTED BY DWR
- 25% IMPROVEMENT
EVERY 5 YEARS
- CONSTANT OVERDRAFT
MITIGATION MAY NOT BE
PRACTICAL; INITIAL
PROGRESS MAY TAKE
SEVERAL YEARS

Example for Illustrative Purposes Only

ALTERNATIVE D – PHASED MITIGATION

Groundwater Level - Sustainability Criteria
Alternative 2 - Phased Mitigation
(higher mitigation in later years)



- MAY BE MOST PRACTICAL, REALISTIC APPROACH
- HIGHER MITIGATION IN LATER YEARS
- PHASED MITIGATION NEEDED DUE TO POSSIBLE EARLY DELAYS IN BUILDING PROJECTS (FUNDING, PERMITTING, DESIGN) AND AVAILABILITY OF FLOOD WATER FOR RECHARGE

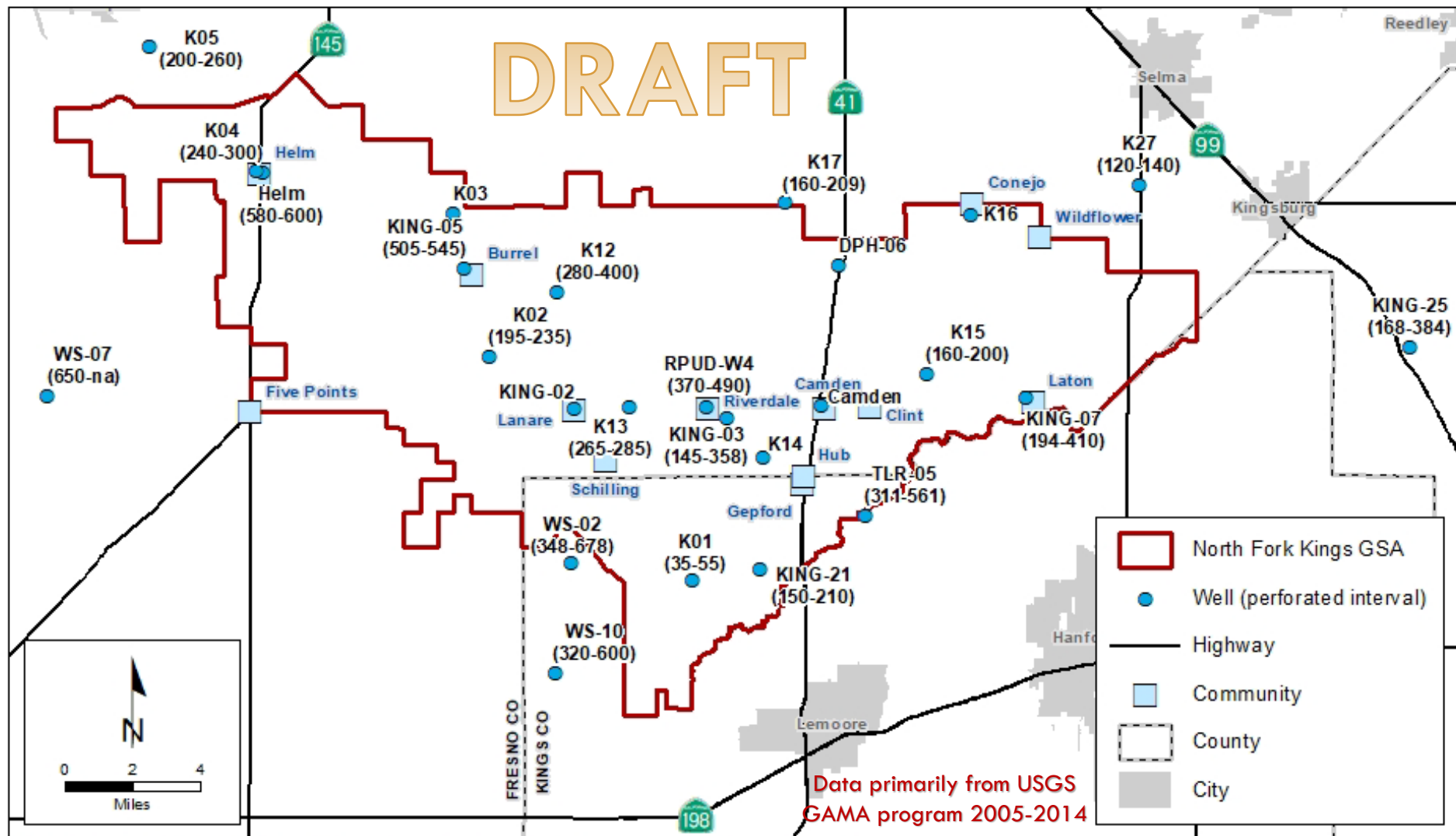
The background is a light blue gradient. In the top-left and bottom-right corners, there are several realistic water droplets of various sizes, some overlapping. The droplets have highlights and shadows, giving them a 3D appearance.

PRELIMINARY WATER QUALITY CHARACTERIZATION

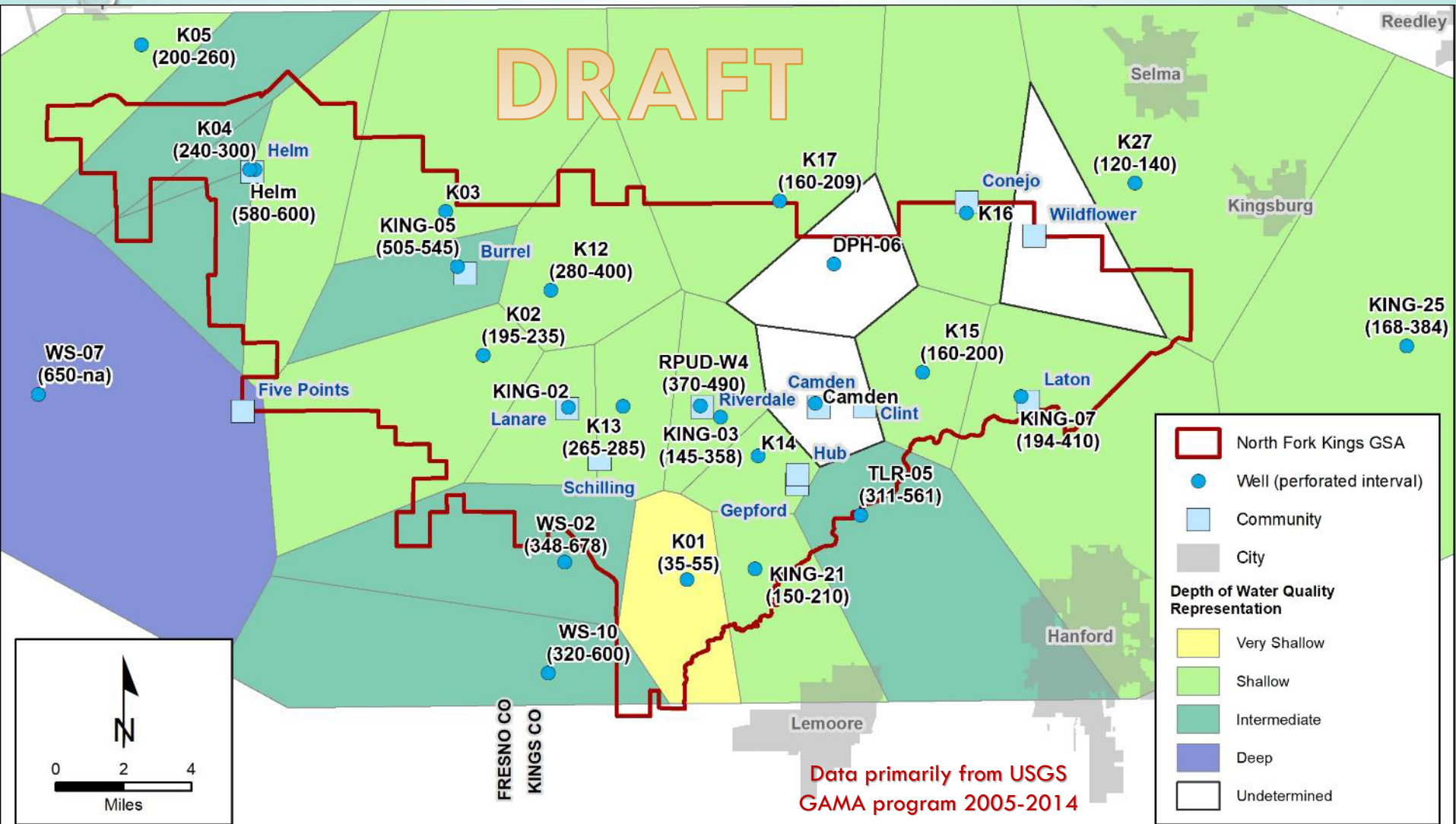
PRELIMINARY WATER QUALITY CHARACTERIZATION

- IN PROCESS OF REVIEWING AVAILABLE WATER QUALITY INFORMATION TO DEVELOP BACKGROUND DATA
- PRIMARILY USGS REPORTS AS PART OF GROUNDWATER AMBIENT MONITORING ASSESSMENT (GAMA) PROGRAM
- OTHER DATA SOURCES ALSO BEING REVIEWED, INCLUDING SOME PUBLICLY AVAILABLE POTABLE WATER SOURCE INFORMATION
- RECENT DATA DESIRED, WITHIN LAST 10-15 YEARS
- SOME DATA IS AVERAGED FROM SEVERAL SAMPLES, OTHER DATA IS INDIVIDUAL SPOT SAMPLES – DEPENDS ON DATA SOURCE
- SEPARATING DATA BY SAMPLE DEPTH

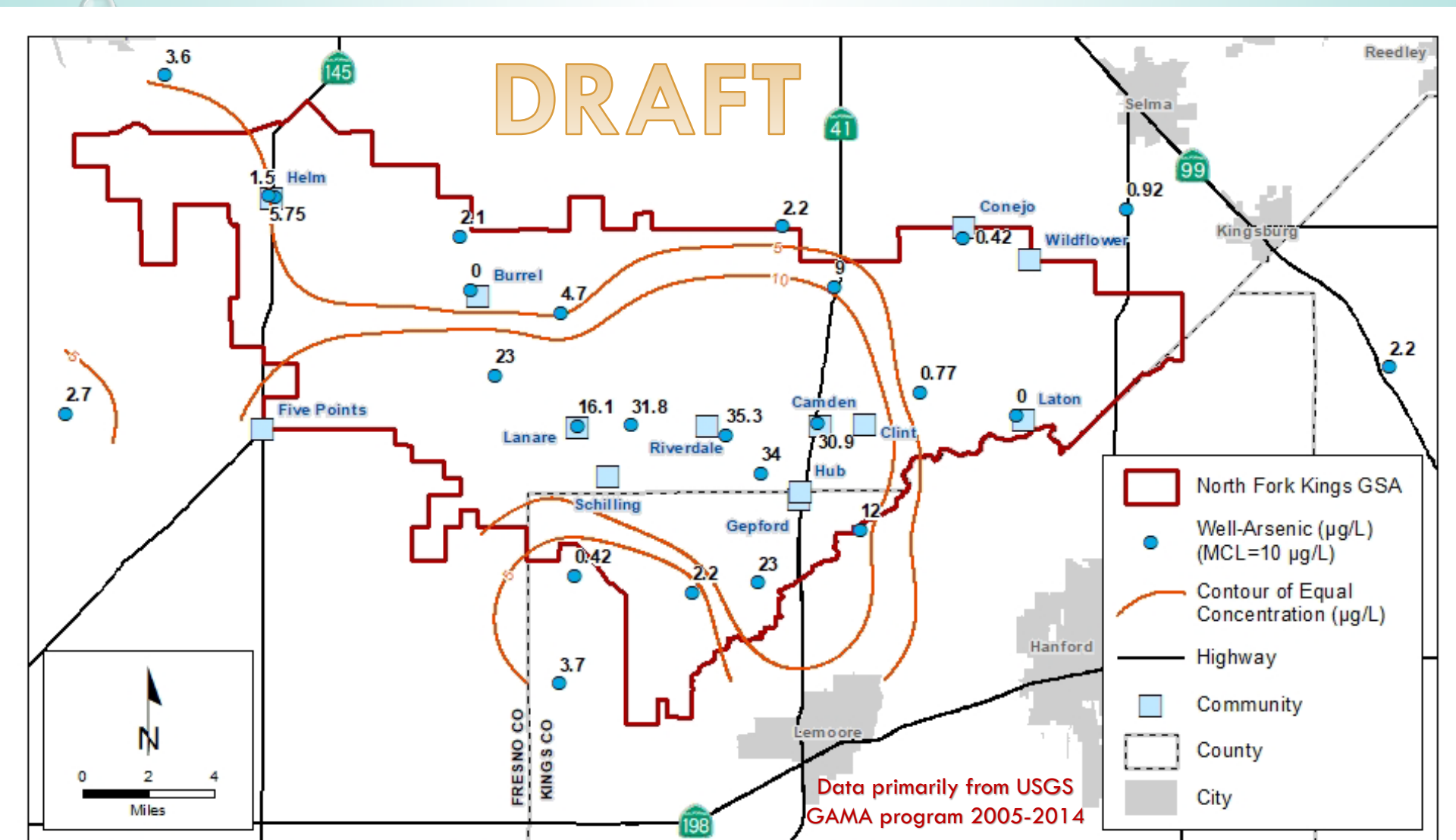
PRELIMINARY WQ DATA - DEPTH INFORMATION



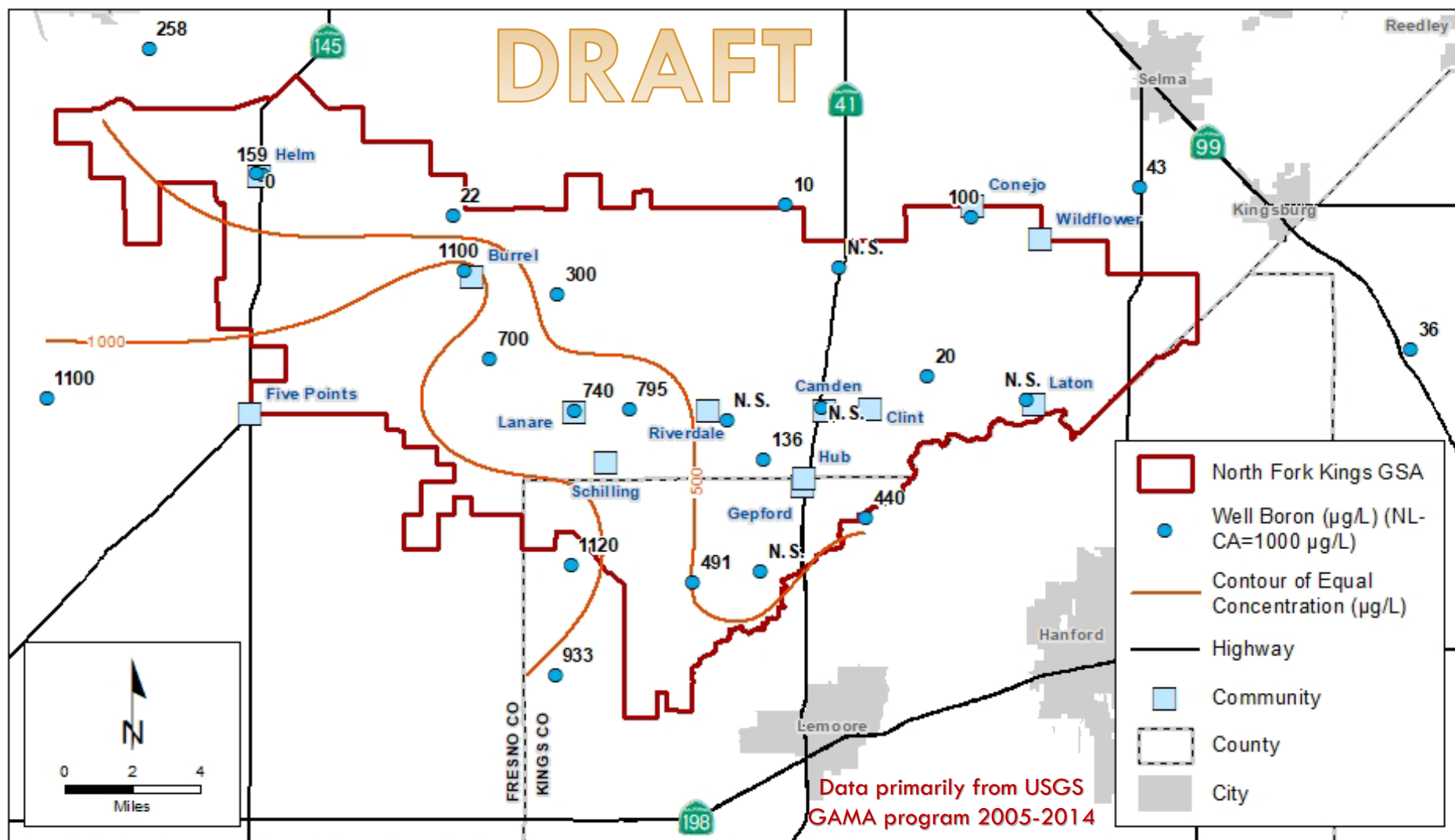
PRELIMINARY WQ DATA – DEPTH REPRESENTATION



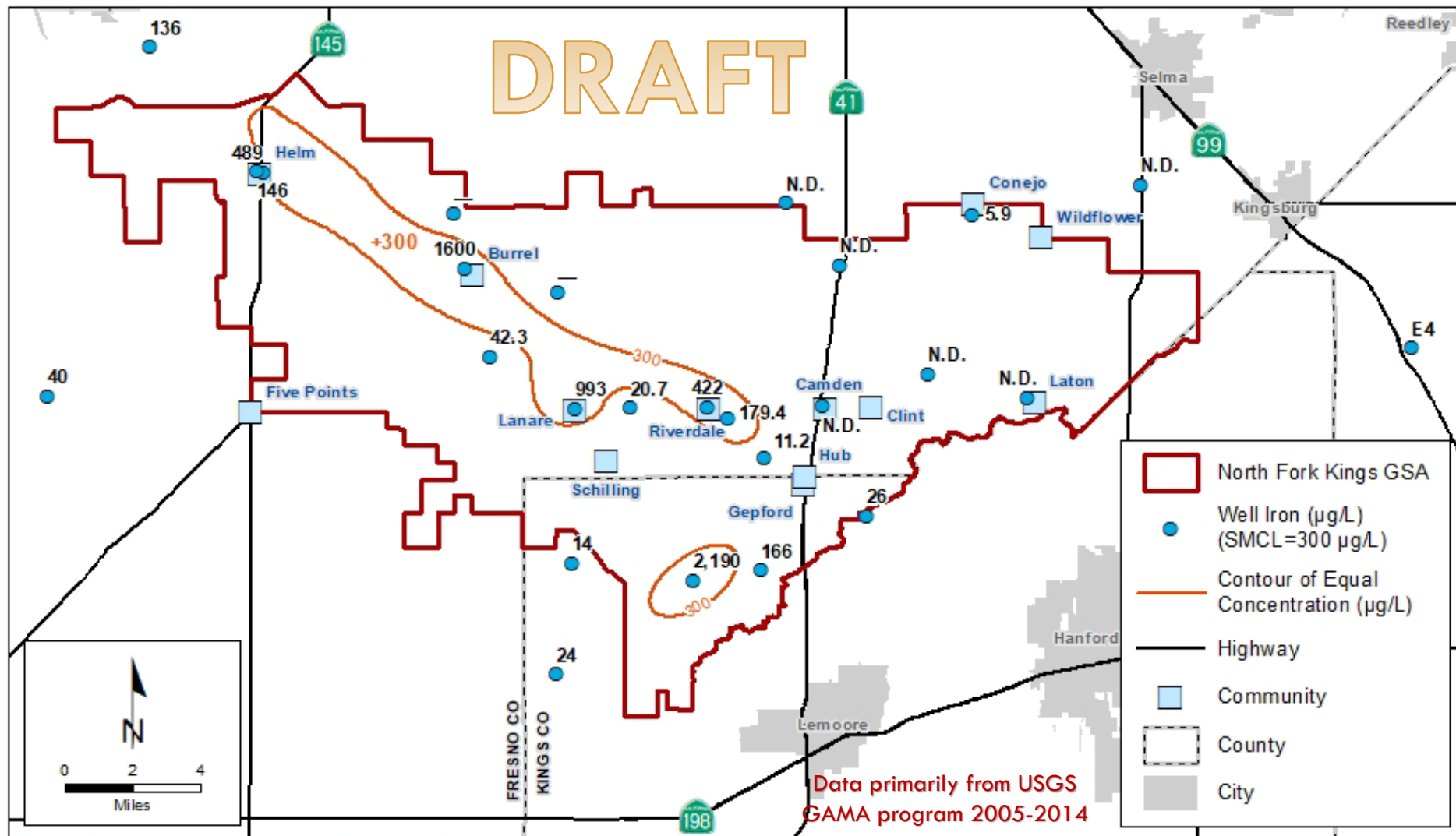
PRELIMINARY WQ DATA – ARSENIC



PRELIMINARY WQ DATA – BORON



PRELIMINARY WQ DATA – IRON



The background is a light blue gradient. In the top-left and bottom-right corners, there are several realistic water droplets of various sizes, some with highlights and shadows, giving them a 3D appearance.

MANAGEMENT AREA CONSIDERATIONS

MANAGEMENT AREAS VS GSA “SUB-AREAS”

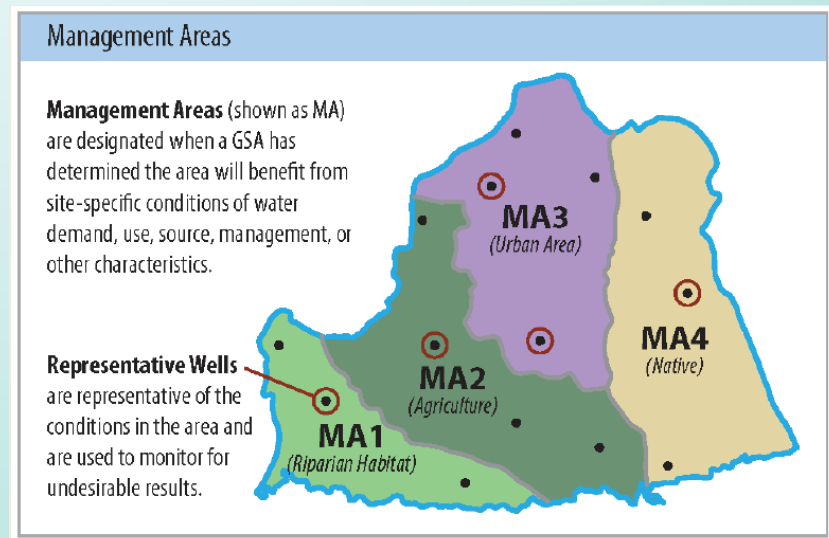
SOME GSAs ARE CONSIDERING USE OF “SUB-AREAS”

DWR’S MANAGEMENT AREAS

- DESCRIBED IN DWR REGULATIONS
- AREA WITHIN A BASIN THAT NEEDS DIFFERENT MIN. THRESHOLDS (MTs) & MEASURABLE OBJECTIVES (MOs)
- REQUIRED TO DISCUSS HOW DIFFERENT MTs AND MOs WILL NOT CAUSE UNDESIRABLE RESULTS
- OPTIONAL....NOT REQUIRED

GSA SUB-AREAS

- NOT DESCRIBED IN DWR REGULATIONS
- BELIEVED NEEDED TO TRACK IMPACTS/RESPONSIBILITIES BY AGENCIES WITHIN A GSA
- BELIEVED SAME MTs AND MOs AS WHOLE GSA



MANAGEMENT AREAS

IF INCLUDED, GSP MUST:

- STATE REASON FOR EACH MANAGEMENT AREA
- STATE MIN THRESHOLDS AND MOS FOR EACH AREA
- MONITORING AND APPROACH REQUIRED FOR EACH AREA
- DISCUSSION ON HOW MGT AREA CAN OPERATE UNDER DIFFERENT CRITERIA WITHOUT CAUSING UNDESIRABLE RESULTS TO OTHER AREAS

The background is a solid teal color. It is decorated with several realistic water droplets of various sizes. Some droplets are in the top-left corner, some in the top-right, and others are scattered along the bottom edge. Each droplet has a highlight and a shadow, giving it a three-dimensional appearance.

FUTURE WORK AND NEXT STEPS

FUTURE WORK

- DETERMINE METHODOLOGY (ENTIRE KINGS BASIN MUST BE CONSISTENT)
 - DETERMINE RANGE OF YEARS FOR INITIAL CONDITIONS
 - DETERMINE RATE OF MITIGATION
 - DETERMINE BASIS FOR OPERATIONAL FLEXIBILITY
- DETERMINE EVALUATION AREAS (AGENCY BOUNDARIES, SUB-AREAS, ETC.)
- CRITERIA FOR 'UNDESIRABLE RESULTS' – MEASURABLE OBJECTIVES AND MINIMUM THRESHOLDS
 - WATER LEVELS WILL VARY BY MANAGEMENT AREA OR SUB-AREA
 - HOW MANY WELLS BELOW THE MINIMUM THRESHOLD IS UNACCEPTABLE?

NEXT STEPS

- CONTINUE GSP DEVELOPMENT – START REVIEWING PLAN SECTIONS
- BEGIN WATER BUDGET
- NEED TO BEGIN WORKING ON PROJECT DEVELOPMENT AND/OR MANAGEMENT ACTIONS TO ACHIEVE SUSTAINABILITY
- NEED TO BEGIN ESTABLISHING MINIMUM THRESHOLDS AND MEASURABLE OBJECTIVES
- DIVISION GROUPS MAY WANT TO MEET REGARDING LOCAL CONDITIONS



QUESTIONS?



The background is a solid teal color. It is decorated with several realistic water droplets of various sizes. Some droplets are in the top-left corner, some in the top-right, and others are clustered in the bottom-right. Each droplet has a highlight and a shadow, giving it a 3D appearance.

EXTRA SLIDES

KINGS COORDINATION TECHNICAL MEMORANDUMS

- TM1 - BASE OF UNCONFINED AQUIFER
- TM2 - SPECIFIC YIELD VALUES
- TM3 - HYDROLOGIC BASE PERIOD DETERMINATION
- TM4 - STORAGE CHANGE ESTIMATION (UNCONFINED AQUIFER)
- TM5 - BOUNDARY FLOW ESTIMATED (UNCONFINED AQUIFER)
- TM6 - DEMAND AND GROUNDWATER USE ESTIMATION
- TM7 - RESPONSIBILITY ALTERNATIVES EVALUATION

GSP DEVELOPMENT UPDATE

- **PLAN AREA CHAPTER**
 - **PLAN PARTICIPANTS**
 - **LAND USE**
 - **WELL DENSITY AND CHARACTERISTICS**
 - **IMPACTS TO OPERATIONAL FLEXIBILITY**

GSP DEVELOPMENT UPDATE

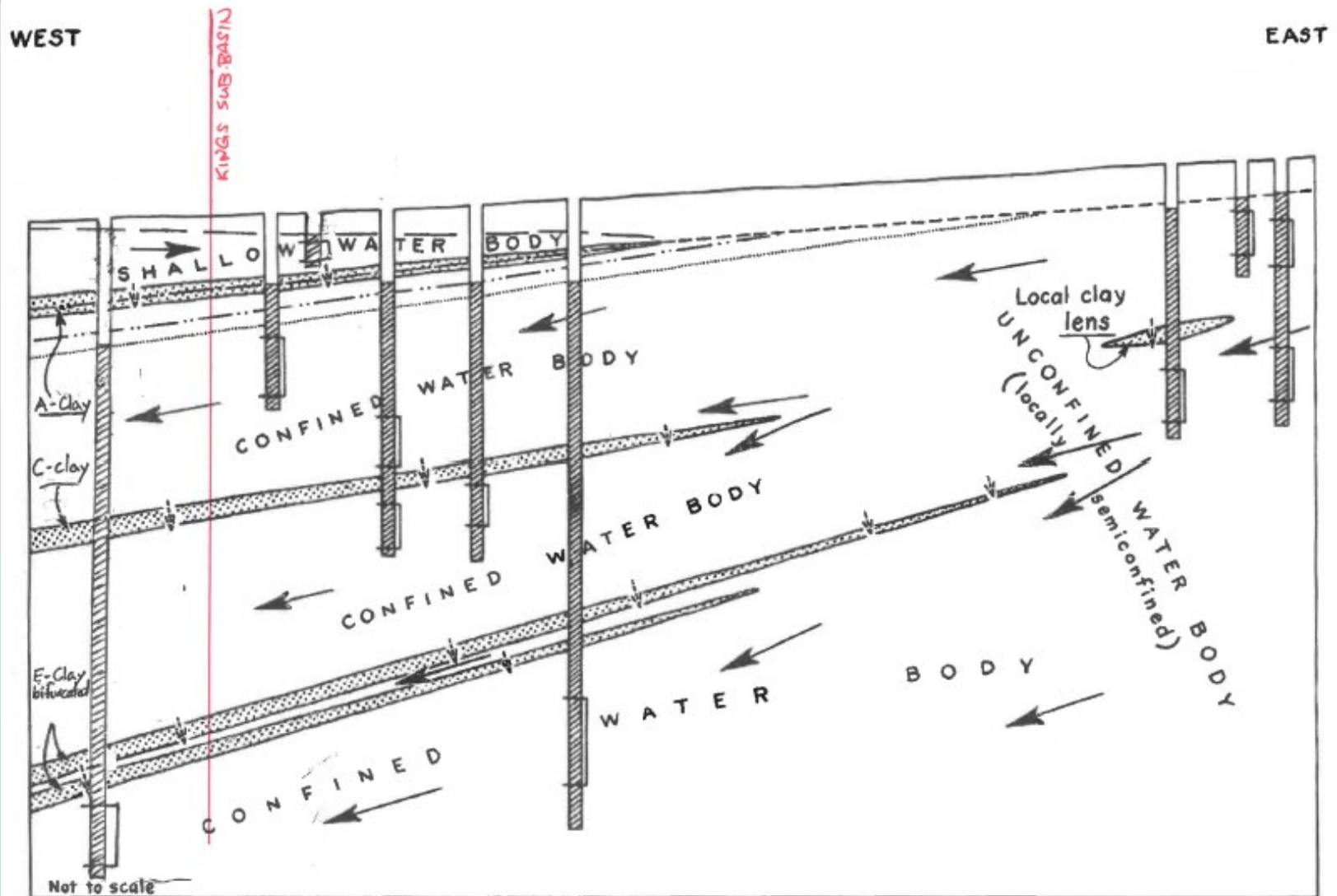
- HYDROGEOLOGIC CONCEPTUAL MODEL CHAPTER
 - VISUAL AND NARRATIVE DESCRIPTION OF GROUNDWATER CONDITIONS
 - CROSS SECTIONS
 - SUMMARY OF AQUIFER PROPERTIES AND CONDITIONS
 - AQUIFER USES
 - GW QUALITY (CONTAMINANT MIGRATION)
 - SURFACE WATER FEATURES
 - RECHARGE AND DISCHARGE AREAS
 - SUB-BASIN VS GSA

GSP DEVELOPMENT UPDATE

- **GROUNDWATER CONDITIONS CHAPTER**
 - GROUNDWATER ELEVATION AND DEPTH (CONTOUR MAPS)
 - GROUNDWATER FLOWS/MOVEMENT
 - GW STORAGE VARIATION
 - HYDROGRAPHS AND TRENDS
 - GROUNDWATER QUALITY
 - LAND SUBSIDENCE
 - SW-GW INTERACTION
 - GW DEPENDENT ECOSYSTEMS

COMPLICATED GEOLOGY

UNCONFINED VS CONFINED AQUIFERS



MINIMUM THRESHOLDS

- NEED TO CONSIDER ALL RELEVANT SUSTAINABILITY INDICATORS WHEN ESTABLISHING MINIMUM THRESHOLDS
- MUST STATE HOW EACH MINIMUM THRESHOLD:
 - WILL AVOID UNDESIRABLE RESULTS IN THE BASIN
 - WILL AVOID CAUSING UNDESIRABLE RESULTS IN ADJACENT BASINS
 - MAY AFFECT BENEFICIAL USE OF GROUNDWATER
 - DIFFERS FROM OTHER STATE, FEDERAL OR LOCAL REGULATORY STANDARDS
 - WILL BE MEASURED CONSISTENT WITH THE MONITORING NETWORK

Groundwater Level - Sustainability Criteria Variables

Example for Illustrative Purposes Only

