							U
•							17N/3W-32 H
							Do Not Fill I-
					тн	STATE OF (	CALIFORNIA DU IVUL FUL IM RCES AGENCY NO. O O COO
ORIGI Tilo wi				DEI	PARTMI	ENT OF V	WATER RESOURCES Nº 93568
1.110 W				WA	TER V	WELL D	DRILLERS REPORT State Well No.
•							Other Well No: Cache Sec. 10
							(11) WELL LOG:
							Tradition 11/2
					<u></u>		Formation: Describe by color, character, size of material, and structure
							fr. to fr.
(2) LO	CATIO	N OF	WELL:				0 - 18- Zellow Cloy
Township, R	ange, and Se	<u>M</u>	(	)wner's number,	ifany		22 TA- 2014 Monet
Distance fro	m cities, roa	ds, railroad	1s, etc. 2 7	i W.	+ 3/4 -	mi Th.	70 - 71 - Sauce
of th	a orf ai	yll s	on Per	metar	Dea	ad	71 - 105. Jellow clou
(A) TY	PF/OF	WOR	K (check)	): []		_	105 - 108. Sauch Cloy & Desoul
inew Well If destruci	ion, descri	eepening be materi	□ Recon- al and broced w	aitioning 🔲	Destroyi	ng 📋	112 - 112 Zellow Cloy
(4) <b>PR</b>	OPOSE	6 USE	(cbeck):		(5) <b>EOU</b>	IPMENT:	
Domesti	c 🗗 Inc	dustrial	🔲 Munici	ipal 🗌	Rotary	L.	
Irrigatio	n 🗌 Te	st Well		her	Cable		
(6) <b>CA</b>	SING		UED.		Other		
st.	EEL:2	01	HER:	If	gravel pac	ked .	
SINGLE							
	1		Gage	Diameter	1	1	
From ft.	To ft.	Diam	ı. Wall	of Bore	From ft.	To ft.	
0	112	1, 5/	P 10 20	1)	0	IND	
		-				/	
	1						
Describe juin	r vell ring:	#	212 00	Size of gravel	<u>`````````````````````````````````````</u>	<u></u>	
(7) PR	RFORA	TIONS	S OR SCR	EEN:	<u>^</u>	<u> </u>	CONFIDENTIAL LOG
l'ype of perf	oration or na	ime of scree	en <u>3/16</u> 2	× 1/2	Punc	hed	Water Code Sec. 13752
Γ		_	Perf.	Rows		p	
ft.		10 ft.	per row	ft.	in	Size	
67	2 7	12		P	3/16	×1/2	
104	//	2					
/							
			<b></b>				
(8) CO	NSTRU	CTIO	N:		-		Plotted and Coded
₩as a surfac	e sanitary sea	l provided	? Yes N	<u> </u>	what depth	<b>УО</b> ft.	As Well 17N / 3W - 32 H80
Were any str	ata scaled aga	inst pollut	ion? Yes 🚺	No []	If yes, not	depth of strata	
rom	67	10 7	<u>ft,</u>				Work started 3/20 1977 Completed 3/20 19 70
Aethod of se	aling C	eme	nt				WELL DRILLER'S STATEMENT:
(9) WA	TER L	EVEL	S:				This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Uepth at wh	ich water w	as first for	und, if known		<u>ft.</u>		NAME 2 Justo 20 CC 12 M. D.
Standing lev	el after perf	orating an	d_developing	A. P	ft,		(Person, firm, or corposetion) (Typed or printed)
(10) <b>W</b>	ELL TI	ESTS: 4	ais gette	apping	2000	PP In.	Address to Bay 470 20 illows
Was pump te	st made? Y	es 🗗 I	No 🗌 🛛 If	yes, by whom?			
<u>ield:</u>		il. min. wi	ith	ft. drawdown	after	hrs.	[SIGNED] Steph g chmith)
. comperature	lan made af	well? Yes	Was a chemica	If you are	Yes 1	No 4	1 195115 11 11
₩as electric	tog made or		1	11 YES. #**	асл сору	1	License No // / / b h Duri M/ L







Section No.\_\_\_\_\_





B. Location of well in areas not sectionized. Sketch roads, railroads, streams, or other features as necessary. Indicate distances.

		WATER WEL	L DRILLERS REPORT		
		FIEL	D WORK SHEET		
Report N Owner Pump No. Meter No	5UB		110	And E En	- Le
Section Township Range	32H 17N 3W	• . 		10 Two	
MAXWELL	SIKES RD MAXWELL LEMETERN				
N STONE CORR. CREE	K K		E BARN feet feet REMARKS	North, West from S. E. of Sect	corner tion
neo	of ten	- the	which en	on the i	nest

Field Checked by B-12-74



ÆL:

°st m

File with	l DWR					WELL	STATE COMP	OF CALIFOR	NIA N REPOR			20		
Page 1 of 1	2	7000					Refer to In	struction Pa	mphlet LAAA		STATEW		J./ STAT	<u>IUN NO.</u>
Owner's	Well No.	<u>7986</u>				0/11/20	006	CU43	9412				LC	
Date Worl	Began _	9/5/2000	<u>)</u>		_, F	Ended 9/14/20						1 1		1 1 1
Local F	ermit A	gency (	il El	NN CO	UN			5/2006		-   !!	AP	N/TRS/	OTHER	Ĺ
Permi	t No. <u>IV</u>	<u>vv 247-t</u>	CF(		IC I	Permit	Date 0/1	5/2000						
		,	GLA	orog.		.00								
ORIENTAT	[ION (⊥)			AL	HOR	ZONTAL		(SPECIFY)						
DEPTH	FROM	METHOD	5 <u>RC</u>	JIARY		FL								
SURF	ACE		Desci	ribe mo	DE: teria	SCRIPTION	, color, etc							
	20	DARK	BRC	WN C	LAY	/	<u>.</u>		Address .93 MI	NOF RD 68 & 5	LOCATI	NOF	RMAN	RD
20	100	SILTY	OR/	NGE	BRC	WN CLAY			City CA					
100	170	SILTY	YEL	LOW E	BRO	WN CLAY	WITH FIN	E SAND	County GLENN					
170	210	TAN C	LAY	WITH	MIN	IMUM SAN	ID		APN Book 013	Page 280	Parcel	001		
210	280	BROW	ΝŤ	AN CL	AY ۱	NITH COAF	RSE SANI	D ,	Townshin 18 N	Range2 W	Section	n 18		
280	400	BROW	N T/	AN CL	٩Y١	WITH SAND	)		Latitude	I	_ 50010		I	t
400	520	SOFT	YEL	LOW E	RO	WN CLAY \	NITH CO.	ARSE	DEG.	MIN. SEC.	<b>or</b>		DEG.	MIN.
	·	SAND							ĹO	NORTH	1			
520	700	SAND	ANE	GRA	/EL	WITH BRIT	TLE YEL	LOW					MODI	
		BROW	NC	LAY										Deepe
700	710	BLUE	CLA	Y WITI	I S/	AND AND G	RAVEL						·	Other
710	720	SOFT	YEL	LOW E	RO	WN CLAY \	NITH SAN	ND					r	DESTROY (
		AND G	RA\	/EL									F	Procedures
720 <sup> </sup>	760	SOFT	BLU	E GRA	Y C	LAY WITH	SAND AN	ID					PLA	NNED U
		GRAVE	EL						_				WATE	R SUPPLY
760	800	SOFT	YEL	LOW	CLA'	Y WITH SAI	ND	į				AST		)omestic rrigation
800	850	SOFT	YEL		LA	Y WITH BR	ITTLE GR	AY 5	5 · · . 			Ш	l	MONIT
·		CLAY	AND	SANE	)	•			•			. '		TEST
850	1025	BRITTI	_E @	BRAY B	BRC	WN CLAY	WITH SAI	ND		· · · · ·			CATHO	DIC PROTE
I I		AND G	RA\	/EL					er 1930 - 1	an the second	·			HEAT EXC
1025	1040	COAR	SE S	SAND		<u>Elista y</u>						, i		INJE
1040	1195	BRITT	_E G	SRAY E	BRO	WN CLAY	WITH SAI			网络克莱尔普波克	 2	• • •		OR EXTRA
	ан на стали. Спорта стали		RA/	/EL SI	RE	AKS		· · · · · · · · · · · · · · · · · · ·	i tang ng ng ng tang tang tang tang tang	and a second s	s se ser e S	• •	1.1.1.1	SPA
									Illustrate or Describe 1	Distance of Well from Road	s, Buildings,		1	REMED
		1.							Fences, Rivers, etc. and necessary. PLEASE B	i attach a map. Usc addit BE ACCURATE & CO	MPLETE.	f		JINER (SP
		1					· · · · · · · · · · · · · · · · · · ·		WATE	R LEVEL & YIEL	D OF CO	MPL	ETED	WELL
		1 									BELOW SI	IRÉACI	F	
		1							DEPTH OF STATIC	WATE:				
		1							WATER LEVEL	(Ft.) & D/	TE MEASU	RED _		·
			100	Ω.					ESTIMATED YIELD	* (GPM)	& TEST TY	'PE		
TOTAL DI	SPTH OF I	BORING.	120		Feet	)			TEST LENGTH	(Hrs.) TOTAL DR	AWDOWN_		_ (Ft.)	,
TOTAL DI	SPIH OF	COMPLE	IED	WELL_		<u> </u>	2 		May not be repr	esentative of a well'.	s long-tern	n yield	1	1
DEP	гц		•			Ċ	ASING (S)			DEDTU		ANN	ULAR	MATERI
FROMSU	RFACE	HOLE	TY	<u> PE (스)</u>	m.	i.			p(r,r) = 0	FROM SURFACE			TY	(PE
		DIA.	¥		힌	MATERIAL /	INTERNAL DIAMETER	GAUGE OR WALI	SLOT SIZE		CE-	BEN-	= ====	FILTE
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ZONE	1			╧┤╴╡╴	1				<b>-</b>	0 13		<u>``</u> '		SAND
0	246	14	-		F	VC F480	2.5	SCH 8	0	130 13	4	~		BENT
246	256	14			F	PVC F480	2.5	SCH 8	0.030	134 22	3		<b>√</b> •	SRI#8
256	266	14	-		F	PVC F480	2.5	SCH 8	0	223 23	5	~		BENTO
ZONE	2			·	· ·	•				235 28	10			SRI#8
0,	510	14			F	PVC F480	2.5	SCH 8	0	280 29	0	V .		BENTO
	ATTACE	IMENTS	(⊻)			1			- CERTIFICA	ATION STATEME	NT			2.147
	- Geologic Well Con	Log Istruction Di	iaaren	• 2 <sup>5</sup> 2 − 1 1 + 2 +		I, the undersit	aned, certify th	at this report is	complete and accurat	te to the best of my know	ledge and b	elief.		4977
	Geophysi	cal Log(s)		ing dia si San		(PER	SON, FIRM, O	R CORPORAT	ION) (TYPED OR PR	RINTED)				
	- Soil/Wate	r Chemical	Analy	/sis		ADDRESS	KENTUC				AND		CA STATE	956
АТТАСН АП	_ Uther DITIONAI //	VEORMATIC		ITEXIST	 S.	Signed	Martiel	amon			10/05/00	6	(	<u>C57 A HI</u>
1					- <i>•</i> .	WEI	L DRILLER/A	UTHORIZED F	REPRESENTATIVE		DATE SIGN	ied -		C-57 LICEN

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ORIGÎNA	NL.							STATE	OF CALIFO	OR	INIA	DW	R US		<u>.Y</u>	DO	NOT FILL IN
File with	DWR						WELL	COMP	LETIC	DI	N REPOR	T					
Page 2 of 1	12							Refer to In	struction	Pa	mphlet		S	TATE W		D./ STAT	TION NO.
<b>Owner's</b>	Well No.	7986						No	<sup>.</sup> E04	5	5412					I	
Date Worl	k Began _	9/5/2006	3			,	Ended 9/14/2	2006								L(	DNGITUDE
Local E	Permit Ag	gency G	ЪЕ	NN		วมเ	NTY HEALTH	I DEPT				- [[					
Permi	it No. <u>M</u>	W 247-0	6				Permit	Date _ 6/1	5/2006		tend for that ?	_		Al	<u>-N/TRS/</u>	OTHER	
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ORIENTAT	「ION (攵)		RTIC	AL		– нс	ORIZONTAL	ANGLE	(SPECIFY)								
DEBTH	EPON	METHOD	3 <u>R</u>	DT.	AR'	Y	F	LUID MUD									
SURF			-			D	ESCRIPTION										
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20'	100	SILTY					NI CLAY			4	Address <u>.93 MI</u>	NUF RD 68 8	, 520	EOF	· NUF		
100	170	SILTY		10		BR	NUN CLAY	WITH FIN		5	City CA						
170	210	TAN CI		<u> </u>		1 M			<u> </u>	1	County GLENN	- 000			004		
210	280	BROW	NT	AN		AY		RSE SAN	ה	1	APN Book 013_	Page <u>280</u>		Parcel	10		
280	400	BROW	NT	AN			WITH SAND			1]	Township 10 N	Range <u>Z vv</u>		Sectio	n <u>10</u>		
400	520	SOFT		ĪC	Ŵ	BR	OWN CLAY		ARSE	1	Latitude	AIN. SEC.	_		-	DEG.	MIN. SEC.
		SAND								┢	LO	CATION SKET	CH-				CTIVITY (Z) —
520	700	SAND	ANE	0 0	RA	VE		TTLE YEL	LOW			NORTH				~	NEW WELL
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700	710	BLUE C	CLA	YI	WIT	Ή :	SAND AND G	GRAVEL		1						·	Other (Specify)
710	720	SOFT	YEL	LC	W	BR	OWN CLAY	WITH SAI	١D	-							
i		AND G	RA۱	٧E	L												Procedures and Materials
720	760	SOFT I	BLU	iE (	GR	AY	CLAY WITH	SAND AN	ID							PLA	NNED USES ( )
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760 ¦	800	SOFT	YEL	LC	W	CL	AY WITH SA	ND		ยื่อ	2				<b>A</b> ST		Domestic Public mination industrial
800 ¦	850	SOFT	YEL	LC	W	CL	AY WITH BR	ITTLE GF	AY	3	\$				Ш		
		CLAY A	AND	) S	AN	D											TEST WELL
850	1025	BRITTL	E C	GR.	AY	BR	ROWN CLAY	WITH SA	ND	_						сатно	DIC PROTECTION
		AND G	RA	VE.	L					_							HEAT EXCHANGE
1025	1040	COARS	SE S	SA				MUTLLOAD		-							INJECTION
1040	1195	BRITTL	E C	jR.	AY		COWN CLAY	WITH SA	ND	-						VAP	
		AND G	RA	VE.	LS	IR	EAKS			-							SPARGING
										-	Illustrate or Describe I	Distunce of Well from 1	couds,	Buildings	,		
										-	necessary. PLEASE B	allach a map. Usca E ACCURATE &	COM	u paper PLETE.	ır	<u>`</u>	
										-	WATE	R LEVEL & YI	ELD	OF CC	MPL	ETED	WELL
											DEPTH TO FIRST V	WATER (	Ft.) BE	LOW S	URFAC	E	
						•					DEPTH OF STATIC						
										1	WATER LEVEL	(Ft.) 8	DATE	MEASU	JRED		
TOTAL DI	PTH OF	BORING	120	)0		Œ	(art)				ESTIMATED YIELD	• (GP	M)& '	TEST T	YPE		· ·
TOTAL DI	REPTH OF	COMPLE	TED	w	ELL	.10	00 (Feet)			l	TEST LENGTH			DOWN_		(Ft.)	
						-	(100)			-	May not be repr	esentative of a w	211 5 10	ng-teri	n yieri		····
DEP	тн	BORE -					C	ASING (S)				DEPTH			ANN	JLAR	MATERIAL
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		(inches)	ANK	<u>ا</u>	żβ	튁	MATERIAL / GRADE	DIAMETER	OR WAL	= _L	IF ANY			CE- MENT	BEN-	E FILL	FILTER PACK
FL. 10	г.		ם	ប្ដី	٥Ħ	E		(Inches)	THICKNE	:SS	6 (Inches)	⊢t. to F	ι.	(⊻)	( <u>⁄</u> )	$(\checkmark)$	(TYPE/SIZE)
510	520	14	ļĻļ	4	_		PVC F480	2.5	SCH	8(	0030	290	488			~	SRI#8 SAND
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ZUNE	3	- 17				_				01		500	543			•	SRI#8 SAND
620	630	14	⊢┻	7	-+	_	DVC E480	2.5	SCH	8( 0/	0 000	552	003 500				SENTUNITES
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	ATTACI																DEITIONITEO
	- Geologic	Log	(⊻)	-			), the undersi	igned. certify th	at this report	t is	complete and accurate	e to the best of my k	newier	ige and 1	bellef.		
-	Well Con	struction Di	agran	n			NAME_E	ATON DRI	LING CC	<u>).</u>							
_	_ Geophysia	c Chemice'	Anal	vsie			20 WEST	T KENTUC	KY AVE	Aľ	ION) (IYPED OR PR	WOOI		D		CA	95695
_	- Other		7 11 124				ADDRESS	AM. IN	1)	L		0	ITY		c	STATE	
ATTACH AD	DITIONAL IN	IFORMATIC	N, IF	π	EXIS	TS.	Signed WE	LL DRILLER/A	UTHORIZED	272 D R	REPRESENTATIVE		DA	TE SIG	NED		C-57 LICENSE NUMBER
DWR 188 REV	. 11-97			IF	AD	DIT	IONAL SPACE I	S NEEDED.	USE NEXT	ГC	CONSECUTIVELY	UMBERED FOR	м				•

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		2					WELL	i CO Refe	<b>JIVLEY</b> er to Ins	truction 1	JIN Pami	The second secon	┖ᅟ┃└──┴	s	TATE V	VELL N	0./ STAT	TION NO.
	Curver's	.4 Wali Na	7986						No	F04	5/	112		1 1		1 🗌 1	1	
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	Ft. to	Ft.		Descrit	e ma	terial	, grain, s	ize, col	lor, etc.					VELLLA	CAT	(ON		
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	2801	400	BROW			NY W	/ITH SAN	ND				wnship 10 N	Kange	<u> </u>	Sectio	<u>10</u>		
	4001	520	SOFT Y	ELL	DW B	ROV	VN CLA	Y WIT	H COA	RSE	Li	DEG. M	IN. SEC	D.		-	DEG.	MIN. SEC
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			BROW		AY	_											MODI	FICATION/REPAI
	700	710	BLUE C	LAY	WITH	I SA	ND AND	GRA	VEL		1						•	Other (Spec
	710	720	SOFT Y	'ELLC	OW B	RO	VN CLAY	Y WIT	H SAN	D								
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			GRAVE	L													WATE	NNED USES R SUPPLY
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	800	850	SOFT Y	'ELLC	ow c	LAY	WITH B	RITTL	LE GR	AY	ž					5	'	migation "
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	850	1025	BRITTL	EGF	AY E	BRO	NN CLA	Y WIT	'H SAN	ID							CATHO	DIC PROTECTIC
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											<u> </u>		- SOUTH -				-	REMEDIATIO
	1										III Fc	ustrate or Describe Di mees, Rivers, etc. and	<i>slunce of Well</i> j attach a map.	from Roads, Use addition	Buildings al paper	r, if		OTHER (SPECIF
	·····										пс	cessary. PLEASE BE	ACCURATE	COMI	PLETE.			
	1											WATER	LEVEL &	YIELD	OF CO	OMPL	ETED	WELL
	1										וס	EPTH TO FIRST W	ATER	(Ft.) BE	LOW S	URFAC	E	
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												AIEK LEVEL	(	(Ft.) & DATE	: MEAS	URED _	_,	
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	TOTAL DE	PTH OF	COMPLET	TED W	ELL 1	000	(Feet	t)			"	May not be repre	sentative of	a well's h	ong-ter	m viel	— (FI) d.	
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	070			<u> </u>	<u>  व</u>	<u>-</u>						,			( <u>¥</u> )	( <u>(</u> )	<u>⊢(</u> ,	
	6801	680	14	<u> </u>			VC F480	<u> </u>	2.5	SCH :	80	.030	<u>608 i</u>	<u>693</u>			<b>├</b> ──	SRI#8 SAI
		100	14	<u> </u>	├	1 P	VC F480	<u>'</u>	2.5	SCH	σU		710	/ 16		<u> </u>		DENIUNI
		975	4/8-3/4		├─	P	VC F480		25	SCH	80		011	930		- <b>/</b>	<u> </u>	BENTONI
	975	985	8-3/4		┝╌┠╌	P	VC F480		2.5	SCH	80	030	944	996				SRI#8 SAT
	985	1000	8-3/4	-	$\left  - \right $	†p	VC F480		2.5	SCH	80		996	1002		<b>↓</b> ✓		BENTON
		ATTACH	IMENTS (		L		·····					• CERTIFICA'	LION STA	TEMEN	<u> </u>	l	<u> </u>	L
		Geologic	Log	- /			I, the unde	ersigned,	certify the	it this report	is co	mplete and accurate	to the best of	my knowled	- ige and	belief.		
		Well Con	struction Dia	agram			NAME	EATO	N DRIL	LING CO	) <u>.</u> ATIO			··· •				
		- Soil/Wate	Chemical	Analysis	5		20 WE	ST KE	NTUCK	YAVE	0		W	OODLAN	۱D		CA	95695
	I —	Other				_	ADDRESS	s M.	15	)				CITY			STATE	
						-				J J J J J J J J J J J J J J J J J J J	<b>.</b>							

ORIGINAL File with DWR	WEL	STATE OF	f califoi LETIO	RNIA N REPOR		WR USI	<u>= ONL</u>	<u>Y</u>		
Page 4 of 12		Refer to Inst	truction P	amphlet		ST	ATE W		D./ STAT	ION NO.
Owner's Well No		No. 14/2006	E04	5412						
Date work Began	CLENN COLINEX HEA						1	1	1 1	
Local Permit A	$\frac{1}{247-06}$	6/15	/2006		— [ L	II	AF	N/TRS/	OTHER	
Permit INO.	GEOLOGIC LOG	mit Date <u>or re</u>			_					
	DRILLING DOTADY	ANGLE(	SPECIFY							
DEPTH FROM	METHOD KOTAKT									
SURFACE Ft to Ft	Describe material, grain	, size, color, etc.		I.						
0 20	DARK BROWN CLAY			Address .93 MI	NOF RD 68	ELL LO	CATI	NOF	RMAN	RD
20 100	SILTY ORANGE BROWN C	_AY		City CA						
100 170	SILTY YELLOW BROWN CL	AY WITH FINE	SAND	County GLENN						
170 210	TAN CLAY WITH MINIMUM	SAND		APN Book 013	Page 280	) T	Jarcel	001		
210 280	BROWN TAN CLAY WITH C	OARSE SAND	)	Townshin 18 N	Range2	\	Lectio	n 18		
280 400	BROWN TAN CLAY WITH S	AND		Latitude	Kuigo- <u></u>	<u> </u>	500110	·	1	1
400 520	SOFT YELLOW BROWN CL	AY WITH COA	RSE	DEG.	MIN. SEC.			-	DEG.	MIN. SEC.
	SAND			LO	CATION SKI	ЕТСН-				
520 700	SAND AND GRAVEL WITH	BRITTLE YELL	.ow							
	BROWN CLAY								- WODI	— Деереп
700 710	BLUE CLAY WITH SAND AN	ND GRAVEL							-	Other (Specify)
710 720	SOFT YELLOW BROWN CL	AY WITH SAN	D							
	AND GRAVEL									rocedures and Materials
720 760	SOFT BLUE GRAY CLAY W	ITH SAND ANI	D						DTAT	NNED LISES ( / )
	GRAVEL								WATE	R SUPPLY
760 800	SOFT YELLOW CLAY WITH	SAND		ESI				<b>VST</b>	C	omestic Public
800 850	SOFT YELLOW CLAY WITH	BRITTLE GRA	AY	Š				E	- "	
	CLAY AND SAND									TEST WELL
850¦ 1025	BRITTLE GRAY BROWN CL	AY WITH SAN	D						CATHO	DIC PROTECTION
	AND GRAVEL								I	HEAT EXCHANGE
1025   1040	COARSE SAND									DIRECT PUSH
1040 1195	BRITTLE GRAY BROWN CL	AY WITH SAN	D						VAPO	
1	AND GRAVEL STREAKS									SPARGING
				Illustrate or Describe	Distunce of Well from	n Rouds. B	uildines			REMEDIATION
				Fences, Rivers, etc. and	i aitach a map. Us	e additional	paper	if	Ċ	THER (SPECIFY)
	· · · · · · · · · · · · · · · · · · ·		ł							
				WATE	R LEVEL & J	(IELD C	л сс	MPL	ETED	WELL
i	1			DEPTH TO FIRST	WATER	- (Ft.) BEL	.ow s	URFACE	Ξ	
				DEPTH OF STATIC	(Ft.	) & DATE	MEASL	JRED		
i	1			ESTIMATED YIELD	*(	ЭРМ)& Т	EST T	YPE		
TOTAL DEPTH OF	BORING <u>1200</u> (Feet)			TEST LENGTH	(Hrs.) TOTA		DOWN.		(FL)	
TOTAL DEPTH OF	COMPLETED WELL1000 (F	'eet)		May not be repr	resentative of a	well's lo	ng-teri	m yield	1.	
						T				
DEPTH FROM SURFACE	BORE -	CASING (S)			DEPTH			ANNU	JLAR	MATERIAL
			GAUGE	SLOT SIZE	FROM SUR		CE.	DEN	11	PE
Ft. to Ft.		DIAMETER	OR WALL	IF ANY S (Inches)	Et to	Ft	MENT	TONIT	E FILL	FILTER PACK (TYPE/SIZE)
		(menes)	THORNES	G (increas)			(⊻)	(⊻)	$(\mathbf{V})$	(
						1200	•		v	NATIVE FILL
0 <sub>1</sub> 240	14 V PVC F4	80 2.5		<u>30</u>						
2561 266		80 2.5		0.00						
ZONE 2		2.5	30110						<u> </u>	
0 510		80 2.5	SCH 8	30						
				CEDTIEIC	TION STAT					
Geologic	Log	ndersigned, certify the	t this report i	s complete and accurate	te to the best of m	y knowledn	e and l	belief.		
Well Cor	struction Diagram	E EATON DRILL	LING CO.	DON! (D/255 05 -5						
Geophys	cai Log(s) r Chamical Analysis 20 V	VEST KENTUCK	Y AVE	HON) (TIPED OR PR	WO		D		CA	95695
Other		ESS M. I. T.	) *			CITY		c	STATE	
ATTACH ADDITIONAL I	FORMATION, IF IT EXISTS.	WELL DRILLER/AU	THORIZED	7 REPRESENTATIVE			FE SIG	NED		C-57 LICENSE NUMBER
DWR 188 REV 11-97		CE IS NEEDED II	SE NEYT	CONSECUTIVELV		NPM				

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ORIGINAL File with DWR

#### STATE OF CALIFORNIA THE RESOURCES AGENCY DEPARTMENT OF WATER RESOURCES WATER WELL DRILLERS REPORT

18N/02W - 36M Do not fill in

177869 No.

State Well No .....

Notice of Intent No	WATER WELL DI	RILLERS F	EPORT	State Well No	
Local No. or Date				Other Well No	
_					
(		(12) <b>WELL</b>	LOG: Total de	epth <u>455</u> ft. Depth of c	ompleted well 455ft.
A		from ft. to	ft. Formation (De	scribe by color, character	, size or material)
C			7	top Sail	
(2) LQCATION OF WELL (See instruct	tions):	<u> </u>	38	Brown C	IAY
County COLUSA Owner's	Well Number		41	Gravel	
Well address if different from above	<u> </u>	41 -	88	BROWN (1	IAY
Township 18 N Range 2 W	Section_Section	80	127	SANGE & Gri	Avel
Distance from cities, roads, railroads, fences, etc		12.7-	146 /	Blue CLAI	<u>م</u>
Extenence NotheAst co	rner of	<u> </u>	<u>xx4</u>	Diver ho	<u>έ</u> ξ
SECION 36	·····	114 -	7198 7	<u>&gt; Blue Sl</u>	Ay
	(2) TYPE OF WORK	168	310/	<u>SAND &amp; G</u>	FAVE
	(5) TIPE OF WORK:	310	<u>446 V</u>	- Dine Ch	a.y
	New well 2 Deepening	446 2	× 25 /	2 Shale & G	ravel
	Reconstruction		$\rightarrow$	×~~~~	
		<del>~}</del>	<u> </u>	<u>``</u>	
		1991-	<u> </u>	<u>/</u>	
	destruction (Describe	<u> </u>			#••••••
	(A) PROPOSED DSA		<u></u>		<u> </u>
	(4) FROFOSED UPER		~~ <u>~</u> ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	$\mathcal{A}$	<u> </u>
		$-\sqrt{-}$	$\overline{\theta} = \theta$	$\mathcal{D}_{\mathcal{T}}$	
		$-\infty$	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	<u>_</u> &	
		$\langle \langle \rangle \rangle$	`	<u>V</u>	
. @		$\frac{1}{\sqrt{2}}$	$\sim$		
		=	$\sim$		
(5) FOURDMENT:			<b>N</b>		
	Sacar ()				
Cable D' Air D Dimeter of bu					
Other D Bucket D Packed from	the the	1(1) ×			
(7) CASING INSTALLED:	ATTONS:				
Steel D Plastic D Concrete Type of perfor	ation or size of screen	<u></u>			
	The N - C				
ft. ft. Wall ft.	ft.				
0 134 18 14 88	118 Marile K.	-		······································	
330 A10 HK 8-40 195	3/15 - K	hiso -	· · · · · · · · · · · · · · · · · · ·	· ····································	,
	3.4. K	N/pa "			
(9) WELL SEAL:		-		DEC	3 1005
Was surface sanitary seal provided? Yes 🗋 No 🗙	If yes, to depthft.	-			~ 1303
Were strata sealed against pollution? Yes 🕱 No	Intervalft.	-		- · · ·	
Method of sealing CLAY SEAL		Work started	AN 2 198	5 Completed	AN 16 19.85
(10) WATER LEVELS:	<b>A</b> 0 .	WELL DRIL	LER'S STATEM		0028
Depth of first water, if known	<u>38</u> 4	This well was d knowledge and	rilled under my jur belief.)	isdiction and this report is	true to the best of my
(11) WELL TESTS:		SIGNED 2	ZAR	Vaith	tt -
Was well test made? Yes 🍂 No 🗌 If yes, by	whom PUAlley Pump	177.		(Well Driller)	
Type of test Pump 🖄 Bailer 🗍	Air Hft 🗌	NAME VAL	ey rumpe	motor Work	S J-NC.
Depth to water at start of test $\Delta Q$ it.	At end or test ft	Address 470	No. Geo.	WASH RIUA	incet/
Discharge 3900 gal/min after 70 hours	water temperature	City Luba	Citu	(A)	zip95991
Unerry saliysis made? Yes D No 🐹 If yes, by	whom?	License No DF	56384	Date of this report IY	194 16. 1985
The of the second secon	аса сору то наз тероге	Anochio 140.		and or and report II	

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

* a	001192034					0		•
ORIGINAL			STATE O	F CALIFOR	RNIA			
File with DWR		WELL (	COMPI	<b>ETIO</b>	N REPOR	ΤΙΛΙΝ	mu	-00-
Page 1 of 6		R	Refer to Inst	truction Pa	amphlet	s	TATE WELL NO	D./ STATION NO.
Owner's Well No.	7679	 	NO.	7269	<b>952</b> T			
Date Work Began	//19/2004 , E	nded//23/200	04					LONGITUDE
Local Permit A	gency GLENN COUNT	Y HEALIH	DEPT	2004	······································	-   [	APN/TRS/	
Permit No. M		Permit I	Date 5/3/2	2004				UTIEN.
		UU						
		CONTAL AN	NGLE(	(SPECIFY)				
DEPTH FROM	METHOD REVERSE	CRIPTION FLU		<u>-</u> R				
Ft. to Ft.	Describe material,	grain, size,	color, etc.					
0 68	TAN BROWN CLAY				Address SOF H	WY 162 & EOF C	RATION-	
68 92	SAND AND GRAVEL	·····			City CA			
92 160	TAN BROWN CLAY				County GLENN			
160 202	TAN BROWN SILTY	CLAY			APN Book 016	Page 210	Parcel 012	_
202 226	GRAVEL AND SAND				Township 19 N	Range2_W	Section 8	
226 240		1.014.001			Latitude		-	1 1
240 200	TAN BROWN CLAT		SAND		LOC	AND SEC. CATION SKETCH -		ACTIVITY (~)
298 374	TAN BROWN CLAY		SAND			NORTH		
374 462	TAN BROWN SILTY	CLAY WITH	SAND					MODIFICATION/REPAIR
462 468	GRAVEL							Deepen     Other (Specify)
468 556	TAN BROWN CLAY V	VITH SILTY	SAND					
556 600	TAN BROWN SILTY (	CLAY						<ul> <li>DESTROY (Describe Procedures and Materials</li> </ul>
600 638	SANDSTONE AND C	LAYEY SAN	D					Under "GEOLOGIC LOG")
638 776	TAN BROWN SILTY	CLAY						WATER SUPPLY
776 796	GRAVEL				ES1		AST	Domestic Public Irrigation Industrial
796 822	LIGHT TAN CLAY				3		Ш	
822 826	SANDSTONE			]				TEST WELL
826 856	LIGHT TAN CLAY WI	TH FINE SA	ND					CATHODIC PROTECTION
000 002	TAN DOM/N SILTY					·· ·		
036 950	CRAVEL AND SAND		TAN SI	т <u>v</u>				
930 903		VVIIII BLOL		_ 1 7				VAPOR EXTRACTION
965 1000	BLUE SILTY SANDY	CLAY				— souтн		
					Ilhustrate or Describe L Fences, Rivers, etc. and	Distance of Well from Roads, attach a map. Use additiona	Buildings, I paper if	OTHER (SPECIFY)
·····	]		·		necessary. PLEASE B	E ACCURATE & COMP	LÉTE.	
1					WATER	R LEVEL & YIELD (	OF COMPLI	ETED WELL
1	l				DEPTH TO FIRST V	ATER (Ft.) BE	LOW SURFAC	E
I	l				DEPTH OF STATIC			
I I	l 1				ESTIMATED VIELD *	(GPM) & 1	MEASURED _	
TOTAL DEPTH OF	BORING 1000 (Feet)				TEST LENGTH	(Hrs.) TOTAL DRAW		(Et )
TOTAL DEPTH OF	COMPLETED WELL 939.7	7 (Feet)			May not be repr	esentative of a well's la	ong-term yield	d
						ſ		
DEPTH FROM SURFACE	BORE - TYPE (1)		sing (s)			DEPTH FROM SURFACE	ANNI	ULAR MATERIAL
		MATERIAL /	INTERNAL	GAUGE	SLOT SIZE		CE- BEN-	
Ft. to Ft.		GRADE	(Inches)	OR WALL THICKNES	IF ANY S (Inches)	Ft. to Ft.	MENT TONITE	FILL FILTER PACK (TYPE/SIZE)
							$(\overline{\mathbf{x}})$ $(\overline{\mathbf{x}})$	
0 77	24/18 🗸 🛛 🗖	VC C200	25	SCH P	30	0 59	<b>v</b>	
77 87	18 🖌 P	VC C200	2.5	SCH 8	30 030			BENTONITE S
87 97	18 🗸 🛛 P	VC C200	2.5	SCH 8	30	171 265	<u> </u>	SIN#8 SAND
ZONE 2						265 829		A GENTONITE S
0, 208	24/18 V P	VC C200	2.5	SCH 8	30	829 910	MAT	SRI#8 SAND
ATTACH	MENTS (⊻)	1			- CERTIFICA	TION STATEMENT	ŗ <u> </u>	
Geologic	Log Istruction Diagram	I, the undersign	ned, certify tha	t this report i	is complete and accurat	e to the best of my knowle	dge and belief.	
Geophysi	cal Log(s)	(PERSO	ON, FIRM, OR		TION) (TYPED OR PRI			CA 05605
Soil/Wate	er Chemical Analysis	ADDRESS	MUCKYA		•			STATE ZIP
ATTACH ADDITIONAL IN	IFORMATION, IF IT EXISTS.		DRILLERIAL	THORIZED	REPRESENTATIVE	<u>C</u>	9/16/04	C57 A HIC - 133783
DWR 188 REV. 11-97	IF ADDITION	AL SPACE IS N	VEEDED, US	SE NEXT C	CONSECUTIVELY N	UMBERED FORM		

ORIGINAL File with DWR	STATE OF CALIFO WELL COMPLETION	DRNIA DN RFPORT			- DO NOT FILL IN
Page 2 of 6	Refer to Instruction	Pamphlet	ST/		 D.I STATION NO.
Owner's Well No.	<u>7679</u> No. <b>726</b>	952			
Date Work Began	7/19/2004 Ended 7/23/2004		LATITUDE		LONGITUDE
Local Permit A	gency GLENN COUNTY HEALTH DEPT				
Permit No. M	W 206-04 Permit Date 5/3/2004			APN/TRS/	/OTHER
	GEOLOGIC LOG	T			
DEPTH FROM SURFACE	DESCRIPTION				
Ft. to Ft.	Describe material, grain, size, color, etc.				
0 68	TAN BROWN CLAY	Address SOF HW	Y 162 & EOF C	CATION-	
68 92	SAND AND GRAVEL	City CA			
92 160	TAN BROWN CLAY	County GLENN			
160 202	TAN BROWN SILTY CLAY	- APN Book 016	Page 210 P	Parcel 012	
202 226	GRAVEL AND SAND	Township 19 N	Range 2 W S	ection 8	
226 240	BLUE CLAY	Latitude	1		
240 260	TAN BROWN CLAY	DEG. MIN.	SEC.		DEG. MIN. SEC.
260 298	TAN BROWN SILTY CLAY WITH SAND		NORTH		$ \begin{bmatrix} ACTIVITY ( \underline{\checkmark} ) & \\ \underline{\checkmark} & NEADAGEL \end{bmatrix} $
298 374	TAN BROWN CLAY WITH SAND				
374 462	TAN BROWN SILTY CLAY WITH SAND	_			Deepen
462 468	GRAVEL	_			Other (Specify)
468 556	TAN BROWN CLAY WITH SILTY SAND	_			
556 600	TAN BROWN SILTY CLAY	_			Procedures and Materials
600 638	SANDSTONE AND CLAYEY SAND				
638 776	TAN BROWN SILTY CLAY				WATER SUPPLY
776 796	GRAVEL	ESI		AST	Domestic Public
796 822	LIGHT TAN CLAY	3		Ē	
822 826	SANDSTONE	-			TEST WELL
826 856	LIGHT TAN CLAY WITH FINE SAND				CATHODIC PROTECTION
856 882	GRAVEL	-			HEAT EXCHANGE
882 936	TAN BROWN SILTY, CLAYEY FINE SAND				DIRECT PUSH
936 965	GRAVEL AND SAND WITH BLUE TAN SILTY	-			
	CLAY				SPARGING
965 1000	BLUE SILTY SANDY CLAY	Illustrate an Descrift Dist	SOUTH		REMEDIATION
1		Fences, Rivers, etc. and atta	ch a map. Use additional	paper if	OTHER (SPECIFY)
I I I		necessary. PLEASE BE A	CCURATE & COMPL	EIE.	
		WATER L	EVEL & YIELD O	F COMPLI	ETED WELL
		DEPTH TO FIRST WAT	ER (Ft.) BEL(	OW SURFAC	E
l		DEPTH OF STATIC			
1				NEASURED	
TOTAL DEPTH OF I	BORING 1000 (Feet)		(U		
TOTAL DEPTH OF O	COMPLETED WELL 939.7 (Feet)	May not be represent	(HIS.) IUTAL DRAWD	OVVN	(Ft.) d
I				ig-lerm yleto	•
DEPTH	BORE - CASING (S)		DEPTH	ANNI	ULAR MATERIAL
FROM SURFACE		-	ROM SURFACE	7	ТҮРЕ
	(Inches) 문 법 20년 대 GRADE DIAMETER OR WAI	L IF ANY		CE- BEN-	FILTER PACK
		SS (inches)	Ft. to Ft.	( <u>·</u> ) ( <u>·</u> )	(TYPE/SIZE)
208 218	18 🖌 PVC C200 2.5 SCH	80 .030	910 1000	1	SAND SLURRY
218 228	18 🗸 🛛 PVC C200 2.5 SCH	80	1		
CONE: 3			1		
0; 290.6	24/18 ✓ ASTM-135 4 .3	312	1		
290.6 299.9	18 COMP SEC		1		
200.0 120.9	ASIM-135 4 .3	512	1		
ATTACH	MENTS ( $\leq$ )	CERTIFICATIO	ON STATEMENT		
Geologic Well Con	L <sup>O</sup> 9 II, the undersigned, certify that this report Instruction Diagram I ALAME FATON DRILLING CO	rt is complete and accurate to D.	the best of my knowledg	e and belief.	
Geophysi	cal Log(s) (PERSON, FIRM, OR CORPOR	ATION) (TYPED OR PRINTE	D)		
Soil/Wate	r Chemical Analysis	· · · · ·		<u>ر</u>	CA 95695 STATE 71P
ATTACH ADDITIONAL IN	FORMATION, IF IT EXISTS, Signed	ilon	09	/16/04	<u>C57 A HIC - 13378</u>
DWR 188 REV. 11-97				E SIGNED	C-57 LICENSE NUMBER

ORIGINAL       STATE OF CALIFORNIA         File with DWR       WELL       COMPLETION       REPORT         Page 3 of 6       No. 726952         Owner's Well No. 7679       No. 726952         Date Work Began 7/19/2004       Ended 7/23/2004         Local Permit Agency       GLENN COUNTY HEALTH DEPT         Permit No. MW 206-04       Permit Date 5/3/2004         GEOLOGIC LOG       GEOLOGIC LOG         ORIENTATION (≤)       ✓ VERTICAL       HORIZONTAL       ANGLE       (SPECIFY)         DEPTH FROM       METHOD REVERSE       Fluid WATER       Describe material, grain, size, color, etc.       Address SOF HWY 162 & EOF C/R R       WELL LOCATION	FILL IN
File with DVVR       WELL COMPLETION REPORT         Page 3 of 6       Refer to Instruction Pamphlet         Owner's Well No. 7679       No. 726952         Date Work Began 7/19/2004       Ended 7/23/2004         Local Permit Agency GLENN COUNTY HEALTH DEPT       Latitude         Permit No. MW 206-04       Permit Date 5/3/2004         GEOLOGIC LOG       Permit Date 5/3/2004         ORIENTATION (1)       VERTICAL       HORIZONTAL       ANGLE       (SPECIFY)         DEPTH FROM SURFACE       Describe material, grain, size, color, etc.       Address SOF HWY 162 & EOF C/R R       WELL LOCATION	
Page 3 of 6       Refer to Instruction Pamphlet         Owner's Well No. 7679       No. 726952         Date Work Began 7/19/2004       Ended 7/23/2004         Local Permit Agency GLENN COUNTY HEALTH DEPT       LATITUDE         Permit No. MW 206-04       Permit Date 5/3/2004         GEOLOGIC LOG         ORIENTATION (✓)         ✓ VERTICAL       HORIZONTAL         ANGLE       (SPECIFY)         DEPTH FROM       METHOD REVERSE         SURFACE       Describe material, grain, size, color, etc.         0       68         0       68         0       68         0       68         0       CANED AND ENVINCLAY         0       Address SOF HWY 162 & EOF C/R R	
Owner's Well No. 7679       No. 726952         Date Work Began 7/19/2004       Ended7/23/2004         Local Permit Agency GLENN COUNTY HEALTH DEPT       LATITUDE         Permit No. MW 206-04       Permit Date 5/3/2004         GEOLOGIC LOG       GEOLOGIC LOG         ORIENTATION (≤)       ✓ VERTICAL         HORIZONTAL       ANGLE         BESCRIPTION       DESCRIPTION         Ft       to         ORIENTATION       DESCRIPTION         ORIENTATION       DESCRIPTION         ORIENTATION       DESCRIPTION         ORIENTATION       DESCRIPTION         ORIENTATION	
Date Work Began //19/2004	
Local Permit Agency GLENN COUNTY HEALTH DEPT         Permit No. MW 206-04       Permit Date 5/3/2004         GEOLOGIC LOG       Permit Date 5/3/2004         ORIENTATION (✓)       ✓ VERTICAL — HORIZONTAL — ANGLE (SPECIFY)         DRILLING REVERSE       FLUID WATER         SURFACE       DESCRIPTION         Ft to       Ft         0       68   TAN BROWN CLAY         0       68   TAN BROWN CLAY         0       0           0	
Permit No. INVV 200-04       Permit Date _5/3/2004         GEOLOGIC LOG       GEOLOGIC LOG         ORIENTATION (✓)       ✓ VERTICAL HORIZONTAL ANGLE (SPECIFY)         DEPTH FROM SURFACE       METHOD REVERSE       FLUID WATER         DESCRIPTION       Describe material, grain, size, color, etc.       WELL LOCATION         0       68       TAN BROWN CLAY       Address SOF HWY 162 & EOF C/R R	
ORIENTATION (1)       Image: Construct loss         ORIENTATION (1)       Image: Construct loss         DEPTH FROM       METHOD REVERSE         SURFACE       DESCRIPTION         Ft. to       Ft.         0       68         TAN BROWN CLAY       Address SOF HWY 162 & EOF C/R R	
ORIENTATION ()       DEVENICAL	
DEPTH FROM SURFACE       METHOD REVERSE       FLUID WATER         DESCRIPTION       DESCRIPTION         Ft       to       Ft         0       68       TAN BROWN CLAY         00       00       ON         00       00       00         00       00       00         00       00       00         00       00       00         00       00       00         00       00       00         00       00       00         00       00       00	
SURFACE     DESCRIPTION       Ft     to       Ft     to       0     68       68     TAN BROWN CLAY       0     68       0     68       0     68       0     68       0     68       0     68	
0 68 TAN BROWN CLAY Address SOF HWY 162 & EOF C/R R	
Address Address Address	
08 92 SAND AND GRAVEL City CA	
92 160 TAN BROWN CLAY County GLENN	
160 202 TAN BROWN SILTY CLAY APN Book 016 Page 210 Parcel 012	
202 226 GRAVEL AND SAND Township 19 N Range 2 W Section 8	
226 240 BLUE CLAY Latitude	1
240 260 TAN BROWN CLAY DEG. MIN. SEC. DEG. MIN. SEC. DEG. MIN.	SEC.
200 296 TAN BROWN SILTY CLAY WITH SAND NORTH NEW	WELL
374 462 TAN BROWN SILTY CLAY WITH SAND	ION/REPAIR
462 468 GRAVEI	Deepen Other (Specify)
468 556 TAN BROWN CLAY WITH SILTY SAND	
556 600 TAN BROWN SILTY CLAY	OY (Describe lures and Materials)
600 638 SANDSTONE AND CLAYEY SAND	"GEOLOGIC LOG")
638 776 TAN BROWN SILTY CLAY	D USES (⊥)
776; 796; GRAVEL	stic Public
796 ¦ 822 ¦ LIGHT TAN CLAY	on industrial
822 826 SANDSTONE	ONITORING –
826 856 LIGHT TAN CLAY WITH FINE SAND	
856 882 GRAVEL	EXCHANGE
882, 936, TAN BROWN SILTY, CLAYEY FINE SAND	RECT PUSH
936 965 GRAVEL AND SAND WITH BLUE TAN SILTY	
	SPARGING
SOUTH SAINDT CLAT SOUTH RE Illustrate or Describe Distance of Well from Roads, Buildings,	
Pences, Rivers, etc. and attach a map. Use additional paper if OTHER necessary. PLEASE BE ACCURATE & COMPLETE.	(SPECIFY)
WATER LEVEL & YIELD OF COMPLETED WEI	T
DEPTH TO FIRST WATER (Ft.) BELOW SURFACE	
DEPTH OF STATIC	
WATER LEVEL	
TOTAL DEPTH OF BORING 1000 (Feet) ESTIMATED YIELD • (GPM) & TEST TYPE	
TOTAL DEPTH OF COMPLETED WELL 939.7 (Feet)	
May not be representative of a well's long-term yield.	
DEPTH CASING (S) DEPTH ANNULAR MAT	ERIAL
Ft     to     Ft     to     Ft     <	ILTER PACK
$\overrightarrow{\mathbf{m}} \bigcirc \bigcirc \neg \overrightarrow{\mathbf{n}} \overrightarrow{\mathbf{m}} \bigcirc \bigcirc \neg \overrightarrow{\mathbf{n}} \bigcirc \bigcirc \neg \overrightarrow{\mathbf{n}} \bigcirc \bigcirc \bigcirc \neg \overrightarrow{\mathbf{n}} \overrightarrow{\mathbf{m}} \bigcirc \bigcirc \neg \overrightarrow{\mathbf{n}} \bigcirc \bigcirc \neg \overrightarrow{\mathbf{n}} \bigcirc \bigcirc \neg \overrightarrow{\mathbf{n}} \bigcirc \bigcirc \bigcirc \bigcirc \neg \overrightarrow{\mathbf{n}} \bigcirc \bigcirc \bigcirc \bigcirc \bigcirc \bigcirc \neg \overrightarrow{\mathbf{n}} \bigcirc $	(TYPE/SIZE)
1/20.9     /30.2     18     COMP SEC     0     59     ✓     SA	ND SLURRY
ASIM-135 4 .312 0 136 SR	#8 SAND
876.6 939.7 18 V ASTM-135 4 312 .060 136 171 BE	NIONITE S
265 820 V DE	NTONITE O
	#8 SAND
ATTACHMENTS ( $\leq$ )	
Geologic Log I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.	
Weil Construction Diagram     AME EATON DRILLING CO.     Geophysical Log(s)     (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)	
- Soil/Water Chemical Analysis 20 W. KENTUCKY AVE. WOODLAND CA	95695
AUDRESS Mark Danie CITY STATE 09/16/04 C.57	ZIP A HIC - 133783
ATTACH ADDITIONAL INFORMATION, IF IT EXISTS. WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 L	ICENSE NUMBER

DRIGINAL File with DWR	RE	CEIV	ED WELI	state L COMI	of califori PLETION	NIA N REPORT	г <b>Г"?</b>	<u>v</u> sees VVQ	Zeal		8.2.M
Page of	Dev	3 <b>2</b> 0 1	994	Refer to In	istruction Pa	mphlei		i state	" WELL N	43.7.87開閉	RON NO.
Owner's Well No		5 147 PT		N	• 581	4/5					
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Local Permit Age	ncy <u>Glenn</u>	Count	ty Env	vironm	ental I	lealth	╶╶╽└┸┸┶			<u>   </u> IS/OTHEI	<u> </u>
Permit No	<u>. 59698</u>		Permi	t Date	10/17	/94		1 0 11/11			
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	DiA.	· 티뷰 M	ATERIAL/ GRADE	DIAMETER	OR WALL	IF ANY			BEN- T TONITE	FILL	FILTER PAG
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	MENTS (∠) -			1		CERTIFICA	TION STATEM	IENT -			
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Contac's	Lvy		NAME	511111	van Dri	lling					1768
Geologic		11	(PER:	SON, FIRM, OR C	CORPORATION) (TY	PED OR PRINTED)					
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ile with	DWR	•	<i>"</i> ~~		WELL (	COMPI	ETION	REPOR		<b>) </b>				
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0	9	TOP SC	DIL				A	ddress .35 MI V	VOF ROAD E	B &	<u>64</u> 1	<b>N</b> SOI	F HW	Y 162
9	20	SANDY	' CLA	Y			C	tity CA						
20	30	YELLO	W CL	AY			C	ounty GLENN						
30	42	LOOSE	SAN	ID AND	GRAVEL		A	PN Book 018	Page 030	I	arcel	032		
42	64	SANDY	' BRC	WN C	LAY		Т	ownship <u>19 N</u>	Range 4 W	s	Section	<u>14</u>		
64	70	YELLO	WCL	<u>AY</u>			L	atitude	 	-		_	1	
70	400	BLUE C	CLAY	WITH	SAND			DEG. MI	N. SEC. ATION SKET	сн-		] <del></del>	AC	NUIN. SEC. CTIVITY (⊻) -
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425	494	BLUE C			SAND	(C)						·	MODIF	ICATION/REPAIR
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502	/50	BLUE				I SIREA							<u></u>	
750	/58	SAND		BLUE									[	ESTROY (Describe rocedures and Mater
/ 58	1010	SILLY I					STREAK						i	Inder "GEOLOGIC L
603	1010	BLUE/F								,			PLAN	NNED USES (×
	•						ST					۲		omestic Public
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						•		Zutation on Description D		eade B	wildings			REMEDIATION _
							I.	Fences, Rivers, etc. and Recessary, PLEASE BF	attach a map. Use a CACCURATE &	dditional COMP	paper i LETE.	f	c	OTHER (SPECIFY) _
								WATER	LEVEL & YI	ELD	OF CO	OMPL	ETED	WELL
	<u> </u>							DEPTH TO FIRST W	/ATER (	Ft.) BEL	ow su	JRFACE		
						<u></u>		DEPTH OF STATIC						
							v	VATER LEVEL	(Ft.) 8	DATE	MEASU	RED		
		Dobbio	366	· · · · ·			E	ESTIMATED YIELD *	(GP	M)& T	EST TY	'PË		
TOTAL DI	EPIH OF	BORING .		(F 7571 65	eet) (Foot)		1	TEST LENGTH	(Hrs.) TOTAL	DRAWI			(Ft.) ,	
IOTAL DI	CFIH OF	COMPLE.			(rect)		l	May not be repre	senialive of a w		ng-ien	n yleia		
DEP	тн	BODE			C.	ASING (S)			DEPTH			ANNU	JLAR	MATERIAL
FROM SU	IRFACE	HOLE	TYP	E ( <u>√</u> )					FROM SURFA	CE			ΤY	PE
Ft to	Ft.	DIA. (Inches)	LANK	L PIPI	MATERIAL: / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (inches)	Ft. to Ft		CE- MENT	BEN- TONITE	FILL	FILTER PACK (TYPE/SIZE)
			B S	길르		(incres)					<u>(</u> \)	(⊻)	(⊻)	
0	45	8	-1-1-		PVC ASTM	2-1/2	F480		0	21.5		~		SAND SLUR
45	55	8	<u> </u>	1	PVC ASTM	2-1/2	F480	.030	21.5	25			$\checkmark$	BENTONITE
55	65	8	1		PVC ASTM	2-1/2	F480	)	25	14/		~		DENITONITE
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	1 11 11 1 11				<u> </u>			CEPTIFICA	TION STATE	MENT	r		L	GAND OLON
	ATTAC     Geologic	HMENTS	(⊻)		! the undersi	aned, certify th	at this report is c	CERTIFICA complete and accurate	to the best of my kn	owiedge	t e and be	lief.		
_		notruction D	iaaram		I NAME E	ATON DRI	LING CO.		-					
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Glen	n	- ALTER ALES AN ARCES	ir - ra	ONG	2W   I
NGAR		L-0g# 3669 •	YNER Hos	SCE I	
·		WELL LOG			
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DRILLED BY	CalTrans for	T DWR ADDRESS P. O. Box 607, Red	Bluff	<u>, CA</u>	9608
DRILLING METHO	Rotary	GRAVEL PACKED 0-700 DATE COMP	LETED_		9-
hole	4 % "	TO TO' \$ 41/2" TO 700' DATE STAL	ant D	0_	20-
	AI A 7d-20'	A2 A3	==++= / *	<u> </u>	<u>.</u>
PERFORATIONS	0-40	- NO-160 , @ 440-510	a PV	C PIP	<b>E</b> \$
WATER LEVEL BE	FORE PERFORAT	INGAFTER	-		
TEST DATA: DIGG	HARGE G. P. N	DRAWDOWN FT	HOURI	P RUN_	······
DTHER DATA AVA	ILABLE: WATER	LEVEL RECORD			
	120'	MSL	Geol	ogist	:
		TOURCE OF INFORMATION			
DEPTH	ELEV. OF BOTTJM OF STRATUM	MATERIAL	THICK	VIELD	
рертн 0-31	ELEV. OF BOTTUM OF STRATUM	MATERIAL	THICK.	8P. Vi#LD	
рертн 0-31 3-70	ELEV. OF BOTFUM OF STRATUM	MATERIAL soil vellow clay with some gravel	Тніск. NESB 3'	BP. VitLD	
рерти 0-3' 3-70 70-92	ELEV. OF BOTTUM OF STRATUM	MATERIAL soil vellow clay with some gravel medium-scall gravel	THICK. NESS 3' 67 22	BP. YiflD	
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рентк 0-3' 3-70 70-92 92-109 109-160	ELEV. OF BOTTJM OF STRATUM	MATERIAL soil vellow clay with some gravel medium-scall gravel graveley brown clay medium-small gravel with thin beds	THICK NESS 3' 67 22 11 51		
ренти 0-3' 3-70 70-92 92-109 109-160	ELEV. OF BOTTJM OF STRATUM	MATERIAL soil vellow clay with some gravel medium-scall gravel graveley brown clay medium-scall gravel with thin beds of fine gravel	тніск. NESB 3' 67 22 11 51	BP. YiftLD	
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рерти 0-3' 3-70 70-92 92-109 109-160 160-258 253-283	ELEV. OF BOTTJM OF STRATUM	MATERIAL soil vellew clay with some gravel medium-scall gravel graveley brown clay medium-small gravel with thin beds of fine gravel sandy trown clay coarse cond with medium-small 'gravel	THICK NESS 3' 67 22 11 51 98 25		
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<b>DEPTH</b> 0-3' 3-70 70-92 92-109 109-160 160-258 253-283 283-303 303-335 335-350 350-388 388-398 398-405 405-412 412-438 438-450 450-456 455-480		MATERIAL soil vellew clay with some gravel medium-small gravel graveley brown clay medium-small gravel with thin beds of fine gravel sandy brown clay coarse cond with medium-small gravel brown stady clay fine sori beds (thin) with brown clay coarse send and medium-small gravel with brown clay brown clay with medium sand fine sand fine sand with brown clay fine sand fine sand with brown clay fine-coarse sand brown silty clay fine-coarse sand	THICK           NESS           3'           67           22           11           51           98           25           20           32           15           38           10           8           7           26           12           6           24		
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ретти 0-3' 3-70 70-92 92-109 109-160 160-258 253-283 283-303 303-335 335-350 350-388 388-398 398-405 405-412 412-438 438-450 450-456 455-480 480-515		MATERIAL soil vellew clay with some gravel medium-scall gravel graveley breen clay medium-scall gravel with thin beds of fine gravel sandy brown clay coarse condwith medium-omall gravel brown clay clay fine seri beds (thin) with brown clay coarse send and medium-small gravel with brown clay with medium sand fine sand fine sand with brown clay fine coarse sand brown silty clay fine-coarse sand brown silty clay fine-coarse sand medium-small gravel beds (1' thick) in medium sands	THICK           NEES           3'           67           22           11           51           98           25           20           32           15           38           10           8           7           26           12           6           24           35		
DEPTH           0-3'           3-70           70-92           92-109           109-160           160-258           253-283           283-303           303-335           335-350           350-388           388-398           398-405           405-412           412-438           438-450           450-456           455-480           280-515           515-526		MATERIAL soil. vellew clay with some gravel medium-small gravel graveley bream clay medium-small gravel with thin beds of fine gravel sandy brown clay coarse cond with medium-small gravel brown that clay fine sort beds (thin) with brown clay coarse send and medium-small gravel with brown clay brown clay with medium sand fine sand fine sand with brown clay fine-coarse sand brown silty clay fine-coarse sand medium-small gravel beds (1' thick) in medium sand sand	THICK         NEES         3'         67         22         11         51         98         25         20         32         15         38         10         8         7         26         12         6         24         35		
DEPTH           0-3'           3-70           70-92           92-109           109-160           160-258           253-283           283-303           303-335           335-350           350-388           388-398           398-405           405-412           412-438           438-450           455-480           480-515           515-526           526-578		MATERIAL soil vellew clay with some gravel medium-scall gravel gravelev brean clay medium-scall gravel with thin beds of fine gravel sandy brown clay coarse cond with medium-scall gravel brown trady clay fine sort beds (thin) with brown clay coarse send and medium-scall gravel with brown clay with medium sand fine sand fine sand with brown clay fine coarse sand fine coarse sand brown silty clay fine-coarse sand medium-scall gravel beds (1' thick) in medium sand fire-redium sand with brown clay	THICK         NEES         3'         67         22         11         51         98         25         20         32         15         38         10         8         7         26         12         6         24         35		
реття 0-3' 3-70 70-92 92-109 109-160 160-258 253-283 283-303 303-335 335-350 350-388 388-398 398-405 405-412 412-438 438-450 450-456 455-480 480-515 515-526 526-578 578-592		MATERIAL soil vellew clay with some gravel medium-scall gravel gravelev brean clay medium-scall gravel with thin beds of fine gravel sandy brown clay coarse cond with medium-scall gravel brown clay clay fine sort beds (thin) with brown clay coarse send and medium-scall gravel with brown clay with medium sand fine sand fine sand fine sand with brown clay fine-coarse sand brown silty clay fine-coarse sand medium-scall gravel beds (1' thick) in medium sand fire-redium sand with brown clay fine-coarse sand	THICK         NEES         3'         67         22         11         51         98         25         20         32         15         38         10         8         7         26         12         6         24         35         11         52         14		
реття 0-3' 3-70 70-92 92-109 109-160 160-258 253-283 283-303 303-335 335-350 350-388 388-398 398-405 405-412 412-438 438-450 450-456 455-480 480-515 515-526 526-578 578-592 592-598		MATERIAL soil vellew clay with some gravel medium-scall gravel graveley brean clay medium-scall gravel with thin beds of fine gravel sandy trown clay coarse and with medium-scall gravel brown thaty clay fine some day with brown clay coarse send and medium-scall gravel with brown clay brown clay with medium sand fine sand fine sand with brown clay fine coarse sand brown silty clay fine-coarse sand brown silty clay fine-coarse sand medium canda brown silty clay affine-coarse sand fire-medium sand with brown clay redium coarse sand sith small gravel - sand sith small grav	THICK         NESS         3'         67         22         11         51         98         25         20         32         15         38         10         8         7         26         12         6         24         35         11         52         14		
DEPTH           0-3'           3-70           70-92           92-109           109-160           160-258           253-283           283-303           303-335           335-350           350-388           388-398           398-405           405-412           412-438           438-400           450-456           455-480           480-515           515-526           526-578           578-592           592-598           598-608		MATERIAL soil vellew clay with some gravel medium-scall gravel graveley bream clay medium-scall gravel with thin beds of fine gravel sandy income clay coarse and with medium-scall gravel brown clay clay fine seri beds (thin) with brown clay coarse send and medium-scall gravel with brown clay brown clay with medium sand fine sand fine sand with brown clay fine coarse sand fine sand with brown clay fine-coarse sand brown silty clay fine-coarse sand medium carse brown silty clay fine-coarse sand medium carse brown silty clay fine-coarse sand medium carse brown silty clay fine-coarse sand medium carse brown silty clay fine-coarse sand fire-redium sand with brown clay fine-coarse sand medium carse brown silty clay fine-coarse sand fire-redium sand with brown clay medium carse sand sith brown clay medium coarse sand sith shown clay medium coarse sand shown clay medium clay sand shown clay medium chay sand shown clay san	THICK         NESS         3'         67         22         11         51         98         25         20         32         15         38         10         8         7         26         12         6         24         35         11         52         14         6         10		
DEPTH           0-3'           3-70           70-92           92-109           109-160           160-258           253-283           283-303           303-335           335-350           350-388           388-398           398-405           405-412           412-438           438-400           450-456           455-480           480-515           515-526           526-578           578-592           592-598           598-608		MATERIAL soil. vellew clay with some gravel medium-scall gravel gravelev brown clay medium-small gravel with thin beds of fine gravel sandy trown clay coarse and with medium-small gravel brown this clay fine some beds (thin) with brown clay coarse gend and medium-small gravel with brown clay brown clay with medium sand fine sand fine sand fine sand with brown clay fine-coarse sand brown silty clay with sand fire-medium sand brown silty clay silth and fire-medium sand fire-medium sand brown silty clay silth and fire-medium sand with brown clay medium coarse sand with anown clay medium coarse sand with anown clay medium coarse sand with brown clay medium coarse sand with brown clay medium coarse sand with anown clay medium coarse sand with brown clay medium coarse sand brown clay medium coarse sand brown clay	THICK         NESS         3'         67         22         11         51         98         25         20         32         15         38         10         8         7         26         12         6         24         35         11         52         14         6         10		

Log # 3669



#### DEPARTMENT OF WATER RESOURCES

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BEPTH	BUTTER BUTTER BT BTBATTER	MATERIAL	THICKNESS FEET	<b>%</b> T0:05	ASTOPALE STROPALE ACTOR ALEA			
624-638'		fine sand with layers of brown clay	14'		Alemania - Berlanda i M			
638-700		blue silty clay with fine sand	32		<b></b>			
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ON 102 OPIGINAL STATE OF CALIFORNIA 2011/10 File with DWR WELL COMPLETION REPORT Refer to Instruction Pamphlet . Page \_\_\_\_\_ of \_\_ G-№. 801448A.B.C.D ORLAD REGALE Garaflen. **Owner's Well No.** Date Work Began 193/01 LATITUDE LONGITUDE . Ended. G١ Local Permit Agency APN/TRS/OTHER Permit No. MW Jao-01 Permit Date GEOLOGIC LOG ORIENTATION (스) ANGLE VERTICAL HORIZONTAL (SPECIFY) DRILLING FLUID Y METHOD \_ Kota DEPTH FROM DESCRIPTION SURFACE Describe material, grain size, color, etc. WELL LOCATION. Ft. to Ft. Address Co. RA Clay 34 Ő Brown ton 70 to San 80 City Glenn 0 70 80 130 County Glenn 130 APN Book 019 Page 220 Parcel 120 Sand Q rdvo 100 290 Srown Township Section . Latitude \_\_\_\_\_ 295 San 290 NORTH Longitude WEST DEG. MIN. SEC. Brow SEC. 295 445 to NEW WELL LOCATION SKETCH 45 445 Sand NORTH 451 1490 Brown Clas MODIFICATION/REPAIR 490 500 \_ Deepen d in \_ Other (Specify) Clay 500 55 Vellow tan. 515 525 Sand DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG", Yellow. Clay 525 575 San 580 575 PLANNED USES (∠) Yellow to Zan Clay WATER SUPPLY 580-630 RO Domestic Public ۲ 50 630 ZS Irrigation \_ \_ Industria WEST EAST Yellow to Clay 1050-655 695 Zan MONITORING iona 695 705 SiH/Tuff Deposit TEST WELL Clay 705 750 CATHODIC PROTECTION Zan Brown sitterione w/ tuff Frigments HEAT EXCHANGE 750 805 illow DIRECT PUSH 1 Grey Siltatone 805 822 Green INJECTION 822 18401 Greg Clay VAPOR EXTRACTION Clay 240 905 Brown Hotone with SPARGING SOUTH 65 946 Sand REMEDIATION 1/ Basatt Chips Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE. 940 OTHER (SPECIFY) 950 Blue Grey 977 950 1 VolComic りょく WATER LEVEL & YIELD OF COMPLETED WELL 977 1020 Lt Green to Yellow Clay DEPTH TO FIRST WATER \_\_\_\_ (Ft.) BELOW SUBFACE DEPTH OF STATIC WATER LEVEL \_ (Ft.) & DATE MEASURED ESTIMATED YIELD \* \_\_ (GPM) & TEST TYPE TOTAL DEPTH OF BORING (Feet) TEST LENGTH \_\_\_\_\_\_ (Hrs.) TOTAL DRAWDOWN\_ (Ft.) TOTAL DEPTH OF COMPLETED WELL [DOO\_(Feet) \* May not be representative of a well's long-term yield. CASING (S) ANNULAR MATERIAL DEPTH FROM SURFACE DEPTH BORF-FROM SURFACE TYPE (ニ) TYPE HOLE DIA. CON-DUCTOR FILL PIPE INTERNAL GAUGE SLOT SIZE SCREEN MATERIAL / BEN-CE-BLANK FILTER PACK OR WALL THICKNESS IF ANY (inches) (Inches) GRADE DIAMETER MENT TONITE FILL to Ft. (TYPE/SIZE) Ft. Ft. to Ft. (Inches) (⊻) (∠) ( < 00 Λ 5 <u> 100</u> 9 A ng 9.. ATTACHMENTS (∠) CERTIFICATION STATEMENT I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief. Geologic Log -XOIOFAti K Well Construction Diagram NAME CORPORATION) PRINTED (TYPED OR Geophysical Log(s) anora Soil/Water Chemical Analyses ADDRESS Other 02 Siane ATTACH ADDITIONAL INFORMATION, IF IT EXISTS. DATE SIGNE IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM DWB 188 BEV. 11-97

## Department of Water Resources G - M l10/15/01 - 01/23/02

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## Deep Well

Ft. to Ft.	Borehole Dia.	Type	Material Grade	Internal Dia	Gauge	Slot Size
1000 - 980		Blank	Steel	2"	Sch 40	
980 – 970		Screen	Steel	2"	Sch 40	.020
970 – 930		Blank	Steel	2"	Sch 40	
930 – 920		Screen	Steel	2"	Sch 40	.020
920 <b>-</b> +6"		Blank	Steel	2"	Sch 40	
				•		

#2 Well

<u>Ft. to Ft.</u>	Borehole Dia.	Туре	Material Grade	Internal Dia	Gauge	<u>Slot Size</u>
675 – 655		Blank	Steel	2"	Sch 40	
655 – 635		Screen	Steel	2"	Sch 40	.020
635 - +1		Blank	Steel	2"	Sch 40	

#### Middle Well

Ft. to Ft.	Borehole Dia.	Type	Material Grade	Internal Dia	Gauge	Slot Size
545 - 525		Blank	Steel	2"	Sch 40	
526 - 515		Screen	Steel	2"	Sch 40	.020
515 – 460		Blank	Steel	2"	Sch 40	
460 - 450		Screen	Steel	2"	Sch 40	.020
450 - +2.5		Blank	Steel	2"	Sch 40	

Shallow Well

Ft. to Ft.	Borehole Dia.	Туре	Material Grade	Internal Dia	Gauge	Slot Size
201 - 180		Blank	Steel	2"	Sch 40	
180 - 170		Screen	Steel	2"	Sch 40	.020
170 – 150		Blank	Steel	2"	Sch 40	
150 - 140		Screen	Steel	2"	Sch 40	.020
140 - +2		Blank	Steel	2"	Sch 40	

# Annular Material

Ft. to Ft.	Type
100 - 925	#8 Sand
925 – 917	#60 Sand
917 – 902	Hot Batch Grout
902 - 513	Cement Grout
531 – 403	#8 Sand
403 - 393	#60 Sand
393 – 283	Cement Grout
283 – 171	#8 Sand
171 – 163	#60 Sand
163 - 101	Cement Grout
101 – 35	# 8 Sand
35 – 31	#60 Sand
31 – Surface	Cement Grout

ORIGINAL STATE OF CALIFORNIA WELL COMPLETION REPORT File with DWR Refer to Instruction Pamphlet Page \_\_\_\_ of \_ Owner's Well No. № 782025A.BLD G-2 QUAD LATITUDE Date Work Began\_ , Ended Lenn Co Local Permit Agency APN/TRS/OTHER 10/1/01 Permit No. MWIZI -01 Permit Date -----OTUNIT GEOLOGIC LOG VERTICAL ORIENTATION (∠) \_\_\_ HORIZONTAL \_\_\_\_\_ ANGLE \_\_\_ (SPECIFY) DRILLING FLUID METHOD DEPTH FROM SURFACE DESCRIPTION Describe material, grain size, color, etc. Ft. Ft. 20 Sand 1954 O Address . Glenn 20 60 Brown City \_\_\_\_ 80 60 1 Gravel Glenn County \_\_\_\_ 025 -9 APN Book 019 Page 110 190 80 Clay Parcel\_ Brown 190 Township 1200 Codyse San Section Brown 260 250 144 NORTH WEST Latitude. DEG. MIN. 1 Longitude. SEC. DEG. MIN. SEC. 260 Sand 250 LOCATION SKETCH ACTIVITY (≤) X NEW WELL 260 410 Blue NORTH Grey 440 Sang 410 MODIFICATION/REPAIR 450 Blue \_ Deepen 440 Grey Clay CoRd 39 \_ Other (Specify) 490 San 60 480 1510 Blue DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG" Sand 510 1520 € Grave 520 930 Blue, Grey Clay PLANNED USES (∠) WATER SUPPLY 960 San 930 \_ Domestic \_ Public 960 1000 Blue/ Grey Clay River Irrigation \_\_\_\_ Industria WEST EAST MONITORING X willow 35 TEST WELL Sal CATHODIC PROTECTION Called 44 HEAT EXCHANGE DIRECT PUSH 954 Co.Rd INJECTION 44 VAPOR EXTRACTION SPARGING REMEDIATION OTHER (SPECIFY) WATER LEVEL & YIELD OF COMPLETED WELL DEPTH TO FIRST WATER \_\_\_\_ \_\_\_ (Ft.) BELOW SURFACE DEPTH OF STATIC WATER LEVEL \_ (Ft.) & DATE MEASURED TOTAL DEPTH OF BORING (GPM) & TEST TYPE ESTIMATED YIELD \* TEST LENGTH \_ \_\_ (Hrs.) TOTAL DRAWDOWN\_ . (Ft.) KO\_(Feet) TOTAL DEPTH OF COMPLETED WELL \* May not be representative of a well's long-term yield. CASING (S) ANNULAR MATERIAL DEPTH FROM SURFACE DEPTH BORE-HOLE DIA. FROM SURFACE TYPE TYPE (스) CON-DUCTOR SLOT SIZE PIPE INTERNAL GAUGE BEN-SCREEN CE-MATERIAL / BLANK FILTER PACK DIAMETER OR WALL IF ANY TONITE (Inches) MENT FILL GRADE Ft. Ft. (TYPE/SIZE) Ft. to Ft. to (inches) (inches) (⊻) (⊻)  $( \leq$ ΛØ bnn2 ATTACHMENTS (∠) CERTIFICATION STATEMENT I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief. Geologic Log Onc Moration Well Construction Diagram NAME Geophysical Log(s) Soil/Water Chemical Analyses STATE ADDRESS Other 23 16 ATTACH ADDITIONAL INFORMATION, IF IT EXISTS. Signed SIGN IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM DWR 188 REV. 11-97

# Department of Water Resources G-2

# 782025

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Deep Well

Ft. to Ft.	Borehole Dia.	Type	Material Grade	Internal Dia	Gauge	Slot Size
980 - 960		Blank	Steel	2"	Sch 40	
960 – 940		Screen	Steel	2"	Sch 40	.020
940 - +6"		Blank	Steel	2"	Sch 40	

#2 Well

Ft. to Ft.	Borehole Dia.	Туре	Material Grade	Internal Dia	Gauge	Slot Size
490 - 470		Blank	Steel	2"	Sch 40	
470 – 460		Screen	Steel	2"	Sch 40	.020
460 - 430		Blank	Steel	2"	Sch 40	
430 – 420		Screen	Steel	2"	Sch 40	.020
420 - +1		Blank	Steel	2."	Sch 40	

Middle Well

-	<u>Ft. to Ft.</u>	Borehole Dia.	<u>Type</u>	Material Grade	Internal Dia	Gauge	<u>Slot Size</u>
$(\mathbf{r})$	280 - 260		Blank	Steel	2"	Sch 40	
V	260 - 250		Screen	Steel	2"	Sch 40	.020
	250 - 200		Blank	Steel	2"	Sch 40	
	200 - 190		Screen	Steel	2"	Sch 40	.020
	190 - +2.5		Blank	Steel	2"	Sch 40	
	Shallow Well						
	<u>Ft. to Ft.</u>	Borehole Dia.	Туре	Material Grade	Internal Dia	Gauge	Slot Size
$\overline{\mathbf{n}}$	<u>Ft. to Ft.</u> 85 – 65	Borehole Dia.	<u>Type</u> Blank	Material Grade Steel	Internal Dia 2"	Gauge Sch 40	Slot Size
$\mathbf{r}$	<u>Ft. to Ft.</u> 85 – 65 65 – 55	Borehole Dia.	<u>Type</u> Blank Screen	Material Grade Steel Steel	Internal Dia 2" 2"	Gauge Sch 40 Sch 40	Slot Size

# Annular Material

Ft. to Ft.	<u>Type</u>
985 - 925	#8 Sand
925 - 500	Cement Grout
500 - 400	#8 Sand
400 - 285	Cement Grout
285 - 170	#8 Sand
170 - 85	Cement Grout
85 – 45	#8 Sand
45 – Surface	Cement Grout





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STATE OF CALIFO DEPARTMENT OF 1 NORTHERN DISTRI	FEATURE Customer	TYPE OF HOLE BAN	CONTRACTOR SAME INSPECTED BY _K.S	ADOJOHIU ESSCIPTION	Line Brown Cary	Sand & Ganna	ð Į	Correction of the second s	an Car	Heri Created Sand	Butterson Car			Poorty Graded Sand
RNIA - RESOURCES AGENCY WATER RESOURCES KCT	Ambient Monitoring View. HOLE NUMBER	the Multiplane. TYPE OF RIG . Homenied	NAN EXPORTION IN	Cament Grout (aurtices to 31 A)		B Sand (35 ft to 101 ft)	Camani Gout (101 /1 to 163 21)	(# 121 of W Eill) pues ogd	<b>10</b> Sond (171 R to 283 A)			Comment Grout (255) A to 363 A)	180 Sand (383 ft to 403 ft)	
	CZ. MINNAE FAITH LOCATION . GI	L TOTAL DEPTH JIMPL	Internation Dates 2004 - COMMENTS									D P D A D D P D A D P D A D		
	gen Courty Courts Pil 44 and Others Pil X.	DATE STARTED	4(S) Kanan at. NUMARER OF C	Nock Steel Conductor Coming 1/4-that Not Thainees to 35 ft	Centralizers toblees Steel Wire Wrop Screen And Link American Screen		t-Inch Block Steel Artine 21 ft Sodiment Trop Zentralizere	Statriese Steel Wro Wrop Screen L.CCO-Inch Opening 10 ft Sections.	Can brokinar	Statrieur Steel Wire Wrop Screen 0.0200-bach Opening 10 ft Section. Centraltar 1-back Steel Alafre	21 ft Sediment Trop		And the state of t	1020-Inch Opening 10 R Section.
	UTM COORDINATES	DATE COMPLETED _112202	COMPLETIONS 4	(4) 5 - 41 5 - 5 - 5 - 5 - 5 - 5 - 7 - 8 - 7 - 7 - 7 - 7 - 7 - 7 - 7 - 7 - 7 - 7										
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	<u> </u>	STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES	8481N	5- 20N	21.02 12W - 33B
NEAR		- WELL LOG	OTHER NO	50	(F-6)
	ile wet fo	- interaction of "Prive" and "Bride"	•	·	36
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_ot_interses	<u>ction st</u>	. Rd 46 and irrigation road west of Le	wis hon	<u>ne . N</u>	iest side of
DRILLED BY Cal	trans for	DWR ADDRESS Nor thera Division	Red	Blu	ff, Ca.
	Roti	ACV GRAVEL PACKED VES DATE COM	PLETED	8/15]	r 8/23 - Tr
SIZE OF CASING D	10 5/8	hole : 3" casing 0-20' 6" casing D-320 TRUCK WAT	'ER AT		74'
	100-120	· · · · · · · · · · · · · · · · · · ·	*		
PERFORATIONS	100 120	SIXE SEC	2 (451)	<u> </u>	_No
WATER LEVEL BEP	ORE PERFORAT	NG			
TEST DATA: DISCH	IARGE 6. P. M	BRAWBOWN FT	HOURS	I RUN.	
					· · · · ·
OTHER DATA AVAIL	LABLE: WATER	LEVEL RECORD			
SURFACE ELEV	103	BATUM MSL BOURGE OF INFORMATION_	(	Geol	logist
	FLEY. OF			1	.9
DEPTH	BOTTOM OF STRATUM	MATERIAL	THICK.	VIELD	
0-8		Sandy brown soil	8'		
8-15		Brown clay	7'	ļ	
- 13-20		Pea Gravel lense	5'	ļ	
<u>42-46</u>	+	Sandy brownish-yellow clay I minor gravel	22'		· · · · · · · · · · · · · · · · · · ·
T ( T 10		brown clay, very little time sand	4	ļ	
41 - 70'	1 1		1		
$\frac{46-70'}{70-84'}$			24'		
<u>46 - 70'</u> 70 - 84'		Coarse sand and pea gravel "/minor	24' 14'		
<u>46 - 70'</u> 70 - 84'		Coarse sand and pea gravel "Iminor brown clay	24'		
<u>46 - 70'</u> <u>70 - 84'</u> <u>84 - 86'</u> 86 - 92'		Coarse sand and pea gravel "/minor brown clay Brown clay Coarse sand and pea acrowel	24'		
<u>46 - 70'</u> 70 - 84' <u>84 - 86'</u> 86 - 92' 92 - 98'		Coarse sand and pea gravel "/minor brown clay Coarse sand and pea gravel Brown silty clay	24'		
<u>46 - 70'</u> <u>70 - 84'</u> <u>84 - 86'</u> <u>86 - 92'</u> <u>92 - 98'</u> <u>98 - 120'</u>		Coarse sand and pea gravel "/minor brown clay Coarse sand and pea gravel Brown silty clay Coarse sand and pea gravel	24' 14' 2' 6' 22'		
<u>46 - 70'</u> <u>70 - 84'</u> <u>84 - 86'</u> <u>86 - 92'</u> <u>92 - 98'</u> <u>98 - 120'</u> <u>120 - 144'</u>		Coarse sand and pea gravel. "/minor brown clay Coarse sand and pea gravel Brown silty clay Coarse sand and pea gravel Sandy clay (red-brown areen-brown and	24' 14' 2' 6' 22' 24'		
<u>46 - 70'</u> 70 - 84' <u>84 - 86'</u> <u>86 - 92'</u> <u>92 - 98'</u> <u>98 - 120'</u> <u>120 - 144'</u>		Coarse sand and pea gravel "/minor brown clay Coarse sand and pea gravel Brown silty clay Coarse sand and pea gravel Sandy clay (red-brown, green-brown, and buff-brown)	24' 14' 2' 6' 22' 24'		
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FORM 263A

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INVESTIGATION

### STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES

NUMBER SCF-6

SHEET 2

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	<u>_282-288'</u>		Silty buff clay	·	V0184	PERT	76104
	-288-310	<u> </u>	Pea gravel and coarse sailed	221		<u>├</u>	
	- 326	<u>  </u>	Brown clayey gravel (no water)	$\frac{4}{10}$		┝-──-┼	
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			┨╴╴╋ <del>╪╪┿┥┨┇╘┝┥╡╪┿┥┥╎╋┥┥┊╇┫╡╗┊┇<mark>╊</mark>╋┱╌╷┨┽┇╎╎╏╎┊┇┊╏┆╡┇┪┫┥┥┥╝╏┥╡┊</del>
			╏╴ <del>╶<mark>╈╪╅┊┤┋╄┋┥┧</mark>╗┧┥╡╪┫╎╎┼┼┥╡╄╋╋┥╗┈╶┨┊┱┥┿┧┽╎┦╡╏┇╋╅┨┱┼┥╡┥┥</del>
23 2			┨ <mark>╴╋╃╏┊┇┟┾┽┝╬╎╎┊┊╢╎┼┼┊┊╎╎┼┼╞╉┼╊</mark> ╌┈╎╎┝┽┶┨┿┿┽┽┽┽┥┦╢┨╋╞┧┿┨╎┼┥┾
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File with DWR       WELL COMPLETION REPORT         Page 1 of 12       Refer to Instruction Pamphlet         Owner's Well No. 8123       No. E057712         Date Work Began 6/4/2007       Ended6/18/2007         Local Permit Agency GLENN COUNTY HEALTH DEPT       Permit Date 5/31/2007         ORIENTATION (🖄)       VERTICAL       HORIZONTAL       ANGLE       (SPECIFY)         DEPTH FROM       SURFACE       Description from color       FLUID MUD			
Page 1 of 12       Refer to Instruction Pamphlet         Owner's Well No. 8123       No. E057712         Date Work Began 6/4/2007       Ended6/18/2007         Local Permit Agency GLENN COUNTY HEALTH DEPT			
Owner's Well No. 8123       No. E057712         Date Work Began 6/4/2007       Ended6/18/2007         Local Permit Agency GLENN COUNTY HEALTH DEPT			
Date Work Began <u>6/4/2007</u> , Ended6/18/2007 Local Permit Agency <u>GLENN COUNTY HEALTH DEPT</u> Permit No. <u>MW 280-07</u> <u>GEOLOGIC LOG</u> ORIENTATION (✓) <u>✓ VERTICAL</u> HORIZONTAL — ANGLE(SPECIFY) DRILLING <u>ROTARY</u> FLUID <u>MUD</u> <u>BURFACE</u> Deprif ROM <u>SURFACE</u>		LC	
Local Permit Agency       GLENN COUNTY HEALTH DEPT         Permit No.       MW 280-07         Permit Date       5/31/2007         GEOLOGIC LOG       GEOLOGIC LOG         ORIENTATION (✓)       ✓ VERTICAL         HORIZONTAL       ANGLE         DEPTH FROM       METHOD         SURFACE       DESCRIPTION		VTRS/OTHER	
Permit No. <u>MW 280-07</u> GEOLOGIC LOG         GEOLOGIC LOG       GEOLOGIC LOG         ORIENTATION (⊥)       ⊥ VERTICAL		V/TRS/OTHER	
GEOLOGIC LOG ORIENTATION () VERTICAL HORIZONTAL ANGLE (SPECIFY) DRILLING ROTARY FLUID MUD DEPTH FROM SURFACE DESCRIPTION	алын алалына		
ORIENTATION (-) VERTICAL HORIZONTAL ANGLE			· · · · · · · · · · · · · · · · · · ·
DEPTH FROM METHOD CONTACT FLOID MOD			
et to Et i Describe material grain size color etc			
	ELLAL QCATH	N	
10 40 BROWN CLAY WITH SAND AND GRAVEL		<u>, 35</u>	
40 130 YELLOW BROWN CLAY WITH SAND STREAKS			
130 140 SAND AND GRAVEL	<b>.</b>		
140 250 YELLOW BROWN CLAY WITH SAND STREAKS	Parcel	800	
250 260 SAND AND GRAVEL	VV Section		
2601 310 YELLOW BROWN CLAY WITH SAND STREAKS		DEG	MIN SEC
310 465 YELLOW BROWN CLAY WITH SAND AND LOCATION SK	ЕТСН	AC	TIVITY (Z) —
I GRAVEL		¥`ĭ	IEW WELL
		MODIF	ICATION/REPAIR
			— Deepen — Other (Specify)
5201 625   BLUE AND YELLOW CLAY MIX WITH SAND		p	ESTROY (Describe
			inder "GEOLOGIC LOG"
		PLAN	NED USES (∠)
625 700 SAND AND GRAVEL WITH YELLOW AND BLUE		WATER	SUPPLY
			rigation Industrial
700; 865; YELLOW BROWN AND BLUE CLAY MIX WITH		Ш	
SAND AND GRAVEL	an an	· .	TEST WELL
865 1000 GRAY CLAY WITH SAND AND GRAVEL STREAK		CATHOD	IC PROTECTION
1000 1050 SAND AND GRAVEL		F	IEAT EXCHANGE
1050 1200 SAND AND GRAVEL WITH BLUE GRAY CLAY			DIRECT PUSH
1200 1300 YELLOW ORANGE CLAY WITH SAND AND		VADO	
GRAVEL STREAKS		VALC	SPARGING
1300 1395 SOFT YELLOW GRAY CLAY WITH SAND AND			REMEDIATION
GRAVEL Instance of Describe Distance of weil from Fences, Rivers, etc. and attach a map. U	<i>m Rodas, Buildings</i> , se additional paper if	0	THER (SPECIFY)
1395 1400 HARD ROCK	& COMPLETE,		
WATER LEVEL & `	YIELD OF CON	PLETED	WELL
DEPTH TO FIRST WATER	- (Ft.) BELOW SUP	RFACE	
DEPTH OF STATIC			
WATER LEVEL (Ft	.) & DATE MEASUR	ED	
TOTAL DEPTH OF BORING 1400 (Test)	GPM) & TEST TYP	'Е <u> </u>	<u></u>
TOTAL DEPTH OF COMPLETED WE'L 1034 (Feet)	AL DRAWDOWN		
May not be representative of a	well's long-term	yield.	
DEPTH CASING (S)		ANNULAR	MATERIAL
FROM SURFACE HOLE TYPE (🗹 )	FACE	TY	PE
DIA. Z Z Z Z Z MATERIAL / INTERNAL GAUGE SLOT SIZE	CE- 1	BEN-	
Ft. to Ft. (Inches)	Ft. MENT T	ONITE FILL	(TYPE/SIZE)
		$(\underline{\checkmark})$ $(\underline{\checkmark})$	
	<u>84</u> <u>y</u>	<u>_</u>	SAND SLURRY
	95	· /	BENTONITE C
	160		SKI#8 SAND
ZONE 2 160 170 2.3 300 160 160	176	· · · · ·	BENTONITE C
	318		SKI#8 SAND
	352		BENTONITE C
Geologic Log CERTIFICATION STAT		lief	
Well Construction Diagram	, Allomedye allu be		
Geophysical Log(s) (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)		~~	05005
Other Other Chemical Analysis Contract Ave WO	CITY	CA STATE	<u>95695</u> ZIP
ATTACH ADDITIONAL INFORMATION, IF IT EXISTS. Signed Land auton	07/06/07	<u>C</u>	57 A HIC - 13378
WELL DRILLER/AUTHORIZED REPRESENTATIVE		ι <u>ν</u> C	-or LIGENSE NUMBER

(							, , ,		STAT	TE (	OF CALIFO	RN		<b>.</b> (	-	DWR US		<u> </u>		NOT FILL IN
6 / r	The Will : Dage 1 of 3	DVVR	<b>0</b> 01	1	<u>ان</u>	20	12	WELL	CON Refer to	( <b>LP</b> ) to In	LETIC struction 1	JIN Pan	whilet	1	ĽL			VELL N	D./ STA	TION NO.
	Oumor's	Wall No	7448-	1	-				10,07	No	.726	72	10 A			<u> </u>			1	
	Date Work	Began	8/26/20	02			Fı	nded 9/6/20	02			-	••,/			LATITUDE		·	L	ONGITUDE
	Local P	ermit A	gency C	SLE	NN	I CN	ΓY Η	EALTH DE	EPT.								1 1		1.	
	Permit	No. N	1W-139-0	02				Permit	Date	8/2	1/2002			-			A	PN/TRS	<u>OTHEF</u>	\$
İ				GE	OL	/OGI	C L	OG				1		-						
	ORIENTAT		_√_ VE	RTIC	AL		HORIZ	ONTAL	ANGLE .		(SPECIFY)									
				R	DT/	ARY		FI	шь М	UD										
	DEPTH I SURF/	FROM ACE		,			DES	CRIPTION			· · · · · · · · · · · · · · · · · · ·									
	Ft. to	Ft.		Desc	rib	e ma	terial,	, grain, size	e, color,	, etc	2. CDV//	┝				VELL LO	DCAT	[ON		
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	50		POOR		30							C	ounty GLENN				· · · · · ·			
	60	70	POOR			ADF			GRAV	/FI		A	PN Book 037	F	age <u>31</u>	<u>50</u>	Parcel	060	01	
	70	80	POOR		GR	ADE	D GF		01011				ownship 2/N	ł	lange	<u>2_vv</u>	Sectio	n <u>10</u>		
	80	100	GRAY/	BRO		/N C	LAY	WITH SAN		DG	RAVEL		DEG. N	AIN.	SEC	D.			DEG.	MIN. SEC.
	100	110	POORI	LYO	GR.	ADE	DSA	ND					LO		ON S	KETCH-			A A	CTIVITY (2)
	110	120	POOR	LYC	GR.	ADE	DSA	ND WITH	FINE (	GR	AVEL									
	120	150	POOR	LYC	GR.	ADE	D GF	RAVEL					,						MODI	Deepen
	150	160	GRAVE	EL A	NE	) SA	ND V	N/YELLOV	V STIC	CKY	CLAY									Other (Specify)
	160	190	YELLO	W (		AY M	/ITH	GRAVEL	AND S	SAN	D									DESTROY (Describe
	190	200	POORI	LYC	GR.	ADE	DGF	RAVEL W/	SAND	AN	D CLAY									Procedures and Materials Under "GEOLOGIC LOG")
	200	230	YELLO	W (		AY W	/ITH	SAND AN	D GRA	AVE	EL								PLA	NNED USES(∠)
	230	240	YELLO	W S	SIL	TY C						F						⊢	WATE	R SUPPLY
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	250	200	BOOR					1 SAND AI	TU OA			[							ļ	MONITORING 🖌
-	200	270	POOR		2R				INSA		·									
$\square$	280	300	GRAVE	=	510		00.													HEAT EXCHANGE
$\cup$	300	310	GRAVE	EL V	VIT	'H FI	NES													DIRECT PUSH
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	340	350	TUSCA	N F	200	CKV	VITH	GRAVEL	AND S	SAN	1D									SPARGING
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			OTHEF	R M	ET,	AMO	RPH	IICS, TUFF	F, BAS	AL.	T, SAND	F	ences, Rivers, etc. and	attach	a map.	Use additiona	d paper	, if		DTHER (SPECIFY)
	370	380	COAR	SE S	SAI	ND							tessary. FLEASE D.	E ACC	JORATE		DELE.			
	380	450	TUSCA	AN A	\N[	D ME	TAN	IORPHIC I	RCK W	V/SI	ND, CLY		WATE	R LE	VEL 8	e yield	OF C	OMPL	ETED.	WELL
	450	460	SILTS			WITH		AVEL, QU	ARTZ,	, RI	ED		EPTH TO FIRST V	VATEF	<b>}</b>	(Ft.) BE	LOW SI	URFAC	2	
	400		CHERI	<u>, A</u>						21		Ŵ	ATER LEVEL		(	(Ft.) & DATE	MEASL	RED _		
	460	500	INIXED			REL		AT WITH C	JRAVE			Ε	STIMATED YIELD *	·		. (GPM) & T	EST T	YPE		
	TOTAL DE	PTH OF	BORING	600	)	(	Feet)	¥				Т	EST LENGTH	(ł	irs.) TO	TAL DRAW	DOWN.		(Ft.)	
	TOTAL DE	PTH OF	COMPLE	FED	WE		/8	(Feet)				<u> </u>	May not be repr	esenta	tive of	'a well's lo	ong-ter	m yield	d	
1	DEPT							C	ASING	(S)								ANN	ULAR	MATERIAL
	FROM SUF	RFACE	BORE - HOLE	T	PE	( <u>&lt;</u> )				<u></u>				FR		RFACE			T	(PE
		<u> </u>	DIA.	¥	N U U	ż₿ ä		MATERIAL /					SLOT SIZE	<u> </u>			CE-	BEN-		FILTER PACK
,	Ft. to	Ft.	(incres)	<b>₽</b>	R R	8월 등		GRADE	(inches	s)	THICKNES	ŝŝ	(inches)	1	⁼t. to	Ft.		(√)		(TYPE/SIZE)
	ZONE	1			-		·								0	220	/ ✓	/		SAND SLURRY
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		ATTAC Geologic	HMENTS Log	(⊻)	-			I, the undersid	aned. certi	ify the	at this report i	is co	<ul> <li>CERTIFICA</li> <li>omplete and accurate</li> </ul>	to the	v STA bestofn	N I E MIEN'	L e and be	dief.		
()		Well Co	nstruction Di	agrar	n			NAME_E	ATON E	DRI	LLING CO	) <u> </u>		NTER					·····	
$\smile$		. Geophys - Sojl/Wat	acal Log(s) er Chemical	Anal	vsis			20 W. KE	ENTUCI	.w, 0 KY				14 ( E D)	w		ID		CA	95695
		. Other						ADDRESS	MD	H)	Kut					CITY	0/03/0	2	STATE	: ZIP 133783-0574
	ATTACH ADE	DITIONAL I	NFORMATIO	N, IF	IT E	XISTS.		Signed WEL	LL DRILLE	ER/A	UTHORIZED	RE	PRESENTATIVE				TE SIGI	NED		C-57 LICENSE NUMBER
Ĩ	DWR 188 REV.	11-97			IF	ADD	ITION	AL SPACE IS	NEEDE	D, L	JSE NEXT (	co	NSECUTIVELY N	UMBE	REDF	ORM				

Ć	ORIGIN/							STATE	OF CALIFO	RNIA	_ [=	DWR US		<u>Y</u>	<u>D0</u>	NOT FILL IN
<sub>्य</sub> ा । ग	lie with	DVVR					WELL	COMP Refer to In	ILETIO	ON REPOR <sup>®</sup>	╹╎└	s	TATE .V	VELL NO	D/ STAT	TION NO.
I	Owner's	2 Well No	7448-1	1				Ne	<sup>.,</sup> 7267	740						
$\bigcirc$	Date Wor	k Began	8/26/20	02		;	Ended 9/6/200	02				LATITUDE		1 .	L(	DNGITUDE
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I	Perm	it No. <u>Iv</u>	100-100-0	GEC	DLO	GIC	LOG	Date _0/2	. 1/2002		-					
	ORIENTA	TÍON (⊥)	¥_ VE		AL	<u> </u>	ORIZONTAL A	ANGLE	_ (SPECIFY)							
	DEPTH	FROM		3 RC	TAF	Υ.	FL	UID MUD								
		FACE		Descr	ribe i	L mate	ESCRIPTION trial, grain, size	, color, et	с.							
	555	575	GRAVE	ΞL						Address	SOF C/R	24 & .75	PME		/R V	V .
	575	605	MIXED	COI	LOR	ED	CLAY W/SAN	D AND G	RAVEL	City CA	· · · · · · · · · · · ·					
								····		County GLENN	De 3	60		060		
										Township 22 N	Page <u>o</u> Range	2 W	Parce. Sectio	n <u>15</u>		······································
							······································			Latitude		<u> </u>		-	DEC	MIN 050
											CATION S	SKETCH-				CTIVITY ( <u>~</u> )
İ											NORTH					
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																DESTROY (Describe Procedures and Materials
															PLA	NNED USES(∠)
										10				F	WATE	R SUPPLY Domestic Public
1										WE				EAS	'	rrigation Industrial
$\bigcirc$		•													сатно	
$\bigcirc$																DIRECT PUSH
																SPARGING
								·		Illustrate or Describe D. Fences Rivers etc. and	istance of Well	from Roads,	Building.	s, if		REMEDIATION
										necessary. PLEASE BI	ACCURATI	E & COMI	PLETE.			
Í			1							WATER	LEVEL &	& YIELD	OF C	OMPL	ETED -	WELL
								· · ·		DEPTH TO FIRST W	/ATER	(Fî.) BE	LOWS	URFAC	-	
			 	<u>.</u>	· · · ·		····			WATER LEVEL		(Ft.) & DATE	MEASU	JRED _		
	TOTAL D	EPTH OF	BORING .	600		- Æ	et)			ESTIMATED YIELD *	(Hrs.) TC	_ (GPM) & 1 ) TAI DRAW	EST T	YPE	(Et )	
	TOTAL D	EPTH OF	COMPLET	TED V	WELI	, <u>57</u>	8 (Feet)			May not be repre	sentative of	f a well's k	ong-ter	m yield	_ (1.) 1	
Ī	DE	тн					CA	ASING (S)				<u></u>		ANN	JLAR	MATERIAL
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	Et to	Ft	DIA. (Inches)	ANA ANA		L PP	MATERIAL / GRADE	DIAMETER		IF ANY	Et to	. Fł	CE- MENT	BEN-	FILL	FILTER PACK
						Ē	100500 TD	(inches)	THICKNES				( <u>&lt;</u> )	( <u>~</u> )	( <u>(</u> )	
ł	0	297	12				SCH 40	2			220	230	×	<ul><li>✓.</li></ul>		CHIPS
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		ATTAC	HMENTS	(⊻)		ليسيين	1			CERTIFICA	TION STA	ATEMEN	Γ			
$\bigcirc$	_	_ Geologic _ Well Col	nstruction Di	iagram			NAME EA	TON DRI	LLING CO	S complete and accurate i	UTED)	my knowledg	e and Di			
$\smile$		Geophys	ical Log(s)				(PERS	SON, FIRM, C	OR CORPORA	(TION) (TYPED OR PRI	NIEU) \\				~^	oroor
		- Soil/Wate	er Chemical	Analys	sis		20 W. KE	NIUCKY	H_1A	/	V	VUUUUAN	<u>ب</u> ب	···	CA	95695
		- Soil/Wate Other _	er Chemical	Analy:	sis T FYIS	75	- <u>20 W. KE</u> ADDRESS Signed	MAT	hurt	۷	V		0/03/0	)2	STATE	21P 133783-C57A



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File with DW	R V	VELL	COMPLETIC	ON REPOR	Τ'	
Page 1 of 2			Refer to Instruction	rang last	STATE WALLS	la státich féo 👘 👘
Ounarie Wall	Nn 7448-2		No. 726	741		
Own March 2			102		úan robé	LONG TUDE
Date work neg						
Local Perna	Agoney GLERA CALLER	DALIA D	2MI 1 0.0000		A196, T75	5.01958
Portest No		Permit	Date 8/2/1/2002		<u> </u>	
	GEOLOGIC LO	·G ——		-		
OWENTALEN -	-; VERTEA HORED	a TAL	51;01£ (2PEC85)			
	METEOD ROTABY	=	the MUD			
SUPFACE	DESC	RIPTION				
<u> </u>	Describe Instants	granj, po	$a = 10 Rm^{-1} m_{\pi}^{2}$			
່ວ	10 WELL GRADED SAND	W/SILT /	AND FINE GRVL	Address 25 MI	SOF C/R 24 8 75 M EOF (	
(0)	20 WELL GRADED SAND	WITH FL	NE GRAVEL	Lina, CA		
20	50 POORLY GRADED SAV	O AND	GRAVEL	Course GLENN		
50	50 PCORLY GRADED SNI	D AND G	RV1 W/TAN CLY	Coarty Sterner		
60	70 POORLY GRACED SAT	ND WITH	GRAVEL		. Pape deci - Pareel Veu	1.1.1
70	81 PCORLY CRADED OR			Township 44 19	Range 4 W Section (24	) 2/
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100 -		na na Gra Na S		1.00	CATION SKETCH-	T ACTIVITY AV
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160 1	190 YELLOW CLAY WITH (	GRAVEL	AND SAND	ļ		CESTRON JANAGE
390 3	200 FOORLY GRADED GR	AVEL W	ISAND AND CLAY			Friter delta, er differ i han Under 105 Cli CG/CL CCC
200 2	230 YELLOW CLAY WITH \$	SAND AN	ID GRAVEL			
230 2	40 YELLOW SILTY CLAY					WATER SUPPLY
240 2	50 YELLOW SILTY CLAY	W/SAND	AND GRAVEL	5		Correspondence Public
250 2	60 ISMALE GRAVEL WITH	SAND A	ND SILTY CLAY	2		CLEBYACE STREAM
260 2	70 POORLY GRACED GR	AVEL W:	TH SAND	İ		VOtanos Vol. 🗸
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340 3	TUBEAN FOCK WITH	GRAVEL				0P-4:021/0
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		CS, TUF	F BASALI, SANO	<ul> <li>Colors Products and Description 15 (CAN), 59</li> </ul>	label, se proj i trajnovi nje gelganiji Stati (1951) ni za 19059995015.	OfnER(SA2Cin
370 3	BO COARSI: SANU	_ ::				
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450 4	60 SILTSTONE WITH GRA	AVEL OU	JARTZ, REO	Deeler (Die Bouly	VATER /Ft+ESLOW SURFAC	:e
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460 5	65 MIXED COLORED CLA	Y WITH	GRAVEL	WAREN CEVEL	CHEVIZ (DA TELIME AVAILACE)	
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	on a construction of a sign with a sign with a sign of a	NAME 19 1727	KARON ORIEGING CU 1364 ARV OR GORPON	A MPONE (194920-03-034	NTEO	]
ge.	Water Chemical Analysis	20 W. K	ENTUCKY	1	WOODLAND	QA 95935
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ATTACH ADD/DOA	46 PPEQARATION # 1 5:0315	nopend 116	OL OR LERIAD DICH 281	A PERREADY MINS	5478 C (2, 20	0-671 (CHUCH NUMBER
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IN ADDITIONAL SPACE IS NEEDED, USE NEXT CONSPORTIVELY NUMBERED FOR

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Bunch Well No. 744:2         No. 726741           Date Work Riggs: 828:2022         Intel 2000 2000           Lood Provide Riggs: 828:2022         Refur Date State	Price With Dayyer WELL COMPLETIC	ON REPORT
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Local Period Agenes         GLENN CATV HEALTH DEPT Permit No. MAY-139-02         Sec. 2012         Sec. 20	Date Work Repair 8/26/2002 =	
Permit No. MVM-1992         Remit Data B21/2002         MUT To SPECE           GRED MINA,	Local Permit Agency GLENN ONTY HEALTH DEPT	
Stephanol,, CR01001CLOG	Permit No. MW-139-02 Permit Date 8/21/2002	<u></u>
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absolution         Description           bission         Description           550         575           575         BRAVEL           575         SCALERED CLORED CLAY WISAMD AND GRAVES           576         SCALERED CLORED CLAY WISAMD AND GRAVES           577         SCALERED CLORED CLAY WISAMD AND GRAVES           578         SCALERED CLAY WISAMD AND GRAVES           57	OR:ENTATION / VERTICAL CORRECTIAL ANGLE (SPECIFY) DRNLING = company	
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Ath. Back 507         Page 350         Parcel 380           Lanca         Setting 21 W         Setting 15           Lanca         Downstein 21 W         Reng 21 W         Setting 15           Lanca         Downstein 21 W         Reng 21 W         Setting 15           Low Attain 21 W         Reng 21 W         Setting 15         Reng 22 W         Setting 15           Low Attain 21 W         Reng 22 W         Setting 15         Reng 22 W         Setting 15           Low Attain 21 W         Reng 22 W         Setting 15         Reng 22 W         Setting 15           Low Attain 21 W         Reng 22 W         Setting 15         Reng 22 W         Setting 15           Low Attain 21 W         Reng 22 W         Setting 15         Reng 22 W         Reng 22 W           Setting 15         Reng 22 W         Reng 22 W         Reng 22 W         Reng 22 W           Setting 15         Reng 22 W           Setting 15         Reng 22 W	-	Comp GLENN
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State of the second		Elimination communications
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Onologic Log     Multi Construction Dignet     Multi Construction     Multi Construction Dignet     Multi Construction Di	ATTACINUMES	CERTIFICATION STATEMENT
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Set Water Opening Analy is         XE WV, KEN LUCKY         WOODLAND         CA         95665           Weise         ADDRESS         ADDRESS         COTY         STATE         CH           AT FACH ADDRESS         MODRESS         MODRESS         CTY         STATE         CH           AT FACH ADDRESS         MODRESS         MODRESS         MODRESS         CTY         STATE         CH	Gaber (College)	TICAN TYPED CE PRUTERS
AT TACK ROOMONAL INFORMATION IF IT EXISTS UP TO THE AUTHORIZED TERRECENTATIVE OATE & CLUB CONTRACT CON	Ber Walter Chemice Analysis ZB W, KENTUCKY Apper	WOODLAND CA 95689 OTA DAYE 32
	AT FACH ADDITIONAL INFORMATION OF CLEASING STATE STATES WELL PROLED AUT ADDITED	10/03/02         133782-057A           НЕРЯВЕЕНТАТИЕ         0x16 x 0x20         0x07 unerse исимени

IA ADMITIONAL SPACE IS NEEDED, LISE NEXT DONEEDUT VELY NUMBERED FORM.

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ORIGINAL				STATE OF	CALIFOR			<u>= ONLY</u>	
File with I	owr		WELL	COMPL.	ETIO			ATE WELL NO	/ STATION NO.
Page 9 of 1 Owner's N	2 Well No.	7987		Rejer to Instru No.	E044	<b>112</b>			
Date Work	Began	7/12/2006 , 1	Ended 7/28/2	006					
Local Pe	ermit Ag	ency GLENN COUN	TY HEALTH	I DEPT				APN/TRS/	
Permit	: No. <u>M</u>	N248-06	Permit	Date 6/14/2	2006				
		GEOLOGIC .	LOG						
ORIENTAT	ION (⊻)	DRILLING	RIZONTAL	ANGLE(S	SPECIFY)				
DEPTH P	ROM	METHOD ROTARY	FI						
SURFA	Ft.	Describe materia	al, grain, size	e, color, etc.				CATION	
0	3	TOP SOIL				Address .5 MI SC	DF RD 24 & 67 N	TEOFRD	<u>S</u>
3	20	SAND AND GRAVEL				City CA			······································
20	110	3/4" GRAVEL WITH	YELLOW B	ROWNUL	<u></u>	County GLENN	- 000		
110	150	YELLOW BROWN C		SAND AND	<u>,                                    </u>	APN Book $023$	-Page 220	Parcel 005	18
150	290	GRAVE		0/110/110		Township 2114	$ \text{Range}_{}$	Section 2	
290	330	LOOSE GRAVEL W	ITH SAND			DEG. MI	N. SEC.	-	DEG. MIN. SEC.
330	460	SOFT GRAY CLAY	NITH SAND	AND GRA	VEL		- NORTH		→ ACTIVITY (♥) →
460	500	BRITTLE YELLOW	AND GRAY	CLAY MIX	WITH				MODIFICATION/REPAIR
		COARSE SAND							—— Deepen —— Other (Specify)
500	620	BRITTLE YELLOW	CLAY WITH	SAND AND	<u> </u>				
		GRAVEL	N/ 14/171 1 0 4						DESTROY (Describe
620	920	BRITTLE GRAY CLA	AY WITH SA		DEAKS				Under "GEOLOGIC LOG"
920	1200	SUFT SILTY GRAT	CLAT WITE	T SAND STI					PLANNED USES $(\checkmark)$
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									TEST WELL
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,						a she di kina a s	a kara a ka	·	HEAT EXCHANGE
	·* .		1			• • • •	· · · · ·	• • • • •	INJECTION
			• • •	· · · ·	- <u>-</u>	··· ·			VAPOR EXTRACTION
						• • • • • • • • • • • • • • • • • • •			
						Illustrate or Describe D	istance of Well from Roads,	<i>Buildings</i> , 1 paper if	OTHER (SPECIFY)
-		i 		w		necessary. PLEASE BE	ACCURATE & COMP	léte.	
			· · · · ·	· .		WATER	LEVEL & YIELD	OF COMPLI	ETED WELL
						DEPTH TO FIRST W	ATER (FL) BE	LOW SURFAC	E ·
						DEPTH OF STATIC			
						ESTIMATED VIELD *		EST TYPE	
TOTAL DI	EPTH OF	BORING 1200 (Fee	et)			TEST LENGTH	(Hrs.) TOTAL DRAW	DOWN	(Ft.)
TOTAL DI	EPTH OF	COMPLETED WELL 948	<u>3</u> (Feet)			May not be repre	sentative of a well's l	ong-term yield	đ
r								ANINT	
DEP FROM SU	TH	BORE - TYPE (()		LASING (S)		1	DEPTH FROM SURFACE	Ali	TYPE
			MATERIAL /	INTERNAL	GAUGE	SLOT SIZE		CE- BEN-	FILTER PACK
Ft. to	Ft		GRADE	(Inches)	OR WALL	S (Inches)	Ft. to Ft.		TYPE/SIZE)
	1								
+2.5	57	14 🗸 👘	PVC F480	2.5	SCH 8	30			
57	67	14 🖌	PVC F480	2.5	SCH 8	.030		·	21 - VARDA - 17
67	. 77	14 🗸	PVC F480	2.5	SCH 8	<u>υ</u>	⊢ <u>.</u>	<u> </u>	Line Science States
	2 <del>185</del> -				SCH	30		ID.	00
				<u></u>			L IVE	<u>кт   т (</u>	inter
	ATTACI – Geologic	HMENTS (⊻) ———— : Log	i. the under	signed, certify tha	t this report	is complete and accurate	e to the best of my knowle	dge and belief.	
1 -	- Well Co	nstruction Diagram	NAME	EATON DRILL					· · · · · · · · · · · · · · · · · · ·
	Geophys 	acal Log(s) er Chemical Analysis		ST KENTUCK	YAVE		WOODLAI	ND	CA 95695
1 -	_ Other		ADDRESS	Marts V	Jamin	ויה		9/05/06	STATE 21P C57 A HIC - 13378
ATTACH AL	DITIONAL I	NFORMATION, IF IT EXISTS.	SignedW	ELL DRILLER/AL	THORIZED	REPRESENTATIVE	D,	ATE SIGNED	C-57 LICENSE NUMBER
DWR 188 REV	7. 11-97	IF ADDITI	ONAL SPACE	IS NEEDED, US	SE NEXT (	CONSECUTIVELY N	UMBERED FORM		
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File with [	OWR						WELL	C	OMPI	<b>ETIO</b>	N	<b>REPOR</b>	$\Gamma$				
Page 10 of	12						,,,	Ref	fer to Inst	ruction Pa	'am	iphlet	8			/ STATIO	
Owner's V	Well No.	7987							No.	E044	4	112					
Date Work	Began	7/12/200	6				Ended 7/28/	2006	3				LATITUDE			LO	
Local Pe	ermit Ag	ency G	LEN	IN	co	ú	TY HEALT	HD	EPT								
Permit	No M	N248-06	3				Permi	it Da	ate 6/14	/2006				AF	N/TRS/	DIHER	
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			RTICA	11		uо				SPECIEV							
ORIENTAT	ION ( <u>*</u> _)	DRILLING			DV		RIZONTAL										
DEPTH F	ROM	METHOD				n	SCRIPTION				1						
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0	3	TOP SC	DIL								A	Address .5 MI So	<u>OF RD 24 &amp; 67</u>	MIEO	FRD	S	
3	20	SAND A	AND	G	RA\	/E	L				lc	City CA					
20	110	3/4" GR	RAVE	ΞL	WI	ΤH	YELLOW	BRO	WN CL	AY	d	County GLENN					
110	150	YELLO	ΝB	RC	DWI	N (	CLAY				Δ	PN Book 023	Page 220	Parcel	005		
150	290	YELLO	ΝB	RC	<b>W</b>	10	CLAY WITH	I SA	ND AN	D	Т	ownship 21 N	Range2 W	Sectio	n <u>4</u>		
		GRAVE	L								ĪŦ	atitude	· · · · · · · · · · · · · · · · · · ·		_	1	
290	330	LOOSE	GR	٨	/EL	W	/ITH SAND				-	DEG. M	IN. SEC.			DEG.	MIN. SEC.
330	460	SOFT O	GRA	N C		Y	WITH SAN	ID AI	ND GRA	AVEL			- NORTH			-AC	JEWWEU
460	500	BRITTL	ΕY	EL	LO\	N	AND GRAY	YCL	AY MIX	WITH							
		COARS	SE S	AN	1D											-	Deepen
500	620	BRITTL	ΕY	EL	LO1	N	CLAY WITH	H SA	AND AN	D							- Other (Specify)
		GRAVE	L								1						ESTROY (Describe
620	920	BRITTL	EG	RA	Y C	<u>-</u>	AY WITH S	SANE	D AND	GRAVEL						P	rocedures and Mater
920	1200	SOFT S	SILT	Y	GR/	٩Y	CLAY WIT	H S/	AND ST	REAKS						דע דע	INFD USES (
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		<u> </u>									-	Illustrate or Describe L	istance of Well from Roads	Building	S, if	c	THER (SPECIFY) _
											-  i	necessary. PLEASE B	E ACCURATE & COM	PLÉTE.			
				. <u> </u>							-	WATER	LEVEL & YIELD	OF CC	MPLI	ETED Y	WELL
									····		-	DEPTH TO FIRST W	(ATER(Ft.) B	ELOW S	URFAC	Е.	
											-	DEPTH OF STATIC	( )				
											-  \	WATER LEVEL	(Ft.) & DAT	E MEASL	JRED		
<u> </u>		1									-	ESTIMATED YIELD *		TEST T	/PE		
TOTAL DE	EPTH OF	BORING	120	0		(Fe	et)					TEST LENGTH	(Hrs.) TOTAL DRAV	VDOWN.		(Ft.)	
TOTAL DI	EPTH OF	COMPLE	ΓED	WE		94	8 (Feet	t)				May not be repre	esentative of a well's	long-ter	m yield	ł	
[								<u></u>						1	ADTAT		
DEP	TH	BORE -	-			-		CAS	<u>ing (s)</u>						AININ		DE
	RFACE	HOLE	げ		<u>(</u>			/ 11	NTERNAL	GAUGE	E	SLOT SIZE		- CE.	BEN-		
-	•	(Inches)	AN	こう いっち しょう しょう しょう しょう しょう しょう しょう しょう しょう しょう	żg		GRADE	'   Ö	DIAMETER	OR WAL	LL	IF ANY	Et to Et	MENT	TONITE	FILL	FILTER PACK
FL TO	<b>Р</b> Г.		Ы	Ŋ,	۲ <u>ط</u>				(Inches)	THICKNE	.55	(inches)		(⊻)	(⊻)	(🖌)	
165	175	14		$\checkmark$			PVC F480		2.5	SCH	8(	0030	0 41	$\checkmark$	<i>j</i>		SAND SLUR
175	269	14	1				PVC F480	)	2.5	SCH	80	0	41 45	5	×		BENTONITE
269	279	14		$\checkmark$			PVC F480	)	2.5	SCH	80	0 .030	45 99	)	-	Y	SRI#8 SAND
279	289	14	~				PVC F480	)	2.5	SCH	8	0	99 104	۱			BENTONITE
ZONE	3												104 130	2	1		SKI#8 SAND
+1.5	673.5	14	1	T			PVC F480	)	2.5	SCH	8	U	130 135	2			BENIONITE
ц <u> </u>	ATTACH	IMENTS	<u>(∠)</u>									- CERTIFICA	TION STATEMEN	т —			
	- Geologic	Log					I, the unde	ersigne	ed, certify th	at this report	rt is	complete and accurat	te to the best of my know	edge and	i belief.		
-	- Well Co Geophys	nstruction D	lagrai	n			NAME P	PERSO	UN DRIL	R CORPOR	<u>.</u> АТ	ION) (TYPED OR PRI	NTED)				
_	<ul> <li>Soil/Wat</li> </ul>	er Chemical	Ana	lysis			20 WE	ST K	ENTUC	KY AVE			WOODLA	ND		CA	95695
_	_ Other			<u> </u>				ss M	los L X	Jamin			СПҮ	09/05/0	)6	STATE (	207 A HIC - 133
ATTACH AD	DITIONAL I	NFORMATIC	N, IF	ITE	X/ST	S.	Signed V	WELL I	DRILLER/A	UTHORIZED	DR	REPRESENTATIVE	ī	ATE SIG	NED		C-57 LICENSE NUM
DWR 188 REV	. 11-97			IF	AD	DIT	IONAL SPACE	IS N	EEDED, L	ISE NEXT	C	ONSECUTIVELY N	UMBERED FORM				

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в.																		
ORIGINA	L								STATE OI	F CALIFORI	NIA			DWR USI	E ONL	<u> </u>	00	NOT FILL IN
File with I	DWR						WELL	C	OMPI	ETIO	N	<b>REPOR</b> '	T	'				
Page 11 of	12							Re	efer to Inst	ruction Pa	mph	let		SI				
Owner's	Well No.	7987							NO.	E044	11	12						
Date Work	Began	7/12/200	6			,	Ended7/28	/200	)6							<u> </u>	<u>_</u>	
Local P	ermit Ag	gency G	LEI	NN	_C(	JUI	NTY HEAL	THI	DEPT		·				 AP	N/TRS/C		
Permi	t No. <u>M</u>	N248-06	3				Perm	nit D	Date 6/14	/2006								
			GE	OL	00	ЯC	LOG —											
ORIENTAT	'ION (⊻)		RTIC	AL		- HC	RIZONTAL	AN	IGLE(	SPECIFY)								:
DEDTU	FROM	METHOD	R		AR)	Y		FLU	ID MUD									
SURE	ACE	-	<b>.</b>			D	ESCRIPTIO	N	color etc									
Ft. to	Ft			rioe	: 11	aler	iai, grain, s	126,				1 5 MIS	i C	E BD 24 & 67 M	CATI		S	
3	20	SAND A		- - -	RA		:1			·  ·	Add	aress <u> ivii O</u>		<u>// ICD 24 0.01 1</u>				
20	110	3/4" GR	2AV	/EL	W		I YELLOW	BR	OWN CL	AY	Cu	y <u>ort</u> unty GLENN						
110	150	YELLO	NE	BR		/N	CLAY				100	M Book 023		Page 220	Parcel	005		
150	290	YELLO	N E	BR	OW	/N	CLAY WIT	H S/	AND AN	<b>D</b>	AF. Tox	$m_{\rm Ship} 21 \rm N$		Range2 W	Section	n 4		
		GRAVE	L								Lat	titude			,00010.			
290	330	LOOSE	G	RA	VE	Lν	VITH SAND	)				DEG. N	AIN	N. SEC.		[	DEG.	MIN. SEC.
330	460	SOFT O	GR/	AY	CL	AY	WITH SAN	ND A	AND GRA	AVEL			<u> </u>	- NORTH				
460	500	BRITTL	E١	YEL	LC	W	AND GRA	YC	LAY MIX	WITH							MODIF	ICATION/REPAIR
		COARS	SE (	SA	ND												-	Deepen
500	620	BRITTL	.Ε \	YEL		W	CLAY WIT	TH S	AND AN	D								Other (Specify)
		GRAVE	EL														<u>c</u>	ESTROY (Describe
620	920	BRITTL	E	GR	AY	CL	AY WITH	SAN	D AND	GRAVEL							1 C	Inder "GEOLOGIC LOG")
920	1200	SOFT S	SIL	ΤY	GR	RAY	CLAY WI	THS	SAND S	REAKS							PLA	NED USES $(\checkmark)$
											F					F		R SUPPLY
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		1									_							MONITORING -
																	CATHO	
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		1														1		DIRECT PUSH
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																	VAPO	SPARGING
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											Illu Fer	nstrate or Describe and a ces, Rivers, etc. and	DI. I a	stance of Well from Roads,	paper i	s, f	( (	THER (SPECIFY)
										l	nec	essary. PLEASE E	3E	ACCURATE & COMP	LETE.			······································
												WATE	R	LEVEL & YIELD	OF CO	MPLI	STED '	WELL
											DE	EPTH TO FIRST V	N	ATER (Ft.) BE	low s	URFACI	E	
											DE	PTH OF STATIC			MEASI	IRED		
						<u> </u>					50		+	(i c) @ DATE	EST T	PE		
TOTAL D	EPTH OF	BORING.	12	00		- (Fe	eet)				TE	ST LENGTH		(Hrs.) TOTAL DRAW	DOWN.		(Ft.)	
TOTAL D	EPTH OF	COMPLE'	TEI	) W	ELI	<u>, 94</u>	<u>8</u> (Fe	et)			1	May not be repr	res	sentative of a well's la	ng-ter	m yiela	1.	
			1										ſ					
DEP	TH	BORE -	-			<u>.</u>			SING (S)		1			DEPTH FROM SURFACE	<u></u>	AININU	JLAR	
FROM SU		HOLE DIA.	1 -		<u> </u>	臣		,	INTERNAL	GAUGE	Í	SLOT SIZE			CE-	BEN-		
Ft to	Ft	(Inches)	AN	ЖШ Ш			GRADE	.,	DIAMETER	OR WALL		IF ANY (Inches)		Ft. to Ft.	MENT	TONITE	FILL	(TYPE/SIZE)
				ы М		臣			(				╟	405 007	(⊻)	<u>(Y)</u>	↔	
673.5	683.5	14	┝,	ľ	–		PVC F48	<u>o</u>	2.5	SCH 8	80	.030	lŀ	$\frac{135}{327}$		~	<u> </u>	BENTONITE C
602.5	702 5	14	<b>⊢</b> ∙	1					2.5	<u>зопо</u>	80	020	lŀ	335 647	$\checkmark$		<b>†</b>	SAND SLURRY
703.5	713.5	14	$\downarrow$	ŀ		$\vdash$	PVC F48	$\frac{1}{0}$	2.5	SCH	80	.000	lŀ	647 653				BENTONITE C
ZONE	4		<u> </u>			$\vdash$		-					lŀ	653 715		,		SRI#8 SAND
+1	928	14/8-3/4	<b>∀</b>	┢	+		PVC F48	0	2.5	SCH 8	80			715 736		-¥-		BENTONITE C
	ATTACI	IMENTS	 (√	<u> </u>				i				· CERTIFICA		TON STATEMENT	·		<u></u>	
-	- Geologic	: Log		•			l, the un	dersigr	ned, certify th	at this report	is co	mplete and accura	ate	to the best of my knowle	dge and	belief.		
-	_ Well Co	ical Log(s)	Diagra	am			NAME	EA PERS	ION, FIRM, O	R CORPORA	<u>, .</u> Tion	N) (TYPED OR PR	IN	ITED)				
-	<ul> <li>Soil/Wat</li> </ul>	er Chemica	l An	alysi	is		20 W	EST	KENTUC	KY AVE				WOODLAN			CA	95695 71P
-	Other							.55 /	Marhy	Jamio	v				9/05/0	)6		<u>C57 A HIC - 13378</u>
ATTACH AL	DITIONAL I	NFORMATIC	JN, II	⊢ <i>I</i> T I	EXIS	15.		WEL	L DRILLER/A	UTHORIZED	REF				TESIG	NED		C-57 LICENSE NUMBER
DWR 188 REV	7.11-97			I	FA	ווסט	IONAL SPAC	⊫ IS I	NEEDED, U	JSE NEXT (	UON	NSECUTIVELY N	٩U					

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ORIGINAL							STATE (	OF CALIFO	RNIA		[	DWR U	SE ONL	.Y	- DO	
File with DV	٧R					WELL	COMP	LETIC	DN F	REPOR						
Page 12 of 12	;						Refer to In	struction <b>F</b>	Pamphlet	_	· · · · ·	s	TATE V		D./ STAT	TION NO.
<b>Owner's</b> We	ell No.	7987					No	<sup>,</sup> E04	411	2						
Date Work B	egan _	7/12/200	)6			Ended 7/28/2	2006					LATITUDE	<u> </u>		<u> </u>	ONGITUDE
Local Perr	nit As	rency G	SLEN	IN C	วอบ	NTY HEALT	H_DEPT						1			
Permit 1	<u>vo. Mľ</u>	N248-0	6			Permi	t Date 6/1	4/2006			_ L	. ····	Al	PN/TRS	OTHER	
· · · · · ·			GE	OLO	GI	C LOG			T							
ORIENTATION	N (X)	_✔ VE	ERTIC/	ΑL	Н	ORIZONTAL	ANGLE	(SPECIFY)								
		DRILLING	RC	TAF	۲Y	F	-i un MUD		}							
DEPTH FRC	M	METHOE			I	DESCRIPTION										
Ft. to	Ft.	1	Descr	ibe	mate	rial, grain, siz	te, color, etc	•				WELL LA	DCATI	ON-		
0	3	TOP S							Addres	ss <u>.5 MI S</u>	<u>SOF RD 2</u>	4 8 .67	MEC	FRD	) <u>S</u>	······································
3	20	SAND /	ANL					1 41/	City C	A						
20	110	3/4" Gr				H YELLOW E		LAY	Count	GLENN				-,		
110	150	YELLO							APN E	look 023_	Page 2	20	Parce	<u>005  </u>		
150	290	TELLO		RU	VVIN	CLAT WITH	SAND AN		Towns	hip <u>21 N</u>	Range	2 <u>W</u>	Sectio	n <u>4</u>		
200	220	LOOSE		<u>مر ،</u>	= `				Latitu	de		<u>c</u>		-	DEG	MIN. SEC
290	160	SUCSE			≟∟ \ 1 ∆ \	ANTH SAND				LO	CATION S	SKETCH ·			A	CTIVITY (Z)
460	500	BRITTI			<u></u>						NORTH				-∠	NEW WELL
400	300	COARS			יייט	AND ONAI			·						MODI	FICATION/REPAIR
500	620	BRITTI	EV	ELL	-	CLAY WITH		ND.	•							Other (Specify)
		GRAVE				<u></u>	<u> </u>		-							
620	920	BRITTL	E G	RA	Y CI	AY WITH S	AND AND	GRAVEL	1							DESTROY (Describe Procedures and Materials
920	1200	SOFT S	SILT	YG	RA	CLAY WITH	I SAND S	TREAKS								
															WATE	R SUPPLY
									LST.					ST	—	Domestic Public
									12					1	'	
																TEST WELL
`						<u>.</u>									сатно	DIC PROTECTION
													•			HEAT EXCHANGE
																DIRECT PUSH
																OR EXTRACTION
																SPARGING
									Illustrate	or Describe	SOUTH     Distance of Well	from Roads,	Building	<i>s</i> ,	1	REMEDIATION
								<u></u>	Fences, F	livers, etc. and y. PLEASE I	l attach a map. BE ACCURATI	Use addition: E & COMI	al paper : PLETE.	f		DTHER (SPECIFY)
										WATE	R LEVEL 8	YIELD	OF CC	MPL	ETED	WELL
									DEPTH	TO FIRST V	NATER	(Ft.) BE	LOW S	URFAC	E	
									DEPTH	OF STATIC						
									WATER	LEVEL		(Ft.) & DATE	MEASL	JRED		
TOTAL DEPT	THOFF	RORING	120	0	/6	a a t )			ESTIMA	TED YIELD	*	_ (GPM) & `	TEST TY	'PE		. <u></u>
TOTAL DEPT	'H OF (	COMPLE	TED	WEL	 1.94	B (Feet)			TEST L	ENGTH	(Hrs.) TC		DOWN.		(Ft.) J	
						(			<u>Midy</u>		esemanve of	a weits i	ung-teri	n yield		
DEPTH		BORF -	· · ·		,		CASING (S)				DEF	ΡŢΗ		ANN	ULAR	MATERIAL
FROM SURFA	ACE	HOLE	TY	<u>PE (</u>	수)				.		FROMSU	JRFACE			<u></u>	(PE
		(inches)	ANK	l s	ğ H	GRADE	DIAMETER	OR WAL	L   51	IF ANY		-	CE- MENT	BEN-	Fill	FILTER PACK
			B		필문		(inches)	THICKNES	SS	Inches)	Ft. to	o Ft.	(🗹)	(⊻)	(🗹)	(TYPE/SIZE)
928	938	8-3/4		✓		PVC F480	2.5	SCH	80	.030	736	902	1			SAND SLURRY
938	948	8-3/4	4			PVC F480	2.5	SCH	80		902	914		<b>v</b>		BENTONITE C
			$\square$	_	$\square$						914	964		<b>~</b>	×	SRI#8 SAND
			┝	_	$\square$	······					904	9//		-	-	BENIONITE C
<b>├</b> ──-					+						9//	1200				
			$\square$										<u> </u>		L	
AT AT	LTACH eologic	MENTS	(⊻)			1 the under	signed contribution	at this report	tis complet	ERITFICA	TION STA	TEMENT	dae and	helief		
— »	/ell Con	struction Di	iagran	ı		NAME_E	ATON DRI	LING CC	). 					20001.		
G	eophysic	al Log(s)	A •	·=1-			RSON, FIRM, O	R CORPOR/	ATION) (Th	PED OR PR	INTED)	<u>م</u> ات	סו		CA	95695
	ther		Anal	/515		ADDRESS	OM V		•			CITY			STATE	
ATTACH ADDITI	ONAL IN	FORMATIO	N, IF I	TEXIS	STS.	Signed	ELL DRILLERIA	UTHORIZED	REPRESE			<u> </u>	19/05/0	6 NED	{	<u>C57 A HIC - 1337</u> 83 C-57 LICENSE NUMBER
DWR 188 REV. 11-9	97			IF A	DDIT	IONAL SPACE I	S NEEDED. L	JSE NEXT	CONSEC	UTIVELY N	UMBERED F	ORM				

OB.GINAL File with DWR. WULL COMPLETION REPORT <u>21 M.C. E. W. SMAR</u>  $\Delta \phi = 0.61$ <sup>№</sup> 801406 X 77 and a charge WELL A Owner's Well No. Electric states .... Ser AL and deal Glenn  $= |X_{i}|_{X_{i}} = 1$ . . i in a traing GEOTOGRE LUG otaev\_ .... . ..... OF SCREEKED V **FLOCATION** Grey Sand admission and to a Soll lover Million  $\odot$ 2.0 aQ 12.05 20 Sand & Gravel 1.000 3.0 40 Glenn 1.72.535 45 Ηo Clay\_ MARGER DIST. C-20 i - i Gravelly Sand Gravelly Sand Kan Sutty Clay. 45 58 Yesad pe<u>n</u> :. .<u>..</u>. 94 SS. l traite tin i consis й 4-ј -98 -dayer ganed TOUATION SKEWER Zan Jany LINESS **9**-9-122 134 - ۹، ۸۷:۱۰ 122 132 138 . tan Clay\_ Sindy growly clay 139 14% In Cloy\_ 何效 1.67 176 :169 <u>جامعہ ہے</u> جدہد<u>ا</u>ے 176 19.2 Zan, A PEANNED. ت 13 . 704 X. Servery. 227 232 Chay you find the and the second the 48 6 Q 9. Rd25 Special Sec. ...X Sundy grand chay .304 .. 202 316 304 316 342 Gravel & sand with day. 342 344 Sand 366 Clayer Sand 428 62. Yellow Brown Clay 434 Sound 442 Le Yellow Brown Clay 344 366 ···· · 42.8 HUNCH YOURSHELCOMPUTE 434 . WARREN WEATHER OF COMPLETED WITE 1442 452 Grove 452 518 Lt yellow Benna Clay 11.68.64 1. 518 520 Sandy gravel Emple Co.pletion and 12dep 20milerate 30 Shollow 20102-02 presidente de la pa . . - . . . . . a part of the state 463 · · · · HAG EASING IS WVCUR MALIRAY i ser te 1660 - Saltta di  $\pm 2.46$ . - ..... ) (  $(1,1,\dots,N)$ ادو المراجع المراجع المراجع 23 - 2-Marta Real ··· / [\*. . .... 1.<sup>1</sup>7 1 \* Comp 1. 473,482 452, Sular (ب الا <u>े 5 म</u> # E. Sind 52440 490 423 0.62 . 2.9 452 442 5.5 423 161 . 24 2. 153/22/32, Sulaw Hy Sund Stad 161 108 2.4 132. 7-2. 5.5 185 73 002 HS Swed 73 3 75,44 54, Sulting Stud . 7" Sch46 .... .34 34 0 54 44 c c 25.3. VITV. CERTIFICATION NEAR MENT CAUND need as an an the read of the reaction of the second second Line da ectrum. Exploration) ZAMOTA, CA 95698 5/2261 25/00 20 ALCONTRACTORS ALCONDATIONAL CONCERSION ASSAULTED FOR ACCOMPANY AND A 1995 ACCONDENT.

### Department of Water Resources Jasper Deep

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Deep Well

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81 <u>to Et</u>	<u>Borețiole Dia.</u>	Livee	Material Grade	Inter <u>nai Dia</u>	Gauge	Slot S <u>aze</u>
473-450		Blank.	Steel	-	Sch 40	
452 - 442		Screen	Sicel	2''	Sca 40	026
442 = -		Stank	Steel	2"	Sch 40	
463		Blank	Steel	t"	Sch 40	
Middle Well						
FL to Ft	Borehoie Dia	Type	<u>Material Grade</u>	Internal Dia	Gaute	Slot Size
153 - 132		Blank	Steel	27	Sca 40	
132 - 122		Screen	Steel	2	Sch 40	020
122		Blank	Steel	<u>2</u>	525(40)	
143		Blank	Steel	1"	Sci( 40	

#### Shallow Well

	F) (0.17)	Roteliole <u>Dia</u>		Material Gade	<u>intern</u> ai <u>Dia</u>	Gauge	<u>, Sjor Siza</u>
1	F5 - 54		Blask	Steel	21	Sch 40	
£	54 - 44		Screen	Steel	2"	Sch 40	025
	44		6)ank	Steel	277	Sch 40	
	65		Blank	Steel	1	Sch 40	

### Annular Material

Fs to FL Type





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F	File with I	DWR	AU	G	08	3 2	200	2 WELL	COMP	LETIC	)N	REPOR	T	ZINJ	OZ	<u>W</u>	ŢĴ	<u>13/1</u>
J	Page 1 of 3		7450						Refer to In	struction .	Pani 7	phlet	<u>د ا</u> ر		STATE V		0./STA	
	Owner's V	Vell No.	7450	00					191 2010	. 720		24 40	-   L		<u> </u>			
$\sim$	Date Work	Began_	<u>//1//20</u>	<u>02</u>			—, ```		DEDT		A	ADC			<u>-</u>	11	<u>~</u>	
	Dermit	No M	gency L W134-0	⊒∟r )2			20	Dormit	Dee 1	5/2002	12		- [	I,I	A	PN/TRS	OTHER	└ <u>───</u> ↓
	1 (21)11(	110		GI	EOI	.00	IC	LOG			1							
	ORIENTATI	ON (∡)	_v∠ ve	ERT	CAL		~ н	ORIZONTAL	ANGLE	(SPEĆ/FY)								
	DEDTUG	BOM		BR	EV	ER	SE	FL		ER								
	SURFA	ČE		~	.1		D	ESCRIPTION		_								
	Ft. to	Ft 20	BROW	Des N/	YFL	$\frac{e}{10}$	W	CLAY	, <i>color</i> , <i>el</i>		-			շ ծենքին	<b>REAT</b>	<u>ю</u> м		
	20	36	STICK	YE	RC	W	νγ	ELLOW CLAY	(		A	daress <u>.4 Will IN</u>						
	36	48	PALE	CL	VE	CL	AY					ounty GLENN						
	48	60	DARK	YE	LLC	)W	'BF	ROWN CLAY			A	PN Book 023	Page	190	Parce	1 010		,
	60	80	SUBAN	<b>I</b> GI	JLA	<u>R</u>	ro	ROUNDED G	RAVEL		To	wnship 21 N	Rang	ge 2 W	Sectio	m <u>33</u>		
	80	100	SILTY	SA SA		YC					L	atitude				` <u>-</u>	1	MIN OF O
ł	133	133	POOR							AVEL	_		CATION	SKETCH			A(	CTIVITY (2)
ł		100	SUBRO		NDI		GR	AVEL	<u> </u>				NOR	'H			$\mathbf{I}$	NEW WELL
f	160	190	DUSKY	ΥY	ELL	.01	V/E	ROWN SILTY	CLAY								MODI	FICATION/REPAIR
ĺ	190	209	DUSKY	ΥY	ELL	.OV	V/E	ROWN SILTY	CLAY W	VITH								Other (Specify)
			SIL AN	D	SAN	1D											6	ESTROY (Describe
	209	229	MEDIU	M				CRAVEL WIT									F	Procedures and Materials Jnder "GEOLOGIC LOG"
	229	240	COAR	LY SF	50		=0	GRAVEL WIT	HVERT								PLA	NNED USES (∠)
ŀ	240	250	GRAVE	=							ST					ST	WATE	R SUPPLY Domestic Public
ł	250	260	YELLO	w/	BR	ÖŴ	N I	CLAY			Š					EA	I	rigation Industrial
ľ	260	270	BLUE/	GR	EEI	V C	LA	Y										
Ī	270	280	GRAVE	ELL	.Y (	CLA	Y											
	280	290	BLUE/	GR	EEI	V C		Y AND GRAV	ELLY SA	ND							l	
Ť	290	310	BLUE/C	K ت				Y V										
ŀ	320	330	BLUE/	GR	FFI	v s											VAPO	REXTRACTION
ŀ	330	340	CLAY A	ANI	) G	RA	VE	<u>ц</u>					— souт	н	· · · · · ·			
ŀ	340	430	BLUE/0	GR	ÉEI	V C	LA	Y		· · · · · · · · · · · · · · · · · · ·	Illi Fe	ustrate or Describe D ences, Rivers, etc. and	Distance of W attach a m	ell from Roads, ap. Use addition	Buildings al paper	s, if	0	
	430	469	BLUE/	GR	EEI	V C	LA'	Y WITH GRA	/EL AND	SAND	ne	cessary. PLEASE B	E ACCURA		PLEIĘ,		E	CTENSOMETE_
	469	529	GREEM	<u>V/B</u>				Y				WATE	R LEVEI	A & YIELD	OF C	OMPL	ETED	WELL
ŀ	529	549	GRAVE							EINE S		EPTH TO FIRST V EPTH OF STATIC	NATER	(Ft.) BE	LOW S	URFACE		
ŀ	589	689	BLUE/	GR			LA	Y WITH COAF	RSE SAN		w	ATER LEVEL		_ (Ft.) & DATE	E MEASL	JRED		
ł	TOTAL DEL			10	20		 	-4			ES	STIMATED YIELD *	•	(GPM) & `	TEST T	YPE		······································
ļ	TOTAL DEI	TH OF C	COMPLET	TED	WI	ELL	97	4.2 (Feet)			TE	EST LENGTH	(Hrs.)	of a wall's l	VDOWN	m viole	_ (Ft.)	
L t				1										oj u wen s i	1	In yieu	:	·····
			BORE -			1.1	<del>.</del> .	CA	SING (S)				D	EPTH		ANNU	LAR	MATERIAL
			HOLE DIA.	<u> </u>		<u>, </u>		MATERIAL /	INTERNAL	GAUGE		SLOT SIZE	FROM	SURFACE	RE.C	BENO	<u>TY</u>	PE
	Ft. to	Ft.	(Inches)	ZAN	CREI	ğğ	님	GRADE	DIAMETER (Inches)	OR WALL	- SS	IF ANY (Inches)	Ft.	aug i	MENT	town	FILL	FILTER PACK (TYPE/SIZE)
ł	MON	1		-	S	- 1	<u> </u>	· · · · · · · · · · · · · · · · · · ·						40		<u>(⊻)</u>	<u>(¥)</u>	
ł	0	161.1	36/18				-+	ACCESS TB	1	SCH	40		0	95.5				HALLIBURTON
İ	0	140	36/18	1				BLCK PIPE	2	SCH 4	40		95.5	210			$\checkmark$	#8 GRD SAND
ļ	140	150	18		<b>1</b>			STL STEEL	2	6011	10	.020	210	507.5	ļ			HALLIBURTON
4	MON	2		-		_	-	BLCK PIPE	2	50n /	<del>4</del> 0		507.5	577				#8 GRD SAND
<u>ا ۲</u>		ATTACH	MENTS	$\frac{1}{\sqrt{2}}$	<u> </u>				I			CERTIFICA		TATEMEN	r			TALLIBURION
		Geologic	Log	•	, 			I, the undersign	ned, certify the	t this report i	s cor	mplete and accurate	to the best	of my knowledg	e and be	elief.		
ا	$\sim -$	vveil Con: Geophysic	struction Di al Log(s)	agra	m			NAME _EA	SON, FIRM, O	R CORPORA		N) (TYPED OR PRI	NTED)					
$\langle \cdot \rangle$	/	Soil/Water	Chemical	Ала	lysis			20 W. KE	MUCKY			<u>.</u>		WOODLAN CITY	ND		CA STATE	95695 ZIP
	ATTACH ADDI	TIONAL IN	FORMATIO	N, IF	IT E	xist	s.	Signed	Mark	amon	Der	DECENTATUE		<u>(</u>	08/07/0	2	]	33783-C57A
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Date Work Regar 2/11/2002         Dealer 2/12/2002           Local Permit Agency GLEAN ROUNDLY HEAT TO DEPT.		Owner's V	Well No	7450						No	·726	7	24			·			1		
Doal Penit Agency GLENN.COUNTY_HEATH DEPT         Photom Date 9252002           Penit N. MM134-02         "Penit N. MM134-02         "Penit N. MM134-02           OBELLING REVERSE         FLO MATER         Decomposition         Decomposition           Mathing         Decomposition         Decomposition         Decomposition         Decomposition           Mathing         Decomposition         Decomposition         Decomposition         Decomposition           7001         F301         FAULING REVERSE         FLO MATER         Decomposition         Decomposition           7001         F301         FAULING REVERSE         Address		Date Work	Began	7/11/20	02				Ended 7/19/20	002						LATITUDI	1		LC	ONGITUDE	
Parmit No. MW134-22         Permit Date         6/25/2002         Antimization           ORENTATION (2)	$\bigcap$	Local P	ermit A	gency C	SLE	INN	LC	ou	NTY HEALTH	DEPT.				-			11				
GREWATION (2)         December maker         Weithing           Destination (2)         December maker         Filling           Martino         December maker         Beschwicht, große, state, color, ste.           760         FSO (POCK)         Sorten (State)         December maker           780         FSO (POCK)         SORTED GRAVEL AND COARSE SANG         City CA           780         FSO (POCK)         SORTED GRAVEL AND COARSE SANG         Address, AMIN OF CIR SYLW VSchuldes           670         400 (POCK)         SORTED GRAVEL MITH PYRITE         Lambde         December maker           670         400 (POCK)         SORTED SILTY CLAY         Soction 33         Lambde           960         1000 (GRAV CELWY SILT TO FINE SAND         LocATION SKUTCH         Activity sterm           10000 (I202) SAND AND GRAVEL         CLAY WITH FINE SAND         Monter Sterm Sterm         Corrections State Sterm S	·	Permit	No. 🖊	IW134-0	2				Permit	Date _6/2	5/2002				L		A	PNIRS	OTHER		
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Describer         Describer         Describer         Describer         Describer           688         705         GRAVEL         Address 4 ML NOF CR SYELV-IOCATIONS           730         760         POORLY SORTED GRAVEL AND COARSE SANK         Commy General Sector         C		DEPTH	ROM	METHOD	5 R	EV	ER	<u>SE</u>	FL	UID WAT	ER										
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BIT         Difference         Difference <td></td> <td>850</td> <td>870</td> <td></td> <td>LY ; =1</td> <td>50</td> <td>RI</td> <td>ED</td> <td>SUBANGULA</td> <td>RIURC</td> <td>JUNDED</td> <td>4 I</td> <td>Township 21 N</td> <td>······</td> <td>Range</td> <td>2<u>W</u></td> <td>Sectio</td> <td>on <u>33</u></td> <td></td> <td></td> <td></td>		850	870		LY ; =1	50	RI	ED	SUBANGULA	RIURC	JUNDED	4 I	Township 21 N	······	Range	2 <u>W</u>	Sectio	on <u>33</u>			
040         960         GRAY CEMENTED SILTY CLAY		870	940	POOPL		80	PT	FD	GRAVEL WIT			-  I	Latitude	MIN	SE	<u>C.</u>			DEG.	MIN. SI	FC
960         920         DARK GRAY SILT TO FINE SAND           980         1000         GRAYFILUE CLAY WITH FINE SAND           1000         1020         SAND AND GRAVEL           1000         1000         SAND AND GRAVEL           1000         1000         SAND AND AND AND GRAVEL           1000         SAND AND AND AND AND AND AND AND AND AND	-	940	960	GRAY		MF	NT	FD	SILTY CLAY		<u> </u>	┢	LO	CAT	ION	SKETCH-				CTIVITY (	<u>∠)</u> —
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1000         1020         SAND AND GRAVEL		980	1000	GRAY/	BL	UE	CL	AY	WITH FINE S	AND										ICATION/REP Deepen	AIR
Image: Source of the source of the		1000	1020	SAND	AN	DG	<b>BRA</b>	VE	EL											— Other (Sp	ecify)
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Source         Source<																				DIRECT P	USH
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WATER LEVEL & YIELD OF COMPLETED WELL         WATER LEVEL & YIELD OF COMPLETED WELL         DEPTH TO FIRST WATER												- 1	rences, Rivers, etc. and necessary. PLEASE B	E AC	n a map. CCURAT	E & COM	LETE.	ш 	E	(TENSON	AETE.
Depth to First WATER(FL) BELOW SURFACE         Depth of static         TOTAL DEPTH OF BORING 1020(Feet)         TOTAL DEPTH OF BORING 1020(Feet)         TOTAL DEPTH OF COMPLETED WELL 974.2(Feet)         DEPTH OF COMPLETED WELL 974.2(Feet)         DEPTH OF COMPLETED WELL 974.2(Feet)         DEPTH OF COMPLETED WELL 974.2(Feet)         DEPTH OF PROTECTION SURFACE         DORE - HOLE         TYPE ()         DIA         Yet of Rational Completence         O         328         36/18         O         540         550         550         560         STIL STEEL         2         0         3689         36/18         V         STL STEEL         2         0         540         550         18       V         STL STEEL       2         0       269         36/18       BLCK PIPE         4       SCH 400         0       869         0       869         36/18       BLCK PIPE										L		Г	WATE	R LI	EVEL	& YIELD	OF C	OMPI	LETED	WELL	
DEPTH OF STATIC     DEPTH OF STATIC       WATER LEVEL     (FL) & DATE MEASURED       TOTAL DEPTH OF BORING     1020       TOTAL DEPTH OF COMPLETED WELL 974.2     (Feet)       TYPE     (TYPE       DEPTH (Inches)     TYPE       O 328 36/18     ACCESS TB 1       Stat STL STEEL 2     020       540 350 18     STL STEEL 2       0 369 36/18     BLCK PIPE 2       CERTIFICATION STATEMENT       Geologic Log					Ú.	<u> </u>				,,,,,_,,,,,,,,,,,,,,,,,,,,,,,,		1	DEPTH TO FIRST \	NATE	R	(Ft.) BE	LOW S	URFAC	E		
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$												1	DEPTH OF STATIC								
TOTAL DEPTH OF BORING       1020 (Feet)         TOTAL DEPTH OF COMPLETED WELL 974.2 (Feet)       TEST LENGTH							ć						NATER LEVEL	*		(FI.) & DATE	MEASU	JRED VDE			
TOTAL DEPTH OF COMPLETED WELL $974.2$ (Feet)       May not be representative of a well's long-term yield.         May not be representative of a well's long-term yield.         May not be representative of a well's long-term yield.         DEPTH FROM SURFACE       OF E. DIAL         DIAL TYPE ( $\angle$ ) $\exists$ $\exists$ $\exists$ $d$ $\exists$ $\exists$ $d$ $d$ $d$ $d$ d $d$ $d$ $dd$ $d$ $d$ $dd$ $d$ $d$ $dd$ $d$ $d$ $dd$ $d$ $d$ $dd$ $d$ $dd$ $d$ $d$ $dd$ $d$ $dd$ $d$ $dd$ $d$ $dd$ $d$ $dd$ $d$ $dd$ $d$ $dd$ $d$ $dd$ $d$ $dd$ $d$ $dd$ $d$ $dd$ $d$ $dd$ $d$ $dd$ $d$ $dd$ $d$ $dd$ $d$ $dd$ $dd$ $d$ $dd$ $d$ $dd$ $d$ $dd$ $d$ $dd$ $dd$ $d$ $dd$ $d$ $dd$ $d$ $dd$ $dd$ $dd$ $d$ $dd$ $d$ $dd$ $dd$ $dd$ $d$ $dd$ $dd$ $d$ $ddd$ $dd$ $ddd$ $ddd$ $ddd$ $dd$ $dddd$ $dddddddddd$		TOTAL DE	PTH OF	BORING .	10;	20		. (Fe	eet)				TEST LENGTH		(Hrs.) T(	TAL DRAW		11" 60	(Et.)	· · · · ·	
$\mathcal{B} = \begin{bmatrix} \frac{DEPTH}{FROM SURFACE} & \frac{BORE}{HOLE} & \frac{TYPE(\angle)}{TYPE(\angle)} \\ \frac{R}{V} & \frac{I}{V} & $		TOTAL DE	PTH OF	COMPLET	IED	W	ELL	<u>97</u>	4.2 (Feet)				May not be repr	esen	tative o	f a well's l	ong-ter	m yiel	d		
DEPTH FROM SURFACE       BORE HOLE       TYPE (1) WE # 200 #       MATERIAL/ GRADE       INTERNAL DIAMETER (Inches)       GAUGE OR WALL IF ANY (Inches)       SLOT SIZE IF ANY (Inches)       DEPTH FROM SURFACE       ANNULAR MATERIAL (TYPE.(I)         0       328       36/18       ACCESS TB       SCH 40       FL       FL       ITTONITE FILE       FL       FL       ITTONITE FILE       FL       FL       ITTONITE FILE       ITTONITE FILE <td>1</td> <td></td> <td> </td> <td></td> <td>1</td> <td></td> <td></td> <td></td> <td>~</td> <td>SINC (S)</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>A 3131</td> <td></td> <td>MATERIA</td> <td></td>	1				1				~	SINC (S)								A 3131		MATERIA	
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Pt. to       Pt.       (inches) $\overrightarrow{a}$ $\overrightarrow{b}$ $\overrightarrow{b}$ $\overrightarrow{c}$				DIA.	¥	EN	7g	E	MATERIAL /	INTERNAL	GAUGE	1	SLOT SIZE	<u> </u>			CE-1	BEN	2002		PACK
0       328       36/18       ACCESS TB       1       SCH 40       796       929.3       ✓       #8 GRD SAND         0       540       36/18       Image: Signed State Stat		Ft. to	Ft.	(Inches)	BLA	CRE	85	Ш	GRADE	(Inches)		SS	(inches)		Ft. to	Ft. AU	MENT	TONIT	EVFILLE	(TYPE/S	IZE)
0       540       36/18       ✓       BLCK PIPE       2       SCH 40       929.3       1020       ✓       25% LIME         540       550       18       ✓       STL STEEL       2       .020		0	328	36/18			-9	<u> </u>	ACCESS TR	1	SCH	40			796	929.3	<u>/</u> /_	<u>(-</u> /	$\overline{\checkmark}$	#8 GRD	SAND
540       550       18       ✓       STL STEEL       2       .020         550       571.1       18       ✓       BLCK PIPE       2       SCH 40         EXT       1       0       869       36/18       ✓       BLCK PIPE       4       SCH 40         O       869       36/18       ✓       BLCK PIPE       4       SCH 40       Image: Construction Statement	-	0	540	36/18	1				BLCK PIPE	2	SCH	40		9	29.3	1020		1	1	25% LIM	E
B       550       571.1       18       ✓       BLCK PIPE       2       SCH 40         B       EXT       1       Image: State of the state of th		540	550	18		1			STL STEEL	2			.020								
B       EX I       1       1       BLCK PIPE       4       SCH 40		550	571.1	18					BLCK PIPE	2	SCH	40	)								
ATTACHMENTS (∠)	$\mathcal{B}$	EXT	1	36/18	<u>                                     </u>						80U	10									
ATTACHINENTS (*)  Geologic Log  Well construction Diagram  Geophysical Log(s)  SolfWater Chemical Analysis  Other  ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.  DWR 188 REV. 11-97  DWR 188 REV. 11-97  LEADDITIONAL SPACE IS NEEDED. USE NEXT CONSECUTIVELY NUMBERED FORM			ATTACT	IMENING	Ľ	Ĺ				4	<u> 30 П</u>	40			NI CUT	A (T) [5] R (T = 1 = 1	 	<u> </u>	L		
Mell Construction Diagram     Geophysical Log(s)     Soil/Water Chemical Analysis     Other     ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.     WARE EXAMPLE ADDITIONAL SPACE IS NEEDED. USE NEXT CONSECUTIVELY NUMBERED FORM			Geologic	Log	(⊻.	, -			I, the undersig	ned, certify th	at this report	is c	CENTIFICA	to th	e best of	my knowledg	e and be	elief.			
Soll/Water Chemical Analysis     Soll/Water Chemical Analysis     Other     ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.     DWR 188 REV. 11-97     JE ADDITIONAL SPACE IS NEEDED. USE NEXT CONSECUTIVELY NUMBERED FORM		Ц —	Well Cor	nstruction Di	iagrai	m				ATON DRII	LLING CC	). ATK	ON) (TYPED OR PR	INTE	 D)					······	
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J	Page 3 of	3							Refer to I	nstruction	Pan Pan	aphlet						J.STAT		7
	Owner's	Well No	7450						11	°. / 26	17	24								
~	Date Wo	rk Began	7/11/20	02			_, E	Ended //19/2	2002									<u> </u>		٦
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	48	60	DARK	YE	LLC	DW/E	BRO	WN CLAY			- A	PN Book 023		Page 190	Pa	rcel	010			
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	190	209	DUSK	Y YI	ЕЦ	_OW	/BR	OWN SILT	Y CLAY V	NITH									Other (Specify)	_
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	209	229	MEDIU	M	3R(		I/YE	LLOW CLA	4Y		-							P	rocedures and Materia Inder "GEOLOGIC LO	als ⊮G")
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Ć	280	290	BLUE	SRI				AND GRAY	ELLI SP		-							5	DIRECT PUSH	-
1	230	310	CPAVE								·								INJECTION	_
	310	320					$\frac{1}{TV}$				·							VAPO	REXTRACTION	-
	330	340				RA\					·			- SOUTH						-
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]	890	974.2	18	1			Ē	<b>SLCK PIPE</b>	4	SCH	40		L	0 95	.5		~		HALLIBURTO	N
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_	,	Well Cor	struction D	iagra	m			NAME_E	ATON DR	ILLING CO	). ATIC		11.17							-
· (	) –	Geophysi	cal Log(s) c Chemical	Anal	vsie			20 W. KE	ENTUCKY		л IIO 			WOODL	<u>AN</u> D			CA	95695	_
· 1	-	Other						ADDRESS	M. L	$\sum_{i=1}^{n}$				CITY	/ /	07/01	>	STATE	ZIP	
	ATTACH AL	DDITIONAL II	FORMATIO	N, IF	IT E	XISTS	•	Signed WE	LL DRILLER/	AUTHORIZED	RE	PRESENTATIVE			DATE	SIGN	ED		2-57 LICENSE NUMBI	ĒR
7	WD 188 DEV	/ 11-97			16		ITIO	MAI SPACE IS	S NEEDED	USE NEXT	CO	NSECUTIVELY N	IUM	ABERED FORM						



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21N/02W-36M

#### ORIGINAL File with DWR

#### STATE OF CALIFORNIA THE RESOURCES AGENCY DEPARTMENT OF WATER RESOURCES WATER WELL DRILLERS REPORT

Do not fill in

No. 315494

e of Intent No.	State Well No
Local Permit No. or Date <u>B5768</u>	Other Well No90215-1
	(10) WELL LOC: Total donth 155 ft Completed depth 145 ft
	from ft. to ft. Formation (Describe by color, character, size or material)
	0 - 15 Brn sandy clay
(2) LOCATION OF WELL (See instructions): 447	15 - 25 Brn sandy clay and gravel
Gienn Owner's Well Number DMW-2	25 - 34 Grev clav and sand
County <u>Greenn</u> Owner's wen Number <u>Brite B</u>	34 - 40 Clay
Well address it different from above 2 \scale	40 - 55 Clay sand and gravel
Township Range Section	$55 - 68$ Gravel $\wedge$
Distance from cities, roads, railroads, fences, etc.	53 - 130 Gravel and CAV
<u>APN#: 23-08-041</u>	
	130 - 155 Graves
(3) TYPE OF WORK:	
See Attached New Well X Deepening	
Reconstruction	
Reconditioning	
Horizontal Well	
destruction materials and p	
cedures in Item 12)	
(4) PROPOSED USE	
Domestic	Mrs - (10) - (12)
Irrigation	
Industrial	
Test Well	
Municipal	
Other	$\frac{1}{\sqrt{2}}$
WELL LOCATION SKETCH	nq v - v
(5) EQUIPMENT:	
Rotary Reverse Reverse No Size	
Cable Air Air Reserved bore	
Other $\Box$ Bucket $\Box$ Recked from 1/10 to 155	$(\mathbf{w})$ –
(7) CASING INSTALLED: (8) PERFORATIONS:	-
Steel It Plastic Oncrete Type of performion or size of screen	-
From The Dia Core or Fibre To Abo	_
ft. ft. Wall Wall	_
	0 –
	_
(9) WELL SEAL: $110$	A 1980
Was surface sanitary seal provided? Yes $\Box_{\mathbf{x}}$ No $\Box$ If yes, to depth $\Box_{\mathbf{x}}$	
Were strata sealed against pollution? Yes 🗌 No 📋 Interval	. it
Method of sealing	Work started $3-22$ 19 09 Completed $3-24$ 19 02
(10) WATER LEVELS:	WELL DRILLER'S STATEMENT: 153
Depth of first water, if known	. ft. This well was drilled under my jurisdiction and this report is true to the
Standing level after well completion	ft. best of my knowledge and belief Z Na
(11) WELL TESTS:	Signed Sturker Il Maggin
Was well test made? Yes No 🕱 If yes, by whom?	(Well Driller)
Turne of test Pump Bailer Air lift	NAME Maggiora Bros. Driffing, Inc.
to water at start of test tt. At end of test	Address
Discnarge gal/min after hours Water temperature	City Watsonville, CA ZIP 95076
Chemical analysis made? Yes L No 🗠 It yes, by whom?	License No. 249957 Date of this report 6-30-89
Was electric log made Yes [ ] No 🔀 It yes, attach copy to this report	LICENSE NO Date of this report O

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

Page 1 of 1								Refer to l	nstru	ection Pa	amphlet			S	TATE W	ELL N	O/STAT	TION NO.
Owner's V	Well No.	7617 M	101	1				N	o. 7	268	94		1				I	
Date Work	Began .	12/10/20	003			. En	ded 12/17/	2003						LATITUDE	1	·	L	ONGITUDE
Local P	ermit A	gency C	зLЕ	NN	COI	UNTY	HEALTH	I DEPT.								1		
Permit	No. M	W 188-C	)3				Permit	Date 12	/16/	2003		L			AF	PN/TRS	OTHER	2
[			GE	OL	OGI	C LO	)G											
ORIENTAT	ION (⊥)	_ <b>_</b> VE	RTIC	AL .	I	HORIZO	ONTAL	ANGLE	_ (SP	ECIFY)								
DEDTU			3 R0	)T/	<b>NRY</b>		F!		)									
SURF			~			DESC	RIPTION											
Ft. to	Ft. 2	TOPSC		ribe	ma	terial,	grain, size	e, color, e	<i>c</i> .					ELL L	OCAT			
2	70	SAND			RAV	/E)					Address 50 FT	N OF C	/R 2	5 & 3.	5 MI E	: OF	-5	
70	82	YELLO					Y W/SAN		RA	VEL	City CA			*****	*****			
82	100	SAND		$\frac{\pi}{10}$	RAV	/FI					County GLENN			•		045		
100	190	YELLO	W F				N/SND A		ST	RKS	APN Book 024	Pag	e <u>02</u>		Parcel	015		
190	230	BILLE		YV	NISA		AND GRA	VEL STE	REA	KS	Township $\frac{21}{10}$	Ran	ige 3	VV	Sectio	n <u>1</u>		
230	254	SAND		G	RAV	ÆL					Latitude	MIN.	SEC.			-	DEG.	MIN.
254	324	BLUE (	CLA	ΥV		ISAN	1D				LC	CATION		етсн-				CTIVITY
324	340	SAND	ANE	G	RAV	EL		د مسلو با برا مسل با من ماین از این این این ا				NOR	(IFI				<u> </u>	NEW WELL
340	780	BLUE	CLA	YV	V/SA	ND /	AND GRA	VEL STF	REA	KS							MODI	FICATION/RE
780	800	BLACK	SA	ND	AN	D GR	AVEL											Other (8
800	808	DARK	GR/	٩Y	BRIT	TLE	CLAY											
808	830	BLACK	SA	ND	AN	DGR	AVEL					*						Procedures an
830	894	BRITTI	_E [	)AF	<b>κ</b> G	RAY	CLAY W	ITH SAN	D								DIA	NINGER GEOL
894	920	BLACK	SA	ND	AN	D GR	AVEL										WATE	RSUPPLY
920	1038	LIGHT	GR	AY	CLA	YW/	SAND AN	ND GRVL	ST	RKS	2					AST	[	Domestic
1038	1066	BLACK	SA	ND	WI1	rh si	VIALL GR	AVEL			3					ш	· · ·	MONITO
1066	1100	LIGHT	GR	AY	CLA	Y W	TH SANE	D STREA	KS									TEST
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		+									Illustrate or Describe	Distance of i	Well fre	om Roads,	Buildings	, 		REMEDIA
		+							inthe		necessary. PLEASE	BE ACCUR	hap. C ATE	& COM	PLETE.			
			·				,			T	WATI	R LEVE	L &	YIELD	OF C	OMPI	ETED	WELL
		+					,		•••••••		DEPTH TO FIRST	WATER		(Ft.) BE	LOW S	URFAC	E	
		+									DEPTH OF STATIC							
											WATER LEVEL		(F	t.) & DATE	MEASU	ired		
TOTAL DE	TH OF	BORING	153	30		(Cant)					ESTIMATED YIELD	•	(	(GPM) & "	TEST T	/PE	·····	
TOTAL DE	PTH OF 0	COMPLET	TED	WF	$\frac{1}{112}$	55	(Feet)				TEST LENGTH	(Hrs.)	) TOT	AL DRAW	DOWN		(Ft.)	
							(+ ••••)			l	May not be rep	resentativ		i weii s ii	ong-ler	m yieu	<i>u</i> .	
DEPT	н	BORE					C	ASING (S)	)			r	DEPT	н		ANN	ULAR	MATERIA
FROM SUF	RFACE	HOLE	TY	PE	<u>(~)</u>	r .		HITCOMAL		041405	01.07.0175	FROM	SUR	FACE			<u>۲۲</u>	PE
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Ft, to	۴۲.		ळ	<u>S</u>	<u>,                                    </u>	!		(Inches)	TI	HICKNESS	S (Inches)	Ft.	to	Ft.	( <u>×</u> )	(⊻)	(1)	(TYPE
0	235	6-5/8	4			PV	'C	2		SCH 4	0		0	204	1			SAND S
235	245	6-5/8		1		PV	'C	2		SCH 4	0 .030	20	4	263			<ul> <li>✓</li> </ul>	#8 GRD
245	25 <del>5</del>	6-5/8	-			PV	'C	2		SCH 4	0	26	3	271	ļ	~		CHIPS
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	ATTACH	IMENTS	(∠)			······	,				- CERTIFIC	ATION	STAT	remen	т —			
	Geologic	1.00	-				L the underei	ioned certify t	nat thi	ie ronart ie	complete and accura	e to the hes	t of mu	knowleda	ia and ha	liof		

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL STATE OF CALIFORNIA File with DWR WELL COMPLETION REPORT Refer to Instruction Pamphlet Page \_\_\_\_ of WELL №. 8014044 TPCIPCIEI En pletto Owner's Well No. \_\_\_\_\_\_\_ Date Work Began \_\_\_\_\_\_ WET LONGITUDE LATITUDE \_\_\_\_. Ended Glenn Co Itl. Local Permit Agency NO APN/TRS/OTHER 3/12/0'= Permit No. Permit Date GEOLOGIC LOG ORIENTATION (∠) HORIZONTAL ANGLE (SPECIEY) VEBTIGAL-DRILLING Kotar METHOD FLUID \_ DEPTH FROM DECRIPTION SUBFACE Describe material, grain size, color, etc •••• Et to Et. Every Location Sand O 120 med COArse Address to 20 30 Artois City\_ Ordve Fine 38 Ło Sand grave Gle 30 6401 Codise County \_\_\_\_ APN Book 024 Page 050 Parcel 014-9 38 139 ardvel Sand and 39 40 Clay Township 🔿 🖄 \_ Range \_ Section Sand 40 60 to NORTH Grav Carrie Latitude. Longitude . WEST DEG. MIN DEG. MIN. SEC SEC 60 70 Sand <u><u>arave</u></u> LOCATION SKETCH ACTIVITY (∠) 80 NEW WELL 70 andve ેલા Sanc Clay - NORTH 80 140 RNOW Clay 7+ W Grave MODIFICATION/REPAIR 150 \_ Deepen 14 O Same undvi \_ Other (Specify) 160 150 Grave Sana odinse m 60 170 Clay avive TAN DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG", 170 180 Bret Zan 長 GVOVE d 190 80 Clay 6 Sana (JVAV PLANNED USES (∠) WATER SUPPLY Clay 220 190 Grave Krown たるい \_ Domestic \_ 220 320 Winnor Clór Irrigation \_\_\_\_ Industria p. Rd 30 العمو بالطوراك EAST 330 Clay 320 tran Brown 1 arrive MONITORING Clay 330 340 Gravel Brow Zan TEST WELL ٠N Clai 360 340 CATHODIC PROTECTION HEAT EXCHANGE 370 4, 360 Clay gravel minor amounts F Sand DIRECT PUSH 460 Clay 370 MINON grave w amounts of INJECTION 460 500 Clay Savy grave in minor anounts VAPOR EXTRACTION SPARGING SOUTH REMEDIATION Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE. OTHER (SPECIFY) w/3 Thic 400 completions Con structed 32 Shallow Izdeen = moderate WATER LEVEL & YIELD OF COMPLETED WELL 191.5 93.51 393. DEPTH TO FIRST WATER \_\_\_\_\_ (Ft.) BELOW SURFACE DEPTH OF STATIC WATER LEVEL (Ft.) & DATE MEASURED ESTIMATED YIELD \* ..... \_\_\_\_ (GPM) & TEST TYPE 420 TOTAL DEPTH OF BORING (Feet) TEST LENGTH \_ (Hrs.) TOTAL DRAWDOWN\_ ..... (Ft.) .5 (Feet) TOTAL DEPTH OF COMPLETED WELL 39.3 \* May not be representative of a well's long-term yield. CASING (S) ANNULAR MATERIAL DEPTH DEPTH BORE FROM SURFACE FROM SURFACE TYPE(∠) TYPE HOLE GAUGE OR WALL THICKNESS CON-DUCTOR FILL PIPE SLOT SIZE DIA. INTERNAL SCREEN MATERIAL / CE-BEN-BLANK DIAMETER FILTER PACK (inches) GRADE MENT TONITE FILL Com Et. to Et. (Inches) (Inches) Ft. to Ft. (TYPE/SIZE) (≤) (⊻) (∠) #8 Sand 393, 363 373, Sonace Stee if 420 339 52240 1 73 1363 <u>339</u> 5 1200 2 0. 020 2" 11,142,160-152,142,0 ch40 127 #8 Sand tee 200 24 70, 152, 160, 14 1 0.020 127 184 21 Sch 40 # 8 Sand 3 84 33 13,42 72, Sur Stee 24 0.020 33 142 is <u>00</u>2 ATTACHMENTS (∠) **CERTIFICATION STATEMENT** the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief. Geologic Log Exploration trum 2 \_ Well Construction Diagram NAME CORPORATION) (TYPED OR PRIN (PER Geophysical Log(s) 95698 AMOTA Soil/Water Chemical Analyses ADDRESS CITY STATE \_ Other /8 5 02 ATTACH ADDITIONAL INFORMATION, IF IT EXISTS LER/AUTHORIZED REPRESENTATIV DWR 188 REV. 11-97 IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

#### Department of Water Resources Van Tol Deep

# 801404

# Casing

### Deep Well

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Ft to Ft.	Borehole Dia.	Type	Material Grade	Internal Dia	Gauge	Slot Size
393 5- 373		Blank	Steel	2"	Sch 40	
373 - 363		Screen	Steel	2"	Sch 40	.020
363 - +1'		Blank	Steel	2"	Sch 40	

#### Middle Well

Ft to Ft.	Borehole Dia.	Туре	Material Grade	Internal Dia	Gauge	Slot Size
$\frac{1915 - 170}{1915 - 170}$		Blank	Steel	2"	Sch 40	
170 - 160		Screen	Steel	2"	Sch 40	.020
160 - 152		Blank	Steel	2"	Sch 40	
152 - 142		Screen	Steel	2"	Sch 40	.020
142 - +1.5'		Blank	Steel	2"	Sch 40	

#### Shallow Well

Ft. to Ft.	Borehole Dia.	Type	Material Grade	Internal Dia	Gauge	Slot Size
93.5 - 72		Blank	Steel	2"	Sch 40	
72 - 42		Screen	Steel	2"	Sch 40	.020
42 - +2		Blank	Steel	2"	Scn 40	

# Annular Material

Ft. to Ft.	Type
393.5 - 353	#8 Sand
353 - 345	#60 Sand
345 - Surface	Cement Grout

	-	STA	TE OF CALIFORNIA	RESOURCES AGENCY	STATE WELL NUMBERS: 21N030723D01M-Deep6	, ,
			DEPARTMENT OF W	ATER RESOURCES DISTRICT	21N03W23D02M-Middle Zone 21N03W23D03M-Shallow Zone	د،
PROJECT Stony Creek Recharge	e Pilot Project	HOLE NUMBER	Well A - Van Tol Site	NUMBER OF COMPLETIONS 3	CONTRACTOR Spectrum Exploration, Inc.	
FEATURE Triple Completion Mc	onitoring Well	TOTAL DEPTH	420 A	TYPE OF HOLE Direct Rotary	DRILL FOREMAN Randy Criner	( TES
LOCATION Glenn County, Count	ly Rd 27 and County Rd M	DATE STARTED	3/20/02	TYPE OF RIG Ingersoll Rand	INSPECTED BY Kelly Staton	area a
UTM COORDINATES UTM 1	10 NAD 83 570561, 4391 143	DATE COMPLETE	D_3/29/02	COMMENTS Test hole drilled to 500 ft.	; well completed to 393 ft.	itte
PERCERIPTION DESCRIPTION						
LITH DEI				Upper borehole reamed out to 16 inch		
Figure 1 Poorly graded medium		L.N.F.W		diameter and 40 ft. depth		
Poorly graded gravel	Cement grout (gs to 32 ft)	FILL		Sanitary grout seal to 40 ft. depth		
Properties of the fine to med, sand		inter		wall thickness to 40 ft.		
sub-rounded clasts	#60 sand (32 ft to 36 ft)					1
Clay		4				
Gravel with fine to				<ul> <li>Stainless steel wire wrap screen 0.020 inch opening (three 10 ft. sections).</li> </ul>		
ECC States and fine to	#8 sand (36 ft to 84 ft)					
Coarse-grained sand				Centralizer		
amount of clay and sand						Π
				1 inch black steel airline		
				21 ft sediment trap		
Lt. brown to tan clay	Cement grout (84 ft to 127 f	(l		Doroholo momod to 15.5 inde diamater		 []
		. 9.	. 0.	from 40 ft. to 420 ft.		
Sand with gravel and						
Gravel and medium to						
Gravel and tan to brown	#8 sand (132 ft to 200 ft)					<u></u>
Tan/brown clay with	•			Centralizer		
Tan/brown clay with						
				1 inch black steel airline		
brown clay				21 ft sediment trap		
			•			<del> </del>

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# 801 404



File with DWR	OF CALIFOR	NIA N REPOR	r ZIN	03 W	<b>- 34</b>
Page 1 of 6 MAY 3 1 2005 Refer to 1	Instruction Pa	mphlet		TATE WELL NO	D. / STATION NO.
Owner's Well No. 7786	∾. 8162	24			
Date Work Began 3/7/2005 Ended 3/14/2005			LATTIUDE	<u></u>	LONGITUDE
Local Permit Agency GLENN COUNTY HEALTH DEPT					
Permit No. IRW280-04 Permit Date 11	1/4/2004		. L	APN/TRS/	OTHER
GEOLOGIC LOG					
ORIENTATION (1) - VERTICAL - HORIZONTAL - ANGLE -	(SPECIFY)				
DRILLING ROTARY	D				
DEPTH FROM DESCRIPTION					
Ft. to Ft. Describe material, grain, size, color, e	etc.		WELL L	CATION-	
		Address <u>.1 MI N</u>	<u>OF RD 33 &amp; .4 M</u>	WOF DE	TOUR RD
6, 24, SAND AND SWALL GRAVEL		City CA		<u></u>	
		County GLENN			ANT
33: 45: SANDY BROWN CLAY WITH SAND AN	DGRAVE	APN Book 024	Page <u>130</u>	Parcel 009	<u></u>
	AVOTOC	Township 21 N	Range3 W	Section 34	
45 90 SAND AND GRAVEL WITH BROWN CL	ATSIKE	Latitude		-	DEG MIN. S
901 145 SANDY YELLOW CLAY			CATION SKETCH -		ACTIVITY
	†		- NORTH		
					MODIFICATION/RE
					Other (S
333 342 SAND AND SWALL GRAVEL					
400 TAN CLAY WITT SAND	STREAKS				DESTROY (De Procedures an
400 440, TAN CLAY WITH SAND AND CHAVEE C					Under "GEOL(
5801 585 SAND AND GRAVEL					PLANNED US
	[	Цо		Ц	Domestic
620' 635' SAND AND GRAVEL	·	Ň		EA	Irrigation
635 650 SANDY TAN CLAY	<u> </u>				MONITO
650' 656' SAND AND GRAVEL			antes de la servici		CATHODIC PROTEC
656 678 SANDY TAN CLAY			يە مەمەمەمەر بۇيساياتىر مەمىي با	n i segn men anter en ser si a des	HEAT EXCH
678 688 SAND AND GRAVEL		1 · · ·			DIRECT
688 750 SANDY TAN CLAY		1			
750 860 TAN CLAY			· · ·		SPAR
860 960 SANDY TAN CLAY WITH SAND AND G	RAVEL		SOUTH	Buildings	REMEDIA
STREAKS		Fences, Rivers, etc. and	attach a map. Use addition	al paper if	OTHER (SPE
960 1100 BROWN CLAY WITH HARD CLAY STR	EAKS	necessary. PLEASE B	E ACCORATE & COM		
1100 1140 BLUE CLAY WITH SAND		WATEF	R LEVEL & YIELD	OF COMPL	ETED WELL
1140 1170 SAND WITH BLUE CLAY STREAKS		DEPTH TO FIRST V	VATER (FL) BE	LOW SURFAC	Æ
1170 BLUE CLAY WITH BRITTLE CLAY STR	EAKS	DEPTH OF STATIC	(Et) & DATE		
			(GPM) &	TEST TYPE	
TOTAL DEPTH OF BORING 1020 (Feet)		TEST LENGTH	(Hrs.) TOTAL DRAW	VDOWN	(Ft.)
TOTAL DEPTH OF COMPLETED WELL 980 (Feet)		May not be repr	esentative of a well's l	ong-term yiel	<i>d</i> .
		1	[	1	
DEPTH BORE - CASING (S	<u>s)</u>		DEPTH	ANN	ULAR MATERIAL
FROM SURFACE HOLE TYPE (*)		SLOT SIZE			
		IF ANY	Et to Et	MENT TONIT	FILL FILTER
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0 60 12 √ PVC F-480 2.	<u>5  SCH 8</u>	<u>su</u>			BENIO
00, 70, 12, 12, 12, PVC F-480, 2.	SCH				DENITO
$12 \times 12 \times 12 \times 12 \times 12 \times 12 \times 12 \times 12 \times$			105 105		
	5 SCH	30	135 560	+	
			TION STATEMENT	<u> </u>	
ATTACHMENTS (⊻) — Geologic Log	v that this report	is complete and accura	te to the best of my knowle	edge and belief.	:
Well Construction Diagram NAME EATON D	RILLING CO				<u></u>
Geophysical Log(s) (PERSON, FIRM	N, OR CORPORA		WOODLA	ND	CA 9569
CallANator Chamical Analysis II /II VV KETUTITISK					

IF ADDITIONAL SPACE IS NEEDED, U SE

DWR 188 REV. 11-97

File with D	WR					W	ELL	STATE O	f califoi LETIO	RNIA N	REPOR	r <b>Z</b>			34		
Page 2 of 6		7700						Refer to Ins	truction P	ampi <b>D D</b>	hlet A					13171	
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DEPTH FF	ROM	METHOD	RO	IA	<u> </u>		FL										
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	Geophys	nstruction D ical Loo(s)	agrai	n			NAME (PER	RSON, FIRM, C	DR CORPOR	ATIO	N) (TYPED OR PRI	NTED)					
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Page 3 of 6	、					* *	I	Refer to Inst	truction P	amph	let	-   <u></u>		TATE W	ELL NO.	/ STATI	ON NO.
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Ft. to	Ft	(nones)	BLA	S S	걸금		GRAVE	(Inches)	THICKNE	ss	(inches)	Ft.	to Ft	_ (⊻)	()	$(\mathcal{L})$	(TYPE/S
ZONE	3				7-							0	4	0 🗸	ļ.,	ļ	SAND S
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_ †	220	230	WELL (	GRAD	EDS	AND	WITH CL	AY								CATHO	DIC PROTECTION
$\bigcap$	230	250	POOPI	VGR				GRAVEL									HEAT EXCHANGE
$\smile$	250	200															DIRECT PUSH
	250	200															INJECTION
	260	270	POORL	Y GR		JOA										VAPO	DREXTRACTION
	270	280	WELL	JRAD	EDS	ND V	WFINE G	RVL, TAN	I CLAY								SPARGING
	280	300	SILSTC	NE W	/ITH S	SAN	2			Illustri	ate or Describe I	Distance of V	FH Vell from Roads.	Buildings		1	REMEDIATION
	300	310	SILT W	ITH S	AND	AND	GRAVEL	-		Fences	s, Rivers, etc. and	attach a m	ap. Use addition	al paper	íf		THER (SPECIFY)
	310	320	POORL	YGR	ADE	) SA	ND WITH	I CLAY		necessi	ary. PLEASE B	SE ACCUR	ATE & COM	PLEIE.			
l	320	340	WELL	GRAD	EDS	AND	WITH FI	NE GRAV	EL		WATE	R LEVE	l & YIELD	OF C	OMPL	ETED	WELL
	340	350	WELL	GRAD	FDS	AND	W/SILST	ONE. TA	N CLAY	DEPT	TH TO FIRST V	WATER-	(Ft.) BE	LOW S	URFACE	E	
	350	380	SILTW	UTH S		GR				DEPT	TH OF STATIC						
		400	CDAVE							WATE	ER LEVEL		(Ft.) & DATE	MEASU	IRED _		
	360	400	GRAVE		<u>п э</u> ,	LIS	UNE			ESTIN	MATED YIELD	*	(GPM) & `	TEST T	/PE		
	TOTAL DEP	TH OF	BORING .	<u>640</u>	(i	leet)				TEST	LENGTH	(Hrs.)	TOTAL DRAV	IDOWN		(Ft.)	
	TOTAL DEP	TH OF	COMPLET	ED WF	ELL <u>È</u>	29	(Feet)			Mo	w not he rent	resentativ	e of a well's l	ong-ter	m vield	d.	I
1										1110	xy not be repr			1			······
	DEPT	н		1			C	ASING (S)					EDTH		ANN	ULAR	MATERIAL
	FROM SUR	FACE	BORE -	TYPE	<u>(⊻)</u>							FROM	SURFACE			TY	PE
			DIA.	훅 집	→뭐립	N	ATERIAL /	INTERNAL	GAUGE		SLOT SIZE	·		CE-	BEN-	ļ	
	Ft. to	Ft.	(inches)	1 2 1 2 1 2 1 2	8 <u>9</u> -		GRADE	(Inches)	OR WALL	s	(Inches)	Ft	to Ft.	MENT	TONITI	E FILL	(TYPE/SIZE)
				<sup>™</sup> X	ĭ₫ Ē			(menes)			(		•	(⊻)	(~)	(⊻)	
	ZONE	1				<u> </u>						ļ(	208	<b>↓</b> ✓			SAND SLURRY
	0	240	12-1/4			AC	CESS TH	3 1				208	3 219	ļ	✓	ļ	CHIPS
1	0	247	12-1/4			SC	CH 40	2				219	323	ļ	<u> </u>	V	#8 GRD SAND
1	247	257	12-174			ST	L STEEL	. 2			.030	323	3 548	$\checkmark$			SAND SLURRY
1	257	278	12-1/4			SC	CH 40	2				548	3 559		~		CHIPS
1	ZONE	2				1		1				559	9 640			1	#8 GRD SAND
1	1 	ATTACT	IMENTS	└ <u>──</u> └──┴ ( ✓ ) =		<u>.</u>					CERTIFICA	TION	STATEMEN	т —	-		
$\sim$		Geologic	Log	· — /			I, the unders	igned, certify th	at this report i	s compl	lete and accurate	e to the best	of my knowledg	e and be	lie[.][		2 2 2002
()		Weil Con	struction Di	agram			NAME_E	ATON DRI	LLING CO						~ *		
$\smile$		SollAtion	Car Log(S)	Analysis			20 W K						WOODLAI	ND		CA	95695
		Other	onenical	/-maiy\$1\$			ADDRESS	Alisti	lat-				CITY			STATE	ZIP
	ATTACH ADD	ITIONAL IN	FORMATIO	N, IF IT E	XISTS.		Signed		UTUODIZED	PEDDE	SENTATIVE		^	10/01/C		-	133783-C57A
						1	VVE		U DANE	1/10/2 1/14							

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

DWR 188 REV. 11-97

:t																	
( F	ORIGINA						XX/IFT T	STATE	OF CALIFO	DRN	NA J <b>REPOR</b>	<b>T</b>			<u>-Y</u> 	 	NOT FILL IN
, 1	ace 2 of a						¥¥ JL⊥L⊥	Refer to It	nstruction	רבי Pan	mphlet	•	S	TATE V	VELLNO	D/STAT	ION NO.
	Owner's	Well No.	7449					N	° <sup>.</sup> 726	73	39		1 1 1	1		1	
$\frown$	Date Work	k Began .	8/19/20	02			, Ended 8/23/2	2002		_			LATITUDE			LC	DNGITUDE
	Local P	ermit A	gency C	SLE	NN	CNT	Y HEALTH D	EPT				╴╎└┘		<u> ·  ·</u>			
· · · · ·	Permi	t No. <u>M</u>	W133-0	2	01	0.01	Permit	Date <u>6/2</u>	25/2002					^			
				GE	OL	JGI	C LOG			-							Ì
	ORIENTAT	rion (⊥)		RTIC			HORIZONTAL	ANGLE	_(SPECIFY)								
	DEPTH	FROM	METHOD	B R		<u>RY</u>			)								
	Ft. to	Ft.	·	Desc	cribe	ma	terial, grain, siz	ze, color, el	lc.	-1					TON:		
	400	510	SILTS	ION	<u>IE, 1</u>	SAN	D WITH GRA	VELS		- A	ddress SOF C	/R 25 & E	OF C/R	D	101		
	510	530	COAR	<u>SE (</u>	SAN	D				-  c	City <u>CA</u>	<del></del>					
	530	540	GRAVE	=						-  0	County GLENN						
	550	560				VITH	GRAVEL AN	D SAND			APN Book 024_	Page 2	<u>00</u>	Parcel	1210		
	560	570	COARS	SE :	SAN	ID					ownship $\leq 1$	Kange	4 VV	Sectio	n <u>12</u>	1	
	570	580	MEDIU	МС	GRA	INE	D SAND			-  <sup>_</sup>	DEG, N	IN. SE	C.		-	DEG.	MIN. SEC.
<i>'</i>	580	640	COARS	SE (	SAN	ID A	ND GRAVEL						SKETCH-				JIIVIIY (⊻) NEW WELL
										-						MODI	FICATION/REPAIR
			<u> </u>							-							Deepen Other (Specify)
																I	DESTROY (Describe Procedures and Materials
																	JINDER "GEOLOGIC LOG")
										]						WATE	R SUPPLY
										ES1					AST		Domestic Public rrigation Industrial
										< <u>ح</u>	•				ш		
										·							
$\bigcap$								···· ·· ··		-							HEAT EXCHANGE
$\smile$																	DIRECT PUSH
			· · · · · ·														
																	SPARGING
											Illustrate or Describe L	SOUTH Distance of Well	from Roads,	Building	5,		
			·						. <u></u>	-   h	Fences, Rivers, etc. and necessary. PLEASE B	attach a map. E ACCURAT	Use additional E & COM	l paper PLETE.	1Î		
										-	WATEI	LEVEL	& YIELD	OF C	OMPL	ETED	WELL
											DEPTH TO FIRST V	VATER	(Ft.) BE	LOW S	URFACE	5	
			1								STIMATED VIELD *		(GPM) & T	EST T	YPE	<u>.</u>	
	TOTAL DE	EPTH OF	BORING	64(	2	(J	reet)				TEST LENGTH	(Hrs.) TC	DTAL DRAW	DOWN		_ (Ft.)	
	TOTAL DE	EPTH OF	COMPLE	IED	WE	LL <u>6</u>	29 (Feet)	·			May not be repr	esentative o	<u>f a well's le</u>	ong-ter	m yield	1	
1				1				CASING (S)							ANNI	JLAR	MATERIAL
	FROM SU	RFACE	BORE - HOLE	T	YPE	<u>(⊻)</u>		1	1		1	FROM	JRFACE			ΤY	PE
			DIA. (inches)	¥	N N		MATERIAL /	INTERNAL DIAMETER		Е .L	SLOT SIZE			CE-	BEN-	E FULL	FILTER PACK
	Ft. to	Ft.		물	SCR	걸릴		(Inches)	THICKNE	ss	(Inches)	Ft. to	o Ft.	(⊻)	(~)	(⊻)	(TYPE/SIZE)
	0	240	12-1/4				ACCESS T	в 1	<u> </u>			0	208	1			SAND SLURRY
	0	598	12-1/4	11			SCH 40	2	<u> </u>			208	219		~		CHIPS
	808	600	12-1/4	$\left  \right\rangle$	*	_		- 2			.030	219	323	-			FORD SAND
-		020	12 17 7				3CH 40	2				548	559	<b></b>			CHIPS
												559	640			<b>~</b>	#8 GRD SAND
1		ATTACI	IMENTS	(⊻)	) —		1				- CERTIFICA	TION ST	ATEMEN	Г			
$\bigcap$		Geologic Well Cor	Log Instruction Di	iagra	m		I, the unders	signed, certify the EATON DR	nat this report	is c ).	complete and accurate	to the best of	my knowledg	e and be	ellef.		
$\cup$		_ Geophys	ical Log(s)		hat.		(PE	RSON, FIRM, O	OR CORPOR	ATK	ON) (TYPED OR PRI	NTED) V		םו		CA	95695
		- Soil/Wate	er Cnemical	Anal	ysis		ADDRESS	This	4/45	7	<	V	CITY	0/04 //		STATE	E ZIP
	ATTACH AD	DITIONAL II	VFORMATIO	N, IF	IT EX	asts.	Signed W	ELL DRILLER/	AUTHORIZED	DRE	EPRESENTATIVE		1 DA	U/U1/C	NED		C-57 LICENSE NUMBER
	DWR 188 REV	. 11-97			IF	ADD	TIONAL SPACE	IS NEEDED.	USE NEXT	CC	NSECUTIVELY N	UMBERED	FORM				

1



ORIGINA	L.	15.11.0	. A	/	20	15	)	STATE	OF CALIF	ORI	NIA			DWR US	E ON	LY	- DO	NOT FILL IN
File with D	OWR 1	JAN U	8	ŹШ	99		WELL	COMP	LETI	ON Par		3]	г   🕹	LN				
Page 1 of 3 Owner's N	Vell No.	8434						N	o. <b>F01</b>	[ <b>n</b>	3388 A	C		<b>}</b>			<u>, 31</u>	
Date Work	Began _	11/23/2	009			., E	nded12/3/2	009						LATITUDE	:		L	
Local Pe	ermit A	gency (	Glen	n C	ount	уH	ealth Dept				<u></u>							
Permit	<u>No. M</u>	W 319-(	<u>)9</u> : CF		CI	Γī	Permit	Date <u>11</u>	/19/2009	)			L		A	PN/180/		
	<b></b>		GE		JOI				(00-01-0)									
ORIENTATI	ON (⊻)			רב אדנ	RY	IORIZ	ONTAL	ANGLE	_(SPECIFY)	)								
DEPTH F	ROM	METHOL	) [22	2.1.2.1	]	DES	CRIPTION											
<u> </u>	Ft.	Ton ao	Desc	ribe	mat	eria	l, grain, siz	e, color, e	tc.	-+-				WELL LO	CAT	ION_		
5		Sand a	II and c	ากลง	/el					- I	Address 70' So	of I	Road 25	<u>&amp; 70' W</u>	of Ro	ad D		
65	170	Sandy	brov	<u>vn</u> c	lay	·				-10	City <u>CA</u> CountyGLENN	1						
170	180	Sanda	ind ç	jrav	/el						APN Book 024		Page 2	00	Parce	1 021		
180	230	Sandy	brov	vn c	clay				·	] <sub>1</sub>	Township 21 N		Range	4 W	Sectio	on <u>12</u>	(	A-3-4)
230	260	Sand a	ind ç	jrav	'el					_  Î	Latitude						1	
260	275	Sandy	brov	<u>vn c</u>	lay					-		мі ЭС	N. SEC ATION S	). KETCH-			DEG.	MIN. SEC. CTIVITY (🗹) —
275	280	Sand a	ina g	jrav	vei vlav					-[-			- NORTH				<b>⊥</b>	NEW WELL
370	380	Sand a	and c	<u>irav</u>	rel					-	or (	1	No.	N).			MODI	FICATION/REPAIR
380	515	Sandy	blue	cla	iy			,			HG.	X	$\mathcal{W}_{\mathcal{O}}$	. X				Other (Specify)
515	540	Sand w	vith s	sma	ill gra	ave					5.1.2	V	'n	$\mathcal{V}^{\sim}$				
540¦	650	Sandy	blue	; cla	ıý wi	th s	mall grave	1				1	y.					Procedures and Materials
650 <sup>1</sup>	879	Sandy	blue	: cla	ıy						00%	5	•				PLA	NNED USES $(\checkmark)$
879¦	900	Small g	<u>jrave</u>							- ;;	jur					ь	WATE	R SUPPLY Domestic Public
950	1080	Blacks	and		<u>iy</u>					-I¥						EAS		rrigation Industrial
	1000	Diaoke								-								
		   															САТНО	DIC PROTECTION
1																		HEAT EXCHANGE
		 								_								DIRECT PUSH
		 								-							VAP	OR EXTRACTION
													— зоштн -					
		 I								- 1	Illustrate or Describe	<i>Dis</i> da	stance of Well	from Roads, . Use additiona	<i>Building</i> Il paper	s, if		DTHER (SPECIFY)
1											necessary. PLEASE H	BE	ACCURATE	E & COMP	PLĒŤE.			·····
											WATE	R	LEVEL &	2 YIELD	OF C	OMPL	ETED	WELL
										-	DEPTH TO FIRST	W	ATER	— (Ft.) BE	LOW S	SURFACE	Ξ	
L L		 								-  v	NATER LEVEL	;	(	(Ft.) & DATE	MEAS	URED _		
i			108							-  6	ESTIMATED YIELD	•_		. (GPM) & T	TEST T	YPE		
TOTAL DEI	TH OF I	BORING.	<u>100</u>	WE	— (F тт 1(	reet) 770	(East)			1	TEST LENGTH		(Hrs.) TC	TAL DRAW	/DOWN		(Ft.)	
		COMFLE		WE.		010	(Feet)				May not be rep	res	sentative of	f a well's l	ong-te	rm yiel	d.	
DEPT	н	BORE -					C	ASING (S)					DEP	тн		ANNU	JLAR	MATERIAL
FROM SUR	FACE	HOLE	TY	<u>PE</u> Z   .	<u> </u>	ł			GALIGE	=	SLOT SIZE		FROM SU	IRFACE			<u> </u>	
Ft. to	Ft.	(Inches)	ANK				GRADE	DIAMETER	OR WAL		IF ANY (Inches)	۱Ĩ	Et to	Ft	MENT	TONITE	FILL	FILTER PACK
7000	- 4			<u> </u>	릴트			(inches)	THERME		(increa)	╢			<u>(×)</u>	( <u>~</u> )	( <u>~</u> )	
	520	10-3/4		_	_		VC	25	SCH	80		╢	0	265	✓	-		Sand Slurry
520;	530	10-3/4	†††	~		P		2.5	SCH	80	.030	╢	285	<u></u>			~	SRI#8 Sand
530;	590	10-3/4	$\checkmark$			P	VC	2.5	SCH	80	)		480	496				Bentonite Seal
590¦	600	10-3/4	$\square$	✓_		P	VC ·	2.5	SCH	80	.030		496	658			~	SRI#8 Sand
600	630	10-3/4	$ \mathbf{v} $			P	VC	2.5	SCH	80	ין 	ļĹ	658	675	<u> </u>	<b>v</b>		Bentonite Seal
	ATTACH Geologic	LOG	(⊻)				I, the undersi	aned, certify t	nat this repor	rt is	<ul> <li>CERTIFIC, complete and accura</li> </ul>	AJ ate	to the best of	TEMENT	l' ige and	belief.		
-	Well Cor	struction D	)iagran	n			NAME E	ATON DRI	LLING CO	<u>).</u>								······································
	Soil/Wate	r Chemical	Anal	ysis			20 WES	<u>KENTUC</u>	KY AVE	v-110			b, W		ID		CA	95695
	Other					-	ADDRESS Signed	Mark	Dam	ion	2			CITY 1	2/31/0	9	STATE	ZIP C57 A HIC - 13378
DWR 188 REV	11 UNAL II	vrukma i 10	<i>,</i> IF		ADIS.							NIC			TE SIG	NED		C-57 LICENSE NUMBER

ORIGINAL	JAN 0 8 2009		STATE	OF CALIFO	RNIA			<u>( -                                   </u>	O NOT FILL IN
File with DWR	2000	WELL	COMP Refer to In		N REPOR				
Page 2 of 3	8434		Nejer 10 II.	o. <b>EN1</b>	N3388				
Dote Work Began	<u>. 0404</u> 11/23/2009 т		009		03300		I		
Local Permit A	genery Glenn County H	lealth Dent					1 1		
Permit No N	IW 319-09	Permit	Date 11/	19/2009		—	AP	N/TRS/OTH	ER
	GEOLOGIC L					_			
				(SPECIFY)					
	DRILLING ROTARY	EU.							
DEPTH FROM SURFACE	DES	SCRIPTION	.010						
Ft. to Ft.	Describe materia	ıl, grain, size	e, color, et	tc.		WELL LO	CATIO	<u></u>	
	1 10p SOII				Address 70' So	f Road 25 & 70 W	of Roa	id D	
65 170	Sandy brown clay				City CA				
170 180	Sand and gravel				County GLENN	- 000		0.04	
180 230	Sandy brown clay				APN Book 024	Page <u>200</u>	Parcel	12	
230 260	Sand and gravel				I ownship 21 N	Range <u>4_vv</u>	Section	1 14	
260 275	Sandy brown clay				DEG.	MIN. SEC.		DEG	MIN. SEC.
275 280	Sand and gravel				LO	CATION SKETCH			ACTIVITY (🗹 )
280 370	Sandy brown clay								
370 380	Sand and gravel								Deepen
380 515	Sandy blue clay								Other (Specify)
515 540	Sand with small grave							_	_ DESTROY (Describe
650 970	Sandy blue clay with s	small gravel							Under "GEOLOGIC LOG"
879' 900	Small gravel							PL	ANNED USES (∠)
900' 950	Sandy blue clav				ST				Domestic - Public
950 1080	Black sand				×			- E	_ Irrigation Industrial
	, 1 1								
I	1						CATH	HODIC PROTECTION	
		HEAT EXCHANGE							
1	v								
1		SPARGING							
	LETE,								
	; ; 1				WATE	R LEVEL & YIELD	OF CO	MPLETE	ED WELL
	¦			·	DEPTH TO FIRST	WATER (Ft.) BE	LOW SU	RFACE	
	/ / / /				DEPTH OF STATIC				
1					WATER LEVEL	(Ft.) & DATE	MEASU	RED	
TOTAL DEPTH OF	BORING 1080 (Feet)	)			TEST LENGTH	(GPM) & (GPM) & (Hrs.) TOTAL DRAM		PE	5+ \
TOTAL DEPTH OF	COMPLETED WELL 1070	) (Feet)			May not be repr	esentative of a well's l	ong-terr	n vield.	)
i									
DEPTH FROM SURFACE	BORE -	CA	ASING (S)					ANNULAI	R MATERIAL
		MATERIAL /	INTERNAL	GAUGE	SLOT SIZE		CE-	BEN-	
Ft. to Ft.		GRADE	DIAMETER (Inches)	OR WALL THICKNES	IF ANY S (Inches)	Ft. to Ft.	MENT 1	TONITE FIL	L FILTER PACK (TYPE/SIZE)
630 640			0.5			075 070	( <u>~)</u>	<u>(~)</u> ( <u>~</u>	
640 660	<u>10-3/4</u> ↓ P	2VC	2.5		101 .030 101	870 870		V -	Bentonite Seal
Zone 2						977 1080		~	SRI#8 Sand
0, 955	1078 V F	VC	2.5	SCH 8	30				
955 975	8-3/4 ✓ F	VC	2.5	SCH 8	.030				
975 -1030	0-3/4 V F	YUC	2.5	SCH 8	50				•
ATTACH	IMENTS ( $\checkmark$ )			al ibi		ATION STATEMENT	[	ollof	
Well Co	nstruction Diagram		TON DRI	LLING CO.	s complete and accura	le to the pest of my knowled	Jye and b	ellet.	
Geophysi	cal Log(s)	(PERS	SON, FIRM, C		TION) (TYPED OR PF		חו	CA	95695
Sou/wate	a onemical Analysis	ADDRESS			n-	CITY	<u></u>	STA	
ATTACH ADDITIONAL I	NFORMATION, IF IT EXISTS.	Signed WEL	<u>/////</u>	<u>UTHORI</u> ZED	REPRESENTATIVE	<u>1</u> DA	<u>2/31/09</u> TE <u>SI</u> GN	9 ED	<u>C57 A HIC - 1337</u> 8 <u>C-57 LICENSE</u> NUMBER
DWR 188 REV. 11-97	IF ADDITIO	NAL SPACE IS	NEEDED,	USE NEXT (	CONSECUTIVELY	UMBERED FORM			

ORIGINAL	JAN 0 8 2009 STATE OF CALIF	ORNIA DWR USE ONLY DO NOT FILL IN
File with DWR	WELL COMPLETI	
Page 3 of 3		
Deta Work Boson	11/23/2009 $E = 4.412/3/2009$	
Lagel Dermit A	consy. Glenn County Health Dept	
Permit No N	W 319-09 Permit Data 11/19/2009	APN/TRS/OTHER
	GEOLOGIC LOG	
DEPTH FROM	DESCRIPTION	
Ft. to Ft.	Describe material, grain, size, color, etc.	
0 5	Top soil	Address 70' Sof Road 25 & 70' Wof Road D
5 65	Sand and gravel	City CA
65 170	Sandy brown clay	CountyGLENN
170 180	Sand and gravel	APN Book 024 Page 200 Parcel 021
180 230	Sandy brown clay	Township 21 N Range 4 W Section 12
230 260	Sand and gravel	
260 275	Sandy brown clay	DEG. MIN. SEC. DEG. MIN. SEC.
275 280	Sand and gravel	
280 370	Sandy brown clay	MODIFICATION/REPAIR
370 380	Sand and gravel	- Deepen
380 515	Sandy blue clay	
515 540	Sand with small gravel	DESTROY (Describe
540; 650	Sandy blue clay with small gravel	- Procedures and Material Under "GEOLOGIC LOC
650; 879	Sandy blue clay	PLANNED USES $(\checkmark)$
879 900	Small graver	WATER SUPPLY
900 950	Diank aand	
950 1080		
		. TEST WELL
		CATHODIC PROTECTION
		- DIRECT PUSH
		INJECTION
		VAPOR EXTRACTION
		SPARGING
		- Illustrate or Describe Distance of Well from Roads, Buildings, Ences Bivers etc. and attach a man Use additional paper if OTHER (SPECIEY)
		necessary. PLEASE BE ACCURATE & COMPLETE.
	l	WATER LEVEL & YIELD OF COMPLETED WELL
·!	l	- DEPTH TO FIRST WATER
	1	DEPTH OF STATIC
	I	WATER LEVEL (Ft.) & DATE MEASURED
TOTAL DEPTH OF	$\mathbf{R}_{\text{OPING}} = 1080 \qquad (\mathbf{E}_{\text{C}})$	ESTIMATED YIELD * (GPM) & TEST TYPE
TOTAL DEPTH OF	COMPLETED WELL 1070 (Feet)	TEST LENGTH(Hrs.) TOTAL DRAWDOWN(Ft.)
TO THE DEFINION		May not be representative of a well's long-term yiela.
DEPTH	CASING (S)	DEPTH ANNULAR MATERIAL
FROM SURFACE	HOLE TYPE ( <u>&lt;</u> )	FROM SURFACE TYPE
	UIA. 폴 쇼 · 영 요 MATERIAL / INTERNAL GAUG (Inches) 중 및 중단 요 GRADE DIAMETER OR WA	E   SLOT SIZE   CE-   BEN-       FILTER PACK
Ft. to Ft.	· / 굽 방 2 글 (inches) THICKNE	SS (Inches) Ft. to Ft. $(\checkmark)$ ( $\checkmark$ ) ( $\checkmark$ ) (TYPE/SIZE)
1030 1050	8-3/4 V PVC 2.5 SCH	80
1050¦ 1070	8-3/4 🖌 🛛 PVC 2.5 SCH	80
ļ		
ATTACH		CERTIFICATION STATEMENT
Well Co	nstruction Diagram	יום שהוקיים מוש מששומנס גם זורב שבאר טו זווץ אושאיבעשים מוש שפוופו. C.
Geophysi		
Soil/Wate		CITYSTATEZIP
ATTACH ADDITIONAL I	NFORMATION, IF IT EXISTS. Signed MIEL DOLLEDIALITHODIZE	
DWR 188 REV. 11-97	IF ADDITIONAL SPACE IS NEEDED, USE NEXT	CONSECUTIVELY NUMBERED FORM



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	-lie with	DVVR							WELL	COMP	<b>LET</b>		N	REPOR	1			17		E		
]	Page 1 of	13	7677 .							Rejer to In								3 .	IA E V		J SIAI	
	Owner's Date Worl	Well No. Began	<u>/6// 1</u> 5/6/2004	<u>иО</u> 1	N				Inded 5/14/20	004	<sup>.</sup> / 2	03	2	2			LA					NGITUDE
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	820	900	MED-C	RS	\$ B	BLA	CK	SA	AND AND G	RAVEL			Fenc	rale or Describe L es, Rivers, etc. and	Du iai ar	ttach a map	Ujrom Use a	dditions	Building al paper :	<i>s,</i> if	(	OTHER (SPECIFY)
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	·····		DIA. (Inches)	¥	EEN	Ż	a di di		MATERIAL /	DIAMETER		UGË VALL		SLOT SIZE					CE-		EN I	FILTER PACK
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	_	ATTACH Geologic	IMENTS Log	(⊻	)	-			I, the undersi	gned. certify t	that this re	eport is	s con	CERTIFICA npiete and accurate	AT. ate	ION ST. to the best	ATE of mv	MEN] knowle	l' dge and	belief.		
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	Jwner's We	ell No7	7677 <b>M</b> O	N				No.	726	922	2			ATTUDE	ЦL			
	Date Work B	egan <u>5/</u>	6/2004		,	Endec	15/14/200							1	1			
$\mathcal{D}$	Local Pern	nit Age	ncy GLE	INN	COUN	ITY H	Domait I	DEPL	2004			L	L L	· · · · · · · · · · · · · · · · · · ·	APN/	TRS/OT	HER	
_ ۱	Permit I	NO	<u> </u>	EOL	OGIC	LOG												
	ORIENTATIO	N (⊻)		CAL	—— но	RIZONT	AL A	NGLE	(SPECIFY)									
			NETHOD E	OT	ARY		FLI	JUD <u>MUD</u>	<u> </u>									
	SURFAC		De	cribe	Di materi	ial, gr	PTION rain, size,	color, etc.		ы						u		
		20		ID C	GRAVE	L				Add	ress 75 FT N	N OF	- C/R <sup>W</sup> 1	88.9W	<u>n E O</u>	F C/F	<u> </u>	
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	160	220	TAN/BRO	W	N SILT		٩Y	ingen and an and a		Lat	itude	L						I SEC
	220	240	MED-CR	<u>s s</u>				. Y	ilago - co-		LOC	IN. CATI	ON SK	етси —		Ĩ	- ACT	TVITY (2) -
	240	260	MED-CR									- r	NORTH			-	MODIFIC	W WELL
	320	360	POORLY	GF	NOV DS	CAN	IC SANE	)		]								- Deepen Other (Specify)
	360	380	POORLY	SR	TD SA	ND II	A VOL	CANIC A	SHY CL	ľ						-		
	380	400	POORLY		RD SAN				CLAY	-							DE Pro	STROY (Describe cedures and Materials
	400	480   520	MED-CR	S S	AND V		CLAY			1							PLAN	NED USES (⊥)
	520	540	POORL	GF	RD SAI	ND		else verein <del>gentes e</del> n		1						⊢ l	WATER	SUPPLY
	540	580 ¦	TAN CL	AY						-NES						EAS	Irri	gation Industrial
	580	620	POORLY		RD SAI		ND GRA		VEL	-[								MONITORING -
	640	660	BLUE C		W/PO	ORL	GRDS	SAND		-						þ	ATHOD	
$\cap$	660	680	NED-CR	s s	SAND V	V/ME	TAMOR	PHIC GR	AVEL								н	EAT EXCHANGE DIRECT PUSH
U	680	760	BLUE C	LAY	W/SA	ND A	ND GRA	VEL		_								INJECTION
	760	780	TAN/BR				Y W/FIN			-1							VAPO	R EXTRACTION SPARGING
	800	820	MED-CF	25 5	SAND V	N/BLI	JE CLA	<u>Y</u>			retrate or Describe	Distar	SOUTH -	from Roads. B	Buildings			
	820	900	MED-CF	RS E	BLACK	SAN	D AND G	BRAVEL		Fei	nces, Rivers, etc. and essary. PLEASE	d attac BE AC	h a map.	Use additional	paper il	r I	0	THER (SPECIFY)
	900	1020	TUSCA	N C	LAY AN	ID AS	SH W/SC	DME FINE	SAND	-	WATE	R LI	EVEL &	YIELD C	of co	MPLE	TED V	WELL
	n 2, - 2, -									DE	epth to first	WATE	ER	(Ft.) BEL	low si	JRFACE	E	
			}	- -		<b>x</b> (4)-42		an an an Anna an Anna Anna Anna Anna An			PTH OF STATIC			(Ft) & DATE	MEASU	red		
	1		i L							- ES	STIMATED YIELD	•		. (GPM) & T	EST TY	PE		
	TOTAL DE	PTH OF	BORING	920	(F	Feet)				Т	EST LENGTH		(Hrs.) TC	TAL DRAW	DOWN_	. 1	_ (Ft)	
	TOTAL DE	PTH OF	COMPLET	ED	WELL 9	00	(Feet)				May not be rep	nreser	itative of	a well's la	ong-teri	n yieu	<u>.                                    </u>	
	DEPT	гн	POPE				(	CASING (S	<u>)</u>			╢.	DEF	TH		ANN	ILAR	MATERIAL
	FROM SUF	RFACE	HOLE	<u>۲۲</u>	PE ( <u>/)</u> 값 [. 여 집	Н м	ATERIAI /	INTERNAL	. GAU	GE	SLOT SIZE	<b>  </b> _′			CE-	BEN-		
	Fit. 10	PL.	(inches)	IAN			GRADE	DIAMETE (Inches)	R ORW	ALL NESS	IF ANY (Inches)		PL 1	D FL	MENT	TONITE (√)	FILL	(TYPE/SIZE)
	ZONE	2			이 겁피	· <b> </b>						1上	725	789	1			SAND SLURRY
	0	130	12	1		PV	C	2.	5 SC	H 80		╢┝	789	920	<u> </u>			THE GRU SAND
	130	140	12		▲	PV	C	2.	S SC	H 80 H 80	.030	╢╴		 	- N	hig	17	100-
	140	150	12	┝┻┤	+		ic i	2.	5 SC	H 80	.030	<u>1</u>  -	01	44 <sub>3</sub> /	F	00		in a star with the star
	160	250	12	1		PV	'C	2.	5 SC	H 80				 		<u> </u>	<u> </u>	
		ATTAC	HMENTS	(∠)			I the under	reigned contin	that this re	port is r	<ul> <li>CERTIFIC</li> <li>complete and accur</li> </ul>	ATIC trate to	DN ST.	ATEMEN of my knowle	l'	beli <b>e</b> f.		
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IGINAL with DWR WELL	STATE OF CALIFORNIA COMPLETION RE Refer to Instruction Pamphlet No. 726922			
wher's Well No. 7677 MON				
ate Work Began 5/6/2004, Ended 5/14/2			APN/T	RS/OTHER
Local Permit Agency GLENN COUNTY HEALTH	Deta 5/3/2004			
Permit No. MW207-04 Permit	Date			I
GEOLOGIC LOG	ANCIE (SPECIEV)			
ORIENTATION (1) VERTICAL				
DEPTH FROM METHOD DESCRIPTION	e color etc.	WF	LL LOCATION	ECIRP
SURFACE Describe material, grain, siz		<u>, 75 FT N OF C/R 18</u>	S& .9 MIEO	
0 20 SAND AND GRAVEL	City C/	Α		
20 60 TAN SILTY CLAY	Coumty	GLENN		260
60 70 SAND AND GRAVEL	APN R	ook 046 Page 310	Parcel	30
70 120 TAN SILTY CLAY	Townsl	nip 22 N Range 2 V	vv Section	
120 160 SAND AND GRAVEL	T atitiv	ie		DEG. MIN. SEC.
160 220 TAN/BROWN SILTY CLAY	Lautu	DEG. MIN. SEC.	етсн	ACTIVITY (2)
220 240 MED-CRS SAND		NORTH -		
240 260 MED-CRS SAND WITH CLAY				MODIFICATION/REPAIK
260 320 TAN SILTY CLAY				Other (Specify)
320 360 POORLY GRD VOLCANIC SA	OL CANIC ASHY CLY			
360 380 POORLY SRTD SAND IN A	PAVE			<ul> <li>DESTROY (Describe Procedures and Materials)</li> </ul>
380 400 POORLY GRD SAND AND G	CRAVEL WICLAY			Under "GEOLOGIC LOG")
400 480 POORLY SRTD SAND AND				PLANNED USES (1)
480' 520' MED-CRS SAND WITH CLA	· · · · · · · · · · · · · · · · · · ·			Domestic Public
520 540 POORLY GRD SAND	t			Industrial
540' 580'TAN CLAY				
580' 620 POORLY GRD SAND AND C	KAVEL			TEST WELL
620 640 TAN/BLUE CLAY W/POORL	Y GRU GRAVEL			LEAT EYCHANGE
640 660 BI UE CLAY W/POORLY GF	RD SAND			DIRECT PUSH
680 NED-CRS SAND W/METAN	IORPHIC GRAVEL			INJECTION
760 BILLE CLAY W/SAND AND	GRAVEL			VAPOR EXTRACTION
700 TAN/RROWN CLAY				SPARGING
100 100 TARK BI UF/GRAY CLAY	V/FINE SAND	SOUTH	n	REMEDIATION
180 BOULDAIR BLOS SAND W/BLUE	CLAY Illus	trate or Describe Distance of We	ell from Roads, Buildi b. Use additional pap	er if OTHER (SPECIFT)
800 820 MED CRS BLACK SAND A	ND GRAVEL	SSARY. PLEASE BE ACCURA	TE & COMPLET	
820 900 MED-CRS DECORD AND ASH	W/SOME FINE SAND	WATER LEVEL	& YIELD OF	COMPLETED WELL
900 1020 103CAN CEAT AND 131		TO EIRST WATER	(Ft) Below	V SURFACE
	DE	TH OF STATIC		
	Martin Lang	TER LEVEL	(Ft.) & DATE ME	
and the second	50	TIMATED YIELD	(GPM) & TEST	
	П	EST LENGTH (Hrs.)	TOTAL DRAWDO	win (ru)
TOTAL DEPTH OF BORING 920 (Feet)	(Feet)	May not be representative	e of a well's long	-161 m y1000.
TOTAL DEPTH OF COMPLETED WELL 900	(1.001)			ANNULAR MATERIAL
	CASING (S)	EDA		ТҮРЕ
DEPTH BORE		SLOT SIZE		CE- BEN- FILTER PACK
FROM SURFACE HOLE	ERIAL / INTERNAL GAUGE	IF ANY	to FL N	$(\mathbf{T})  (\mathbf{T})  (\mathbf{T})$
	ADE (Inches) THICKNESS	(incnes)		SAND SLURF
FL to FL III S TI	25 SCH 80	.030	$\frac{0}{1}$ 31	✓ #8 GRD SAN
250 260 12 V PVC	2.5 SCH 80	<u>ا</u> ـــــا		SAND SLURF
260 275 12 V PVC			20   114 14 201	#8 GRD SAN
ZONE: 3	2.5 SCH 80		14 1 201 01 307	VING ISAND SLUR
0 850 12/10 V PVC	2.5 SCH 8	0 .030 2	07 - 725	
850; 880 10 V PVC	2.5 SCH 8	0 3		
880 900 10 7 700		- CERTIFICATION	STATEMENT best of my knowler	lge and belief.
ATTACHMENTS ( )	the undersigned, certify that this report i	s complete and accurate to the	Dear of my knowled	
Geologic Log	NAME EATON DRILLING CO.	TION) (TYPED OR PRINTED)		ID CA 95695

		JU	N	30	20	04					_					<b>D</b> 0		
le with [	- SWR					V	VELL (	STATE OF	F CALIFOR	NIA N REPOR	T	2	2		DZ	Ŵ		
Page 1 of 🖡	3						I	Refer to Inst	truction Pa	mphlet	1	1	ទា			J STATI	ON NO.	_
Owner's V	Well No.	7678 M	101	1				No.	7269	23	1							_
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Local Pe	ermit Ag	ency G	LEC 1	NN C	<u>.OU</u>	N LY		DEPT.	2004		- [				N/TRS/	OTHER		-1
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ORIENTAT	10N (⊻)		RTIC	AL	— нс	ORIZO	NTAL A	NGLE	(SPECIFY)									
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SURFA		r	2000	<b>ih</b> a	D	ESC	RIPTION	color ato										
FL to	<u> </u>	POORL	Y C	GRD	SAN	ND	gruin, size,	color, etc.		A JJ 125 ET			<u>, щ</u>	CATIO	아~ 드	OF		-1
10	20	SAND A	<b>NE</b>	GR	AVE	EL				City CA			<u> </u>	1000			<u>/////////////////////////////////////</u>	-
20	40	GRAVE	LV	V/CR	SS	ANE	)			County GLENN								_
40	50	MED-C	RS	SAN	DW	V/GF	RAVEL	1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -		APN Book 046	P	age 150	)	Parcel	036			_
50	60	MED-CI	RS	SAN	D					Township 22 N	R	ange3	W	Section	n 24			
60	70	LARGE	GF	RAVE	<u>-L N</u>	V/FII	NE-CRS S	AND		Latitude						<u> </u>	<u> </u>	
	<u>80  </u>	MED-CI	<u> </u>	SAN		v/GF	<b>AVEL</b>	-		DEG. N	MIN. C <b>ati</b> (	SEC. D <b>N SK</b> I	етсн -			DEG.	MIN. SEC. CTIVITY (1/1) -	
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150	250	MED-C	RS	SAN	DV	V/GF	RAVEL											
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I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

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Appendix 4B

Colusa Subbasin 2020 Groundwater Quality Monitoring Network Wells (THIS PAGE LEFT BLANK INTENTIONALLY)
Table 4B-1. Groundwater Quality Monitoring Network Wells					
County	Well ID	Agency	Latitude <sup>(a)</sup>	Longitude	
Glenn	1100404-001 <sup>(b)</sup>	Del Oro Water Company – Black Butte District	39.75970	-122.22526	
Glenn	1100405-001	Black Butte Mobile Home Park	39.75373	-122.21006	
Glenn	1110001-001	City of Orland	39.73808	-122.17203	
Glenn	1110001-002	City of Orland	39.73808	-122.17203	
Glenn	1110001-005	City of Orland	City of Orland 39.73820		
Glenn	1110001-008	City of Orland	City of Orland         39.73920           39.73977         39.73977		
Glenn	1110001-009	City of Orland	City of Orland         39.73977           City of Orland         39.75348		
Glenn	1110001-017	City of Orland	City of Orland         39.75348           Oliver         39.75399		
Glenn	1100413-002	Country Leisure Mobile Estates     39.74592		-122.13595	
Glenn	1100444-001	Orland Estates Mobile Home Park     39.74015		-122.20960	
Glenn	1100444-002	Orland Estates Mobile Home Park     39.74015       Orland Estates Mobile Home Park     39.74012		-122.20972	
Glenn	1100445-002	Orland Lstates Wobile Home Park     39.74012       Orland Mobile Home Park     39.73423		-122.19709	
Glenn	1100436-002	Orland Oaks Mobile Home Park	39.75274	-122.21581	
Glenn	1100452-001	Shady Oaks Trailer Park	39.76262	-122.19667	
Glenn	1100254-003	Voyles Trailer Park	39.53352	-122.19526	
Glenn	1100237-003	Willows Mobile Home Community & RV Park	39.52326	-122.23170	
Glenn	1100203-001	Artois Community Service District	39.61738	-122.19492	
Glenn	1100203-002	Artois Community Service District	39.62235	-122.19494	
Glenn	1110003-003	Cal-Water Service Company - Willows	39.51426	-122.19905	
Glenn	1110003-006	Cal-Water Service Company - Willows	39.53016	-122.20706	
Glenn	1110003-007	Cal-Water Service Company - Willows	39.50981	-122.19533	
Glenn	1110003-008	Cal-Water Service Company - Willows	39.52162	-122.21130	
Glenn	1110003-009	Cal-Water Service Company - Willows	39.51903	-122.18713	
Glenn	0600013-001	Colusa County Water Works District #2 – Princeton	39.40283	-122.01008	
Glenn	0600013-002	Colusa County Water Works District #2 – Princeton	39.40916	-122.00992	
Colusa	0610003-003	Maxwell Public Utility District	39.27650	-122.18944	
Colusa	0610002-002	City of Colusa	39.21073	-122.01404	
Colusa	0610002-003	City of Colusa	39.20768	-122.01175	
Colusa	0610002-004	City of Colusa	39.20114	-122.02074	
Colusa	0610002-005	City of Colusa	39.20293	-122.00906	
Colusa	0610002-006	City of Colusa 39.2		-122.01429	
Colusa	0610004-004	City of Williams 39.15214		-122.14661	
Colusa	0610004-009	City of Williams 39.15742		-122.13924	
Colusa	0610004-011	City of Williams	39.15203	-122.13548	
Colusa	0600008-001	Colusa County Water Works District #1 – Grimes         39.07		-121.89445	
Colusa	0610001-001	Arbuckle Public Utility District	39.01261	-122.05584	
Colusa	0610001-002	Arbuckle Public Utility District	39.01677	-122.06172	
Colusa	0610001-004	Arbuckle Public Utility District	39.01997	-122.05846	
Colusa	0610001-005	Arbuckle Public Utility District	39.01662	-122.07124	
Colusa	0605011-001	Del Oro Water Company – Arbuckle District	39.00503	-122.06048	
Glenn	25A1M	California Rice Commission <sup>(c)</sup>	39.56459	-122.02759	
Glenn	32J1M	California Rice Commission	39.54292	-122.09912	
Glenn	23E1M	California Rice Commission	39.49160	-122.05584	
Glenn	25E1M	California Rice Commission	39.47299	-122.16428	
Glenn	25R1M	California Rice Commission	39.47080	-122.13686	
Glenn	12G2M	California Rice Commission	39.42900	-122.03237	
Colusa	14G1M	California Rice Commission	39.28179	-122.17190	
Colusa	35M1M	California Rice Commission	39.18317	-122.07808	
Colusa	03E1M	California Rice Commission	39.14835	-122.07927	
Colusa	16R1M	California Rice Commission	39.71070	-122.10610	
Glenn	SVWQC00005	Sacramento Valley Water Quality Coalition <sup>(d)</sup> 39.01040		-122.06760	
Colusa	SVWQC00019	Sacramento Valley Water Quality Coalition	39.37720	-122.01330	
Colusa	SVWQC00021	Sacramento Valley Water Quality Coalition	38.96060	-122.01810	
Colusa	SVWQC00006	Sacramento Valley Water Quality Coalition	39.75970	-122.22526	
<ul> <li>(a) Latitude and longitude are reported in North American Datum of 1983 (NAD 83), decimal degrees.</li> <li>(b) Bolded wells are those that were selected to be included in the representative groundwater quality monitoring network. The representative groundwater quality monitoring network and its corresponding wells are discussed more in Section 4.2.5 of this GSP.</li> </ul>					
(c) Central Valley Regional Water Quality Control Board. 2016.					
(d) Luhdorff and	Scalmanini. 2019.				

December 2021

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# Appendix 5A

Colusa Groundwater Authority and Glenn Groundwater Authority Technical Advisory Committees Records of Decision for Sustainable Management Criteria (THIS PAGE LEFT BLANK INTENTIONALLY)

#### **INTRODUCTION**

This appendix documents the decision-making process and adoption of the Colusa Subbasin Sustainable Management Criteria (SMC) by the Colusa Groundwater Authority and Glenn Groundwater Authority Technical Advisory Committees (referred to as the Joint TAC).

A record of decision is provided for each of the sustainability indicators applicable to the Colusa Subbasin (Subbasin):

- 1. Chronic Lowering of Groundwater Levels
- 2. Reduction of Groundwater Storage
- 3. Seawater Intrusion (not applicable to the Colusa Subbasin)
- 4. Degraded Water Quality
- 5. Land Subsidence
- 6. Depletions of Interconnected Surface Water

#### SUSTAINABILITY INDICATOR #1: CHRONIC LOWERING OF GROUNDWATER LEVELS

#### **Decision Record**

At their joint meeting on May 13, 2021, the Colusa Groundwater Authority (CGA) Technical Advisory Committee (TAC) and Glenn Groundwater Authority (GGA) TAC each voted unanimously to recommend to their respective boards the criteria listed below for setting quantitative Sustainable Management Criteria (SMC) for groundwater Sustainability Indicator #1: Chronic Lowering of Groundwater Levels. These actions were taken in relation to Agenda Item 4.a.i. with the roll call vote documented in the meeting minutes.

The SMC for Chronic Lowering of Groundwater Levels will be calculated and conditioned as follows. The calculation will be made individually for each of the 48 representative monitoring wells comprising the Groundwater Level monitoring network. Water levels are defined as the depth to groundwater below ground surface.

- 1) Minimum Thresholds will be set equal to the lower of the following two calculated water levels:
  - a. 50 percent of the historical range in observed water levels below the observed low water level, AND,
  - b. The 20<sup>th</sup> percentile depth of domestic wells in the Thiessen polygon represented by each monitoring well. This means that 20 percent of the domestic wells are shallower and 80 percent deeper than the 20<sup>th</sup> percentile depth.
- 2) Measurable Objectives will be calculated as the average of the most recent five (5) years of available groundwater levels. The calculated water level is fixed and is not a running average that changes over time.
- 3) An Undesirable Result will be detected when water levels in 25 percent or more (at least 12) of the 48 representative monitoring wells fall below their respective Minimum Thresholds continuously for 24 months. The 12 wells must be the same subset of wells, not any combination of 12 wells.
- 4) To ensure operational compatibility with adjoining subbasins, the Minimum Thresholds and Measurable Objectives for monitoring wells near subbasin boundaries will be reviewed and adjusted, as needed, in consultation with representatives of adjoining subbasin Groundwater Sustainability Agencies.

#### **Adoption Record**

The TAC decisions were presented to and adopted by their respective Boards as follows:

- CGA: Approved May 25, 2021
- GGA: Approved June 16, 2021

#### SUSTAINABILITY INDICATOR #2: REDUCTION OF GROUNDWATER STORAGE

#### **Decision Record**

At their joint meeting on April 23, 2021, the Colusa Groundwater Authority (CGA) Technical Advisory Committee (TAC) and Glenn Groundwater Authority (GGA) TAC the Consultant Team recommended to the TACs that Sustainable Management Criteria (SMC) for groundwater Sustainability Indicator #2: Reduction of Groundwater Storage be addressed using Sustainability Indicator #1: Groundwater Levels as a proxy indicator, as allowed under DWR's Groundwater Sustainability Plan regulations.

The CGA TAC and GGA TAC each voted unanimously to recommend to their respective boards that SMC for groundwater Sustainability Indicator #2: Reduction of Groundwater Storage be addressed by proxy as described above. These actions were taken in relation to Agenda Item 4.b.i. with the roll call vote documented in the meeting minutes.

#### **Supporting Rationale**

The Consultant Team explained that the freshwater aquifers in the Colusa Subbasin are deep relative to existing well infrastructure and the Measurable Objectives (MOs) and Minimum Thresholds (MTs) under consideration for Sustainability Indicator #1: Groundwater Levels. Large volumes of fresh groundwater would remain in storage even if MTs were reached. Therefore, the MTs and MOs adopted for Groundwater Levels are protective of Groundwater Storage.

#### **Adoption Record**

The TAC decisions were presented to and adopted by their respective Boards as follows:

- CGA: Approved May 25, 2021
- GGA: Approved May 10, 2021

## SUSTAINABILITY INDICATOR #3: SEAWATER INTRUSION

Seawater intrusion is not considered to be an applicable sustainability indicator for the Colusa Subbasin. Thus, SMC were not established for seawater intrusion.

Seawater intrusion is not currently occurring in the Subbasin, and is not likely to occur due to the substantial distance between the Subbasin and the Pacific Ocean, bays, deltas, or inlets.

## SUSTAINABILITY INDICATOR #4: DEGRADED WATER QUALITY

#### **Decision Record**

At their joint meeting on April 9, 2021, the Colusa Groundwater Authority (CGA) Technical Advisory Committee (TAC) and Glenn Groundwater Authority (GGA) TAC each voted to recommend to their respective boards to adopt a policy not to adopt quantitative Sustainable Management Criteria (SMC) for groundwater Sustainability Indicator #4: Degraded Water Quality, and instead to improve the water quality monitoring network and adopt quantitative SMC in the 2027 Groundwater Sustainability Plan (GSP) update.

Subsequent to the April 9 meeting, additional information became available causing the Consultant Team to reconsider its earlier advice to the TACs. The new information included an opinion provided by GGA counsel and results of the Department of Water Resources evaluations of GSPs prepared for other groundwater subbasins. Based on this additional information, the Consultant Team changed its approach and recommended to the TACs at their June 11, 2021, meeting that quantitative SMC for water quality be developed for Sustainability Indicator #4.

At the June 11, 2021, Joint TAC meeting, each TAC voted unanimously, with Ben King of the CGA TAC abstaining, to recommend to their respective boards the criteria listed below for setting quantitative SMCs for Sustainability Indicator #4. These actions were taken in relation to Agenda Item 4.a.i. with the roll call vote documented in the meeting minutes.

The SMCs for Degraded Water Quality pertain to salinity only, applicable to each of 23 representative monitoring wells, are as follows:

- 1) The Minimum Threshold will be 900 μS/cm<sup>1</sup> (the recommended California Secondary Maximum Contaminant Level) OR the pre-2015 historical maximum measured salinity.
- 2) The Measurable Objective will be 700  $\mu$ S/cm (corresponding to an agricultural water quality objective providing for no yield reduction for crops commonly grown in the Colusa Subbasin).
- 3) An Undesirable Result will be detected when salinity (as indicated by electrical conductivity) in 25 percent of the representative monitoring wells (6 of 23 monitoring wells) exceeds the Minimum Threshold for two (2) consecutive years.

 $<sup>^{1}</sup>$  µS/cm stands for micro Siemens per centimeter, a measure of the electrical conductivity (EC) of water. 1,000 µS/cm is equal to approximately 640 parts per million of total dissolved solids in water.

## **Clarifying Points**

The foregoing SMC were established with the TACs' understanding that 23 representative monitoring wells are not sufficient for long-term, sustainable management of the Colusa Subbasin and that additional new or existing wells will need to be added to the monitoring network over time. Additionally, the TACs acknowledge that the SMC will need to be reviewed and evaluated, and potentially refined, as additional monitoring wells are added, and additional data is collected and analyzed.

## **Adoption Record**

The TAC decisions were presented to and adopted by their respective Boards as follows:

- CGA: Approved July 8, 2021
- GGA: Approved June 16, 2021, and approved as amended July 12, 2021

## SUSTAINABILITY INDICATOR #5: LAND SUBSIDENCE

#### **Decision Record**

At their joint meeting on April 9, 2021, the Colusa Groundwater Authority (CGA) Technical Advisory Committee (TAC) and Glenn Groundwater Authority (GGA) TAC each voted unanimously to recommend to their respective boards the criteria for setting quantitative Sustainable Management Criteria (SMCs) for groundwater Sustainability Indicator #5: Land Subsidence. These actions were taken in relation to Agenda Item 4.b.ii. with the roll call vote documented in the meeting minutes.

In September 2021, the Consultant Team prepared revised recommendations for the land subsidence SMCs to bring those SMCs into closer alignment with neighboring subbasins. Revisions to the quantitative SMCs for groundwater Sustainability Indicator #5: Land Subsidence were presented to and adopted by the CGA and GGA Boards in September and October 2021. During this process, the GGA Board recommended one additional revision regarding the process used to determine whether undesirable results have occurred.

The GGA Board voted unanimously to adopt the amended land subsidence SMCs listed below at their Board meeting on October 11, 2021. These actions were taken in relation to Agenda Item 9.e. with the roll call vote documented in the meeting minutes.

The CGA voted unanimously to adopt the amended land subsidence SMCs at their Board meeting on September 28, 2021, and amended again at the Board meeting on October 26, 2021.<sup>2</sup> These actions were taken in relation to Agenda Item 5 (September 28, 2021) and Agenda Item 7 (October 26, 2021) with the roll call vote documented in the corresponding meeting minutes.

The SMCs for Land Subsidence are as follows. The SMCs are applicable to each of 63 land subsidence monitoring benchmarks belonging to the Sacramento Valley Height Modernization Project.

- 1) The Minimum Threshold (MT) rate of subsidence at all 63 land subsidence benchmarks is 0.5 feet per five years.
- 2) The Measurable Objective (MO) rate of subsidence at all 63 land subsidence benchmarks is 0.25 feet per five years.
- 3) An Undesirable Result is considered to occur when the MT is exceeded at 20 percent (13 of 63) of the land subsidence monitoring benchmarks.

<sup>&</sup>lt;sup>2</sup> The CGA adopted the revised land subsidence SMCs recommended by the Consultant Team as presented at their September 28, 2021 Board meeting. The CGA later adopted the land subsidence SMCs as revised by the GGA and presented at their October 26, 2021 CGA Board meeting.

Additionally, the GSAs will evaluate adding subsidence monitoring benchmarks, especially in areas of concern and will review InSAR data annually (regulations do not require subsidence reporting in annual reports).

## **Supporting Rationale and Clarifying Points**

- 1) The SMCs will be reviewed and adjusted to account for potential changes in subsidence rates brought about by implementation of PMAs and future groundwater resource development. The extent of subsidence-prone areas, which may be underlain by sediments that have greater susceptibility to subsidence due to groundwater withdrawal, will continue to be delineated as data gaps are filled through the ongoing subsidence monitoring programs (using data from benchmarks, extensometers and InSAR surveys) and subsidence-prone sediments are characterized during drilling for well construction, extensometer installation or other subsurface investigations needed for the development of specific PMAs.
- 2) The GSAs expect that projects and management actions would be implemented before the MT rates are reached.
- 3) DWR reports that the probable error in the subsidence values reported for the monitoring benchmarks is  $\pm 0.17$  feet, meaning that for any reported value, the actual subsidence value is likely to fall in a range between plus or minus 0.17 feet of the reported value. The selected MO subsidence rate of 0.25 feet per five year is deliberately greater than the reported probable error of  $\pm 0.17$  feet as a means of avoiding false exceedance of the MO.

## **Adoption Record**

The revised SMC were presented to and adopted by their respective Boards as follows:

- CGA: Approved April 27, 2021, and approved as amended September 28, 2021, and October 26, 2021
- GGA: Approved May 10, 2021, and approved as amended October 11, 2021

#### SUSTAINABILITY INDICATOR #6: DEPLETIONS OF INTERCONNECTED SURFACE WATER

#### **Decision Record**

At their joint meeting on May 19, 2021, the Colusa Groundwater Authority (CGA) Technical Advisory Committee (TAC) and Glenn Groundwater Authority (GGA) TAC each voted to recommend to their respective boards certain criteria for setting quantitative Sustainable Management Criteria (SMCs) for groundwater Sustainability Indicator #6: Depletions of Interconnected Surface Water. The vote of the GGA TAC was unanimous. The vote of the CGA TAC was "yes" for all members except Bill Vanderwaal who voted no. These actions were taken in relation to Agenda Item 4.a.i. with the roll call vote documented in the meeting minutes.

Subsequent to the TACs' May 19 decisions, the CGA Board acted to adopt the CGA TAC's recommendation with a certain modification of the Undesirable Result (UR) criteria. Additionally, the Consultant Team conducted additional analyses to better understand the connectivity of Stony Creek surface water to underlying groundwater, and to address surface water depletion in the Colusa Basin Drain. (Prior surface water depletion discussions had only addressed Stony Creek and the Sacramento River.) The modified UR criteria and results of these additional analyses along with associated recommendations were presented by the Consultant Team to the TACs at their joint meeting on June 11, 2021.

At the June 11, 2021, joint TAC meeting, each TAC voted unanimously to recommend to their respective boards the criteria listed below for setting quantitative Sustainable Management Criteria (SMCs) for groundwater Sustainability Indicator #6: Depletions of Interconnected Surface Water. These actions were taken in relation to Agenda Item 4.a.ii. with the roll call vote documented in the meeting minutes.

The SMCs for Depletions of Interconnected Surface Water will be set or calculated and conditioned as follows. The calculation will be made individually for each of the 12 representative monitoring wells comprising the surface water depletion monitoring network. Water levels are defined as the depth to groundwater below ground surface.

- 1) Minimum Thresholds will be calculated as the Fall 2015 observed water level minus 10 feet, with the observed Fall 2015 water level being the level recorded closest to October 15, 2015.
- 2) Measurable Objectives will be calculated as the average of the most recent five (5) years of available, measured groundwater levels. The calculated water level is fixed and is not a running average that changes over time.
- 3) An Undesirable Result will be detected when water levels in 25 percent of the representative monitoring wells (3 of 12 monitoring wells) fall below their respective Minimum Thresholds continuously for 24 months. The 3 wells must be the same subset of wells, not any combination of 3 wells.

4) To ensure operational compatibility with adjoining subbasins, the Minimum Thresholds and Measurable Objectives for monitoring wells near subbasin boundaries will be reviewed and adjusted, as needed, in consultation with representatives of adjoining subbasin Groundwater Sustainability Agencies.

The foregoing SMCs were established with the TACs' understanding that 12 representative monitoring wells are not sufficient for long-term, sustainable management of the Colusa Subbasin and that additional new or existing wells will need to be added to the monitoring network over time. Additionally, the TACs acknowledge that the SMCs will need to be reviewed and evaluated, and potentially refined, as additional wells are added, and additional data is collected and analyzed.

#### **Adoption Record**

The TAC decisions were presented to and adopted by their respective Boards as follows:

- CGA: Approved June 22, 2021
- GGA: Approved June 16, 2021

# Appendix 5B

Process and Rationale for Setting Minimum Thresholds and Measurable Objectives for Groundwater Levels and Depletions of Interconnected Surface Waters (THIS PAGE LEFT BLANK INTENTIONALLY)



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# **Technical Memorandum**

To: Colusa Groundwater Authority and Glenn Groundwater Authority

From: Davids Engineering and Woodard & Curran

Date: November 30, 2021

Subject:Process and Rationale for Setting Minimum Thresholds and Measurable Objectives for<br/>Groundwater Levels and Depletions of Interconnected Surface Waters

#### Introduction

Sustainable Management Criteria (SMC) for the Colusa Subbasin (Subbasin) have been established in consultation with the Technical Advisory Committees of the two groundwater sustainability agencies in the Subbasin, those being the Colusa Groundwater Authority (CGA) and Glenn Groundwater Authority (GGA). SMC consist of the following: the Sustainability Goal adopted for the Subbasin; Undesirable Results describing significant and unreasonable effects to be avoided; quantitative Minimum Thresholds (MTs) that define conditions that, if exceeded, may cause Undesirable Results; and quantitative Measurable Objectives (MOs) to achieve the Sustainability Goal of the Subbasin. Undesirable results, MTs, and MOs are all established in relation to the six sustainability indicators referenced in the GSP Emergency Regulations, five of which are applicable in the Colusa Subbasin.

This Technical Memorandum (TM) documents the process and rationale for setting MTs and MOs for two specific sustainability indicators: Chronic Lowering of Groundwater Levels (Groundwater Levels), and Depletions of Interconnected Surface Water (Streamflow Depletion). As specified in 23 CCR 354.28(c)(6), Streamflow Depletion MTs and MOs shall be based on "the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." However, the regulations also allow the use of groundwater levels as a proxy for streamflow rates or volumes. Because the location and accuracy of existing stream gages on the Sacramento River and its tributaries are not sufficient to directly analyze streamflow accretions and depletions in the Colusa Subbasin, water levels were used as a proxy. Analyses of streamflow depletions in the Colusa Subbasin are described in the GSP and in Appendix 3G of the GSP. Thus, both of the sustainability indicators addressed in this TM involve groundwater levels and are therefore related. In particular, for representative monitoring network wells that are included in the monitoring networks for both indicators, there are two MTs and MOs. Both are valid with respect to the indicator but operationally the shallower MTs and MOs will govern.

The discussion of MOs and MTs for Groundwater Levels and Streamflow Depletion follow, preceded by a brief description of the outreach process used for SMC development (not just for Groundwater Levels and Streamflow Depletion, but also for other sustainability indicators and other GSP development tasks), and brief statements of the Sustainability Goal and Undesirable Results for the two sustainability indicators addressed here.

#### **Outreach and Public Involvement Process**

Outreach and public involvement in support of SMC development in the Colusa Subbasin were achieved primarily through a series of public meetings with the Technical Advisory Committees (TACs) formed by the Colusa Groundwater Authority (CGA) and Glenn Groundwater Authority (GGA), respectively. The meetings were publicly noticed on the CGA and GGA websites, with agendas noting action items posted in advance of each meeting, and minutes prepared following each meeting. The technical topics and content for each meeting were developed by the Colusa Subbasin GSP Technical Team led by Davids Engineering, with Woodard & Curran serving as the lead SMC subconsultant. The TACs met together, with the meetings referred to as Joint TAC meetings.

Joint TAC meetings were held approximately monthly, with a total of 13 meetings held between May 8, 2020, and June 11, 2021. SMC were addressed at nine of the 13 meetings, and at all of the seven meetings held between January 8 and June 11, 2021. TAC members engaged in a very thorough, thoughtful, and constructive manner, giving consideration to all interests in the Subbasin involved with or affected by groundwater use and management, including domestic well users, disadvantaged communities, small disadvantaged communities, California Native American Tribes, and environmental beneficial uses and users. This engagement process and consideration for these stakeholders is documented in Chapter 2 of the GSP, as well as meeting minutes and related materials available online.<sup>1</sup> SMC were ultimately vetted and approved by both the CGA and GGA Boards at open Board meetings. Public notice was given in advance of those meetings. The decision records for the SMC are documented in Appendix 5A of the GSP.

Members of the public were welcome to attend the Joint TAC and open Board meetings and were encouraged to express their opinions, suggestions, and comments on the SMC, as well as other aspects of the GSP. Members of the public attended and participated in most Joint TAC meetings, including those in which SMC were discussed.

#### Sustainability Goal

The Sustainability Goal for the Colusa Subbasin as accepted by the TACs and adopted by the CGA and GGA is:

...to maintain, through a cooperative and partnered approach, locally managed sustainable groundwater resources to preserve and enhance the economic viability, social well-being and culture of all Beneficial Uses and Users, without experiencing undesirable results.

#### **Undesirable Results**

The undesirable results statements proposed for Groundwater Levels and Streamflow Depletion, respectively, are as follows:

• The undesirable result for the chronic lowering of groundwater levels is a result that would cause significant and unreasonable reduction in the long-term viability of beneficial uses and users over the planning and implementation horizon of this GSP.

<sup>&</sup>lt;sup>1</sup> CGA meeting materials are available at: <u>https://colusagroundwater.org/meetings/</u>. GGA meeting materials are available at: <u>https://www.countyofglenn.net/dept/planning-community-</u> <u>development-services/water-resources/glenn-groundwater-authority/gga</u>.

• The undesirable result for the depletion of interconnected surface water is a result that causes significant and unreasonable adverse effects on beneficial uses and users of interconnected surface waters within the Colusa Subbasin over the planning and implementation horizon of this GSP.

Additional consideration for undesirable results is discussed in Chapter 5 of the GSP.

#### Measurable Objectives

MOs represent the desired conditions for sustainable operation of the Subbasin while MTs define conditions that are to be avoided because of the risk that Undesirable Results could occur if the MTs are exceeded. For both sustainability indicators addressed in this TM, the MOs were set as the numerical average of all recorded groundwater levels over the most recent five years of record available for each well. For all but four wells, the most recent five years of record ends in Spring 2020. Setting MOs in this manner reflects the GSAs' intention to operate the Subbasin without persistent declines below recent historical groundwater levels, consistent with the Sustainable Groundwater Management Act (SGMA).

#### **Minimum Thresholds**

The rationale and parameters considered in establishing MTs for Groundwater Levels and Streamflow Depletion are discussed below in respective sections.

#### Groundwater Levels

The primary parameters and general objectives considered in establishing Groundwater Levels MTs were:

- Avoiding significant and unreasonable impacts to shallow (primarily domestic) wells: setting MT groundwater levels shallow enough to be reasonably protective of a majority of existing domestic wells.
- 2. Avoiding significant and unreasonable effects on groundwater dependent ecosystems (GDEs): setting MT groundwater levels shallow enough to be reasonably protective of GDEs and potential GDEs.
- 3. Avoiding significant and unreasonable impacts to (constraints on) conjunctive management of Colusa Subbasin surface water and groundwater supplies: setting MT groundwater levels deep enough to allow a range of operational flexibility that ensures adequate water supply reliability over variable, wet and dry hydrologic conditions.

Available GDE mapping was analyzed and GDE areas ranked with regard to their likelihood of actually being dependent on groundwater as opposed to being sustained by streamflow or applied irrigation water. However, due to lack of reliable shallow groundwater elevation data, the analysis was inconclusive<sup>2</sup> and objectives 1 and 3, above, became the primary focus for setting Groundwater Level MTs. However, GDEs were still considered in the selection of Streamflow Depletion SMC and monitoring sites (see below). To reconcile potential conflicts between objectives 1 and 3, setting MTs involved striking balance and compromise between them to reasonably protect domestic well users while also supporting ongoing conjunctive management of the Subbasin.

<sup>&</sup>lt;sup>2</sup> The lack of shallow groundwater data is identified as a data gap and will be addressed along with other data gaps during plan implementation.

For each of the 48 wells in the Groundwater Level representative monitoring network, Thiessen polygons were drawn around each well and the depths of all domestic wells expressed as an exceedance function. For example, the 20 percent exceedance for the domestic wells in any given polygon is the depth at which 20 percent of the wells are shallower and 80 percent deeper, meaning 80 percent of the wells would be protected and 20 percent would be subject to potential stranding if groundwater levels fell to the 20 percent exceedance depth. Information about existing domestic well infrastructure in the Colusa Subbasin was obtained from Well Completion Reports (WCR) available in DWR's database<sup>3</sup>. The WCR database generally includes all historical wells that have been reported in the system, which may include old wells that are no longer operational, have been refurbished, or have been dewatered for many years, long preceding conditions in 2015. The data is self-reported, and some data entries are incomplete. As such, the domestic well inventory for the Subbasin is incomplete and will be addressed with other data gaps in the Subbasin to support GSP implementation (see Chapters 4, 6 and 7). The analysis to support setting MT was developed considering these limitations.

The analyses of well completion depths conducted to support the MT development process is conservative and protective of beneficial uses because it included domestic wells that were shallower than the historic low groundwater level in each polygon. As documented in Appendix 5C, for the Subbasin as a whole, approximately 46 percent of the domestic wells in the WCR database are shallower than the pre-2015 historical groundwater levels as defined by the Groundwater Level representative monitoring network. Many of these shallow wells may no longer be used or they may have been deepened because they would have otherwise been dry at times prior to 2015. Including these shallow, and potentially unused or deepened wells in the well depth analysis, resulted in Groundwater Level MTs that are shallower than they would have been if the wells had been excluded.

As described in Chapter 4 of the GSP, data gaps related to domestic wells will be addressed in future GSP updates, and this analysis may be refined with new information. Based on the available information at the time of GSP development, technical team analysis, and TAC discussion, a 20 percent exceedance threshold emerged as being reasonable for protection of existing domestic well infrastructure.

For the same 48 representative monitoring wells, historical water levels, generally for the period from spring 2000 to spring 2020 (subject to availability for any particular well), were reviewed and analyzed as a basis for understanding how groundwater levels have fluctuated and when historical minimum groundwater levels have occurred. In particular, the magnitude of the range of historical fluctuation was regarded as an indicator of how the well has behaved over wet and dry hydrologic periods, and whether there are any persistent upward or downward trends. For many wells, especially those relatively far from streams, groundwater levels have trended downward since approximately the mid-2000s and record low groundwater levels were observed in the fall of 2015 following back-to-back critically dry years. These observations led to the approach of alternatively setting MTs at historical low levels plus some percentage of the observed groundwater level range to allow for conjunctive operation of the Subbasin during droughts. The TACs considered 20 percent and 50 percent of historical range as the increment to add to the observed historical low groundwater level. After careful review of the 48 well records, 50 percent of historical range below the historical low was selected as an MT that would allow the range of fluctuation necessary to manage through future dry periods while avoiding undesirable results. To support evaluation of Groundwater Level MTs, the technical team developed an economic analysis of the costs (additional pumping costs, domestic well replacement costs) and benefits (avoided costs of other projects and management actions) associated with the proposed MTs. The analysis illustrated the direct monetary cost-benefit tradeoffs of setting MTs at different levels. The central

<sup>&</sup>lt;sup>3</sup> Available at: https://data.cnra.ca.gov/dataset/well-completion-reports

conclusion was that the additional cost of raising the MT for most monitoring wells was substantially greater than the additional benefit to groundwater users in the Subbasin. Results of this analysis were presented to the TAC at a public meeting held on May 13, 2021 and are described in more detail in Appendix 5C of the GSP.

Hydrographs for the 48 wells in the Groundwater Level representative monitoring well network are provided in Attachment A illustrating both possible MTs: one based on the 20<sup>th</sup> percentile domestic well depth exceedance and the other on 50 percent of historical range below the historical low. The two MTs are shown in relation to available historical data for each well. For 13 of the wells, the lower of the MTs is represented by the 50 percent of range below the historical low with the lower MT for the remaining 35 wells represented by 20<sup>th</sup> percentile domestic well depth exceedance. Based on the information in these graphs and supporting analysis by the technical team, the technical team recommended, and the TACs accepted, adopting the lower of the two MTs as the governing threshold.

For the 13 wells with MTs based on 50 percent of historical range below the historical low, it was possible that more than 20 percent of domestic wells would be shallower than the MT, and therefore would be at risk of dewatering. An additional analysis was developed to quantify the share of domestic wells that could potentially be affected under the selected MT. The inventory of domestic wells for each polygon was screened to remove wells that were shallower than the historical low groundwater level observed prior to January 1, 2015. These wells would have been dewatered based on historical groundwater levels that occurred in the Subbasin prior to the implementation of SGMA. The proportion of the remaining wells that are shallower than the proposed MT was calculated for each polygon. In aggregate, less than 20 percent of domestic wells are shallower than the proposed MT. This was viewed as an acceptable balance between avoiding significant and unreasonable impacts to domestic (and other shallow) wells and allowing sufficient flexibility for conjunctive management of Subbasin surface and groundwater supplies, given the uncertainty of available information on domestic wells in the WCR database. As described in Chapter 4 of the GSP, data gaps related to domestic wells will be addressed in future GSP updates, and this analysis may be refined with new information.

It is important to emphasize that groundwater levels will be managed for MOs, which are generally set substantially above MTs. MTs define the levels that would not be exceeded to avoid Undesirable Results. However, recognizing the importance of protecting domestic wells in the Subbasin, the GSP includes a potential management action in which the GSAs would develop a domestic well mitigation program<sup>5</sup>. This would provide an additional safety net for domestic well users by providing potential compensation for impacts to domestic wells that are associated with GSP implementation.

A hydrograph series showing the selected MT relative to historical water levels at each representative monitoring well is presented in Attachment B.

#### Streamflow Depletion

As explained in the Introduction, Streamflow Depletion MTs are based on groundwater levels as a proxy for streamflow depletion volume or rate. The basic rationale postulated, evaluated, and recommended by the Environmental Defense Fund (EDF) in support of using groundwater levels as a proxy for depletion volumes or rates is that adverse impacts to surface water uses and users can be avoided if

<sup>&</sup>lt;sup>5</sup> See Chapter 6, Section 6.5.2 of the GSP.

groundwater gradients and levels near interconnected streams are maintained at levels that existed when implementation of the SGMA began in 2015<sup>6</sup>.

Only 12 wells could be identified that were considered to reasonably represent groundwater levels near the three major, potentially interconnected streams in the Subbasin, based on an assessment of their proximity to the streams and the depth to the bottom of their screened interval. The 12 wells were selected based on the following criteria developed using recommendations in the EDF report:

- Located greater than 2,000 feet and not more than 5 miles from an interconnected stream
- Depth to bottom of screened interval less than or equal to 200 feet

The three streams are: Stony Creek, which borders the Subbasin to the north; the Sacramento River, which mostly borders the Subbasin to the east but also runs through a portion of the Subbasin (approximately between Princeton and Colusa); and, the Colusa (Basin) Drain, which originates in and flows southward out of the Subbasin at the Colusa-Yolo Subbasin boundary (county line). The 12 wells are not considered adequate for long-term sustainable groundwater management but are determined to be the best available monitoring sites at this time for evaluating streamflow depletion. Additional dedicated near-stream shallow monitoring wells are needed and will be designed and installed during GSP implementation.

Nevertheless, quantitative MTs were established for these wells as described below. These MTs are considered to be provisional pending additional data collection and analysis and updating and refining the C2VSim FG-Colusa model.

Three *alternative* MTs were evaluated for the 12 wells currently in the Streamflow Depletion representative monitoring network, as follows:

- 1. The observed Fall 2015 groundwater level (on the date closest to October 15), OR
- 2. 20 percent of the historical range in groundwater levels below the observed Fall 2015 groundwater level (depth to water), <u>OR</u>
- 3. 10 feet below the observed Fall 2015 groundwater level (on the date closest to October 15).

The first MT is consistent with the EDF recommendation that aims to avoid or minimize incremental post-SGMA effects on stream depletions but prevents any opportunity for exercising groundwater storage, such as might be needed during prolonged droughts. The second MT is based on a similar concept as that used for Groundwater Levels, where the MT is set at 20 percent of the historical range below the observed Fall 2015 water level. However, historical water levels in most near-stream wells are generally stable and do not fluctuate much. Thus, the historical range is typically small, and the resulting MT was still very constraining on the ability to exercise groundwater storage when needed. Finally, due to concerns among TAC members regarding overly constrained groundwater operations, a third MT was introduced defined as 10 feet deeper than the Fall 2015 groundwater level at each well.

A series of hydrographs showing all three alternative MTs in relation to historical groundwater levels at each of the 12 wells is presented in Attachment C. For all wells, the highest MT is represented by the Fall 2015 water level. The lowest MT is represented by the 10 feet deeper than Fall 2015 groundwater level at 10 of the 13 wells. For the three wells where the 20 percent of historical range below the

<sup>&</sup>lt;sup>6</sup> Environmental Defense Fund, (EDF), 2018, Addressing Regional Surface Water Depletions in California: A Proposed Approach for Compliance with the Sustainable Groundwater Management Act. Available online at http://edf.org/california-surface-water-report.

observed Fall 2015 groundwater level is the deepest MT, the margin between the two deepest MTs is typically small.

Based on careful consideration of the alternative Streamflow Depletion MTs and evaluation of historical groundwater levels at the wells, the TAC selected the MT defined as 10 feet deeper than the observed Fall 2015 water level. A series of hydrographs showing the selected MT relative to historical groundwater levels is presented in Attachment D.

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# Appendix 5C

Economic Analysis of Groundwater Level Minimum Thresholds (THIS PAGE LEFT BLANK INTENTIONALLY)

## **Technical Memorandum**

То:	Glenn and Colusa County Groundwater Authorities
From:	ERA Economics
Date:	November 24, 2021
Subject:	Economic Benefit-Cost Analysis of Potential Groundwater Level Minimum Thresholds

## Introduction

Sustainable Management Criteria (SMC) for the Colusa Subbasin (Subbasin) were established in consultation with the Technical Advisory Committees (TACs) of the Colusa Groundwater Authority (CGA) and Glenn Groundwater Authority (GGA). SMCs consist of the following: the Sustainability Goal adopted for the Subbasin; Undesirable Results describing significant and unreasonable effects to be avoided; quantitative Minimum Thresholds (MTs) that define conditions that, if exceeded, may cause Undesirable Results; and quantitative Measurable Objectives (MOs) to achieve the Sustainability Goal of the Subbasin. Undesirable Results, MTs, and MOs are all established in relation to the six sustainability indicators referenced in the GSP Emergency Regulations, five of which are applicable in the Subbasin.

Subbasin MTs were developed with substantial public and technical team input. A total of 13 joint meetings of the TACs were held between May 8, 2020, and June 11, 2021, and SMCs were addressed at 9 of the 13 meetings. This included all 7 meetings held between January 8 and June 11, 2021. Several technical analyses were developed to evaluate potential MTs. This appendix describes an economic analysis of MTs that was developed and presented to the TAC at the June 11, 2021 meeting.

The Subbasin MTs are described in detail in Chapter 5 and Appendices 5A and 5B. The general approach to setting MTs for Groundwater Levels was developed with consideration for both the historical groundwater levels at each well and the distribution of shallow (primarily domestic) well depths in the area surrounding the well. Potential MTs were considered based on a percent margin below historical lows or domestic well depths. These were set to balance avoiding significant and unreasonable impacts to domestic wells while also allowing sufficient flexibility for conjunctive management of Subbasin surface and groundwater supplies.

To support evaluation of MTs, an economic analysis was developed to assess whether it would be cost-effective to set MTs higher (or lower) than the MTs based on the lower of 50 percent below the historical low groundwater level or 20<sup>th</sup> percentile of domestic well depths.

This appendix describes the economic analysis, assumptions, and results considered for evaluating potential Groundwater Level MTs. The reconnaissance-level economic analysis was based on the data available for GSP development and the simplifying assumptions described in the sections below. Important assumptions include: (i) the analysis was developed for MTs, not MOs that the Subbasin will be managed for and are substantially higher than MTs, (ii) only a subset of costs and benefits (pumping cost, well replacement cost, avoided costs of projects and management actions (PMA)) associated with PMA implementation and potentially dewatered domestic were considered, and (iii) the example PMA considered was demand management (reducing pumping). The analysis can be refined and expanded as GSP data gaps are addressed and additional information

becomes available. It is also noted that the GSP includes additional potential actions for monitoring potential impacts to domestic wells, as described in Section 6.5.2.1, Domestic Well Mitigation Program.

## **Economic Analysis Overview**

A benefit-cost analysis was developed to monetize and compare the benefits and costs to groundwater users in the Subbasin under the Groundwater Level MTs. It was developed as a reconnaissance-level assessment to establish preliminary costs and benefits associated with different level MTs. There are additional benefits and costs associated with MTs that relate to four other sustainability indicators defined in the GSP Emergency Regulations that are applicable to the Subbasin that were not considered in this analysis. The analysis could be refined in the future to support updates to the GSP or additional consideration of threshold levels. The information presented in this appendix is developed to illustrate the general magnitude of costs, benefits, and the associated tradeoff.

The benefit of higher MTs is the avoided cost of replacing dewatered domestic wells and the avoided energy cost of additional pumping lifts from lower groundwater levels. Dewatered domestic well costs would fall on individual domestic well owners. Additional pumping costs would fall on Subbasin groundwater users in the vicinity of the monitoring well (defined by Thiessen polygons). In contrast, the incremental cost of setting higher MTs is due to more rapid (and larger scale) implementation of projects and management actions. For example, preventing additional declines in groundwater levels may require larger recharge projects, and these projects would need to be implemented more rapidly. This imposes additional costs on groundwater users in the Subbasin.

The benefit-cost ratio is calculated from the monetized benefits and costs over the relevant planning horizon (in this case, the 20-year GSP implementation period). When the benefit-cost ratio is greater than 1, the benefits are at least as large as the cost, suggesting it could be cost-effective to make the MTs shallower in selected areas.

The following costs were considered in the economic analysis of groundwater level MTs:

- Capital cost of replacing or refurbishing potentially dewatered domestic wells. For the purposes of this analysis, a domestic well is defined as dewatered, and completely replaced when the groundwater level MT is below the total well depth. In practice, pumping impacts would occur earlier depending on the screened interval of the well and other aquifer- and well-specific characteristics. The domestic well inventory in the Subbasin is based on DWR's Well Completion Report (WCR) data (see GSP Chapter 3).
  - a. The capital cost of well replacement is set at \$40,000 per well based on costs for domestic well replacement used in other GSPs<sup>1</sup> and adjusted for inflation. These costs generally include drilling at \$40 per foot, a sanitary seal for \$2,500, and a pump for \$5,000. This does not include permit costs. Actual costs will vary based on the costs of materials and supply and demand for well drilling services.

<sup>&</sup>lt;sup>1</sup> Madera Joint GSP. Technical Appendix 3C: Economic Analysis and Framework for Potential Domestic Well Mitigation Program.

- 2. Additional energy costs caused by additional pumping lifts that would affect all groundwater users in the Subbasin. Lower groundwater levels increase the energy cost to pumpers (domestic and agriculture) in the Subbasin.
  - Agricultural pumping energy cost depends on lift, pump efficiency, and the power rate which varies by time of use and size of load. For purposes here, the analysis used an average over several 2021 PG&E agricultural power rates to get a total variable pumping cost of about \$0.52 per acre-foot per foot of lift.

The following benefits (avoided costs) were considered in the economic analysis of groundwater level MTs:

1. Cost of demand management (reducing pumping) to prevent additional declines in groundwater levels. The cost of demand management is used instead of the cost of specific projects because demand management could be implemented more rapidly than most projects (there is no construction required). It is noted that demand management is not a planned PMA in the Subbasin, and these costs are used as a proxy for the costs of other projects. Chapter 6 Appendix 6B describes the cost of demand management in the Subbasin. The costs include the direct cost of land idling only, and do not include any additional indirect costs or administrative costs to set up and implement a demand management program.

Existing domestic well infrastructure in the Subbasin is based on WCR available in DWR's database<sup>2</sup>. The WCR data generally include all historical wells that have been reported in the system, which may include old wells that are no longer operational or have been refurbished. The domestic well inventory for the Subbasin will be addressed with other data gaps in the Subbasin to support GSP implementation (see Chapter 3).

An analysis was developed to evaluate the WCR data regarding well depths for the wells in the inventory. For each well in a Thiessen polygon, the reported well depth was compared to the historical low groundwater level recorded prior to January 1, 2015. The purpose of the analysis was to establish what share of domestic wells in the WCR database may have been previously dewatered and/or are no longer used. Wells that were shallower than the historic low were flagged, counted, and compared to the total domestic wells for each Thiessen polygon. In total, approximately 46 percent of the domestic wells in the WCR database for the Subbasin show a total depth that is shallower than the historic groundwater level low. The results of the analysis for each Thiessen polygon are summarized in Table 1.

<sup>&</sup>lt;sup>2</sup> Available at: https://data.cnra.ca.gov/dataset/well-completion-reports

Monitoring Well #	Total Domestic Wells	Wells Shallower than Historic low before 1/2015	Share
13N02W20H002	180	28	0.16
14N02W22A002	16	NA	-
14N03W24C001	26	8	0.31
14N03W14Q003	23	14	0.61
16N02W25B002	368	2	0.01
15N03W08Q001	56	0	0.00
16N04W02P001	24	0	0.00
16N03W14H003	45	0	0.00
15N03W20Q001	85	4	0.05
17N03W32H001	43	0	0.00
14N02W29J001	97	5	0.05
13N01W07G001	181	34	0.19
13N01W22P002	52	0	0.00
12N01E06D004	7	NA	-
16N02W05B001	32	0	0.00
14N02W13N001	20	0	0.00
13N02W15J001	196	43	0.22
13N02W12L001	61	6	0.10
14N01W04K003	117	7	0.06
13N01E11A001	8	0	0.00
13N01W13P001	8	0	0.00
14N01E35P001	26	0	0.00
15N02W19E001	201	1	0.00
20N02W18R005	71	3	0.04
20N03W07E001	94	41	0.44
19N04W14M002	265	1	0.00
17N03W08R001	80	0	0.00
17N02W09H002	38	2	0.05
21N02W33M001	50	39	0.78
21N02W01F001	40	3	0.08
21N03W34Q002	173	121	0.70
21N03W23D001	118	101	0.86
21N03W01R002	109	24	0.22
21N02W04G002	69	18	0.26
21N04W12A004	636	591	0.93
15N01W05G001	111	6	0.05
18N02W36B001	107	2	0.02
19N02W33K001	108	2	0.02
18N02W18D001	41	0	0.00

#### Table 1. Benefit-Cost Analysis of an Incremental Increase in MT (by 5 feet bgs)

Monitoring Well #	Total Domestic Wells	Wells Shallower than Historic low before 1/2015	Share
20N02W33B001	52	0	0.00
19N02W08Q001	176	2	0.01
17N02W30J002	10	0	0.00
22N03W24E001	1,677	1,589	0.95
20N02W25F001	105	0	0.00
22N02W30H002	173	168	0.97
21N02W36A002	97	38	0.39
20N02W11A001	56	0	0.00
21N02W05M001	36	22	0.61
Total	6,364	2,925	0.46

#### **Economic Analysis of Subbasin MTs**

The economic analysis considers the Subbasin groundwater level MTs. It is important to note that the Subbasin will be managed to meet MOs, which are set substantially higher than MTs. The costs and benefits described in this TM are generally conservative, corresponding to Groundwater Level MTs that are lower than current groundwater levels, MOs, and observed historical levels in many areas.

Figure 1 illustrates the aggregate annual cost curve for an example Thiessen polygon (21N03W01R002) in the Subbasin. The same calculations are repeated for the other 47 polygons. A range of groundwater depths including the MT (155 feet bgs) specified in the GSP are evaluated. Costs increase as depth to groundwater increases. The capital cost of replacing dewatered domestic wells is annualized using a discount rate of 5 percent over a 30-year economic life. Pumping costs are the additional annual energy cost of pumping from a lower depth in that year. The total cost is the sum of the pumping costs and well replacement cost. All costs are additional (incremental) costs in addition to the current pumping costs at current groundwater depths.



Figure 1. Colusa Subbasin Incremental Annual Cost by Depth to Groundwater

Figure 2 illustrates the benefit (avoided cost) of a change in the MT for the same example Thiessen polygon (21N03W01R002) in the Subbasin (1 of 48 total polygons). In contrast to the static pumping and well replacement costs shown in Figure 1, the benefit is an avoided cost and is therefore expressed as a change in depth to groundwater. The irrigated acreage within the Thiessen polygon is also shown in the figure. The mix of crops grown affects the cost of demand management. The example polygon is predominantly planted to permanent crops (almonds and olives), which are costly to idle due to higher net return relative to other annual crops and the substantial capital investment required to establish orchards. A range of projects and management actions that are specified in the GSP could be implemented to achieve a change in groundwater levels across the Subbasin (see Chapter 6). As described above, the cost of demand management to reduce pumping is used to develop the aggregate cost curve shown in Figure 2 (and the individual cost curves for each polygon). The change is shown over the full GSP implementation timeline (20 years).



Figure 2. Colusa Subbasin Incremental Demand Management Cost by Depth to Groundwater

As described in Chapter 5 and Appendices 5A and 5B, the MT for groundwater levels is set based on the lower of 50 percent below the historical low groundwater level or the 20<sup>th</sup> percentile of the domestic well depth within each of the 48 Thiessen polygons corresponding to the 48 monitoring wells. The benefit-cost analysis evaluates whether an incremental change in the MT would result in a positive benefit-cost ratio in each polygon. The analysis is developed for an incremental increase in the MT of 5 feet.

Table 2 summarizes the benefit-cost analysis of an incremental (defined as 5 feet) increase in the MT. This illustrates the central economic tradeoff: whether a change in the MT (in this case an increase in the MT level by 5 feet) would generate economic benefits for the Subbasin that are greater than the costs that would be incurred. The table summarizes each polygon and the annual benefits, costs, and net benefits. Since the analysis evaluates an incremental increase in the MT, the benefits are defined as the avoided pumping and well replacement cost. Costs are defined as the additional cost of idling land (demand management) to achieve the 5-foot increase in MT. The net benefit shows the absolute difference between benefits and costs, and the final column shows the associated benefit-cost ratio. A benefit-cost ratio greater than 1 shows benefits are greater than costs, implying that a 5-foot shallower MT would generate benefits greater than costs. The aggregate benefit-cost ratio over all polygons is 0.33 (each dollar of cost returns only 33 cents in benefits). There are five polygons where the benefit-cost ratio is slightly greater than 1 (between 1.0 and 2.1). However, the total annual net benefit across the Subbasin.

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Monitoring Well Polygon	Pump + Well Cost Saving (Annual Benefit in thousands)	Idling Cost (Annual Cost in thousands)	Net Benefit (thousands)	B/C Ratio
13N02W20H002	\$25	\$579	(\$554)	0.0
14N02W22A002	\$42	\$57	(\$15)	0.7
14N03W24C001	\$30	\$48	(\$18)	0.6
14N03W14Q003	\$20	\$469	(\$449)	0.0
16N02W25B002	\$159	\$170	(\$11)	0.9
15N03W08Q001	\$2	\$111	(\$109)	0.0
16N04W02P001	\$9	\$91	(\$82)	0.1
16N03W14H003	\$13	NA	-	0.0
15N03W20Q001	\$17	\$167	(\$150)	0.1
17N03W32H001	\$5	\$157	(\$152)	0.0
14N02W29J001	\$27	\$52	(\$25)	0.5
13N01W07G001	\$65	\$65	\$0	1.0
13N01W22P002	\$41	\$70	(\$29)	0.6
16N02W05B001	\$47	\$79	(\$32)	0.6
14N02W13N001	\$45	\$59	(\$14)	0.8
13N02W15J001	\$39	\$66	(\$27)	0.6
13N02W12L001	\$13	\$30	(\$17)	0.4
14N01W04K003	\$117	\$145	(\$28)	0.8
13N01E11A001	\$8	\$36	(\$28)	0.2
13N01W13P001	\$28	\$120	(\$92)	0.2
14N01E35P001	\$38	\$42	(\$4)	0.9
15N02W19E001	\$45	\$123	(\$78)	0.4
20N02W18R005	\$75	\$57	\$18	1.3
20N03W07E001	\$52	\$277	(\$225)	0.2
19N04W14M002	\$41	\$198	(\$157)	0.2
17N03W08R001	\$11	\$399	(\$388)	0.0
17N02W09H002	\$70	\$388	(\$318)	0.2
21N02W33M001	\$41	\$45	(\$4)	0.9
21N02W01F001	\$57	\$43	\$14	1.3
21N03W34Q002	\$59	\$69	(\$10)	0.9
21N03W23D001	\$33	\$73	(\$40)	0.5
21N03W01R002	\$31	\$29	\$2	1.1

#### Table 2. Benefit-Cost Analysis of an Incremental Increase in MT (by 5 feet bgs)

Effect of Raising Groundwater Level MT 5 feet Relative to Proposed Groundwater Level MT

Monitoring Well Polygon	Pump + Well Cost Saving (Annual Benefit in thousands)	Idling Cost (Annual Cost in thousands)	Net Benefit (thousands)	B/C Ratio
21N02W04G002	\$35	\$31	\$4	1.1
21N04W12A004	\$100	\$287	(\$187)	0.3
15N01W05G001	\$79	\$130	(\$51)	0.6
18N02W36B001	\$64	\$96	(\$32)	0.7
19N02W33K001	\$50	\$314	(\$264)	0.2
18N02W18D001	\$25	NA	-	0.0
20N02W33B001	\$20	NA	-	0.0
19N02W08Q001	\$47	NA	-	0.0
17N02W30J002	\$1	NA	-	0.0
22N03W24E001	\$2	\$65	(\$63)	0.0
20N02W25F001	\$44	\$184	(\$140)	0.2
22N02W30H002	\$6	\$38	(\$32)	0.2
21N02W36A002	\$61	\$29	\$32	2.1
20N02W11A001	\$4	\$33	(\$29)	0.1
21N02W05M001	\$11	\$26	(\$15)	0.4
Total	\$1,854	\$5,547	(\$3,799)	0.33

#### Effect of Raising Groundwater Level MT 5 feet Relative to Proposed Groundwater Level MT

Notes: "NA" or missing values reflect polygons with zero acreage or insufficient data to support the benefit-cost calculations.

# Discussion

The results indicate that the cost of raising the MT would not be cost effective from a Subbasin-wide perspective, or for most individual polygons. The aggregate benefit-cost ratio of 0.33 shows each dollar of cost from setting MTs incrementally higher returns only 33 cents in benefits across the entire Subbasin. The avoided costs (fewer domestic wells requiring replacement and reduced pumping lifts) would be modest (\$1.9 million) relative to the cost of lost agricultural net return from demand management (\$5.5 million). The general conclusions are robust to the assumptions used – that is, results are not sensitive to reasonable ranges in key assumptions, including the loss in net return per acre-foot of demand management, additional pumping costs, or the cost of replacing a domestic well. The analysis is developed to support long-run planning for setting MTs. PMAs needed to support higher MTs require time to develop and implement and cannot be implemented rapidly in response to severe, unprecedented drought. The short-run costs of wells running dry during severe drought events can include other cost factors that were not explicitly analyzed. For example, in the crisis of a severe drought, local drilling capacity and well repair services can be limited, which can result in higher cost or increased wait times. This can place additional financial stress on households with domestic wells.

There are five polygons that show a benefit-cost ratio slightly greater than 1, indicating that benefits would be slightly greater than the costs. The total net benefit is \$70,000 across these five polygons. The benefit-cost ratio for these polygons is between 1.1 and 2.1. These occur in polygons 21N02W36A002, 21N02W04G002,

21N03W01R002, 21N02W01F001, and 20N02W18R005.The total annual net benefit of \$70,000 is less than 1 percent of the estimated -\$3,800 thousand (-\$3.8 million) in total annual net benefits across the Subbasin. In addition, the cost of setting higher MT includes the direct cost of demand management only, and does not include other program administrative costs, or potential third-party impacts that may occur in the Subbasin. Including these costs would push the benefit-cost ratio below one in these areas. Finally, it is noted that the inventory of domestic wells for each polygon includes all wells in the DWR WCR database. Many wells are shallower than the historical low groundwater level observed prior to January 1, 2015. These wells would have been dewatered based on historical groundwater levels that occurred in the Subbasin prior to the implementation of SGMA. Removing these wells from the database would reduce the benefit of increasing MT, further reducing the benefit-cost ratio in all polygons.

The conclusion of the economic analysis is that it would not be cost-effective from a Subbasin or polygon-wide perspective to raise Groundwater Level MTs in the Subbasin. Therefore, the proposed MTs were viewed as an acceptable balance between avoiding significant and unreasonable impacts to domestic (and other shallow) wells and allowing sufficient flexibility for conjunctive management of Subbasin surface and groundwater supplies. In addition, as summarized in Table 1 and described in Appendices 5A and 5B, a substantial share of domestic wells in the WCR database appear to be shallower (total depth) than the observed low groundwater levels in each of the Thiessen polygons.

It is important to emphasize again that groundwater levels will be managed for MOs, which are set substantially above MTs. MTs are set below where the Subbasin is expected to be operated, defining the levels that would not be exceeded to avoid increasing risk of Undesirable Results. However, recognizing the importance of protecting domestic wells in the Subbasin, the GSP includes a potential management action in which the GSAs would develop a domestic well impact mitigation program (see Chapter 6). This would provide an additional safety net for domestic well users by providing potential compensation for impacts to domestic wells that are associated with GSP implementation.
# Appendix 5D

Electrical Conductivity Historical Trends, Minimum Thresholds, and Measurable Objectives



#### Colusa Subbasin

Active Public Water Supply Well ullet

#### Representative Groundwater Quality Monitoring Network Well



Representative Public Water Supply Well



- Representative California Rice Commission Groundwater Monitoring Well
- Representative Sacramento Valley Water Quality  $\otimes$ Coalition Groundwater Monitoring Well

Horizontal Datum: North American Datum of 1983 (NAD 83), California State Plane Zone II, feet.



#### Figure 5D-1

#### **Representative Groundwater Quality Monitoring Network**

**Colusa Groundwater Authority** and Glenn Groundwater Authority Colusa Subbasin Groundwater Sustainability Plan



















































Appendix 6A

Surface Water Available for Recharge and Financial Incentives in the Colusa Subbasin



# **Technical Memorandum**

Environment • Resources • Agriculture

ERA Econor

To:Glenn and Colusa Groundwater AuthoritiesFrom:Davids Engineering and ERA Economics

**Date:** July 1, 2021

Subject: Surface Water Available for Recharge and Financial Incentives

### Purpose

More than 30 projects and management actions (PMAs) are included in the Colusa Subbasin GSP to achieve and maintain sustainable groundwater management. Five of the PMAs are on track for implementation, six are ongoing, with the remaining PMAs being in various stages of investigation and evaluation. The five projects on track for implementation are all groundwater recharge projects involving the use of surface water for direct or in-lieu recharge. Three of the five projects are substantial in-lieu recharge projects, meaning that they will require regulated surface water sources available on an irrigation demand schedule. All three projects are planning to acquire all or most of the required surface water through transfers of Central Valley Project (CVP) water supplies that are surplus to the needs of other CVP water supply contractors or Sacramento River Settlement Contractors (Settlement Contractors).

All three in-lieu recharge projects on track for implementation include incentivizing landowners to utilize existing CVP supplies. CVP supplies in some years are surplus to CVP contractor needs in some cases because contractors are still building out their systems and acreage over time to use the CVP water, but in other cases, the cost of CVP supply is too high to be competitive with groundwater pumping or other local transfers. Growers currently using groundwater also benefit from the convenience of having a clean, reliable, on-demand supply from their pumps and not having to order water for delivery through local district conveyance.

This appendix serves two purposes. First, it summarizes the three in-lieu recharge projects and the potential sources of surface water available for irrigation use to enable reduction of groundwater pumping. Second, it provides an overview of the current costs of CVP water, how those costs are changing, and provides a discussion of financial incentives to increase use of those supplies for some contractors in some years. The description uses information for two districts, Orland-Artois Water District and Colusa County Water District, but the concept could be applied to other districts as well.

## Colusa Subbasin In-Lieu Recharge Projects On-track for Implementation

The three substantial in-lieu groundwater recharge projects that are on track for implementation are described below.

### Colusa County Water District In-Lieu Groundwater Recharge

Colusa County Water District (CCWD) has a total service area of approximately 46,000 acres of which 39,875 are currently irrigable with existing district infrastructure. This area is planted to predominantly permanent crops. The district delivers surface water to approximately 35,000 acres, with the remaining acres being idle or irrigated with privately pumped groundwater. CCWD has a CVP water supply contract that provides a maximum

of 62,200 acre-feet (AF) annually. The district also holds a CVP contract water supply for 5,666 AF that was part of a Colusa County subcontract assigned to CCWD in 2006. Both contracts are subject to curtailments determined by the Bureau of Reclamation (Reclamation) each year based on Sacramento River watershed hydrologic conditions and planned CVP operations.

Additionally, CCWD typically transfers in additional CVP water supplies to augment water available under its CVP contract. Historical transfers have been primarily from Westside Water District and, more recently, from Reclamation District 108 (RD108) under a five-year pilot transfer agreement that ends in 2022. Despite the availability of district surface water, some CCWD growers choose to pump groundwater because is it less expensive than surface water (and because groundwater requires less screening and filtering compared to district surface water).

Under the CCWD In-Lieu Groundwater Recharge project, the district will acquire additional surface water and incentives will be put in place to make the cost of surface water the same or less expensive than pumped groundwater, thereby incentivizing growers who would otherwise use groundwater to use surface water. The additional surface water is expected to be acquired under long-term water transfer agreements with other CVP contractors, including Sacramento River Settlement Contractors, and potentially other sources. The plan is to acquire and deliver 30,000 acre-feet per year (AF/yr) except in Shasta Critical years<sup>1</sup> when groundwater banked through in-lieu recharge in prior years would be used. It is estimated that the average additional surface water use over the long term would be approximately 27,000 AF/yr.

### Colusa Drain MWC In-Lieu Groundwater Recharge

The Colusa Drain Mutual Water Company (CDMWC) encompasses approximately 46,000 acres of agricultural land and environmental habitat located adjacent to the Colusa Basin Drain (Drain) in the Colusa Subbasin (Subbasin). Shareholders in CDMWC divert water for summer irrigation from the Drain under a combination of appropriative water rights held individually by the shareholders, a long-term water supply agreement with Reclamation, and annual and multi-year transfer agreements with neighboring Sacramento River Settlement Contractors. Historically, many CDMWC diverters use both groundwater and surface water for irrigation because flow in the Drain is often insufficient and unreliable to fully satisfy all irrigation requirements on a timely basis.

For the period 1990 through 2015, average surface water diversions from the Drain were estimated to be 48,000 AF/yr while groundwater pumping during the same period was estimated to be 40,000 AF/yr. It is estimated that approximately 70 percent of the historical groundwater pumping can be eliminated through the provision of additional surface water, provided that the surface water cost is approximately equal to the cost of groundwater. The cost comparison of surface and groundwater would include the full cost of each source (e.g., filtering, system costs, and other on-farm costs in addition to the delivery charge per AF of surface water and variable cost to pump groundwater). The potential in-lieu recharge is estimated to be 28,000 AF/yr on average across all years, and 31,000 AF in Shasta Non-Critical years. The planned source of additional surface water is primarily upstream Sacramento River Settlement Contractors that can discharge water into the Drain for use downstream by CDMWC shareholders.

### Orland-Artois Water District Land Annexation and Groundwater Recharge

Orland-Artois WD (OAWD) has an existing service area of about 29,000 acres and delivers water to district landowners through 110 miles of pipelines and 300 metered deliveries. Surface water delivered by the district is available under a CVP water supply contract with Reclamation and through short- and long-term transfer

<sup>&</sup>lt;sup>1</sup> In general, Shasta Critical conditions are declared when the forecast inflow to Lake Shasta for a particular water year is equal to or less than 3.2 million AF.

agreements with other CVP water contractors and Sacramento River Settlement Contractors. The district's water supply contract provides a maximum of 53,000 AF/yr, subject to curtailments determined by Reclamation each year based on Sacramento River watershed hydrologic conditions and planned CVP operations. Historically, water transfers have been from Maxwell Irrigation District, Princeton-Codora-Glenn Irrigation District, and others.

The district is working with a group of neighboring, non-district landowners to annex approximately 12,000 acres of groundwater-dependent agriculture into the district. Additional surface water for the annexed lands would be secured through multi-year purchase or transfer agreements with willing sellers, conveyed through the existing Tehama-Colusa Canal<sup>2</sup> (TCC), and distributed to the annexed lands through new distribution facilities. Potential transferors include CVP water supply contractors and Sacramento River Settlement Contractors. The plan is to acquire and deliver 25,000 AF/yr of surface water to the annexed lands except in Shasta Critical years when groundwater banked through in-lieu recharge in prior years would be used. It is estimated that the average additional surface water use, and thus in-lieu groundwater recharge, over the long term would be about 23,000 AF/yr.

### Sources of Surface Water for In-Lieu Recharge

The aggregate volume of water needed for the three in-lieu recharge projects described above is 86,000 AF/yr, in Shasta Non-Critical years, as summarized in Table 1.

Project	Average Additional Surface Water Needed in Shasta Non-Critical Years (acre-feet)
Colusa County Water District	30,000
Colusa Basin Drain Mutual Water Company	31,000
Orland Artois Water District	25,000
T	btal 86,000

 Table 1. Proponents and Water Needs Associated with Colusa Subbasin In-Lieu Groundwater Recharge

 Projects on Track for Implementation

Potential surface water sources to meet these requirements are discussed below:

### Full use of Available CVP Contract Water

In recent years, both CCWD and OAWD have not used all the water available under their respective CVP water supply contracts, due primarily to the high cost of the upper two price tiers according to Reclamation pricing policy. The cost of CVP water is determined by CVP pricing policy and cost allocation. Up until recently, all CVP water contracts in the Tehama-Colusa Service Area were Water Service Contracts, and the water price was calculated using three<sup>3</sup> components: The O&M (operations and maintenance) charge, the capital component

<sup>&</sup>lt;sup>2</sup> The Tehama-Colusa Canal has a maximum capacity of approximately 2,530 cubic feet per second at the canal inlet (Stene, 1994), and a capacity of approximately 1,700 cubic feet per second at the southern end of the canal. Considering historical canal operations, it is likely that conveyance capacity is available to facilitate such a program, subject to certain conditions (see Attachment A).

<sup>&</sup>lt;sup>3</sup> Contractors also pay for power use and a restoration charge, which is currently about \$11 per AF.

(paid back without interest), and the full cost rate that includes O&M and capital plus interest. The sum of the O&M and capital components is called the cost of service rate. Some or all of the rate's capital component could be removed as "ability-to-pay" relief, and many of the area contractors have received this in the past. The resulting contract rate (cost of service potentially reduced by ability-to-pay relief) applies to the first 80 percent of the contract maximum. The full cost rate includes cost of service plus interest on the capital component and is generally substantially greater than the cost of service rate. In 2020 for example, OAWD's contract rate (cost of service) was about \$60 per AF and its full cost rate was about \$218 per AF, calculated according to section 205(a)(3) of the Reclamation Reform Act. According to federal law (the CVP Improvement Act of 1992), CVP irrigation (and M&I) water supply contracts required payment of tiered water rates for contractual water entitlements, which are summarized as follows:

- Tier 1: The Cost of Service water rate developed through the federal water rate setting process. The Tier 1 rate applies to the first 80% of the delivered contractual water entitlement.
- Tier 2: The rate is the numerical average of the Tier 1 rate and the Tier 3 rate. The Tier 2 rate applies to the next 10% of the delivered contractual water entitlement.
- Tier 3: This rate is the full cost rate developed through the federal water rates setting process. Tier 3 applies to the last 10% of the delivered contractual water entitlement.

Even when blended with Tier 1 water, using Tier 2 and Tier 3 water resulted in excessive water cost, and so some or all of the Tier 2 and Tier 3 water went unused.

### Incentivizing Utilization of CVP Supplies

As of 2021, Tehama-Colusa Canal (TCC) CVP water service contractors have converted their contracts to repayment contracts, thus paying off and removing the capital component from their CVP water rates. The new repayment rates (not including restoration charges and other power charges) are \$23.43 per AF for CCWD and \$26.67 per AF for OAWD. Under the revised rates, these contractors intend to use all of their CVP contract water. The additional CVP water (the difference between what OAWD and CCWD would have used under their old rate structure versus under their new repayment rate) can fulfill a portion of the in-lieu recharge quantities shown.

Repayment of CVP capital required the contractors to borrow money that they will be paying off over the next 15 years or more. Contractors vary in how they recover that fixed cost. Some, like OAWD, have acreage assessments on lands in the district. Others, like CCWD, include more fixed costs in their water rate, so when CVP delivery goes down, the water rates must go up to cover the fixed costs. Due to critical drought conditions, the CVP has announced no contract deliveries to the Tehama Colusa Service Area in 2021. As a result, CCWD's announced water rate for 2021 is currently estimated to be \$288 per AF, though this may change as conditions and availability of water transfers change.

OAWD has estimated that its water rate after conversion to the repayment contract would be about \$42 per AF under conditions of full CVP supply and \$62 per AF with a 50 percent supply.<sup>4</sup> CCWD has estimated that its water rate after conversion to the repayment contract would be in the range of \$70 per AF under conditions of full CVP supply.<sup>5</sup>

Depending on the relative costs of district supply versus groundwater, under the repayment contracts, the districts' rates may be low enough already to encourage full use of CVP supply. However, if groundwater pumping remains a lower cost alternative to CVP water for some growers, incentivizing their use of CVP water in lieu of pumping would require paying at least the difference between district surface supply and the variable

<sup>&</sup>lt;sup>4</sup> According to a Proposition 218 informational presentation to the OAWD Board in August 2020.

<sup>&</sup>lt;sup>5</sup> This is a rough estimate based on personal communication with CCWD Manager, Shelly Murphy, June 30, 2021.
cost of pumping groundwater. Other advantages of groundwater over delivered surface water include the growers' convenience of having a clean, reliable, on-demand supply from their pumps. Some groundwater users also may need to incur some on-farm water distribution costs to take surface water.

A program to incentivize CVP use would be specific to individual districts. Therefore, a full evaluation was not developed for the GSP. It is anticipated that an economic analysis to establish incentives and program design would be completed as part of GSP implementation activities. The economic analysis would generally include the following components:

- The initial evaluation would include estimating the incentive payments needed to achieve greater or full use of CVP contract water. The payments should compensate for the difference between CVP water cost (full cost as delivered by the district) and variable cost of groundwater pumping in areas receiving the in-lieu recharge, plus the value of any additional advantages or cost savings of groundwater over surface water.
- Estimate the projected total annual cost of the incentive payments, considering the payments per AF (which may vary by area) and the expected additional amounts of CVP water purchased and used in lieu of pumping. The estimate should account for variability in CVP supply by year and the costs of other supplies or activities related to that variability. In addition, economic benefits should be quantified and assigned to project beneficiaries.
- Estimate the recharge benefits to the GSA or to subareas within the GSA, considering avoided pumping costs and/or cost of other PMAs that could be avoided by this action. This would include an assessment and assignment of economic benefits that accrue to different parties and over time.
- Consider and evaluate other policies that may be used to assure that increased use of CVP water is effective as in-lieu groundwater recharge and does not simply enable expansion of irrigated area with little or no effect on groundwater recharge.
- Using the results of the cost and benefits calculations developed in the economic analysis described above, develop a method for assigning (if necessary) project costs in proportion to benefits received.

It is important to note that the switch to repayment contracts could provide alternative ways to incentivize use of CVP supplies with districts. An economic analysis could develop strategies to shift and restructure district charges to lower the effective cost of CVP water. This would generally include recovering a greater proportion of fixed costs as land-based charges rather than through variable water rates. For example, OAWD's recent approval of an acreage assessment to recover costs of its CVP capital conversion loan effectively reduces the per AF cost of CVP water. As a result, its water rate is substantially lower than before it converted to a repayment contract. This approach could be explored by other districts if they find that their water rate discourages full use of available CVP supply.

## Transfers of Other Unused CVP Contract Project Water

Other CVP water contractors (not Sacramento River Settlement Contractors) within and outside the Colusa Subbasin, including members of the Tehama Colusa Canal Association served by the TCC, also have contract water available for transfer in some years. Historically, some but not all of this water has been transferred under the provisions of Section 3405(a) of the Central Valley Project Improvement Act (CVPIA) (Title 34 of Public Law 102-575).

## Transfers of Available Settlement Contract Water

There are 127 Sacramento River Settlement Contractors. The total surface water supply quantities associated with each settlement contract have a "base supply" component and a "project water" component<sup>6</sup>. In general, project water can be transferred in-basin under the provisions of CVPIA Section 3405(a) and base supply cannot<sup>7</sup>.

There are 17 Sacramento River Settlement Contractors with total contract supplies of 10,000 AF or more (Table 2). The aggregate base supply for these entities is approximately 1.7 million AF, and the project water supply is about 296,000 AF. The 110 remaining, smaller Settlement Contractors, have aggregate base supplies of about 92,000 AF and project water supplies of about 34,000 AF. Thus, the total quantity of project water under the settlement contracts is about 330,000 AF.

It is estimated that in Shasta Non-Critical years about 25 percent of this volume, or approximately 83,000 AF, is available for transfer. Glenn Colusa Irrigation District and RD108, the two largest Settlement Contractors, estimate that they could provide approximately 40,000 AF and 14,000 AF of project water for transfer in Shasta Non-Critical years, respectively. The combined quantity of 54,000 AF constitutes roughly two-thirds of the estimated 83,000 AF of project water available for transfer.

<sup>&</sup>lt;sup>6</sup> Base supply is intended to replace water that could have been diverted under each entity's underlying, senior water right(s), while project water is an additional amount negotiated as part of the settlement to supply supplemental water during the summer that might not have been available under the underlying rights. All settlement contracts have a base supply component and most, but not all, also have a project water component.

<sup>&</sup>lt;sup>7</sup> Base supply can be transferred to the extent its use is reduced by land fallowing, groundwater substitution, or conservation.

Name	Contract Number	Base Supply	Project Supply	Total Supply
Glenn-Colusa Irrigation District	14-06-200-855A-R-1	720,000	105,000	825,000
Sutter Mutual Water Company	14-06-200-815A-R-1	169,500	56,500	226,000
Reclamation District No. 108	14-06-200-876A-R-1	199,000	33,000	232,000
Natomas Central Mutual Water Company	14-06-200-885A-R-1	98,200	22,000	120,200
Reclamation District No. 1004	14-06-200-890A-R-1	56,400	15,000	71,400
Princeton-Codora-Glenn Irrigation District	14-06-200-849A-R-1	52,810	15,000	67,810
Meridian Farms Water Company	14-06-200-838A-R-1	23,000	12,000	35,000
Sycamore Family Trust	14-06-200-2146A-R-1	22,000	9,800	31,800
Anderson-Cottonwood Irrigation District	14-06-200-3346A-R-1	121,000	7,000	128,000
Maxwell Irrigation District	14-06-200-6078A-R-1	11,980	6,000	17,980
Provident Irrigation District	14-06-200-856A-R-1	49,730	5,000	54,730
Redding, City of	14-06-200-2871A-R-1	17,850	3,150	21,000
Pleasant Grove-Verona Mutual Water Company	14-06-200-5520A-R-1	23,790	2,500	26,290
Bardis, Christo D., et al. (Broomieside Farms)	14-06-200-1286A-R-1	8,070	2,000	10,070
Pacific Realty Associates, L.P. (M&T Chico Ranch)	14-06-200-940A-R-1	16,980	976	17,956
Conaway Preservation Group, LLC	14-06-200-7422A-R-1	50,190	672	50,862
River Garden Farms Company	14-06-200-878A-R-1	29,300	500	29,800
	Total	1,669,800	296,098	1,965,898

#### Table 2. Sacramento River Settlement Contractors with Total Supplies of 10,000 AF or More

## Summary

There are three in-lieu groundwater recharge projects on track for implementation in the Colusa Subbasin with a combined surface water requirement of approximately 86,000 AF in Shasta Non-Critical years. Each project intends to acquire the necessary surface water primarily via water transfers from other entities with available CVP contract supplies and CVP Settlement Contract project water under the provisions of CVPIA Section 3405(a). Transfer of available project water supplies under settlement contracts alone would nearly meet these needs, with full use of existing contract supplies (CCWD and OAWD only) and potential transfers of surplus CVP contract supplies adding to that amount.

It is recognized that the actual feasibility of acquiring the water is subject to the willingness of both buyers and sellers, and the negotiation of mutually acceptable contract terms. These negotiations have been initiated informally and will be continued as the projects move toward implementation.

A key element of all three projects will be creating incentives for growers to use the surface water made available rather than pumping groundwater. The preliminary analysis presented in this appendix suggests that the variable cost to pump groundwater may already be greater than the district rate under the new repayment contracts in some districts. In other districts, the water rate is around \$10 to \$25 per AF greater than the variable cost to pump groundwater. These are just the variable costs of water supply, and do not include additional on-farm costs associated with each source. As described above, incentivizing use of surface water can be accomplished by developing an incentive program funded by the beneficiaries of such a program, or through adjustments to the district water rate structure. It is anticipated that these specific incentive structures would be evaluated and developed as part of project implementation.

It is also noted that the in-lieu recharge volumes referred to above are maximum quantities. Based on monitoring of project performance and groundwater conditions, it may be possible to operate the Subbasin within its sustainable yield with less than the maximum in-lieu recharge quantities described above.

## References

Stene, E.A. 1994. Sacramento River Diversion, Central Valley Project. United States Bureau of Reclamation.

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## Attachment A. Personal Communication with J. Sutton Regarding the Tehama-Colusa Canal Capacity.

From: Jeffrey P. Sutton (Tehama-Colusa Canal Authority)
Sent: Tuesday, August 10, 2021, 4:55 PM
To: Grant Davids (Davids Engineering, Inc.)
Cc: Katherine Klug (Davids Engineering, Inc.)
Subject: RE: TCC Capacity

#### Grant,

Caveated with the following first blush comments (reserve the right to add to this list), I respond:

- 1. TCCA will not be responsible for providing the subject water rights or water supply that is diverted for this purpose.
- 2. TCCA will not be responsible for any permits, mitigation, or other regulatory responsibilities associated with such a program.
- 3. CCWD and OAWD will be responsible for any and all charges, contracting, Warren Act or other fees and/or costs associated with such a program.
- 4. TCCA will be paid appropriate conveyance charges pursuant to the rates in the TCCA JPA Agreement that CCWD and OAWD currently pay or other rates as agreed.

I respond to your question as follows: Currently, it is my opinion that under most (in fact all that I currently think of) scenarios experienced, there would be plenty of pumping/diversion capacity (currently maxed out at 2000 cfs) and conveyance capacity in the TC Canal (2500 cfs at the top of the canal, 2100 cfs at Funks Reservoir, 1700 cfs at the south end of the canal) to facilitate such a program. However, historical operations are not always a good predictor of future conditions. In a typical year, we typically divert/convey a maximum amount of water of around 1300-1500 cfs. I would also add that I have not yet discussed particulars details of such a program (because I have not been provided such details until this time) with my Board of Directors. Bill Vanderwaal and Emil Cavagnolo did generally outline the recharge concept being explored at my last meeting, which the Board was generally supportive of - notwithstanding the need to hear the details. However, I anticipate that this water would have to somewhat take a second tier position in the atypical case of a conflict over the available diversion/conveyance capacity.

I hope this is helpful Grant, sorry for the long caveated answer. But I don't want to give the misimpression of complete acquiescence or create a reliance on a simple statement of "sure we have capacity" until all of the details are more fully vetted and the necessary terms have been contemplated. I will leave it to your discretion on how you wish to articulate capacity availability in the Colusa GSP based on the foregoing.

### Jeffrey P. Sutton

General Manager Tehama-Colusa Canal Authority (THIS PAGE LEFT BLANK INTENTIONALLY)

Appendix 6B

Economic Analysis of Demand Management and Conceptual Allocation Approaches (THIS PAGE LEFT BLANK INTENTIONALLY)



# **Technical Memorandum**

Subject:	Economic Analysis of Demand Management and Conceptual Allocation Approaches
Date:	November 19, 2021
From:	ERA Economics
То:	Glenn and Colusa County Groundwater Authorities

## Introduction

More than 30 projects and management actions (PMAs) are included in the Colusa Subbasin GSP to achieve and maintain sustainable groundwater management. Five projects are on track for implementation, which are all groundwater recharge projects that use surface water for direct and/or inlieu recharge. Recognizing that projects can take several years to develop, and in light of the current severe drought conditions across the Colusa Subbasin (Subbasin) and state, the GSP includes two "backstop" demand management actions that could be implemented relatively quickly, primarily because they do not require construction of new infrastructure. These management actions include a targeted demand management program that would incentivize temporary pumping reductions (and/or local water transfers) in periods of extreme drought, and a broader demand management program that would incentivize pumping reductions in the Subbasin.

Demand management can be implemented fairly quickly and can be included as part of a cost-effective mix of PMAs to achieve and maintain sustainable groundwater conditions. This appendix describes the direct economic costs of demand management in the Subbasin. It also describes considerations for, and the process of setting, a groundwater allocation. It is noted that a groundwater allocation is not required to implement the demand management programs included in the GSP, but it does generate incentives to manage demand and increase supply. To provide some context for the costs of demand management, a general summary of agricultural water use, economic values, and Subbasin conditions is presented first. This is followed by a summary of an economic analysis of the direct costs associated with two example demand management programs: one targeted to specific areas with groundwater sustainability concerns, and another targeted more broadly across the Subbasin. The allocation discussion is presented last.

## Economic Value of Agriculture in the Colusa Subbasin

Glenn and Colusa County agriculture includes a diverse mix of rice, nut crops, seed, feed, and other field and row crops. Farming activities to raise these crops support jobs, income, and economic activity for a range of transportation, processing, manufacturing, and retail industries in the Subbasin. These activities support the local tax base as well as jobs and income in businesses not directly related to agriculture. Changes in the cost and availability of water under the PMAs included in the GSP, as well as potential demand management programs, can have important implications for the local economies and communities in the Subbasin. This section describes the current contribution of agriculture to the Subbasin economies.

The Subbasin spans most of Glenn and Colusa counties. The annual economic activity, measured as value-added, across all industries (including agriculture) in the counties is around \$7.4 billion. These industries support around 26,000 full-time equivalent (FTE) jobs, mostly for individuals that both live

and work in the counties. Table 1 summarizes the top ten industry sectors by value, and the direct jobs associated with each industry. Eight of the top 10 industry sectors are agriculture and related industries. Notable exceptions include local government industries and the wholesale trade sector. However, wholesale trade includes warehousing and storage industries that are closely linked to the agricultural sector.

		Annual Value Added	
Rank	Industry	(\$ in Millions)	Direct FTE Jobs
1	Tree nut farming	\$965	2,790
2	Rice milling	\$750	450
3	Local government	\$625	3,750
4	Grain farming	\$500	405
5	Wholesale trade	\$475	1,620
6	Canned fruits and vegetables manufacturing	\$470	695
7	Vegetable and melon farming	\$180	630
8	Dairy cattle and milk production	\$160	155
9	Support activities for agriculture and forestry	\$145	1,690
10	Other animal food manufacturing	\$145	70

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Source: IMPLAN 2014 R3 multipliers, current USDA crop prices and returns, current 2021 dollars

A substantial share of local economic activity is directly or indirectly related to farming. A conservative analysis using the IMPLAN model data shows that at least one in three jobs depend on farming activities in the Subbasin. Similarly, a substantial share of local wage income for employees, value added, and gross output are a result of farming-related industries in the Subbasin.

The primary crops produced in the Subbasin include rice, walnuts, and almonds. The total rice acreage footprint has been largely steady for several years, with annual fluctuations in planted acreage based on rice market conditions and water availability in the Sacramento and San Joaquin Valleys. On average, Colusa and Glenn counties produce around 45 percent of California's annual rice crop. The share of acreage planted to almonds and walnuts has been steadily increasing, driven by favorable market conditions and consistent with trends across the state. Relative to annual crops, these permanent plantings require a substantial capital investment to establish and require consistent irrigation in all years. This has led to hardening of irrigation water demand in areas with increasing permanent plantings.

Figure 1 illustrates recent trends in the gross value of production by crop type in Glenn and Colusa Counties. The gross output value of the crops produced in the Subbasin is around \$1.75 billion per year, with fruit and nut crops accounting for more than half of the total value in recent years. Fruit and nut crops accounted for around 30 percent of gross value in 2010, increasing to nearly 60 percent by 2015.



Source: Glenn and Colusa County Crop Reports

Figure 1. Trends in Gross Value of Crop Production, 2010 – 2019

The trends in crop acreage and value in Glenn and Colusa counties are consistent with trends in other parts of the state. Robust export demand for California almonds and walnuts through the mid-2010's supported strong prices and profitability. This led to increasing plantings that are continuing across the state. However, new plantings of nut trees have slowly leveled-off in response to softer prices caused by increasing supply (production) in California and other regions (e.g., Australia) and a weaker export market (e.g., tariffs and macroeconomic conditions including a stronger U.S. dollar). Groundwater concerns in Critically Overdrafted subbasins in the San Joaquin Valley may continue to push permanent plantings north into the Sacramento Valley, and as such this general trend appears likely to continue in Glenn and Colusa Counties for the next several years.

The agricultural industries in the Subbasin create a substantial share of local jobs, business, and economic activity. Demand management programs can be structured in ways to minimize the economic costs to growers and the regional economy. The following section quantifies the direct costs of potential demand management programs in the Subbasin.

## **Demand Management Costs**

Demand management generally refers to actions that reduce the net consumptive use of water, which in turn reduces net groundwater pumping<sup>1</sup> in the Subbasin, or selected areas of the Subbasin. Areas selected for demand management would be determined by the GSAs in consideration of local groundwater conditions and sustainability indicators.

This appendix summarizes the results of an analysis that establishes the potential costs of demand management in the Subbasin. The results of the analysis can be used for multiple purposes. Demand management costs can be compared to the cost of potential projects to support developing a cost-effective portfolio of PMAs. In addition, demand management costs are interpreted as the minimum willingness to accept payment to forgo irrigation, which can be used to structure potential incentives to reduce groundwater pumping under applicable PMAs.

To illustrate the cost of demand management, two scenarios are developed. The cost of a specific demand management program will ultimately depend on the location, scale, and market conditions at the time the program is implemented. The outputs summarized in this report are intended to support PMA development for the GSP, and comparison of demand management with other projects and management actions. These cost estimates would be refined in the future and would be specific to each PMA. The final section in this appendix describes the general steps for this future analysis.

The cost of demand management depends on the location, scale, and timing of the program. For the purposes of this analysis, it was assumed that the timing of the program would be the GSP implementation period (2022 – 2042). The scale of the program (i.e., total volume of demand management achieved in each year) was developed over a range consistent with preliminary changes in groundwater storage shown in the initial GSP water budgets (see Chapter 3). Lastly, two alternatives were developed for the location of the program. The first alternative would apply Subbasin-wide and the second would target demand management to specific areas of concern near the Orland and Arbuckle areas in the Subbasin (as generally defined below).

The direct cost of demand management is estimated here as the loss of net return to irrigated lands and is expressed on a per acre-foot (AF) basis for comparison to other PMA costs. Costs were established in the Subbasin using a standard economic analysis that considers the water budget (e.g., quantity of water applied and consumed by Subbasin crops), costs and returns to farming, and current market conditions for major Subbasin crops. The results of the analysis show how the cost of demand management changes over an increasing scale of a potential program, and how those costs vary across different areas.

Reduced net return from crop production may, in turn, lead to secondary losses to other sectors within the local economy. The extent of such losses would depend on how irrigated agriculture on other lands changes. For example, if production shifts to other lands within the same regional economy (e.g., the broader Sacramento Valley), then regional secondary effects on input suppliers, trucking, processing, farm labor, and other businesses may be small. But if this does not occur, then secondary economic impacts may warrant more analysis and quantification. These secondary impacts have not been quantified in this appendix. In addition, this analysis does not quantify any additional administrative costs for the GSAs to develop and administer a demand management program. These indirect costs would be assessed as part of demand management program design in the future.

<sup>&</sup>lt;sup>1</sup> Net groundwater pumping would be defined as part of the demand management program. In general, it would include crop ETAW plus any unrecoverable return flows.

### Methods

The cost of demand management fundamentally depends on supply and demand for irrigation water. Examples of factors that affect supply include annual water year conditions, carry-over storage, CVP allocation, GSA costs, water supply costs, and other GSP implementation (e.g., PMAs). Examples of factors that affect demand include export and domestic market conditions for California crops that affect returns to farming and willingness to pay for water.

An economic model of the Subbasin was applied to evaluate the supply and demand for water and establish the cost of demand management. It reflects the local water supplies and uses, financial data on returns to farming, and current crop market conditions for Sacramento Valley crops. This includes current crop prices and yields. Production costs are representative averages based on University of California Cooperative Extension crop budgets. The model is calibrated to the GSP water budget (applied water and evapotranspiration of applied water) and geospatial land use data described in Chapter 3 of the GSP. A technical description of the economic calibration method is beyond the scope of this technical appendix. The method applied is a standard, peer-reviewed economic analysis approach that is widely applied for valuation of water supply and water supply projects in California<sup>2</sup>. This same technical approach was applied for calibration of an economic optimization model of the Subbasin.

The model quantifies the effect of changes in water supply availability and cost on farm income (e.g., net income and gross farm revenues) and simulates how the agricultural sector would respond to changes in water availability and cost. Responses include switching to higher value and/or lower water use crops, adjusting input use, and idling land. The decision to switch crops and/or idle land depends on agricultural market conditions simulated by the model under increasing levels of a range of (hypothetical) demand management. The economic analysis quantifies the direct economic cost of changing crops and idling land under implementation of demand reduction. For this technical appendix, costs are expressed on a per acre-foot basis for comparability to other PMAs in the GSP.

The analysis reflects average water supply conditions. That is, the results of the analysis are the incremental cost of demand management in an average water supply year, not under critical drought conditions, or conversely, years with above-average supplies. The framework can be extended to evaluate these factors as part of future program design.

The economic model is developed on a geospatial scale that can be refined to evaluate Subbasin-wide demand management and demand management in specific areas. Two "areas of concern" were defined in the model. Figure 2 illustrates areas of concern and crop types<sup>3</sup> in the economic model for the Subbasin. Areas of concern are more precisely defined based on hydrogeologic conditions that are described in Chapter 3 of the GSP. Areas shown below include two broad regions: North (around Orland) and South (between Williams and Arbuckle).

<sup>&</sup>lt;sup>2</sup> See the following references for example:

Department of Water Resources. Water Plan Update. 2009. Data and Tools Technical Appendix. Economic Modeling of Agriculture and Water in California using the Statewide Agricultural Production Model.

U.S. Bureau of Reclamation. 2019. CVP Long Term Operations EIS. Appendix 12A: Statewide Agricultural Production Model (SWAP) Documentation.

<sup>&</sup>lt;sup>3</sup> Crop types are aggregated into seven groups for map display purposes. The economic analysis has 20 crop types that better reflect the unique costs, returns, and markets for each crop.



Figure 2. Colusa Subbasin Crops

### Colusa Subbasin Demand Management Costs

This section summarizes the direct cost of demand management for the following alternatives:

- **Colusa Subbasin-wide demand management**. This assumes demand management would occur across the entire Subbasin. That is, demand management is not targeted to specific areas. The implicit assumption is that water can be moved (exchanged, conveyed, in-lieu) across the Subbasin.
- **Targeted demand management**. This assumes demand management would occur in specific areas defined as the North and South areas of concern.

For each alternative, the cost of demand management was estimated as the mix of crops that could be idled at the lowest loss in net return. This is based on the aggregate supply of the crops produced in the Subbasin evaluated as part of the economic analysis (i.e., the lowest net return is not a static accounting measure of the least profitable crop). This is the minimum cost of the demand management program, defined by the opportunity cost of water for the crops that would be idled (the net return that the water would have provided on those crops).

#### Costs of Demand Management Applied to Entire Colusa Subbasin

This section summarizes the results of the demand management costs for the scenario where demand management is applied broadly to the entire Subbasin.

Figure 3 illustrates the range of demand management costs over a program scale of 2,500 and 25,000 AFY reduction in irrigation water demand. The cost ranges from around \$120 per AF at 2,500 AFY of demand management to \$210 per AF at 25,000 AFY. These are the direct cost of idling land, inclusive of groundwater pumping cost. The analysis estimates that the lowest net return lands and crops would idle first (hence the low cost for the smallest scale program), with higher net return lands included as the program scale increases.



Figure 3. Costs of Demand Management Applied to Entire Subbasin

#### Costs of Demand Management Targeted to Areas of Concern

This section summarizes the results of the demand management costs for the scenario where demand management is targeted to two areas of concern. The specific lands are not identified. Rather, the demand management program is broadly defined for the general region.

Figure 4 illustrates the range of demand management costs for a demand management program between 1,250 and 12,500 AFY. The demand management volumes are specific to each region (e.g., 1,250 AFY in the north area and south area, separately). A smaller scale program for each region (up to 12,500 rather than 25,000 AFY) is shown because the total level of demand management is independent in each region. The cost ranges from \$115 to \$185 per AF in the north area of concern and \$115 to \$250 per AF in the south area of concern. These higher values reflect the crop mix in these areas – more permanent crops with less flexible water demand and higher-value annual crops. These are the direct cost of idling land, inclusive of groundwater pumping cost.



Figure 4. Costs of Demand Management Targeted to Areas of Concern

## **Groundwater Allocation Concepts**

Demand management can be achieved without a groundwater allocation, so long as the program is able to quantify and verify the program demand management targets are achieved. However, an allocation can support implementation of a demand management program. It can also provide incentives for other PMAs (e.g., recharge) by defining the amount of groundwater available, and the additional quantities that would be associated with the development of new projects.

This section provides an overview of concepts and approaches related to allocation of groundwater in a Subbasin with diverse water users, water rights, and sources of recharge. It is not an allocation plan for the Subbasin, it is a discussion of the analysis that would be completed to set an allocation at a future date, if the GSAs decide to do so, either separately or together.

## Introduction and Definitions

A groundwater allocation specifies quantities of groundwater available to groundwater pumpers, which for the purposes of GSP development would include irrigators in the Subbasin. According to the Sustainable Groundwater Management Act (SGMA) and its regulations, *de minimis* pumpers (defined as less than two AF per year) would not be limited by an allocation. This section provides a general overview of allocation approaches, technical considerations, and summary of economic implications of alternative approaches. It is not an allocation plan for the Subbasin and it does not address all necessary considerations for defining and implementing an allocation. Developing a specific allocation would require careful analysis of the legal, hydrogeologic, economic, and engineering implications, and would require vigorous and informed discussions with stakeholders.

Allocation involves setting an overall amount of permissible net groundwater extraction for the subbasin and the apportionment of that overall amount among pumpers. It is important to note that implementing an allocation does not necessarily result in reducing groundwater use. For example, if the allocation is greater than historical use and it is apportioned in a way that all pumpers receive more than their historical use, then the allocation would not constrain groundwater users and would not result in less consumptive groundwater use. In the context of GSP implementation, the first step – the overall allocation – is typically tied to the sustainable yield (defined below) of the Subbasin. The second step – apportioning the allocation among users – can be based on different factors related to, for example, land use, recent water use, location, and other policy goals. Apportionment of the overall allocation can be made to individual wells, parcels, farming operations, or other defined entities. When the sustainable yield (including yield of other PMAs like recharge projects) is less than current pumping, the effect of an allocation is an overall reduction in net groundwater use.

Allocation based on sustainable yield often considers the various components of the subbasin water balance that contribute to sustainable yield. This is useful because the components vary geographically across the basin, under future conditions, and PMAs may affect those components over time. Defining the different types of groundwater and components of sustainable yield typically involves substantial data, modeling, and stakeholder input. Sources of groundwater that can be included in the allocation can include native/natural recharge, percolation of water developed and imported into the basin, other intentional recharge, and net subsurface groundwater flow into the basin from/to adjacent areas. Some concepts used in discussing allocation are defined below:

• **Native/natural recharge**. Native or natural recharge is recharge that is from deep percolation of precipitation or losses through natural water ways and channels in the Subbasin. These are sources of groundwater recharge that do not rely on the action of any individual entity within the basin, although certain actions (e.g., conversion of native land to urban uses) can affect their quantity.

- Imported/developed water recharge. Imported or developed sources of groundwater recharge are a result of investments by specific entities in the subbasin. For example, groundwater recharge from unlined canals developed, and paid for, by a district to import and deliver surface water rights. This is considered separately from native/natural recharge because it would not have contributed to groundwater recharge in the Subbasin without the investments of the district. A substantial amount of the developed water recharge is percolation from applied irrigation of developed water supply, some occurs during conveyance of the developed water, and some is the result of projects designed specifically to recharge groundwater, either in dedicated recharge areas, spread over lands during uncropped or dormant periods of the season (Flood MAR)<sup>4</sup>. Another kind of recharge, in-lieu recharge, does not increase percolation but rather reduces or avoids the net extraction of groundwater by providing a replacement supply.
- Net subsurface flow. Groundwater flows laterally across the Subbasin boundaries to and from adjacent areas outside the subbasin, driven by the gradients resulting from groundwater elevation differences. Many subbasins have groundwater flowing both in from some adjacent areas and out to other adjacent areas. The net flows change over time according to changes in precipitation, land use, and groundwater management both in the subbasin and in adjacent areas.
- **Transitional pumping**. Transitional pumping is also referred to as planned depletion of groundwater storage. SGMA provides for GSAs to transition to sustainable yield over a period of twenty years. In areas where current groundwater extraction is greater than the sustainable yield, an allocation will need to be less than current groundwater use. PMAs typically require time to implement, during which time growers subject to an allocation must reduce pumping, for example, by switching crops or idling land. A gradual time path for adjustment helps lessen the economic costs of this type of adjustment. Transitional water is effectively an overdraft that, consistent with SGMA and the GSP, decreases to zero over time as extraction is brought into balance with recharge.

### Time Dimension of Allocations

Allocation quantities are typically defined on an annual basis using long-run average components of the current and projected water balances. However, an allocation need not be the same every year; it can include transitional water that declines over time or it can be reduced or increased annually according to conditions, so long as on average it follows the path to sustainability laid out in the GSP. For example, the allocation can be increased in drought years to allow better conjunctive use of surface and groundwater, and then reduced in non-drought years to offset the increases in pumping in drought years. The yearly pattern of allocation could vary by subregion within the GSA (or subbasin) according to the situation. For example, lands fully dependent on groundwater may do better on a more consistent allocation, whereas lands with access to both ground and surface water might benefit from a variable allocation.

Another option to implement and manage a groundwater allocation is to allow growers to carryover some or all of their assigned allocation. The ability to carryover unused allocation may vary by different components. For example, unused natural recharge allocation may be carried over and used in subsequent years, but transitional pumping may not. In addition, carryover could be limited to a not-to-exceed amount each year, limited in the number of years an allocation carryover can be used, or even subject to annual "losses". The ability to "borrow" current pumping against next year's allocation could

<sup>&</sup>lt;sup>4</sup> These sources of developed recharge are typically part of GSP PMAs, which can be included as separate categories of recharge under an allocation, but are discussed jointly here.

be considered. Essentially a carryover could be implemented like a bank account, where growers take responsibility to manage their account over time within the rules defined by the GSA.

The allocation can be and probably will be adjusted over time. Transitional allocation has already been described above. In addition, periodic reassessment of quantities will be made as more current data is acquired (e.g., as data gaps are filled), changes in hydrologic conditions (e.g., climate change) are observed, and PMAs are implemented.

### Spatial Dimension of Allocations

An overall allocation is typically developed initially at a subbasin, or GSA-level based on the water balance. It is also possible to subdivide the GSA into smaller subareas or zones based on important variations in the components of an allocation, and with respect to groundwater conditions. For example, some zones may receive percolation from imported surface water that is included in their allocation, whereas other zones do not. Or some smaller areas may support and pay for a recharge project to boost their allocation while another zone does not need to do this. These kinds of differences can be easier to understand and manage if the allocation is built up from components rather than a single, annual amount.

Another possible rationale for subregional differences can involve sustainability criteria other than groundwater elevation. Groundwater dependent ecosystems, streamflow effects, and subsidence are examples of other conditions that may be considered in subregional allocations.

### Apportionment of the Allocation

After the components of groundwater are defined and the overall allocation is determined (either for the entire GSA or for subareas), the next step in groundwater allocation is defining how to apportion the allocation among the irrigators in the subbasin.

Some important considerations include:

- Allocation eligibility. Once the volume for different components of a groundwater allocation is defined, it is necessary to determine which lands and users are eligible for an allocation and how specific volumes are assigned. This could vary by groundwater component. For example, native recharge could be allocated on a per acre basis to all eligible parcels in the subbasin. Transitional water could be allocated in the same manner, or it could be allocated based on historical use. The yield from a recharge project could be assigned according to proportionate contributions to the cost of the project. Allocations may also consider other non-consumptive uses, such as habitat benefits.
- Non-irrigated parcels. A topic of much discussion during development of many GSPs (and GSP implementation in Critically Overdrafted subbasins) is whether and how non-irrigated lands are included in the allocation. Non-irrigated parcels can include parcels that were never irrigated and parcels that were previously irrigated but are not currently irrigated. Never irrigated parcels may not be economically feasible to develop into irrigated agriculture, whereas currently unirrigated parcels may have been temporarily retired for various reasons. An allocation typically includes defining a point in time where a parcel is defined as non-irrigated (e.g., if it has not been irrigated since a specific date). Non-irrigated parcels may be eligible for some components of the groundwater allocation. This may include portions of the sustainable yield, but typically does not include any transitional water. Additional considerations may include lands near sensitive habitat areas.

## Additional Considerations and Analysis

Developing a groundwater allocation should include consideration of legal, economic, engineering, hydrogeologic, and political considerations. In areas with both ground and surface water supplies, the ability to use them conjunctively can provide sufficient water (from delivered surface water and groundwater allocation) during droughts.

In areas where the groundwater allocation is less (and in some cases substantially less) than current groundwater use, there can be important economic implications for different allocation design approaches. An analysis to inform allocation development typically includes quantifying the economic implications of alternative groundwater allocation design approaches. This includes evaluating financial impacts to individual groundwater users (e.g., growers) as well as the regional economic implications.

Assigning quantities of groundwater available to individual pumpers can incentivize them to think about the costs and benefits of reducing their water use or developing new recharge opportunities. An allocation effectively creates a scarcity of groundwater, whereby the value of groundwater is driven by the economic value (net return) it can produce. Economic effects of an allocation depend on many factors, including: the size of the allocation relative to crop water demand (how limiting is the allocation); the sources, costs, and distribution of current and prospective surface supplies; and the flexibility allowed to growers in how they manage their allocation.

A strict allocation and apportionment are a rigid method for implementing demand management. They effectively limit water use on a well, parcel, or operation basis. Economic analysis can illustrate the advantages, both to individual growers and to the regional economy, of increasing the flexibility of allocations. Allowing growers to move their allocated groundwater freely (subject to some review) is one step to increase flexibility. Rather than allocating pumping to each well or parcel, a grower can make choices about distributing allocation among fields and crops, in maximize return, and reduce the costs of demand management. A more ambitious step is to allow growers to buy and sell allocation among themselves, using either short-term or long-term agreements. A number of other GSAs in California are currently evaluating and pilot-testing groundwater trading markets for this purpose.

## Administering an Allocation

If a GSA, or subbasin, decides to adopt an allocation and defines the mechanism to calculate how to assign allocation to different individuals, entities, or wells, it must then monitor pumping and enforce the allocation. If carryover across years is allowed, the GSA must also track that and incorporate it in the annual water budget accounting. Most groundwater management entities outside the state use some form of measurement, including wellhead metering, to track allocations. In California, many GSAs are proposing or considering direct measurement or using crop type and/or ET calculations to estimate water use and groundwater pumping. Estimation versus measurement is a GSA policy decision that can have important effects on the cost and its ability to manage the allocation effectively.

## Summary of Steps in Considering and Implementing an Allocation

- 1. Develop the key components of the GSP baseline conditions, water budgets, criteria and thresholds, and PMAs.
- 2. Determine if an allocation is necessary and useful to achieve targets and implement PMAs, particularly demand management actions, effectively.

- 3. If an allocation is warranted, use data and analysis to evaluate, compare, and select allocation amounts and other characteristics that best meet the needs of the GSA.
- 4. Monitor conditions and pumping over time to verify the effectiveness of the allocation and to modify as needed.

## Discussion

This appendix summarized an analysis of the cost of demand management for two hypothetical programs: one covering the entire Subbasin, and another targeted to two areas of concern. The cost of demand management is estimated as the loss in net return to farming. It does not include program administrative costs or any secondary impacts, and it does not consider what the market price for water would be under a local groundwater market. Secondary economic impacts should be considered in future iterations of this analysis to support implementation of PMAs.

Implementing an annual allocation can provide a strong impetus for growers to adopt demand management and may be a prerequisite for effective demand management in some cases. It is not clear that an allocation is warranted at this time for the Subbasin, though it may become more useful in the future. Developing a specific allocation would require careful analysis of the legal, hydrogeologic, economic, and engineering implications, and would require vigorous and informed discussion with stakeholders.

Future analysis of demand management program costs and allocation design would be specific to the program being considered in the Subbasin. For example, under the "targeted demand management" PMA summarized under Chapter 6 Section 6.5.2, the economic analysis would be developed for the regions that would participate in the program (both buyer and seller regions). This would define incentives to participate in the program. The general steps to define a demand management program costs include:

- 1. Define the location, scale, and timing of the program. Prepare economic data specific to the program areas and define any program-specific conditions that would affect participation.
- 2. If a groundwater allocation will be included, define the groundwater allocation approach and specify the allocation to lands/entities in the Subbasin. Prepare an economic analysis and hydrogeologic analysis of the impacts of alternative groundwater allocation designs.
- 3. Use the general method described above to quantify the direct cost of demand management in each area. The analysis would additionally consider the opportunity cost of water in other, non-farming, uses, such as a local or regional water transfer market. Market prices can exceed the values in irrigated agriculture in some years and would drive demand management program costs in these years.
- 4. Evaluate potential secondary economic impacts, and to whom those impacts may occur. Also consider any benefits associated with the program, and to whom those benefits accrue. For example, this may include broader groundwater level benefits in the area, and regions down-gradient. Monetize any anticipated secondary economic impacts and benefits.
- 5. Use the results of the steps above to develop an appropriate incentive structure (accounting of costs and benefits) that would support demand management program design. See Section 6.5.2 of GSP Chapter 6 for a summary of different types of potential demand management programs.

Appendix 6C

**Overview of Projects and Management Actions** 

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Specialists in Agricultural Water Management

## **Technical Memorandum**

To: Glenn and Colusa County Groundwater Authorities

**From:** Davids Engineering

Date: November 19, 2021

Subject: Overview of Projects and Management Actions

## Introduction

More than 30 projects and management actions (PMAs) are included in the Colusa Subbasin GSP to achieve and maintain sustainable groundwater conditions in the Colusa Subbasin (Subbasin). PMAs are categorized and presented in this appendix according to the current status of implementation and development:

- <u>Planned</u> Projects and Management Actions are PMAs that the GSAs or other project proponents are working to implement that will support sustainable groundwater management in the Subbasin, and mitigate historical and current drought effects. Five projects are currently planned for implementation, all of which are groundwater recharge projects that use surface water for direct and/or in-lieu recharge.
- Ongoing Projects and Management Actions are PMAs that are ongoing and will support sustainable groundwater management in the Subbasin. In accordance with 23 CCR §354.44(a), these are PMAs that would allow GSAs to achieve the sustainability goal for the Subbasin and avoid reaching the minimum thresholds defined in this GSP under future, changing conditions. Six PMAs are currently ongoing in the Subbasin.
- <u>Potential</u> Projects and Management Actions are PMAs that may be implemented if necessitated by groundwater conditions in the Subbasin. These may have been studied by the project proponent or in earlier regional water planning documents, but most project design, cost estimates, and planning work have yet to be completed, and would only be initiated if the project is eventually triggered for implementation as a result of continued monitoring of groundwater conditions. There are more than 20 potential PMAs proposed for the Subbasin.

Each of the PMAS are designed to support the long-term sustainability of groundwater resources of the Subbasin. The information currently available for each of these PMAs is provided in Tables 1 through 6 below. These tables summarize the following information:

- Table 1. Brief Description of all Projects and Management Actions
- Table 2. Project Type, Category, Proponent, and Location for all Projects and Management Actions.
- Table 3. Implementation Criteria, Notice Process, Permitting and Regulatory Process, and Timeline for all Projects and Management Actions.
- Table 4. Anticipated Benefits of all Projects and Management Actions.
- Table 5. Benefit Evaluation and Water Source for all Projects and Management Actions.

• Table 6. Legal Authority Requirements, Estimated Cost, and Potential Funding Sources for all Projects and Management Actions.

The fields in these tables have been designed to meet the requirements for PMAs as described in the California Code of Regulations (CCR); when applicable, a reference to a specific CCR location is provided as the first row of each table.

#### Colusa Subbasin Groundwater Sustainability Plan

CCR § 354.44	CCR §354.44(a)		
Project/Management Action Name	Brief Project Description		
Planned			
Colusa County Water District (CCWD) In-Lieu Groundwater Recharge	CCWD will utilize up to an additional 30 thousand acre-feet (taf) of surface water for irrigation in all years but Shasta Critical years for in-lieu recharge (an average of 27 taf per year). The additional surface water will be made available through full use of the CCWD's existing CVP contract and annual and multi-year water purchase and transfer agreements. The additional water will be conveyed through the existing Tehama-Colusa Canal (TCC) and CCWD facilities. It is expected to be used on existing district lands, though as an optional component of this project CCWD is considering relatively small annexations of lands adjoining the district and supplying surface water to these lands (currently dependent on groundwater, requiring additional infrastructure for surface water delivery), resulting in in- lieu groundwater recharge through reduction of groundwater pumping.		
Colusa Drain MWC (CDMWC) In- Lieu Groundwater Recharge	CDMWC encompasses approximately 46,000 acres of agricultural land and environmental habitat adjacent to the Colusa Basin Drain (Drain). Shareholders in CDMWC divert water for summer irrigation from the drain under a combination of appropriative water rights held individually by the shareholders, a long-term service supply agreement with USBR and annual and multi-year transfer agreements with neighboring USBR settlement contractors. Historically, many CDMWC diverters use both groundwater and surface water for summer irrigation because physical supplies of water in the Colusa Drain are often unreliable and insufficient to satisfy those irrigation requirements. This project would provide additional surface supplies averaging approximately 28 taf per year, allowing CDMWC diverters to increase their diversions of surface water from the Drain to provide in-lieu groundwater recharge and decrease groundwater pumping by an equal amount.		
Colusa Subbasin Multi-Benefit Groundwater Recharge	The Nature Conservancy (TNC) is partnering with growers and the Colusa and Glenn Groundwater Authorities for an on-farm, multi-benefit groundwater recharge incentive program. Program objectives are to benefit disadvantaged communities and other communities in the Subbasin by replenishing critical domestic and agricultural water supplies, growers economically through incentive payments, migratory shorebirds through the creation of critical winter habitat on farms, and groundwater conditions (via groundwater recharge). Surface water from the Sacramento River, subject to availability, is conveyed to and applied to flood and maintain ponds on selected fields using existing diversion, conveyance, and on-farm infrastructure. The pilot program was initiated in Colusa County in 2018 and concluded in the spring of 2021, with plans to expand and continue into the future. DWR will be participating in the Colusa Subbasin Multi-Benefit Groundwater Recharge project as it is expanded into a larger program.		

CCR § 354.44	CCR §354.44(a)		
Project/Management Action Name	Brief Project Description		
Orland-Artois Water District (OAWD) Land Annexation and Groundwater Recharge	OAWD is working with a group of neighboring non-district landowners to annex approximately 12,000 acres of groundwater-dependent agriculture into the district. Surface water for the annexed lands would be secured through multi-year purchase or transfer agreements with willing sellers, conveyed through the existing TCC, and distributed to the annexed lands through new distribution facilities. It is estimated that a long-term average of approximately 23 taf per year of surface water would be available, reducing groundwater pumping by 23 taf per year. Additionally, certain annexed lands with high infiltration characteristics would be configured for direct recharge by surface spreading, primarily using Section 215 water. Preliminary project design shows seven proposed recharge areas totaling 371 acres in the project. OAWD is evaluating recharge potential and will refine these estimates. The direct recharge capacity has not yet been estimated. This project will address an area within the Subbasin where groundwater levels have been in decline in recent years due to drought and increasing water demands being met through increasing groundwater pumping.		
Sycamore Slough Groundwater Recharge Pilot Project	Proctor and Gamble (P&G) and Davis Ranches have entered into a cooperative agreement to implement a 10-year groundwater recharge pilot project. The project will apply surface water diverted from the Sacramento River to a 66-acre field on Davis Ranches for groundwater recharge and to provide habitat for migrating shorebirds for 30 to 45 days during the fall or winter each year. The timing of the project may be targeted to provide fall and winter habitat for migratory shorebirds, in addition to groundwater recharge benefits. However, the precise timing of the project is flexible to accommodate changes in water availability and other factors between years. Sacramento River water is available to Davis Ranches under riparian rights and a Sacramento River settlement contract with Reclamation. If the project starts before November 1, settlement contract water would be used. Otherwise, riparian water rights would be exercised for beneficial use (habitat). The goal is to recharge 5,000 af over the 10-year study period and to revegetate a portion of Sycamore Slough. Monitoring of groundwater conditions will be done in eight existing groundwater wells, including dedicated monitoring wells and production wells. If the project is successful and cost effective, it could be continued in perpetuity to sustain long-term groundwater recharge and revegetation in the neighboring Sycamore and Dry Sloughs.		

CCR § 354.44	CCR §354.44(a)		
Project/Management Action Name	Brief Project Description		
Ongoing			
Reclamation District 108 (RD 108) and Colusa County Water District (CCWD) Agreement for Five-Year In- Lieu Groundwater Recharge Project	CCWD (and Dunnigan Water District [DWD] located in the Yolo Groundwater Subbasin) purchase surface water from RD108 for distribution within their service areas under a five-year agreement, expiring after 2022. Under the five-year agreement, 10,000 af is purchased by and transferred to CCWD and DWD, with 80 percent to CCWD and 20 percent to DWD. This project supplies additional surface water to CCWD and DWD that provides in-lieu recharge to meet water demands that otherwise would be met through groundwater pumping.		
Glenn-Colusa Irrigation District (GCID) Strategic Winter Water Use for Groundwater Recharge and Multiple Benefits	GCID holds a 1999 water right permit to divert Sacramento River water for irrigation and rice straw decomposition between November 1 and March 31; water used under the permit is referred to as "winter water." The potential exists to increase the groundwater recharge and habitat enhancement benefits of winter water use by increasing winter use for rice straw decomposition, winter irrigation, and frost control provided that certain constraints can be alleviated. Under this project, working in collaboration with partners within the subbasin and with environmental advocacy groups, GCID will investigate opportunities to increase winter water use by alleviating these constraints.		
Sycamore Marsh Farm Direct Recharge Project	Sycamore Marsh Farm has been in process of developing a groundwater recharge plan to store water in our aquifer by several different methods. The plan provides for 205 acres of year-round recharge basins and 163 additional acres of winter recharge areas.		
Glenn-Colusa Irrigation District (GCID) Expansion of In-Basin Program for In-lieu Groundwater Recharge	In cooperation with Reclamation, GCID has developed temporary arrangements to supply district surface water to neighboring non-district agricultural lands that primarily use groundwater. These temporary arrangements were implemented under agreements that recently expired in 2020. There is interest in continuing and expanding this inbasin surface water use. GCID is currently working in cooperation with Reclamation to renew these agreements and expand this program for the purpose of reducing groundwater pumping and in-lieu groundwater recharge.		
Orland Unit Water Users Association (OUWUA) Irrigation Modernization for Increased Surface Water Delivery and Reduced Groundwater Pumping	Continue the modernization of the association's southside irrigation conveyance and distribution system; these improvements are expected to result in more reliable and flexible farm deliveries that will provide incentive for growers to use more surface water and less groundwater.		
Urban Water Conservation in Willows	California Water Service - Willows District is implementing urban water conservation measures through water waste prevention ordinances, metering, conservation pricing, public education and outreach, programs to assess and manage distribution system real loss, water conservation program coordination and staffing support, and other demand management measures. These are described in greater detail in Chapter 9 of the 2020 UWMP for California Water Service - Willows District.		

CCR § 354.44	CCR §354.44(a)		
Project/Management Action Name	Brief Project Description		
Potential			
Colusa County Public Water System Water Treatment Plant	Construct a water treatment plant on the Sacramento River between Colusa and Grimes to provide fresh drinking water to public water supply systems in Colusa and possibly Sutter and Yolo Counties.		
Delevan Pipeline Colusa Basin Drain Intertie	Construct an intertie between the proposed Delevan Pipeline component of the Sites Reservoir Project and the Colusa Basin Drain. Currently, the only proposed intertie is the Dunnigan intertie. This intertie will provide a connection to downstream water users to utilize surface water storage from Sites Reservoir, improve conjunctive use, and potentially decrease groundwater pumping. This intertie will also provide protection for the ecosystems upstream of the proposed Dunnigan intertie and redundancy in case the TCC becomes inoperable due to subsidence or earthquake damage.		
Sycamore Slough Colusa Basin Drain Multi-Benefit Recharge Project	Restoration of portions of Sycamore Slough through voluntary landowner participation in a multi-benefit recharge project. The recharge site will be hosted by Davis Ranches, a participating landowner within the Sycamore Mutual Water Company service. Water would be sourced from the Sacramento River during high flows in the system. The Sycamore Mutual Water Company is a Sacramento River Settlement Contractor, and could use a portion of its settlement contract water supplies for recharge if the project is initiated prior to November 1. If the project is initiated after November 1, water could be accessed using existing riparian water rights exercised for beneficial use (habitat). Field flooding would provide recharge, restoration, and multi-benefits such as winter floodplain habitat for migrating shorebirds/waterfowl, or habitat restoration for monarch butterflies and other pollinator species. Excess flows in winter could be diverted from the Colusa Basin Drain for recharge, and restoration could include a multi-benefit focus with environmental benefits such as habitat restoration for monarch butterfly or other pollinator species.		
The TCC has existing gates that are used to dewater sections of the canal. The gates discharge into epher that intersect the canal. Water could be discharged from the TCC into these streams at a rate where the out of the subbasin, but recharge the groundwater system. Flow measurement devices would need to be the gates. Surface water for recharge would be Sacramento River available water under existing Bureau Reclamation water supply contracts held by TCC contractors, existing water rights settlement contracts, Section 215 contracts.			
Westside Streams Diversion for Direct or In-lieu Groundwater Recharge	There are a number of ephemeral streams that originate in the Coastal Range to the west of the Subbasin and flow eastward into the Subbasin. During periods of flow in the winter and spring, a portion of these flows could be diverted for either (1) off-stream storage and subsequent use for irrigation or (2) direct groundwater recharge through Flood-MAR, dedicated recharge basins, or modified stream beds.		
Reduce Non-beneficial Evapotranspiration/Invasive Species Eradication (Arundo, Eucalyptus, Tamarisk, etc.)	Removal of invasive, non-native plant species (i.e., arundo donax, eucalyptus, tamarisk, etc.) from riparian corridors, and other areas they may be present, will provide both a reduction in evapotranspiration from shallow groundwater and native ecosystem restoration.		

CCR § 354.44	CCR §354.44(a)		
Project/Management Action Name	Brief Project Description		
Enhanced Infiltration of Precipitation on Agricultural Lands	Current cultural practices, particularly in almond orchards, tend to reduce infiltration and increase runoff of precipitation. Development and adoption of on-farm cultural practices to reduce precipitation runoff and increase infiltration would result in increased storage of precipitation in the crop root zone, thereby reducing irrigation water requirements. Additionally, to the extent that infiltrated precipitation percolates through the root zone, this would result in direct groundwater recharge. This project is proposed as a potential research management action, for example, a collaborative initiative between the GSAs and other interested organizations.		
Colusa Subbasin Flood-MAR	The CGA and GGA, in coordination with landowners and other agencies, would investigate, develop, and implement a program to divert flood waters within the Subbasin, when available, for spreading across agricultural lands or other working landscapes for direct groundwater recharge.		
Reclamation District 108 "Boards In" Program	RD108 would institute a voluntary or financially incentivized program in which landowners leave their spill board in place during the winter to capture rainfall and hold it on the fields for recharge.		
Glenn-Colusa Irrigation District (GCID) In-lieu Groundwater Recharge	Despite GCID having highly reliable surface water supplies, a small percentage of district lands rely primarily on groundwater for irrigation supply. GCID will investigate, develop, and implement measures to incentivize associated growers to utilize surface water supplied by GCID, which will provide in-lieu recharge through reduced groundwater pumping.		
Glenn-Colusa Irrigation District (GCID) Water Transfers to TCCA CVP Contractors	GCID is exploring the possibility of transferring surface water to Central Valley Project (CVP) contractors served by the Tehama Colusa Canal to provide in-lieu groundwater recharge and reduce groundwater pumping. Transferred water would be diverted into the TCC at the Red Bluff Pumping Plant and Fish Screen facility rather than at the GCID pumping plant and fish screen facility north of Hamilton City.		
Orland-Artois Water District (OAWD) Direct Groundwater Recharge	OAWD would directly recharge groundwater through Managed Aquifer Recharge (MAR) on agricultural land to improve aquifer conditions, especially in the groundwater cone of depression to the west of Artois. A pilot project for MAR was conducted in 2017 on the VanTol site using water from a Section 215 Temporary Water Contract from USBR. Section 215 water is low-cost, but is only available during high flow conditions in rivers and streams.		
Orland Unit Water Users Association (OUWUA) Flood Water Conveyance	During periods of high flow and reservoir release on Stony Creek, divert water at OUWUA's south diversion and convey it to various locations for direct recharge within the OUWUA service area.		
Sites Reservoir	The Sites Project would utilize existing infrastructure to divert unregulated and unappropriated flow from the Sacramento River at Red Bluff and Hamilton City and convey water to a new off stream reservoir west of the town of Maxwell. New and existing facilities would move water into and out of the reservoir. Depending on project operation and yield, there is potential for groundwater benefits to accrue to the Subbasin using water from Sites Reservoir.		

CCR § 354.44	CCR §354.44(a)		
Project/Management Action Name	Brief Project Description		
Colusa Subbasin In-lieu Recharge & Banking Program	Incentivize landowners to take surplus contract surface water in-lieu of pumping groundwater. A predetermined portion of the additional water brought into the districts would be dedicated to contributing to local groundwater sustainability and some portion of the remaining quantities would be available for delivery, directly or by exchange, to South Valley members in the San Joaquin Valley.		
Sycamore Marsh Farm In-lieu Recharge Project	Sycamore Marsh Farm is in the process of developing an in-lieu groundwater recharge plan. Sycamore Marsh Farm encompasses approximately 420 acres in the Colusa Drain Mutual Water Company (CDMWC) and has an additional 449 acres that could potentially be annexed into the CDMWC, allowing for diversion of surface water from CDMWC.		
Westside Off-stream Reservoir and In-Lieu Groundwater Recharge	TCCA Contractors would construct off-stream surface reservoirs along the western edge of the Subbasin and up-slope from the TCC diverting surplus Sacramento River flows (e.g., Section 215 water) into these storage reservoirs. Stored water would be released into the TCC for irrigation supply to enable reduction of groundwater pumping (i.e. in-lieu groundwater recharge). New facilities on the TCC and new storage impoundments would need to be planned, designed and constructed subject to a determination of economic and environmental feasibility.		
Domestic Well Mitigation Program	Groundwater level measurable objectives (MOs) adopted for sustainable management of the Subbasin operation should be highly protective of domestic water supply wells. However, it is possible that in certain portions of the Subbasin, groundwater levels will fall. Projects and management actions will be implemented for recovery of groundwater levels, but some domestic wells may go dry. To mitigate the effects of domestic well stranding due to groundwater level decline, the CGA and GGA will investigate implementing domestic well mitigation programs in their respective portions of the subbasin.		
Strategic Short-Term Demand Management	The program would be focused in specific local areas with sustainability challenges and would provide GSAs with a voluntary, flexible, short-run response to alleviate impacts of drought. It would be voluntary and provide financial incentives (payments) to encourage participation. Payment terms and other conditions would be specified as part of program design. Two potential structures for the program are idling lands in drought-affected areas of the subbasin with groundwater sustainability challenges or idling lands in participating surface water-using portions of the Subbasin and conveying the saved surface water to the drought-affected areas with groundwater sustainability challenges.		
Long-Term Demand Management Action	Demand management broadly refers to any water management activity that reduces the consumptive use of irrigation water. A demand management action is one that incentivizes, enables, or possibly requires water users to reduce their consumptive use.		
Well Abandonment Outreach and Funding Program	The CGA and GGA will coordinate with Colusa and Glenn counties, respectively, to create a program providing outreach and education to landowners regarding the proper procedures for well decommissioning and abandonment, as well as a funding source to assist landowners with these procedures. This program is anticipated to improve the subbasin well inventory and potentially have water quality benefits, as improperly abandoned wells are a potential point source for water quality contaminant transport from the ground surface to the underlying groundwater system.		

CCR § 354.44	CCR §354.44(a)		
Project/Management Action Name	Brief Project Description		
Preservation of Lands Favorable for Recharge	The CGA and GGA will coordinate with those agencies having authority over land use planning in and Glenn counties, respectively, to investigate, design, and implement a program providing incentives to landowners with lands favorable to groundwater recharge to preserve them as agricultural or undeveloped lands on which groundwater recharge will be possible in perpetuity.		
Review of County Well Permitting Ordinances	Review and revise the county well permitting processes in the Subbasin to ensure that future well permitting aligns with the Subbasin sustainability goal and that future changes to well permitting are reviewed by the GSAs. The GSAs would work with the counties to review and suggest revisions to ordinances (these are outside of the jurisdiction of the GSAs).		
Drought Contingency Planning for Urban Areas	The CGA and GGA will coordinate with cities, towns and other municipal and industrial water suppliers, which are all fully dependent on groundwater in the Subbasin, to encourage drought contingency planning and drought preparedness in a manner consistent with sustainable groundwater management according the GSP.		
Development of a Dedicated Network of Shallow Monitoring Wells for GDE Monitoring	Evaluate and develop a dedicated network of shallow monitoring wells specifically planned and sited for monitoring conditions in areas of the Subbasin where GDEs are most likely to be found. This action is also expected to incorporate biological monitoring to inform the location of new shallow monitoring wells and monitor whether GDEs are being impacted by changing groundwater conditions		

Table 2. Project Type	. Category. Proponent. an	d Location for all Proiects	s and Management Actions.
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CCR § 354.44						
Project/Management Action Name	Project Type	Project GSP Category (Planned, Ongoing, or Potential)	Project Proponent	Project Location		
Planned						
Colusa County Water District In- Lieu Groundwater Recharge	In-lieu Groundwater Recharge	Planned	CCWD	CCWD		
Colusa Drain MWC In-Lieu Groundwater Recharge	In-lieu Groundwater Recharge	Planned	CDMWC	CDMWC		
Colusa Subbasin Multi-Benefit Groundwater Recharge	Direct Groundwater Recharge	Planned	CGA, GGA and TNC	Colusa County		
Orland-Artois Water District Land Annexation and Groundwater Recharge	Direct and In-lieu Groundwater Recharge	Planned	OAWD	OAWD		
Sycamore Slough Groundwater Recharge Pilot Project	Direct Groundwater Recharge	Planned	Davis Ranches	Sycamore Slough		
Ongoing						
Reclamation District 108 and Colusa County Water District Agreement for Five-Year In-Lieu Groundwater Recharge Project	In-lieu Groundwater Recharge	Ongoing	RD108 and CCWD	CCWD		
Glenn-Colusa Irrigation District Strategic Winter Water Use for Groundwater Recharge and Multiple Benefits	Direct and In-lieu Groundwater Recharge	Ongoing	GCID	GCID		
Sycamore Marsh Farm Direct Recharge Project	Direct Groundwater Recharge	Ongoing	Sycamore Marsh Farm	Sycamore Marsh Farm		
Glenn-Colusa Irrigation District Expansion of In-Basin Program for In-lieu Groundwater Recharge	In-lieu Groundwater Recharge	Ongoing	GCID	GCID and Neighboring Areas		

CCR § 354.44				
Project/Management Action Name	Project Type	Project GSP Category (Planned, Ongoing, or Potential)	Project Proponent	Project Location
Orland Unit Water Users Association Irrigation Modernization for Increased Surface Water Delivery and Reduced Groundwater Pumping	In-lieu Groundwater Recharge	Ongoing	OUWUA	OUWUA
Urban Water Conservation in Willows	Management Action	Ongoing	California Water Service - Willows District	Willows
Potential				-
Colusa County Public Water System Water Treatment Plant	In-lieu Groundwater Recharge	Potential	Ben King (stakeholder)	Colusa County
Delevan Pipeline Colusa Basin Drain Intertie	Direct and In-lieu Groundwater Recharge	Potential	Ben King (stakeholder)	Intersection of Colusa Basin Drain and Proposed Delevan Pipeline
Sycamore Slough Colusa Basin Drain Multi-Benefit Recharge Project	Direct Groundwater Recharge	Potential	Ben King (stakeholder)	Sycamore Slough (Davis Ranches)
Tehama-Colusa Canal Trickle Flow to Ephemeral Streams	Direct Groundwater Recharge	Potential	Bill Vanderwaal (RD 108)	At TCC and ephemeral stream crossings
Westside Streams Diversion for Direct or In-lieu Groundwater Recharge	Direct and In-lieu Groundwater Recharge	Potential	CGA and GGA	Colusa and Glenn Counties
Reduce Non-beneficial Evapotranspiration/Invasive Species Eradication (Arundo, Eucalyptus, Tamarisk, etc.)	Reduce Groundwater Demand	Potential	CGA and GGA	Subbasin-wide
Enhanced Infiltration of Precipitation on Agricultural Lands	Direct Groundwater Recharge	Potential	CGA and GGA	Subbasin-wide
Colusa Subbasin Flood-MAR	Direct Groundwater Recharge	Potential	CGA and GGA	Subbasin-wide

#### Table 2. Project Type, Category, Proponent, and Location for all Projects and Management Actions.

CCR § 354.44				
Project/Management Action Name	Project Type	Project GSP Category (Planned, Ongoing, or Potential)	Project Proponent	Project Location
Reclamation District 108 "Boards In" Program	Direct Groundwater Recharge	Potential	Bill Vanderwaal (RD 108)	RD108 / Subbasin-wide
Glenn-Colusa Irrigation District In- lieu Groundwater Recharge	In-lieu Groundwater Recharge	Potential	GCID	GCID
Glenn-Colusa Irrigation District Water Transfers to TCCA CVP Contractors	In-lieu Groundwater Recharge	Potential	GCID	Participating TCCA CVP Contractors
Orland-Artois Water District Direct Groundwater Recharge	Direct Groundwater Recharge	Potential	OAWD	OAWD
Orland Unit Water Users Association Flood Water Conveyance	Direct Groundwater Recharge	Potential	OUWUA	OUWUA
Sites Reservoir	Direct and In-lieu Groundwater Recharge	Potential	Sites Project Authority	Antelope Valley (to west of Colusa Subbasin)
Colusa Subbasin In-lieu Recharge & Banking Program	In-lieu Groundwater Recharge	Potential	South Valley Water Resources Authority	Within any districts willing to participate
Sycamore Marsh Farm In-lieu Recharge Project	In-lieu Groundwater Recharge	Potential	Sycamore Marsh Farm	Sycamore Marsh Farm
Westside Off-stream Reservoir and In-Lieu Groundwater Recharge	In-lieu Groundwater Recharge	Potential	TCCA Contractors	Participating TCCA CVP Contractors
Domestic Well Mitigation Program	Management Action	Potential	CGA and GGA	Subbasin-wide
Strategic Short-Term Demand Management	Management Action	Potential	CGA and GGA	Subbasin-wide
Long-Term Demand Management Action	Management Action	Potential	CGA and GGA	Subbasin-wide
Well Abandonment Outreach and Funding Program	Management Action	Potential	CGA and GGA	Subbasin-wide

#### Table 2. Project Type, Category, Proponent, and Location for all Projects and Management Actions.
CCR § 354.44				
Project/Management Action Name	Project Type	Project GSP Category (Planned, Ongoing, or Potential)	Project Proponent	Project Location
Preservation of Lands Favorable for Recharge	Management Action	Potential	CGA and GGA	Subbasin-wide
Review of County Well Permitting Ordinances	Management Action	Potential	CGA and GGA	Subbasin-wide
Drought Contingency Planning for Urban Areas	Management Action	Potential	CGA, GGA, and cities (GSA member agencies)	Subbasin-wide
Development of a Dedicated Network of Shallow Monitoring Wells for GDE Monitoring	Management Action, Closing Data Gaps	CGA and GGA	CGA and GGA	Subbasin-wide

#### Table 2. Project Type, Category, Proponent, and Location for all Projects and Management Actions.

		CCR				
CCR § 354.44	CCR §354.44(b)(1)(A)	§354.44(b)(1)(B)	CCR §354.44(b)(3)	CCR	§354.44(b)(4)	
			Required			
	Implementation and		Permitting and	Current Status		
	Termination	Public and/or Inter-	Regulatory	(Ongoing, Planned,	Anticipated	Anticipated
Project/Management Action	Timing/Criteria for	Agency Notice	Process or Status	Potential or	Start Date	Completion
Name	Implementation	Process	of Permitting	Concept)	(Year)	Date (Year)
Planned	1	1		1		
Colusa County Water District In-Lieu Groundwater Recharge	Planning currently ongoing; no construction of new facilities needed.	See Note 2 below	See Note 4 below	Planned	2022	See note 6 below
Colusa Drain MWC In-Lieu Groundwater Recharge	Planning currently ongoing	See Note 3 below	See Note 5 below	Planned	See Note 6 below	See Note 6 below
Colusa Subbasin Multi-Benefit Groundwater Recharge	Planning currently ongoing	See Note 2 below	See Note 4 below	Planned (pilot project complete)	2021	See Note 6 below
Orland-Artois Water District Land Annexation and Groundwater Recharge	Planning currently ongoing; intent is to proceed expeditiously to design and construction of new facilities	See Note 2 below	See Note 4 below	Planned	2020	2025
Sycamore Slough Groundwater Recharge Pilot Project	See Note 1 below	See Note 3 below	See Note L2 below	Planned	See Note 6 below	See Note 6 below
Ongoing						
Reclamation District 108 and Colusa County Water District Agreement for Five-Year In-Lieu Groundwater Recharge Project	See Note 1 below	See Note 3 below	See Note 5 below	Ongoing and Planned	See Note 6 below	See Note 6 below
Glenn-Colusa Irrigation District Strategic Winter Water Use for Groundwater Recharge and Multiple Benefits	Currently ongoing	See Note 2 below	See Note 4 below	Ongoing	2021	See Note 6 below
Sycamore Marsh Farm Direct Recharge Project	Currently ongoing	See Note 2 below	See Note 4 below	Ongoing	2020	See Note 6 below

Table 3. Implementation Criteria, Notice Process, Permitting and Regulatory Process, and Timeline for all Projects and Management Actions.

CCR § 354.44	CCR §354.44(b)(1)(A)	CCR §354.44(b)(1)(B)	CCR §354.44(b)(3)	CCR §354.44(b)(4)		
Project/Management Action Name	Implementation and Termination Timing/Criteria for Implementation	Public and/or Inter- Agency Notice Process	Required Permitting and Regulatory Process or Status of Permitting	Current Status (Ongoing, Planned, Potential or Concept)	Anticipated Start Date (Year)	Anticipated Completion Date (Year)
Glenn-Colusa Irrigation District Expansion of In-Basin Program for In-lieu Groundwater Recharge	Currently ongoing	See Note 2 below	See Note 4 below	Ongoing	2021	See Note 6 below
Orland Unit Water Users Association Irrigation Modernization for Increased Surface Water Delivery and Reduced Groundwater Pumping	See Note 1 below	See Note 3 below	See Note 5 below	Ongoing	See Note 6 below	See Note 6 below
Urban Water Conservation in Willows	Currently ongoing	See Note 2 below	See Note 4 below	Ongoing	2016	See Note 6 below
Potential						
Colusa County Public Water System Water Treatment Plant	See Note 1 below	See Note 3 below	See Note 5 below	Potential	See Note 6 below	See Note 6 below
Delevan Pipeline Colusa Basin Drain Intertie		See Note 3 below	See Note 5 below	Concept	See Note 6 below	See Note 6 below
Sycamore Slough Colusa Basin Drain Multi-Benefit Recharge Project		See Note 3 below	See Note 5 below	Concept	See Note 6 below	See Note 6 below
Tehama-Colusa Canal Trickle Flow to Ephemeral Streams		See Note 3 below	See Note 5 below	Concept	See Note 6 below	See Note 6 below
Westside Streams Diversion for Direct or In-lieu Groundwater Recharge	See Note 1 below	See Note 3 below	See Note 5 below	Potential	See Note 6 below	See Note 6 below
Reduce Non-beneficial Evapotranspiration/Invasive Species Eradication (Arundo, Eucalyptus, Tamarisk, etc.)	See Note 1 below	See Note 3 below	See Note 5 below	Concept	See Note 6 below	See Note 6 below

Table 3. Implementation Criteria, Notice Process, Permitting and Regulatory Process, and Timeline for all Projects and Management Actions.

CCD 5 254 44				COD	5054 44/h\/4\	
CCR § 354.44	CCR 9354.44(D)(1)(A)	9354.44(b)(1)(B)	CCR 9354.44(D)(3)	CCR	9354.44(D)(4)	
Project/Management Action Name	Implementation and Termination Timing/Criteria for Implementation	Public and/or Inter- Agency Notice Process	Required Permitting and Regulatory Process or Status of Permitting	Current Status (Ongoing, Planned, Potential or Concept)	Anticipated Start Date (Year)	Anticipated Completion Date (Year)
Enhanced Infiltration of Precipitation on Agricultural Lands	See Note 1 below	See Note 3 below	See Note 5 below	Concept	See Note 6 below	See Note 6 below
Colusa Subbasin Flood-MAR	See Note 1 below	See Note 3 below	See Note 5 below	Concept	See Note 6 below	See Note 6 below
Reclamation District 108 "Boards In" Program	See Note 1 below	See Note 3 below	See Note 5 below	Concept	See Note 6 below	See Note 6 below
Glenn-Colusa Irrigation District In-lieu Groundwater Recharge	See Note 1 below	See Note 3 below	See Note 5 below	Potential	See Note 6 below	See Note 6 below
Glenn-Colusa Irrigation District Water Transfers to TCCA CVP Contractors	See Note 1 below	See Note 3 below	See Note 5 below	Potential	See Note 6 below	See Note 6 below
Orland-Artois Water District Direct Groundwater Recharge	See Note 1 below	See Note 2 below	See Note 4 below	Concept (pilot project complete)	See Note 6 below	See Note 6 below
Orland Unit Water Users Association Flood Water Conveyance	See Note 1 below	See Note 3 below	See Note 5 below	Potential	See Note 6 below	See Note 6 below
Sites Reservoir	See Note 1 below	See Note 3 below	See Note 5 below	Concept, developing funding	See Note 6 below	See Note 6 below
Colusa Subbasin In-lieu Recharge & Banking Program	See Note 1 below	See Note 3 below	See Note 5 below	Concept	See Note 6 below	See Note 6 below
Sycamore Marsh Farm In-lieu Recharge Project	See Note 1 below	See Note 2 below	See Note 4 below	Concept	See Note 6 below	See Note 6 below
Westside Offstream Reservoir and In-Lieu Groundwater Recharge	See Note 1 below	See Note 3 below	See Note 5 below	Concept	See Note 6 below	See Note 6 below
Domestic Well Mitigation Program	See Note 1 below	See Note 3 below	See Note 5 below	Potential	See Note 6 below	See Note 6 below
Strategic Short-Term Demand Management	See Note 1 below	See Note 3 below	See Note 5 below	Concept	See Note 6 below	See Note 6 below

		CCR				
CCR § 354.44	CCR §354.44(b)(1)(A)	§354.44(b)(1)(B)	CCR §354.44(b)(3)	CCR §354.44(b)(4)		
			Required			
	Implementation and		Permitting and	Current Status		
	Termination	Public and/or Inter-	Regulatory	(Ongoing, Planned,	Anticipated	Anticipated
Project/Management Action	Timing/Criteria for	Agency Notice	<b>Process or Status</b>	Potential or	Start Date	Completion
Name	Implementation	Process	of Permitting	Concept)	(Year)	Date (Year)
Long-Term Demand		Coo Noto 2 holow	Coo Noto C holow	Concert	See Note 6	See Note 6
Management Action		See Note 3 below	See Note 5 below	Concept	below	below
Well Abandonment Outreach	Cae Nata 1 halaw	Coo Noto 2 holow	Coo Noto E bolow	Concert	See Note 6	See Note 6
and Funding Program	See Note 1 below	See Note 3 below	See Note 5 below	Concept	below	below
Preservation of Lands	See Note 1 holow	See Note 2 holow	See Nete F below	Concent	See Note 6	See Note 6
Favorable for Recharge	See Note 1 below	See Note 3 below	See Note 5 below	Concept	below	below
Review of County Well	See Note 1 holow	See Note 2 holow	See Nete F below	Concent	See Note 6	See Note 6
Permitting Ordinances	See Note 1 below	See Note 3 below	See Note 5 below	Concept	below	below
Drought Contingency	See Note 1 holow	See Note 2 holow	See Note E below	Detential	See Note 6	See Note 6
Planning for Urban Areas	See Note 1 below	See Note 5 below	See Note 5 below	Potential	below	below
Development of a Dedicated						
Network of Shallow	See Note 1 holow	See Note 2 holow	See Nete F below	Detential	See Note 6	See Note 6
Monitoring Wells for GDE	See NOLE I DEIOW	See Note 3 DelOW	See Note 5 below	Potential	below	below
Monitoring						

Table 3. Implementation Criteria, Notice Process, Permitting and Regulatory Process, and Timeline for all Projects and Management Actions.

#### Notes:

1. This project is currently in the early conceptual stage. Thus the implementation and termination dates have yet to be determined. Criteria for implementation may, among other factors, be linked to the measurable objectives and provided in annual reports.

- 2. Public and/or Inter-Agency Noticing is being facilitated through GSA board meetings, GSA and/or cooperating agency website(s), GSA newsletter, member agency newsletter, inter-basin coordination meetings, member agency governing body public meetings, GSP annual report(s), public scoping meetings and environmental/regulatory permitting notification.
- 3. Public and/or Inter-Agency Noticing will be facilitated through GSA board meetings, GSA and/or cooperating agency website(s), GSA newsletter, member agency newsletter, inter-basin coordination meetings, member agency governing body public meetings, GSP annual report(s), public scoping meetings and environmental/regulatory permitting notification.
- 4. Required permitting and regulatory review is being initiated through consultation with applicable governing agencies. Governing agencies for which consultation is being initiated may include, but is not limited to: the California Department of Water Resources (DWR), the California State Water Resources Control Board (SWRCB), the California Department of Fish and Wildlife (CDFW), the Central Valley Flood Protection Board (Flood Board), Regional Water Boards, the United States Bureau of Reclamation or USBR), the United States Army Corps of Engineers (USACE), the United States Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), Local Agency Formation Commissions (LAFCO), the Counties of Colusa and/or Glenn, and the California Air Resources Board (CARB).
- 5. Required permitting and regulatory review will be project specific and initiated through consultation with applicable governing agencies. Governing agencies for which consultation is being initiated may include, but is not limited to: DWR, SWRCB, CDFW, Flood Board, Regional Water Boards, USBR, USACE, USFWS, NMFS, LAFCO, Counties of Colusa and/or Glenn, and CARB.
- 6. This project is currently in the early conceptual stage. Thus, the start and completion dates for this project have yet to be determined and will be provided in annual reports when known.

CCR § 354.44	CCR §354.44(b)(5)			
Project/Management Action Name	Measurable Objectives Expected to Benefit	Multi-Benefits Expected	Serves Disadvantaged Community (If so, which one?)	Expected Yield
Planned				
Colusa County Water District In- Lieu Groundwater Recharge	Groundwater levels, groundwater storage, and depletions of interconnected surface water		See Note 1 below	27,000 af/year
Colusa Drain MWC In-Lieu Groundwater Recharge	Groundwater levels, groundwater storage, and depletions of interconnected surface water		See Note 1 below	28,000 af/year
Colusa Subbasin Multi-Benefit Groundwater Recharge	Groundwater levels, groundwater storage, and depletions of interconnected surface water	Ponded habitat for migratory birds	See Note 1 below	5,200 af/year
Orland-Artois Water District Land Annexation and Groundwater Recharge	Groundwater levels, groundwater storage, and depletions of interconnected surface water		See Note 1 below	23,000 af/year
Sycamore Slough Groundwater Recharge Pilot Project	Groundwater levels, groundwater storage, and depletions of interconnected surface water	Ponded habitat for migratory birds	See Note 1 below	5,000 af over 10 years
Ongoing				
Reclamation District 108 and Colusa County Water District Agreement for Five-Year In-Lieu Groundwater Recharge Project	Groundwater levels, groundwater storage, and depletions of interconnected surface water		See Note 1 below	8,000 af/year
Glenn-Colusa Irrigation District Strategic Winter Water Use for Groundwater Recharge and Multiple Benefits	Groundwater levels, groundwater storage, and depletions of interconnected surface water	Increased ponded habitat for migratory birds and improved air quality through reduced rice straw burning	See Note 1 below	See Note 2 below

CCR § 354.44	CCR §354.44(b)(5)			
Project/Management Action Name	Measurable Objectives Expected to Benefit	Multi-Benefits Expected	Serves Disadvantaged Community (If so, which one?)	Expected Yield
Sycamore Marsh Farm Direct Recharge Project	Groundwater levels, groundwater storage, depletions of interconnected surface water, land subsidence, and potentially groundwater quality	Ponded habitat for migratory birds	See Note 1 below	See Note 2 below
Glenn-Colusa Irrigation District Expansion of In-Basin Program for In-lieu Groundwater Recharge	Groundwater levels, groundwater storage, and depletions of interconnected surface water		See Note 1 below	See Note 2 below
Orland Unit Water Users Association Irrigation Modernization for Increased Surface Water Delivery and Reduced Groundwater Pumping	Groundwater levels, groundwater storage, and depletions of interconnected surface water		See Note 1 below	See Note 2 below
Urban Water Conservation in Willows	Groundwater levels, groundwater storage, and depletions of interconnected surface water		See Note 1 below	2 af/year
Potential				
Colusa County Public Water System Water Treatment Plant	Groundwater levels, groundwater storage, and depletions of interconnected surface water	Improved drinking water quality; Arbuckle and Dunnigan face loss of well supply; Grimes and Princeton have drinking well arsenic contamination; Williams has elevated salinity (TDS) levels	See Note 1 below	See Note 2 below
Delevan Pipeline Colusa Basin Drain Intertie	Groundwater levels, groundwater storage, depletions of interconnected surface water, and land subsidence (to the extent that project yield is dedicated to recharge projects)		See Note 1 below	See Note 2 below

CCR § 354.44	CCR §354.44(b)(5)			
Project/Management Action Name	Measurable Objectives Expected to Benefit	Multi-Benefits Expected	Serves Disadvantaged Community (If so, which one?)	Expected Yield
Sycamore Slough Colusa Basin Drain Multi-Benefit Recharge Project	Groundwater levels, groundwater storage, and depletions of interconnected surface water	Ponded habitat for migratory birds, along with other environmental benefits	See Note 1 below	See Note 2 below
Tehama-Colusa Canal Trickle Flow to Ephemeral Streams	Groundwater levels, groundwater storage, and depletions of interconnected surface water		See Note 1 below	See Note 2 below
Westside Streams Diversion for Direct or In-lieu Groundwater Recharge	Groundwater levels, groundwater storage, depletions of interconnected surface water, land subsidence	Reduced flood impacts to the extent that diversions reduce the severity of downstream flooding	See Note 1 below	Dependent on scale of implementation; between roughly 1,000 to 16,000 af/year
Reduce Non-beneficial Evapotranspiration/Invasive Species Eradication (Arundo, Eucalyptus, Tamarisk, etc.)	Groundwater levels, groundwater storage, and depletions of interconnected surface water	Decreased ET; increased native vegetation / habitat; decreased sediment trapping	See Note 1 below	See Note 2 below
Enhanced Infiltration of Precipitation on Agricultural Lands	Groundwater levels, groundwater storage, and depletions of interconnected surface water	Increased groundwater recharge	See Note 1 below	See Note 2 below
Colusa Subbasin Flood-MAR	Groundwater levels, groundwater storage, and depletions of interconnected surface water		See Note 1 below	See Note 2 below
Reclamation District 108 "Boards In" Program	Groundwater levels, groundwater storage, and depletions of interconnected surface water	Possible ponded habitat for migratory birds	See Note 1 below	Dependent on scale of implementation; estimated 1,800 af/year (if 20% of rice fields in RD108 participate)
Glenn-Colusa Irrigation District In- lieu Groundwater Recharge	Groundwater levels, groundwater storage, and depletions of interconnected surface water		See Note 1 below	See Note 2 below

CCR § 354.44	CCR §354.44(b)(5)			
Project/Management Action Name	Measurable Objectives Expected to Benefit	Multi-Benefits Expected	Serves Disadvantaged Community (If so, which one?)	Expected Yield
Glenn-Colusa Irrigation District Water Transfers to TCCA CVP Contractors	Groundwater levels, groundwater storage, and depletions of interconnected surface water		See Note 1 below	See Note 2 below
Orland-Artois Water District Direct Groundwater Recharge	Groundwater levels, groundwater storage, and depletions of interconnected surface water	Possible ponded habitat for migratory birds depending on timing of flooding	See Note 1 below	See Note 2 below
Orland Unit Water Users Association Flood Water Conveyance	Groundwater levels, groundwater storage, and depletions of interconnected surface water		See Note 1 below	See Note 2 below
Sites Reservoir	Groundwater levels, groundwater storage, depletions of interconnected surface water, and land subsidence (to the extent that project yield is dedicated to recharge projects).	Increased local, regional, and statewide water supply reliability, climate change resiliency, recreation, increased cold water pool for endangered salmon	See Note 1 below	See Note 2 below
Colusa Subbasin In-lieu Recharge & Banking Program	Groundwater levels, groundwater storage, depletions of interconnected surface water, land subsidence, and potentially groundwater quality		See Note 1 below	See Note 2 below
Sycamore Marsh Farm In-lieu Recharge Project	Groundwater levels, groundwater storage, depletions of interconnected surface water, land subsidence, and potentially groundwater quality		See Note 1 below	See Note 2 below
Westside Off-stream Reservoir and In-Lieu Groundwater Recharge	Groundwater levels, groundwater storage, and depletions of interconnected surface water		See Note 1 below	See Note 2 below
Domestic Well Mitigation Program	None		See Note 1 below	None

CCR § 354.44	CCR §354.44(b)(5)			
Project/Management Action Name	Measurable Objectives Expected to Benefit	Multi-Benefits Expected	Serves Disadvantaged Community (If so, which one?)	Expected Yield
Strategic Short-Term Demand Management	Groundwater levels, groundwater storage, and depletions of interconnected surface water in areas with potential sustainability challenges	Yes, potential for multi- benefits on temporarily idled lands, depending on program design	See Note 1 below	See Note 2 below
Long-Term Demand Management Action	Groundwater levels, groundwater storage, and depletions of interconnected surface water		See Note 1 below	See Note 2 below
Well Abandonment Outreach and Funding Program	Water quality		See Note 1 below	None
Preservation of Lands Favorable for Recharge	Groundwater levels, groundwater storage, and depletions of interconnected surface water		See Note 1 below	See Note 2 below
Review of County Well Permitting Ordinances	Potentially: groundwater levels, groundwater storage, depletions of interconnected surface water, land subsidence, and groundwater quality		See Note 1 below	See Note 2 below
Drought Contingency Planning for Urban Areas	Groundwater levels, groundwater storage, and depletions of interconnected surface water		See Note 1 below	See Note 2 below
Development of a Dedicated Network of Shallow Monitoring Wells for GDE Monitoring	Groundwater levels, groundwater storage, and depletions of interconnected surface water	GDEs, riparian habitat	See Note 1 below	See Note 2 below

#### Notes:

1. The majority of the areas within the Colusa Subbasin are classified as either Severely Disadvantaged Communities, Disadvantaged Communities, or Economically Distressed Areas.

2. This project is currently in the early conceptual stage. Thus, the expected yield of this project has yet to be determined and will be reported in annual reports when known.

#### Table 5. Benefit Evaluation and Water Source for all Projects and Management Actions.

CCR § 354.44	CCR §354.44(b)(5)	CCR §354	4.44(b)(6)
Project/Management Action Name	Benefit Evaluation Methodology	Water Source	Water Source Reliability
Planned		•	•
Colusa County Water District In- Lieu Groundwater Recharge	See Note 1 below	Sacramento River through CCWD's existing CVP contract and annual and multi-year water purchases and transfer agreements	Water purchases and transfers in all but Critical years
Colusa Drain MWC In-Lieu Groundwater Recharge	See Note 2 below	Sacramento River through CDMWC contractual rights with USBR together with annual and multi-year transfer agreements with USBR settlement contractors utilizing the Colusa Basin Drain.	To be determined
Colusa Subbasin Multi-Benefit Groundwater Recharge	See Note 1 below	Sacramento River under a variety of water rights, contracts, and water purchase and transfer agreements	Uncertain at this time
Orland-Artois Water District Land Annexation and Groundwater Recharge	See Note 1 below	Sacramento River through annual and multi-year water purchases and transfer agreements for in-lieu recharge, and Section 215 water for direct recharge	Water purchases and transfers in all but Critical years; Section 215 water subject to hydrology and river system conditions
Sycamore Slough Groundwater Recharge Pilot Project	See Note 2 below	Sacramento River	Uncertain at this time
Ongoing			
Reclamation District 108 and Colusa County Water District Agreement for Five-Year In-Lieu Groundwater Recharge Project	See Note 2 below	Sacramento River water available to RD108 through contractual rights under Sacramento River Settlement Contract 14-06-200-876A between RD108 and the Bureau of Reclamation	Settlement contract water supply subject to 25% reductions in Shasta critical years
Glenn-Colusa Irrigation District Strategic Winter Water Use for Groundwater Recharge and Multiple Benefits	See Note 1 below	Appropriative water right for diversion and use of "winter water" from November 1 through March 31 each year	Appropriative winter water supplies subject to availability and curtailments according to water right Term 91

#### Table 5. Benefit Evaluation and Water Source for all Projects and Management Actions.

CCR § 354.44	CCR §354.44(b)(5)	CCR §354	4.44(b)(6)
Project/Management Action Name	Benefit Evaluation Methodology	Water Source	Water Source Reliability
Sycamore Marsh Farm Direct Recharge Project	See Note 1 below	Colusa Basin Drain	To be determined
Glenn-Colusa Irrigation District Expansion of In-Basin Program for In-lieu Groundwater Recharge	See Note 1 below	Sacramento River under GCID's contractual and appropriative rights	Supplies potentially available only in Shasta Non-Critical years; reliable during those years
Orland Unit Water Users Association Irrigation Modernization for Increased Surface Water Delivery and Reduced Groundwater Pumping	See Note 2 below	Stony Creek water available to the OUWUA under the Angle Decree	Highly reliable with significant shortages historically occurring once every 10 to 20 years on average
Urban Water Conservation in Willows	See Note 1 below	N/A	N/A
Potential			
Colusa County Public Water System Water Treatment Plant	See Note 2 below	Sacramento River under new appropriative water rights	Uncertain at this time
Delevan Pipeline Colusa Basin Drain Intertie	See Note 2 below	Sacramento River under new appropriative water rights (conveyed to Sites Reservoir and through Delevan Pipeline)	Uncertain at this time
Sycamore Slough Colusa Basin Drain Multi-Benefit Recharge Project	See Note 2 below	Sacramento River (settlement contracts before November 1; riparian rights at other times)	Expected to be reliable, but the precise volume of available water is uncertain at this time
Tehama-Colusa Canal Trickle Flow to Ephemeral Streams	See Note 2 below	Sacramento River (conveyed through TCC)	Uncertain at this time
Westside Streams Diversion for Direct or In-lieu Groundwater Recharge	See Note 2 below	Westside Streams: Willow Creek, Logan Creek, Hunters Creek, Funks Creek, Stone Corral Creek, Salt Creek, and potentially smaller streams	Only available during periods of runoff occurring during heavy precipitation events or wet years
Reduce Non-beneficial Evapotranspiration/Invasive Species Eradication (Arundo, Eucalyptus, Tamarisk, etc.)	See Note 2 below	N/A	N/A

#### Table 5. Benefit Evaluation and Water Source for all Projects and Management Actions.

CCR § 354.44	CCR §354.44(b)(5)	CCR §354	1.44(b)(6)
Project/Management Action Name	Benefit Evaluation Methodology	Water Source	Water Source Reliability
Enhanced Infiltration of Precipitation on Agricultural Lands	See Note 2 below	Precipitation	Variable
Colusa Subbasin Flood-MAR	See Note 2 below	To be determined	To be determined
Reclamation District 108 "Boards In" Program	See Note 2 below	Precipitation	Variable
Glenn-Colusa Irrigation District In- lieu Groundwater Recharge	See Note 2 below	Sacramento River under GCID's contractual rights according to its Sacramento River Water Right Settlement contract and under an appropriative water right for diversion and use of "winter water" from November 1 through March 31 each year.	Settlement contract water supplies subject to 25% reductions in Shasta Critical years; appropriative winter water subject to availability and curtailments according to water right Term 91
Glenn-Colusa Irrigation District Water Transfers to TCCA CVP Contractors	See Note 2 below	Sacramento River under GCID's contractual rights according to its Sacramento River Water Right Settlement contract	Settlement contract water supply subject to 25% reductions in Shasta Critical years
Orland-Artois Water District Direct Groundwater Recharge	Orland-Artois Water District Direct Groundwater Recharge		Highly variable; available only during periods of high flow in Sacramento River and tributaries
Orland Unit Water Users Association Flood Water Conveyance	See Note 2 below	Stony Creek flood releases that cannot be held in Stony Creek reservoirs	Highly variable year to year depending on hydrology
Sites Reservoir	See Note 2 below	Sacramento River under new appropriative water rights	New water rights would have junior priority and therefore would be subject to senior rights and water right Term 91
Colusa Subbasin In-lieu Recharge & Banking Program	See Note 2 below	To be determined	To be determined
Sycamore Marsh Farm In-lieu Recharge Project	See Note 1 below	Colusa Basin Drain	To be determined

Table 5.	<b>Benefit Evaluation</b>	and Water Source	e for all Proiect	ts and Management	Actions.
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CCR § 354.44	CCR §354.44(b)(5)	CCR §354.44(b)(6)		
Project/Management Action Name Benefit Evaluation Methodology		Water Source	Water Source Reliability	
Westside Off-stream Reservoir and In-Lieu Groundwater Recharge	See Note 2 below	Sacramento River Section 215 water	Highly variable; available only during periods of high flow in Sacramento River and tributaries	
Domestic Well Mitigation Program	See Note 2 below	N/A	N/A	
Strategic Short-Term Demand Management	See Note 2 below	N/A	N/A	
Long-Term Demand Management Action	See Note 2 below	N/A	N/A	
Well Abandonment Outreach and Funding Program	See Note 2 below	N/A	N/A	
Preservation of Lands Favorable for Recharge	See Note 2 below	N/A	N/A	
Review of County Well Permitting Ordinances	See Note 2 below	N/A	N/A	
Drought Contingency Planning for Urban Areas	See Note 2 below	N/A	N/A	
Development of a Dedicated Network of Shallow Monitoring Wells for GDE Monitoring	See Note 2 below	N/A	N/A	

#### Notes:

1. Evaluation of benefits will be based on analysis of pre- and post-project measurements supported by modeling. These analyses may include: flow measurement consistent with SBx7-7 (23 CCR §931-938), ET analysis, reductions in GW use, well monitoring, determination of infiltration rates, water balance analysis, as-built drawings and stream gaging. Modeling will be done with the C2VSimFG-Colusa model used for GSP development.

Evaluation of benefits is based on analysis of pre- and post-project measurements supported by modeling. These analyses may include: flow measurement consistent with SBx7-7 (23 CCR §931-938), ET analysis, reductions in GW use, well monitoring, determination of infiltration rates, water balance analysis, as-built drawings and stream gaging. Modeling will be done with the C2VSimFG-Colusa model used for GSP development.

CCR § 354.44	CCR §354.44(b)(7)	CCR §354	.44(b)(8)
Project/Management Action Name	Legal Authority Required	Estimated Cost	Potential Funding Sources
Planned			
Colusa County Water District In-Lieu Groundwater Recharge	As a water district formed under state law, CCWD has the legal authority to annex land into the district and provide water service to annexed lands	Under development; 10% design and capital cost estimate expected August 2021.	See Note 2 below
Colusa Drain MWC In-Lieu Groundwater Recharge	GSAs, Districts and individual project proponents have the authority to plan and implement projects	\$1,725,000	See Note 2 below
Colusa Subbasin Multi-Benefit Groundwater Recharge	GSAs, Districts and individual project proponents have the authority to plan and implement projects	Under development	See Note 2 below
Orland-Artois Water District Land Annexation and Groundwater Recharge	As a water district formed under state law, OAWD has the legal authority to annex land into the district and provide water service to annexed lands	\$20 million estimated capital cost; \$2.63 million per year (water supply cost and other O&M cost)	See Note 2 below
Sycamore Slough Groundwater Recharge Pilot Project	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below
Ongoing			
Reclamation District 108 and Colusa County Water District Agreement for Five-Year In-Lieu Groundwater Recharge Project	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below
Glenn-Colusa Irrigation District Strategic Winter Water Use for Groundwater Recharge and Multiple Benefits	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below
Sycamore Marsh Farm Direct Recharge Project	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below
Glenn-Colusa Irrigation District Expansion of In-Basin Program for In- lieu Groundwater Recharge	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below

#### Table 6. Legal Authority Requirements, Estimated Cost, and Potential Funding Sources for all Projects and Management Actions.

CCR § 354.44	CCR §354.44(b)(7)	CCR §354	I.44(b)(8)
Project/Management Action Name	Legal Authority Required	Estimated Cost	Potential Funding Sources
Orland Unit Water Users Association Irrigation Modernization for Increased Surface Water Delivery and Reduced Groundwater Pumping	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below
Urban Water Conservation in Willows	GSAs, Districts and individual project proponents have the authority to plan and implement projects	Cost covered by rate structure of Cal Water - Willows Division	See Note 2 below
Potential			
Colusa County Public Water System Water Treatment Plant	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below
Delevan Pipeline Colusa Basin Drain Intertie	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below
Sycamore Slough Colusa Basin Drain Multi-Benefit Recharge Project	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below
Tehama-Colusa Canal Trickle Flow to Ephemeral Streams	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below
Westside Streams Diversion for Direct or In-lieu Groundwater Recharge	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below
Reduce Non-beneficial Evapotranspiration/Invasive Species Eradication (Arundo, Eucalyptus, Tamarisk, etc.)	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below
Enhanced Infiltration of Precipitation on Agricultural Lands	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below
Colusa Subbasin Flood-MAR	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below
Reclamation District 108 "Boards In" Program	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below
Glenn-Colusa Irrigation District In-lieu Groundwater Recharge	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below

Table 6. Legal Authority	v Requirements	, Estimated Cost,	and Potential Fundin	g Sources for all Pro	jects and Management Actions.
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CCR § 354.44	CCR §354.44(b)(7)	CCR §354	I.44(b)(8)
Project/Management Action Name	Legal Authority Required	Estimated Cost	Potential Funding Sources
Glenn-Colusa Irrigation District Strategic Winter Water Use for Groundwater Recharge and Multiple Benefits	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below
Glenn-Colusa Irrigation District Expansion of In-Basin Program for In- lieu Groundwater Recharge	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below
Glenn-Colusa Irrigation District Water Transfers to TCCA CVP Contractors	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below
Orland-Artois Water District Direct Groundwater Recharge	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below
Orland Unit Water Users Association Flood Water Conveyance	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below
Sites Reservoir	GSAs, Districts and individual project proponents have the authority to plan and implement projects	\$5.2 billion	See Note 2 below
Colusa Subbasin In-lieu Recharge & Banking Program	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below
Sycamore Marsh Farm In-lieu Recharge Project	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below
Westside Off-stream Reservoir and In- Lieu Groundwater Recharge	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below
Domestic Well Mitigation Program	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below
Strategic Short-Term Demand Management	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below
Long-Term Demand Management Action	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below
Well Abandonment Outreach and Funding Program	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below
Preservation of Lands Favorable for Recharge	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below

Table 0. Legal Authonty Requirements, Estimated Cost, and Potential Punding Sources for an Projects and Management Actio	Table 6. Lega	<b>I</b> Authority	ity Requirements, Estima	ted Cost, and Potential	<b>Funding Sources for all P</b>	rojects and Management Action
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CCR § 354.44	CCR §354.44(b)(7)	CCR §354.44(b)(8)		
Project/Management Action Name	ne Legal Authority Required Estimated Cost		Potential Funding Sources	
Review of County Well Permitting Ordinances	GSAs, Districts and individual project proponents have the authority to plan and implement projects, and Counties have the authority to review and modify county well permitting ordinances	See Note 1 below	See Note 2 below	
Drought Contingency Planning for Urban Areas	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below	
Development of a Dedicated Network of Shallow Monitoring Wells for GDE Monitoring	GSAs, Districts and individual project proponents have the authority to plan and implement projects	See Note 1 below	See Note 2 below	

#### Table 6. Legal Authority Requirements, Estimated Cost, and Potential Funding Sources for all Projects and Management Actions.

#### Notes:

1. This project is currently in the early conceptual stage. Thus, the anticipated costs of this project have yet to be determined and will be reported in GSP annual reports and five-year updates when known.

Potential funding sources are being evaluated as project planning continues; they include, but are not limited to, the following: grants, loans, bonds, assessment fees, and cost-sharing programs. Potential funding sources will be reported in GSP annual reports and five-year updates when known.

## Appendix 6D

Development of Modeling Parameters for Simulating Projects and Management Actions in the Colusa Subbasin (THIS PAGE LEFT BLANK INTENTIONALLY)



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## **Technical Memorandum**

To: Colusa Groundwater Authority and Glenn Groundwater Authority

From: Davids Engineering

**Date:** July 14, 2021

Subject:Development of Modeling Parameters for Simulating Projects and ManagementActions in the Colusa Subbasin

## Introduction

The Groundwater Sustainability Plan (GSP) emergency regulations, described in 23 CCR §354.44<sup>1</sup>, require Groundwater Sustainability Agencies (GSAs) to describe projects and management actions (PMAs) that will achieve the sustainability goal for the basin and respond to changing conditions in the basin. Among other required information, GSAs must describe the benefits that are expected to be realized from the PMAs and how those benefits will be evaluated (23 CCR §354.44(b)(5)). The development and description of PMAs must be supported by the best available information and best available science (23 CCR §354.44(c)).

This technical memorandum (TM) describes the modeling approach and model inputs that were used to simulate the expected benefits of planned PMAs in the Colusa Subbasin (Subbasin) using the C2VSimFG-Colusa model (model). The model inputs reflect the anticipated volume and timing of surface water supply available through specific PMAs for direct and in-lieu groundwater recharge. The model inputs also characterize where that water would be beneficially used within the Subbasin.

In addition to the model inputs, this memorandum summarizes model results from the PMA simulations that represent the quantitative benefits of these PMAs on projected future groundwater conditions in the Subbasin. At the time of GSP development, the model is considered to provide the best available information on groundwater conditions in the Subbasin, and the accuracy of this information is generally sufficient to support GSP preparation, including description of PMA benefits.

<sup>&</sup>lt;sup>1</sup> California Code of Regulations, Title 23, Division 2, Chapter 1.5, Subchapter 2 Groundwater Sustainability Plans, Article 5, Section 354.28 Minimum Thresholds.

## **Overview of Modeled PMAs**

There are five planned projects described in the Colusa Subbasin GSP that are on track for implementation. Three of those projects were selected for simulation in the model in order to gain initial insights into the magnitude of impacts from these projects. These three projects are substantial recharge projects that could have large effects on groundwater conditions relative to other PMAs. Model inputs and model results for the three modeled projects are the focus of this TM. However, the modeling approach and inputs described for these projects can be adapted to simulate other similar projects.

General background on the three modeled projects is provided below. Additional information about these PMAs and others is included in Chapter 6 of the Colusa Subbasin GSP, Projects and Management Actions.

### Colusa County Water District In-Lieu Groundwater Recharge

Colusa County Water District (CCWD) has a total service area of approximately 46,000 acres, of which 39,875 acres are currently irrigable with existing District infrastructure. The majority of irrigated land is used to cultivate permanent crops. CCWD delivers surface water to approximately 35,000 acres, with the remaining acres being idle or irrigated with privately pumped groundwater. Currently, CCWD has access to Central Valley Project (CVP) water supplies through its own contracts and through transfers primarily from Westside Water District and, more recently, from Reclamation District 108 (RD108). Despite the availability of surface water, some CCWD growers choose to pump groundwater because it is less expensive than surface water and because groundwater requires less screening and filtering compared to district surface water.

Under the CCWD In-Lieu Groundwater Recharge project, CCWD will acquire additional surface water and will establish incentives to make the cost of surface water the same or less than the cost of pumping groundwater, thereby incentivizing growers who would otherwise use groundwater to use surface water. The additional surface water is expected to be acquired under long-term water transfer agreements with other CVP contractors, including Sacramento River Settlement Contractors (settlement contractors), and potentially other sources. The plan is to acquire and deliver 30,000 acre-feet per year (AF/yr) except in Shasta Critical years (approximately one in 10 years<sup>2</sup>) when groundwater stored through in-lieu recharge in prior years would be used.

### Orland-Artois Water District Land Annexation and In-Lieu Groundwater Recharge

Orland-Artois Water District (OAWD) has an existing service area of about 29,000 acres and delivers water to district landowners through 110 miles of pipelines and 300 metered delivery points. Surface water delivered by OAWD is available under a CVP water supply contract with the United States Bureau of Reclamation (Reclamation) and through short- and long-term transfer agreements with other CVP water contractors and settlement contractors. Historically, water transfers have been from Maxwell Irrigation District, Princeton-Codora-Glenn Irrigation District, and others.

As part of the OAWD Land Annexation and In-Lieu Groundwater Recharge project, OAWD is working with a group of neighboring non-district landowners to annex approximately 12,000 acres of groundwater-dependent agricultural land into the district. Additional surface water for the annexed lands would be secured through multi-year purchase or transfer agreements with willing sellers, conveyed through the existing Tehama-Colusa (TC) Canal, and distributed to the annexed lands through

<sup>&</sup>lt;sup>2</sup> Over the 50-year period from 1966-2015, five years were declared "Shasta Critical."

new distribution facilities. Potential transferors include CVP water supply contractors and settlement contractors. The plan is to acquire and deliver 25,000 AF/yr of surface water to the annexed lands except in Shasta Critical years (approximately one in 10 years) when groundwater banked through inlieu recharge in prior years would be used.

### Colusa Subbasin Multi-Benefit Groundwater Recharge

The Colusa Groundwater Authority (CGA) and The Nature Conservancy (TNC) collaborated in a multibenefit pilot project from 2018 through 2021 to demonstrate the project benefits to direct groundwater recharge and creation of habitat for migrating shorebirds. In the pilot project, multi-benefit recharge was conducted by recharging groundwater through normal farming operations at strategic times of year in order to provide critical wetland habitat for shorebirds migrating along the Pacific Flyway, and potential ancillary benefits for water levels near disadvantaged communities in the Subbasin. The pilot project concluded that multi-benefit recharge is feasible and does generate the intended recharge and habitat benefits, serving as an example of how the Subbasin-wide program could work.

The planned Colusa Subbasin Multi-Benefit Groundwater Recharge project would expand on the pilot project to identify and contract with willing landowners who will participate in the program, and to develop program incentives and funding opportunities that will encourage enrollment, especially in areas that are most suitable for multi-benefit recharge. Each year, multi-benefit recharge would be implemented by applying surface water to participating fields and maintaining a shallow depth (4 inches maximum) for typically four to six weeks in the late summer and early fall (July 15 to October 15) and/or spring (March 15 to April 15),) when migratory bird habitat is needed.

While the actual location and scale of the project will depend on voluntary landowner participation, areas in the Subbasin that are potentially favorable for multi-benefit recharge have already been identified through preliminary mapping based on:

- Land use and crop characteristics that are suitable for recharge and could accept flooding in late summer and early fall (the period prioritized for modeling), with minimal impacts to crops and farming operations
- Soil characteristics that are suitable for recharge, using the Soil Agricultural Groundwater Banking Index (SAGBI<sup>3</sup>) rating
- Availability of surface water supplies for field-flooding during prime periods when migratory bird habitat is needed
- Proximity to the Sacramento River, as those lands are expected to have the greatest positive impact on streamflows

<sup>&</sup>lt;sup>3</sup> SAGBI is a suitability index indicating the potential for groundwater recharge on agricultural land, determined according to five main factors: deep percolation, root zone residence time, topography, chemical limitations, and soil surface condition. SAGBI ratings for lands in California are developed by the California Soil Resource Lab at UC Davis and UC-ANR, and are available online at: https://casoilresource.lawr.ucdavis.edu/sagbi/.

## Analytic Approach

### Modeling Approach

The quantitative benefits of the three modeled projects to groundwater conditions in the Subbasin were evaluated using the C2VSimFG-Colusa model (model), an integrated hydrologic flow model for the Subbasin. Development and refinement of this model to support GSP development is described in Appendix 3D. The C2VSimFG-Colusa model was adapted from the Fine Grid California Central Valley Groundwater-Surface Water Simulation Model (C2VSimFG).

The model simulates inflows and outflows between the Subbasin surface water system and groundwater system in a grid of land elements, stream nodes, and groundwater nodes that span and surround the Subbasin. The model calculates a water budget for each element and node on a monthly timestep for different historical, current, and projected (future) scenarios described in the GSP. Results of these element and node-level water budgets are aggregated to quantify the historical, current, and projected water budgets for the entire Subbasin, as required in the GSP regulations.

Among their many functions, user-defined model inputs are used to determine when, where, and how much water is applied to lands and ultimately recharges the groundwater system. Key water budget parameters that were evaluated to quantify the groundwater recharge benefits of the three modeled projects include:

- Surface Water Diversions: Surface water diverted from a stream node and delivered to elements. Surface water diversions are a user-defined model input, and are summarized to describe the average annual surface water volume diverted for the PMA.
- Groundwater Pumping: Groundwater pumped to meet water demand in elements. For these projects, groundwater pumping is calculated by the model to meet the remaining irrigation demand after surface water is applied.
- Seepage: For these projects, seepage represents water that is lost from streams, canals, or conveyance systems, flowing through the soil and to the groundwater system. Seepage is a component of groundwater recharge, and is calculated by the model.
- Deep Percolation: For these projects, deep percolation represents the fraction of water applied to fields that flows through the soil and to the groundwater system. Deep percolation is a component of groundwater recharge, and is calculated by the model.

Additional information about how the model operates, its inputs, and assumptions are provided in the model documentation and Appendix 3D.

### **Modeled Project Areas**

Three project areas were explicitly defined in the C2VSimFG-Colusa model to quantify the effects and benefits of PMAs on the Subbasin water budget, specifically those related to groundwater conditions. These project areas, shown in Figure 1, include:

- 1) Planned CCWD Project Area: a group of elements that approximately represents the CCWD service area
- 2) **Planned OAWD Project Area**: a group of elements that approximately represents the existing OAWD service area and the 12,000 acres that OAWD plans to annex

 Multi-Benefit Recharge Project Area: a group of elements that represents a hypothetical selection of potential recharge areas, containing fields identified through the process described later in this TM

Each project area is represented by a group of elements that approximately represents the areas in which specific projects are expected to occur. Model inputs developed for the three modeled PMAs were applied and simulated in the elements represented in each project area.

The C2VSimFG-Colusa model calculates the water budget for each model element for each monthly timestep, including the elements in each project area. For all elements in each project area, the element-level water budget results were summed to aggregate project area water budget results.

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Planned CCWD PMA Project Area Multi-Benefit Recharge PMA Project Area

Planned OAWD PMA Project Area

Model Elements Without Modeled PMAs

Colusa Subbasin Boundary

Horizontal Datum: North American Datum of 1983 (NAD 83), California State Plane Zone II, feet.

#### Note:

 Multi-benefit recharge locations will depend on grower enrollment and could be anywhere within the Colusa Subbasin where surface water supplies are available and recharge conditions are favorable. For purposes of modeling project impacts, elements were selected based on lands with cropping schedules that allow for flooding during bird migration periods and total roughly 4,000 acres.



#### Figure 1 Modeling Projects and Management Actions

Colusa Groundwater Authority and Glenn Groundwater Authority Colusa Subbasin Groundwater Sustainability Plan (THIS PAGE LEFT BLANK INTENTIONALLY)

### **Model Scenarios**

Two model scenarios were considered for quantifying the effects and benefits of PMAs on the Subbasin:

- Without-Projects Scenario—Projected Future Conditions with 2070 Climate Change and without Projects. This is the projection of future conditions over the 50-year period from 2016 through 2065, assuming climate change effects are occurring, but that no groundwater recharge or other types of projects are implemented. Climate change adjustments were made to the precipitation, evapotranspiration, and surface water supply model inputs to reflect the estimated effects of climate change based on the 2070 Central Tendency climate change datasets provided by DWR to support GSP development.<sup>4</sup> The main effect of these adjustments is an estimated increase in future crop water requirements, which result in the need for increased groundwater pumping.
- With-Projects Scenario—Projected Future Conditions with 2070 Climate Change and with <u>Projects.</u> This is the same as the "without-projects" scenario, except that it is assumed that the three modeled projects are in operation during the full duration of the 50-year simulation.

Hereinafter, for convenience, these model scenarios are referred to as the "without-project" and "withproject" scenarios, respectively. The model inputs differ only due to projects; thus, differences in model results between these scenarios are due entirely to the effects of the projects.

The analysis period and assumptions about hydrology, land use, and water supplies associated with each model scenario are summarized in **Table 1**. Projected future water supplies and land use are expected to vary depending on Shasta watershed hydrologic conditions and related CVP operations plans prepared by Reclamation. Water supplies and flows through the Subbasin may be reduced in hydrologic years designated by Reclamation as Shasta Critical<sup>5</sup>, such as 2015, resulting in reduced cropped acreage in those years. In Shasta Non-Critical years, water supplies and land use are expected to be similar to current conditions in recent non-drought years, such as 2013. In the future analysis period (2016-2065), future years are mapped to a series of historical years that were selected to represent historical hydrology as the baseline for estimating future hydrology (23 CCR §354.18(c)(3)). The Shasta Critical or Non-Critical designation of those historical years was also mapped to the corresponding future years.

Additional information on these scenarios is provided in Chapter 3, Section 3.3, of the Subbasin GSP.

<sup>&</sup>lt;sup>4</sup> Climatological, hydrological, and water operations datasets, change factors, and the DWR Climate Change Resource Guide are available at: https://data.cnra.ca.gov/dataset/sgma-climate-change-resources.

<sup>&</sup>lt;sup>5</sup> In general, Shasta Critical conditions are declared when the forecast inflow to Lake Shasta for a particular water year is equal to or less than 3.2 million AF. Conversely, Shasta Non-Critical conditions are declared when the forecast inflow to Lake Shasta for a particular water year exceeds 3.2 million AF. Between 1966-2015, five years were "Shasta Critical," or approximately 1 in 10 years.

# Table 1. Summary of Water Budget Assumptions Used for the Without-Projects Scenario and With-Projects Scenario

Model Scenario	Analysis Period <sup>1</sup>	Hydrology	Land Use	Water Supplies
Without-Projects Scenario: Projected Future Conditions with 2070 Climate Change and without Projects	2016 to 2065	Historical (1966 to 2015), adjusted based on 2070 Central Tendency climate change datasets	Current (2013 and 2015) used for Shasta Non-Critical and Shasta Critical, respectively	Same as Current (see above), adjusted for 2070 Central Tendency climate change
With-Projects Scenario—Projected Future Conditions with 2070 Climate Change and with Projects.	2016 to 2065	Historical (1966 to 2015), adjusted based on 2070 Central Tendency climate change datasets	Current (2013 and 2015) used for Shasta Non-Critical and Shasta Critical, respectively	Same as Current (see above), adjusted for 2070 Central Tendency climate change

Results over the analysis period are summarized by water year (October 1 through September 30)

## **Model Inputs for PMAs**

1

As described above, model inputs for the three modeled PMAs reflect the anticipated volume and timing of surface water supply available through the PMAs for direct and in-lieu groundwater recharge. The model inputs also characterize where that water is beneficially used within the Subbasin. Model inputs developed for each of the three modeled PMAs are described below.

### Colusa County Water District In-Lieu Groundwater Recharge

Under the CCWD In-Lieu Groundwater recharge project, CCWD plans to acquire and deliver 30,000 AF/yr of additional surface water except in Shasta Critical years (approximately one in 10 years<sup>6</sup>).

For modeling, it was assumed in the with-project scenario that an additional 30,000 AF/yr will be delivered to all irrigated agricultural land in model elements that approximately represent the CCWD service area (Figure 1) during Shasta Non-Critical years in the 2016-2065 analysis period. The 30,000 AF is in addition to surface water supplies delivered in the without-project scenario. In Shasta Critical years, no additional surface water is delivered to those elements.

### Orland-Artois Water District Land Annexation and Groundwater Recharge

As part of the OAWD Land Annexation and In-Lieu Groundwater Recharge project, OAWD plans to annex approximately 12,000 acres of groundwater-dependent agricultural land into the district. OAWD also plans to acquire and deliver 25,000 AF/yr of surface water to the annexed lands except in Shasta Critical years (approximately one in 10 years).

For modeling, it was assumed in the with-project scenario that an additional 25,000 AF/yr will be delivered to all irrigated agricultural land in the OAWD project area (Figure 1) during Shasta Non-Critical years in the 2016 to 2065 analysis period. The OAWD project area contains model elements that approximately represent the OAWD service area as well as the 12,000 acres that OAWD plans to annex. The 25,000 AF/yr is in addition to surface water supplies delivered in the without-project scenario. In

<sup>&</sup>lt;sup>6</sup> Over the 50-year period from 1966-2015, five years were declared "Shasta Critical."

Shasta Critical years, no additional surface water is delivered to the OAWD service area and groundwater is the sole irrigation supply source for the annexed area.

#### Colusa Subbasin Multi-Benefit Groundwater Recharge

In the Colusa Subbasin Multi-Benefit Recharge project, voluntarily participating growers will apply surface water to fields and maintain a shallow depth (4 inches maximum) for typically four to six weeks in the late summer and early fall (July 15 to October 15) and/or spring (March 15 to April 15),) when migratory shorebird habitat is needed.

For modeling the multi-benefit groundwater recharge project, key assumptions and analyses were developed to identify one hypothetical project configuration as a "bookend" scenario, in which maximal grower participation occurs in areas with the greatest multi-benefit groundwater recharge potential. In practice, the actual location and scale of the project will depend on voluntary landowner participation from year to year. The assumptions and analyses underpinning the with-project scenario model inputs were formulated to estimate:

- Where the greatest potential combination of multi-benefits could occur (considering groundwater recharge potential, habitat creation suitability, and other factors of interest)
- When the project would be implemented (on a monthly and annual basis)
- How much voluntary participation could occur (assuming, at a maximum, that all lands with the greatest potential combination of multi-benefits will participate each year water is available)

The specific approach and assumptions are as follows:

- A geospatial analysis was completed to identify all "potential recharge areas" in the Subbasin. All lands with the following characteristics were identified as potentially suitable for multibenefit groundwater recharge, and were assumed to enroll in the program in the with-project scenario:
  - o <u>Location</u>:
    - Within the service area of a surface water supplier (Lands were assumed to have access to surface water supplies)
    - Within six miles of the Sacramento River (Lands were considered to allow maximum mitigating effects on streamflow depletion, a factor of interest to modeling; this may not necessarily be a factor in actual program implementation)
  - <u>Soil characteristics</u>: Soils that are suitable for groundwater recharge (indicated by a SAGBI rating of "moderately good," "good," or "excellent")
  - Land use: Crops that are suitable for recharge and could accept flooding in late summer and early fall (the period prioritized for modeling), with minimal impacts to crops and farming operations (excluded lands include: non-agricultural land uses (urban, native vegetation, riparian), permanent crops, ponded crops, and other crops with growing seasons incompatible with flooding between August-October)

• Minimum size of 25 acres

A total of 4,122 acres were found to satisfy these criteria, and are located within the model elements identified in Figure 1. These "potential recharge areas" were assumed to all participate in multi-benefit groundwater recharge.

- For all potential recharge areas, it was assumed that:
  - <u>Shasta Non-Critical years</u>: Multi-benefit groundwater recharge would occur and lands would be flooded with surface water for 30 days (during the month of September)
  - <u>Shasta Critical years</u>: Normal farming and irrigation practices would continue, without multi-benefit groundwater recharge due to likely surface water shortages in those years.
- For all potential recharge areas, model inputs for the with-project scenario were changed from the without-project scenario as follows:
  - <u>Crop assignment</u>: In Shasta Non-Critical years, lands were classified as non-ponded crops planted in March or April and harvested by August. In Shasta Critical years, lands remained in their original crop assignment.
  - <u>Soil characteristics</u>: In September, target soil moisture (TSM) was set equal to the total porosity of the soil to simulate ponding. In other months, TSM was estimated as the weighted average TSM of all lands identified from the geospatial analysis.
  - Irrigation period: Set to March or April through September in all years.
  - <u>Crop evapotranspiration</u>: In Shasta Non-Critical years, crop evapotranspiration was estimated as the weighted average evapotranspiration of all lands identified from the geospatial analysis, with adjustment for idle lands that are typically unirrigated. In Shasta Critical years, crop evapotranspiration returned to the original crop assignment.
  - o <u>Diversions:</u>
    - In Shasta Non-Critical years: Additional diversions to potential recharge areas were estimated based on a simulation of average additional water demand in project area elements in September of Shasta Non-Critical years. The additional diversions were then specified as new supply from the Sacramento River, and applied to project area elements.
    - In Shasta Critical years: No additional diversions were specified.

## **Model Results for PMAs**

This section compares the model results in the with-projects and without-projects scenarios. The difference between the without-project and with-project model results represents the net effect of the project on those water budget parameters.

### Results for Each Modeled Project Area

The tables below summarize key results of the without-project and with-project model scenarios for each of the three modeled PMAs. Results are averaged over the entire 2016 to 2065 projected future period, including Shasta Critical years (approximately 10 percent of all years) when it is expected that

additional surface water supplies will be unavailable for projects. The results are aggregated from the water budgets of elements in the project areas identified in Figure 1.

The average net benefit to the groundwater system of each modeled project is reported as "net recharge from the surface water system," calculated as the sum of all groundwater recharge (seepage and deep percolation) minus the sum of all groundwater extraction (groundwater pumping) in the project area and model scenario. Positive values indicate that more recharge is occurring, on average, while negative values indicate that more extraction is occurring.

On average across all years, the CCWD In-Lieu Groundwater Recharge project is expected to provide approximately 27,000 AF/yr of additional surface water to the CCWD project area, offsetting a similar volume of groundwater pumping (**Table 2**). The average net benefit to the groundwater system of the CCWD project is estimated to be approximately 27,000 AF/yr.

The OAWD Land Annexation and In-Lieu Groundwater Recharge project is expected to provide approximately 22,500 AF/yr of additional surface water to the OAWD project area, offsetting a similar volume of groundwater pumping on average across all years (**Table 3**). The average net benefit to the groundwater system of the OAWD project is estimated to be approximately 22,500 AF/yr.

The Colusa Subbasin Multi-Benefit Groundwater Recharge project is expected to provide approximately 11,500 AF/yr (2.8 AF per acre [AF/ac]) of surface water to potential recharge areas for field flooding (**Table 4**). A portion of this water results in deep percolation (approximately 4,000 AF/yr, or 1.0 AF/ac) or additional seepage (approximately 900 AF/yr, or 0.2 AF/ac). The average net benefit to the groundwater system of the OAWD project is estimated to be approximately 5,200 AF/yr (1.25 AF/ac).

Scenario	Surface Water Diversions	Groundwater Pumping	Seepage	Deep Percolation	Net Recharge from the Surface Water System <sup>1</sup>
Without-Project	65,859	63,314	0	48,460	-14,854
With-Project	92,901	36,140	0	48,403	12,263
Difference (With-Project – Without-Project)	27,042	-27,174	0	-57	27,117

Table 2. Key Model Results from the Colusa County Water District In-Lieu Groundwater RechargeProject (Average AF/yr, 2016 to 2065)

<sup>1</sup> Net Recharge from the Surface Water System = Seepage + Deep Percolation – Groundwater Pumping

# Table 3. Key Model Results from the Orland-Artois Water District Land Annexation and In-LieuGroundwater Recharge Project (Average AF/yr, 2016 to 2065)

Scenario	Surface Water Diversions	Groundwater Pumping	Seepage	Deep Percolation	Net Recharge from the Surface Water System <sup>1</sup>
Without-Project	48,026	62,067	0	45,324	-16,742
With-Project	70,534	39,520	0	45,307	5,788
Difference (With-Project – Without-Project)	22,509	-22,547	0	-17	22,530

<sup>1</sup> Net Recharge from the Surface Water System = Seepage + Deep Percolation – Groundwater Pumping

# Table 4. Key Model Results from the Colusa Subbasin Multi-Benefit Groundwater Recharge Project(Average AF/yr, 2016 to 2065)

Scenario	Surface Water Diversions	Groundwater Pumping	Seepage	Deep Percolation	Net Recharge from the Surface Water System <sup>1</sup>
Without-Project	34,151	7,521	5,037	7,565	5,081
With-Project	45,683	7,212	5,924	11,540	10,252
Difference (With-Project – Without-Project) (AF/yr)	11,533	-308	886	3,976	5,171
Difference (With-Project – Without-Project) (AF/ac <sup>2</sup> )	2.8	-0.1	0.2	1.0	1.25

<sup>1</sup> Net Recharge from the Surface Water System = Seepage + Deep Percolation – Groundwater Pumping

<sup>2</sup> Calculated assuming 4,122 acres of "potential recharge area" will participate in multi-benefit groundwater recharge.

#### Results for the Colusa Subbasin

The tables below summarize key results of the without-projects and with-projects model scenarios for the entire Subbasin. Results are averaged over the entire 2016 to 2065 projected future period, including Shasta Critical years (approximately 10 percent of all years) when it is expected that additional surface water supplies will be unavailable for projects. The results are aggregated across all model elements in the Subbasin.

**Table 5** summarizes the water budget results for the Subbasin surface water system. On average acrossall years, all three modeled projects are expected to reduce groundwater pumping by approximately49,000 AF/yr and increase the total surface water inflows to the Subbasin by approximately27,000 AF/yr. Stream gains from groundwater are also expected to increase by nearly 15,000 AF/yr

compared to the without-projects scenario.<sup>7</sup> Deep percolation in the with-projects scenario is expected to slightly increase (approximately 4,000 AF/yr), while seepage is expected to slightly decrease (approximately 10,000 AF/yr) compared to the without-projects scenario.

**Table 6** summarizes the water budget results for the Subbasin groundwater system. In the withoutprojects scenario, the average annual change in groundwater storage across all years is expected to be approximately -7,000 AF/yr, indicating an average net decline in groundwater storage. When all three modeled projects are in effect, the average annual change in groundwater storage across all years is expected to be approximately 0 AF/yr, indicating no net decrease in groundwater storage.

These model results suggest that planned projects in the Subbasin are sufficient to support sustainable management of groundwater extractions and recharge to ensure that chronic lowering of groundwater levels or depletion of supply during periods of drought is offset by increases in groundwater storage during other periods (23 CCR §354.44(b)(9)).

<sup>&</sup>lt;sup>7</sup> A more detailed assessment of projected streamflow accretion-depletion is presented in Appendix 3-G. The analysis considers the Sacramento River, Stony Creek, and the Colusa Drain individually and collectively, and evaluates temporal accretion-depletion patterns over the 50-year simulation period.

			Difference
			(With-Projects –
Component	Without-Projects	With-Projects	Without-Projects)
Inflows			
Surface Water Inflows	12,714,561	12,741,210	26,649
Sacramento River Diversions	1,195,939	1,255,291	59,352
Stony Creek Diversions	90,707	90,707	0
Sacramento River Inflows	11,335,460	11,302,757	-32,703
Other Inflows from Boundary Streams	92,455	92,455	0
Precipitation	1,257,503	1,257,503	0
Groundwater Pumping	558,561	509,702	-48,859
Agricultural	515,996	466,936	-49,059
Urban and Industrial	10,098	10,098	0
Managed Wetlands	32,467	32,668	201
Stream Gains from Groundwater	322,713	337,389	14,676
Total Inflow	14,853,338	14,845,804	-7,534
Outflows			
Evapotranspiration	1,900,935	1,902,885	1,949
Agricultural	1,596,222	1,597,393	1,171
Urban and Industrial	28,407	28,410	3
Managed Wetlands	73,292	73,292	0
Native Vegetation	167,144	167,146	2
Canal Evaporation	35,869	36,643	774
Deep Percolation	411,004	415,312	4,308
Precipitation	156,055	157,003	947
Applied Surface Water	158,089	170,370	12,281
Applied Groundwater	96,859	87,940	-8,919
Seepage	400,727	391,052	-9,675
Streams	252,897	242,325	-10,572
Canals and Drains	147,829	148,727	898
Surface Water Outflows	12,140,789	12,136,608	-4,180
Precipitation Runoff	59,795	60,180	384
Applied Surface Water Return Flows	90,012	91,563	1,551
Applied Groundwater Return Flows	20,352	20,096	-256
Sacramento River	11,186,667	11,156,439	-30,227
Colusa Basin Drain	773,816	786,947	13,130
Colusa Weir to Sutter Bypass	0	0	0
Other Outflows to Boundary Streams <sup>1</sup>	10,146	21,384	11,238
Total Outflow	14,853,455	14,845,858	-7,597
Change in Storage (Inflow - Outflow)	-117	-53	63
Stream gains minus seepage	-78,014	-53,663	24,351

# Table 5. Without-Projects and With-Projects Surface Water System Water Budget Results for the Entire Colusa Subbasin (Average AF/yr, 2016 to 2065)
			Difference
Component	Without-Projects	With-Proiects	(With-Projects – Without-Projects)
Inflows			
Subsurface Water Inflows	208,855	196,891	-11,964
Deep Percolation	411,004	415,312	4,308
Precipitation	156,055	157,003	947
Applied Surface Water	158,089	170,370	12,281
Applied Groundwater	96,859	87,940	-8,919
Seepage	400,727	391,052	-9,675
Streams	252,897	242,325	-10,572
Canals and Drains	147,829	148,727	898
Total Inflow	1,020,586	1,003,255	-17,330
Outflows			
Subsurface Water Outflows	146,626	156,416	9,790
Groundwater Pumping	558,561	509,702	-48,859
Agricultural	547,769	498,906	-48,862
Urban and Industrial	10,098	10,098	0
Managed Wetlands	34,672	34,870	198
Stream Gains from Groundwater	322,713	337,389	14,676
Total Outflow	1,027,899	1,003,507	-24,392
Change in Storage (Inflow - Outflow)	-7,314	-252	7,062

# Table 6. Without-Projects and With-Projects Groundwater System Water Budget Results for the EntireColusa Subbasin (Average AF/yr, 2016 to 2065)

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Appendix 7A

Funding, Financing, and Cost Allocation

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# **Technical Memorandum**

Subject:	Funding and Financing Mechanisms and Cost Allocation Overview for the Colusa Subbasin	
Date:	November 19, 2021	
From:	ERA Economics	
То:	Glenn and Colusa County Groundwater Authorities	

#### Introduction

Development of the Colusa Subbasin GSP was primarily funded through a Proposition 1 Sustainable Groundwater Planning Grant. Additional funding for Glenn and Colusa Groundwater Authorities (GGA and CGA) activities to support GSP development was from fees collected under rate studies covering the five-year period spanning fiscal years 2019/20 through 2023/24. These were prepared as propertyrelated fees for water service under Proposition 218<sup>1</sup>. The rate study fees supported GSP development, which was estimated to cost approximately \$465,000 per year in the CGA and \$450,000 to \$550,000 per year in the GGA. The fee is up to approximately \$1.09 and \$1.60 per assessable acre in the CGA and GGA in the current fiscal year (actual fees are less than the max).

After submission of the GSP to Department of Water Resources (DWR), CGA and GGA activities will shift from GSP development to GSP implementation<sup>2</sup>. Implementation of the GSP will be a substantial undertaking, encompassing continuing activities for GSP development (e.g., outreach and coordination) as well as new activities to support implementation (e.g., projects and management actions and addressing data gaps in the Subbasin). Implementation will likely require GSAs and other local entities to fund these required activities. As described in Chapter 7 of the GSP, total GSP implementation costs are estimated to increase from approximately \$1.5 million to around \$9.5 million per year at full implementation of planned projects and management actions (including annualized capital costs).

GSAs and other local entities implementing projects and management actions will develop a GSP financing plan that will likely include a combination of fees, assessments, and taxes, as well as additional outside funding, grants, and low interest borrowing. The financing plan will, among other items, identify funding and financing sources for components of GSP implementation. This will include consideration of allocation of those costs to different entities—and ultimately water users—in the subbasin. This technical memorandum/appendix to the GSP describes options for GSP funding and financing and introduces cost allocation concepts and approaches that may be considered.

<sup>&</sup>lt;sup>1</sup> Fee Study for the Glenn Groundwater Authority. May 2019.

Fee Study for the Colusa Groundwater Authority. May 2019.

<sup>&</sup>lt;sup>2</sup> There is substantial overlap between development activities covered under the existing rate study and implementation activities. For example, GSA administration and technical development work, to support refinements to the GSP, are largely the same.

# **Colusa Subbasin GSP Implementation Costs**

The total cost of GSP implementation is approximately \$9.5 million per year once planned projects and management actions are fully implemented. GSP implementation costs are broken into the following four categories, which are appropriate for different funding and financing mechanisms:

- **GSA Administration and Studies**. These include general GSA administrative and operating costs for management of the GSP, GSA coordination, other coordination with local entities, annual and five-year reports, and management of technical tasks. Studies include technical work that the GSAs will do to support GSP implementation. Total costs are around \$1 million per year. GSA administration and studies are annual costs that are typically covered under local assessments.
- Project and Management Action Capital Repayment. Projects and management action (PMAs) capital repayment costs are estimated at approximately \$1 million. The total capital outlay is around \$20 million, which is primarily attributed to the Orland-Artois Water District (OAWD) land annexation and in-lieu recharge project. Project capital costs may be funded under future bond funding opportunities and other grant solicitations. Low interest borrowing options may be used to finance project capital.
- Other PMA Capital and Studies. These include project and management action development technical studies and non-debt financed capital. The estimated cost is \$0.4 to \$1 million per year. Project capital and studies may be eligible for some sources of grants but are typically paid on a pay-go basis.
- Project Operations and Maintenance. Annual O&M for projects is approximately \$4 to \$6.7 million per year. These are annual costs for the project. A substantial share of project O&M costs are attributed to water purchases for in-lieu recharge projects providing approximately 84,000 acre-feet (af) of benefits at full implementation.

Figure 1 illustrates the estimated costs over the first five years of GSP implementation. The largest single component is the cost to purchase water included in the PMA O&M estimate. The timing of costs may vary from what is shown on Figure 1. For example, some projects and management actions may be implemented more (less) rapidly resulting in accelerated (delayed) costs associated with capital and project operations and maintenance. The financing plan for GSP implementation would be updated to reflect these changes over time.



Figure 1. Colusa Subbasin GSP Implementation Cost Summary

# Funding and Financing Mechanisms

Administering the GSP, groundwater monitoring, reporting, and project and management action implementation is projected to cost approximately \$9.5 million per year across the Colusa Subbasin (Subbasin). GSA annual budgets and GSP implementation costs will be reviewed, revised if needed, and updated by the GSAs based on subbasin conditions, actual expenditures, and the immediate future needs. Expected costs will be adjusted over time as the GSP implementation costs are better understood through sustainable management activities and guidance from DWR on the submitted GSP and subsequent reporting.

Covering the costs of PMAs and general GSP implementation requires evaluating both financing and funding mechanisms. Financing relates to identifying sources of capital (typically state/federal grants, bonds, and bank loans) to pay for project capital expenses. Funding relates to sources of money required to cover capital repayment (pay back the debt-financed projects) as well as project O&M, GSA administration, and other annual expenses.

The agencies in the Subbasin have the powers and authority to impose fees and assessments and pursue other financing sources for capital projects and funding sources for repayment of debt, operations, and other ongoing expenses. The GSAs also have explicit fee authorities under Sustainable Groundwater Management Act (SGMA) legislation (Water Code §10730 and §10730.2). Table 1 summarizes potential financing and funding sources that may be used by GSAs for GSP implementation.

Capital Financing	Considerations	
State (DWR) Grants (Prop. 68 and future bonds)	Solicitations are typically targeted to general types of projects and specific benefits that are in the State's interest	
US Bureau of Reclamation WaterSmart Grants	Project-specific funding that can support planning studies (e.g., water market strategy grants)	
Other targeted potential grant programs (e.g., AB 252)	Potential for multi-benefit projects	
Local bond issuance	Local borrowing based on agency authority	
Private borrowing	Current low interest rate environment may make these options attractive	
State or Federal low interest loans	This could include future bond-funded loan programs	
Funding Sources	Considerations	
Fee – General	General options for legal authority pre- and post-GSP development: Prop. 26, Prop. 218, Water Code §10730, Water Code §10730.2	
Regulatory Fee	Typically, pre-GSP fee that is related to regulatory cost. Prop. 26 and Water Code §10730	
Service Fee	Related to cost of service. Prop 218 and Water Code §10730.2. Subject to majority protest vote	
Special Tax	Subject to 2/3 majority approval vote	
Special Benefit	Special benefit assessment subject to majority protest vote	

#### Table 1. Potential Funding and Financing Sources for GSP Implementation

#### Capital Financing

Capital financing options include a mix of grants and low interest loans. There are typically limits on what costs can be covered by the funding source, or what specific benefits can be paid for. These can be specified in statute or defined by agencies administering the programs.

State opportunities for project capital funding under voter-authorized bonds are a common source of cost share for project capital. For example, Proposition 68, the Parks and Water Bond Act of 2018, bonds support the California DWR Sustainable Groundwater Management (SGM) Grant Program Implementation Grants. Project funding applications are submitted in a competitive process under grant proposal solicitation packages (PSP) administered by DWR. PSP guidelines define the requirements for project applications, eligibility for funding, and the desirable public benefits provided by the proposed project. The 2020 PSP for GSP implementation focused heavily on recharge opportunities and benefits to local disadvantaged communities. Planned GSP projects should be reviewed in advance and positioned for eligibility for future PSPs.

Multi-benefit projects have received increasing attention as part of GSP development and for state grant opportunities. The Governor's Executive Order N-10-19 directed state agencies to work together to prepare a "water resilience portfolio that meets the needs of California's communities, economy, and the environment through the 21<sup>st</sup> century" and prioritizes multi-benefit projects/policies. The 2020 DWR SGM PSP provided explicit definition of multi-benefit types, minimum requirements for grant eligibility, and weights assigned to project scoring. Other opportunities for multi-benefit project funding are related to SGMA implementation. For example, AB 252 Department of Conservation: Multi-benefit Land Repurposing Program outlines a potential program for providing state grants to support agricultural land repurposing under GSP implementation<sup>3</sup>. The Governor's May Revise budget included a proposal for a similar \$500 million program for drought support administered by the Department of Conservation for "Multi-Benefit Land repurposing<sup>4</sup>" in collaboration with the Department of Food and Agriculture. The program concept is to "prioritize ecosystem-based strategies that are implemented with landowners" to support land repurposing from irrigated agriculture to other uses. While the program would primarily be targeted to the Critically Overdrafted Subbasins, potential multi-benefit recharge projects included in the Colusa Subbasin GSP (see Chapter 6) may be eligible under this or similar programs.

Grant funding opportunities can define specific public benefits that are eligible. Various state and federal laws have established some benefit types as public eligible for public funding. For example, Proposition 1, the Water Quality, Supply, and Infrastructure Improvement Act of 2014, defined five public benefit categories eligible for funding under the Water Storage Investment Program. Flood control benefits have often been considered to include a mix of public (state or federal) and private (local) benefits, so a cost share approach is common. Ecosystem benefits that accrue to the entire state are considered public benefits.

Grants and low interest loans are expected to be an important option for reducing the cost of SGMA to local communities. The Colusa Subbasin GSAs will continue to pursue these opportunities to help fund planning studies, projects, and other GSA activities. However, grants and low-interest loans are not expected to cover most GSA operating costs for GSP implementation or annual operating and maintenance costs of projects. In addition, these rely on relatively unpredictable funding (e.g., state general obligation bonds that require voter approval) and are subject to changing rules and requirements.

#### **Funding Sources**

Example funding methods that are available to GSAs to fund projects, studies, and operations were reviewed. Groundwater extraction fees and groundwater permit fees are specifically included in the SGMA legislation (California Wat Code 10730 et seq), but other methods may be available to a GSA, depending on the agency's authorities under law. All methods adopted must comply with the requirements of statute and the California Constitution. The following summary includes many common funding methods but is not necessarily comprehensive.

Assessments based on costs of service or special benefits under Proposition 218 could include a per-acre (or per-parcel) charge to cover GSA costs, or other fees under Proposition 26. For example, benefits of a recharge project might accrue differentially across the Subbasin. The assessment could be calculated in proportion to the special benefit received (by subarea and/or user class), as calculated in the reports supporting the rate study. For cost-based fees and charges (including extraction and permit fees), the report would calculate the cost of providing the service to each parcel or to categories of parcels. Categories would be based on costs imposed on the program and could be based on location, level of use, or other characteristics related to costs.

Another option for funding GSP implementation is taxes. Taxes do not have to be directly tied to the cost or benefit of the service provided. Potential taxes could include general property related taxes that are not directly related to the benefits or costs of a service (ad valorem and parcel taxes), or special taxes imposed for specific purposes related to GSA activities. Based on an initial review of GSA funding

<sup>&</sup>lt;sup>3</sup> https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\_id=202120220AB252

<sup>&</sup>lt;sup>4</sup> May Revised Budget. Submitted 5/14/2021.

approaches in Critically Overdrafted Subbasins, this is not a common funding mechanism for GSP implementation.

Other fees and charges may include permitting fees for new wells or development, transaction fees associated with contemplated groundwater markets, or commodity-use fees, all directed at aiding with sustainability objectives. Depending on the justification and basis for a fee, it may be considered a property-related fee subject to voting requirements of Article XIII D of the California Constitution (passed by voters in 1996 as Proposition 218) or a regulatory fee exempt from such requirements.

Some of the potential funding approaches can affect the cost of water for specific uses in the Subbasin. For example, districts supplying surface water recognize that recovering GSP related costs as part of their surface water charge can be counter-productive by disincentivizing surface water use. All agencies are concerned that any fees, charges, or assessments will affect business (farm) income and, if large, may affect cropping decisions and farming practices in the Subbasin. Based on groundwater monitoring, land use changes, and other future conditions, the GSAs will reconsider or adjust fees/assessments as needed to achieve sustainability.

#### Funding and Financing Mechanisms in Example GSAs

A brief review of some GSA funding approaches was developed to illustrate examples of the different bases for their fee or assessment structure. Most of the rate studies were for GSP development. This includes studies stating that the GSA is exempt from voting requirements (see the Kings River East GSA below).

• McMullin Area GSA

McMullin Area GSA is in central Fresno County within the Kings Subbasin. It adopted a property-based fee to fund GSA costs, calculated as the annual cost of service divided by the number of acres served. The adopted fee excludes parcels that are less than two acres, which it determines are "de minimis" groundwater users under SGMA. The resulting annual fee of \$19 per acre was adopted as a water service fee under Proposition 218 after a public hearing at which a majority of land subject to the fee did not protest. The rate study suggested that the agency may consider converting some or all of its fee to a volumetric basis in the future but did not at the time have the information to do so.

• South Fork Kings GSA

The South Fork Kings GSA is in the Tulare Lake Subbasin. It adopted an annual charge to fund its costs, following requirements for a public hearing and protest vote. Its charge was authorized for five years, beginning at up to \$9.80 per acre for 2019 (the first year after the rate study). The amount per acre is calculated as the costs of specified implementation and administrative costs divided by assessable acres within the boundaries of the GSA, except for the City of Lemoore. A separate amount is calculated annually for the City of Lemoore by negotiated agreement. The GSA generally refers to the proposed charge as an assessment and describes the process for justifying a benefit assessment apportioned among parcels according to special benefit received. However, it also describes the fee as apportioned among parcels according to cost of providing the service.

• Kings River East GSA

The Kings River East GSA is in the Kings Subbasin. It prepared a groundwater fee study to calculate and justify a volumetric fee per af pumped. It used a cost-of-service approach to determine appropriate fees for different areas and jurisdictions within its boundaries. The agency argued that, under Proposition 26, the fee is a regulatory fee that covers the cost of compliance with SGMA, and therefore it is exempt from the public voting requirement. Fees were calculated according to area, land use, and water use. Some areas were not charged a volumetric fee because of their "lack of deep groundwater pumping from the alluvium"; they were only charged a nominal, fixed annual fee to cover a share a share of fixed administrative costs. Other areas were charged \$1.45 per af of estimated pumping. Pumping is not currently metered in the area, so the fee was based on land use and a water balance calculation to estimate pumping.

### **Cost Allocation and Cost Recovery for GSP Implementation**

The fee and assessment methods summarized in the previous section allow (and in most cases require) agencies to consider the relative benefits and costs, and to whom they accrue, in setting rates or amounts.

Cost allocation is a multi-step process that determines how costs of implementation components will be spread among and recovered from entities and areas covered by the GSP. The implementation plan includes several categories of activities that must be paid for: administration, projects and management actions, monitoring, and studies. The categories may have their costs spread in different ways (among different entities and areas) depending on discussions and policy decisions about issues like: who is responsible for a cost, who benefits from an activity, what is fair, what is legally allowed or possible, what are the requirements for determining and justifying a cost allocation?

An initial step in cost allocation is to determine which agency (or agencies) are responsible for financing and funding. This may vary based on fairness and equity concerns, and across different GSP PMAs. For example, the lead agency for a specific GSP project may work to secure financing and explore funding mechanisms. Alternatively, the GSA could lead some of these activities and in turn recover costs from the lead agency (or agencies). Under both approaches, the cost allocation would consider the share of benefits received from the project. Using the four GSP cost categories defined above, example considerations for each category include:

- GSA Administration and Studies. General GSA administrative costs and required studies to support GSP implementation (e.g., address data gaps) generally provide a benefit to the entire Subbasin. This could be viewed as a basis for allocating costs broadly across all groundwater users. However, some areas may receive a disproportionate share of benefits from the actual implementation of the GSP and this could be reflected in how general costs are allocated. Potentially, some areas could be judged as not responsible for groundwater issues or benefitting from groundwater management.
- Project and Management Action Capital Repayment. Projects typically have a single project
  proponent that has specific financing and funding options available. Project benefits may
  primarily accrue to the proponent. However, under SGMA requirements for subbasin-wide
  sustainability, other entities and areas may derive some potential indirect benefits of
  sustainability. In addition, there may be direct project-related benefits (e.g., higher groundwater
  elevations that reduce pumping costs or reduce stream depletions) that accrue to other parties.

- Other PMA Capital and Studies. Project capital costs that will not be debt-financed and project study costs could be treated similar to PMA capital costs. However, the GSA may initiate studies to support GSP implementation and cover a portion of costs. Some of these studies have been initiated under GSP development (e.g., subbasin conditions, data management system, and data gaps).
- **Project Operations and Maintenance**. Specific PMA O&M costs could be paid by the project proponent. A portion of costs could be allocated to other parties that receive direct or indirect benefits from the project, or to the entire Subbasin for general SGMA benefits.

Cost allocation for a GSP that incorporates many agencies may occur at multiple levels, perhaps including basin-wide, within a GSA, or within an individual entity such as a water district or other local agency. The general steps in cost allocation are:

- Determine costs of implementation activities and when they are to be incurred. Generally, the different cost components of an activity need to be aggregated in a consistent way to allow for a fair and objective allocation. This is especially important if cost components (e.g., capital costs versus annual O&M) may be paid by different parties. A life-cycle cost approach is commonly used, in which all costs over the life of the activity are adjusted for when they occur (using standard financial discounting) and expressed as an annual or lump-sum amount.
- Based on stakeholder discussions and technical support, make decisions about which costs apply across the entire GSA versus apply to subareas or specific agencies. For GSP activities that serve the entire GSA (perhaps GSA administration or certain monitoring costs), the GSA would lead the discussions and policy decisions; for projects proposed by or to be developed by a specific member agency, that agency could take the lead. Discussions and decisions may also address which groups or users will be included in the cost allocation for a particular activity for example, the discussion could consider a group's past or current use of groundwater.
- Develop information to support the actual calculations needed to allocate and recover costs, which may include cost of service and benefit information. This step is based on the policy decisions and will help determine who pays for the GSP activity. Defensible information is required to meet legal requirements. An open and fair process is essential for the political support needed to implement activities and recover costs.

Allocating and recovering costs involve policy decisions and technical analysis and must follow a process that meets legal requirements. Costs of projects and activities that serve large areas and multiple groups are typically allocated using cost-of-service principles, whereby the total project cost is split based on each area or group's demonstrated proportional split of total cost. Costs can also be allocated based on benefits received (for example the California Constitution allows for assessments to be based on special benefits received). Ultimately, decisions about cost allocation must involve meaningful input from affected parties so that the outcome is viewed both as fair and technically justified.

## Summary

Cost allocation and repayment are important and difficult decisions that require ongoing and open discussions. The GSAs are already implementing financing mechanisms to pay for their administrative costs. Development of a financing plan will require making further decisions with stakeholders and member agencies using a timely process that supports the subbasin sustainability goal and GSP implementation schedule.

This memorandum/appendix provides a general overview of funding and financing methods available to Subbasin agencies. Methods generally allow agencies to consider the distribution of costs and benefits when setting a fee or assessment. An analysis to establish a financing plan for the Subbasin would:

- Review specific issues that affect the distribution of costs and benefits within the subbasin. This would include establishing potential project costs and beneficiaries. It would also consider the agency (or agencies) that would be responsible for recovering the costs of different activities.
- Listen to different groups' perspectives on fairness, contribution to groundwater issues, and benefits from groundwater management.
- Coordinate with GSA legal counsel and agency legal counsel to evaluate fee and assessment options.
- Prepare technical analyses to support cost allocation and repayment. This potentially can
  include some options or examples that illustrate different allocations of fees/assessments, for a
  specific project or management action with multiple payers and beneficiaries to demonstrate
  how fees can be calculated when benefits or costs are assigned to different areas and/or
  customer groups.

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