APPENDIX 8
P&A PROCEDURE FOR WELLS TO BE ABANDONED PRIOR TO INJECTION

1. Introduction

CTV will abandon 16 wells within the area of review (AoR) prior to injection of carbon dioxide (CO_2) to isolate the injection zone from other permeable reservoirs and to ensure confinement through the upper confining layer. **Appendix 7** provides the list of all wells within the AoR and indicates which wells will be abandoned prior to injection. This appendix provides the plugging and abandonment procedures to demonstrate that plugging will ensure isolation of the injection zone.

Abandonment operations will be conducted using methods designed to prevent the movement of fluid into underground sources of drinking water (USDWs) and will include the use of materials compatible with the carbon dioxide stream. As these are oil and gas wells regulated through CalGEM primacy, procedures and cement plug placement will also adhere to regulations established within the California Code of Regulations, Chapter 4, Article 3, §1723.

2. Plugging Procedures

The following procedures describe the proposed plugging operations:

1. Blowout prevention equipment (BOPE) is installed on the wellhead.
2. Downhole production or injection equipment is removed from the casing, and the well is cleaned out to plugback measured depth (PBMD). The cleanout depth will be witnessed by CalGEM and approved.
3. Plug 1 will be placed from the approved cleanout depth across the production interval and >100 feet into the confining layer. The plug will be tagged and witnessed by CalGEM to ensure that the plug depth and length satisfy permit requirements.
4. Plug 2 will be placed across the top of the Mokelumne River Formation and >100 feet into the Capay Shale Formation. The plug may or may not be required by CalGEM, and the plug may be tagged and witnessed accordingly by CalGEM to ensure that the plug depth and length satisfy permit requirements.
5. Plug 3 will be placed as a balanced plug at the base of the USDW in undifferentiated marine sediments. The plug will be extended to cover >100 feet above the base of the USDW. The plug will be tagged and witnessed by CalGEM to ensure that the plug depth and length satisfy permit requirements.
6. Plug 4 will be placed such that the surface plug is >25 feet in length, and well casing can be cut off between 5 feet and 10 feet from surface. The surface plug will be witnessed and approved by CalGEM.
7. BOPE will be removed, and well casing will be cut between 5 feet and 10 feet below surface.

8. A steel plate will be stamped with the last five digits of the API well number for identification. The steel plate will be at least as thick as the outer well casing, and it will be welded around the circumference.

All portions of the well not plugged with cement are filled with inert mud meeting specifications according to California Code of Regulations, Chapter 4, Article 3, §1723(b) to prevent migration of fluids within the wellbore.

3. Plugging Details for Wells to be Abandoned

Well-specific plugging plans are provided in the following tables for each well to be abandoned prior to CO_2 injection. Cement type, volume, density, and placement method for each plug described above are indicated. The indicated top and bottom plug depths necessary to ensure isolation of the injection zone and meet CalGEM abandonment requirements are determined based on the well-specific measured depths of the relevant geologic formations described above.

Wells	BROOKS_10-2				GALLI_1			
Plugs	**Plug 1**	**Plug 2**	**Plug 3**	**Plug 4**	**Plug 1**	**Plug 2**	**Plug 3**	**Plug 4**
Hole Size (in.)	4	4	4	4	4.778	8.755	8.755	8.755
Bottom of tubing (ft)	9575	3901	2354	25	10123	4215	2462	25
Cement Volume (sacks)	9	9	17	2	14	45	82	9
Slurry Volume (bbl)	1.84	1.84	3.48	0.41	2.87	9.22	16.79	1.84
Slurry Weight (lb/gal)	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8
Top of plug (ft)	9450	3776	2129	0	9998	4090	2237	0
Bottom of Plug (ft)	9575	3901	2354	25	10123	4215	2462	25
Type of Cement	Class G	Class G	Class G	Class G	Class G	Class G	Class G	Class G
Method of placement	Balanced Plugs				Balanced Plugs			

Wells	MARCHINI_A_1				POOL_B_1_RD1			
Plugs	**Plug 1**	**Plug 2**	**Plug 3**	**Plug 4**	**Plug 1**	**Plug 2**	**Plug 3**	**Plug 4**
Hole Size (in.)	4.892	4.892	4.892	4.892	4.276	4.276	4.892	4.778
Bottom of tubing (ft)	9629	3964	2394	25	10627	4657	2426	25
Cement Volume (sacks)	14	14	26	3	11	11	26	3
Slurry Volume (bbl)	2.87	2.87	5.33	0.61	2.25	2.25	5.33	0.61
Slurry Weight (lb/gal)	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8
Top of plug (ft)	9504	3839	2169	0	10502	4532	2201	0
Bottom of Plug (ft)	9629	3964	2394	25	10627	4657	2426	25
Type of Cement	Class G	Class G	Class G	Class G	Class G	Class G	Class G	Class G
Method of placement	Balanced Plugs				Balanced Plugs			

Wells	SONOL_SECURITIES_10				SONOL_SECURITIES_11_ST1			
Plugs	**Plug 1**	**Plug 2**	**Plug 3**	**Plug 4**	**Plug 1**	**Plug 2**	**Plug 3**	**Plug 4**
Hole Size (in.)	4.892	6.875	6.875	6.875	4	4	4	4
Bottom of tubing (ft)	9702	3991	2397	25	10627	4657	2426	25
Cement Volume (sacks)	14	28	50	6	9	9	17	2
Slurry Volume (bbl)	2.87	5.73	10.24	1.23	1.84	1.84	3.48	0.41
Slurry Weight (lb/gal)	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8
Top of plug (ft)	9577	3866	2172	0	10502	4532	2201	0
Bottom of Plug (ft)	9702	3991	2397	25	10627	4657	2426	25
Type of Cement	Class G	Class G	Class G	Class G	Class G	Class G	Class G	Class G
Method of placement	Balanced Plugs				Balanced Plugs			

Wells	SONOL_SECURITIES_5				SONOL_SECURITIES_7			
Plugs	**Plug 1**	**Plug 2**	**Plug 3**	**Plug 4**	**Plug 1**	**Plug 2**	**Plug 3**	**Plug 4**
Hole Size (in.)	4.778	4.778	4.778	4.778	6.276	6.276	6.276	6.276
Bottom of tubing (ft)	9742	3928	2388	25	9603	3864	2369	25
Cement Volume (sacks)	14	14	24	3	23	23	42	5
Slurry Volume (bbl)	2.87	2.87	4.92	0.61	4.71	4.71	8.60	1.02
Slurry Weight (lb/gal)	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8
Top of plug (ft)	9617	3803	2163	0	9478	3739	2144	0
Bottom of Plug (ft)	9742	3928	2388	25	9603	3864	2369	25
Type of Cement	Class G	Class G	Class G	Class G	Class G	Class G	Class G	Class G
Method of placement	Balanced Plugs				Balanced Plugs			

Wells		SONOL_SECURITIES_8			
Plugs		**Plug 1**	**Plug 2**	**Plug 3**	**Plug 4**
Hole Size (in.)		4.778	4.778	4.778	4.778
Bottom of tubing (ft)		9551	3906	2362	25
Cement Volume (sacks)		14	14	24	3
Slurry Volume (bbl)		2.87	2.87	4.92	0.61
Slurry Weight (lb/gal)		15.8	15.8	15.8	15.8
Top of plug (ft)		9426	3781	2137	0
Bottom of Plug (ft)		9551	3906	2362	25
Type of Cement		Class G	Class G	Class G	Class G
Method of placement		Balanced Plugs			

Wells		GALLI_2			
Plugs		**Plug 1**	**Plug 2**	**Plug 3**	**Plug 4**
Hole Size (in.)		4.892	4.892	4.892	4.892
Bottom of tubing (ft)		9943	3960	2412	25
Cement Volume (sacks)		14	14	26	3
Slurry Volume (bbl)		2.87	2.87	5.33	0.61
Slurry Weight (lb/gal)		15.8	15.8	15.8	15.8
Top of plug (ft)		9818	3835	2187	0
Bottom of Plug (ft)		9943	3960	2412	25
Type of Cement		Class G	Class G	Class G	Class G
Method of placement		Balanced Plugs			

Wells		UNION_PROPERTIES_1			
Plugs		**Plug 1**	**Plug 2**	**Plug 3**	**Plug 4**
Hole Size (in.)		4.892	4.892	4.892	4.892
Bottom of tubing (ft)		9836	5487	2397	25
Cement Volume (sacks)		14	14	26	3
Slurry Volume (bbl)		2.87	2.87	5.33	0.61
Slurry Weight (lb/gal)		15.8	15.8	15.8	15.8
Top of plug (ft)		9711	5362	2172	0
Bottom of Plug (ft)		9836	5487	2397	25
Type of Cement		Class G	Class G	Class G	Class G
Method of placement		Balanced Plugs			

Well	Sonol Securities 1-A			
Plugs	**Plug 1**	**Plug 2**	**Plug 3**	**Plug 4**
Hole Size (in.)	4.276	6.276	6.276	6.276
Bottom of tubing (ft)	9880	5591	2406	37
Cement Volume (sacks)	60	23	23	5
Slurry Volume (bbl)	12.29	4.71	4.71	1.02
Slurry Weight (lb/gal)	15.8	15.8	15.8	15.8
Top of plug (ft)	9192	5466	2281	12
Bottom of Plug (ft)	9880	5591	2406	37
Type of Cement	Class G	Class G	Class G	Class G
Method of placement	Balanced Plug, Retainer, or CT Plug			

Well	Sonol Securities 3			
Plugs	**Plug 1**	**Plug 2**	**Plug 3**	**Plug 4**
Hole Size (in.)	4.778	8.835	8.835	8.835
Bottom of tubing (ft)	9865	4112	2399	25
Cement Volume (sacks)	40	46	46	9
Slurry Volume (bbl)	8.19	9.42	9.42	1.84
Slurry Weight (lb/gal)	15.8	15.8	15.8	15.8
Top of plug (ft)	9499	3987	2274	0
Bottom of Plug (ft)	9865	4112	2399	25
Type of Cement	Class G	Class G	Class G	Class G
Method of placement	Balanced Plug, Retainer, or CT Plug			

Well	Brooks 10-1 RD1			
Plugs	**Plug 1**	**Plug 2**	**Plug 3**	**Plug 4**
Hole Size (in.)	4.778	8.5	8.5	8.921
Bottom of tubing (ft)	8624	3926	2363	25
Cement Volume (sacks)	73	43	43	10
Slurry Volume (bbl)	14.95	8.81	8.81	2.05
Slurry Weight (lb/gal)	15.8	15.8	15.8	15.8
Top of plug (ft)	7957	3801	2238	0
Bottom of Plug (ft)	8624	3926	2363	25
Type of Cement	Class G	Class G	Class G	Class G
Method of placement	Balanced Plug, Retainer, or CT Plug			

Well	Pool B-2			
Plugs	**Plug 1**	**Plug 2**	**Plug 3**	**Plug 4**
Hole Size (in.)	4.778	4.778	8.755	8.755
Bottom of tubing (ft)	10460	4046	2443	37
Cement Volume (sacks)	102	23	77	15
Slurry Volume (bbl)	12.42	2.77	9.31	1.86
Slurry Weight (lb/gal)	15.8	15.8	15.8	15.8
Top of plug (ft)	9900	3921	2318	12
Bottom of Plug (ft)	10460	4046	2443	37
Type of Cement	Class G	Class G	Class G	Class G
Method of placement	Balanced Plug, Retainer, or CT Plug			

Wells	Yamada LW 1			
Plugs	**Plug 1**	**Plug 2**	**Plug 3**	**Plug 4**
Hole Size (in.)	5.892	5.892	5.892	5.892
Bottom of tubing (ft)	9884	3961	2418	25
Cement Volume (sacks)	21	21	37	4
Slurry Volume (bbl)	4.30	4.30	7.58	0.82
Slurry Weight (lb/gal)	16.8	16.8	16.8	16.8
Top of plug (ft)	9759	3836	2193	0
Bottom of Plug (ft)	9884	3961	2418	25
Type of Cement	Class G	Class G	Class G	Class G
Method of placement	Balanced Plug, Retainer, or CT Plug			