APPENDIX V

Artifact Catalog

Artifact Catalog
Sites ORA-441, ORA-442, ORA-443, ORA-445, ORA-446, ORA-447
The Portola Center Project

SDI Number	Cat. No.	Provenience Type	Provenience No.	Depth (cm)	Artifact Class	Artifact Type	Material Class	Material Type	Portion of Artifact	Portion Elaborate	Quan-tity	Weight (g)	Measure-ment 1	Measure-ment 2	Measure-ment 3
ORA-441 (2006)	1	Surface			Ecofacts	Shell	Shell	Unsorted	fragment(s)			6.7			
ORA-441 (2006)	2	Surface			Lithic Production Waste	Debitage	Lithic	Medium-grained Metavolcanic			1				
ORA-441 (2006)	3	Shovel Test	1	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	4	Shovel Test	1	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	5	Shovel Test	1	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	6	Shovel Test	2	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	7	Shovel Test	2	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	8	Shovel Test	2	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	9	Shovel Test	3	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	10	Shovel Test	3	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	11	Shovel Test	3	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	12	Shovel Test	4	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	13	Shovel Test	4	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	14	Shovel Test	4	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	15	Shovel Test	4	30-40	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	16	Shovel Test	4	40-50	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	17	Shovel Test	5	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	18	Shovel Test	5	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	19	Shovel Test	5	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	20	Shovel Test	6	0-10	No Recovery	No Recovery	No Recovery	No Recovery							

Artifact Catalog
Sites ORA-441, ORA-442, ORA-443, ORA-445, ORA-446, ORA-447
The Portola Center Project

SDI Number	Cat. No.	Provenience Type	Provenience No.	Depth (cm)	Artifact Class	Artifact Type	Material Class	Material Type	Portion of Artifact	Portion Elaborate	Quan-tity	Weight (g)	Measure-ment 1	Measure-ment 2	Measure-ment 3
ORA-441 (2006)	21	Shovel Test	6	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	22	Shovel Test	6	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	23	Shovel Test	7	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	24	Shovel Test	7	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	25	Shovel Test	7	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	26	Shovel Test	8	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	27	Shovel Test	8	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	28	Shovel Test	8	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	29	Shovel Test	8	30-40	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	30	Shovel Test	9	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	31	Shovel Test	9	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	32	Shovel Test	9	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	33	Shovel Test	9	30-40	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	34	Shovel Test	10	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	35	Shovel Test	10	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	36	Shovel Test	10	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	37	Shovel Test	11	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	38	Shovel Test	11	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	39	Shovel Test	11	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	40	Shovel Test	11	30-40	No Recovery	No Recovery	No Recovery	No Recovery							

Artifact Catalog
Sites ORA-441, ORA-442, ORA-443, ORA-445, ORA-446, ORA-447
The Portola Center Project

SDI Number	Cat. No.	Provenience Type	Provenience No.	Depth (cm)	Artifact Class	Artifact Type	Material Class	Material Type	Portion of Artifact	Portion Elaborate	Quan-tity	Weight (g)	Measure-ment 1	Measure-ment 2	Measure-ment 3
ORA-441 (2006)	41	Shovel Test	11	40-50	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-441 (2006)	42	Test Unit	1	0-10	Ecofacts	Shell	Shell	Unsorted	undifferentiated fragment	Fossilized		0.7			
ORA-441 (2006)	43	Test Unit	1	10-20	Ecofacts	Shell	Shell	Unsorted	fragment(s)	Fossilized		16			
ORA-441 (2006)	44	Test Unit	1	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	1	Surface	1		Lithic Production Waste	Debitage	Lithic	Medium-grained Metavolcanic			1				
ORA-442 (2006)	2	Surface	2		Lithic Production Waste	Flake(s)	Lithic	Chalcedony	complete		1				
ORA-442 (2006)	3	Surface	2		Lithic Production Waste	Core(s)	Lithic	Medium-grained Metavolcanic	complete		1				
ORA-442 (2006)	4	Surface	2		Lithic Production Waste	Flake(s)	Lithic	Quartzite	complete		1				
ORA-442 (2006)	5	Surface	3		Lithic Production Waste	Flake(s)	Lithic	Chert	complete		1				
ORA-442 (2006)	6	Surface	3		Precision Tools	Cobble Scraper(s)	Lithic	Quartzite	complete		1	385.7			
ORA-442 (2006)	7	Surface	4		Groundstone Tools	Mano(s)	Lithic	Medium-grained Metavolcanic	fragment(s)	25-50% /unifacial /light wear /burnt /fc	1	663.7	13.3	9	4.9
ORA-442 (2006)	8	Surface	4		Lithic Production Waste	Flake(s)	Lithic	Medium-grained Metavolcanic	complete		1				
ORA-442 (2006)	9	Surface	4		Precision Tools	Scraper(s)	Lithic	Quartzite	complete		1	165.7	7.5	6.2	3.7
ORA-442 (2006)	10	Surface	5		Lithic Production Waste	Flake(s)	Lithic	Medium-grained Metavolcanic	complete		1				
ORA-442 (2006)	11	Surface	6		Precision Tools	Scraper(s)	Lithic	Medium-grained Metavolcanic	almost complete	core based	1	218.5	8.2	7.1	4.2
ORA-442 (2006)	12	Surface	7		Not an Artifact	Not an Artifact	Not an Artifact	Not an Artifact							

Artifact Catalog
Sites ORA-441, ORA-442, ORA-443, ORA-445, ORA-446, ORA-447
The Portola Center Project

SDI Number	Cat. No.	Provenience Type	Provenience No.	Depth (cm)	Artifact Class	Artifact Type	Material Class	Material Type	Portion of Artifact	Portion Elaborate	Quan-tity	Weight (g)	Measure-ment 1	Measure-ment 2	Measure-ment 3
ORA-442 (2006)	13	Shovel Test	1	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	14	Shovel Test	1	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	15	Shovel Test	1	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	16	Shovel Test	1	30-40	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	17	Shovel Test	1	40-50	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	18	Shovel Test	2	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	19	Shovel Test	2	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	20	Shovel Test	2	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	21	Shovel Test	2	30-40	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	22	Shovel Test	3	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	23	Shovel Test	3	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	24	Shovel Test	3	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	25	Shovel Test	4	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	26	Shovel Test	4	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	27	Shovel Test	4	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	28	Shovel Test	5	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	29	Shovel Test	5	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	30	Shovel Test	5	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	31	Shovel Test	6	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	32	Shovel Test	6	10-20	No Recovery	No Recovery	No Recovery	No Recovery							

Artifact Catalog
Sites ORA-441, ORA-442, ORA-443, ORA-445, ORA-446, ORA-447
The Portola Center Project

SDI Number	Cat. No.	Provenience Type	Provenience No.	Depth (cm)	Artifact Class	Artifact Type	Material Class	Material Type	Portion of Artifact	Portion Elaborate	Quan-tity	Weight (g)	Measure-ment 1	Measure-ment 2	Measure-ment 3
ORA-442 (2006)	33	Shovel Test	6	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	34	Shovel Test	7	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	35	Shovel Test	7	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	36	Shovel Test	7	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	37	Shovel Test	8	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	38	Shovel Test	8	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	39	Shovel Test	8	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	40	Shovel Test	9	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	41	Shovel Test	9	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	42	Shovel Test	9	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	43	Shovel Test	10	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	44	Shovel Test	10	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	45	Shovel Test	10	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	46	Shovel Test	11	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	47	Shovel Test	11	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	48	Shovel Test	11	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	49	Test Unit	1	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	50	Test Unit	1	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-442 (2006)	51	Test Unit	1	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	1	Surface	1		Groundstone Tools	Mano(s)	Lithic	Granite	fragment(s)	<25%/ und/ burn/ pol/ med wear	1	489.4	9.6	8.6	5.4

Artifact Catalog
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The Portola Center Project

SDI Number	Cat. No.	Provenience Type	Provenience No.	Depth (cm)	Artifact Class	Artifact Type	Material Class	Material Type	Portion of Artifact	Portion Elaborate	Quan-tity	Weight (g)	Measure-ment 1	Measure-ment 2	Measure-ment 3
ORA-443 (2006)	2	Surface	2		Lithic Production Waste	Flake(s)	Lithic	Medium-grained Metavolcanic	complete		1				
ORA-443 (2006)	3	Surface	3		Groundstone Tools	Mano(s)	Lithic	Granite	fragment(s)	25-50%/ uni/ pol/ light wear /burn	1	765.2	8.8	8.2	7.6
ORA-443 (2006)	4	Surface	3		Lithic Production Waste	Flake(s)	Lithic	Chert	complete		1				
ORA-443 (2006)	5	Surface	4		Groundstone Tools	Mano(s)	Lithic	Granite	fragment(s)	25 /50% /bi /light wear /burnt	1	619.5	11	7	5.9
ORA-443 (2006)	6	Surface	5		Groundstone Tools	Mano(s)	Lithic	Coarse-grained Metavolcanic	fragment(s)	<25%/und/light wear/ burnt	1	54.9	6.2	4.3	1.7
ORA-443 (2006)	7	Surface	5		Lithic Production Waste	Debitage	Lithic	Medium-grained Metavolcanic			1				
ORA-443 (2006)	8	Surface	6		Lithic Production Waste	Flake(s)	Lithic	Medium-grained Metavolcanic	complete		1				
ORA-443 (2006)	9	Surface	7		Groundstone Tools	Mano(s)	Lithic	Quartzite	complete	pol/ light wear /FC	1	462	9.6	8.5	3.7
ORA-443 (2006)	10	Surface	8		Not an Artifact	Not an Artifact	Not an Artifact	Not an Artifact							
ORA-443 (2006)	11	Surface	9		Lithic Production Waste	Debitage	Lithic	Chert			1				
ORA-443 (2006)	12	Surface	9		Lithic Production Waste	Flake(s)	Lithic	Chert	almost complete		1				
ORA-446 (2006)	1	Surface	1		Lithic Production Waste	Flake(s)	Lithic	Quartzite	almost complete		1				
ORA-446 (2006)	2	Surface	2		Lithic Production Waste	Flake(s)	Lithic	Medium-grained Metavolcanic	complete		1				
ORA-446 (2006)	3	Surface	3		Lithic Production Waste	Flake(s)	Lithic	Medium-grained Metavolcanic	complete		1				

Artifact Catalog
Sites ORA-441, ORA-442, ORA-443, ORA-445, ORA-446, ORA-447
The Portola Center Project

SDI Number	Cat. No.	Provenience Type	Provenience No.	Depth (cm)	Artifact Class	Artifact Type	Material Class	Material Type	Portion of Artifact	Portion Elaborate	Quan-tity	Weight (g)	Measure-ment 1	Measure-ment 2	Measure-ment 3
ORA-446 (2006)	4	Surface	4		Lithic Production Waste	Flake(s)	Lithic	Quartzite	complete		1				
ORA-443 (2006)	13	Shovel Test	1	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	14	Shovel Test	1	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	15	Shovel Test	1	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	16	Shovel Test	2	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	17	Shovel Test	2	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	18	Shovel Test	2	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	19	Shovel Test	3	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	20	Shovel Test	3	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	21	Shovel Test	3	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	22	Shovel Test	4	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	23	Shovel Test	4	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	24	Shovel Test	4	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	25	Shovel Test	5	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	26	Shovel Test	5	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	27	Shovel Test	5	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	28	Shovel Test	6	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	29	Shovel Test	6	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	30	Shovel Test	6	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	31	Shovel Test	7	0-10	No Recovery	No Recovery	No Recovery	No Recovery							

Artifact Catalog
Sites ORA-441, ORA-442, ORA-443, ORA-445, ORA-446, ORA-447
The Portola Center Project

SDI Number	Cat. No.	Provenience Type	Provenience No.	Depth (cm)	Artifact Class	Artifact Type	Material Class	Material Type	Portion of Artifact	Portion Elaborate	Quan-tity	Weight (g)	Measure-ment 1	Measure-ment 2	Measure-ment 3
ORA-443 (2006)	32	Shovel Test	7	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	33	Shovel Test	7	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	34	Shovel Test	8	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	35	Shovel Test	8	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	36	Shovel Test	8	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	37	Shovel Test	9	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	38	Shovel Test	9	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	39	Shovel Test	9	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	40	Shovel Test	10	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	41	Shovel Test	10	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	42	Shovel Test	10	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	43	Shovel Test	11	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	44	Shovel Test	11	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	45	Shovel Test	11	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	46	Shovel Test	12	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	47	Shovel Test	12	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	48	Shovel Test	12	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	49	Shovel Test	13	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	50	Shovel Test	13	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	51	Shovel Test	13	20-30	No Recovery	No Recovery	No Recovery	No Recovery							

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ORA-443 (2006)	52	Shovel Test	14	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	53	Shovel Test	14	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	54	Shovel Test	14	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	55	Shovel Test	15	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	56	Shovel Test	15	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	57	Shovel Test	15	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	58	Test Unit	1	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	59	Test Unit	1	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-443 (2006)	60	Test Unit	1	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-445 (2006)	1	Shovel Test	1	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-445 (2006)	2	Shovel Test	1	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-445 (2006)	3	Shovel Test	1	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-445 (2006)	4	Shovel Test	2	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-445 (2006)	5	Shovel Test	2	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-445 (2006)	6	Shovel Test	2	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-445 (2006)	7	Shovel Test	3	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-445 (2006)	8	Shovel Test	3	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-445 (2006)	9	Shovel Test	3	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-445 (2006)	10	Shovel Test	4	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-445 (2006)	11	Shovel Test	4	10-20	No Recovery	No Recovery	No Recovery	No Recovery							

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The Portola Center Project

SDI Number	Cat. No.	Provenience Type	Provenience No.	Depth (cm)	Artifact Class	Artifact Type	Material Class	Material Type	Portion of Artifact	Portion Elaborate	Quan-tity	Weight (g)	Measure-ment 1	Measure-ment 2	Measure-ment 3
ORA-445 (2006)	12	Shovel Test	4	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-445 (2006)	13	Shovel Test	5	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-445 (2006)	14	Shovel Test	5	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-445 (2006)	15	Shovel Test	5	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-446 (2006)	5	Shovel Test	1	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-446 (2006)	6	Shovel Test	1	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-446 (2006)	7	Shovel Test	1	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-446 (2006)	8	Shovel Test	2	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-446 (2006)	9	Shovel Test	2	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-446 (2006)	10	Shovel Test	2	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-446 (2006)	11	Shovel Test	3	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-446 (2006)	12	Shovel Test	3	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-446 (2006)	13	Shovel Test	3	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-446 (2006)	14	Shovel Test	4	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-446 (2006)	15	Shovel Test	4	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-446 (2006)	16	Shovel Test	4	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-446 (2006)	17	Shovel Test	5	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-446 (2006)	18	Shovel Test	5	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-446 (2006)	19	Shovel Test	5	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-446 (2006)	20	Shovel Test	6	0-10	No Recovery	No Recovery	No Recovery	No Recovery							

Artifact Catalog
Sites ORA-441, ORA-442, ORA-443, ORA-445, ORA-446, ORA-447
The Portola Center Project

SDI Number	Cat. No.	Provenience Type	Provenience No.	Depth (cm)	Artifact Class	Artifact Type	Material Class	Material Type	Portion of Artifact	Portion Elaborate	Quan-tity	Weight (g)	Measure-ment 1	Measure-ment 2	Measure-ment 3
ORA-446 (2006)	21	Shovel Test	6	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-446 (2006)	22	Shovel Test	6	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-446 (2006)	23	Shovel Test	7	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-446 (2006)	24	Shovel Test	7	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-446 (2006)	25	Shovel Test	7	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-446 (2006)	26	Shovel Test	8	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-446 (2006)	27	Shovel Test	8	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-446 (2006)	28	Shovel Test	8	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-446 (2006)	29	Test Unit	1	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-446 (2006)	30	Test Unit	1	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-446 (2006)	31	Test Unit	1	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	1	Surface	1		Lithic Production Waste	Flake(s)	Lithic	Medium-grained Metavolcanic	fragment(s)		1				
ORA-447 (2006)	2	Surface	2		Not an Artifact	Not an Artifact	Not an Artifact	Not an Artifact							
ORA-447 (2006)	3	Surface	3		Percussion Tools	Hammerstone(s)	Lithic	Medium-grained Metavolcanic	complete	circular	1		6.7	5.5	3
ORA-447 (2006)	4	Surface	3		Lithic Production Waste	Flake(s)	Lithic	Medium-grained Metavolcanic	complete		1				
ORA-447 (2006)	5	Surface	3		Precision Tools	Domed Scraper(s)	Lithic	Quartzite	fragment(s)		1		5.1	3.6	3
ORA-447 (2006)	6	Surface	4		Groundstone Tools	Mano(s)	Lithic	Granite	fragment(s)	50-75% /bi /burnt /po l/light wear /FC	1	732	10.7	10	5.2
ORA-447 (2006)	7	Surface	4		Lithic Production Waste	Flake(s)	Lithic	Quartzite	fragment(s)		1				

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ORA-447 (2006)	8	Surface	5		Lithic Production Waste	Flake(s)	Lithic	Medium-grained Metavolcanic	complete		1				
ORA-447 (2006)	9	Surface	6		Precision Tools	Retouched Flake(s)	Lithic	Medium-grained Metavolcanic	fragment(s)		1	63.1	6.7	4.5	1.9
ORA-447 (2006)	10	Surface	6		Groundstone Tools	Mano(s)	Lithic	Quartz	complete	bi /pol /peck /light wear /FC	1	924.6	10.9	9.8	6.1
ORA-447 (2006)	11	Surface	7		Groundstone Tools	Mano(s)	Lithic	Medium-grained Metavolcanic	fragment(s)	<25% /und /pol /burn /med /FC	1	121.8	5	4.4	4.1
ORA-447 (2006)	12	Surface	7		Lithic Production Waste	Debitage	Lithic	Medium-grained Metavolcanic			1				
ORA-447 (2006)	13	Surface	8		Precision Tools	Cobble Tool(s)	Lithic	Medium-grained Metavolcanic	fragment(s)		1	264.7	9.5	7.2	3.5
ORA-447 (2006)	14	Surface	8		Lithic Production Waste	Flake(s)	Lithic	Quartzite	fragment(s)		1				
ORA-447 (2006)	15	Surface	9		Lithic Production Waste	Flake(s)	Lithic	Medium-grained Metavolcanic	fragment(s)		1				
ORA-447 (2006)	16	Surface	10		Groundstone Tools	Mano(s)	Lithic	Granite	fragment(s)	25-50%/burnt/uni/pol/med wear	1	404.4	10.2	8	4.5
ORA-447 (2006)	17	Surface	11		Groundstone Tools	Metate(s)	Lithic	Sandstone	fragment(s)	<25% /und /burnt	1	773.2	11.6	11.3	7
ORA-447 (2006)	18	Surface	12		Groundstone Tools	Mano(s)	Lithic	Granite	fragment(s)	25-50% /bi /burnt /light wear /FC	1	176.5	6.6	5.3	3.7
ORA-447 (2006)	19	Surface	12		Percussion Tools	Hammerstone(s)	Lithic	Medium-grained Metavolcanic	fragment(s)	und type	1	84.4	7.3	4.3	3.3
ORA-447 (2006)	20	Shovel Test	1	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	21	Shovel Test	1	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	22	Shovel Test	1	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	23	Shovel Test	2	0-10	No Recovery	No Recovery	No Recovery	No Recovery							

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SDI Number	Cat. No.	Provenience Type	Provenience No.	Depth (cm)	Artifact Class	Artifact Type	Material Class	Material Type	Portion of Artifact	Portion Elaborate	Quan-tity	Weight (g)	Measure-ment 1	Measure-ment 2	Measure-ment 3
ORA-447 (2006)	24	Shovel Test	2	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	25	Shovel Test	2	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	26	Shovel Test	3	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	27	Shovel Test	3	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	28	Shovel Test	3	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	29	Shovel Test	4	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	30	Shovel Test	4	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	31	Shovel Test	4	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	32	Shovel Test	5	0-10	Expedient Tools	Utilized Flake(s)	Lithic	Chert	complete		1	68.1	5.8	5.3	2.3
ORA-447 (2006)	33	Shovel Test	5	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	34	Shovel Test	5	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	35	Shovel Test	5	30-40	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	36	Shovel Test	6	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	37	Shovel Test	6	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	38	Shovel Test	6	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	39	Shovel Test	7	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	40	Shovel Test	7	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	41	Shovel Test	7	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	42	Shovel Test	8	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	43	Shovel Test	8	10-20	No Recovery	No Recovery	No Recovery	No Recovery							

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ORA-447 (2006)	44	Shovel Test	8	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	45	Shovel Test	9	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	46	Shovel Test	9	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	47	Shovel Test	9	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	48	Shovel Test	9	30-40	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	49	Shovel Test	9	40-50	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	50	Shovel Test	10	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	51	Shovel Test	10	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	52	Shovel Test	10	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	53	Shovel Test	10	30-40	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	54	Shovel Test	11	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	55	Shovel Test	11	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	56	Shovel Test	11	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	57	Shovel Test	12	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	58	Shovel Test	12	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	59	Shovel Test	12	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	60	Shovel Test	12	30-40	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	61	Shovel Test	13	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	62	Shovel Test	13	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	63	Shovel Test	13	20-30	No Recovery	No Recovery	No Recovery	No Recovery							

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ORA-447 (2006)	64	Shovel Test	13	30-40	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	65	Shovel Test	14	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	66	Shovel Test	14	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	67	Shovel Test	14	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	68	Shovel Test	15	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	69	Shovel Test	15	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	70	Shovel Test	15	20-30	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	71	Test Unit	1	0-10	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	72	Test Unit	1	10-20	No Recovery	No Recovery	No Recovery	No Recovery							
ORA-447 (2006)	73	Test Unit	1	20-30	No Recovery	No Recovery	No Recovery	No Recovery							

PALEONTOLOGICAL RESOURCE ASSESSMENT, PORTOLA CENTER PROJECT, LAKE FOREST, ORANGE COUNTY, CALIFORNIA

(TTM Nos. 15353 and 17300)

Prepared for:

USA Portola Properties
610 West Ash Street, Suite 1500
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and

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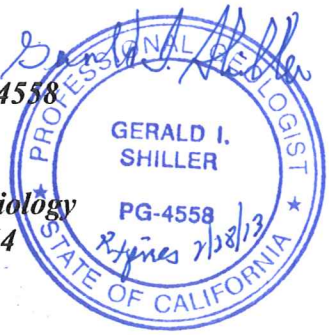

18 August 2011

PALEONTOLOGICAL RESOURCE ASSESSMENT, PORTOLA CENTER PROJECT, LAKE FOREST, ORANGE COUNTY, CALIFORNIA

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Appendix

Appendix 1	Museum collections and records search results

INTRODUCTION

Preface

This report summarizes the results of a paleontological resource assessment of the proposed Portola Center Project site in the northern part of the City of Lake Forest, Orange County, California (see location maps, Figures 1 through 3). A preliminary due diligence letter report was submitted to USA Portola Properties in February 2007 and updated in November 2010. Since the original report, we examined additional records and paleontological monitoring reports of adjacent properties, all of which confirm the presence of significant paleontological resources in the sedimentary formations that are exposed across the Portola Center Project site. An outside review of these preliminary reports was conducted in July 2011 by SWCA Environmental Consultants, Pasadena for RBF Consulting in Irvine. Although the reviewers generally agreed with our original conclusions, they wished for inclusion of a greater amount of documentation and supplementary explanatory materials. The present report fully addresses these concerns. Our original overall assessment of the subject property, however, remains unchanged.

Location

The several parcels that make up the subject property (Tentative Tract Maps 15353 and 17300; APNs 606-161-10, -12, and -25 to -32; 606-321-01 to -09; 606-331-01 to -03; 606-332-01; 606-341-01, and -03 to -07; 606-351-01) are located on the northwest side of the Aliso Creek drainage along El Toro Road / Los Alisos Avenue, north of the new Foothill Transportation Corridor (State Route 241, a toll road), east of the adjacent Whiting Ranch property and the Serrano Creek drainage, and south of the present Portola Hills residential neighborhood (Figure 3). The project area is bisected into northern and southern halves by the east-west trending Glenn Ranch Road, a four-lane parkway, and the northern part is bisected into eastern and western parts by Saddleback Ranch Road (Figure 3). On the U. S. Geological Survey 7.5-minute, 1:24,000-scale El Toro, Calif. topographic quadrangle (Figure 2), the subject property is located in unsectioned lands of the old Cañada de los Alisos Spanish land grant, in projected Sections 5 (southwestern third), 6 (eastern edge), and 8 (northern part) in Township 6 South, Range 7 West, San Bernardino Base and Meridian. The property represents the southernmost part of the original Glenn Ranch property as delineated by Cooper (1977, pl. 1).

Laws, ordinances, regulations and standards (LORS)

Paleontological materials (*i.e.*, fossils) represent limited, nonrenewable, and sensitive scientific and educational resources. Federal and state laws require the protection of paleontological resources in public and private sector land planning and development through the building permit process by local governing agencies. In California, negative impacts to such resources are addressed under the regulations of the California Environmental Quality Act (CEQA) and, if applicable, by the National Environmental Policy Act (NEPA). In unincorporated areas of Orange County, the guidelines for paleontological resource mitigation procedures as outlined by Eisentraut and Cooper (2002) have been adopted by the Orange County Board of Supervisors. The City of Lake Forest has only general guidelines for preserving historical, archaeological and

paleontological resources, but any reports are required to comply with CEQA guidelines (E. G. Torres, City of Lake Forest, personal communication, August 2011). The procedural guidelines outlined in Eisentraut and Cooper (2002) follow generally accepted practices in the paleontological profession as currently practiced in several southern California cities and counties and serve as professional standards/best management practices for work to be conducted in Orange County.

Federal and state LORS applicable to the protection of paleontological resources

Antiquities Act of 1906 (16 United States Code [USC] 431–433). The Antiquities Act of 1906 was established to prevent the appropriation, excavation, injury or destruction of "any historic or prehistoric ruin or monument, or any object of antiquity, situated on lands owned or controlled by the Government of the United States." Although paleontological resources are not specifically mentioned in the Act itself, or in the Act's uniform rules and regulations (Title 43 Part 3, Code of Federal Regulations [43 CFR 3]), "objects of antiquity" are interpreted by federal agencies such as the National Park Service, Bureau of Land Management and the Forest Service to include fossils.

National Environmental Policy Act of 1969 (42 USC 4321). This Act directs federal agencies to use all practicable means to "Preserve important histoic, cultural, and natural aspects of our national heritage …" (Section 101(b)(4)). Consideration of paleontological resources may be required under NEPA when a project is proposed for development on federal land, or land under federal jurisdiction.

Omnibus Public Land Management Act of 2009 (Public Law 111-11). This Act includes a variety of bills lumped together under a single title, but includes the "**Paleontological Resources Preservation Act**" that sets out to restrict the unauthorized collection of "vertebrate fossils and other rare and significant fossils" from federal public lands.

California Environmental Quality Act of 1970 (CEQA, 13 PRC, 2100, et seq.). This Act, modeled after the NEPA of 1969, has been amended several times. Paleontological resources are given little attention in this act, and typically mentioned only under the heading of "cultural resources." In the latest edition, as amended January 1, 1999, paleontological resources are given less significance, and would be regarded as potentially significant only if there were a positive response to the question (Appendix G Environmental Checklist Form), "Would the project directly or indirectly destroy a unique paleontological resource or site or unique geological feature?" To protect local paleontological resources, some cities and counties, as the lead agencies, have resorted to establishing their own criteria for the definition of what a "unique paleontological resource" is within their own jurisdiction.

Local ordinances

It is important to note that CEQA does not actually include any particular mitigation guidelines for the preservation of paleontological resources, but leaves it up to the permitting lead agency or local governing body for the project, be it county, city, or utility or school district, to establish its own guidelines. In the case of the Portola Center Project, the City of Lake Forest, as the lead

agency, is responsible for establishing the level of mitigation effort to be conducted under CEQA guidelines to preserve paleontological resources.

In the 1970s, the County of Orange, recognizing the need to protect its archaeological heritage and paleontological resources during a period of rampant growth and development, instituted a policy of requiring that all fossils recovered during construction projects be retained within Orange County. This was subsequently amended when it became apparent that there were no appropriate places to house the enormous numbers of fossils and artifacts that were continuing to come in. In 2002, Eisentraut and Cooper (2002) produced a document that provided a curation model and monitoring and mitigation guidelines for the conservation of archaeological and paleontological materials in the County of Orange. This document and its recommendations were subsequently adopted by the Orange County Board of Supervisors, and now provide a standard by which the paleontological profession can use in the paleontological mitigation process in Orange County. In 2011, the John D. Cooper Archaeological and Paleontological Center was opened in Santa Ana, with the intent to provide a place to receive future incoming collections. However, it might be several years before there is enough funding to even catch up with the preexisting collections in their old warehouse building, and the question of where fossils should be archived in the immediate future will have to be addressed case by case.

GEOLOGY AND STRATIGRAPHY

Geology

Geologically, the subject property is located in the foothills of the southern Santa Ana Mountains within a southwestwardly dipping sequence of Tertiary sedimentary rocks that range in age from Eocene-Oligocene(?) to early Pliocene (see geologic map, Figure 4, colored and enlarged, after Fife, 1974, pl. 1). The Cristianitos Fault, an important high-angle normal fault, parallels the western side of the project area and juxtaposes younger and older sedimentary formations. More detailed geologic maps of the Glenn Ranch area can be found in Cooper (1977, Paleontologic assessment of Glenn Ranch, Orange County, California, pl. 1), at a scale of 1 inch to 200 feet (1:2,400), and in the geotechnical reports prepared for the Portola Center Project (Hoobs and Weedon, 2011a, 2011b), at a scale of 1 inch to 100 feet (1:1,200). The geology of the project area is also shown on the northeast corner of the geologic map of the San Joaquin Hills-San Juan Capistrano area by Vedder *et al.* (1957, 1975). The geology of the area immediately adjacent to the north is included on Schoellhamer *et al.* (1981, Geology of the northern Santa Ana Mountains, California, pl. 1).

Stratigraphy

The Tertiary sediments exposed within the Portola Center Project area are assigned to the following geologic formations, from youngest to oldest: the lower Pliocene Oso Sand Member of the Capistrano Formation (Tco on geologic map, Figures 4 and 5), the upper Miocene Puente Formation, including the siltstone (Tpst) and sandstone (Tps) submembers of the Soquel Member, and the underlying La Vida (Tplv) Member, and the middle Miocene Topanga Formation (Tt). The Oso Sand is present only as a very narrow sliver along the southwest margin of the project area, representing the formational sediments present on the western, downthrown side of the north-northwest trending Cristianitos Fault, which roughly parallels the western project boundary. Most of the project area is composed of Puente Formation siltstone (Tpst), sandstone (Tps), and shale (Tplv). Tiny outcrops of the Topanga Formation (Tt) may be present at the far eastern end of the project area. Based on their contained fossils, the exposures of the Soquel Member (sandstone submember) of the Puente Formation represent a shallow-water marine sedimentary environment, whereas the La Vida Member and the siltstone submember of the Soquel Member of the Puente Formation represent a moderately deeper-water marine environment (Fife, 1974; Cooper, 1977, 1978; Sundberg, 1991).

Also mapped within the project area are Quaternary landslides (Qls), slope wash (Qsw), fluvial terrace deposits (Qtr) and alluvium (Qal) (Figure 4). Landslides are only common along dip slopes in the softer sediments of the La Vida Member and the siltstone submember of the Soquel Member of the Puente Formation, which are similar to the westward topographic slopes across the project. Grading and earthmoving activities in recent years (dates not established) have resulted in most of the northwest part of the project site west of Saddleback Ranch Road being covered with engineered fill materials, as has the western part of the area east of Saddleback Ranch Road (Hoobs and Weedon, 2011b). Fill materials, consisting of both engineered and undocumented materials, cover much of the area south of Glenn Ranch Road between the two

main topographic highs that have been partly cut away by the roadway of Glenn Ranch Road (Hoobs and Weedon, 2011a).

Field survey

A field survey of the project site was conducted on foot on August 3 and 4, 2011 by the principal investigator. Although large areas, particularly north of Glenn Ranch Road and in the central area south of the same roadway, had previously been covered by thick sections of both engineered and undocumented fill (see Hoobs and Weedon, 2011a, figs. 2-3, and 2011b, figs. 2-3), our understanding of the geology and stratigraphic relationships revealed during this foot survey closely matched those as mapped by Fife (1974, pl. 1). Particularly noteworthy were exposures of the contact between the La Vida and Soquel (sandstone) Members of the Puente Formation, north-northeast of the intersection of Saddleback Ranch Road and Glenn Ranch Road, and the contact between the sandstone and siltstone submembers of the Soquel Member near the top of the topographic high just south of the same road intersection, confirming the contacts of these units as mapped by Fife (1974). Figure 4, herein, shows the geology of the project area greatly enlarged and colorized, whereas Figure 5 shows what the formational exposures might be if the Quaternary surficial deposits (alluvium, slope wash and landslides) were removed. Because surficial deposits are required to be removed before placement of engineered fill, the map shows the extent of areas that will need to be monitored paleontologically during grading and earthmoving activities.

PALEONTOLOGY

Paleontological sensitivity

In general, the "paleontological resource potential" of a formation, that is, the likelihood that any particular formation will yield fossiliferous materials during monitoring and mitigation activities, is essentially equivalent to the formation's assigned paleontological sensitivity. There are a few cases, however, where the resource potential of a formation may be low, but it is assigned a "high paleontological sensitivity" because of the desire of local paleontologists to recover fossils of particular significance during monitoring activities. In the County of Orange, "paleontological sensitivity" is given a slightly different definition (Eisentraut and Cooper, 2002, pp. 12-14 and appendix C), not simply related to the potential for yielding fossils. According to Eisentraut and Cooper (2002), "... formations are rated or ranked according to their **paleontologic sensitivity**, which, in turn, is determined by: the **scientific significance** (importance) of the fossils, defined and determined by criteria such as: new or rare taxa; the abundance (likelihood of fossils being recovered) or rarity of fossils; the quality of preservation; the geologic age (important from the perspective of evolutionary stage of the particular taxonomic group, and for correlation with stratigraphy in other localities); and the paleoecologic implications." The key issue is thus "the determination of the relative degree of scientific significance of fossils" recovered or expected to be recovered during paleontological monitoring activities (Eisentraut and Cooper, 2002). The paleontological sensitivity scale is defined thusly:

- **Very high** (scientifically very significant fossils and critical age) -- very important for research;
- **High** (quality preservation and scientifically significant fossils -- important for research and/or very important for display;
- **Moderate** (abundant fossils of good quality) -- important for education and display;
- **Low** (poorly preserved) -- useful for education; and
- **None** (no recovery).

The sedimentary formations exposed within, or closely adjacent to, the Portola Center Project area are the Oso Sand Member of the Capistrano Formation, the Puente Formation, which is divided into three members and submembers (siltstone and sandstone submembers of the Soquel Member, and the underlying La Vida Member), and the Topanga Formation. The Oso Sand Member is accorded a "very high" paleontologic sensitivity, but may be present only as a tiny sliver along the Cristianitos Fault on the west side of the project site. The three members or submembers of the Puente Formation, which make up almost all of the exposed outcrop areas within the project site (Figure 4), are accorded a "high" paleontologic sensitivity (Eisentraut and Cooper, 2002). The Topanga Formation is also accorded a "very high" sensitivity, but may be present at only a very few isolated small outcrop areas at the very eastern end of the project site. Non-marine (fluvial) terrace deposits (Qtr) are also accorded a "high" paleontologic sensitivity

by Eisentraut and Cooper (2002), a ranking also supported by McLeod (2011). Geologically, young surficial sediments mapped within the project area include Quaternary alluvium (Qal), slope wash (Qsw), and landslide deposits (Qls), but none of these types of deposits is regarded as having paleontologic sensitivity by Eisentraut and Cooper (2002). However, because landslide deposits within any formational terrain will contain the same sorts of fossils as found in adjacent nondisturbed areas of the formation, they are regarded herein as having the same paleontologic sensitivity. Certainly the different lithologies of the Puente Formation members and submembers are distinct enough to be readily distinguished within any mapped landslide deposit. Landslide deposits within the project area are treated herein the same as *in situ* exposures of the formation. The paleontological sensitivity of the geologic units within and closely adjacent to the project area is shown on the legend for Figures 4 and 5.

Formation or Member	Sensitivity
Capistrano Formation, Oso Sand Member	Very High
Puente Formation, Soquel Member, siltstone submember	High
Puente Formation, Soquel Member, sandstone submember	High
Puente Formation, La Vida Member	High
Topanga Formation	Very High

FOSSIL LOCALITIES

Previously recorded fossil localities

Paleontologically, all of the Tertiary sedimentary formations within the project boundaries have yielded marine fossils, either on the subject property or in nearby exposures. Recorded fossil localities in the published literature, or in informally prepared paleontologic assessment or monitoring and mitigration reports (*e.g.*, Cooper, 1977, 1978; Sundberg, 1991; Morgan and Raschke, 1991a, 1991b; and references therein), are more numerous in those areas that have been monitored paleontologically during grading and earth-moving activities concomitant with site preparations than they are in areas that have not been assessed or monitored. Fossils vary in size from microscopic single-celled organisms (foraminifera and diatoms) to large marine mammals (*e.g.*, whales).

Fossil types that have been recovered from local exposures of the Oso Sand Member of the Capistrano Formation in Oso Creek, Aliso Creek and Serrano Creek drainages, but outside of the project boundary, include abundant remains of both cartilaginous fish (*e.g.*, large shark teeth) and bony fish, as well as marine birds and marine mammals (*e.g.*, baleen and toothed whales, dophins and sea lions) (Cooper, 1977, 1978; Sundberg, 1991). Cooper (1977) did not report any fossils from the limited exposure of Oso Sand in his report on Glenn Ranch, but did report both shark and marine mammal remains from two localities within the original Portola Center property in his report on the adjacent Whiting Ranch (Cooper, 1978). The Soquel Member of the Puente Formation has yielded several fossiliferous horizons in the nearby Foothill Ranch area (Sundberg, 1991) containing marine mammals, marine crocodile, bony and cartilaginous fish, microfossils (*e.g.*, rich diatom assemblages), macro-invertebrates (*e.g.*, bivalve and gastropod mollusks, bryozoan remains, decapod crustaceans, goose-neck barnacles, and echinoderm remains) and marine algae and terrestrial vascular plant assemblages. A few scattered marine mammal bones were reported from the Glenn Ranch area by Cooper (1977). The La Vida Member of the Puente Formation covers the greatest amount of area within the proposed Portola Center Project boundary, which makes up only a part of the original Glenn Ranch property (*cf.* Cooper, 1977, pl. 1). Fossils reported from surface exposures in the Glenn Ranch area by Cooper (1977) include poorly preserved fish remains (scales, fin and bone fragments), and rare internal and external molds of deep-water bivalve and gastropod mollusks. Microfossils such as diatoms and foraminifera are also common in the formation (Schoelhamer *et al.*, 1981).

The Topanga Formation, exposed mainly outside the project area to the northeast, locally has yielded the greatest amount of fossil material in surface exposures in areas adjacent to the project site (Cooper, 1977). Shallow-water marine fossils typically include bivalve mollusks such as giant oysters, scallops and clams, as well as gastropods, particularly the index fossil snail, *Turritella ocoyana*. "Throughout the entire mapped area [of Glenn Ranch] ... almost every inplace exposure as well as surface 'float' blocks contain fossils" (Cooper, 1977). Fossil vertebrate remains are also particularly abundant and include bones of whale and marine carnivores (sea lions and relatives). The surficial marine mammal remains represent a significant concentration and strongly suggest that more complete and better preserved materials may be present in the subsurface and would likely be exposed during any grading and earth-moving

activities concomitant with site preparations for the Portola Center Project development. Additional fossil localities east of the project site in the vicinity of Upper Oso Reservoir have also yielded important vertebrate as well as invertebrate fossils (Raschke, 1984a, 1984b; Whistler and Lander, 2003; and LACMNH collection records for both vertebrate and invertebrate fossils). At least one new species, of a rock-boring bivalve mollusk, has been described from the Upper Oso Reservoir area (Kennedy, 1993). McLeod (2011, *q.v.*, herein) cites several publications that have described new species from the general area of the Portola Center property and Upper Oso Reservoir.

Museum collections and records searches

Fossil occurrences are also documented in the collections and records of the Orange County paleontological collection in Santa Ana (now the John D. Cooper Archaeological and Paleontological Center), the Vertebrate Paleontology (LACM) and the Invertebrate Paleontology (LACMIP) collections of the Natural History Museum of Los Angeles County in Los Angeles (LACMNH), the University of California Museum of Paleontology in Berkeley (UCMP), and the U. S. Geological Survey (USGS) collections in the Smithsonian Institution in Washington, D.C. It should be noted also that the LACMNH collections also include the imporant previously orphaned collections of the University of California at Los Angeles (UCLA) and the California Institute of Technology in Pasadena (CIT). The inventory of fossils in the Cooper Center (*cf.* Eisentraut and Cooper, 2002, Part VI) lists several collections from "Glenn Ranch," but data associated with them seems to have been lost or misplaced.

The Invertebrate Paleontology (LACMIP) collection records downloaded from the mueum's internet web site in August 2011 included 289 Miocene localities from Orange County, of which 16 are from within a one-mile radius of the Portola Center Project site (see Appendix 1). None is from within the project outline itself. Bivalve and gastropod mollusks are the dominant fossils from these formations, which include the Topanga Formation (seven localities), Vaqueros Formation (four localities), Vaqueros-Sespe Formation undifferentiated (one locality), Capistrano Formation undifferentiated (one locality), Puente Formation undifferentiated (one locality), lower Temblor Stage (one locality), and none cited (one locality). A report on the Vertebrate Paleontology (LACM) fossil records from the musuem was prepared on August 16, 2011 by Dr. Samuel A. McLeod, and is included in Appendix 1. His report does not cite any localities from within the bounds of the project site, but does include six localities in the Oso Sand south of the project site that yielded an impressive list of marine vertebrate fossils, including cartilaginous and bony fish, turtles, crocodile, diving birds, and marine and terrestrial mammals (see Appendix 1). Additional localities from the Topanga Formation have also yielded important vertebrate fossils. The closest locality in the Puente Formation yielded fossil specimens of tonguefish, *Symphurus* sp. Several of the LACM vertebrate fossil localities along Aliso Creek and around Upper Oso Reservoir are shown on the LACMNH Invertebrate Paleontology (LACMIP) locality records in Appendix 1.

The collection records of the Univerity of California Museum of Paleontology internet website were also queried. Of 262 Miocene localities in Orange County, only nine are listed as from Aliso Creek (or Canyon) or vicinity, and only one of these is from the Puente Formation (UCMP loc. V68103, from the Aliso Creek drainage). This locality is shown on the locality data sheet

for LACMIP loc. 6207 and yielded bony fish remains (Appendix 1). The other Aliso Creek area invertebrate fossil localities are cited as from the Vaqueros Formation (UCMP loc. 1152), the Modelo Formation (four localities, UCMP locs. 1909, 1910, 1912, and 1913), and Temblor Stage sediments (three localities, UCMP locs. A530, A531, and A532). More detailed information on any of these localities is available from UCMP. Fossils from the few USGS microfossil localities shown on the geologic map of Schoellhamer *et al.* (1981) are housed in the Smithsonian Institution, Washington, D.C., and specific information may be available from them or from the U. S. Geological Survey in Reston, Virginia.

Field survey

In addition to the previously recorded fossil localities from the vicinity of the Portola Center Project site, a pedestrian field survey conducted by the senior investigator on August 3 and 4, 2011 revealed the presence of both *in situ* fossil remains of bony fish (large scales, vertebrae and indeterminate bone fragments) and plant materials (leaves and indeterminate plant debris) in outcrop exposures of both the La Vida Member and the siltstone submember of the Soquel Member of the Puente Formation both north and south of Glenn Ranch Road. No *in situ* fossils were recognized in sandstone outcrops of the Soquel Member. Float materials, some with abundant specimens of small bivalve mollusks (*e.g., Nuculana* sp.) were present in finer-grained concretionary clasts at multiple locations on the engineered fill surfaces north of Glenn Ranch Road. One of these specimens was associated with marine mammal bone in the same clast. These may have been derived from Topanga Formation outcrops farther up the slope from the current property during grading activities associated with development of the Portola Hills residential community (Figure 3). South of Glenn Ranch Road, large concretionary sandstone boulders used as rip-rap to channel drainage runoff contained numerous specimens of large bivalve mollusks, such as giant oysters and scallops, as well as marine mammal bones. The coarseness of the sand grains in the enclosing sediments appeared identical to *in situ* outcrops of Soquel sandstone and could well have been derived from the subject property during the latest phase of earth-moving activities. The abundance of fossils *in situ* and as float is strongly suggestive that any new excavation and/or grading activities will expose many more fossil specimens, possibly of considerable significance.

MITIGATION MEASURES

Mitigation Monitoring and Reporting Program (MMRP)

A Mitigation Monitoring and Reporting Program (MMRP) includes all of the mitigation measures and procedures that must be implemented and completed before final compliance can be acknowledged. These measures are divided into activities that must be implemented before grading and earthmoving activities can begin, those mitigation procedures enacted during the actual grading process, and the final, post-grading, steps to prepare, curate and analyze any paleontological resources recovered during grading, preparation of a final monitoring and mitigation report, and the archiving of all fossil specimens into a recognized paleontological institution that will provide long-term care and conservation.

Pregrade mitigation recommendations

Prior to the issuance of any grading permit and the initiation of any mass grading and/or earth-moving activities, the applicant/developer shall retain a County-certified paleontologist to complete a literature and collections and records search to identify any previously recorded fossil localities in the area and to review any previously surveyed property reports. This paleontological resource assessment report and EIR satisfies this requirement. The County-certifed paleontologist shall conduct a pedestrian field survey of the property to identify any existing fossiliferous outcrops on the property that will need to be surveyed and collected before any grading activities can begin. The County-certified paleontologist will also conduct a pre-grade salvage program to collect and recover all significant paleontological resources previously recognized and recorded during the pre-grade survey of the property. All exposed specimens, even those occurring only as float, should be collected at this stage of the mitigation. If the paleontologist of record will be responsible for supervising the paleontological monitoring program during mass grading and earth-moving activities, all fossils salvaged at that time can be retained and processed with those recovered during the paleontological monitoring program.

Also prior to initiation of grading, the project applicant shall provide written evidence to the City of Lake Forest that the applicant has retained a County-certified paleontologist to observe grading activities, supervise the monitoring program and be responsible for all aspects of the paleontological MMRP. The paleontologist shall be present at the pre-grade conference, shall establish procedures for paleontological resource surveillance, and shall establish, in cooperation with the applicant, precedures for temporarily halting or redirecting work to permit sampling, identification, and evaluation of the fossils. If the paleontological resources are found to be significant, the paleontologist shall determine appropriate actions, in cooperation with the applicant, which ensure proper exploration and/or salvage.

Paleontological monitoring program

Paleontological monitoring of mass grading and excavation activities in areas identified as likely to contain paleontological resources will be required by a qualified paleontologist and/or paleontological monitor(s). Monitoring will be conducted in areas of grading or excavation in

undisturbed formational deposits, as well as in areas where over-excavation of surficial sediments or deposits will encounter these formations in the subsurface. Paleontological monitors will be equipped to salvage fossils as they are unearthed to avoid construction delays and to remove samples of sediment that are likely to contain the remains of small fossil invertebrates and vertebrates. The monitor must be empowered to temporarily halt or divert equipment to allow removal of abundant or large specimens in a timely manner. Monitors will be expected to carefully record the location, elevation, and stratigraphic position, and fully document all aspects of the recovery of all significant collections. It is recommended that monitors be equipped with GPS devices to accurately record the position of any fossil localities in a continuously changing landscape.

Monitoring may be reduced in areas if the potentially fossiliferous units are not present in the subsurface, or if present, are determined upon exposure and examination by qualified paleontological personnel to have low potential to contain fossil resources.

Post-monitoring mitigation program

Preparation of recovered specimens to a point of identification and permanent preservation will be necessary. Screen-washing of sediments to recover small invertebrates and vertebrates may also be necessary. Preparation procedures include cleaning, physical removal of matrix surrounding individual fossils, and repair of damaged specimens. Large specimens of fossil vertebrates encased in cemented matrix, as has been observed on the property and on adjacent properties, may be extremely time consuming to prepare properly, and in such cases, consultation between the lead agency (City of Lake Forest), the developer, the institutional repository, and the project paleontologist may be necessary. In general, preparation of individual vertebrate fossils is more time consuming than for accumulations of invertebrate fossils.

Following preparation of recovered specimens to a point of identification, fossils must be properly curated to museum standards, before being offered to any institutional collection for permanent long-term archival care and conservation. Curation steps include identification of fossils to the lowest level possible, painting and numbering of specimens, and production of labels. Prearrangements should be made with an institution so that the receiving institution's specimen and/or locality numbers can be applied to each specimen. Numbers should be applied with waterproof India ink on permanent enamel or acrylic paint. Small specimens should be placed in glass vials with inert plastic caps, and the appropriate locality and/or specimens numbers enclosed with the fossils. All labels should be printed on acid-free paper or card or cover stock.

Curation of specimens into a professional, accredited public museum repository with a commitment to archival conservation and permanent retrievable storage (*e.g.*, the Ralph B. Clark Regional Park Interpretive Center) is a requirement. The paleontological program should include a written repository agreement prior to the initiation of post-grade mitigation activities. Copies of all field notes, field maps, photographs, and documentary materials must accompany the fossils when offered to the archiving institution. The developer must agree to be responsible for any one-time archival fees charged by the receiving institution. These fees cover the cost of

steel storage cabinets or shelving, cabinet drawers, specimen trays, and the time and materials necessary to catalogue and fully integrate the new materials into the preexisting collections.

Preparation of a final monitoring and mitigation report of findings and significance, including lists of all fossils recovered and necessary maps and graphics to accurately record their original location will also be necessary. The report must include documentation of acceptance or deed of gift from the receiving institution. The final report, when submitted to the appropriate Lead Agency (City of Lake Forest), will signify satisfactory completion of the project program to mitigate impacts to any potential nonrenewable paleontological resources (*i.e.*, fossils) that might have been lost or otherwise adversely affected without such a program in place. Final release of any grading bond must be approved by the City of Lake Forest only when they have accepted the final monitoring and mitigation report and the fossil collections have been accepted by the receiving institution and any fees paid.

SUMMARY

Based on this assessment and the well-documented fossil record of the underlying geologic formations (Oso Sand Member of the Capistrano Formation, the Soquel and La Vida Members of the Puente Formation, and the Topanga Formation) within and surrounding the footprint of the proposed Portola Center Project, full-time paleontological monitoring of mass grading and excavation and trenching activities must be implemented in order to salvage and preserve any potential nonrenewable paleontological resources (*i.e.*, fossils) that would otherwise be destroyed and lost to science without this mitigation. All fossils should be collected and properly prepared to a point of identification, curated to museum standards, and deposited into an institutional collection where they can be given long-term care and archival conservation. The Ralph B. Clark Regional Park Interpretive Center and the John D. Cooper Archaeological and Paleontological Center are two Orange County entities that should be given first consideration. The Natural History Museum of Los Angeles County in Los Angeles and the University of California Museum of Paleontology in Berkeley contain the two largest, and most important, paleontological collections in western North America and would also be logical choices for depositing fossils if they could not be housed in an Orange County facility. All institutions require a one-time archival fee for the acceptance of fossils, which varies from institution to institution and depends on a variety of factors.

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