

**INDEX OF CONSERVATION PRACTICE STANDARDS AND SPECIFICATIONS
(Listed in Alphabetical Order by Practice Name)**

CODE	PRACTICE NAME	Responsible Discipline(s)	CA Standard	-----DATE OF CURRENT-----				
				CA Specif-ication	Material Specif-ication	Practice Require-ments	Operation & Main-tenance	Statement of Work
560	Access Road	ENG	9/04	10/02	-----	9/04	3/04	8/04
702	Agrichemical Handling Facility 1/	ENG	9/05	2/	-----	9/05	9/05	9/05
311	Alley Cropping	FOR	10/02	3/	-----		-----	8/04
365	Anaerobic Digester, Ambient Temperature	ENG	9/04	2/	-----		-----	7/05
366	Anaerobic Digester, Controlled Temperature	ENG	9/04	2/	-----		-----	7/05
316	Animal Mortality Facility	ENG	3/04	2/	-----	3/04	-----	8/04
575	Animal Trails and Walkways	ENG-RANGE	10/03	10/03	-----	10/03	3/04	8/04
450	Anionic Polyacrylamide (PAM) Erosion Control	ENG	10/02	10/02	-----	10/02	3/04	8/04
397	Aquaculture Ponds	BIO-ENG	3/04	2/	-----		3/04	8/04
370	Atmospheric Resource Quality Management	AIR QUALITY	12/05	-----	-----	-----	-----	12/05
370A	Atmospheric Resource Quality Management (A), Dust/Particulate Matter	AIR QUALITY	-----	12/05	-----	-----	-----	-----
370A1	Atmospheric Resource Quality Management (A2), Dust/Particulate Matter - On-Field Cultivation/Harvesting Activities	AIR QUALITY	-----	-----	-----	12/05	-----	-----
370A2	Atmospheric Resource Quality Management (A2), Dust/Particulate Matter - On-Field Cultivation/Harvesting Activities	AIR QUALITY	-----	-----	-----	12/05	-----	-----
370A3	Atmospheric Resource Quality Management (A3), Dust/Particulate Matter - Confined Animal Feeding Operations (CAFO)	AIR QUALITY	-----	-----	-----	12/05	-----	-----
370B	Atmospheric Resource Quality Management (B), Smoke Reduction-Field Crops/Orchard/Vineyard	AIR QUALITY	-----	12/05	-----	12/05	-----	-----
370C	Atmospheric Resource Quality Management (C), Odor	AIR QUALITY	-----	12/05	-----	12/05	-----	-----
370D	Atmospheric Resource Quality Management (D), Greenhouse Gases	AIR QUALITY	-----	12/05	-----	12/05	-----	-----

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370E	Atmospheric Resource Quality Management (E), Ammonia Loss Reduction	AIR QUALITY	-----	12/05	-----	12/05	-----	-----
370F	Atmospheric Resource Quality Management (F), Ozone	AIR QUALITY	-----	12/05	-----	-----	-----	-----
370F1	Atmospheric Resource Quality Management (F1), Ozone (NOx) - Engines	AIR QUALITY	-----	-----	-----	12/05	-----	-----
370F2	Atmospheric Resource Quality Management (F2), Ozone – Volatile Organic Compounds – Pesticides	AIR QUALITY	-----	-----	-----	12/05	-----	-----
370F3	Atmospheric Resource Quality Management (F3), Ozone – Volatile Organic Compounds – Livestock Waste Management	AIR QUALITY	-----	-----	-----	12/05	-----	-----
310	Bedding	ENG	3/04	2/	-----		3/04	8/04
314	Brush Management	RANGE	10/02	10/02	-----	7/00	-----	8/04
584	Channel Stabilization	ENG	10/03	10/03	-----	10/03	3/04	8/04
322	Channel Vegetation	AGRON	7/00	7/00	-----	7/00	-----	8/04
326	Clearing and Snagging	ENG	10/03	10/03	-----	10/03	3/04	8/04
360	Closure of Waste Impoundments	ENG	10/02	2/	-----		3/04	8/04
317	Composting Facility	ENG-AGRON	9/04	2/	-----		3/04	8/04
327	Conservation Cover	AGRON-BIO	10/02	7/00	-----	7/00	-----	8/04
328	Conservation Crop Rotation	AGRON	10/02	7/00	-----	7/00	-----	8/04
656	Constructed Wetland	ENG-BIO	10/02	2/	-----		3/04	8/04
332	Contour Buffer Strips	AGRON	7/00	5/	-----		-----	8/04
330	Contour Farming	AGRON	10/02	7/00	-----	7/00	-----	8/04
331	Contour Orchard and Other Fruit Area	AGRON	7/00	7/00	-----		-----	8/04
585	Contour Stripcropping	AGRON	10/02	7/00	-----	7/00	-----	
340	Cover Crop	AGRON	10/02	-----	-----	-----	-----	8/04
340A	Cover and Green Manure Crop (A)	AGRON	-----	7/00	-----	7/00	-----	-----
340B	Cover Crop (B)	AGRON	-----	7/00	-----	7/00	-----	-----

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				CA Specif-ication	Material Specif-ication	Practice Require-ments	Operation & Main-tenance		
342	Critical Area Planting	AGRON-BIO	7/00	-----	-----	-----	-----	8/04	
342A	Critical Area Planting(A), Straw Mulch	AGRON-BIO	-----	7/00	-----	7/00	-----	-----	
342B	Critical Area Planting(B), Hydro-Mulch	AGRON-BIO	-----	7/00	-----	7/00	-----	-----	
342C	Critical Area Planting(C), Split Hydro-Mulch	AGRON-BIO	-----	7/00	-----	7/00	-----	-----	
342D	Critical Area Planting(D), Tackified Straw	AGRON-BIO	-----	7/00	-----	7/00	-----	-----	
342E	Critical Area Planting(E), Erosion Control Blanket	AGRON-BIO	-----	7/00	-----	7/00	-----	-----	
342F	Critical Area Planting(F), Bermudagrass	AGRON-BIO	-----	7/00	-----	7/00	-----	-----	
342G	Critical Area Planting(G), Woody Cuttings	AGRON-BIO	-----	7/00	-----	7/00	-----	-----	
342H	Critical Area Planting(H), Container Plants	AGRON-BIO	-----	7/00	-----	7/00	-----	-----	
342I	Critical Area Planting(I), Dune Stabilization	AGRON-BIO	-----	7/00	-----	7/00	-----	-----	
589A	Cross Wind Ridges	AGRON	7/00	7/00	-----	7/00	-----	8/04	
589C	Cross Wind Trap Strips	AGRON	7/00	7/00	-----	7/00	-----	8/04	
402	Dam	ENG	10/03	2/	-----	10/03	3/04	7/05	
348	Dam, Diversion	ENG	10/02	10/02	-----	10/02	3/04	8/04	
324	Deep Tillage	AGRON	10/02	5/	-----	-----	-----	8/04	
356	Dike	ENG	10/03	10/03	-----	10/03	3/04	8/04	
362	Diversion	ENG	10/02	10/02	-----	10/02	3/04	8/04	
554	Drainage Water Management	ENG	10/02	2/	-----	-----	3/04	7/05	
432	Dry Hydrant	ENG	7/00	2/	-----	-----	3/04	8/04	
647	Early Successional Habitat Development/Management	BIO	7/00	4/	-----	-----	-----	8/04	
382	Fence	RANGE	7/00	-----	-----	-----	-----	8/04	
382A	Fence (A), Standard	RANGE	-----	7/00	-----	7/00	-----	-----	
382B	Fence (B), Suspension	RANGE	-----	7/00	-----	7/00	-----	-----	
382C	Fence (C), Electrical	RANGE	-----	7/00	-----	7/00	-----	-----	

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386	Field Border	AGRON-ENG	9/04	9/04	-----	9/04	-----	8/04
393	Filter Strip	ENG-AGRON	7/00	2/	-----		3/04	8/04
394	Firebreak	FOR	10/02	-----	-----	-----	-----	8/04
394A	Firebreak, Standard	FOR	-----	10/02	-----	10/02	-----	-----
394B	Firebreak, Fuel-Break	FOR	-----	7/00	-----	10/02	-----	-----
396	Fish Passage	BIO-ENG	10/02	2/	-----		3/04	7/05
398	Fish Raceway or Tank	BIO-ENG	9/04	2/	-----		3/04	7/05
399	Fishpond Management	BIO	10/02	4/	-----		-----	8/04
511	Forage Harvest Management	AGRON-RANGE	7/00	5/	-----		-----	8/04
490	Forest Site Preparation	FOR	10/02	-----	-----	-----	-----	8/04
490A	Windbreaks/Hedgerows Site Preparation	FOR	-----	10/02	-----	10/02	-----	-----
490B	Forest Site Preparation	FOR	-----	10/02	-----	10/02	-----	-----
666	Forest Stand Improvement	FOR	10/02	-----	-----	-----	-----	8/04
666A	Forest Stand Improvement (A), Coastal Douglas Fir/Redwood	FOR	-----	10/02	-----	10/02	-----	-----
666B	Forest Stand Improvement (B), Ponderosa Pine/Jeffrey Pine/Sierra Nevada Mixed Conifer	FOR	-----	10/02	-----	7/00	-----	-----
666C	Forest Stand Improvement (C), Aspen/Cottonwood/Other	FOR	-----	10/02	-----	10/02	-----	-----
666D	Forest Stand Improvement (D), Competing Vegetation Control	FOR	-----	10/02	-----	10/02	-----	-----
655	Forest Trails and Landings	FOR	10/02	10/02	-----	10/02	-----	8/04
410	Grade Stabilization Structure	ENG	7/00	7/00	-----	7/00	3/04	8/04
410A	Grade Stabilization Structure (A), Rock Drops	ENG	-----	7/00	-----	7/00	-----	-----
412	Grassed Waterway	AGRON-ENG	10/02	10/02	-----	10/02	3/04	8/04
548	Grazing Land Mechanical Treatment	RANGE	7/00	7/00	-----	7/00	-----	8/04
561	Heavy Use Area Protection	ENG	7/05	2/	-----		3/04	8/04

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422	Hedgerow Planting	BIO	10/02	7/00	-----	7/00	-----	7/05
603	Herbaceous Wind Barriers	FOR	10/02	10/02	-----	10/02	-----	8/04
423	Hillside Ditch	ENG	10/03	2/	-----		3/04	8/04
320	Irrigation Canal or Lateral	ENG	3/04	3/04	-----	3/04	3/04	8/04
388	Irrigation Field Ditch	ENG	3/04	3/04	-----	3/04	3/04	8/04
464	Irrigation Land Leveling	ENG	10/02	7/00	-----	10/02	3/04	8/04
552	Irrigation Regulating Reservoir	ENG	10/03	2/	-----		3/04	8/04
436	Irrigation Storage Reservoir	ENG	10/03	2/	-----		3/04	8/04
441	Irrigation System, Microirrigation	ENG	10/02	10/02	-----	10/02	3/04	8/04
442	Irrigation System, Sprinkler	ENG	7/00	7/00	-----	7/00	3/04	8/04
442A	Irrigation System, Sprinkler (A), Above Ground Mainlines and Laterals	ENG	-----	9/04	-----	9/04	-----	-----
443	Irrigation System, Surface and Subsurface	ENG	3/04	3/04	-----	3/04	3/04	8/04
447	Irrigation System, Tailwater Recovery	ENG	10/02	10/02	-----	10/02	3/04	8/04
428A	Irrigation Water Conveyance (A), Ditch & Canal Lining, Plain Concrete	ENG	3/04	3/04	-----	3/04	3/04	8/04
428B	Irrigation Water Conveyance (B), Ditch and Canal Lining, Flexible Membrane	ENG	12/04	2/	-----		12/04	7/05
428C	Irrigation Water Conveyance (C), Ditch and Canal Lining, galvanized steel	ENG	3/04	2/	-----		3/04	8/04
430AA	Irrigation Water Conveyance (AA), Aluminum Tubing Pipeline	ENG	7/00	2/	-----		3/04	8/04
430CC	Irrigation Water Conveyance (CC), Nonreinforced Concrete Pipeline	ENG	7/00	7/00	-----	7/00	3/04	8/04
430DD	Irrigation Water Conveyance (DD), High-pressure, Underground, Plastic Pipeline	ENG	7/00	7/00	7/00	7/00	3/04	8/04
430EE	Irrigation Water Conveyance (EE), Low-pressure, Underground, Plastic Pipeline	ENG	7/00	7/00	7/00	7/00	3/04	8/04

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430FF	Irrigation Water Conveyance (FF), Steel Pipeline	ENG	10/02	10/02	-----	10/02	3/04	8/04
430GG	Irrigation Water Conveyance (GG), Reinforced Plastic Mortar Pipeline	ENG	7/00	7/00	7/00	7/00	3/04	8/04
430HH	Irrigation Water Conveyance (HH), Rigid Gated Pipeline	ENG	7/00	7/00	-----	7/00	3/04	8/04
449	Irrigation Water Management	ENG	7/00	7/00	-----	7/00	-----	8/04
460	Land Clearing	ENG	9/04	2/	-----		-----	8/04
453	Land Reclamation, Landslide Treatment	ENG	7/05	2/	-----		7/05	7/05
455	Land Reclamation, Toxic Discharge Control	ENG	7/00	2/	-----		3/04	8/04
543	Land Reconstruction, Abandoned Mined Land	AGRON-ENG	9/04	2/	-----		9/04	8/04
544	Land Reconstruction, Currently Mined Land	AGRON-ENG	9/04	2/	-----		9/04	8/04
466	Land Smoothing	ENG	10/03	2/	-----		3/04	8/04
468	Lined Waterway or Outlet	ENG	6/06	10/03	-----	10/03	3/04	8/04
634	Manure Transfer	ENG	7/05	2/	-----		3/04	8/04
457	Mine Shaft and Adit Closing	ENG	7/05	2/	-----		7/05	7/05
482	Mole Drain	ENG	3/04	2/	-----			8/04
353	Monitoring Well	ENG	9/04	2/	-----		9/04	8/04
484	Mulching	AGRON	10/02	10/02	-----	10/02	-----	8/04
590	Nutrient Management	AGRON-ENG	10/02	7/00	-----	7/00	-----	8/04
500	Obstruction Removal	ENG	10/02	2/	-----		-----	8/04
582	Open Channel	ENG	7/00	2/	-----		3/04	8/04
512	Pasture and Hay Planting	AGRON	7/00	7/00	-----	7/00	-----	8/04
595	Pest Management	AGRON	10/04	10/04	-----	10/04	-----	8/04
516	Pipeline	ENG	10/02	10/02	-----	10/02	3/04	8/04
378	Pond	ENG	9/05	10/03	-----	10/03	3/04	8/04
521A	Pond Sealing or Lining (A), Flexible Membrane	ENG	10/03	10/03	10/03	10/03	3/04	8/04

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521B	Pond Sealing or Lining (B), Soil Dispersant	ENG	10/02	10/02	-----	10/02	3/04	8/04
521C	Pond Sealing or Lining (C), Bentonite Sealant	ENG	10/02	10/02	-----	10/02	3/04	8/04
740	Pond Sealing or Lining, Soil Cement	ENG	1/06	1/06		1/06	1/06	1/06
462	Precision Land Forming	ENG	10/03	2/	-----		-----	8/04
338	Prescribed Burning	FOR	10/02	10/02	-----	10/02	-----	8/04
528	Prescribed Grazing	RANGE-AGRON	10/02	-----	-----	-----	-----	8/04
528A	Prescribed Grazing (A), Annual Rangeland	RANGE-AGRON	-----	7/00	-----	7/00	-----	-----
528B	Prescribed Grazing (B), Irrigated Pasture	RANGE-AGRON	-----	7/00	-----	7/00	-----	-----
528C	Prescribed Grazing (C), Perennial Rangeland	RANGE-AGRON	-----	7/00	-----	7/00	-----	-----
528D	Prescribed Grazing (D), Wetlands	RANGE-AGRON-BIO	-----	7/00	-----	7/00	-----	-----
528E	Prescribed Grazing (E), Woodland/Forestland	RANGE-FOR	-----	7/00	-----	7/00	-----	-----
533	Pumping Plant	ENG	10/03	-----	-----	-----	3/04	8/04
533A	Pumping Plant For Water Control, Air Quality – Emissions Reduction	ENG	-----	10/02	-----	10/02	-----	-----
550	Range Planting	RANGE	7/00	7/00	-----	7/00	-----	8/04
562	Recreation Area Improvement	FOR	10/02	10/02	-----	10/02	-----	8/04
566	Recreation Land Grading and Shaping	ENG	10/02	2/	-----		3/04	8/04
568	Recreation Trail and Walkway	ENG	10/02	2/	-----		3/04	8/04
329A	Residue Management (A), No-Till and Strip Till	AGRON	7/00	7/00	-----	7/00	-----	8/04
329B	Residue Management (B), Mulch Till	AGRON	7/00	7/00	-----	7/00	-----	8/04
329C	Residue Management (C), Ridge Till	AGRON	7/00	7/00	-----	7/00	-----	8/04
344	Residue Management, Seasonal	AGRON	7/00	7/00	-----	7/00	-----	8/04
344A	Residue Management, Seasonal (A), Rice Residue	AGRON	-----	7/00	-----	7/00	-----	-----

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643	Restoration and Management of Declining Habitats	BIO	10/02	7/00	-----	7/00	-----	8/04
391	Riparian Forest Buffer	FOR	10/02	3/	-----		-----	8/04
390	Riparian Herbaceous Cover	BIO	7/00	4/	-----		-----	8/04
722	Road/Landing Removal 1/	ENG	7/00	7/00	-----	7/00	-----	
555	Rock Barrier	ENG	10/03	2/	-----		3/04	8/04
558	Roof Runoff Structure	ENG	10/02	2/	-----		3/04	8/04
557	Row Arrangement	ENG	10/03	2/	-----		-----	8/04
570	Runoff Management System	ENG	10/02	2/	-----		3/04	8/04
350	Sediment Basin	ENG	9/04	2/	-----		3/04	8/04
646	Shallow Water Management for Wildlife	BIO	7/00	4/	-----		-----	8/04
571	Soil Salinity Management - Nonirrigated	ENG-AGRON	10/03	2/	-----		-----	8/04
632	Solid/Liquid Waste Separation Facility	ENG	9/05	2/	-----			
572	Spoil Spreading	ENG	9/04	2/	-----		-----	8/04
574	Spring Development	ENG	10/02	10/02	-----	10/02	3/04	8/04
578	Stream Crossing	ENG	12/04	2/	-----		12/04	7/05
395	Stream Habitat Improvement & Management	BIO	10/02	4/	-----		3/04	8/04
580	Streambank and Shoreline Protection	ENG	7/05	7/05	-----	7/05	7/05	7/05
587	Structure for Water Control	ENG	12/04	-----	-----	-----	12/04	8/04
587A	Structure for Water Control (A), Corrugated Metal Pipe	ENG	-----	12/04	-----	12/04	-----	-----
587B	Structure for Water Control (B), Corrugated Thermoplastic Culverts	ENG	-----	12/04	-----	12/04	-----	-----
587C	Structure for Water Control (C), Fish Screen	ENG	-----	12/04	-----	12/04	-----	-----
606	Subsurface Drain	ENG	9/04	-----	-----	-----	3/04	8/04
606A	Subsurface Drain, Tubing, 15 Inches or Less	ENG	-----	9/04	-----	9/04	-----	-----
607	Surface Drainage, Field Ditch	ENG	3/04	3/04	-----	3/04	3/04	8/04

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608	Surface Drainage, Main or Lateral	ENG	10/03	10/03	-----	10/03	3/04	8/04
609	Surface Roughening	AGRON	10/02	7/00	-----	7/00	-----	8/04
600	Terrace	ENG	10/03	2/	-----		3/04	8/04
610	Toxic Salt Reduction	AGRON	7/00	7/00	-----	7/00	-----	8/04
612	Tree/Shrub Establishment	FOR	10/02	-----	-----	-----	-----	8/04
612A	Tree/Shrub Establishment (A), Bareroot/Containerized Stock	FOR	-----	10/02	-----	7/00	-----	-----
612B	Tree/Shrub Establishment (B), Direct Seeding	FOR	-----	10/02	-----	7/00	-----	-----
612C	Tree/Shrub Establishment (C), Pole plantings/cuttings	FOR	-----	10/02	-----	7/00	-----	-----
660	Tree/Shrub Pruning	FOR	10/02	10/02	-----	7/00	-----	8/04
620	Underground Outlet	ENG	10/02	10/02	-----	10/02	3/04	8/04
645	Upland Wildlife Habitat Management	BIO	7/00	7/00	-----	7/00	-----	8/04
472	Use Exclusion	RANGE	10/02	7/00	-----	7/00	-----	8/04
601	Vegetative Barrier	AGRON	10/02	5/	-----		-----	8/04
630	Vertical Drain	ENG	12/04	2/	-----		12/04	8/04
367	Waste Facility Cover	ENG	9/04	2/	-----		-----	8/04
313	Waste Storage Facility	ENG	6/06	-----	-----	-----	3/04	8/04
313A	Waste Storage Facility (A), Shotcrete Structure	ENG	-----	9/04	-----	9/04	-----	-----
313B	Waste Storage Facility (B), Pond	ENG	-----	9/04	-----	9/04	-----	-----
313C	Waste Storage Facility (C), Concrete Structure	ENG	-----	9/04	-----	9/04	-----	-----
629	Waste Treatment	ENG	9/05	2/	-----			
359	Waste Treatment Lagoon	ENG	9/04	9/04	-----	9/04	3/04	8/04
633	Waste Utilization	AGRON-ENG	10/02	2/	-----		-----	8/04
635	Wastewater Treatment Strip	ENG	10/02	2/	-----	10/02	3/04	8/04
638	Water and Sediment Control Basin	ENG	10/02	2/	-----		3/04	8/04
636	Water Harvesting Catchment	ENG	9/04	2/	-----		3/04	8/04
642	Water Well	ENG	1/06	1/06	-----	1/06	1/06	1/06

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CODE	PRACTICE NAME	Responsible Discipline(s)	CA Standard	-----DATE OF CURRENT-----				
				CA Specif-ication	Material Specif-ication	Practice Require-ments	Operation & Main-tenance	Statement of Work
614	Watering Facility	ENG	10/02	10/02	-----	10/02	3/04	8/04
640	Waterspreading	ENG	10/03	2/	-----		3/04	8/04
351	Well Decommissioning	ENG	9/04	2/	-----		9/04	8/04
355	Well Water Testing	ENG	7/05	2/	-----	7/05		7/05
658	Wetland Creation	BIO-ENG	7/00	2/	-----		3/04	8/04
659	Wetland Enhancement	BIO-ENG	7/00	2/	-----		3/04	8/04
657	Wetland Restoration	BIO-ENG	7/00	2/	-----		3/04	8/04
644	Wetland Wildlife Habitat Management	BIO	7/00	4/	-----	-----		8/04
648	Wildlife Watering Facility	BIO	7/00	7/00	-----	7/00	-----	8/04
380	Windbreak/Shelterbelt Establishment	FOR-BIO	10/02	7/00	-----		-----	8/04
650	Windbreak/Shelterbelt Renovation	FOR-BIO	10/02	10/02	-----	10/02	-----	8/04

**INDEX OF CONSTRUCTION SPECIFICATIONS
(Listed in Numerical Order)**

CODE	PRACTICE NAME	RESPONSIBLE DISCIPLINE	----- DATE OF CURRENT -----	
			CONSTRUCTION SPECIFICATION	LAST REVIEW
901	Concrete	ENG	7/05	7/05
902	Concrete Block Structure	ENG	7/05	7/05
903	Earthfill	ENG	7/05	7/05
904	Gabions	ENG	7/05	7/05
905	Geotextile Fabric	ENG	7/05	7/05
906	Post and Wire Revetment	ENG	7/05	7/05
907	Rock Riprap	ENG	7/05	7/05
908	Grouted Rock Riprap	ENG	7/05	7/05
909	Control of Water (to facilitate construction)	ENG	7/05	7/05

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				CA Specif-ication	Material Specif-ication	Practice Require-ments	Operation & Main-tenance	Statement of Work
310	Bedding	ENG	3/04	2/	-----		3/04	8/04
311	Alley Cropping	FOR	10/02	3/	-----		-----	8/04
313	Waste Storage Facility	ENG	6/06	-----	-----	-----	3/04	8/04
313A	Waste Storage Facility (A), Shotcrete Structure	ENG	-----	9/04	-----	9/04	-----	-----
313B	Waste Storage Facility (B), Pond	ENG	-----	9/04	-----	9/04	-----	-----
313C	Waste Storage Facility (C), Concrete Structure	ENG	-----	9/04	-----	9/04	-----	-----
314	Brush Management	RANGE	10/02	10/02	-----	7/00	-----	8/04
316	Animal Mortality Facility	ENG	3/04	2/	-----	3/04	-----	8/04
317	Composting Facility	ENG-AGRON	9/04	2/	-----		3/04	8/04
320	Irrigation Canal or Lateral	ENG	3/04	3/04	-----	3/04	3/04	8/04
322	Channel Vegetation	AGRON	7/00	7/00	-----	7/00	-----	8/04
324	Deep Tillage	AGRON	10/02	5/	-----	-----	-----	8/04
326	Clearing and Snagging	ENG	10/03	10/03	-----	10/03	3/04	8/04
327	Conservation Cover	AGRON-BIO	10/02	7/00	-----	7/00	-----	8/04
328	Conservation Crop Rotation	AGRON	10/02	7/00	-----	7/00	-----	8/04
329A	Residue Management (A), No-Till and Strip Till	AGRON	7/00	7/00	-----	7/00	-----	8/04
329B	Residue Management (B), Mulch Till	AGRON	7/00	7/00	-----	7/00	-----	8/04
329C	Residue Management (C), Ridge Till	AGRON	7/00	7/00	-----	7/00	-----	8/04
330	Contour Farming	AGRON	10/02	7/00	-----	7/00	-----	8/04
331	Contour Orchard and Other Fruit Area	AGRON	7/00	7/00	-----		-----	8/04
332	Contour Buffer Strips	AGRON	7/00	5/	-----		-----	8/04
338	Prescribed Burning	FOR	10/02	10/02	-----	10/02	-----	8/04
340	Cover Crop	AGRON	10/02	-----	-----	-----	-----	8/04
340A	Cover and Green Manure Crop (A)	AGRON	-----	7/00	-----	7/00	-----	-----
340B	Cover Crop (B)	AGRON	-----	7/00	-----	7/00	-----	-----
342	Critical Area Planting	AGRON-BIO	7/00	-----	-----	-----	-----	8/04

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342A	Critical Area Planting(A), Straw Mulch	AGRON-BIO	-----	7/00	-----	7/00	-----	-----
342B	Critical Area Planting(B), Hydro-Mulch	AGRON-BIO	-----	7/00	-----	7/00	-----	-----
342C	Critical Area Planting(C), Split Hydro-Mulch	AGRON-BIO	-----	7/00	-----	7/00	-----	-----
342D	Critical Area Planting(D), Tackified Straw	AGRON-BIO	-----	7/00	-----	7/00	-----	-----
342E	Critical Area Planting(E), Erosion Control Blanket	AGRON-BIO	-----	7/00	-----	7/00	-----	-----
342F	Critical Area Planting(F), Bermudagrass	AGRON-BIO	-----	7/00	-----	7/00	-----	-----
342G	Critical Area Planting(G), Woody Cuttings	AGRON-BIO	-----	7/00	-----	7/00	-----	-----
342H	Critical Area Planting(H), Container Plants	AGRON-BIO	-----	7/00	-----	7/00	-----	-----
342I	Critical Area Planting(I), Dune Stabilization	AGRON-BIO	-----	7/00	-----	7/00	-----	-----
344	Residue Management, Seasonal	AGRON	7/00	7/00	-----	7/00	-----	8/04
344A	Residue Management, Seasonal (A), Rice Residue	AGRON	-----	7/00	-----	7/00	-----	-----
348	Dam, Diversion	ENG	10/02	10/02	-----	10/02	3/04	8/04
350	Sediment Basin	ENG	9/04	2/	-----		3/04	8/04
351	Well Decommissioning	ENG	9/04	2/	-----		9/04	8/04
353	Monitoring Well	ENG	9/04	2/	-----		9/04	8/04
355	Well Water Testing	ENG	7/05	2/	-----	7/05		7/05
356	Dike	ENG	10/03	10/03	-----	10/03	3/04	8/04
359	Waste Treatment Lagoon	ENG	9/04	9/04	-----	9/04	3/04	8/04
360	Closure of Waste Impoundments	ENG	10/02	2/	-----		3/04	8/04
362	Diversion	ENG	10/02	10/02	-----	10/02	3/04	8/04
365	Anaerobic Digester, Ambient Temperature	ENG	9/04	2/	-----		-----	7/05
366	Anaerobic Digester, Controlled Temperature	ENG	9/04	2/	-----		-----	7/05
367	Waste Facility Cover	ENG	9/04	2/	-----		-----	8/04

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				CA Specif-ication	Material Specif-ication	Practice Require-ments	Operation & Main-tenance		
370	Atmospheric Resource Quality Management	AIR QUALITY	12/05	-----	-----	-----	-----	12/05	
370A	Atmospheric Resource Quality Management (A), Dust/Particulate Matter	AIR QUALITY	-----	12/05	-----	-----	-----	-----	
370A1	Atmospheric Resource Quality Management (A2), Dust/Particulate Matter - On-Field Cultivation/Harvesting Activities	AIR QUALITY	-----	-----	-----	12/05	-----	-----	
370A2	Atmospheric Resource Quality Management (A2), Dust/Particulate Matter - On-Field Cultivation/Harvesting Activities	AIR QUALITY	-----	-----	-----	12/05	-----	-----	
370A3	Atmospheric Resource Quality Management (A3), Dust/Particulate Matter - Confined Animal Feeding Operations (CAFO)	AIR QUALITY	-----	-----	-----	12/05	-----	-----	
370B	Atmospheric Resource Quality Management (B), Smoke Reduction-Field Crops/Orchard/Vineyard	AIR QUALITY	-----	12/05	-----	12/05	-----	-----	
370C	Atmospheric Resource Quality Management (C), Odor	AIR QUALITY	-----	12/05	-----	12/05	-----	-----	
370D	Atmospheric Resource Quality Management (D), Greenhouse Gases	AIR QUALITY	-----	12/05	-----	12/05	-----	-----	
370E	Atmospheric Resource Quality Management (E), Ammonia Loss Reduction	AIR QUALITY	-----	12/05	-----	12/05	-----	-----	
370F	Atmospheric Resource Quality Management (F), Ozone	AIR QUALITY	-----	12/05	-----	-----	-----	-----	
370F1	Atmospheric Resource Quality Management (F1), Ozone (NOx) - Engines	AIR QUALITY	-----	-----	-----	12/05	-----	-----	
370F2	Atmospheric Resource Quality Management (F2), Ozone – Volatile Organic Compounds – Pesticides	AIR QUALITY	-----	-----	-----	12/05	-----	-----	
370F3	Atmospheric Resource Quality Management (F3), Ozone – Volatile Organic Compounds – Livestock Waste Management	AIR QUALITY	-----	-----	-----	12/05	-----	-----	
378	Pond	ENG	9/05	10/03	-----	10/03	3/04	8/04	

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380	Windbreak/Shelterbelt Establishment	FOR-BIO	10/02	7/00	-----		-----	8/04
382	Fence	RANGE	7/00	-----	-----	-----	-----	8/04
382A	Fence (A), Standard	RANGE	-----	7/00	-----	7/00	-----	-----
382B	Fence (B), Suspension	RANGE	-----	7/00	-----	7/00	-----	-----
382C	Fence (C), Electrical	RANGE	-----	7/00	-----	7/00	-----	-----
386	Field Border	AGRON-ENG	9/04	9/04	-----	9/04	-----	8/04
388	Irrigation Field Ditch	ENG	3/04	3/04	-----	3/04	3/04	8/04
390	Riparian Herbaceous Cover	BIO	7/00	4/	-----		-----	8/04
391	Riparian Forest Buffer	FOR	10/02	3/	-----		-----	8/04
393	Filter Strip	ENG-AGRON	7/00	2/	-----		3/04	8/04
394	Firebreak	FOR	10/02	-----	-----	-----	-----	8/04
394A	Firebreak, Standard	FOR	-----	10/02	-----	10/02	-----	-----
394B	Firebreak, Fuel-Break	FOR	-----	7/00	-----	10/02	-----	-----
395	Stream Habitat Improvement & Management	BIO	10/02	4/	-----		3/04	8/04
396	Fish Passage	BIO-ENG	10/02	2/	-----		3/04	7/05
397	Aquaculture Ponds	BIO-ENG	3/04	2/	-----		3/04	8/04
398	Fish Raceway or Tank	BIO-ENG	9/04	2/	-----		3/04	7/05
399	Fishpond Management	BIO	10/02	4/	-----		-----	8/04
402	Dam	ENG	10/03	2/	-----	10/03	3/04	7/05
410	Grade Stabilization Structure	ENG	7/00	7/00	-----	7/00	3/04	8/04
410A	Grade Stabilization Structure (A), Rock Drops	ENG	-----	7/00	-----	7/00	-----	-----
412	Grassed Waterway	AGRON-ENG	10/02	10/02	-----	10/02	3/04	8/04
422	Hedgerow Planting	BIO	10/02	7/00	-----	7/00	-----	7/05
423	Hillside Ditch	ENG	10/03	2/	-----		3/04	8/04
428A	Irrigation Water Conveyance (A), Ditch & Canal Lining, Plain Concrete	ENG	3/04	3/04	-----	3/04	3/04	8/04

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				CA Specif-ication	Material Specif-ication	Practice Require-ments	Operation & Main-tenance	Statement of Work
428B	Irrigation Water Conveyance (B), Ditch and Canal Lining, Flexible Membrane	ENG	12/04	2/	-----		12/04	7/05
428C	Irrigation Water Conveyance (C), Ditch and Canal Lining, galvanized steel	ENG	3/04	2/	-----		3/04	8/04
430AA	Irrigation Water Conveyance (AA), Aluminum Tubing Pipeline	ENG	7/00	2/	-----		3/04	8/04
430CC	Irrigation Water Conveyance (CC), Nonreinforced Concrete Pipeline	ENG	7/00	7/00	-----	7/00	3/04	8/04
430DD	Irrigation Water Conveyance (DD), High-pressure, Underground, Plastic Pipeline	ENG	7/00	7/00	7/00	7/00	3/04	8/04
430EE	Irrigation Water Conveyance (EE), Low-pressure, Underground, Plastic Pipeline	ENG	7/00	7/00	7/00	7/00	3/04	8/04
430FF	Irrigation Water Conveyance (FF), Steel Pipeline	ENG	10/02	10/02	-----	10/02	3/04	8/04
430GG	Irrigation Water Conveyance (GG), Reinforced Plastic Mortar Pipeline	ENG	7/00	7/00	7/00	7/00	3/04	8/04
430HH	Irrigation Water Conveyance (HH), Rigid Gated Pipeline	ENG	7/00	7/00	-----	7/00	3/04	8/04
432	Dry Hydrant	ENG	7/00	2/	-----		3/04	8/04
436	Irrigation Storage Reservoir	ENG	10/03	2/	-----		3/04	8/04
441	Irrigation System, Microirrigation	ENG	10/02	10/02	-----	10/02	3/04	8/04
442	Irrigation System, Sprinkler	ENG	7/00	7/00	-----	7/00	3/04	8/04
442A	Irrigation System, Sprinkler (A), Above Ground Mainlines and Laterals	ENG	-----	9/04	-----	9/04	-----	-----
443	Irrigation System, Surface and Subsurface	ENG	3/04	3/04	-----	3/04	3/04	8/04
447	Irrigation System, Tailwater Recovery	ENG	10/02	10/02	-----	10/02	3/04	8/04
449	Irrigation Water Management	ENG	7/00	7/00	-----	7/00	-----	8/04
450	Anionic Polyacrylamide (PAM) Erosion Control	ENG	10/02	10/02	-----	10/02	3/04	8/04

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453	Land Reclamation, Landslide Treatment	ENG	7/05	2/	-----		7/05	7/05
455	Land Reclamation, Toxic Discharge Control	ENG	7/00	2/	-----		3/04	8/04
457	Mine Shaft and Adit Closing	ENG	7/05	2/	-----		7/05	7/05
460	Land Clearing	ENG	9/04	2/	-----		-----	8/04
462	Precision Land Forming	ENG	10/03	2/	-----		-----	8/04
464	Irrigation Land Leveling	ENG	10/02	7/00	-----	10/02	3/04	8/04
466	Land Smoothing	ENG	10/03	2/	-----		3/04	8/04
468	Lined Waterway or Outlet	ENG	6/06	10/03	-----	10/03	3/04	8/04
472	Use Exclusion	RANGE	10/02	7/00	-----	7/00	-----	8/04
482	Mole Drain	ENG	3/04	2/	-----			8/04
484	Mulching	AGRON	10/02	10/02	-----	10/02	-----	8/04
490	Forest Site Preparation	FOR	10/02	-----	-----	-----	-----	8/04
490A	Windbreaks/Hedgerows Site Preparation	FOR	-----	10/02	-----	10/02	-----	-----
490B	Forest Site Preparation	FOR	-----	10/02	-----	10/02	-----	-----
500	Obstruction Removal	ENG	10/02	2/	-----		-----	8/04
511	Forage Harvest Management	AGRON-RANGE	7/00	5/	-----		-----	8/04
512	Pasture and Hay Planting	AGRON	7/00	7/00	-----	7/00	-----	8/04
516	Pipeline	ENG	10/02	10/02	-----	10/02	3/04	8/04
521A	Pond Sealing or Lining (A), Flexible Membrane	ENG	10/03	10/03	10/03	10/03	3/04	8/04
521B	Pond Sealing or Lining (B), Soil Dispersant	ENG	10/02	10/02	-----	10/02	3/04	8/04
521C	Pond Sealing or Lining (C), Bentonite Sealant	ENG	10/02	10/02	-----	10/02	3/04	8/04
528	Prescribed Grazing	RANGE-AGRON	10/02	-----	-----	-----	-----	8/04
528A	Prescribed Grazing (A), Annual Rangeland	RANGE-AGRON	-----	7/00	-----	7/00	-----	-----
528B	Prescribed Grazing (B), Irrigated Pasture	RANGE-AGRON	-----	7/00	-----	7/00	-----	-----

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528C	Prescribed Grazing (C), Perennial Rangeland	RANGE-AGRON	-----	7/00	-----	7/00	-----	-----
528D	Prescribed Grazing (D), Wetlands	RANGE-AGRON-BIO	-----	7/00	-----	7/00	-----	-----
528E	Prescribed Grazing (E), Woodland/Forestland	RANGE-FOR	-----	7/00	-----	7/00	-----	-----
533	Pumping Plant	ENG	10/03	-----	-----	-----	3/04	8/04
533A	Pumping Plant For Water Control, Air Quality – Emissions Reduction	ENG	-----	10/02	-----	10/02	-----	-----
543	Land Reconstruction, Abandoned Mined Land	AGRON-ENG	9/04	2/	-----		9/04	8/04
544	Land Reconstruction, Currently Mined Land	AGRON-ENG	9/04	2/	-----		9/04	8/04
548	Grazing Land Mechanical Treatment	RANGE	7/00	7/00	-----	7/00	-----	8/04
550	Range Planting	RANGE	7/00	7/00	-----	7/00	-----	8/04
552	Irrigation Regulating Reservoir	ENG	10/03	2/	-----		3/04	8/04
554	Drainage Water Management	ENG	10/02	2/	-----		3/04	7/05
555	Rock Barrier	ENG	10/03	2/	-----		3/04	8/04
557	Row Arrangement	ENG	10/03	2/	-----		-----	8/04
558	Roof Runoff Structure	ENG	10/02	2/	-----		3/04	8/04
560	Access Road	ENG	9/04	10/02	-----	9/04	3/04	8/04
561	Heavy Use Area Protection	ENG	7/05	2/	-----		3/04	8/04
562	Recreation Area Improvement	FOR	10/02	10/02	-----	10/02	-----	8/04
566	Recreation Land Grading and Shaping	ENG	10/02	2/	-----		3/04	8/04
568	Recreation Trail and Walkway	ENG	10/02	2/	-----		3/04	8/04
570	Runoff Management System	ENG	10/02	2/	-----		3/04	8/04
571	Soil Salinity Management - Nonirrigated	ENG-AGRON	10/03	2/	-----		-----	8/04
572	Spoil Spreading	ENG	9/04	2/	-----		-----	8/04
574	Spring Development	ENG	10/02	10/02	-----	10/02	3/04	8/04
575	Animal Trails and Walkways	ENG-RANGE	10/03	10/03	-----	10/03	3/04	8/04

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**INDEX OF CONSERVATION PRACTICE STANDARDS AND SPECIFICATIONS
(Listed in Numerical Order by Code Number)**

CODE	PRACTICE NAME	Responsible Discipline(s)	CA Standard	-----DATE OF CURRENT-----				
				CA Specif-ication	Material Specif-ication	Practice Require-ments	Operation & Main-tenance	Statement of Work
578	Stream Crossing	ENG	12/04	2/	-----		12/04	7/05
580	Streambank and Shoreline Protection	ENG	7/05	7/05	-----	7/05	7/05	7/05
582	Open Channel	ENG	7/00	2/	-----		3/04	8/04
584	Channel Stabilization	ENG	10/03	10/03	-----	10/03	3/04	8/04
585	Contour Stripcropping	AGRON	10/02	7/00	-----	7/00	-----	
587	Structure for Water Control	ENG	12/04	-----	-----	-----	12/04	8/04
587A	Structure for Water Control (A), Corrugated Metal Pipe	ENG	-----	12/04	-----	12/04	-----	-----
587B	Structure for Water Control (B), Corrugated Thermoplastic Culverts	ENG	-----	12/04	-----	12/04	-----	-----
587C	Structure for Water Control (C), Fish Screen	ENG	-----	12/04	-----	12/04	-----	-----
589A	Cross Wind Ridges	AGRON	7/00	7/00	-----	7/00	-----	8/04
589C	Cross Wind Trap Strips	AGRON	7/00	7/00	-----	7/00	-----	8/04
590	Nutrient Management	AGRON-ENG	10/02	7/00	-----	7/00	-----	8/04
595	Pest Management	AGRON	10/04	10/04	-----	10/04	-----	8/04
600	Terrace	ENG	10/03	2/	-----		3/04	8/04
601	Vegetative Barrier	AGRON	10/02	5/	-----		-----	8/04
603	Herbaceous Wind Barriers	FOR	10/02	10/02	-----	10/02	-----	8/04
606	Subsurface Drain	ENG	9/04	-----	-----	-----	3/04	8/04
606A	Subsurface Drain, Tubing, 15 Inches or Less	ENG	-----	9/04	-----	9/04	-----	-----
607	Surface Drainage, Field Ditch	ENG	3/04	3/04	-----	3/04	3/04	8/04
608	Surface Drainage, Main or Lateral	ENG	10/03	10/03	-----	10/03	3/04	8/04
609	Surface Roughening	AGRON	10/02	7/00	-----	7/00	-----	8/04
610	Toxic Salt Reduction	AGRON	7/00	7/00	-----	7/00	-----	8/04
612	Tree/Shrub Establishment	FOR	10/02	-----	-----	-----	-----	8/04
612A	Tree/Shrub Establishment (A), Bareroot/Containerized Stock	FOR	-----	10/02	-----	7/00	-----	-----
612B	Tree/Shrub Establishment (B), Direct Seeding	FOR	-----	10/02	-----	7/00	-----	-----

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				CA Specif-ication	Material Specif-ication	Practice Require-ments	Operation & Main-tenance	Statement of Work
612C	Tree/Shrub Establishment (C), Pole plantings/cuttings	FOR	-----	10/02	-----	7/00	-----	-----
614	Watering Facility	ENG	10/02	10/02	-----	10/02	3/04	8/04
620	Underground Outlet	ENG	10/02	10/02	-----	10/02	3/04	8/04
629	Waste Treatment	ENG	9/05	2/	-----			
630	Vertical Drain	ENG	12/04	2/	-----		12/04	8/04
632	Solid/Liquid Waste Separation Facility	ENG	9/05	2/	-----			
633	Waste Utilization	AGRON-ENG	10/02	2/	-----		-----	8/04
634	Manure Transfer	ENG	7/05	2/	-----		3/04	8/04
635	Wastewater Treatment Strip	ENG	10/02	2/	-----	10/02	3/04	8/04
636	Water Harvesting Catchment	ENG	9/04	2/	-----		3/04	8/04
638	Water and Sediment Control Basin	ENG	10/02	2/	-----		3/04	8/04
640	Waterspreading	ENG	10/03	2/	-----		3/04	8/04
642	Water Well	ENG	1/06	1/06	-----	1/06	1/06	1/06
643	Restoration and Management of Declining Habitats	BIO	10/02	7/00	-----	7/00	-----	8/04
644	Wetland Wildlife Habitat Management	BIO	7/00	4/	-----	-----		8/04
645	Upland Wildlife Habitat Management	BIO	7/00	7/00	-----	7/00	-----	8/04
646	Shallow Water Management for Wildlife	BIO	7/00	4/	-----		-----	8/04
647	Early Successional Habitat Development/Management	BIO	7/00	4/	-----		-----	8/04
648	Wildlife Watering Facility	BIO	7/00	7/00	-----	7/00	-----	8/04
650	Windbreak/Shelterbelt Renovation	FOR-BIO	10/02	10/02	-----	10/02	-----	8/04
655	Forest Trails and Landings	FOR	10/02	10/02	-----	10/02	-----	8/04
656	Constructed Wetland	ENG-BIO	10/02	2/	-----		3/04	8/04
657	Wetland Restoration	BIO-ENG	7/00	2/	-----		3/04	8/04
658	Wetland Creation	BIO-ENG	7/00	2/	-----		3/04	8/04
659	Wetland Enhancement	BIO-ENG	7/00	2/	-----		3/04	8/04
660	Tree/Shrub Pruning	FOR	10/02	10/02	-----	7/00	-----	8/04

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				CA Specif-ication	Material Specif-ication	Practice Require-ments	Operation & Main-tenance	Statement of Work
666	Forest Stand Improvement	FOR	10/02	-----	-----	-----	-----	8/04
666A	Forest Stand Improvement (A), Coastal Douglas Fir/Redwood	FOR	-----	10/02	-----	10/02	-----	-----
666B	Forest Stand Improvement (B), Ponderosa Pine/Jeffrey Pine/Sierra Nevada Mixed Conifer	FOR	-----	10/02	-----	7/00	-----	-----
666C	Forest Stand Improvement (C), Aspen/Cottonwood/Other	FOR	-----	10/02	-----	10/02	-----	-----
666D	Forest Stand Improvement (D), Competing Vegetation Control	FOR	-----	10/02	-----	10/02	-----	-----
702	Agrichemical Handling Facility 1/	ENG	9/05	2/	-----	9/05	9/05	9/05
722	Road/Landing Removal 1/	ENG	7/00	7/00	-----	7/00	-----	
740	Pond Sealing or Lining, Soil Cement	ENG	1/06	1/06		1/06	1/06	1/06

**INDEX OF CONSTRUCTION SPECIFICATIONS
(Listed in Numerical Order)**

CODE	PRACTICE NAME	RESPONSIBLE DISCIPLINE	----- DATE OF CURRENT -----	
			CONSTRUCTION SPECIFICATION	LAST REVIEW
901	Concrete	ENG	7/05	7/05
902	Concrete Block Structure	ENG	7/05	7/05
903	Earthfill	ENG	7/05	7/05
904	Gabions	ENG	7/05	7/05
905	Geotextile Fabric	ENG	7/05	7/05
906	Post and Wire Revetment	ENG	7/05	7/05
907	Rock Riprap	ENG	7/05	7/05
908	Grouted Rock Riprap	ENG	7/05	7/05
909	Control of Water (to facilitate construction)	ENG	7/05	7/05

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NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

WASTE STORAGE FACILITY

(No.)
CODE 313

DEFINITION

A waste storage impoundment made by constructing an embankment and/or excavating a pit or dugout, or by fabricating a structure.

SCOPE

Embankments are limited to an effective height of 35 ft or less and to hazard class (a). This standard does not apply to waste treatment lagoon.

PURPOSE

To temporarily store wastes such as manure, wastewater, and contaminated runoff as a storage function component of an agricultural waste management system.

CONDITIONS WHERE PRACTICE APPLIES

- where the storage facility is a component of a planned agricultural waste management system;
- where temporary storage is needed for organic wastes generated by agricultural production or processing;
- where the storage facility can be constructed, operated and maintained without polluting air or water resources;
- where site conditions are suitable for construction of the facility;
- to facilities utilizing embankments with an effective height of 35 feet or less, where potential damages resulting from failure would be limited to farm buildings, agricultural land, or township and country roads; and
- to fabricated structures including tanks, stacking facilities, and pond appurtenances.

CRITERIA

General Criteria Applying to All Waste Storage

Facilities.

Laws and regulations. Waste storage facilities must be planned, designed, and constructed to meet all federal, state, and local laws and regulations.

Location. To minimize the potential for contamination of streams, waste storage facilities should be located outside of floodplains. However, if site restrictions require location within a floodplain, they shall be protected from inundation or damage from a 25-year flood event, or larger if required by laws, rules, and regulations. Waste storage facilities shall be located so the potential impacts from breach of embankment, accidental release, and liner failure are minimized; and separation distances are such that prevailing winds and landscape elements such as building arrangement, landforms, and vegetation minimize odors and protect aesthetic values.

Storage period. The storage period is the maximum length of time anticipated between emptying events. The minimum storage period shall be based on the timing required for environmentally acceptable waste utilization, which considers climatic and agronomic factors, soils, farm operations and equipment, and applicable regulations.

Design storage volume. The design storage volume shall equal the required storage volume, and shall consist of the sum of the following as appropriate:

- (a) Manure, wastewater, and other wastes accumulated during the storage period;
- (b) Normal precipitation less evaporation on the surface area (at the design storage volume level) of the facility during the storage period;

- (c) Normal runoff from the facility's drainage area during the storage period;
- (d) 25-year, 24-hour precipitation on the surface (at the required design storage volume level) of the facility;
- (e) 25-year, 24-hour runoff from the facility's drainage area;
- (f) Residual solids after liquids have been removed (A minimum of 6 inches shall be provided for tanks); and
- (g) Additional storage required to meet management goals or regulatory requirements.

Inlet. Inlets shall be of any permanent type designed to resist corrosion, plugging, freeze damage and ultraviolet ray deterioration while incorporating erosion protection as necessary.

Emptying Component. Design shall include some type of component that allows for the storage facility to be emptied. Potentially feasible components include a gate, pipe, dock, wet well, pumping platform, retaining wall, or ramp. Features to protect against erosion, tampering, and accidental release shall be incorporated as necessary.

Accumulated solids removal. Provision shall be made for periodic removal of accumulated solids to preserve storage capacity. The anticipated method for doing this must be considered in planning, particularly in determining the configuration of ponds and type of seal, if any.

Safety. Design shall include appropriate safety features to minimize the hazards of the facility. Ramps used to empty liquids shall have a slope of 4 horizontal to 1 vertical or flatter. Those used to empty slurry, semi-solid, or solid waste shall have a slope of 10 horizontal to 1 vertical or flatter unless special traction surfaces are provided. Warning signs, fences, ladders, ropes, bars, rails, and other devices shall be provided as appropriate, to ensure the safety of humans and livestock.

Ventilation and warning signs shall be provided for covered waste holding structures as necessary, to prevent explosion, poisoning, or asphyxiation. Where gases have the potential to enter buildings or other confined spaces, pipelines shall be provided with a water-sealed trap and vent or similar device.

Ponds and uncovered fabricated structures for liquid or slurry waste with walls less than 5 feet above ground surface shall be fenced and warning

signs posted to prevent children and others from using them for other than their intended purpose.

Erosion protection. Embankments and disturbed areas surrounding the facility shall be treated to control erosion.

Additional Criteria for Waste Storage Ponds

Seepage Control. Seepage-related criteria for siting, investigating, and designing liquid waste storage facilities are presented in Table 1. Additional information and guidance regarding seepage control of waste impoundments are found in the Agricultural Waste Management Field Handbook (AWMFH), Appendix 10D.

The target maximum specific discharge (unit seepage) shall be $1 \times 10^{-6} \text{ cm}^3/\text{cm}^2/\text{sec}$. No credit shall be given for manure sealing. General sampling and soil mechanics testing requirements are summarized in Tables 1 and 2. Testing requirements vary depending on the relative vulnerability of the site to groundwater contamination, and on the potential impacts of seepage on designated uses of groundwater and hydraulically-connected surface water resources including drinking water supply and fisheries habitat.

The pond shall have a bottom elevation that is a minimum of 5 feet above the seasonal high water table.

Liners shall meet or exceed the criteria in NRCS Practice Standard 521, Pond Sealing or Lining

Seepage control criteria developed for the specially designated Chino Basin shall be used in lieu of the criteria described above.

Maximum Operating Level. The maximum operating level for waste storage ponds shall be the pond level that provides for the required volume less the volume contribution of precipitation and runoff from the 25-year, 24-hour storm event plus the volume allowance for residual solids after liquids have been removed. A permanent marker or recorder shall be installed at this maximum operating level to indicate when drawdown should begin. The marker or recorder shall be referenced and explained in the O&M plan.

Outlet. No outlet shall automatically release storage from the required design volume. Manually operated outlets shall be of permanent type designed to resist corrosion and plugging.

Table 1- Criteria for Siting, Investigation, & Design of Liquid Waste Storage Facilities

<p style="text-align: right;">Risk→</p> <p style="text-align: center;">Vulnerability ↓</p>	<p>Very High</p> <p><1,500' from public drinking water supply wells; OR < 100' from any domestic well or Class 1 stream</p>	<p>High</p> <p>Doesn't meet Very High Risk criteria; AND Recharge areas for Sole Source aquifers; OR 100' - 600' from unconfined domestic water supply well (or where degree of aquifer confinement is unknown) or Class 1 stream</p>	<p>Moderate</p> <p>Doesn't meet High Risk criteria; AND 600' - 1,000' from unconfined domestic well (or where degree of aquifer confinement is unknown) or Class 1 stream; OR < 600' from unconfined non-domestic water supply well (or where degree of aquifer confinement is unknown) or Class 2 stream</p>	<p>Slight</p> <p>Doesn't meet Moderate Risk criteria; AND >1,000' from unconfined domestic well (or where degree of aquifer confinement is unknown) or Class 1 stream; AND > 600' from unconfined non-domestic water supply well (or where degree of aquifer confinement is unknown) or Class 2 stream</p>
<p>Very High</p> <p>Large voids (e.g. karst, lava tubes, mine shafts); OR Highest anticipated groundwater elevation within 5' of invert; OR < 600' from improperly abandoned well*</p>	<p>Evaluate other storage alternatives * (or properly seal well and re-evaluate vulnerability)</p>			
<p>High</p> <p>Doesn't meet Very High Vulnerability criteria: AND Bedrock (assumed fractured) within 2' of invert; OR Coarse soils/parent material (Permeability Group I soils as defined in AWMFH, always including GP, GW, SP, SW); OR Highest anticipated groundwater elevation is between 5' - 20' below invert; OR 600' - 1,000' from improperly abandoned well*</p>	<p>Evaluate other storage alternatives * (or properly seal well and re-evaluate vulnerability)</p>	<p>Synthetic Liner Required * (or properly seal well and re-evaluate vulnerability). No additional site characterization required</p>	<p>Liner Required * (or properly seal well and re-evaluate vulnerability). ~ Specific Discharge $\leq 1 \times 10^{-6}$ cm³/cm²/sec ~ No manure sealing credit ~ Earthen liner design includes sampling and testing of liner material (Classification, Standard Proctor compaction, Permeability)</p>	<p>Liner Required * (or properly seal well and re-evaluate vulnerability). ~ Specific Discharge $\leq 1 \times 10^{-6}$ cm³/cm²/sec ~ No manure sealing credit ~ Earthen liner design includes sampling and testing of liner material ~ Published permeability data and construction method specifications may be used.</p>
<p>Moderate</p> <p>Doesn't meet High Vulnerability criteria; AND Medium soils/parent material (Permeability Group II soils as defined in AWMFH, usually including CL-ML, GM, SM, ML); OR Flocculated or blocky clays (typically associated with high Ca); OR Complex stratigraphy (discontinuous layering); OR Highest anticipated groundwater elevation is between 21'- 50' below invert</p>		<p>Evaluate other alternatives or Synthetic liner as allowed.</p> <p>Local regulations may apply</p>	<p>Further evaluate need for liner ~ Specific Discharge $\leq 1 \times 10^{-6}$ cm³/cm²/sec ~ No manure sealing credit ~ Earthen liner/no liner design includes sampling and testing of liner/ in-place material (Classification, Standard Proctor compaction/ in-place density, Remolded/ Undisturbed sample Permeability)</p>	<p>Further evaluate need for liner ~ Specific Discharge $\leq 1 \times 10^{-6}$ cm³/cm²/sec ~ No manure sealing credit ~ Earthen liner/no liner design includes sampling and testing of liner/ in-place material (Classification, Standard Proctor compaction/ in-place density, Remolded/ Undisturbed sample Permeability)</p>
<p>Low</p> <p>Doesn't meet Moderate Vulnerability criteria; AND Fine soils/parent material (Permeability Group III and IV soils as defined in AWMFH, usually including GC, SC, MH, CL, CH); AND Highest anticipated groundwater elevation is >50' below invert</p>	<p>Consult with Area Engineer</p>		<p>Further evaluate need for liner ~ Specific Discharge $\leq 1 \times 10^{-6}$ cm³/cm²/sec ~ No manure sealing credit ~ Earthen liner/no liner design includes sampling and testing of liner/ in-place material (Classification, Standard Proctor compaction/ in-place density, Remolded/ Undisturbed sample Permeability) ~ Scarify and recompact surface to seal cracks and break down soil structure as appropriate</p>	<p>Liner not required ~ Specific Discharge $\leq 1 \times 10^{-6}$ cm³/cm²/sec ~ Field classification and published permeability data may be used ~ Construction method specifications may be used ~ Scarify and recompact surface to seal cracks and break down soil structure as appropriate</p>

Table 1, continued
Criteria for Siting, Investigation, & Design of Liquid Waste Storage Facilities
Definitions

AWMFH. NRCS Agricultural Waste Management Field Handbook (210-VI-651). *Individual chapters online at <http://www.info.usda.gov/CED/>.*

Class 1 Stream. Watercourses that provide domestic supplies (including springs, on site and/or within 100 feet downstream of the operations area), and/or where fish are always or seasonally present onsite (including habitat to sustain fish migration and spawning). *Definition from California Forest Practice Rules, online at http://www.fire.ca.gov/php/rsrc-mgt_content/downloads/2005FPRRulebook.pdf (Sections 916.5, 936.5, 956.5).*

Class 2 Stream. Watercourses where fish are always or seasonally present offsite within 1000 feet downstream; and/or aquatic habitat is available for nonfish aquatic species. Definition excludes Class III waters (no aquatic life present) that are tributary to Class 1 waters. *Definition from California Forest Practice Rules.*

Permeability Group (I through IV) Soils. Empirically-derived permeability classification of soils based on percent passing the 200 sieve and Plasticity Index (PI). *Specific criteria for each of the four classes are listed in Table 10D-1 of Appendix 10D of the AWMFH (<http://www.info.usda.gov/CED/ftp/CED/neh651-ch10.pdf>).*

Risk. Risk categories (very high, high, moderate, slight) are based on the potential impacts of seepage on designated uses of groundwater and hydraulically connected surface water resources. *Designated uses include drinking water supply, nondomestic water supply, and aquatic habitats including fisheries.*

Sole Source Aquifer. An EPA-administered program that requires EPA review of all Federal financially assisted projects which have the potential to contaminate officially designated Sole Source Aquifers (<http://www.epa.gov/safewater/ssanp.html>). *Currently there are four Sole Source Aquifer areas in California, including the Fresno aquifer (http://www.epa.gov/safewater/swp/ssa/pdfs/map_ssa_fresno.pdf).*

Unconfined Aquifer. An aquifer containing water that is not under pressure; the water level in a well is the same as the water table outside the well (<http://www.epa.gov/OCEPAterms/uterms.html>). *Compared to confined aquifers, unconfined aquifers tend to be close to the ground surface and lack a low permeability confining layer that reduces seepage of potential contaminants from surface sources.*

Vulnerability. Vulnerability categories (very high, high, moderate, low) are based on geologic and hydrogeologic conditions at the site that influence seepage rates from the surface to the aquifer. *Geologic and hydrogeologic conditions include the texture and plasticity of the soil and geologic material in the vadose zone; and the separation distance between the invert of the proposed storage facility and the water table. The presence of improperly abandoned water wells is also considered a potential vulnerability factor.*

Table 2 - Soil Mechanics Testing Requirements for Design of Waste Storage Ponds

Test		ASTM reference	Where test should be run	
			No liner alternative	Compacted earth liner alternative
Classification	Sieve Analysis	D 422	X ^a	X
	Hydrometer	D 422	X ^a	X
	Atterberg Limits	D 4318	X ^a	X
Compaction	(Standard Proctor)	D 698		X ^b
In-place density		D 1556; D 2922	X	
Permeability	Remolded	D 5084		X ^b
	Undisturbed and/or in-situ	D 5126	X	

^a Field Classification of soil material may be used in lieu of laboratory-based classification where vulnerability is low and risk is slight or moderate

^b Published permeability data and assumed compaction may be used in lieu of lab testing of remolded samples where risk is slight

Embankments. The minimum elevation of the top of the settled embankment shall be 1 foot above the waste storage pond's required volume. This height shall be increased by the amount needed to ensure that the top elevation will be maintained after settlement. This increase shall be not less than 5 percent.

The minimum top widths are shown in Table 3.

The combined side slopes of the settled embankment shall not be less than 5 horizontal to 1 vertical, and neither slope shall be steeper than 2 horizontal to 1 vertical unless provisions are made to provide stability. Lined ponds may require flatter inside slopes as described in Practice Standard 521, Pond Sealing and Lining.

Table 3 – Minimum Top Widths

Total embankment Height, ft.	Top Width, ft.
15 or less	8
15 – 20	10
20 – 25	12
25 – 30	14
30 – 35	15

Excavations. Unless supported by a soil investigation, excavated side slopes shall be no steeper than 2 horizontal to 1 vertical. Lined ponds may require flatter inside slopes as described in Practice Standard 521, Pond Sealing and Lining.

Emergency spillway. An emergency spillway shall be constructed if: 1) the pond includes an embankment with a maximum liquid elevation of one foot or more above natural ground; 2) the drainage area of the contributing watershed is five or more acres; and 3) the storm water inlet is uncontrolled. Spillways shall be designed to pass the peak flow rate resulting from a 25-year, 24-hour storm event and constructed to prevent erosion of the embankment.

Additional Criteria for Fabricated Structures

Foundation. The foundations of fabricated waste storage structures shall be proportioned to safely support all superimposed loads without excessive movement or settlement.

Where a non-uniform foundation cannot be avoided or applied loads may create highly variable foundation loads, settlement should be calculated from site-specific soil test data. Index tests of site soil may allow correlation with similar soils for which test data is available. If no test data is available, presumptive bearing strength values for assessing actual bearing pressures may be obtained from Table 4 or another nationally recognized building code. In using presumptive bearing values, adequate detailing and articulation shall be provided to avoid distressing movements in the structure.

Foundations consisting of bedrock with joints, fractures, or solution channels shall be treated or a separation distance provided consisting of a minimum of 1 foot of impermeable soil between the floor slab and the bedrock or an alternative that will achieve equal protection.

Table 4 - Presumptive Allowable Bearing Stress Values¹

Foundation Description	Allowable Stress
Crystalline Bedrock	12000 psf
Sedimentary Rock	6000 psf
Sandy Gravel or Gravel	5000 psf
Sand, Silty Sand, Clayey Sand, Silty Gravel, Clayey Gravel	3000 psf
Clay, Sandy Clay, Silty Clay, Clayey Silt	2000 psf

¹ Basic Building Code, 12th Edition, 1993, Building Officials and Code Administrators, Inc. (BOCA)

Liquid tightness. Applications such as tanks, that require liquid tightness shall be designed and constructed in accordance with standard engineering and industry practice appropriate for the construction materials used to achieve this objective.

Structural loadings. Waste storage structures shall be designed to withstand all anticipated loads including internal and external loads, hydrostatic uplift pressure, concentrated surface and impact loads, water pressure due to seasonal high water table, and frost or ice pressure and load combinations in compliance with this standard and applicable local building codes.

The lateral earth pressures should be calculated from soil strength values determined from the results of

appropriate soil tests. Lateral earth pressures can be calculated using the procedures in TR-74. If soil strength tests are not available, the presumptive lateral earth pressure values indicated in Table 5 shall be used.

Lateral earth pressures based upon equivalent fluid assumptions shall be assigned according to the following conditions:

- **Rigid frame or restrained wall.** Use the values shown in Table 5 under the column “Frame tanks,” which gives pressures comparable to the at-rest condition.
- **Flexible or yielding wall.** Use the values shown in Table 5 under the column “Free-standing walls,” which gives pressures comparable to the active condition. Walls in this category are designed on the basis of gravity for stability or are designed as a cantilever having a base wall thickness to height of backfill ratio not more than 0.085.

Internal lateral pressure used for design shall be 65 lb/ft² where the stored waste is not protected from precipitation. A value of 60 lb/ft² may be used where the stored waste is protected from precipitation and will not become saturated. Lesser values may be used if supported by measurement of actual pressures of the waste to be stored. If heavy equipment will be operated near the wall, an additional two feet of soil surcharge shall be considered in the wall analysis.

Tank covers shall be designed to withstand both dead and live loads. The live load values for covers contained in ASAE EP378.3, Floor and Suspended Loads on Agricultural Structures Due to Use, and in ASAE EP 393.2, Manure Storages, shall be the minimum used. The actual axle load for tank wagons having more than a 2,000 gallon capacity shall be used.

If the facility is to have a roof, snow and wind loads shall be as specified in ASAE EP288.5, Agricultural Building Snow and Wind Loads. If the facility is to serve as part of a foundation or support for a building, the total load shall be considered in the structural design.

Structural design. The structural design shall consider all items that will influence the performance of the structure, including loading assumptions, material properties and construction quality. Design assumptions and construction requirements shall be indicated on standard plans.

Tanks may be designed with or without covers. Covers, beams, or braces that are integral to structural performance must be indicated on the construction drawings. The openings in covered tanks shall be designed to accommodate equipment for loading, agitating, and emptying. These openings shall be equipped with grills or secure covers for safety, and for odor and vector control.

All structures shall be underlain by free draining material or shall have a footing located below the anticipated frost depth. Fabricated structures shall be designed according to the criteria in the following references as appropriate:

- Steel: “Manual of Steel Construction”, American Institute of Steel Construction.
- Timber: “National Design Specifications for Wood Construction”, American Forest and Paper Association.
- Concrete: “Building Code Requirements for Reinforced Concrete, ACI 318”, American Concrete Institute.
- Masonry: “Building Code Requirements for Masonry Structures, ACI 530”, American Concrete Institute.

Slabs on grade. Slab design shall consider the required performance and the critical applied loads along with both the subgrade material and material resistance of the concrete slab. Where applied point loads are minimal and liquid-tightness is not required, such as barnyard and feedlot slabs subject only to precipitation, and the subgrade is uniform and dense, the minimum slab thickness shall be 4 inches with a maximum joint spacing of 10 feet. Joint spacing can be increased if steel reinforcing is added based on subgrade drag theory.

For applications where liquid-tightness is required such as floor slabs of storage tanks, the minimum thickness for uniform foundations shall be 5 inches and shall contain distributed reinforcing steel. The required area of such reinforcing steel shall be based on subgrade drag theory as discussed in industry guidelines such as American Concrete Institute, ACI 360, “Design of Slabs-on-Grade”.

When heavy equipment loads are to be resisted and/or where a non-uniform foundation cannot be avoided, an appropriate design procedure incorporating a subgrade resistance parameter(s) such as ACI 360 shall be used.

TABLE 5 - LATERAL EARTH PRESSURE VALUES¹

Soil		Equivalent fluid pressure (lb/ft ² /ft of depth)			
		Above seasonal high water table ²		Below seasonal high water table ³	
Description ⁴	Unified Classification ⁴	Free-standing walls	Frame tanks	Free-standing walls	Frame tanks
Clean gravel, sand or sand-gravel mixtures (maximum 5% fines) ⁵	GP, GW, SP, SW	30	50	80	90
Gravel, sand, silt and clay mixtures (less than 50% fines) Coarse sands with silt and and/or clay (less than 50% fines)	All gravel sand dual symbol classifications and GM, GC, SC, SM, SC-SM	35	60	80	100
Low-plasticity silts and clays with some sand and/or gravel (50% or more fines) Fine sands with silt and/or clay (less than 50% fines)	CL, ML, CL-ML SC, SM, SC-SM	45	75	90	105
Low to medium plasticity silts and clays with little sand and/or gravel (50% or more fines)	CL, ML, CL-ML	65	85	95	110
High plasticity silts and clays (liquid limit more than 50) ⁶	CH, MH	-	-	-	-

¹ For lightly compacted soils (85% to 90% maximum standard density). Includes compaction by use of typical farm equipment.

² Also below seasonal high water table if adequate drainage is provided.

³ Includes hydrostatic pressure.

⁴ All definitions and procedures in accordance with ASTM D 2488 and D 653.

⁵ Generally, only washed materials are in this category

⁶ Not recommended. Requires special design if used.

CONSIDERATIONS

Waste storage facilities should be located as close to the source of waste and polluted runoff as practicable.

Non-polluted runoff should be excluded from the structure to the fullest extent possible except where its storage is advantageous to the operation of the agricultural waste management system.

Freeboard for waste storage tanks should be considered.

Solid/liquid separation of runoff or wastewater entering pond facilities should be considered to minimize the frequency of accumulated solids removal and to facilitate pumping and application of the stored waste.

Due consideration should be given to environmental concerns, economics, the overall waste management system plan, and safety and health factors.

Considerations for minimizing the potential for and impacts of sudden breach of embankment or accidental release from the required volume.

Features, safeguards, and/or management measures to minimize the risk of failure or accidental release, or to minimize or mitigate impact of this type of failure should be considered when any of the categories listed in Table 6 might be significantly affected.

The following should be considered either singly or in combination to minimize the potential of or the consequences of sudden breach of embankments when one or more of the potential impact categories listed in Table 6 may be significantly affected:

1. Additional freeboard;
2. Storage for wet year rather than normal year precipitation;
3. Reinforced embankment -- such as, additional top width, flattened and/or armored downstream side slopes;
4. Secondary containment.

The following options should be considered to minimize the potential for accidental release from the required volume through gravity outlets when one or more of the potential impact categories listed in Table 6 may be significantly affected:

1. Outlet gate locks or locked gate housing;
2. Secondary containment;
3. Alarm system;
4. Another means of emptying the required volume.

Table 6- Potential Impact Categories from Breach of Embankment or Accidental Release

1. Surface water bodies -- perennial streams, lakes, wetlands, and estuaries
2. Critical habitat for threatened and endangered species.
3. Riparian areas
4. Farmstead, or other areas of habitation
5. Off-farm property
6. Historical and/or archaeological sites or structures that meet the eligibility criteria for listing in the National Register of Historical Places.

Considerations for improving air quality

An anaerobic lagoon instead of a waste storage pond should be considered for sites located in rural areas where odors are a concern. This should be especially considered where odors would affect neighboring farms having enterprises that do not cause odors and/or neighbors who earn a living off-farm. The recommended loading rate for anaerobic lagoons at sites where odors must be minimized is one-half the values given in AWMFH Figure 10-22.

For sites located near urban areas practices such as the following should be considered to reduce odor emissions:

1. Covering the storage facility with a suitable cover;
2. Using naturally aerated or mechanically aerated lagoons;
3. Using composting in conjunction with a solid waste system rather than a liquid or slurry system;
4. Using a methane digester and capture system.

To reduce emissions of greenhouse gases, ammonia, and volatile organic compounds, other practices such as Anaerobic Digester – Ambient Temperature (365), Anaerobic Digester – Controlled Temperature (366), Waste Facility Cover (367), and Composting Facility (317) can be added to the waste management system.

Adjusting pH below 7 may reduce ammonia emissions from the waste storage facility but may increase odor when waste is surface applied (see Waste Utilization, 633).

Cultural Resources Considerations

NRCS's objective is to avoid any effect to cultural resources and protect them in their original location. Determine if installation of this practice will have any effect on any cultural resources.

Document any specific considerations for cultural resources in the design docket and the Practice Requirements worksheet.

GM 420, Part 401, the California Environmental Handbook and the California Environmental Assessment Worksheet provide guidance on how the NRCS must account for cultural resources. The Field Office Technical Guide, Section II contains general information, with Web sites for additional information.

Endangered Species Considerations

Determine if installation of this practice with any others proposed will have any effect on any federal or state listed Rare, Threatened or Endangered species or their habitat. NRCS's objective is to benefit these species and others of concern or at least not have any adverse effect on a listed species. If the Environmental Evaluation indicates the action may adversely affect a listed species or result in adverse modification of habitat of listed species which has been determined to be critical habitat, NRCS will advise the land user of the requirements of the Endangered Species Act and recommend alternative conservation treatments that avoid the adverse effects. Further assistance will be provided only if the landowner selects one of the alternative conservation treatments for installation; or at the request of the landowners, NRCS may initiate consultation with the Fish and Wildlife Service, National Marine Fisheries Service and/or California Department of Fish and Game. If the Environmental Evaluation indicates the action will not affect a listed species or result in adverse modification of critical

habitat, consultation generally will not apply and usually would not be initiated. Document any special considerations for endangered species in the Practice Requirements Worksheet.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying the practice to achieve its intended use.

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be developed that is consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for its design.

The plan shall contain the operational requirements for emptying the storage facility. This shall include the requirement that waste shall be removed from storage and utilized at locations, times, rates, and volume in accordance with the overall waste management system plan. In addition, for ponds, the plan shall include an explanation of the permanent marker or recorder installed to indicate the maximum operating level. The plan shall include a strategy for removal and disposition of waste with least environmental damage during the normal storage period to the extent necessary to insure the pond's safe operation. This strategy is for the removal of the contribution of unusual storm events that may cause the pond to fill to capacity prematurely with subsequent design inflow and usual precipitation prior to the end of the normal storage period. Development of an emergency action plan should be considered for waste storage facilities where there is a potential for significant impact from breach or accidental release. The plan shall include site-specific provisions for emergency actions that will minimize these impacts.

NATURAL RESOURCES CONSERVATION SERVICE
 CONSERVATION PRACTICE STANDARD

LINED WATERWAY OR OUTLET

(feet)
CODE 468

DEFINITION

A waterway or outlet having an erosion-resistant lining of concrete, stone, synthetic turf reinforcement fabrics, or other permanent material. The earth above the permanent lining may be vegetated or otherwise protected.

Scope

This standard applies to waterways or outlets having linings of non-reinforced, cast-in-place concrete; flagstone mortared in place; rock riprap; or similar permanent linings. It does not apply to irrigation water conveyance, grassed waterways with stone centers or small lined sections to carry prolonged flows.

PURPOSE

This practice may be applied as part of a resource management system to support one or more of the following purposes:

- Provide for safe conveyance of runoff from conservation structures or other water concentrations without causing erosion or flooding
- Stabilize existing and prevent future gully erosion
- Protect and improve water quality

Properly designed linings may also control seepage, piping, and sloughing or slides.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies if the following or similar conditions exist:

1. Concentrated runoff, steep grades, wetness, prolonged base flow, seepage, or piping is such that a lining is needed to control erosion.
2. Use by people or animals precludes use of

vegetation waterways or outlets.

3. Limited space is available for design width, which requires higher velocities and lining.
4. Soils are highly erosive or other soil or climatic conditions preclude using vegetation only.
5. Steep grades, wetness, prolonged base flow, seepage, or piping would cause erosion.
6. Installation of non-reinforced concrete or mortared flagstone linings, shall be made only on low shrink-swell soils that are well-drained or where subgrade facilities are installed.

CRITERIA

General Criteria Applicable To All Purposes

Capacity. The maximum capacity of the waterway flowing at designed depth shall not exceed 200 ft³/s. The minimum capacity shall be adequate to carry the peak rate of runoff from a 10-year, 24-hour frequency storm. Velocity shall be computed by using Manning’s Formula with a coefficient of roughness “n” as follows:

Lining	“n” Value
Concrete	
Trowel finish.....	0.012 – 0.014
Float finish.....	0.013 – 0.017
Shotcrete.....	0.016 – 0.022
Flagstone.....	0.020 – 0.025
¹ / ₂ Riprap - (Angular Rock)	$n = 0.047(D_{50} S)^{0.147}$
Synthetic Turf Reinforcement Fabrics and Grid Pavers	Manufacturer’s recommendations

¹/₂ Applies on slopes between 2 and 40% with a rock mantle thickness of 2 x D₅₀ where:
 D₅₀ = median rock diameter (in.),
 S = lined section slope (ft./ft.) (.02 ≤ S ≤ .4)

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard contact your Natural Resources Conservation Service [State Office](#), or download it from the [electronic Field Office Technical Guide](#) for your state.

Velocity. Maximum design velocity and rock gradation limits for rock riprap-lined channel sections shall be determined using Appendix 16A, Engineering Field Handbook for slopes less than 2 percent.

Stable rock sizes and flow depths for rock-lined channels having gradients between 2 percent and 40 percent shall be determined using the following detailed design process. This design process is from **Design of Rock Chutes** by Robinson, Rice, and Kadavy.

For channel slopes between 2% and 10%:

$$D_{50} = [q(S)^{1.5}/4.75(10)^{-3}]^{1/1.89}$$

For channel slopes between 10% and 40%:

$$D_{50} = [q(S)^{0.58}/3.93(10)^{-2}]^{1/1.89}$$

$$z = [n(q)/1.486(S)^{0.50}]^{3/5}$$

D_{50} = Particle size for which 50% of the sample is finer, in.

S = Bed slope, ft./ft.

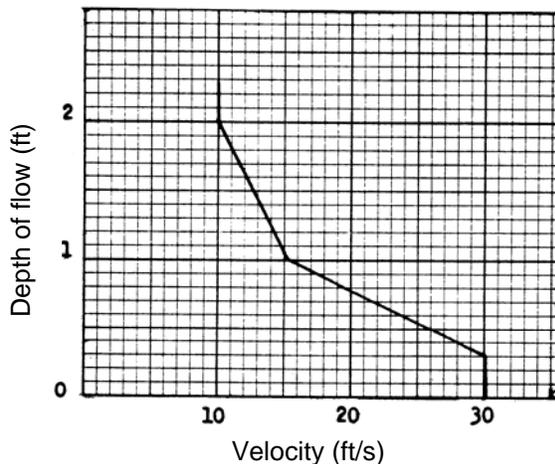
z = Flow depth, ft.

q = Unit discharge, ft³/s/ft

(Total discharge÷Bottom width)

Maximum design velocity for concrete-lined sections should not exceed those using Figure 2.

Figure 2. Maximum velocity versus depth of flow for concrete-lined channels



Maximum design velocity for synthetic turf reinforcement fabrics and grid pavers shall not exceed manufacturer's recommendations.

Except for short transition sections, flow in the range of 0.7 to 1.3 of the critical slope must be avoided unless the channel is straight. Velocities exceeding critical velocity shall be restricted to straight reaches.

Waterways or outlets with velocities exceeding critical velocity shall discharge into an energy dissipator to reduce discharge velocity to less than critical.

Side slope. The steepest permissible side slopes, horizontal to vertical, shall be:

Nonreinforced concrete:

Hand-placed, formed concrete

Height of lining, 1.5 ft or lessVertical

Hand-placed screeded concrete or mortared in place flagstone

Height of lining, less than 2 ft1 to 1

Height of lining, more than 2 ft2 to 1

Slip form concrete:

Height of lining, less than 3 ft1 to 1

Rock riprap2 to 1

Synthetic Turf Reinforcement Fabrics ..2 to 1

Grid Pavers.....1 to 1

Cross section. The cross section shall be triangular, parabolic, or trapezoidal. Cross section made of monolithic concrete may be rectangular.

Freeboard. The minimum freeboard for lined waterways or outlets shall be 0.25 ft above design high water in areas where erosion-resistant vegetation cannot be grown adjacent to the paved or reinforced side slopes. No freeboard is required if vegetation can be grown and maintained.

Lining thickness. Minimum lining thickness shall be:

Concrete.....4 in. (In most problem areas, minimum thickness shall be 5 in. with welded wire fabric reinforcing.)

Rock riprap.....Maximum stone size plus thickness of filter or bedding

Flagstone.....4 in., including mortar bed

Synthetic Turf

Reinforcement Fabrics

and Grid Pavers.....Manufacturer's Recommendations

Lining Durability. Use of non-reinforced concrete or mortared flagstone linings shall be made only on low shrink-swell soils that are well drained or where subgrade drainage facilities are installed.

Related structures. Side inlets, drop structures, and energy dissipaters shall meet the hydraulic and structural requirements for the site.

Outlets. All lined waterways and outlets shall have a stable outlet with adequate capacity to prevent erosion and flooding damages.

Geotextiles. Geotextiles shall be used where appropriate as a separator between rock, flagstone, or concrete linings and soil to prevent migration of soil particles from the subgrade, through the lining material. Geotextiles shall be designed according to AASHTO M288, Section 7.3.

Filters or bedding. Filters or bedding shall be used where appropriate to prevent piping. Drains shall be used to reduce uplift pressure and to collect water, as required. Filters, bedding, and drains shall be designed according to NRCS standards. Weep holes may be used with drains if needed.

Concrete. Concrete used for lining shall be proportioned so that it is plastic enough for thorough consolidation and stiff enough to stay in place on side slopes. A dense durable product shall be required.

Specify a mix that can be certified as suitable to produce a minimum strength of 3,000 pounds per square inch. Cement used shall be Portland cement, Types I, II, or if required, Types IV or V. Aggregate shall have a maximum size of 1-1/2 inch.

Contraction joints. Contraction joints in concrete linings, if required, shall be formed transversely to a depth of about one-third the thickness of the lining at a uniform spacing in the range of 10 to 15 feet. Provide welded wire fabric or other uniform support to the joint to prevent unequal settlement.

Rock riprap of flagstone

Stone used for riprap shall be dense and hard enough to withstand exposure to air, water, freezing, and thawing. Flagstone shall be flat for ease of placement and have the strength to resist exposure and breaking.

Mortar

Mortar used for mortared in-place flagstone shall consist of a workable mix of cement, sand, and water with a water-cement ratio of not more than 6 gallons of water per bag of cement.

CONSIDERATIONS

Cultural resources need to be considered when planning this practice. Where appropriate, local cultural values need to be incorporated into practice design in a technically sound manner.

Consider adding widths of appropriate vegetation to the sides of the waterway for wildlife habitat.

Important wildlife habitat, such as woody cover or wetlands, should be avoided or protected if possible when siting the lined waterway. If trees and shrubs are incorporated, they should be retained or planted in the periphery of the grassed portion of the lined waterways so they do not interfere with hydraulic functions and roots do not damage the lined portion of the waterway. Mid- or tall bunch grasses and perennial forbs may also be planted along waterway margins to improve wildlife habitat. Waterways with these wildlife features are more beneficial when connecting other habitat types; e.g., riparian areas, wooded tracts and wetlands.

Provide livestock and vehicular crossings as necessary to prevent damage to the waterway. Crossing design shall not interfere with design flow capacity.

Establish filter strips on each side of the waterway to improve water quality.

When designing riprap linings and specifying rock gradations, consider that rock delivered to the site is often segregated by size or does not conform exactly to the specified gradation. Adequate safety factor should be incorporated.

Cultural Resources Considerations

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Water Quantity

1. Effects upon components of the water budget, especially effects on volumes and rates of runoff, infiltration, evaporation transpiration, deep percolation, and ground water recharge.
2. Variability of the practice's effect caused by seasonal and climatic changes.

Water Quality

1. Filtering effects of vegetation on the movement of sediment and dissolved and sediment attached substances will be evaluated.
2. Effects on the visual quality of the water resources.
3. Short-term and construction effects on the quality of water resources.

PLANS AND SPECIFICATIONS

Plans and specifications for lined waterways or outlets shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose(s).

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be provided to and reviewed with the landowner. The plan shall include the following items and others as appropriate.

A maintenance program shall be established to maintain waterway capacity and outlet stability. Lining damaged by machinery or erosion must be repaired promptly.

Inspect lined waterways regularly, especially following heavy rains. Damaged areas shall be repaired immediately. Remove sediment deposits to maintain capacity of lined waterways.

Landowners should be advised to avoid areas where forbs have been established when applying herbicides. Avoid using waterways as turn-rows during tillage and cultivation operations. Prescribed burning and mowing may be appropriate to enhance wildlife values, but must be conducted to avoid peak nesting seasons and reduced winter cover. Control noxious weeds. Do not use as a field road. Avoid crossing with heavy equipment.

REFERENCES

- National Engineering Handbook, Part 650, Engineering Field Handbook: Chapter 16, Streambank and Shoreline Protection.
- Robinson, K.M., C.E. Rice, and K.C. Kadavy. 1998. Design of Rock Chutes. Transactions of ASAE, Vol. 41(3): 621-626.