List of Illustrations for Rainwater Harvesting for Drylands and Beyond, Volume 2, 2nd Edition

P.1.	Mr. Phiri in hand-dug reservoir	1
P.2.	Mr. Phiri tending his tree nursery	1
P.3.	Kayaking flooded street, Tucson	2
P.4A.	Santa Cruz River, Tucson, early 1900s	3
P.4B.	Same stretch of Santa Cruz River, Tucson, 2017	3
P.5.	Begin with long and thoughtful observation	4
Р.б.	Start at the top (highpoint) of your watershed	4
P.7.	Start small and simple	5
P.8.	Slow, spread, and infiltrate	5
P.9.	Always plan an overflow route	6
P.10.	Create a living sponge	6
P.11.	Do more than just harvest water	7
P.12.	Continually reassess your system	7
I.1.	Rain-fed bounty	13
I.2A.	Landscape actively wasting and consuming	
	resources	14
I.2B.	Landscape passively harvesting resources	14
I.3A.	Draining, water-consumptive landscape of turf	16
I.3B.	Draining, water-conserving landscape of gravel	16
I.3C.	Harvesting, water-restoring landscape	16
1.4.	Living sponge and pump	18
I.5A.	Poor soil supporting limited life	20
I.5B.	Healthy and diverse soil life supporting diversity	20
1.6.	Nutrient flows whereby soil life transforms	24
	wastes and nutrients	21
I.7A.	Depleting by vacuuming fallen-leaf resources	21
I.7B.	Enhancing by leaving leaves	21
1.8.	Condition of soil carbon sponge controls the fate of rainfall and affects climate	22
1.9.	Fog-harvesting vegetation	23
I.10.	Salt buildup with municipal water irrigation	24
I.11.	Well and field abandoned, Rajasthan, India	24
I.12.	Water-harvesting field, Rajasthan, India	24
I.13.	Check dam seeping flow weeks after last rain	25
I.14.	Available rainfall multiplied by runon	26
I.15A.	Natural native plant density without earthworks	26

I.15B.	Increased native plant density with earthworks	26
I.16.	Concrete shade structure, built before now-mature trees planted, Laporiya, India	29
1.17.	Y. Kumar, L. Singh, R. Poar, J. Singh, of GVNML	30
I.18.	Map of Laporiya, India	32
1.19.	Goats in pasture of Chaukas	33
1.20.	Sahalsagar chaukas	33
1.21.	Chaukas full of water after rain	34
1.22.	Chaukas full of grass after rain	34
1.23.	Phool Sagar earthen tank empty	34
1.24.	Phool Sagar earthen tank full	34
1.25.	Sunken, water-harvesting garden	35
1.26.	R. Poar, J. Singh with map of Laporiya	36
1.27.	Villagers on annual Efforts for Earth march	36
	0	
1.1.	Water-harvesting mooning	39
1.2.	Dendritic pattern of branching watercourses	40
1.3.	Erosion triangle	41
1.4.	Slopes in proportions, degrees, and percentages	43
1.5.	Range of slopes from 0 to 90 degrees	43
1.6.	Using line level to measure slope	44
1.7.	Using bunyip water level to measure slope	45
1.8.	Solar arc of trees and shrubs	49
1.9.	Infiltration basins, new plantings within	
	wetter oasis zone	50
1.10.	Runoff from raised pathways and road drains	
	to sunken basins	50
1.11.	Integrated landscape site plan for urban lot	52
1.12.	Integrated landscape site plan for suburban or rural lot	53
1.13.	Three important elevations	55 54
1.13. 1.14A.	Runoff from commercial/industrial site to	54
1.144.	one single-purpose basin	55
1.14B.	Runoff directed to many multipurpose basins	55
1.15A.	Too much runoff to one earthwork	56
1.15B.	Runoff turned into soak-in with multiple	
	earthworks	56
1.16.	Downspout directing water to high point	57

1.17A.	Piped overflow from one basin to another	58	2.32.	Flow-through rain gardens, very urban	90
1.17B.	Overland overflow from one basin to another	58	2.33.	Daylighted headwaters of Dolph Creek	90
1.18.	Earthworks and plantings emphasized on periphery of yards	59	2.4		0.1
1.19A.	House set low in landscape and prone	<i>JJ</i>	3.1.	Berm and basin	91 92
1.1273.	to flooding	60	3.2. 3.3.	Boomerang berms and contour berms	92 93
1.19B.	House with landscape regraded to		з.з. 3.4А.	Berm 'n basins and terraces at varying slopes Contour line identified and marked	95 94
	prevent flooding	60	3.4A. 3.4B.	Digging of berm 'n basin on contour	94 94
1.20.	Site map of property and rainfall income	63	3.5A.	Cut-away (side) view of berm 'n basin	95
1.21.	Site map, with estimated runoff and runon	65	3.5B.	Overhead (top) view of berm 'n basin	95
	volumes for each type of catchment surface	65	3.6.	Berm thickness and height ratio	96
2.1.	Series of infiltration basins along curbless street	67	3.7.	Raised path with rock-stabilized edges	96
2.1.	Lancaster side yard and winter garden	68	3.8.	Cross section, b'nb depth and width	
2.3.	Trees: atop mound, in circular berm,	00		measurement	99
2.5.	in infiltration basin	69	3.9.	Perspective view, b'nb length measurement	99
2.4A.	Infiltration basins and solar arc of young trees	70	3.10.	Berm 'n basins spacing	99
2.4B.	Trees at full size forming solar arc	70	3.11.	Contour berm and rototiller	99
2.5.	Terraced or stepped basins with overflows	71	3.12A.	Undisturbed strip speeds up revegetation	100
2.6.	Raised path between basins	71	3.12B.	Vegetation seeds adjacent bare area	100
2.7A.	Basin diameter bigger than tree canopy	72	3.13.	Speeding up revegetation with undisturbed strip	100
2.7B.	Percentage of water absorbed by tree roots,	70	3.14A.	between multiple basin sections Failed unlevel berm	100
2.0	distance from tree center	72	3.14A. 3.14B.	Successful level berm	101
2.8.	Large basin divided into small basins	72	3.1 4 5.	Line of folks stomping berm	101
2.9A.	Circular-basin measurements	74 75	3.16.	Boomerang berms stabilized with rock	101
2.9B. 2.10.	Rectangular-basin measurements Infiltration basin spillway and depth	75 75	3.17.	Spillway tips	102
2.10.	Basins constrained by narrow right-of-way	75 76	3.18A.	Poorly planned berm 'n basin	103
2.11.	Water from roof drains away from building	76 76	3.18B.	Well-planned berm 'n basin	103
2.12.	Infiltration basins in small urban yard	76	3.19.	One-rock dams placed within berm 'n basin	
2.13.	Tree crown high and basin beyond canopy	77		placed off contour	103
2.15A.	Stabilized spillways connecting terraced basins,		3.20.	Contour berms	104
	sloped site	77	3.21A.	Unfinished contour berm	104
2.15B.	Stabilized spillways connecting basins, flat site	77	3.21B.	Finished contour berm	104
2.16.	Spillway with stone stabilization	78	3.22A.	Boomerang berms overflowing to each other	105
2.17.	Planting for water needs and tolerance	79	3.22B.	Less water-tolerant tree placement	105
2.18A.	Erosive runoff over slope from downspout	80	3.22C.	Planting on raised pedestals	105
2.18B.	Stone-stabilized downspout spillway	80	3.23.	Boomerang berm with rocked overflow	106
2.18C.	Calm outlet of downspout above basin mulch	81	3.24.	Net-and-pan system of berms	106 107
2.19.	Basin between two young trees, ready for mulch	81	3.25. 3.26.	Net-and-pan berms Aleppo, Syria Native grass contour plantings	107
2.20A.	Yard with vegetation losing runoff in storms	82	3.20.	Dryfarmed contour crop plantings, Syria	107
2.20B.	Same yard with perimeter berm, raised pathway	82	3.28.	Contour plantings of veggies in wet climate	108
2.21.	Beneficial microclimate of sunken garden basin	83	3.29.	Berm as a raised path	108
2.22.	Sunken garden beds Milagro Cohousing site plan	83 84	3.30.	Burned trees felled on contour	109
2.23. 2.24A.	Milagro Cohousing site plan	84 85	3.31.	Plan view of windberms, contour berms,	.05
2.24A. 2.24B.	Milagro, newly constructed basins Milagro basins mulched and vegetated	85 85		young trees	110
2.24C.	Milagro basins indicited and vegetated Milagro basins seven years after planting	85	3.32.	Side view of windberms, young trees,	
2.25.	Low-tech subsurface clay-pot irrigation	85		harvested snow	110
2.26A.	Garden site fenced and pre-garden	86	3.33.	Contour plantings and b' nbs, Zimbabwe	112
2.26B.	Volunteers digging sunken garden beds	86		-	
2.27.	Sunken garden beds after rain	87	4.1.	Terraces with dry-laid urbanite walls	113
2.28.	Established garden beds	87	4.2.	Terraces with dry-laid stone walls	114
2.29.	Dancing sculpted figure, rain garden, Portland	88	4.3. 4.4A.	Strategies for different steepness of slope	115 117
2.30.	Celebrate the rain, Portland	89	4.4A. 4.4B.	Terrace components and measurements Earthen terrace measurements	117
2.31A.	Salmon swimming up downspout, Portland	89	4.4b. 4.5.	Height of terrace retaining wall and	11/
2.31B.	Downspout salmon, green roof, rain garden	89		depth of cut into slope	118
2.31C.	Rain garden wall plaque	89	4.6.	Narrow terraces on steep slope	118

4.7.	Terrace without retaining walls	119
4.8.	Terraces with sandstone retaining walls	119
4.9.	Retaining wall components	121
4.10A.	Tampers, homemade and purchased	121
4.10B.	Tamping with tamper	121
4.11.	Building terraces starting at bottom	123
4.12.	Terrace retaining walls' zig-zagging overflows	123
4.13.	Rock-mulch rundown overflows	124
4.14.	Earthen terrace overflows	124
4.15.	Vegetation between retaining-wall rocks	125
4.16.	Path repaired with terrace-like steps	125
4.17.	Terraced fields, Peru	126
4.18A.	Urbanite retaining walls, driveway, stairs	127
4.18B.	Urbanite retaining walls, driveway, stairs	127
4.19.	Tie stones create retaining wall steps	127
4.20.	New trinchera and field, Chihuahua, Mexico	128
4.21.	Old trinchera and field, Chihuahua, Mexico	128
4.22.	Gardens and cistern steps, Vine Street, Seattle	129
4.23.	Beckoning Cistern and terraced planters, Seattle	130
4.24.	Beckoning Cistern, second view	131
4.25.	More Vine Street water-harvesting terraces	131
4.26.	Close up of Vine Street terraced planters	131
1.20.		191
5.1.	Pipeless infiltration trench beside driveway	133
5.2.	Infiltration trench for runoff from roof and patio	133
5.3.	Canale roof drain, drain box, pipe to	
5.51	infiltration trench	135
5.4.	Berms upslope of infiltration trench	136
5.5.	Infiltration trench without pipe; overflow	
	to infiltration basin	136
5.6A.	Round mixed-sized particles, dense-graded	420
5 6 5	aggregate	138
5.6B.	Angular same-sized particles, open-graded	138
5.7A.	aggregate Pond liner and drain box	
	Canale and drain below	139
5.7B.		139
5.8.	Infiltration trench with pipe connected to downspout	140
5.9A.	Perforated pipe laid within infiltration trench	140
5.9B.	Cut-away view, perforated pipe in	140
J.9D.	infiltration trench	140
5.10A.	Before infiltration trench installation	142
5.10B.	After infiltration trench installation	142
5.11.	Infiltration trench with infiltration chamber	143
5.12A.	Deep-pipe irrigation	144
5.12B.	Rock-tube irrigation	144
5.13.	Structural soil volumes for different tree sizes	145
5.14.	Silva soil cells beneath porous paving	145
5.15.	Driveway sloped toward infiltration trench	147
5.15.	Driveway sloped toward minitation trenen	147
6.1.	Bulldozer pulling imprinter roller	149
6.2A.	Exposed, compacted soil	150
6.2B.	Imprinted soil encourages infiltration	150
6.3.	Fresh imprints	150
6.4.	Imprinting steep slope	152
6.5.	Bulldozer with self-cleaning tracks	152
6.6.	Roller core of imprinter and alternating star rings	153
0.0.	the set of imprinter and alternating star fings	

6.7.	Imprinter teeth, standard and steep-slope	155
6.8.	Millet growing in zai pits, Burkina Faso	156
6.9A.	Marking lines where zai pits to be dug	157
6.9B.	Digging zai pits	157
6.9C.	Adding manure and compost to zai pits	157
6.10.	Zai pits integrated with rock bunds	157
6.11A.	Before intensive short duration herding/dunging/urinating, Zimbabwe	158
6.11B.	After intensive short duration	100
0.110.	herding/dunging/urinating, Zimbabwe	158
6.11C.	Grass response to impact after rainy season	158
6.11D.	Mass of fungi in impacted area	158
6.11E.	Grass response three years after impact	158
6.12.	Imprinter squashing tumbleweed	159
6.13.	Dust storm on denuded land, Marana, AZ	160
6.14A.	Imprinting and seeding	160
6.14B.	Post-imprinting	160
7.1A.	Bare earth, high evaporation, small tree	161
7.1B.	Mulched earth, low evaporation, large tree	161
7.2.	Bladed land versus healthy sponge-like watershed	162
7.3A.	Strip-mining leaves and nutrients = more work	164
7.3B.	Costs increase with purchased fertilizer	164
7.4A.	Harvesting leaf-drop and nutrients = less work	164
7.4B.	Let nature do the work	164
7.5.	Free mulch delivered	165
7.6A.	Before. Compact, bare soil	166
7.6B.	Capturing leaf drop and cut-up prunings	166
7.6C.	After. Sponge-like, fertile soil	166
7.7.	Layered mulch	167
7.8A.	Unanchored mulch washed off slope	168
7.8B.	Mulch anchored within basins	168
7.9A.	Mulching between seedlings	170
7.9B.	Mulched garden with mature vegetables	170
7.10.	Vertical mulch	171
7.11.	Bermuda grass uncontrolled versus hunted	172
7.12.	Fruit-tree urinal	173
7.13A.	Newly planted tree beside hole for junk mail	176
7.13B.	Hole filled with junk mail	176
7.13C.	Junk mail and hole topped with straw	176
7.14A.	Contour berms of woodchips	178
7.14B.	After. Abundant growth of new grass	179
7.15A.	Before – impervious concrete drainageway	180
7.15B.	After –porous cobble infiltrationway	180
8.1A.	Impervious landscape	181
8.1A. 8.1B.	Mountain Avenue as a river of runoff	181
8.2.	Highway runoff grows bigger trees	182
8.3.	Two-track driveway paves 60% less area	183
8.4.	Narrow street and mesquite trees	183
8.5.	Traffic circle with curb cuts in concave	105
5.5.	intersection	184
8.6.	Traffic circle with curb cuts in convex	
	intersection	184
8.7.	Water-harvesting chicanes, speed hump, trees	184
8.8.	Chicanes or pullouts with flush curbs	185
8.9.	Sunken planting basin in cul-de-sac	185

8.10.	Snow shows unused paved areas	186	8.47A.	Small space eddy basin no steel grate	217
8.11.	Pavement sloped to water trees, Israel	186	8.47B.	Small backwater basin elevation view	217
8.12.	Curb cut directs street runoff to landscape	187			
8.13.	Shade tree contour basin cut into parking lot	188	9.1.	Diversion swale	219
8.14.	Permeably paved parking lot	189	9.2.	Sheet flow spreader below culvert	220
8.15.	Raised garden path mulched with woodchips	191	9.3.	Diversion swales as overflows from one basin	
8.16.	Porous aggregate bicycle parking	191		to another	220
8.17A.	Round mixed-sized, dense-graded aggregate	192	9.4.	Diversion swales as inlet and outlet channels	221
8.17B.	Angular same-sized, open-graded aggregate	192	9.5.	Erosional and depositional slopes	222
8.18A.	Gravelpave2 geocells installation,	4.0.2	9.6A.	Using water to level to mark contour line	223
0.400	Milagro Cohousing	193	9.6B.	Using water level to mark diversion swale's path	223
8.18B.	Completed Gravelpave2 parking lot	193	9.7.	Diversion berm, speed hump directing runoff to basin	225
8.19.	UNI Eco-Stone open-jointed paving blocks	194	9.8A.	Stabilized diversion swale to collect hillside	223
8.20.	Salvaged concrete sidewalk patio	195	2.07.	runoff, Jaipur Fort, India	226
8.21.	Open-jointed paving block construction components	195	9.8B.	Diversion swale entering Jaipur Fort	226
8.22A.	Runoff and sediment misdirected over pavement		9.8C.	Diversion swale directs water to Fort's cistern	226
8.22B.	Runoff correctly directed to sunken basins	197	9.9.	Berm thickness and height	227
8.23.	Layered courses of pavement	197	9.10.	Water pooling and spreading at swale's end	228
8.24.	Stabilized edging for porous pavement	197	9.11.	Spreader drain's berm-less overflow creates	
8.25A.	Zemachs in garden, where driveway used to be	199		calm sheetflow	228
8.25B.	Zemachs' and neighbor's yard	200	9.12.	One-rock-high check dams within diversion swale	229
8.26A.	Before Street Edge Alternatives (SEA) Project	200	9.13.	Dirt road as an eroding waterway	230
8.26B.	Seattle street after SEA renovation	201	9.14.	Rolling dip drains dirt road	231
8.26C.	Same SEA street, with maturing vegetation	201	9.15.	Bulldozer track imprints harvest water	231
8.27.	Curb cuts along residential street,	201	9.16.	Rolling dip sized to typical vehicle driving over it	232
0.27.	sidewalk strip and scuppers	201	9.17.	Rolling dip, plan view	233
8.28.	Curb cuts along arterial street, Portland	202	9.18.	Waist-high grass that rolling dip waters	234
8.29.	Water-harvesting parking lot, Portland	202	9.19.	Typical plug and spread complex	236
8.30A.	Tucson right-of-way, 1994, before		9.20.	Key features of a plug and spread structure	237
	rainwater harvesting	204	9.21A.	Initial results of plug and pond, plug	
8.30B.	Tucson right-of-way, 2006, after			and spread, and worm ditch, Valles Caldera,	220
	water harvesting and plantings	204	0.210	New Mexico	238
8.31.	Basins extending to existing driveway curb cut	204	9.21B. 9.22.	New plug and pond enhances results	239 240
8.32A.	Tucson right-of-way, 1994, before trees	205	9.22. 9.23.	Plug and pond regenerates a wetland	240 240
8.32B.	Tucson right-of-way, 2004, after trees	205		Harvesting runoff from rock outcrop, Kenya Creek is buried under street, Los Angeles	
8.32C.	Tucson right-of-way, 2014, after curb cuts	205	9.24A. 9.24B.	6	241 241
8.33.	Curb cut, basin, pedestrian platform	207	9.24b. 9.25.	Creek is daylighted, Los Angeles Raised berm accessways and sunken basins	241
8.34A.	Curb-cut and basin detail drawing, plan view	209	9.25. 9.26.	-	
8.34B.	Curb-cut detail drawing, elevation views	209	9.20. 9.27.	Water flow from primary ridge to primary valley Keypoint and keyline cultivation patterns	242 243
8.35A.	Concrete cutting, beginning horizontal curb cut	210	9.27. 9.28.	Keypoint and keyline in a landscape	243
8.35B.	Concrete cutting, angled curb cut	210	9.28. 9.29A.	Snow berm directs snow melt into yard	243 244
8.36.	Smoothing cuts and edges with grinder	210	9.29A. 9.29B.	Snow berm directs snow melt into yard	244 244
8.37A.	Finished curb cuts, basins, trees, 2007	211	9.30.	Laying out spreader drain, contour line	244
8.37B.	Curb cuts, basins, and vegetation, 2013	211	9.30. 9.31.	Marking spreader drain route	
8.38.	Curb coring with hand-held drill	212	9.31. 9.32.	Grader cutting diversion swale	246 246
8.39.	Curb core directing stormwater to basin	212	9.33A.	Original slope	240
8.40.	Finished core with minimum drop to mulch	212	9.33A. 9.33B.	Early passes with road grader	247
8.41.	Well-done curb core cuts dip in street gutter	212	9.336. 9.33C.	Drain with basin (latter passes with grader)	247
8.42A.	Poorly-placed utilities deaden right-of-way	213	9.33D.	Completed drain	247
8.42B.	Well-placed utilities allow life to grow	213	9.34A.	Diversion swale harvesting runoff, 1997	248
8.43.	Backwater basin key elevation relationships	214	9.34A. 9.34B.	Same diversion swale in 2013	248 248
8.44.	Streetside basin key elevation relationships	215	9.34b. 9.35.	Completed swale, surge basin, windbreak	248
8.45.	Increasing street runoff-harvesting capacity with vertical mulch and connecting basins	215	9.35. 9.36A.	Elevation view, Village Homes	240 249
8.46A.	Small space eddy basin with steel grate	215	9.36A. 9.36B.	Plan view of Village Homes, diversion swales	249 250
8.46B.	Small space eddy basin with steel grate	216	9.30b. 9.37A.	Buried Gheong Gye Cheon River, South Korea	250
0. 100.	Sman space eady basin close up	210	2.2711.	balled Greens are cheori fiver, south forea	271

8.47A.	Small space eddy basin no steel grate	217
8.47B.	Small backwater basin elevation view	217
9.1.	Diversion swale	219
9.2.	Sheet flow spreader below culvert	220
9.3.	Diversion swales as overflows from one basin	220
2.2.	to another	220
9.4.	Diversion swales as inlet and outlet channels	221
9.5.	Erosional and depositional slopes	222
9.6A.	Using water to level to mark contour line	223
9.6B.	Using water level to mark diversion swale's path	223
9.7.	Diversion berm, speed hump directing runoff	
	to basin	225
9.8A.	Stabilized diversion swale to collect hillside	226
9.8B.	runoff, Jaipur Fort, India Diversion swele entering Jaipur Fort	226
9.8C.	Diversion swale entering Jaipur Fort Diversion swale directs water to Fort's cistern	226
9.9.	Berm thickness and height	220
9.10.	Water pooling and spreading at swale's end	227
9.11.	Spreader drain's berm-less overflow creates	220
2.11.	calm sheetflow	228
9.12.	One-rock-high check dams within diversion swale	229
9.13.	Dirt road as an eroding waterway	230
9.14.	Rolling dip drains dirt road	231
9.15.	Bulldozer track imprints harvest water	231
9.16.	Rolling dip sized to typical vehicle driving over it	232
9.17.	Rolling dip, plan view	233
9.18.	Waist-high grass that rolling dip waters	234
9.19.	Typical plug and spread complex	236
9.20.	Key features of a plug and spread structure	237
9.21A.	Initial results of plug and pond, plug	
	and spread, and worm ditch, Valles Caldera, New Mexico	238
9.21B.	New plug and pond enhances results	230
9.216.	Plug and pond regenerates a wetland	239
9.23.	Harvesting runoff from rock outcrop, Kenya	240
9.24A.	Creek is buried under street, Los Angeles	241
9.24B.	Creek is daylighted, Los Angeles	241
9.25.	Raised berm accessways and sunken basins	242
9.26.	Water flow from primary ridge to primary valley	242
9.27.	Keypoint and keyline cultivation patterns	243
9.28.	Keypoint and keyline in a landscape	243
9.29A.	Snow berm directs snow melt into yard	244
9.29B.	Snow berm directs snow melt into rain garden	244
9.30.	Laying out spreader drain, contour line	245
9.31.	Marking spreader drain route	246
9.32.	Grader cutting diversion swale	246
9.33A.	Original slope	247
9.33B.	Early passes with road grader	247
9.33C.	Drain with basin (latter passes with grader)	247
9.33D.	Completed drain	247
9.34A.	Diversion swale harvesting runoff, 1997	248
9.34B.	Same diversion swale in 2013	248
9.35.	Completed swale, surge basin, windbreak	248
9.36A.	Elevation view, Village Homes	249
9.36B.	Plan view of Village Homes, diversion swales	250
9.37A.	Buried Gheong Gye Cheon River, South Korea	251

0.270		
9.37B.	Daylighted Gheong Gye Cheon River and ancient bridge	251
9.37C.	Daylighted Gheong Gye Cheon River	251
10.1.	Eroded Ancheta Creek, New Mexico	254
10.2.	Grasses and sedges reestablished upslope	
	of one-rock dam	254
10.3.	Ancheta Creek wetland vegetation reestablished	255
10.4.	Grasses and sedges growing uphill	255
10.5.	Waterway and its floodplains	256
10.6.	Evolution of a water channel	257
10.7.	Impact of vegetation, erosion, and water table	
	on each other	258
10.8A.	Headcuts dehydrating meadow	259
10.8B.	Headcuts stabilized	259
10.9. 10.10.	Log and rock step down	260
10.10.	Patterns within a healthy meandering waterway	261
10.11.	Water flows perpendicular to what it	201
	flows over	262
10.12.	Increasing force of flow at curb cut inlet	263
10.13.	Placement of in-channel strategies based	265
10.14.	on landform Flow patterns in a "play creek"	265 266
10.14.	Bookended rock in one-rock dam	266
10.15.	Tools and materials for rockwork	267
10.17.	Rock litter for carrying rock	267
10.18.	Rock-mulch rundown	269
10.19A.	Headcut elevation view	270
10.19B.	Rock-mulch rundown elevation view	270
10.20A.	Rolling dip diverts water off road	271
10.20B.	Hybrid structure combining rock-mulch	
	rundown, rock-lined plunge pool, and sheet flow spreader	271
10.20C.	Structure during runoff event	271
10.20C.	Structure one year after implementation	271
10.21A.		272
10.21B.	Sheetflow collector stabilizing headcut	272
10.21C.	Dense vegetation two years later	272
10.22A.	Headcut and failed gabion	273
10.22B.	Multi-stepped Zuni bowl stabilizing headcut	273
10.22C.	One year later	273
10.23A.	Side view of a headcut	274
10.23B.	Side view of a Zuni bowl	274
10.24.	Looking upstream at Zuni bowl	275
10.25.	Center of one-rock dam must be low point	276
10.26A. 10.26B.	Before one-rock dam in flowing creek After one-rock dam in flowing creek	276 276
10.26B. 10.27A.	Side view of one-rock dam	270
10.27R.	Laying another one-rock dam atop the first	277
10.28.	Spacing one-rock dams in natural stream	278
10.29.	Spacing one-rock dams in road-side ditch	278
10.30.	Each one-rock dam is part of a series of	
	structures	279
10.31.	Filter dam	280
10.32A.	•	281
10.32B.	Brush sheet flow spreader one year later	281

10.33.	Effect of induced meandering	282
10.34A.	Degrading wash before induced meandering Hubble Trading Post National Historic Site	283
10.34B.	Aggrading wash after induced meandering	283
10.35.	Wicker weir schematic	284
10.36.	Picket baffle evolving a point bar	284
10.37.	Beaver dam	285
10.38.	Salmon delivering nutrients to watershed	285
10.39.	Beaver	286
10.40A.	Don Jose stormdrain outlet	287
10.40B.	Don Jose stormpark outlet	287
10.40C.	Don Jose stormpark flow during storm	287
10.41A.	Workshop in large gully, Cebolla Creek	288
10.41B.	Vegetative response in gully bottom	288
10.42.	Constructing a burrito dam	289
10.43	Working on sheet flow spreader	290
10.44.	Picket baffle and wicker weirs	291
10.45.	Weaving branches into picket baffle	291
10.46A.	Cluster of headcuts	292
10.46B.	Machine-built Zuni bowl arrests headcuts	292
10.47.	Expanding wetland in Cebolla Canyon	292
11.1.	Tree selected to provide multiple resources	294
11.2A.	Hot, bleak environment hinders community	295
11.2B.	Sheltered environment inviting community	295
11.3.	Planting for cold and warmth needs	297
11.4.	Solar arc and windbreak of trees	298
11.5.	Wind harvester of trees and shrubs	298
11.6A.	Plants placed too close together	300
11.6B.	Plants well-placed, based on expected mature size	300
11.7A.	Evergreen tree misplaced, winter sun exposure lost	301
11.7B.	Deciduous tree misplaced, so 50% winter sun exposure lost	301
11.7C.	Winter sun exposure retained	301
11.7D.	Trees maximizing winter sun and summer shade	301
11.8.	Section of two-tiered berm 'n basin at OAEC	303
11.9.	Annual irrigation demand of three native trees	305
11.10.	Annual irrigation demand of one citrus tree	305
11.11.	Annual irrigation demand of veggie garden	305
11.12A.	Planting for water needs and tolerance	306
11.12B.	Rain garden bottom zone filled	306
11.12C.	Rain garden terrace zone filled	307
11.12D.	Rain garden water infiltrated	307
11.12E.	Rain garden water within plants and soil	307
11.13.	Tree needing better drainage beside basin	308
11.14.	Food grown with harvested water	308
11.15.	Mesquite guild	310
11.16.	Tree planted within a basin without hardpan	312
11.17.	Tree growing at an angle planted straight	313
11.18A.	Pedestaling within a basin for better drainage	314
11.18B.	Planting on a basin-side terrace	314
11.19.	Protection from browsing animals, fenced tree	314
11.20.	Fencing protects base of vegetation from animals	315
11.21.	Staked young tree	315
11.22A.	Bucket drip-irrigation	317

11.22B.	Bucket with emitter hole in side	317
11.23A.	Watering at base of tree limits root expansion	318
11.23B.	Watering far from base expands root growth	318
11.24A. 11.24B.	Pruning a young dryland tree	319
	Tree after pruning and growth	319
11.25.	Three-step technique for pruning large limb	319
11.26.	Rain-irrigated cactus fruit	321
11.27. 11.28A.	Planting living totem saguaros	322 323
11.28A. 11.28B.	Girl Scouts planting a neighborhood tree, 1996	323 323
11.28Б. 11.29.	Same velvet mesquite tree, 2006	323 324
11.29.	Mesquite pancakes Mobile hammermill grinding mesquite pods	324 324
11.30.	Planting native food-bearing Christmas trees	324 325
11.51.	Flanting flative food-bearing christinas trees	525
12.1.	A bathtub/shower greywater "spring"	327
12.2.	Evaporative-cooler-drain "spring"	328
12.3.	Air-conditioner condensate drains to bare dirt	329
12.4A.	More beneficial bacteria higher in soil profile	332
12.4B.	More beneficial life higher in soil profile	332
12.10.	Collaboration of fungi and plants	332
12.6.	Harvesting greywater in cold climate greenhouse	335
12.7A.	Greywater stub-out not yet connected	338
12.7B.	Greywater stub-out connected to landscape	338
12.8.	Three-way diverter valve under sink	339
12.9.	Three-way diverter valve between	555
12.2.	toilet and sink, Ecohood	339
12.10.	Bathtub installed higher to access	
	tub's diverter valve	339
12.11.	Electric switch for three-way diverter valve	339
12.12.	Two branched-drain greywater systems	345
12.13.	Discharge of greywater into mulched basin	346
12.14.	Placement of plants near greywater outlet	347
12.15A.	Subsurface outlet chambers before	240
12 150	covering with soil Same outlet chambers covered with soil	349
12.15B.		349
12.15C. 12.16.	Earthworms from within the outlet chambers	350
12.16.	Interior of healthy outlet chambers "Failed" outlet chambers	350 350
12.17.	Failed undersized chamber system	350 351
12.18.	Checking where in the landscape	551
12.19.	gravity can distribute greywater	351
12.20.	Sample site plans with average	
	annual greywater discharge	352
12.21.	Conducting soil infiltration test	354
12.22.	Four options for diverting and	
	distributing greywater flow	356
12.23.	Branched-drain system under construction	357
12.24.	Measuring 2% slope on greywater pipe	357
12.25.	Outdoor tree shower	358
12.26.	Outdoor bath	358
12.27.	Outdoor shower schematic	358
12.28.	Multi-drain pipe system for outdoor shower	359
12.29A.	Multi-drain pipe system for washing machine	359
12.29B.	Multi-drain pipe system for outdoor washer	359
12.30A.	Multi-drain pipe system for indoor washer	360
12.30B.	Multi-drain pipe system for indoor washer, expanded view	360
	expanded view	200

12.31A.	Bucket your shower's greywater	360
12.31B.	Chuck it to flush toilet or to water plants	360
12.32.	Hand pump siphons tub's greywater to exterior	361
12.33.	Food caught in wire screen for kitchen sink	362
12.34.	Kitchen Resource Drain (KRD), elevation view	362
12.35.	Garden watered with KRD and rainwater	364
12.36. 12.37A.	Sapote fruit grown with rainwater and greywater	366
12.37A. 12.37B.	Wash and Well (Sitting Tree), front view Wash and Well, back view	367 367
12.37Б. 12.37С.	Multi-drain greywater system for washer	507
12.57 С.	and water filter	367
12.38.	Alluvial fan of lint from community laundry	368
12.39.	AC condensate overflows from cistern	
	to pond, CAPLA	370
12.40.	Urban canyons can be transformed to lush canyons with their harvested "wastes"	370
	fush canyons with then harvested wastes	570
E.1.	Wasteful path to scarcity	374
E.2.	Stewardship path to abundance	375
A1.1.	Bunyip water level	379
A1.2.	Testing the bunyip level; water is level	380
A1.3.	Removing air bubbles from tubing	381
A1.4A.	Non-vertical bunyip stake gives incorrect reading	382
A1.4B.	Bunyip stake vertical for correct reading	382
A1.5.	Leapfrogging the bunyip to mark contour line	382
A1.6A.	Bunyip shows land slopes toward house	383
A1.6B.	Using a bunyip, confirming slope drains away from house	384
A1.6C.	Celebrating completion of water-harvesting	704
//1.00.	landscape	385
A1.7.	A-frame level	385
A1.8A.	Calibrating A-frame, step one	386
A1.8B.	Calibrating A-frame, step two	386
A1.8C.	Calibrating A-frame, final step	386
A1.9.	Using A-frame level, finding and	200
44.40	marking contour line	386
A1.10. A1.11A.	Line-level A-frame	387
AT.TTA.	Using laser level to find reference elevation of street-side basin's curb cut inlet	388
A1.11B.	Measuring depth of basin in relation to inlet	388
	Measuring planting terrace elevation in	
	relation to inlet	389
A1.11D	Measuring the basin's downstream	
	top zone in relation to inlet	389
A1.12.	Arrow on laser's receiver signifies direction receiver must be moved to find level	389
A1.13.	Checking planting terrace elevation in	505
////.	relationship to inlet with less expensive	
	laser level	390
	Tool box level measuring slope of pipe	390
	Close up of tool box level bubble vial	390
A1.14C.	Vari-pitch vial turned to be viewed from above	390
47.4		
A3.1.	Plan view of KRD, composting toilet, and greywater system	394
A3.2.	KRD with inspection pipe doubling as	577
	auxiliary vent	395