APPENDIX A

Representative Project Photographs – Final 2008 Tamarisk Management Report Phase II-B
Management & Control of Tamarisk and Other Invasive Vegetation at Backcountry Seeps, Springs and Tributaries in Grand Canyon National Park



Picture 1. The hard working crew, spring 2006.



Picture 2. Transportation to work sites via oar-powered rafts.



Picture 3. Recording transect point intercept data.



Picture 4. Installing and retaking photopoints.



Picture 5. Hualapai Tribal representative Sharon Wilder collecting soils data.

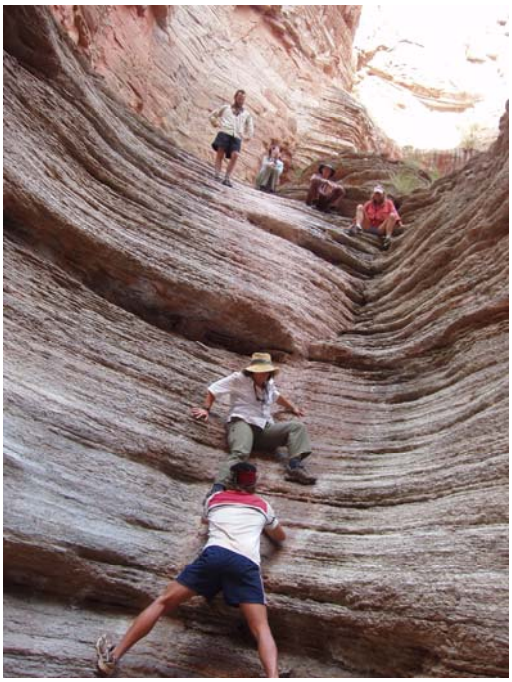


Picture 6. Drying out plant presses each afternoon at camp.

APPENDIX A

Representative Project Photographs – Final 2008 Tamarisk Management Report Phase II-B

Management & Control of Tamarisk and Other Invasive Vegetation at Backcountry Seeps, Springs and Tributaries in Grand Canyon National Park



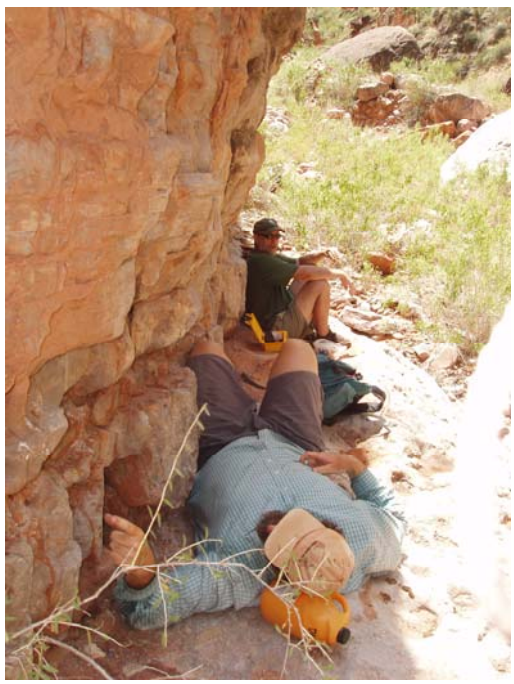
Picture 7. Spotting one another on the climb down at National Canyon.



Picture 8. Hydrology data team working at Topaz Canyon.



Picture 9. Monitoring crew makes dinner after a long day reading transects.



Picture 10. Mapping crew takes a break to find shade in the Mojave Desert.

APPENDIX A

Representative Project Photographs – Final 2008 Tamarisk Management Report Phase II-B
Management & Control of Tamarisk and Other Invasive Vegetation at Backcountry Seeps, Springs and Tributaries in Grand Canyon National Park



Picture 11. Pulling seedlings on the way back from re-reading transects at Trail Canyon.



Picture 12. Carefully collecting teddy bear cholla.



Picture 13. Mohawk Canyon hydro point in foreground and transect team in background.



Picture 14. Three Springs transect 3B end showing dense native vegetation.



Picture 15. Granite Park Transect 2A start point.



Picture 16. Comparing notes on the transect line.

APPENDIX A

Representative Project Photographs – Final 2008 Tamarisk Management Report Phase II-B

Management & Control of Tamarisk and Other Invasive Vegetation at Backcountry Seeps, Springs and Tributaries in Grand Canyon National Park



Picture 17. The hard working river crew, fall 2006.



Picture 18. Backpacking across the Tonto to Slate Creek.



Picture 19. Starting the day with warm-up stretches.



Picture 20. Volunteers hard at work slaying tamarisk.



Picture 21. Spraying stumps with herbicide.



Picture 22. Repairing stainless steel herbicide sprayers.

APPENDIX A

Representative Project Photographs – Final 2008 Tamarisk Management Report Phase II-B

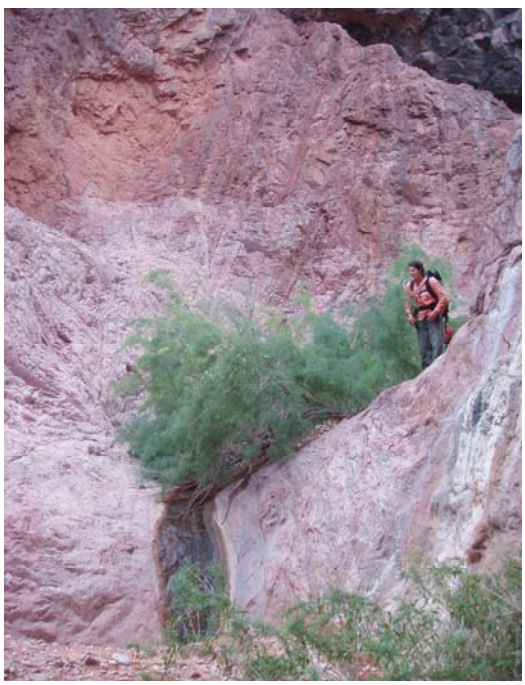
Management & Control of Tamarisk and Other Invasive Vegetation at Backcountry Seeps, Spring and Tributaries in Grand Canyon National Park



Picture 23. Hualapai crew members make fry bread.



Picture 24. Fierce boatwomen tackle tamarisk when not on the oars.



Picture 25. 190 Mile Canyon tamarisk thicket before.



Picture 26. 190 Mile Canyon tamarisk thicket after cutting crew.

APPENDIX A

Representative Project Photographs – Final 2008 Tamarisk Management Report Phase II-B

Management & Control of Tamarisk and Other Invasive Vegetation at Backcountry Seeps, Springs and Tributaries in Grand Canyon National Park



Picture 27. Photopoint and data collection in the fading light.



Picture 28. Teamwork removing giant tamarisk from canyon seep.



Picture 29. Excavating and cutting tamarisk from drainage bottom.



Picture 30. A moment for recording data.



Picture 31. Crew leaders take control of the kitchen.



Picture 32. A bird's eye view of river camp.

APPENDIX A

Representative Project Photographs – Final 2008 Tamarisk Management Report Phase II-B

Management & Control of Tamarisk and Other Invasive Vegetation at Backcountry Seeps, Springs and Tributaries in Grand Canyon National Park



Picture 33. Boatmen rigging boats with gear, tools and supplies for 20 days on the river.



Picture 34. Manuel accessing a tricky spot in National Canyon.



Picture 35. Tamarisk removal is a community effort.



Picture 36. Refilling Garlon sprayers.



Picture 37. Applying Garlon 4 to cut stumps.



Picture 38. Grand Canyon Youth (GCY) participant removing camelthorn (*Alhagi maurorum*) at Unkar.



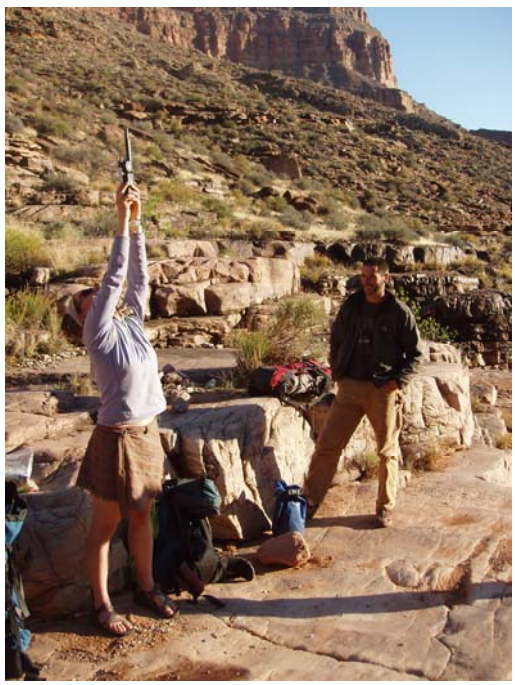
Picture 39. NPS boatmen work to cut down trees.



Picture 40. Close-up of the combo method with both cut and girdled trees.



Picture 41. Backpacking crew cooking dinner at Slate Creek.



Picture 42. Melissa, crew leader at Slate Creek checking in via sat phone with park dispatch.

APPENDIX A

Representative Project Photographs – Final 2008 Tamarisk Management Report Phase II-B

Management & Control of Tamarisk and Other Invasive Vegetation at Backcountry Seeps, Springs and Tributaries in Grand Canyon National Park



Picture 43. The hard-working tamarisk monitoring crew, spring 2007.



Picture 44. Crew leaders, volunteers and boatmen make dinner together.



Picture 45. Monitoring team at work estimating cover classes.



Picture 46. All participants learn the hydrology protocols.



Picture 47. Native plants prospering where tamarisk has been removed.



Picture 48. Recovery of willows and arrow-weed at Granite Park.



Picture 49. Crew leaders revisiting soil sampling protocols.



Picture 50. Globemallow blooming in tamarisk debris.



Picture 51. Collecting total vegetation volume (TVV) data on transects.

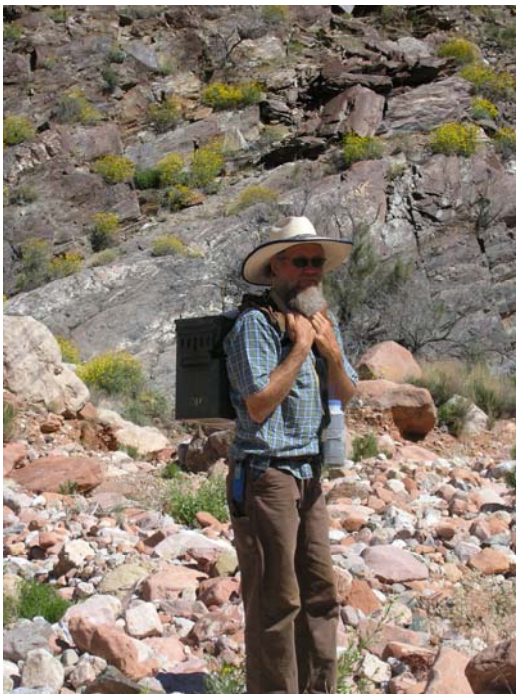


Picture 52. Wendy Hodgson collecting plants in transect areas.

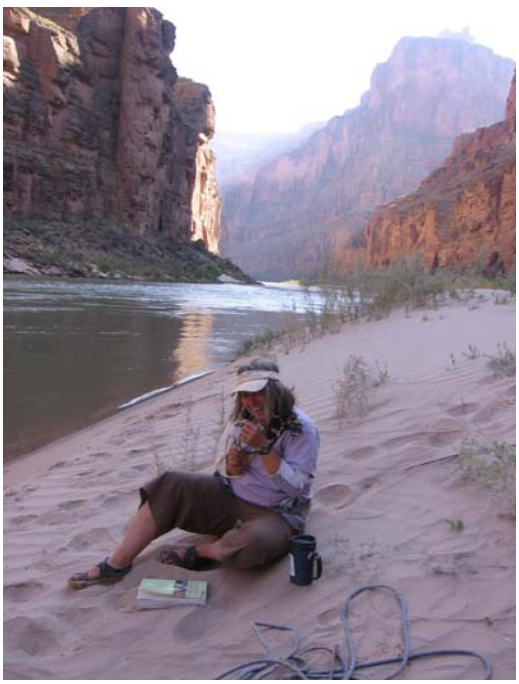
APPENDIX A

Representative Project Photographs – Final 2008 Tamarisk Management Report Phase II-B

Management & Control of Tamarisk and Other Invasive Vegetation at Backcountry Seeps, Springs and Tributaries in Grand Canyon National Park



Picture 53. Hauling herbicide supplies.



Picture 54. Plant identification with a dislocated shoulder.



Picture 55. Cactus flower collection.



Picture 56. The hard working monitoring crew.



Picture 57. The fun-filled tamarisk monitoring crew, April 2008.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP L Fork Horn 1	396584	3993995	1	11/9/06	Pre	Granite/schist boulder on creek left about 50m up canyon from a large pourover. Cannot pass this pourover without a rope.	Looking up drainage at TAMRAM thicket.
PP L Fork Horn 1	396584	3993995	1	11/9/06	Post	"	Post work.
PP L Fork Horn 1	396584	3993995	2	11/9/06	Pre	"	Looking down canyon at pourover.
PP L Fork Horn 1	396584	3993995	A	11/9/06	Pre	"	Kari at photopoint rock.
PP R Fork Horn 1	396639	3994020	1	9/6/06	Pre	Sections starts at chockstone boulder in the drainage, impassable without rope.	Looking down canyon over chockstone boulder.
PP R Fork Horn 1	396639	3994020	2	11/9/06	Pre	"	Looking up canyon from the start point of the right fork of Horn.
PP R Fork Horn 1	396639	3994020	A	11/9/06	Pre	"	Kari's backpack at photopoint on creek left just before chockstone.
PP R Fork Horn 1	396639	3994020	1	10/10/07	Post	"	Photo update.
PP R Fork Horn 1	396639	3994020	2	10/10/07	Post	"	Photo update.
PP Salt Creek 1	395049	3995326	1	10/20/00	Pre	300m up canyon - corners from river	No description given. When re-taking this photo, use the 2004 photo - they may be in different locations.
PP Salt Creek 1	395049	3995326	A	10/20/00	Pre	"	Chris at photopoint.
PP Salt Creek 1	395049	3995326	1	6/1/04	Post	"	Post treatment photo update.
PP Salt Creek 1	395049	3995326	A	6/1/04	Post	"	Different A view
PP Salt Creek 2-1	394761	3995519	1	11/11/06	Pre	Beginning of Salt Creek section 2. Starts at pourover about 200 to 250 meters below the trail. No GPS coverage. UTMs taken from map. 11/07/2007: Photos taken from schist ledge on creek left in between two pouroffs and just below a Tapeats monolith.	Looking downstream at impassable pourover. Pourover is about 200 ft plus. Can't see the bottom.
PP Salt Creek 2-1	394761	3995519	2	11/11/06	Pre	"	Up canyon view.
PP Salt Creek 2-1	394761	3995519	B	11/11/06	Pre	"	Large monolith Tapeats structure to creek right of photopoint spot.
PP Salt Creek 2-1	394761	3995519	1	11/7/07	Post	"	View downstream at impassable pouroff.
PP Salt Creek 2-1	394761	3995519	2	11/7/07	Post	"	View up canyon.
PP Salt Creek 2-1	394761	3995519	A	11/7/07	Pre	"	Pencil pointing at PP.
PP Salt Creek 2-1	394761	3995519	B	11/7/07	Post	"	Large Tapeats monolith.
PP Salt Creek 2-2	394930	3995353	1	11/11/06	Pre	No GPS - this is a total estimate from map and could be way off, try again to get UTMs in field or place on map. This is on creek right at the base of the tapeats monolith.	Looking at seepy wall with TAMRAM.
PP Salt Creek 2-2	394930	3995353	1	11/11/06	Post	"	Post work.
PP West Fork of Salt 1	395217	3994028	1	11/8/07	Pre	Taken from first sandstone ledge in drainage as you come off Tonto Trail next to short bus sized black and salmon colored limestone boulder. This is about 10 m below Tonto Trail on creek right.	View upstream of TAMRAM.
PP West Fork of Salt 1	395217	3994028	1	11/8/07	Post	"	Post work.
PP West Fork of Salt 1	395217	3994028	A	11/8/07	Pre	"	Pencil pointing at PP.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Cedar Spring 1	393879	3994533	1	11/8/07	Post	Taken from a flat Tapeats and salmon colored boulder that is the size of a 19" TV. This is about 10 m downstream from a mature willow on creek left.	Post work.
PP Cedar Spring 1	393879	3994533	1	11/8/07	Pre	"	View downstream looking at TAMRAM.
PP Cedar Spring 1	393879	3994533	A	11/8/07	Pre	"	Pen pointing at PP.
PP Drainage east of Cedar Springs	394215	3994486	1	11/11/06	Pre	This is where this section begins. These TAMRAM are not doing well.	On trail, looking at TAMRAM.
PP Drainage east of Cedar Springs	394215	3994486	2	11/11/06	Pre	"	On trail, looking at TAMRAM.
PP Drainage east of Cedar Springs	394215	3994486	3	11/11/06	Pre	"	Looking down at TAMRAM.
PP Topaz 1	385586	3995585	1	4/28/05	Pre	1150m elevation. 25-30 m down from a dry waterfall. This was the highest point reached in the canyon. It is a scramble to get further. UTM's came from tamarisk mapping data form. They are the start point UTM's.	Looking down canyon.
PP Topaz 1	385586	3995585	2	4/28/05	Pre	"	Looking up canyon.
PP Topaz 1	385586	3995585	3	4/28/05	Pre	"	Looking canyon left.
PP Topaz 1	385586	3995585	A	4/28/05	Pre	"	Roger at photopoint.
PP Topaz 1	385586	3995585	1	4/14/08	Post	"	Photo update.
PP Topaz 1	385586	3995585	2	4/14/08	Post	"	Photo update.
PP Topaz 1	385586	3995585	3	4/14/08	Post	"	Photo update.
PP Topaz 2	387726	3996878	1	11/9/06	Pre	Taken from a 2x1m Redwall limestone boulder on creek right. This sits on top of 7x10m Tapeats slab that is half buried.	Looking downstream.
PP Topaz 2	387726	3996878	1	11/9/06	Post	"	Post work.
PP Topaz 2	387726	3996878	2	11/9/06	Pre	"	Looking upstream.
PP Topaz 2	387726	3996878	2	11/9/06	Post	"	Post work.
PP Topaz 2	387726	3996878	A	11/9/06	Pre	"	Rachel on PP rock taken from the north side of drainage. Taken from 5m downstream with a Tapeats narrows in the background.
PP Topaz 2	387726	3996878	1	4/14/08	Post	"	Photo update.
PP Topaz 2	387726	3996878	2	4/14/08	Post	"	Photo update.
PP Topaz 7	385860	3996004	1	4/24/06	Pre	Taken about 80m into the muav narrows from a medium sized boulder on creek left. There is a seep in the wall on creek right. There is a significant change in the vegetation.	Looking downstream towards narrows at the water.
PP Topaz 7	385860	3996004	2	4/24/06	Pre	"	Looking upstream at seeps.
PP Topaz 7	385860	3996004	A	4/24/06	Pre	"	Kelly at photopoint. Taken from about 10m downstream.
PP Topaz 7	385860	3996004	1	4/14/08	Post	"	Photo update.
PP Topaz 7	385860	3996004	2	4/14/08	Post	"	Photo update.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Topaz 8	385505	3995829	1	11/9/06	Pre	Taken from a medium size limestone reddish boulder in the middle of the drainage. There is a medium sized birchleaf buckthorn about 5m away.	Looking upstream, no TAMRAM.
PP Topaz 8	385505	3995829	2	11/9/06	Pre	"	Looking downstream.
PP Topaz 8	385505	3995829	A	11/9/06	Pre	"	Travis at photopoint. Taken from about 10m upstream.
PP Topaz 8	385505	3995829	1	4/14/08	Post	"	Photo update.
PP Topaz 8	385505	3995829	2	4/14/08	Post	"	Photo update.
PP Topaz Hydro 1	387730	3996874	1	4/14/08	Post	Sandy area with gravel where creek comes to surface. The creek flows next to steep boulder slope on creek left.	Downstream 20m from hydro point looking back upstream at hydro spot.
PP Topaz Hydro 1	387730	3996874	2	4/14/08	Post	"	20m upstream looking at backpack which marks the spot. View looking downstream.
PP Topaz Hydro 1	387730	3996874	3	4/14/08	Post	"	20m away on boulder in rock island looking towards hydro point. Backpack marks the spot.
PP Topaz Hydro 1	387730	3996874	4	4/14/08	Post	Sandy area with gravel where creek comes to surface. The creek flows next to steep boulder slope on creek left.	Looking downstream and close up.
PP Topaz Hydro 6	0	0	1	4/14/08	Pre	Small pool at base of dry falls.	Looking up at dry falls. Hydro point is below dry fall.
PP Topaz Hydro 6	0	0	2	4/14/08	Pre	"	From hydro point looking down creek.
PP Topaz Hydro 6	0	0	3	4/14/08	Pre	"	Close up view of hydro point.
PP Topaz Hydro 7	385885	3996054	1	4/14/08	Pre	Muav limestone contact with creekbed. The bottom of muav limestone narrows.	15m downstream of first muav pool looking back upstream to hydro point.
PP Topaz Hydro 7	385885	3996054	2	4/14/08	Pre	"	25m upstream of hydro point looking down creek.
PP Topaz Hydro 7	385885	3996054	3	4/14/08	Pre	"	Close up view.
PP Topaz Hydro 8	385565	3995825	1	4/14/08	Pre	Small pool near shale ledges on creek left.	20m away, looking up creek. Pool is near backpack.
PP Topaz Hydro 8	385565	3995825	2	4/14/08	Pre	"	Looking downcreek. Pool at orange backpack.
PP Topaz Hydro 8	385565	3995825	3	4/14/08	Pre	"	10m away looking at shaley deposits in muav.
PP Topaz Hydro 8	385565	3995825	4	4/14/08	Pre	"	Close up view of pool.
PP Topaz T1A End	387766	3996880	1	4/23/06	Pre	End is near a large white prominent boulder.	Looking u canyon at transect tape through a TAMRAM thicket on creek right.
PP Topaz T1A End	387766	3996880	A	4/23/06	Pre	"	Transect tape is at the base of Kari's feet. There is a large white prominent boulder about 5m up canyon.
PP Topaz T1A End	387766	3996880	B	4/23/06	Pre	"	Kari at the end of the transect. Taken from white boulder looking down canyon.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Topaz T1A End	387766	3996880	C	4/23/06	Pre	"	Close up of transect end. Taken from about 1m away in the drainage.
PP Topaz T1A End	387766	3996880	1	4/14/08	Post	"	Standing at transect end looking up transect toward start point.
PP Topaz T1A End	387766	3996880	A	4/14/08	Post	"	Standing at 45m point looking toward endpoint.
PP Topaz T1A End	387766	3996880	B	4/14/08	Post	"	Looking at transect end from 4m down wash.
PP Topaz T1A End	387766	3996880	C	4/14/08	Post	"	Photo update.
PP Topaz T1A Start	387717	3996876	1	4/23/06	Pre	Standing at the start of transect. This is on a medium sized sandstone boulder on creek right.	Transect tape going through TAMRAM thicket on creek right.
PP Topaz T1A Start	387717	3996876	A	4/23/06	Pre	"	Kari at transect start. Taken from about 10m downstream from transect start.
PP Topaz T1A Start	387717	3996876	B	4/23/06	Pre	"	Looking at transect start showing a view across drainage from the start and start point.
PP Topaz T1A Start	387717	3996876	C	4/23/06	Pre	"	Kari on boulder where transect starts. There is a prominent light colored boulder in the background.
PP Topaz T1A Start	387717	3996876	D	4/23/06	Pre	"	The X marked on rock where metal part of transect tape starts. X is in silver paint.
PP Topaz T1A Start	387717	3996876	1	4/14/08	Post	"	Looking down transect, down canyon.
PP Topaz T1A Start	387717	3996876	A	4/14/08	Post	"	Lori at transect start, taken from 5m point on transect.
PP Topaz T1A Start	387717	3996876	B	4/14/08	Post	"	Looking at Lori standing at transect start.
PP Topaz T1A Start	387717	3996876	C	4/14/08	Post	"	Looking at start point.
PP Topaz T1A Start	387717	3996876	D	4/14/08	Post	"	Close up of start point.
PP Topaz T1B End	387830	3996874	1	4/23/06	Pre	Taken from the end of transect 1B.	Looking down canyon along transect tape on creek right. The end of the transect tape is in view.
PP Topaz T1B End	387830	3996874	2	4/23/06	Pre	"	Looking up transect.
PP Topaz T1B End	387830	3996874	1	4/14/08	Post	"	Photo update.
PP Topaz T1B End	387830	3996874	2	4/14/08	Post	"	Photo update.
PP Topaz T1B End	387830	3996874	3	4/14/08	Post	"	Looking at transect end and down canyon.
PP Topaz T1B End	387830	3996874	A	4/14/08	Post	"	Standing at 45m point looking at transect end with Lori's foot on transect end.
PP Topaz T1B End	387830	3996874	B	4/14/08	Post	"	Close up of transect end with view downs canyon.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Topaz T1B Start	387785	3996854	1	4/23/06	Pre	Transect 1B is about 30m downcanyon from Transect 1A. This is approximately 8m creek right. Taken sitting on a limestone boulder on creek right where the transect tape begins. The limestone boulder is about 40x4x2m. Tapeats is in view. Both transects (1A and 1B) are down canyon from Tapeats bedrock section.	Looking at beginning of transect where the stone holds transect tape. The X is under the rock.
PP Topaz T1B Start	387785	3996854	2	4/23/06	Pre	"	Looking at tape as it travels 50m through the plants.
PP Topaz T1B Start	387785	3996854	A	4/23/06	Pre	"	Looking at Steve sitting on limestone photopoint boulder.
PP Topaz T1B Start	387785	3996854	B	4/23/06	Pre	"	Silver X where the transect starts. It is about 1/2 way up slope of boulder. Look for X!
PP Topaz T1B Start	387785	3996854	1	4/14/08	Post	"	Photo update.
PP Topaz T1B Start	387785	3996854	2	4/14/08	Post	"	Photo update.
PP Topaz T1B Start	387785	3996854	C	4/14/08	Post	"	Looking at boulder with start point from 33m down wash.
PP Slate 1	387910	3999555	1	11/21/06	Post	Taken atop a 2x2x1m schist boulder in the drainage bottom. Colorado River is in view (just barely) when looking downstream.	Post work.
PP Slate 1	387910	3999555	1	11/21/06	Pre	"	Looking downstream at a large mature with the Colorado river (Crystal Rapid) in the background.
PP Slate 1	387910	3999555	2	11/21/06	Post	"	Post work.
PP Slate 1	387910	3999555	2	11/21/06	Pre	"	Looking across stream at TAMRAMs.
PP Slate 1	387910	3999555	3	11/21/06	Post	"	Post work.
PP Slate 1	387910	3999555	3	11/21/06	Pre	"	Looking upstream at TAMRAM aisle lining creek right.
PP Slate 1	387910	3999555	A	11/21/06	Pre	"	Taken 10m downstream of PP rock. South rim is in view behind.
PP Slate 11	384043	3997573	1	11/22/06	Post	Taken from the creek bottom. Seepy wall midway up the Muav.	Post work.
PP Slate 11	384043	3997573	1	11/22/06	Pre	"	Looking up at a mature clump of TAMRAM. S. Rim in background.
PP Slate 11	384043	3997573	A	11/22/06	Pre	"	Trevor at photopoint. Taken from tamarisk looking downstream.
PP Slate 2-1	387667	3999308	1	4/23/06	Pre	Taken from a schist outcropping on creek right above bedrock bottom between 2 TAMRAM thickets. Also about 500m up from the river. This is from the drainage bottom at the end of Slate 1 section and the beginning of Slate 2 section.	Looking up canyon at TAMRAM ticket. The Tapeats and Redwall are in view.
PP Slate 2-1	387667	3999308	2	4/23/06	Pre	"	Looking down canyon at TAMRAM and schist.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Slate 2-1	387667	3999308	A	4/23/06	Pre	"	Looking at Kari on the photopoint rock. Taken from about 5m downstream.
PP Slate 2-1	387667	3999308	1	1/9/07	Post	"	Post work.
PP Slate 2-1	387667	3999308	2	1/9/07	Post	"	Post work.
PP Slate 2-2	387254	3999004	1	3/24/07	Post	Didn't have original PPs so these are 2 photos up and downstream.	Post work - looking downstream.
PP Slate 2-2	387254	3999004	2	3/24/07	Post	"	Post work - looking upstream.
PP Slate 3-1	387274	3999023	1	1/10/07	Pre	Taken from an approx. 18m wide gradually sloping fall/pool, mostly schist and granite patio. This is about 25 min. down from the up and over.	Looking upstream.
PP Slate 3-1	387274	3999023	2	1/10/07	Pre	"	Looking downstream.
PP Slate 3-1	387274	3999023	A	1/10/07	Pre	"	Pen pointing at box sitting on PP. Taken from about 15m downstream of PP. Notice skyline.
PP Slate 3-2	387039	3998889	1	3/28/07	Pre	Taken from a nice sitting rock stream right (granite) placed in the center of a C shaped bend in the canyon. Also across from one large boulder about 12 ft. above.	Looking upstream of the canyon before the blind corner. The stream meanders through granite and stream pebbles.
PP Slate 3-2	387039	3998889	1	3/28/07	Post	"	Post work.
PP Slate 3-2	387039	3998889	2	3/28/07	Post	"	Post work.
PP Slate 3-2	387039	3998889	2	3/28/07	Pre	"	Looking downstream before the curve to the right -small triangle- like view of far away Grand Canyon view.
PP Slate 3-2	387039	3998889	3	3/28/07	Post	"	Post work - looking directly across from PP.
PP Slate 3-2	387039	3998889	A	3/28/07	Pre	"	Yellow box marks the PP. Photo taken looking upstream and to stream right.
PP Slate 3-2	387039	3998889	B	3/28/07	Pre	"	Yellow box marks PP. Taken looking upstream.
PP Slate 6	386345	3998828	1	11/22/06	Pre	Taken from a granite boulder/basement rock about 3x15x15m on creek left. This is just before a large cairn marking the up and over.	Looking down canyon. TAMRAM in drainage.
PP Slate 6	386345	3998828	1	11/22/06	Post	"	Post work.
PP Slate 6	386345	3998828	2	11/22/06	Post	"	Post work.
PP Slate 6	386345	3998828	2	11/22/06	Pre	"	View from boulder looking as close to straight down into the drainage as possible. TAMRAM and water pool in view.
PP Slate 6	386345	3998828	3	11/22/06	Post	"	Post work.
PP Slate 6	386345	3998828	3	11/22/06	Pre	"	Looking up canyon.
PP Slate 6	386345	3998828	A	11/22/06	Pre	"	Kari at photopoint. Taken from creek left. Tapeats monolith in the backdrop.
PP Slate 7	385696	3998494	1	11/22/06	Post	Taken at the top of Tapeats dryfall at the Tonto junction.	Post work.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Slate 7	385696	3998494	1	11/22/06	Pre	"	Looking below the pouroff at 2 big matures. This is down canyon.
PP Slate 7	385696	3998494	A	11/22/06	Pre	"	Jeff at photopoint. Taken from 20m below looking back up at Jeff at the top of the waterfall near a tent.
PP Slate 8	385594	3998398	1	11/22/06	Post	Taken 120 m above camp (junction of Tonto with Slate Canyon) at a Tapeats bedrock section.	Post work.
PP Slate 8	385594	3998398	1	11/22/06	Pre	"	Looking down canyon. Mature TAMRAM is on creek left.
PP Slate 8	385594	3998398	2	11/22/06	Post	"	Post work.
PP Slate 8	385594	3998398	2	11/22/06	Pre	"	Looking up canyon at many small TAMRAMs.
PP Slate 8	385594	3998398	A	11/22/06	Pre	"	Pen points at photopoint. Taken 10m upstream in creek bottom.
PP Slate 9	384909	3998132	1	11/22/06	Post	150m above the nice Bright Angel staircase that has a small cottonwood at the top.	Post work.
PP Slate 9	384909	3998132	1	11/22/06	Pre	"	Looking upstream at 2 matures in the foreground. Cottonwoods behind.
PP Slate 9	384909	3998132	A	11/22/06	Pre	"	Grant at photopoint. Taken from 7m upstream.
PP Slate Hydro 1	387667	3999308	1	4/23/06	Pre	Taken at the junction of Slate 1 and Slate 2 in schist at base of drainage about 500 meters up canyon from the river.	Melissa at hydro data pool #1 for Slate Canyon. Looking up canyon.
PP Slate Hydro 1	387667	3999308	2	4/23/06	Pre	"	Melissa in foreground with TAMRAM thicket and canyon skyline in view. Looking up canyon.
PP Slate Hydro 2	386387	3998841	1	4/23/06	Pre	This is the second hydro site and is about 150m up canyon from pourovers in schist.	Melissa, Kelly, and Steve doing hydro.
PP Slate Hydro 2	386387	3998841	2	4/23/06	Pre	"	Melissa, Kelly, and Steve doing hydro work.
PP Slate Hydro 2	386387	3998841	3	4/23/06	Pre	"	Melissa, Kelly, and Steve doing hydro work.
PP Slate Hydro 2	386387	3998841	4	4/23/06	Pre	"	Looking down canyon.
PP Upper Slate 1	382855	3996953	1	4/25/06	Pre	Photopoint boulder is 5m downstream of a large chockstone that is impassable. This is at the very top of the Redwall. Forty feet higher and crew would be in the Supai.	Looking upstream at the chockstone that was to sketchy to climb.
PP Upper Slate 1	382855	3996953	2	4/25/06	Pre	"	Looking downstream at thick vegetation.
PP Upper Slate 1	382855	3996953	A	4/25/06	Pre	"	Looking at photopoint. Taken from beneath the chockstone.
PP Upper Slate 6	385547	3998388	1	4/25/06	Pre	Taken on a Tapeats slab across from a large juniper.	Looking upstream at a limestone grey boulder with TAMRAM.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Upper Slate 6	385547	3998388	2	4/25/06	Pre	"	Looking downstream with two large boulders and some mature TAMRAMs.
PP Upper Slate 6	385547	3998388	A	4/25/06	Pre	"	Steve at photopoint. Taken from in front of an acacia tree.
PP Agate 1	384792	4000578	1	10/23/07	Pre	Standing on granite bubble on creek left. Centered on a triangle of darker rock intrusion.	Looking upstream.
PP Agate 1	384792	4000578	1	10/23/07	Post	"	Post work.
PP Agate 1	384792	4000578	2	10/23/07	Pre	"	Looking across the drainage.
PP Agate 1	384792	4000578	2	10/23/07	Post	"	Post work.
PP Agate 1	384792	4000578	A	10/23/07	Pre	"	Looking at Loren at PP from the middle of the drainage.
PP Agate 2	384619	3999921	1	10/23/07	Pre	Standing on a pink granite ledge some 15-20 feet above the drainage on creek right. This is roughly 30 m above the confluence.	Looking down the drainage.
PP Agate 2	384619	3999921	2	10/23/07	Pre	"	Looking up the drainage.
PP Agate 2	384619	3999921	1	10/24/07	Post	"	Post work.
PP Agate 2	384619	3999921	2	10/24/07	Post	"	Post work.
PP Agate 2	384619	3999921	A	10/24/07	Pre	"	Looking downstream toward PP.
PP Agate Hydro 1	384811	4000563	1	4/26/06	Pre	Taken from the last pool above a 70 ft. waterfall that falls to the river. The water is coming into the pool from 2 different locations.	Looking down at pool.
PP Agate Hydro 1	384811	4000563	2	4/26/06	Pre	"	View upstream of pool.
PP Agate Hydro 1	384811	4000563	A	4/26/06	Pre	"	Looking at Kelly at photopoint. Taken from 2m upstream of photopoint.
PP Agate Hydro 1-2	384674	4000306	1	4/26/06	Pre	Small pool about 2 pools up from waterfall that must be navigated by going up and around. Three rocks surround the pool on 3 sites.	View upstream of pool.
PP Agate Hydro 1-2	384674	4000306	2	4/26/06	Pre	"	View downstream of pool.
PP Agate Hydro 1-2	384674	4000306	A	4/26/06	Pre	"	Kelly's pack in front of pool. Taken from downstream.
PP Upper Agate 1	383883	3998606	1	4/26/06	Pre	Taken at the first water encountered up Agate from the Tonto. Photo taken right at some muav ledges.	Looking downstream at muav ledges and dry agave Canyon.
PP Upper Agate 1	383883	3998606	2	4/26/06	Pre	"	Looking upstream at small pools and native vegetation.
PP Upper Agate 1	383883	3998606	A	4/26/06	Pre	"	Looking at person at photopoint. Taken 10m downstream of photopoint on muav ledge.
PP Sapphire 1	383031	3999784	1	4/26/06	Pre	Taken from a large sandstone boulder on creek right. This is where the Tonto trail crosses the canyon.	No description.
PP Sapphire 1	383031	3999784	2	4/26/06	Pre	"	No description.
PP Sapphire 1	383031	3999784	A	4/26/06	Pre	"	Melissa at photopoint. Taken from 8m downstream.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Sapphire 2	383376	4000319	1	3/26/08	Post	Granite island of rock on creek left, below tapeats looking down at first major pouroff.	Post TAMRAM removal.
PP Sapphire 2	383376	4000319	1	3/26/08	Pre	"	View upstream of TAMRAM on creek L.
PP Sapphire 2	383376	4000319	A	3/26/08	Pre	"	Taken on small brown sandstone boulder (2x6x4m) just below PP in middle of granite up and over.
PP Sapphire 3	383483	4000521	1	3/26/08	Pre	Short bus-sized schist block-shaped 6x20x15m boulder at end of slab on creek right just before small pouroff.	View downstream of TAMRAM on creek R.
PP Sapphire 3	383483	4000521	1	3/26/08	Post	"	Post TAMRAM removal.
PP Sapphire 3	383483	4000521	A	3/26/08	Pre	"	View upstream taken middle of creek on small granite pour off about 50m from PP. Tapeats layer in background.
PP Sapphire Hydro 1	383036	3999791	1	4/26/06	Pre	Taken from the center of the drainage channel where the Tonto trail crosses the canyon. There is a long pool and just above it a smaller pool on creek left just above the ACAGRE.	View upstream of the pool.
PP Sapphire Hydro 1	383036	3999791	2	4/26/06	Pre	"	View downstream of the pool.
PP Sapphire Hydro 1	383036	3999791	A	4/26/06	Pre	"	Kelly at pool. View upstream and taken about 4m below the ACAGRE.
PP Sapphire Hydro 2	382949	3999756	1	4/26/06	Pre	This pool is about 100m above where the trail crosses the drainage. Walking up the drainage it is the first spot where a chockstone blocks the channel. There is a nice Tapeats ledge on creek left and there is a young POPFRE about 7m downstream.	View upstream of pool.
PP Sapphire Hydro 2	382949	3999756	2	4/26/06	Pre	"	View downstream of pool.
PP Sapphire Hydro 2	382949	3999756	A	4/26/06	Pre	"	Taken from about 5m downstream of pool.
PP Sapphire Hydro 3	383543	4000351	1	4/27/06	Pre	Taken of small pool just above 15ft. Drop-off to the narrows of Sapphire.	Looking downstream towards narrows. There is a mature TAMRAM in view.
PP Sapphire Hydro 3	383543	4000351	2	4/27/06	Pre	"	Looking upstream, bouldery slope behind.
PP Sapphire Hydro 3	383543	4000351	A	4/27/06	Pre	"	Kelly pointing at photopoint. Taken from slab of Bright Angel shale, 12m downstream.
PP Upper Sapphire 1	381888	3998232	1	4/27/06	Pre	Taken from mid-channel, there are two boulders stacked on top of one another to one side. This is directly across from a large amphitheater on creek right. Another amphitheater is just downstream on creek left, 500m below a waterfall.	Looking downstream.
PP Upper Sapphire 1	381888	3998232	2	4/27/06	Pre	"	Looking upstream.
PP Upper Sapphire 1	381888	3998232	A	4/27/06	Pre	"	Kari at photopoint. Taken 3m downstream of photopoint.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Upper Sapphire 1	381888	3998232	B	4/27/06	Pre	"	View of amphitheater from creek right.
PP Turquoise 1	381491	4000913	1	3/27/08	Pre	Sitting on white boulder centered in creek looking up canyon and small pouroff on creek left.	View upstream, middle of creek, from small boulder. Pouroff just to the creek right in picture.
PP Turquoise 1	381491	4000913	2	3/27/08	Pre	"	View downstream with TAMRAM in center.
PP Turquoise 1	381491	4000913	A	3/27/08	Pre	"	Picture of photopoint, standing facing down creek.
PP Turquoise 1	381491	4000913	1	3/28/08	Post	"	Post TAMRAM removal.
PP Turquoise 2	381426	4000923	1	3/28/08	Pre	Standing at base of large boulder creek left. Large pouroff on creek left.	View upstream, me standing at base of large grey boulder of creek left, large pouroff on creek left beside boulder.
PP Turquoise 2	381426	4000923	1	3/28/08	Post	"	Post TAMRAM removal.
PP Turquoise 2	381426	4000923	2	3/28/08	Pre	"	View downstream of photo point.
PP Turquoise 2	381426	4000923	A	3/28/08	Pre	"	Picture of photopoint, me standing facing down canyon.
PP Ruby 1	381650	4005719	1	11/4/03	Post	Taken from creek right, up on schist.	Post work.
PP Ruby 1	381650	4005719	1	11/4/03	Pre	"	Looking up canyon at canyon entrance to Ruby.
PP Ruby 1	381650	4005719	A	11/4/03	Pre	"	Kim at photopoint.
PP Ruby 1	381650	4005719	1	3/23/07	Post	"	Photo update.
PP Ruby 10	379895	4004286	1	3/23/07	Post	Taken from a hot dog truck sized sandstone boulder on creek right. This is about 200m from the beginning of the section.	Post work.
PP Ruby 10	379895	4004286	1	3/23/07	Pre	"	Looking creek left at TAMRAM.
PP Ruby 10	379895	4004286	2	3/23/07	Pre	"	Looking upstream at TAMRAM cluster.
PP Ruby 10	379895	4004286	2	3/23/07	Post	"	Post work.
PP Ruby 10	379895	4004286	A	3/23/07	Pre	"	Pen pointing at PP. Taken upstream about 15 m on a Tapeats ledge.
PP Ruby 5	380751	4004773	1	3/23/07	Post	Taken from a sloping schist boulder on creek right. This is across from a weathered mature cottonwood on creek left.	Post work.
PP Ruby 5	380751	4004773	1	3/23/07	Pre	"	Looking upstream at TAMRAM.
PP Ruby 5	380751	4004773	A	3/23/07	Pre	"	Pen points at PP.
PP Ruby 9	379570	4003650	1	3/23/07	Post	No UTMs recorded. Taken from a Tapeats ledge with a small waterfall about 100m from the Tonto (upstream). Entered UTM from the Ruby 9 exotics control data - not sure how close to the site it is.	Post work.
PP Ruby 9	379570	4003650	1	3/23/07	Pre	"	Looking upstream.
PP Ruby 9	379570	4003650	A	3/23/07	Pre	"	Pen points at PP. Taken from upstream of PP.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Above Serpentine East Branch 1	379307	4006373	1	3/25/07	Post	Taken from a short bus-sized sandstone boulder with creamy off-white and black swirls in the middle of the creek.	Post work.
PP Above Serpentine East Branch 1	379307	4006373	1	3/25/07	Pre	"	View of TAMRAM.
PP Above Serpentine East Branch 1	379307	4006373	A	3/25/07	Pre	"	Pen points at PP.
PP Above Serpentine West Branch 1	379339	4006463	1	3/25/07	Pre	Taken from a house-sized boulder about 30m from below the pour off and the Tonto Trail in the middle of the drainage.	View of TAMRAM.
PP Above Serpentine West Branch 1	379339	4006463	1	3/25/07	Post	"	Post work.
PP Above Serpentine West Branch 1	379339	4006463	A	3/25/07	Pre	"	Pen points at PP.
PP Creek Right Fork 1	380657	4014680	1	9/22/06	Pre	This is about 30m down the drainage from the trail in Tapeats. Sitting on a Tapeats ledge about 10m from the TAMRAM.	Four mature TAMRAM near salt seep in the drainage.
PP Creek Right Fork 1	380657	4014680	1	9/22/06	Post	"	Post work.
PP Creek Right Fork 1	380657	4014680	A	9/22/06	Pre	"	Tech box & clipboard at the photopoint site.
PP Flint 1	382332	4012365	1	11/5/07	Pre	Standing on a small boulder creek left about 200 m up from the confluence with Shinumo. This is just down from a group of cottonwoods.	Looking upstream.
PP Flint 1	382332	4012365	1	11/5/07	Post	"	Post work.
PP Flint 1	382332	4012365	2	11/5/07	Post	"	Post work.
PP Flint 1	382332	4012365	2	11/5/07	Pre	"	looking across the drainage.
PP Flint 1	382332	4012365	3	11/5/07	Post	"	Post work.
PP Flint 1	382332	4012365	3	11/5/07	Pre	"	Looking downstream.
PP Flint 1	382332	4012365	A	11/5/07	Pre	"	Looking upstream from drainage center. Pen points to PP.
PP Flint 2	382567	4012221	1	11/6/07	Pre	Standing on a large boulder on creek left. The boulder is pink and white. This boulder is just before the confluence of side canyon coming in on creek left.	Looking upstream.
PP Flint 2	382567	4012221	1	11/6/07	Post	"	Post work.
PP Flint 2	382567	4012221	2	11/6/07	Post	"	Post work.
PP Flint 2	382567	4012221	2	11/6/07	Pre	"	Looking downstream.
PP Flint 2	382567	4012221	A	11/6/07	Pre	"	Pen pointing at PP. Looking upstream from drainage center.
PP Flint 3	382988	4012333	1	11/6/07	Pre	Standing on a black and white rock at the top of a small black rock narrows area. There is a "large" red boulder on creek right.	Looking upstream.
PP Flint 3	382988	4012333	1	11/6/07	Post	"	Post work.
PP Flint 3	382988	4012333	2	11/6/07	Post	"	Post work.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Flint 3	382988	4012333	2	11/6/07	Pre	"	Looking downstream.
PP Flint 3	382988	4012333	A	11/6/07	Pre	"	Looking downstream with pen pointing at PP.
PP Flint 4	383359	4012234	1	11/6/07	Pre	Taken from a small boulder that is white and on creek left. There is a steep wall on creek right.	Looking upstream.
PP Flint 4	383359	4012234	1	11/6/07	Post	"	Post work.
PP Flint 4	383359	4012234	2	11/6/07	Pre	"	Looking downstream.
PP Flint 4	383359	4012234	2	11/6/07	Post	"	Post work.
PP Flint 4	383359	4012234	A	11/6/07	Pre	"	Looking upstream with pen pointing at PP.
PP Flint 5	383733	4011893	1	11/7/07	Post	Tapeats ledges on creek right. This is only plus of minus 50m up from the start of section 5. This is just downstream of S-bend in creek.	Post work.
PP Flint 5	383733	4011893	1	11/7/07	Pre	"	Looking downstream.
PP Flint 5	383733	4011893	2	11/7/07	Post	"	Post work.
PP Flint 5	383733	4011893	2	11/7/07	Pre	"	Looking across / upstream.
PP Flint 5	383733	4011893	A	11/7/07	Pre	"	Taken from down creek. Looking up at PP (hat, box, and backpack).
PP Flint 6	384171	4011712	1	11/7/07	Pre	Standing on Tapeats shelf on creek right.	No bearing recorded. Looking down at single TAMRAM.
PP Flint 6	384171	4011712	1	11/7/07	Post	"	No bearing recorded. Post work.
PP Flint 6	384171	4011712	A	11/7/07	Pre	"	Looking upstream from drainage center. Stick points at PP.
PP Flint 7	384644	4011296	1	11/7/07	Post	Sitting on Tapeats shelf in middle of the drainage. Cottonwood is just downstream of creek right.	Post work.
PP Flint 7	384644	4011296	1	11/7/07	Pre	"	Looking downstream - 5 saplings probably not visible in photo.
PP Flint 7	384644	4011296	A	11/7/07	Pre	"	Looking upstream. Backpack at PP.
PP Flint 8	384716	4011159	1	11/7/07	Post	Standing on a large boulder creek left.	Post work.
PP Flint 8	384716	4011159	1	11/7/07	Pre	"	Looking up and across.
PP Flint 8	384716	4011159	A	11/7/07	Pre	"	Looking up drainage. Pen points to PP.
PP Redwall 1	381084	4015018	1	9/22/06	Pre	No GPS info. No descriptions written - cannot plot this one on map.	No description written.
PP White 1	381045	4013393	1	9/21/06	Post	Standing on block boulder creek right, above a small bouldery pourover.	Post work.
PP White 1	381045	4013393	1	9/21/06	Pre	"	Looking upstream and across creek. In view is a tapeats outcrop and a redwall bluff.
PP White 1	381045	4013393	A	9/21/06	Pre	"	Loren dancing on the photopoint.
PP White 7	380594	4015477	1	9/19/06	Pre	Taken from a Tapeats rock delta at the top of the Tapeats layer.	TAMRAM on creek left at what seems to be a salty seep up on Tapeats bank.
PP White 7	380594	4015477	2	9/19/06	Pre	"	This view is closer and in the vertical orientation.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP White 7	380594	4015477	A	9/19/06	Pre	"	Person at photopoint. Taken from about 20m down canyon of the photopoint, looking up canyon.
PP 122 Mile Canyon L 1	365254	4011346	1	10/3/06	Pre	Taken sitting on top of 15' boulder that has white and grey spots on creek left. Below 80' pouroff.	Looking downstream.
PP 122 Mile Canyon L 1	365254	4011346	1	10/3/06	Post	"	Post work.
PP 122 Mile Canyon L 1	365254	4011346	2	10/3/06	Pre	"	Looking upstream at pouroff.
PP 122 Mile Canyon L 1	365254	4011346	2	10/3/06	Post	"	Post work.
PP 122 Mile Canyon L 1	365254	4011346	A	10/3/06	Pre	"	Person at photopoint. Taken from just downstream of the rock, looking upstream.
PP 122 Mile Canyon L 2	365288	4011639	1	10/2/06	Pre	Sitting on tapeats ledge on creek right just below 40' tapeats pouroff. Approx. 300m up canyon from the mouth.	Looking down and across the drainage. There is a large, flat, and red & yellow slab in the foreground. The TAMRAMs are on creek left.
PP 122 Mile Canyon L 2	365288	4011639	2	10/2/06	Pre	"	Looking across and slightly downstream. Note the TAMRAM in the ledge a good way up the side of the drainage.
PP 122 Mile Canyon L 2	365288	4011639	3	10/2/06	Pre	"	Looking upstream at pouroff and tapeats patio. Large overhanging balcony rock on looker's right.
PP 122 Mile Canyon L 2	365288	4011639	A	10/2/06	Pre	"	Tamarisk branch is pointing at ledge and photopoint from above. Taken from upstream of photopoint.
PP 122 Mile Canyon L 2	365288	4011639	1	10/3/06	Post	"	Post work.
PP 122 Mile Canyon L 2	365288	4011639	2	10/3/06	Post	"	Post work.
PP 122 Mile Canyon L 2	365288	4011639	3	10/3/06	Post	"	Post work.
PP 140 Mile 1	359419	4029254	1	10/4/06	Pre	PP is a Redwall limestone boulder in the middle of the drainage (2x1x3m) located just at the point where you enter the drainage from the beach. This is just below the BA shale ledge on creek right.	Looking upstream at the greatest point of tamarisk infestation.
PP 140 Mile 1	359419	4029254	1	10/4/06	Post	"	Looking upstream - postwork.
PP 140 Mile 1	359419	4029254	2	10/4/06	Post	"	Looking downstream - postwork.
PP 140 Mile 1	359419	4029254	2	10/4/06	Pre	"	Looking downstream at a pool of water and tamarisk on creek left.
PP 140 Mile 1	359419	4029254	A	10/4/06	Pre	"	Steve at photopoint. Taken from 10m downstream of photopoint looking upstream.
PP 140 Mile 1	359419	4029254	1	5/13/07	Post	"	Looking upstream.
PP 140 Mile 1	359419	4029254	2	5/13/07	Post	"	Looking downstream at a pool of water.
PP 140 Mile 1	359419	4029254	1	6/20/08	Post	"	Photo update.
PP 140 Mile 1	359419	4029254	2	6/20/08	Post	"	Photo update.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP 140 Mile HA 1	359332	4028872	1	5/10/06	Pre	This is about 500m above the river above the first 2 dry falls in 140 Mile Canyon.	View upstream at Muav patio.
PP 140 Mile HA 1	359332	4028872	2	5/10/06	Pre	"	View downstream at first dry fall.
PP 140 Mile HA 1	359332	4028872	A	5/10/06	Pre	"	Looking at Kevin and RV on Muav ledge. Taken at lip of pouroff.
PP 140 Mile HA 2	361111	4027074	1	5/10/06	Pre	Above a few tricky climbs in the Redwall are some deep water holes in the Redwall. We are at that point.	View downstream at pools in redwall narrows.
PP 140 Mile HA 2	361111	4027074	2	5/10/06	Pre	"	View upstream at redwall pools.
PP 140 Mile HA 2	361111	4027074	A	5/10/06	Pre	"	Taken from 10m downstream.
PP 140 Mile Hydro 1	359410	4029266	1	5/10/06	Pre	This is at the mouth of 140 Mile L canyon at high water level. There are a couple of pools in the sandstone with many mature tamarisk nearby. This hydro spot is just below the first tamarisk transect in 140 Mile Canyon.	Upstream view at the trickle of water on the sandstone.
PP 140 Mile Hydro 1	359410	4029266	2	5/10/06	Pre	"	Downstream view of a pool in the bottom left of the photo and the river just out of view.
PP 140 Mile Hydro 1	359410	4029266	3	5/10/06	Pre	"	Looking down at the pool.
PP 140 Mile Hydro 1	359410	4029266	A	5/10/06	Pre	"	Looking downstream at Kevin on the Tapeats ledge with large pool below. Taken 10m upstream of photopoint.
PP 140 Mile Hydro 1	359410	4029266	1	5/14/07	Post	"	Upstream view of trickle of water on the sandstone.
PP 140 Mile Hydro 1	359410	4029266	2	5/14/07	Post	"	Downstream view of a pool in the bottom left of the photo. River is just out of view. Less water this year…. Debris build up near square boulder.
PP 140 Mile Hydro 1	359410	4029266	3	5/14/07	Post	"	Looking down at the pool.
PP 140 Mile T1A End	359430	4029267	1	5/10/06	Pre	140 Mile T1A End	T1A End. Looking downstream from photopoint.
PP 140 Mile T1A End	359430	4029267	2	5/10/06	Pre	"	T1A end. Looking upstream along transect tape.
PP 140 Mile T1A End	359430	4029267	A	5/10/06	Pre	"	Middle of the streambed, looking at the photopoint at stream right. T1A endpoint at Pam's feet.
PP 140 Mile T1A End	359430	4029267	B	5/10/06	Pre	"	3.5m upstream along transect tape, looking at T1A endpoint. Point is at Pam's feet.
PP 140 Mile T1A End	359430	4029267	1	5/17/07	Post	"	Photo update.
PP 140 Mile T1A End	359430	4029267	2	5/17/07	Post	"	Photo update.
PP 140 Mile T1A Start	359439	4029214	1	5/10/06	Pre	Start of T1A	The start of Mile 140 T1A. Looking down the transect tape at TAMRAM and boulder.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP 140 Mile T1A Start	359439	4029214	2	5/10/06	Pre	"	The start of T1A, looking upstream along the transect tape.
PP 140 Mile T1A Start	359439	4029214	A	5/10/06	Pre	"	In the streambed looking upstream at the photopoint skyline in the background. Pam at the photopoint.
PP 140 Mile T1A Start	359439	4029214	B	5/10/06	Pre	"	Looking at photopoint from the stream. Right skyline is in the background. Pam at photopoint.
PP 140 Mile T1A Start	359439	4029214	C	5/10/06	Pre	"	Standing over the photopoint looking down at the tape. Photopoint detail.
PP 140 Mile T1A Start	359439	4029214	1	5/14/07	Post	"	The start of T1A. Looking down the transect tape and boulder.
PP 140 Mile T1A Start	359439	4029214	2	5/14/07	Post	"	The start of T1A. Looking upstream along the transect tape.
PP 140 Mile T1B End	359426	4029176	1	5/10/06	Pre	T1B End.	T1B End. Looking upstream along transect tape.
PP 140 Mile T1B End	359426	4029176	2	5/10/06	Pre	"	T1B end. Looking downstream toward creek left.
PP 140 Mile T1B End	359426	4029176	A	5/10/06	Pre	"	On creek right of tape looking downstream at T1B end.
PP 140 Mile T1B End	359426	4029176	B	5/10/06	Pre	"	In stream bed looking to creek right T1B end point.
PP 140 Mile T1B End	359426	4029176	C	5/10/06	Pre	"	Just stream left of T1B end. Close up of T1B end point.
PP 140 Mile T1B End	359426	4029176	1	5/14/07	Post	"	Photo update.
PP 140 Mile T1B End	359426	4029176	2	5/14/07	Post	"	Photo update.
PP 140 Mile T1B End	359426	4029176	3	5/14/07	Post	"	View downstream from end point.
PP 140 Mile T1B End	359426	4029176	A	5/14/07	Post	"	Kelly standing at end point. Taken from 45 m mark looking downstream.
PP 140 Mile T1B Start	359461	4029160	1	5/10/06	Post	T1B start.	T1B start. Looking down transect tape.
PP 140 Mile T1B Start	359461	4029160	3	5/10/06	Post	"	T1B start. Looking upstream to stream right through some Acacias.
PP 140 Mile T1B Start	359461	4029160	A	5/10/06	Post	"	6m directly below photopoint on stream right. T1B start with Amy in the photo.
PP 140 Mile T1B Start	359461	4029160	B	5/10/06	Post	"	In stream bed looking upstream at photopoint. T1B start with Amy by the start.
PP 140 Mile T1B Start	359461	4029160	1	5/14/07	Post	"	Photo update.
PP 140 Mile T1B Start	359461	4029160	2	5/14/07	Post	"	Wendy.
PP 140 Mile T1B Start	359461	4029160	3	5/14/07	Post	"	Photo update.
PP 140 Mile T1B Start	359461	4029160	4	5/14/07	Post	"	Looking across creek to creek left.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP 140 Mile T1B Start	359461	4029160	C	5/14/07	Post	"	Close-up of start point. Taken from 0.7 m. Point is under stone and on a 1.5x2 m boulder.
PP 148.5 Mile Spring 0	0	0	1	10/1/00	Pre	Initial photo of 148 Mile Spring, may have been taken from the boat.	Photo taken from boat or other side of the river?
PP 148.5 Mile Spring 1	350117	4023627	1	11/19/02	Post	Taken from a big limestone rock just downstream of the spring. No GPS available. Spring is about 500m upstream of Matkatamiba creek.	Post work.
PP 148.5 Mile Spring 1	350117	4023627	1	6/9/04	Post	"	Photo update.
PP 148.5 Mile Spring 1	350117	4023627	A	6/9/04	Pre	"	Person at photopoint.
PP 148.5 Mile Spring 1	350117	4023627	B	3/3/05	Pre	"	Alison at photopoint.
PP 148.5 Mile Spring 1	350117	4023627	1	9/18/08	Post	"	Photo update.
PP 148.5 Mile Spring 2	350124	4023639	1	11/19/02	Post	No GPS available. Photopoint is behind spring on muav shelf. Spring is about 500m upstream of Matkatamiba creek.	Post work.
PP 148.5 Mile Spring 2	350124	4023639	1	11/19/02	Pre	"	Looking into spring.
PP 148.5 Mile Spring 2	350124	4023639	A	11/19/02	Pre	"	Kate on the muav shelf photopoint.
PP 148.5 Mile Spring 2	350124	4023639	1	6/9/04	Post	"	Photo update.
PP 148.5 Mile Spring 2	350124	4023639	B	6/9/04	Pre	"	Person at photopoint.
PP 148.5 Mile Spring 2	350124	4023639	1	9/18/08	Post	"	Photo update.
PP 151 Mile 1	345916	4023994	1	2/25/07	Pre	Taken from a 3x4x3m Redwall limestone boulder in between two large muav outcroppings. This is about 2.5 m from the water line. 1km upstream of upper ledges camp hidden in a small pocket obscured by muav point on right.	Looking at spring and TAMRAM.
PP 151 Mile 1	345916	4023994	1	2/25/07	Post	"	Post work.
PP 151 Mile 1	345916	4023994	2	2/25/07	Pre	"	Looking upstream at TAMRAM.
PP 151 Mile 1	345916	4023994	2	2/25/07	Post	"	Post work.
PP 151 Mile 1	345916	4023994	3	2/25/07	Pre	"	Looking downstream at TAMRAM.
PP 151 Mile 1	345916	4023994	3	2/25/07	Post	"	Post work.
PP 151 Mile 1	345916	4023994	A	2/25/07	Pre	"	Pen is pointing at photopoint.
PP 151 Mile 1	345916	4023994	1	9/18/08	Post	"	Photo update.
PP 151 Mile 1	345916	4023994	2	9/18/08	Post	"	Photo update.
PP 151 Mile 1	345916	4023994	3	9/18/08	Post	"	Photo update.
PP National 1-1	330345	4013861	1	3/2/05	Pre	No GPS reading available - estimated from GIS. Muav shale ledges, creek right about 150 ft. downcreek of channeled slick rock waterfall. Taken from a 3x4x2m Muav "picnic" boulder on creek left. This PP is probably about 40m down the transect line and 4 meters to the right of the transect line.	Looking down creek at large tamarisks in boulder clump on creek left.
PP National 1-1	330345	4013861	A	3/2/05	Pre	"	Kari at photopoint.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP National 1-2	330138	4013977	2	2/6/07	Pre	UTMs taken from map. 100m below the first pool/climb in lower National atop a 3x4x2 m Muav "picnic" boulder on creek left. This PP is probably about 40m down the transect line (tamarisk-National 1) and 4 m to creek right of the line. No GPS.	Looking downstream at 1 mature with straggling saplings to the right of it.
PP National 1-2	330138	4013977	1	2/26/07	Pre	"	Looking upstream at tall, nasty clump of TAMRAM.
PP National 1-2	330138	4013977	1	2/26/07	Post	"	Post work.
PP National 1-2	330138	4013977	2	2/26/07	Post	"	Post work.
PP National 1-2	330138	4013977	A	2/26/07	Pre	"	Taken downstream of PP about 10m. Looking at PP boulder and towards the climb in the background.
PP National 1-2	330138	4013977	1	4/20/08	Post	"	Photo update.
PP National 1-2	330138	4013977	2	4/20/08	Post	"	Photo update.
PP National 1-2	330138	4013977	A	4/20/08	Post	"	Photo update.
PP National 1-2	330138	4013977	B	4/20/08	Post	"	From 5m away and up against creek right wall.
PP National 1-2	330138	4013977	C	4/20/08	Post	"	From upstream - closeup.
PP National 2-1	331192	4013832	1	3/2/05	Pre	Standing on a white triangular boulder downstream from where the up and over trail meets with the creek - above slot.	Looking downstream towards slot canyon.
PP National 2-1	331192	4013832	2	3/2/05	Pre	"	Looking upstream.
PP National 2-1	331192	4013832	A	3/2/05	Pre	"	Person at photopoint.
PP National 2-2	331144	4013838	1	2/26/07	Post	Taken 60m above where the traverse (after the climb) drops back down into National Canyon. Creek right on the bedrock near the Muav bench and near some fridge-sized boulders.	Post work.
PP National 2-2	331144	4013838	1	2/26/07	Pre	"	Looking across the stream at large at a single mature TAMRAM.
PP National 2-2	331144	4013838	2	2/26/07	Post	"	Post work.
PP National 2-2	331144	4013838	2	2/26/07	Pre	"	Looking across stream at a smaller, bare TAMRAM.
PP National 2-2	331144	4013838	A	2/26/07	Pre	"	Taken 7m downstream of PP in the creek bottom. Looking up at PP bench and sunny curve in the canyon behind.
PP National 2-2	331144	4013838	1	4/20/08	Post	"	Photo update.
PP National 2-2	331144	4013838	2	4/20/08	Post	"	Photo update.
PP National 2-2	331144	4013838	A	4/20/08	Post	"	Photo update.
PP National 3-1	331500	4013260	1	3/2/05	Pre	No GPS - estimated from GIS. This is after the first boulder climb. There is a line of 3 large white boulders perpendicular to the channel. The photo is taken standing on the center one, which is long with a pointy top.	There is a small TAMRAM clump directly across the canyon.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP National 3-1	331500	4013260	A	3/2/05	Pre	"	Person at photopoint, taken from upstream.
PP National 3-2	331500	4013260	1	2/27/07	Post	Taken atop a pointy Muav boulder on creek left, 120m above where the Muav traverse in section 3 (above the lovely pools) drops down to the creek. It is wider and with more vegetation here.	Post work.
PP National 3-2	331500	4013260	1	2/27/07	Pre	"	Looking downstream at Gisela prepping to saw a mature TAMRAM.
PP National 3-2	331500	4013260	2	2/27/07	Pre	"	Looking across the stream at 1 ugly flashed over TAMRAM.
PP National 3-2	331500	4013260	2	2/27/07	Post	"	Post work.
PP National 3-2	331500	4013260	A	2/27/07	Pre	"	Looking across the stream at a tall 5m high boulder with a west wall in the back.
PP National 3-2	331500	4013260	1	4/20/08	Post	"	Photo update.
PP National 3-2	331500	4013260	2	4/20/08	Post	"	Photo update.
PP National 4	331609	4012915	1	3/2/05	Pre	On 3rd "step" up grey wall on the left, across and just upstream from sandy bank on the right. UTM's taken from tamarisk mapping data form (start point).	TAMRAMs on the next bank and up canyon on the right.
PP National 4	331609	4012915	A	3/2/05	Pre	"	Person at the photopoint, taken from upstream.
PP National 5	331398	4012182	1	3/2/05	Pre	Taken from on a ledge across from boulders in creek center and next to a large boulder leaning on the ledge. UTM's taken from tamarisk mapping data form (start point).	Looking at boulders and TAMRAMs in creek center.
PP National 5	331398	4012182	A	3/2/05	Pre	"	Person at photopoint taken from the creek.
PP National 6	331549	4011457	1	3/2/05	Pre	When the water is cascading over ledges with huge boulders at creek center, then stand on creek right, downstream of cascade and perpendicular to downstream end of boulders. This is the 2nd "step" up against the wall. UTM's taken from tamarisk mapping data form (start point).	Looking at boulders and TAMRAM in creek center.
PP National 6	331549	4011457	A	3/2/05	Pre	"	Person at photopoint, taken from downstream.
PP National East Fork 1	331547	4011111	1	2/27/07	Post	Taken on a muav ledge 30m upstream of the junction on creek left, above a deep pool.	Post work.
PP National East Fork 1	331547	4011111	1	2/27/07	Pre	"	Looking downstream at a mature with many eradicators posed to destroy.
PP National East Fork 1	331547	4011111	2	2/27/07	Pre	"	Looking upstream at several smaller TAMRAM.
PP National East Fork 1	331547	4011111	2	2/27/07	Post	"	Post work.
PP National East Fork 1	331547	4011111	A	2/27/07	Pre	"	Pen points at PP.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP National HA 2	331067	4013851	1	5/12/06	Pre	Photopoint is a point along the Muav shelf on creek right. There is a dry waterfall just above. UTM's came from habitat assessment data form (start point).	View downstream.
PP National HA 2	331067	4013851	2	5/12/06	Pre	"	View upstream.
PP National HA 2	331067	4013851	A	5/12/06	Pre	"	Photo of the bag on the photopoint. Looking upstream at the point.
PP National HA 3	331608	4012912	1	5/12/06	Pre	The photopoint is just below the first major fork in the canyon. Point is on canyon right on the first Muav step.	Looking downstream.
PP National HA 3	331608	4012912	2	5/12/06	Pre	"	Looking upstream.
PP National HA 3	331608	4012912	A	5/12/06	Pre	"	Sam is sitting on the point surrounded by Dan and Kate.
PP National Hydro 1	330364	4013868	2	5/12/06	Pre	UTM's came from hydro data form.	Beginning of Hydro transect about 30m upstream from the end of the veg reference transect. Standing over the stream looking downstream from the beginning of Hydro 1 transect. Sharon standing at the end of Hydro 1 transect.
PP National Hydro 1	330364	4013868	3	5/12/06	Pre	"	Standing from the end of hydro 1 transect. Sharon at the start of hydro 1 transect. Can also see tape at the end of the transect.
PP National Hydro 1	330364	4013868	2	4/20/08	Post	"	Photo update.
PP National Hydro 1	330364	4013868	3	4/20/08	Post	"	Photo update.
PP National Hydro 2	330441	4013819	2	5/12/06	Pre	"	2m downstream from the end (downstream end) of hydro 2 transect. About 20m downstream from the end of National tamarisk transect. Sharon at the end of Hydro 2 (downstream).
PP National Hydro 2	330441	4013819	3	5/12/06	Pre	"	2m downstream from the end of hydro 2 transect. Sharon at the beginning of hydro 2.
PP National Hydro 2	330441	4013819	4	5/12/06	Pre	"	2m from the beginning (upstream end) of hydro 2. Sharon at the end of hydro 2 transect.
PP National Hydro 2	330441	4013819	2	4/20/08	Post	"	Photo update.
PP National Hydro 2	330441	4013819	3	4/20/08	Post	"	Photo update.
PP National Hydro 2	330441	4013819	4	4/20/08	Post	"	Photo update.
PP National Hydro 3	330235	4013953	2	5/12/06	Pre	National Hydro 3	2m from the downstream end of hydro 3 transect. Sharon at the end of hydro 3 transect.
PP National Hydro 3	330235	4013953	3	5/12/06	Pre	"	2m from the downstream end of hydro 3 transect. Sharon at the beginning of hydro 3 transect.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP National Hydro 3	330235	4013953	4	5/12/06	Pre	"	2m upstream of the beginning of hydro 3 transect. Sharon at the end of hydro 3 transect.
PP National Hydro 3	330235	4013953	2	4/20/08	Post	"	Photo update.
PP National Hydro 3	330235	4013953	3	4/20/08	Post	"	Photo update.
PP National Hydro 3	330235	4013953	4	4/20/08	Post	"	Photo update.
PP National T1A End	330458	4013806	1	5/11/06	Pre	No GPS reading available. The end of the transect is about 80m below the climby spot. The transect end point is 80m downstream of the climb at National's Muav pools.	View upstream, of the tape line.
PP National T1A End	330458	4013806	2	5/11/06	Pre	"	Downstream, down canyon through the muav narrows.
PP National T1A End	330458	4013806	3	5/11/06	Pre	"	Looking down at the end of the 50m tape measure with a boulder.
PP National T1A End	330458	4013806	A	5/11/06	Pre	"	10m upstream of the end of the transect.
PP National T1A End	330458	4013806	1	4/20/08	Post	"	Photo update.
PP National T1A End	330458	4013806	2	4/20/08	Post	"	Photo update.
PP National T1A End	330458	4013806	3	4/20/08	Post	"	Photo update.
PP National T1A Start	330508	4013818	1	5/11/06	Pre	No GPS reading available, but the beginning point of the transect is about 30m downstream of the climb on creek left to get above the pool up National. The start of the transect is on a gray 2x2x3 limestone boulder about 500m up National canyon, just below the start of the pool that is tricky to get around.	Upstream view at polished muav and the climby spot to get past the pool.
PP National T1A Start	330508	4013818	2	5/11/06	Pre	"	Downstream view and directly down the transect line. Tape is in the center.
PP National T1A Start	330508	4013818	3	5/11/06	Pre	"	Looking straight down at the start point of the transect.
PP National T1A Start	330508	4013818	A	5/11/06	Pre	"	Taken 10m downstream of the boulder the transect starts on.
PP National T1A Start	330508	4013818	1	4/20/08	Post	"	Photo update.
PP National T1A Start	330508	4013818	2	4/20/08	Post	"	Photo update.
PP National T1A Start	330508	4013818	3	4/20/08	Post	"	Photo update.
PP National T1B End	330342	4013885	1	5/11/06	Pre	End of T1B	Looking upstream and down the transect toward the transect start.
PP National T1B End	330342	4013885	2	5/11/06	Pre	"	Looking downstream from transect start.
PP National T1B End	330342	4013885	3	5/11/06	Pre	"	Looking up canyon and to creek left.
PP National T1B End	330342	4013885	4	5/11/06	Pre	"	Looking up canyon and to creek left.
PP National T1B End	330342	4013885	A	5/11/06	Pre	"	Downstream of transect end 10m, standing in the middle of the drainage. Looking upstream at a girl in a black tank top (Pam Walls standing at transect end point.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP National T1B End	330342	4013885	B	5/11/06	Pre	"	Standing 45m, looking downstream end toward transect. Transect end- Pam is standing at the transect end.
PP National T1B End	330342	4013885	C	5/11/06	Pre	"	Standing 2m downstream of transect end. Closer view of transect end.
PP National T1B End	330342	4013885	1	4/20/08	Post	"	Photo update.
PP National T1B End	330342	4013885	2	4/20/08	Post	"	Photo update.
PP National T1B End	330342	4013885	3	4/20/08	Post	"	Photo update
PP National T1B End	330342	4013885	4	4/20/08	Post	"	Photo update.
PP National T1B Start	330390	4013866	1	5/11/06	Pre	No GPS readings. Transect start is on a muav limestone shelf 1m high.	Standing at transect start on a muav limestone shelf 1m up. Looking down the transect.
PP National T1B Start	330390	4013866	2	5/11/06	Pre	"	Looking from transect start across to creek left.
PP National T1B Start	330390	4013866	3	5/11/06	Pre	"	Looking upstream at the large dead acacia and distinctive bend in drainage.
PP National T1B Start	330390	4013866	A	5/11/06	Pre	"	Standing downstream of transect start at 10m on the transect tape. Looking upstream at the transect start on creek right on a muav shelf.
PP National T1B Start	330390	4013866	B	5/11/06	Pre	"	Standing directly across from the transect start on creek left. Transect start is on a muav shelf.
PP National T1B Start	330390	4013866	C	5/11/06	Pre	"	Standing directly across from transect start on creek left. Zoom in on transect start showing close-up view of placement.
PP National T1B Start	330390	4013866	1	4/20/08	Post	"	Photo update.
PP National T1B Start	330390	4013866	2	4/20/08	Post	"	Photo update.
PP National T1B Start	330390	4013866	3	4/20/08	Post	"	Photo update.
PP National T2A End	331167	4013825	1	5/12/06	Pre	National T2A end point. Endpoint is about .5m from a large, house-sized boulder.	Taken from T2A endpoint, looking downstream.
PP National T2A End	331167	4013825	2	5/12/06	Pre	"	Taken from endpoint, looking upstream toward the start point.
PP National T2A End	331167	4013825	A	5/12/06	Pre	"	Taken from large vehicle sized boulder looking at the endpoint. End point is about .5m from a large house-sized boulder.
PP National T2A End	331167	4013825	B	5/12/06	Pre	"	Taken from 1m south of the 45m point on the tape. Looking at the endpoint with Lori standing on the point.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP National T2A End	331167	4013825	C	5/12/06	Pre	"	From upstream of endpoint. Looking close at the end point with a house sized boulder in the back.
PP National T2A End	331167	4013825	1	4/20/08	Post	"	Photo update.
PP National T2A End	331167	4013825	2	4/20/08	Post	"	Photo update.
PP National T2A Start	331208	4013843	1	5/12/06	Pre	National T2A start point.	Looking downstream, creek right along transect tape through the TAMRAM
PP National T2A Start	331208	4013843	2	5/12/06	Pre	"	Looking downstream, creek right though TAMRAM.
PP National T2A Start	331208	4013843	3	5/12/06	Pre	"	Looking upstream, creek right.
PP National T2A Start	331208	4013843	A	5/12/06	Pre	"	Looking at photopoint from creek left (downstream), yellow camera box indicates start point.
PP National T2A Start	331208	4013843	B	5/12/06	Pre	"	Looking at photopoint from upstream on creek left. Photo of start point with yellow box.
PP National T2A Start	331208	4013843	C	5/12/06	Pre	"	Looking at photopoint from creek left, slightly up stream. A close-up. Photo with yellow box at start point.
PP National T2A Start	331208	4013843	1	4/20/08	Post	"	Photo update.
PP National T2A Start	331208	4013843	2	4/20/08	Post	"	Photo update.
PP National T2A Start	331208	4013843	3	4/20/08	Post	"	Photo update.
PP National T2B End	331389	4013782	1	5/12/06	Pre	The endpoint is 50m downstream just past a stretch of BACSAL on creek left. Below, the canyon opens up a little and has a polished off bedrock patio of muav with little vegetation.	Upstream, looking up the tape line.
PP National T2B End	331389	4013782	2	5/12/06	Pre	"	Downstream clump of mature TAMRAM in distance.
PP National T2B End	331389	4013782	3	5/12/06	Pre	"	Looking more or less down at the endpoint.
PP National T2B End	331389	4013782	A	5/12/06	Pre	"	Taken 10m upstream, looking at the photopoint (transect end) in a cobble field in the middle of muav drainage.
PP National T2B End	331389	4013782	1	4/20/08	Post	"	Photo update.
PP National T2B End	331389	4013782	2	4/20/08	Post	"	Photo update.
PP National T2B End	331389	4013782	3	4/20/08	Post	"	Photo update.
PP National T2B Start	331445	4013768	1	5/12/06	Pre	The start of T2B is at the bottom of a muav ledge that is roughly 250m above where the skinny detour trail above the narrows drops back into the drainage. From the river we are about 900-1000m.	Upstream view at more muav slot canyon.
PP National T2B Start	331445	4013768	2	5/12/06	Pre	"	Down the transect line (downstream).
PP National T2B Start	331445	4013768	3	5/12/06	Pre	"	Looking down at start close-up.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP National T2B Start	331445	4013768	A	5/12/06	Pre	"	Taken 10m downstream from the stream, looking at the start point.
PP National T2B Start	331445	4013768	1	4/20/08	Post	"	Photo update.
PP National T2B Start	331445	4013768	2	4/20/08	Post	"	Photo update.
PP National T2B Start	331445	4013768	3	4/20/08	Post	"	Photo update.
PP National T3A End	331453	4013237	1	5/12/06	Pre	No GPS readings. The end point is 30m above the start of T3B at a small rocky pouroff.	Taken from T3A endpoint. Looking upstream along transect (creek right). Skyline is included.
PP National T3A End	331453	4013237	2	5/12/06	Pre	"	Taken from T3A end point. Looking downstream from transect (creek right).
PP National T3A End	331453	4013237	3	5/12/06	Pre	"	Close-up of T3A endpoint taken from stream bed. Photo of T3A endpoint.
PP National T3A End	331453	4013237	A	5/12/06	Pre	"	Taken from 10m upstream with the pen pointing to the end point with the yellow camera case.
PP National T3A End	331453	4013237	1	4/20/08	Post	"	Photo update.
PP National T3A End	331453	4013237	2	4/20/08	Post	"	Photo update.
PP National T3A End	331453	4013237	3	4/20/08	Post	"	Photo update.
PP National T3A Start	331492	4013184	1	5/12/06	Pre	This spot is about 1 mile from the river, upstream. It is still in the muav gorge, but just above a few pools that required a climb to get around. The first cottonwood up National is just above the start of T3A.	View upstream, cottonwoods to the right of the frame.
PP National T3A Start	331492	4013184	2	5/12/06	Pre	"	Downstream view, the tape is visible in the foreground with a tammy in the background.
PP National T3A Start	331492	4013184	3	5/12/06	Pre	"	Looking down at the boulder to the exact start point.
PP National T3A Start	331492	4013184	A	5/12/06	Pre	"	Standing in the creek, slightly downstream and 10m away.
PP National T3A Start	331492	4013184	1	4/20/08	Post	"	Photo update.
PP National T3A Start	331492	4013184	2	4/20/08	Post	"	Photo update.
PP National T3A Start	331492	4013184	3	4/20/08	Post	"	Photo update.
PP National T3B End	331533	4013282	1	5/12/06	Pre	No description of photopoint.	From the endpoint. Looking toward the start point.
PP National T3B End	331533	4013282	2	5/12/06	Pre	"	From the end point. Looking down canyon at a large boulder (3x1.5m)
PP National T3B End	331533	4013282	A	5/12/06	Pre	"	From 1m downstream looking at the end point. Close up of endpoint with stone and boulder arrangement.
PP National T3B End	331533	4013282	B	5/12/06	Pre	"	From 3m upstream of endpoint. Looking at the end point see the orange tape in the lower right of picture 3m boulder.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP National T3B End	331533	4013282	C	5/12/06	Pre	"	From 3m downstream of endpoint. Looking at the endpoint.
PP National T3B End	331533	4013282	1	4/20/08	Post	"	Photo update.
PP National T3B End	331533	4013282	2	4/20/08	Post	"	Photo update.
PP National T3B Start	331511	4013234	1	5/12/06	Pre	No description of photopoint. National T3B start point.	From upstream side of the large boulder at the start. Looking upstream.
PP National T3B Start	331511	4013234	2	5/12/06	Pre	"	From 3m mark on top of a boulder (2x1.5m) Looking down the transect toward the end.
PP National T3B Start	331511	4013234	A	5/12/06	Pre	"	From boulder on creek right (about 2m across). Looking at start point. The point is at the base of Redland backpack, boulder (2.5x2.5x2.5m) behind the backpack.
PP National T3B Start	331511	4013234	B	5/12/06	Pre	"	From Boulder on creek right. Looking at the start point at the base of the backpack with a 2.5x2.5x2.5m boulder behind it.
PP National T3B Start	331511	4013234	C	5/12/06	Pre	"	2m from the start. Looking at a close-up at the start which is at the base of the backpack.
PP National T3B Start	331511	4013234	1	4/20/08	Post	"	Photo update.
PP National T3B Start	331511	4013234	2	4/20/08	Post	"	Photo update.
PP Mohawk 2	323125	4010713	1	10/6/06	Post	Taken atop a 4x3x3m fray Muav boulder on creek left, just out of the drainage. It is about 30-40m upstream of the white rockmat cave spring. We are in Muav here. UTM's taken from tamarisk mapping data form (start point).	Post work.
PP Mohawk 2	323125	4010713	1	10/6/06	Pre	"	Looking upstream, towards creek right.
PP Mohawk 2	323125	4010713	2	10/6/06	Pre	"	Looking across the stream at many big matures.
PP Mohawk 2	323125	4010713	2	10/6/06	Post	"	Post work.
PP Mohawk 2	323125	4010713	3	10/6/06	Pre	"	Looking downstream at some TAMRAM and the cave-spring on creek right in the background.
PP Mohawk 2	323125	4010713	3	10/6/06	Post	"	Post work.
PP Mohawk 2	323125	4010713	A	10/6/06	Pre	"	Kate at photopoint. Taken 15m upstream of the large photopoint boulder.
PP Mohawk 2	323125	4010713	1	5/15/07	Post	"	Looking upstream, towards creek right.
PP Mohawk 2	323125	4010713	2	5/15/07	Post	"	Looking across the stream.
PP Mohawk 2	323125	4010713	3	5/15/07	Post	"	Looking downstream at the cave-spring on creek right in the background.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Mohawk 4	322211	4008416	1	10/6/06	Post	150m below a huge Muav chockstone in upper Mohawk. This is near the mature redbuds on top of a 1x1m Muav gray boulder.	Post work.
PP Mohawk 4	322211	4008416	1	10/6/06	Pre	"	Looking upstream at 1 smaller TAMRAM on the left and a big one on the right.
PP Mohawk 4	322211	4008416	A	10/6/06	Pre	"	Kate at photopoint. Taken up canyon 15m, midway between photo rock and the big mature TAMRAM, looking down canyon.
PP Mohawk Canyon T1B End	323130	4010685	1	5/13/06	Pre	Mohawk T1B End.	Standing on the end point of the transect. Looking up the transect to the start of the transect, up canyon.
PP Mohawk Canyon T1B End	323130	4010685	2	5/13/06	Pre	"	Standing at the end point of the transect. Looking down canyon showing the creek and Mohawk T1A area.
PP Mohawk Canyon T1B End	323130	4010685	B	5/13/06	Pre	"	From along creek right wall about 5m from the transect end. Looking up canyon to Mike at the end point in the bottom of the corner. Show the skyline!
PP Mohawk Canyon T1B End	323130	4010685	C	5/13/06	Pre	"	From just above the end point. Close up of the end point.
PP Mohawk Canyon T1B End	323130	4010685	1	5/17/07	Post	"	Photo update.
PP Mohawk Canyon T1B End	323130	4010685	2	5/17/07	Post	"	Photo update.
PP Mohawk Canyon T1B End	323130	4010685	A	5/17/07	Post	"	Looking at end point standing on 45 m on transect tape.
PP Mohawk Canyon T1A End	323157	4010593	A	5/13/06	Pre	Mohawk T1A End	Standing at 45m mark on transect tape just upstream of transect end. Looking at transect end point- downstream.
PP Mohawk Canyon T1A End	323157	4010593	B	5/13/06	Pre	"	Muav bedrock on creek right just downstream of transect end. Zoom in to show location of transect tape on bedrock.
PP Mohawk Canyon T1A End	323157	4010593	C	5/13/06	Pre	"	Muav bedrock on creek right just downstream of transect end. Looking across creek at meter tape at the transect end on Muav bedrock shelf and BRITON shrub.
PP Mohawk Canyon T1A End	323157	4010593	D	5/13/06	Pre	"	Standing at the 45m mark on the transect tape just upstream of the transect end. Close up of transect tape location.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Mohawk Canyon T1A End	323157	4010593	1	5/17/07	Post	"	View from end point looking upstream and up the transect tape toward the transect start.
PP Mohawk Canyon T1A End	323157	4010593	2	5/17/07	Post	"	View taken from end point, looking across stream toward bedrock wall.
PP Mohawk Canyon T1A End	323157	4010593	3	5/17/07	Post	"	View taken from endpoint looking downstream.
PP Mohawk Canyon T1A Start	323125	4010708	1	5/13/06	Pre	A cream colored 2m wide boulder on creek left is the transect start.	Standing on the cream colored rock at the transect start. Looking down the transect toward the end point.
PP Mohawk Canyon T1A Start	323125	4010708	2	5/13/06	Pre	"	Looking SW or further to creek left at Muav bedrock where View B was taken from.
PP Mohawk Canyon T1A Start	323125	4010708	3	5/13/06	Pre	"	Looking upstream at Muav bedrock that View A was taken from and the end of transect T1B.
PP Mohawk Canyon T1A Start	323125	4010708	A	5/13/06	Pre	"	Standing on the 5m mark of the transect, downstream of the transect start. Looking upstream at the transect start with two 1.5m limestone boulders in view and Muav bedrock in the background.
PP Mohawk Canyon T1A Start	323125	4010708	B	5/13/06	Pre	"	Muav bedrock on creek left about 15m SW of the transect start. Looking towards creek right at the transect start point on the boulder with the orange cloth.
PP Mohawk Canyon T1A Start	323125	4010708	C	5/13/06	Pre	"	Muav bedrock on creek left about 15m upstream of transect start. Looking downstream at orange cloth marking transect start point on creek left boulders.
PP Mohawk Canyon T1A Start	323125	4010708	1	5/17/07	Post	"	Standing on the cream colored rock at the transect start. Looking down the transect toward the end point.
PP Mohawk Canyon T1A Start	323125	4010708	2	5/17/07	Post	"	Looking SW or further to creek left at Muav bedrock where view b was taken from.
PP Mohawk Canyon T1A Start	323125	4010708	3	5/17/07	Post	"	Looking upstream at Muav bedrock that View C was taken from and the end of transect T1B.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Mohawk Canyon T1A Start	323125	4010708	D	5/17/07	Post	"	Close-up of start point, under stone with GPS next to it. From the 1m mark on tape.
PP Mohawk Canyon T1B Start	323098	4010647	1	5/13/06	Pre	Mohawk T1B start.	Standing on the start point boulder. Looking down the transect tape toward the end showing the vegetation.
PP Mohawk Canyon T1B Start	323098	4010647	2	5/13/06	Pre	"	Standing on start boulder. Looking down transect tape showing more of the skyline.
PP Mohawk Canyon T1B Start	323098	4010647	3	5/13/06	Pre	"	Standing on start point boulder. Looking up canyon toward the creek curve. Shows the shale shelves.
PP Mohawk Canyon T1B Start	323098	4010647	B	5/13/06	Pre	"	From up canyon about 12m of the transect start boulder on creek right. Lori standing on transect start boulder looking down canyon.
PP Mohawk Canyon T1B Start	323098	4010647	C	5/13/06	Pre	"	From about 10 meters down canyon of transect start boulder. Looking up canyon to Lori on the start point.
PP Mohawk Canyon T1B Start	323098	4010647	D	5/13/06	Pre	"	Leaning on start point boulder. Close up of start point on top of the boulder.
PP Mohawk Canyon T1B Start	323098	4010647	1	5/17/07	Post	"	Standing on the start point boulder. Looking down the transect tape toward the end showing the vegetation.
PP Mohawk Canyon T1B Start	323098	4010647	2	5/17/07	Post	"	Standing on start boulder. Looking down transect tape showing more of the skyline.
PP Mohawk Canyon T1B Start	323098	4010647	3	5/17/07	Post	"	Standing on start point boulder. Looking up canyon toward the creek curve. Shows the shale shelves.
PP Mohawk Canyon T1B Start	323098	4010647	A	5/17/07	Post	"	Looking from 5m mark on tape to start point.
PP Mohawk Canyon T2A End	323084	4010315	1	5/13/06	Pre	Mohawk T2A End. Taken from 1m downstream of the end point standing on a Muav ledge wall.	Looking up the transect tape toward the start.
PP Mohawk Canyon T2A End	323084	4010315	2	5/13/06	Pre	"	Looking downstream to the seep on creek right in the Muav wall and a 1x1m boulder mid-channel.
PP Mohawk Canyon T2A End	323084	4010315	B	5/13/06	Pre	"	Taken from the channel bottom. Looking at the end point with Lori standing at the end point.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Mohawk Canyon T2A End	323084	4010315	C	5/13/06	Pre	"	Taken from creek left about 6m away from the end point. Looking at the end point with Lori standing at the endpoint and the Muav ledge wall.
PP Mohawk Canyon T2A End	323084	4010315	D	5/13/06	Pre	"	Taken from about 1m downstream of the end point and toward the channel. Close up of the end point.
PP Mohawk Canyon T2A End	323084	4010315	1	5/17/07	Post	"	Photo update.
PP Mohawk Canyon T2A End	323084	4010315	2	5/17/07	Post	"	Photo update.
PP Mohawk Canyon T2A End	323084	4010315	A	5/17/07	Post	"	Steve Till's a flash of red at the end point, taken from 45 m on transect tape.
PP Mohawk Canyon T2A Start	323043	4010288	1	5/13/06	Pre	Mohawk T2A Start.	Taken from 1m from the start point, toward the channel. Looking downstream toward the end and down the tape.
PP Mohawk Canyon T2A Start	323043	4010288	2	5/13/06	Pre	"	Taken from 1m from the start point, toward the channel. Looking down the channel with BACSAL patch and SALEXI. Channel bottom in picture with the skyline.
PP Mohawk Canyon T2A Start	323043	4010288	3	5/13/06	Pre	"	Taken 1m from start point. Looking upstream with a large boulder (1.25x2m) in the foreground and skyline. Cool rock formations.
PP Mohawk Canyon T2A Start	323043	4010288	B	5/13/06	Pre	"	Standing in the middle of the channel bottom about 4m from the start (downstream). Looking at the start point with Mike standing and pointing at the start.
PP Mohawk Canyon T2A Start	323043	4010288	C	5/13/06	Pre	"	Close up of the start point tied around a SALEXI with orange.
PP Mohawk Canyon T2A Start	323043	4010288	D	5/13/06	Pre	"	Close up of the start point with the Poky man pole bag next to it along with a boulder next to the SALEXI.
PP Mohawk Canyon T2A Start	323043	4010288	1	5/17/07	Post	"	Photo update.
PP Mohawk Canyon T2A Start	323043	4010288	2	5/17/07	Post	"	Photo update.
PP Mohawk Canyon T2A Start	323043	4010288	3	5/17/07	Post	"	Photo update.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Mohawk Canyon T2A Start	323043	4010288	A	5/17/07	Post	"	From 5 m on transect tape looking back to Steve, who is waving from start point.
PP Mohawk Canyon T2B End	323044	4010316	1	5/13/06	Pre	Mohawk Canyon T2B End.	T2B End. View upstream along the tape.
PP Mohawk Canyon T2B End	323044	4010316	2	5/13/06	Pre	"	T2B End. Looking at stream right to a large triangular boulder.
PP Mohawk Canyon T2B End	323044	4010316	B	5/13/06	Pre	"	Middle of drainage, looking towards the endpoint. The endpoint with rocks in the background.
PP Mohawk Canyon T2B End	323044	4010316	1	5/17/07	Post	"	View upstream along tape.
PP Mohawk Canyon T2B End	323044	4010316	2	5/17/07	Post	"	T2B end. Looking at stream right to a large triangular boulder.
PP Mohawk Canyon T2B End	323044	4010316	A	5/17/07	Post	"	Picture of Lisa standing and pointing at end point, within IMPBRE patch, taken from 45m mark.
PP Mohawk Canyon T2B End	323044	4010316	C	5/17/07	Post	"	Close up of endpoint in IMPBRE patch taken from 2m downstream of transect end. Showing tape in background.
PP Mohawk Canyon T2B Start	323019	4010277	1	5/13/06	Pre	Mohawk Canyon T2B Start.	T2B Start. Downstream along the transect.
PP Mohawk Canyon T2B Start	323019	4010277	2	5/13/06	Pre	"	T2B start. Upstream view and skyline.
PP Mohawk Canyon T2B Start	323019	4010277	B	5/13/06	Pre	"	Kate in the middle of the drainage. Looking to stream left. Kate is at the start point.
PP Mohawk Canyon T2B Start	323019	4010277	C	5/13/06	Pre	"	Taken from the top of the boulder at meter 27. Upstream to Kate at start point.
PP Mohawk Canyon T2B Start	323019	4010277	D	5/13/06	Pre	"	Taken from the top of the boulder at meter 27. Downstream view towards end point and grotto in the background.
PP Mohawk Canyon T2B Start	323019	4010277	1	5/17/07	Post	"	T2B start. Downstream along the transect.
PP Mohawk Canyon T2B Start	323019	4010277	2	5/17/07	Post	"	T2B start. Upstream view and skyline.
PP Mohawk Canyon T2B Start	323019	4010277	A	5/17/07	Post	"	Picture of Lisa standing and pointing at start point. Taken from 5m mark on transect.
PP Mohawk Canyon T2B Start	323019	4010277	E	5/17/07	Post	"	Close up of start point. Taken from 1m on transect tape.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Mohawk Canyon T3A End	322848	4009907	1	5/13/06	Pre	Mohawk T3A end point.	Taken from T3A endpoint. Looking upstream along transect tape, large tamarisk in foreground.
PP Mohawk Canyon T3A End	322848	4009907	2	5/13/06	Pre	"	Taken from T3A endpoint. Looking upstream with transect tape creek left. (skyline included)
PP Mohawk Canyon T3A End	322848	4009907	3	5/13/06	Pre	"	Taken from T3A endpoint. Looking downstream from endpoint/creek left (skyline included).
PP Mohawk Canyon T3A End	322848	4009907	B	5/13/06	Pre	"	Looking at photopoint from downstream and creek right. T3A endpoint with yellow camera case.
PP Mohawk Canyon T3A End	322848	4009907	C	5/13/06	Pre	"	Looking at photopoint from upstream and in stream channel. T3A endpoint with yellow camera case indicating end.
PP Mohawk Canyon T3A End	322848	4009907	D	5/13/06	Pre	"	Looking at photopoint from creek right just below a large tamarisk on large limestone boulder.
PP Mohawk Canyon T3A End	322848	4009907	1	5/16/07	Post	"	Taken from T3A endpoint. Looking upstream along transect tape. Large TAMRAM is GONE!
PP Mohawk Canyon T3A End	322848	4009907	2	5/16/07	Post	"	Taken from T3A endpoint. Looking upstream with transect tape creek left. (skyline)
PP Mohawk Canyon T3A End	322848	4009907	3	5/16/07	Post	"	Taken from T3A endpoint. Looking downstream from endpoint, creek left (skyline included).
PP Mohawk Canyon T3A End	322848	4009907	A	5/16/07	Post	"	Wendy at end point taken from 45m mark on transect.
PP Mohawk Canyon T3A Start	322924	4009740	2	5/3/06	Pre	Mohawk T3A start.	Taken from T3A start point. Looking upstream along main channel (skyline included).
PP Mohawk Canyon T3A Start	322924	4009740	1	5/13/06	Pre	"	Taken from T3A start point. Looking downstream along the transect on creek left.
PP Mohawk Canyon T3A Start	322924	4009740	B	5/13/06	Pre	"	Looking upstream from creek left at photopoint. Photopoint is on a large limestone boulder. T3A start point with the yellow camera case indicating the start.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Mohawk Canyon T3A Start	322924	4009740	C	5/13/06	Pre	"	Looking downstream at the photopoint along creek left. T3A start point with yellow camera case indicating start point.
PP Mohawk Canyon T3A Start	322924	4009740	D	5/13/06	Pre	"	Close view of photopoint on large limestone boulder. Photo taken from creek right. T3A start point with yellow camera case indicating the start.
PP Mohawk Canyon T3A Start	322924	4009740	1	5/16/07	Post	"	Taken from T3A start point. Looking downstream along the transect on creek left.
PP Mohawk Canyon T3A Start	322924	4009740	2	5/16/07	Post	"	Taken from T3A start point. Looking upstream along main channel (skyline included)
PP Mohawk Canyon T3A Start	322924	4009740	A	5/16/07	Post	"	View of Wendy at start point taken from 5m mark on transect.
PP Mohawk HA 1	323390	4010930	1	5/13/06	Pre	Taken from a boulder about 500m from the mouth of Mohawk	View upstream at Muav narrows, very dry and cobbly.
PP Mohawk HA 1	323390	4010930	2	5/13/06	Pre	"	View downstream at Mike and cobbly dry creek.
PP Mohawk HA 1	323390	4010930	A	5/13/06	Pre	"	Taken 10 meters from the photopoint.
PP Mohawk HA 2	322850	4009120	1	5/13/06	Pre	This spot is at the end of Mohawk section 5 where a giant boulder stopped our progress upstream.	View upstream at large chockstone-the end of the hike.
PP Mohawk HA 2	322850	4009120	2	5/13/06	Pre	"	View downstream at limestone narrows.
PP Mohawk HA 2	322850	4009120	A	5/13/06	Pre	"	Taken 10m from the photopoint.
PP Mohawk Hydro # 2	323127	4010686	1	5/13/06	Pre	Mohawk Hydro #2	15m upstream from the beginning of T1A transect and 4m downstream of Mohawk hydro #2.
PP Mohawk Hydro # 2	323127	4010686	2	5/13/06	Pre	"	Large boulder at top of small pourover 5m upstream of Mohawk #2 hydro. Length of Mohawk hydro looking downstream.
PP Mohawk Hydro # 2	323127	4010686	A	5/13/06	Pre	"	West side of Hydro transect # 2??? Photo of photopoint label. Also shows entire length of Hydro #2 transect (1m)
PP Mohawk Hydro # 2	323127	4010686	1	5/16/07	Post	"	15m upstream from the beginning of T1A transect and 4m downstream of Hydro 2
PP Mohawk Hydro # 2	323127	4010686	2	5/16/07	Post	"	Large boulder at top of small pourover, 5m upstream of Hydro 2.
PP Mohawk Hydro #1	323157	4010593	1	5/13/06	Pre	Mohawk Hydro #1	2m upstream from Mohawk hydro #1 beginning. Photo label.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Mohawk Hydro #1	323157	4010593	2	5/13/06	Pre	"	2m upstream from beginning of hydro #1. Beginning of 2m channel of transect #1 in Mohawk.
PP Mohawk Hydro #1	323157	4010593	3	5/13/06	Pre	"	5m downstream from end of Mohawk Hydro #1. End of 2m channel marked with water bottle in photo.
PP Mohawk Hydro #1	323157	4010593	2	5/16/07	Post	"	2m upstream from beginning of hydro 1. Beginning of 2m channel in T1.
PP Mohawk Hydro #1	323157	4010593	3	5/16/07	Post	"	5m downstream from end of hydro 1. End of 2m channel.
PP Mohawk Hydro #3	323055	4010622	1	5/13/06	Pre	Mohawk Hydro #3	Same as above but shows entire 2m length of transect marked with water bottles. 2m upstream of Mohawk hydro #3 running along short minor ledge up to cascade.
PP Mohawk Hydro #3	323055	4010622	2	5/13/06	Pre	"	3m upstream of beginning of Mohawk hydro #3. 2m length downstream looking toward end of T1B 50m downstream.
PP Mohawk Hydro #3	323055	4010622	A	5/13/06	Pre	"	3m downstream of end of Mohawk hydro #3 about 5m below the pool. Photopoint label of Mohawk hydro #3 looking upstream along transect.
PP Mohawk Hydro #3	323055	4010622	1	5/16/07	Post	"	2m length of transect. Running along minor ledge up to cascade.
PP Mohawk Hydro #3	323055	4010622	2	5/16/07	Post	"	3m upstream of beginning of Hydro 3. Looking toward end of T1B 50m downstream.
PP Mohawk Hydro #4	323023	4010317	1	5/13/06	Pre	Mohawk Hydro #4	2m downstream of end of Mohawk Hydro #4. Rock ledge and pool of water where velocity measurement was taken.
PP Mohawk Hydro #4	323023	4010317	2	5/13/06	Pre	"	2m upstream of end of Mohawk Hydro #4. Looking downstream on 1.5m pool.
PP Mohawk Hydro #4	323023	4010317	3	5/13/06	Pre	"	About 10m downstream of end of Mohawk hydro #4. Upstream view of where creek bears into B.A. shale on creek right.
PP Mohawk Hydro #4	323023	4010317	4	5/13/06	Pre	"	5m upstream of beginning of Mohawk #4. Downstream view of stream and hanging springs on creek right.
PP Mohawk Hydro #4	323023	4010317	A	5/13/06	Pre	"	standing at end of Mohawk Hydro #4. Photopoint label of Mohawk Hydro #4 looking upstream.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Mohawk Hydro #4	323023	4010317	1	5/16/07	Post	"	2m downstream of end of Hydro 4.
PP Mohawk Hydro #4	323023	4010317	2	5/16/07	Post	"	2m upstream of end of hydro 4, looking downstream on 1.5m pool
PP Mohawk Hydro #4	323023	4010317	3	5/16/07	Post	"	About 10m downstream of hydro 4. Upstream view of where creek bears into BA shale on right.
PP Mohawk Hydro #4	323023	4010317	4	5/16/07	Post	"	5m upstream of beginning of hydro 4. Downstream view of stream and hanging springs on creek right.
PP Mohawk Hydro #5	323032	4010269	1	5/13/06	Pre	UTM's taken from hydro data form.	Directly perpendicular to the start of T2B transect. Downstream view of transect and large boulder on creek right.
PP Mohawk Hydro #5	323032	4010269	2	5/13/06	Pre	"	5m downstream of end of #5 hydro transect. View upstream of 3m hydro transect.
PP Mohawk Hydro #5	323032	4010269	1	5/17/07	Post	"	Directly perpendicular to start of T2B. Downstream view of transect and large boulder on creek right.
PP Mohawk Hydro #5	323032	4010269	2	5/17/07	Post	"	Taken from the same point as view 1. View upstream.
PP Mohawk Hydro #5	323032	4010269	A	5/17/07	Post	"	View creek right of start.
PP Mohawk Hydro #6	322856	4009921	1	5/13/06	Pre	Mohawk Hydro #6	5m downstream of end of #6 hydro and 25m upstream from T3B. Transect runs upstream from view of 3m transect, downstream end of B.A. member.
PP Mohawk Hydro #6	322856	4009921	2	5/13/06	Pre	"	5m upstream of beginning of #6 hydro and about 10m downstream of T3A. View of 3m transect that runs upstream from bottom of B.A. shale.
PP Mohawk Hydro #6	322856	4009921	A	5/13/06	Pre	"	2m downstream of end of #6 hydro transect. Photopoint label.
PP Mohawk Hydro #6	322856	4009921	1	5/17/07	Post	"	5m downstream of end of hydro 6 and 25m upstream from T3B. Transect runs upstream from view.
PP Mohawk Hydro #6	322856	4009921	2	5/17/07	Post	"	5m upstream of beginning of hydro 6 and 10m downstream of T3A. View of 3m transect that runs upstream from bottom of BA shale.
PP Mohawk T3B End	322927	4009859	1	5/13/06	Pre	Mohawk T3B End.	Taken from the endpoint. Looking up the transect toward the start.
PP Mohawk T3B End	322927	4009859	2	5/13/06	Pre	"	Looking up the transect toward the start.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Mohawk T3B End	322927	4009859	3	5/13/06	Pre	"	Looking up the transect toward the start.
PP Mohawk T3B End	322927	4009859	4	5/13/06	Pre	"	Looking downstream.
PP Mohawk T3B End	322927	4009859	5	5/13/06	Pre	"	Looking upstream.
PP Mohawk T3B End	322927	4009859	B	5/13/06	Pre	"	Taken from the end of the channel on creek right looking upstream about 10m from the end point. Looking at the endpoint to the right of Lori in a debris pile, series of huge boulders above.
PP Mohawk T3B End	322927	4009859	C	5/13/06	Pre	"	Taken from the end of the channel on creek right looking upstream about 10m from the end point. Looking at the end point with the skyline included.
PP Mohawk T3B End	322927	4009859	D	5/13/06	Post	"	Taken from 1 m away toward the channel. Looking at the end point close up. The orange tape is the end point and not the boulder on the left.
PP Mohawk T3B End	322927	4009859	1	5/16/07	Post	"	Photo update.
PP Mohawk T3B End	322927	4009859	2	5/16/07	Post	"	Photo update.
PP Mohawk T3B End	322927	4009859	3	5/16/07	Post	"	Photo update.
PP Mohawk T3B End	322927	4009859	4	5/16/07	Post	"	Photo update.
PP Mohawk T3B End	322927	4009859	5	5/16/07	Post	"	Photo update.
PP Mohawk T3B End	322927	4009859	A	5/16/07	Post	"	From 45 m mark looking at Kelly standing at transect end point.
PP Mohawk T3B End	322927	4009859	B	5/16/07	Post	"	Photo update.
PP Mohawk T3B End	322927	4009859	C	5/16/07	Post	"	Photo update.
PP Mohawk T3B Start	322954	4009944	1	5/13/06	Pre	Mohawk T3B start point along the Muav wall/ledge.	Taken from the start point on the Muav wall/ledge. Looking toward the end along the transect.
PP Mohawk T3B Start	322954	4009944	2	5/13/06	Pre	"	Looking along the transect with the skyline.
PP Mohawk T3B Start	322954	4009944	3	5/13/06	Pre	"	Taken from 1m point on the tape on the Muav wall. Looking upstream with the ledge on the right in the picture.
PP Mohawk T3B Start	322954	4009944	4	5/13/06	Pre	"	Taken from the 1m point on the tape on the Muav ledge. Looking upstream with the skyline in the photo.
PP Mohawk T3B Start	322954	4009944	B	5/13/06	Pre	"	Taken from mid-channel about 10m from the start, downstream. Looking at the start with a white stone at the start on the Muav wall. Mike is next to the start.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Mohawk T3B Start	322954	4009944	C	5/13/06	Pre	"	Taken from mid-channel about 10m downstream of start. Looking at the start with Mike in the photo and the skyline.
PP Mohawk T3B Start	322954	4009944	D	5/13/06	Pre	Mohawk T3B start point along the Muav wall/ledge.	Taken from the channel along the wall. Looking at the start, a close up of the distinct crack in the rock.
PP Mohawk T3B Start	322954	4009944	1	5/16/07	Post	"	Photo update.
PP Mohawk T3B Start	322954	4009944	2	5/16/07	Post	"	Photo update.
PP Mohawk T3B Start	322954	4009944	3	5/16/07	Post	"	Photo update.
PP Mohawk T3B Start	322954	4009944	4	5/16/07	Post	"	Photo update.
PP Mohawk T3B Start	322954	4009944	A	5/16/07	Post	"	Steve Till at start point, taken from 5 m on transect tape.
PP Honga 1	315933	4009270	1	3/3/05	Pre	Recheck this GPS it may not be right. Taken from an enormous white boulder on creek right downstream of waterfall. Standing on flattest patch on southern part of rock (not the highest part of rock). Initially there were two PPs with the same UTM reading - combined into one - but left the Honga 2 name on some - re-do this whole site and future it out!	Looking toward waterfall along the creek, looking upstream. This may not be the right photo.
PP Honga 1	315933	4009270	A	3/3/05	Pre	"	Person at photopoint.
PP Honga HA 1	316086	4009160	1	5/14/06	Pre	This photopoint is upper Honga, above the first waterfall and at the base of the second waterfall. Columbines and ferns are plentiful at this dripping falls. Photopoint is 5m below the pool.	Looking downstream at mature tamarisk and beyond.
PP Honga HA 1	316086	4009160	2	5/14/06	Pre	"	Looking at the pool close by with flowering aquilegia.
PP Honga HA 1	316086	4009160	3	5/14/06	Pre	"	Looking up towards the top of the waterfall.
PP Honga HA 1	316086	4009160	A	5/14/06	Pre	"	Taken from 10m downstream of pool at cliff bottom.
PP Honga Hydro #1	315942	4009196	1	5/14/06	Pre	5m from seep pourover about a small pool.	10m from seep pourover on canyon left. View of seep pourover and small pool.
PP Honga Hydro #1	315942	4009196	A	5/14/06	Pre	"	Honga Hydro #1 photopoint label
PP Prospect 2	313035	4007329	1	10/8/06	Pre	About 800m from the mouth of Prospect at seepy spring by a loose dirt wall. In Muav limestone at a small yellowish patio. Photopoint boulder is gray (1x1x1xm) in the drainage bottom.	Looking across stream at mature TAMRAM. Lava boulder at the left of photo.
PP Prospect 2	313035	4007329	1	10/8/06	Post	"	Post work.
PP Prospect 2	313035	4007329	2	10/8/06	Post	"	Post work.
PP Prospect 2	313035	4007329	2	10/8/06	Pre	"	One TAMRAM in the foreground. Looking up canyon.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Prospect 2	313035	4007329	A	10/8/06	Pre	"	Kate at photopoint. Taken 5m upstream.
PP Prospect HA 1	312946	4007454	1	5/14/06	Pre	Basalt rock 500m up canyon. Additional GPS: 312804 4007814 +/- 9	View downstream.
PP Prospect HA 1	312946	4007454	2	5/14/06	Pre	"	View upstream.
PP Prospect HA 1	312946	4007454	A	5/14/06	Pre	"	Standing 5m upstream of basalt rock photopoint. Kate on photopoint rock 500m up canyon.
PP Prospect HA 2	313038	4007051	1	5/14/06	Pre	At the base of a waterfall, about 375m into Prospect 2. (sandstone boulder)	Downstream view.
PP Prospect HA 2	313038	4007051	2	5/14/06	Pre	"	Upstream view.
PP Prospect HA 2	313038	4007051	A	5/14/06	Pre	"	Upstream of photopoint rock. Looking at Kate on photopoint rock.
PP Prospect Hydro 1	313041	4007180	1	5/14/06	Pre	Note: Northing was recorded as 400718. Prospect Hydro 1	Hydro point 1 (3rd pool up about 16m in diameter) View downstream along 2 other pools.
PP Prospect Hydro 1	313041	4007180	2	5/14/06	Pre	"	View upstream.
PP Prospect Hydro 1	313041	4007180	A	5/14/06	Pre	"	3m downstream from the small pool. Hydro point 1 with the pen pointing to it.
PP Prospect Hydro 1	313041	4007180	B	5/14/06	Pre	"	Taken from the middle of the drainage looking at the photopoint. View is of the photopoint behind the large boulder.
PP 190 Mile 1	302092	3999720	1	10/9/06	Pre	Located 10m upstream of the beginning of section #1 (no GPS signal) in an alcove on creek left below a small 10' slickrock slide. UTM's taken from tamarisk mapping data form (start point).	Looking downstream and across the channel. There are N. Rim buttes lighted in the background.
PP 190 Mile 1	302092	3999720	1	10/9/06	Post	"	Post work.
PP 190 Mile 1	302092	3999720	2	10/9/06	Post	"	Post work.
PP 190 Mile 1	302092	3999720	2	10/9/06	Pre	"	Looking up at TAMRAM thicket above the pouroff (small 10' pouroff).
PP 190 Mile 1	302092	3999720	A	10/9/06	Pre	"	Loren standing at photopoint.
PP 190 Mile 2	301911	3998573	1	10/9/06	Post	Photopoint is about 150m into 190 Mile 2, above a Tapeats climb. The canyon opens up in a seepy area. PP is on top of a pile of 4 limestone boulders. The biggest one is a beige 5x10m rock in the middle of the drainage.	Post work.
PP 190 Mile 2	301911	3998573	1	10/9/06	Pre	"	Looking upstream at Tapeats shelves.
PP 190 Mile 2	301911	3998573	2	10/9/06	Post	"	Post work.
PP 190 Mile 2	301911	3998573	2	10/9/06	Pre	"	Looking upstream and at creek left with Nolina in the seep.
PP 190 Mile 2	301911	3998573	3	10/9/06	Pre	"	Looking downstream at main TAMRAM infestation.
PP 190 Mile 2	301911	3998573	3	10/9/06	Post	"	Post work.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP 190 Mile 2	301911	3998573	A	10/9/06	Pre	"	Photopoint is at red clipboard and yellow case. Taken from about 15m downstream of the photopoint.
PP 190 Mile Canyon HA 1	301512	3998829	1	5/15/06	Pre	Creek right above lower bowl, below basalt pile.	Looking down canyon into the lower bowl with the river in the background.
PP 190 Mile Canyon HA 1	301512	3998829	2	5/15/06	Pre	"	Looking up canyon at dense tamarisk and PLUSER.
PP 190 Mile Canyon HA 1	301512	3998829	3	5/15/06	Pre	"	Looking into seepy area with cattails.
PP 190 Mile Canyon HA 1	301512	3998829	A	5/15/06	Pre	"	Just above lower bowl on creek left. RV at photopoint.
PP 190 Mile Canyon HA 2	301759	3998659	1	5/15/06	Pre	Up slight creek right fork on creek right.	Looking down canyon from bend in the creek right fork.
PP 190 Mile Canyon HA 2	301759	3998659	2	5/15/06	Pre	"	Up canyon, showing dry channel.
PP 190 Mile Canyon HA 2	301759	3998659	A	5/15/06	Pre	"	From the middle of the creek right fork of drainage. RV on creek right below a distinctive tapeats outcropping and small drainage..
PP Spring 1	287814	3988547	1	3/1/07	Pre	Taken sitting on a large white boulder on creek right about 150m below the spring source.	Looking downstream at mesquite with mistletoe.
PP Spring 1	287814	3988547	2	3/1/07	Pre	"	Same view as 1, slightly shifted and horizontal to get more vegetation in the photo.
PP Spring 1	287814	3988547	3	3/1/07	Pre	"	Looking upstream and to the left.
PP Spring 1	287814	3988547	4	3/1/07	Pre	"	Looking upstream and to the right.
PP Spring 1	287814	3988547	5	3/1/07	Pre	"	Looking across the creek.
PP Spring 1	287814	3988547	A	3/1/07	Pre	"	Pen points at PP. Taken from upstream looking down.
PP Spring Canyon HA 1	288126	3988705	1	5/16/06	Pre	Spring Canyon Habitat Assessment 1	View of the Delta of Spring Canyon. View looking downstream.
PP Spring Canyon HA 1	288126	3988705	A	5/16/06	Pre	"	View of Kevin at the photopoint.
PP Spring Canyon HA 2	288040	3988638	1	5/16/06	Pre	Spring Canyon Habitat Assessment 2	Photopoint is at the edge of a finger on canyon left. View downstream.
PP Spring Canyon HA 2	288040	3988638	2	5/16/06	Pre	"	Photopoint is at the edge of a finger on canyon left. View upstream.
PP Spring Canyon HA 2	288040	3988638	A	5/16/06	Pre	"	View of Kevin at the photopoint.
PP Spring Canyon HA 3	287769	3988570	1	5/16/06	Pre	Photopoint is 20m upslope on canyon left in the B.A. shale.	View downstream.
PP Spring Canyon HA 3	287769	3988570	2	5/16/06	Pre	"	View down the side slope.
PP Spring Canyon HA 3	287769	3988570	3	5/16/06	Pre	"	View upstream.
PP Spring Canyon HA 3	287769	3988570	A	5/16/06	Pre	"	View up canyon. Kevin in at the photopoint?

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Granite Park 1	291496	3982794	1	10/10/06	Post	Approx. 250m into the section, a 3x3m Muav limestone boulder on creek right in the drainage. This is where an eroded bank is visible at about 10m high.	Post work.
PP Granite Park 1	291496	3982794	1	10/10/06	Pre	"	Looking downstream with a lava shelf in the background and a red outcrop on creek right.
PP Granite Park 1	291496	3982794	2	10/10/06	Post	"	Post work.
PP Granite Park 1	291496	3982794	2	10/10/06	Pre	"	Looking upstream with Muav limestone walls forming a V and cottonwood tree in the distance.
PP Granite Park 1	291496	3982794	A	10/10/06	Pre	"	Gary on photopoint rock with a downstream view.
PP Granite Park 1	291496	3982794	1	5/20/07	Post	"	Photo update.
PP Granite Park 1	291496	3982794	2	5/20/07	Post	"	Photo update.
PP Granite Park 2	291625	3982386	1	11/17/06	Pre	Standing on the end of a granite wall on creek left with a patch of acacia approx. 10m downstream.	Looking upstream.
PP Granite Park 2	291625	3982386	2	11/17/06	Pre	"	Looking downstream at TAMRAM.
PP Granite Park 2	291625	3982386	A	11/17/06	Pre	"	Tech box at the photopoint. Taken from approx. 20m downstream and in the middle of the creek.
PP Granite Park 2	291625	3982386	2	11/18/06	Post	"	Post work.
PP Granite Park 2	291625	3982386	1	5/20/07	Post	"	Photo update.
PP Granite Park 2	291625	3982386	2	5/20/07	Post	"	Photo update.
PP Granite Park HA 1	292600	3980300	1	5/16/06	Pre	We are about 2 miles up from the river, where the Muav starts to narrow with a high wall surrounding…. Still in the main fork.	View upstream at narrowing, high wall of limestone.
PP Granite Park HA 1	292600	3980300	2	5/16/06	Pre	"	Downstream view at Muav and Redwall.
PP Granite Park HA 1	292600	3980300	A	5/16/06	Pre	"	Taken from the middle of the drainage, about 10m below.
PP Granite Park HA 2	291612	3982542	1	5/16/06	Pre	No GPS signal. This photopoint is the furthest point up from the river we got up the main drainage. It is between 3-4 miles from the river at a giant chockstone (that could be bypassed). UTM's taken from habitat assessment data form (start point).	Upstream view at giant chockstone blocking the drainage.
PP Granite Park HA 2	291612	3982542	2	5/16/06	Pre	"	Downstream view over polished rock to dry creek bed.
PP Granite Park HA 2	291612	3982542	A	5/16/06	Pre	"	Taken downstream, about 10m. View of chockstone behind the pen.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Granite Park HA 3	291603	3982432	1	5/16/06	Pre	This area is the densest vegetation in Granite Park. About 1km from the river the canyon narrows briefly and tall thick willows and tamarisk grow in a clump. Above the canyon is dry. The point is above the creek on a yellow colored cliff with a barrel cactus growing tall near the photopoint.	Upstream view at a dry creek bed.
PP Granite Park HA 3	291603	3982432	2	5/16/06	Pre	"	Looking down at the lush 30m section of creek (the spring)
PP Granite Park HA 3	291603	3982432	3	5/16/06	Pre	"	Downstream at the thicket of tammies, 250m long in Granite Park.
PP Granite Park HA 3	291603	3982432	A	5/16/06	Pre	"	Pen pointed at the photopoint. 10m above the creek on a yellow cliff, creek right.
PP Granite Park Hydro 1	291484	3982798	A	5/13/06	Pre	Granite Park Hydro 1	1m downstream of the pool at 11.5m on T1A. Granite Park Hydro 1
PP Granite Park Hydro 1	291484	3982798	1	5/16/06	Pre	"	3m downstream of pool at 11.5m on T1A transect. Upstream view of small pools.
PP Granite Park Hydro 1	291484	3982798	2	5/16/06	Pre	"	3m upstream of pool at 11.5m on T1A transect. Downstream view of where pools are located, but not visible.
PP Granite Park Hydro 1	291484	3982798	1	5/20/07	Post	"	3m downstream of pool at 11.5m on T1A transect. Upstream view of small pools
PP Granite Park Hydro 1	291484	3982798	2	5/20/07	Post	"	3m upstream of pool at 11.5m on T1A transect. Downstream view of where pools are located, but not visible.
PP Granite Park Hydro 2	291578	3982594	1	5/16/06	Pre	Granite Park Hydro 2	5m downstream of end of hydro 2 transect. 1.5m stretch of hydro 2 up canyon.
PP Granite Park Hydro 2	291578	3982594	2	5/16/06	Pre	"	5m downstream of beginning of hydro 2 transect. 1.5m stretch of hydro 2 down canyon.
PP Granite Park Hydro 2	291578	3982594	A	5/16/06	Pre	"	Center of hydro transect on west side of T2A transect at 24m mark. G.P. hydro.
PP Granite Park Hydro 2	291578	3982594	2	5/20/06	Post	"	5m downstream of beginning of hydro 2 transect. 1.5m stretch of hydro 2 down canyon.
PP Granite Park Hydro 2	291578	3982594	1	5/20/07	Post	Granite Park Hydro 2	5m downstream of end of hydro 2 transect. 1.5m stretch of hydro 2 up canyon.
PP Granite Park T1A End	291461	3982831	1	5/17/06	Pre	Granite Park T1A end. On a boulder.	View upstream along the transect.
PP Granite Park T1A End	291461	3982831	2	5/17/06	Pre	"	View downstream.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Granite Park T1A End	291461	3982831	B	5/17/06	Pre	"	Taken about 5m upstream and stream right of T1A end point. T1A end point with the skyline. (These photos might be slightly off as they appear to have been recorded incorrectly.)
PP Granite Park T1A End	291461	3982831	C	5/17/06	Pre	"	Taken directly stream right of the end point, standing on a boulder. T1A End with boulders, skyline and Lori.
PP Granite Park T1A End	291461	3982831	1	5/20/07	Post	"	Photo update.
PP Granite Park T1A End	291461	3982831	2	5/20/07	Post	"	Photo update.
PP Granite Park T1A End	291461	3982831	A	5/20/07	Post	"	Looking at end point. Taken from the 45 m mark on the transect tape.
PP Granite Park T1A Start	291497	3982792	1	5/16/06	Pre	"	Taken from the start of T1A, standing on the boulder. Downstream view along the transect tape.
PP Granite Park T1A Start	291497	3982792	2	5/17/06	Pre	"	T1A start. View upstream with the skyline.
PP Granite Park T1A Start	291497	3982792	B	5/17/06	Pre	"	Taken from the middle of the drainage channel about 3 meters downstream of T1A start. Shows the start and the skyline.
PP Granite Park T1A Start	291497	3982792	C	5/17/06	Pre	"	Taken from the middle of the drainage channel about 4m upstream of T1A start. Shows the start and the skyline.
PP Granite Park T1A Start	291497	3982792	D	5/17/06	Pre	"	Taken from immediate stream left of start boulder. Close up of T1A start boulder.
PP Granite Park T1A Start	291497	3982792	1	5/20/07	Post	"	Photo update.
PP Granite Park T1A Start	291497	3982792	2	5/20/07	Post	"	Photo update.
PP Granite Park T1A Start	291497	3982792	A	5/20/07	Post	"	Looking at start point. Taken from 5 m mark on transect.
PP Granite Park T1B End	291484	3982774	1	5/16/06	Pre	Transect end next to Encelia shrub.	Upstream toward transect start.
PP Granite Park T1B End	291484	3982774	2	5/16/06	Pre	"	Looking west at BA shale overhang where T1B End, View A and B were taken from.
PP Granite Park T1B End	291484	3982774	3	5/16/06	Pre	"	Downstream view.
PP Granite Park T1B End	291484	3982774	4	5/16/06	Pre	"	Looking East across drainage.
PP Granite Park T1B End	291484	3982774	B	5/16/06	Pre	"	Taken from BA shale overhang about 15m west of transect end. Kate at transect end.
PP Granite Park T1B End	291484	3982774	C	5/16/06	Pre	"	Taken from BA shale overhang about 15m west of transect end. Kate at transect end.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Granite Park T1B End	291484	3982774	D	5/16/06	Pre	"	Taken about 8m downstream of transect end. Looking upstream at Kate standing at transect end. Note encelia shrub
PP Granite Park T1B End	291484	3982774	1	5/20/07	Post	"	Photo update.
PP Granite Park T1B End	291484	3982774	2	5/20/07	Post	"	Photo update.
PP Granite Park T1B End	291484	3982774	3	5/20/07	Post	"	Photo update.
PP Granite Park T1B End	291484	3982774	4	5/20/07	Post	"	Photo update.
PP Granite Park T1B End	291484	3982774	A	5/20/07	Pre	"	Taken from 45m towards end point.
PP Granite Park T1B Start	291567	3982528	1	5/16/06	Pre	Transect start on BA shale bedrock.	Down transect toward end point.
PP Granite Park T1B Start	291567	3982528	2	5/16/06	Pre	"	Towards creek right of drainage.
PP Granite Park T1B Start	291567	3982528	3	5/16/06	Pre	"	Upstream view.
PP Granite Park T1B Start	291567	3982528	B	5/16/06	Pre	"	5m east of transect start at corner of BA shale bedrock in creek. Transect start point.
PP Granite Park T1B Start	291567	3982528	C	5/16/06	Pre	"	8m west of transect start on white limestone boulder on creek left. Transect start with orange cloth.
PP Granite Park T1B Start	291567	3982528	1	5/20/07	Post	"	Photo update.
PP Granite Park T1B Start	291567	3982528	2	5/20/07	Post	"	Photo update.
PP Granite Park T1B Start	291567	3982528	3	5/20/07	Post	"	Photo update.
PP Granite Park T1B Start	291567	3982528	A	5/20/07	Pre	"	Taken from 5m from the start point.
PP Granite Park T2A End	291568	3982618	1	5/16/06	Pre	Granite Park T2A end point.	Looking up the transect tape toward the start.
PP Granite Park T2A End	291568	3982618	2	5/16/06	Pre	"	Looking toward schist wall away from the drainage.
PP Granite Park T2A End	291568	3982618	B	5/16/06	Pre	"	Taken from pink granite shelf to NE of transect end.
PP Granite Park T2A End	291568	3982618	C	5/16/06	Pre	"	Taken 2m from the end of the tape. Looking at the tape end and up canyon far ridge line.
PP Granite Park T2A End	291568	3982618	D	5/16/06	Pre	"	Taken from higher up on pink granite about 8m from the transect end. Dense TAMRAM patch past the end of the transect.
PP Granite Park T2A End	291568	3982618	E	5/16/06	Pre	"	Taken from higher up on pink granite about 8m from the transect end. Down canyon view.
PP Granite Park T2A End	291568	3982618	1	5/20/07	Post	"	Photo update.
PP Granite Park T2A End	291568	3982618	2	5/20/07	Post	"	Photo update.
PP Granite Park T2A End	291568	3982618	3	5/20/07	Post	"	Looking downstream.
PP Granite Park T2A End	291568	3982618	4	5/20/07	Post	"	Looking across stream.
PP Granite Park T2A End	291568	3982618	A	5/20/07	Pre	"	Taken from 45m mark towards end point.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Granite Park T2A Start	291598	3982583	B	5/10/06	Pre	Transect start point on large granite outcrop on creek left.	From 10m upstream of transect start on 1x4m tapeats boulder. Looking downstream at photopoint start on granite outcrop.
PP Granite Park T2A Start	291598	3982583	1	5/16/06	Pre	"	Transect start point on large granite outcrop on creek left. Downstream, down transect.
PP Granite Park T2A Start	291598	3982583	2	5/16/06	Pre	"	Creek right outcrop where view B was taken.
PP Granite Park T2A Start	291598	3982583	3	5/16/06	Pre	"	Upstream view.
PP Granite Park T2A Start	291598	3982583	4	5/16/06	Pre	"	Upstream view toward drainage channel and BACSAR.
PP Granite Park T2A Start	291598	3982583	5	5/16/06	Pre	"	Creek left and downstream showing POPFRE.
PP Granite Park T2A Start	291598	3982583	C	5/16/06	Pre	"	Standing on creek right, granite outcrop. Looking SW at transect start on peak of first big granite outcrop to reach drainage channel.
PP Granite Park T2A Start	291598	3982583	D	5/16/06	Pre	"	At the 4m mark on the transect tape. Looking upstream at transect start point.
PP Granite Park T2A Start	291598	3982583	1	5/20/07	Post	"	Photo update.
PP Granite Park T2A Start	291598	3982583	2	5/20/07	Post	"	Photo update.
PP Granite Park T2A Start	291598	3982583	3	5/20/07	Post	"	Photo update.
PP Granite Park T2A Start	291598	3982583	4	5/20/07	Post	"	Photo update.
PP Granite Park T2A Start	291598	3982583	5	5/20/07	Post	"	Photo update.
PP Granite Park T2A Start	291598	3982583	A	5/20/07	Pre	"	Taken from 5m mark towards the start.
PP Granite Park T2B End	291607	3982521	1	5/16/06	Pre	Granite Park T2B end point.	Looking upstream from the endpoint which is on creek left.
PP Granite Park T2B End	291607	3982521	2	5/16/06	Pre	"	Looking downstream through BACSAL with the skyline included.
PP Granite Park T2B End	291607	3982521	B	5/16/06	Post	"	Taken looking at the endpoint on creek left from the creek bed with the skyline included. Photo of T2B endpoint with the red backpack indicating the end point.
PP Granite Park T2B End	291607	3982521	C	5/16/06	Post	"	Looking at the endpoint; a close up with the skyline included. Photo of T2B endpoint with the red backpack indicating the endpoint.
PP Granite Park T2B End	291607	3982521	1	5/20/07	Post	"	Photo update.
PP Granite Park T2B End	291607	3982521	2	5/20/07	Post	"	Photo update.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Granite Park T2B End	291607	3982521	A	5/20/07	Post	"	Amy at transect end. Taken from 45 m on transect.
PP Granite Park T2B Start	291579	3982476	1	5/16/06	Post	Granite Park T2B start.	View looking downstream along the transect line/creek left.
PP Granite Park T2B Start	291579	3982476	2	5/16/06	Post	"	View looking downstream along the transect line and creek bed with the skyline included.
PP Granite Park T2B Start	291579	3982476	3	5/16/06	Post	"	View looking upstream and creek right from the photopoint with the skyline included.
PP Granite Park T2B Start	291579	3982476	B	5/16/06	Post	"	Looking at the start point from the creek bed (creek right). Photo of T2B start point with the yellow camera box indicating the point.
PP Granite Park T2B Start	291579	3982476	C	5/16/06	Post	"	Looking at the start point from the creek be (creek right). Photo of T2B start point with the yellow camera box indicating the point.
PP Granite Park T2B Start	291579	3982476	1	5/20/07	Post	"	Photo update.
PP Granite Park T2B Start	291579	3982476	2	5/20/07	Post	"	Photo update.
PP Granite Park T2B Start	291579	3982476	3	5/20/07	Post	"	Photo update.
PP Granite Park T2B Start	291579	3982476	A	5/20/07	Post	"	GPS unit is at start. Taken from 5 m mark on transect.
PP E Fork of N Fork of Three Springs	294663	3973510	1	3/5/07	Pre	Taken from a approx. 20m long schist ledge which is about 3m from a two level waterfall on creek left.	Looking upstream at TAMRAM.
PP E Fork of N Fork of Three Springs	294663	3973510	A	3/5/07	Pre	"	Taken downstream of PP about 2m creek left and just above the waterfall.
PP Three Springs 1	291657	3973754	1	3/3/07	Post	Follow trail on upstream side of the canyon, as you begin to descend into the drainage the photopoint rock is about 30m down canyon from the trail.	Post work.
PP Three Springs 1	291657	3973754	1	3/3/07	Pre	"	Looking upstream on creek right at a stand of trees. Mostly PROGLA and TAMRAM, with little to no foliage.
PP Three Springs 1	291657	3973754	2	3/3/07	Post	"	Post work.
PP Three Springs 1	291657	3973754	2	3/3/07	Pre	"	Looking at and across the creek at PHRAUS with interspersed TAMRAM.
PP Three Springs 1	291657	3973754	A	3/3/07	Pre	"	Pen points to PP.
PP Three Springs 1	291657	3973754	1	4/25/08	Post	"	Photo update.
PP Three Springs 1	291657	3973754	2	4/25/08	Post	"	Photo update.
PP Three Springs 2	292237	3973633	1	3/3/07	Post	Taken from a 2x2x2 m pumpkin colored boulder on creek right. Below outcropping of Temple Butte formation.	Post work.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Three Springs 2	292237	3973633	1	3/3/07	Pre	"	Looking across the drainage at a dense TAMRAM on bank. Banks are quite prominent from scoured out flashing.
PP Three Springs 2	292237	3973633	2	3/3/07	Pre	"	Looking down creek at TAMRAM on banks. TAMRAM just starting to leaf out.
PP Three Springs 2	292237	3973633	2	3/3/07	Post	"	Post work.
PP Three Springs 2	292237	3973633	3	3/3/07	Pre	"	Looking up creek. TAMRAM thickets on banks, drainage has many, many seedlings.
PP Three Springs 2	292237	3973633	3	3/3/07	Post	"	Post work.
PP Three Springs 2	292237	3973633	A	3/3/07	Pre	"	View of photopoint. No person in PP but it is the pumpkin colored boulder.
PP Three Springs 2	292237	3973633	1	4/25/08	Post	"	Photo update.
PP Three Springs 2	292237	3973633	2	4/25/08	Post	"	Photo update
PP Three Springs 2	292237	3973633	3	4/25/08	Post	"	Photo update.
PP Three Springs 3	292523	3973641	1	3/4/07	Pre	Taken from a limestone boulder about 2x2x1m on creek right. Boulder is in a bend amongst mature ACAGRE and below a natural cairn/hoodoo formation.	Looking up drainage at a flashed TAMRAM and skyline.
PP Three Springs 3	292523	3973641	2	3/4/07	Pre	"	Same bearing but focuses more on the drainage.
PP Three Springs 3	292523	3973641	2	3/4/07	Post	"	Post work.
PP Three Springs 3	292523	3973641	3	3/4/07	Pre	"	Looking across the drainage at flashed TAMRAM.
PP Three Springs 3	292523	3973641	3	3/4/07	Post	"	Post work. Not sure if this is correct photo.
PP Three Springs 3	292523	3973641	4	3/4/07	Pre	"	Looking down creek at TAMRAM.
PP Three Springs 3	292523	3973641	4	3/4/07	Post	"	Post work.
PP Three Springs 3	292523	3973641	A	3/4/07	Pre	"	Tech box is at and pen is pointing to PP. Taken from up creek.
PP Three Springs 3	292523	3973641	1	4/25/08	Post	"	Photo update.
PP Three Springs 3	292523	3973641	2	4/25/08	Post	"	Photo update.
PP Three Springs 3	292523	3973641	3	4/25/08	Post	"	Photo update.
PP Three Springs 3	292523	3973641	4	4/25/08	Post	"	Photo update.
PP Three Springs 4	292763	3973603	1	3/5/07	Pre	There was little option in prominent features to take the photo from. Took photo from the middle of the drainage about 8m from a large mature Gooding's willow.	Looking at TAMRAM forested bank on creek left. Large matures half flashed and gnarly.
PP Three Springs 4	292763	3973603	1	3/5/07	Post	"	Post work.
PP Three Springs 4	292763	3973603	2	3/5/07	Pre	"	Cottonwood (or Gooding's Willow) making spot in drainage where PP was established.
PP Three Springs 4	292763	3973603	3	3/5/07	Pre	"	Close up of view 1.
PP Three Springs 4	292763	3973603	A	3/5/07	Pre	"	Pen points at PP.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Three Springs 4	292763	3973603	B	3/5/07	Pre	"	Photo of large Gooding's Willow taken from downstream where the PP was chosen.
PP Three Springs 4	292763	3973603	1	4/25/08	Post	"	Photo update.
PP Three Springs 4	292763	3973603	2	4/25/08	Post	"	Photo update.
PP Three Springs 4	292763	3973603	3	4/25/08	Post	"	Photo update.
PP Three Springs HA 1	291699	3973706	1	5/17/06	Pre	Tapeats sandstone out-crop across from the first waterfall on creek left where the trail from the river drops into the creek.	Looking up canyon at habitat.
PP Three Springs HA 1	291699	3973706	2	5/17/06	Pre	"	Looking down canyon.
PP Three Springs HA 1	291699	3973706	A	5/17/06	Pre	"	Kate on photopoint rock ledge.
PP Three Springs HA 2	292307	3973657	1	5/17/06	Pre	Ledge of Bright Angel shale that cuts across the drainage channel. Standing mid-drainage on ledge.	View looking downstream.
PP Three Springs HA 2	292307	3973657	2	5/17/06	Pre	"	View looking upstream.
PP Three Springs HA 2	292307	3973657	A	5/17/06	Pre	"	Standing about 10m downstream of the bedrock ledge in the middle of the drainage next to a Muav boulder. Kate on photopoint ledge.
PP Three Springs HA 3	292307	3973657	1	5/17/06	Pre	No GPS reading. Standing on a B.A. shale ledge at the base of a fallen acacia tree. UTM's taken from habitat assessment data form (start point).	Upstream view.
PP Three Springs HA 3	292307	3973657	2	5/17/06	Pre	"	Downstream view.
PP Three Springs HA 3	292307	3973657	A	5/17/06	Pre	"	Standing 10m downstream of the photopoint at the base of the B.A. shale ledge. Kevin at the photopoint.
PP Three Springs Hydro #1	291702	3973711	2	5/17/06	Pre	Three Springs Hydro #1	North side of the pourover looking down on 3m stretch where discharge was read. View of the tape along the side stream channel.
PP Three Springs Hydro #1	291702	3973711	3	5/17/06	Pre	"	Top of the pourover from the middle of the stream. View of the pourover just upstream (2m) of measurement area.
PP Three Springs Hydro #1	291702	3973711	A	5/17/06	Pre	"	5m downstream of transect. 15m downstream of the pourover. 3m long channel water discharge measurement taken.
PP Three Springs Hydro #1	291702	3973711	2	4/25/08	Post	"	Photo update.
PP Three Springs Hydro #1	291702	3973711	3	4/25/08	Post	"	Photo update.
PP Three Springs Hydro #2	291765	3973703	1	5/17/06	Pre	Three Springs Hydro #2	4 meters downstream of end of Hydro 2 transect perpendicular to the end of T2B. 3m stretch used to measure discharge upstream.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Three Springs Hydro #2	291765	3973703	2	5/17/06	Pre	"	6 meters upstream of beginning of Hydro 2. Downstream view of Hydro 2, notice the break in lava flow 200m in the distance.
PP Three Springs Hydro #2	291765	3973703	1	4/25/08	Post	"	Photo update.
PP Three Springs Hydro #2	291765	3973703	2	4/25/08	Post	"	Photo update.
PP Three Springs Hydro #3	292649	3973654	1	5/17/06	Pre	Three Springs Hydro #3	3m downstream of end of transect, Hydro #3. View of Hydro #3 upstream.
PP Three Springs Hydro #3	292649	3973654	2	5/17/06	Pre	"	Just below pourover in B.A. shale. View of Hydro #3 downstream.
PP Three Springs Hydro #3	292649	3973654	1	4/25/08	Post	"	Photo update.
PP Three Springs Hydro #3	292649	3973654	2	4/25/08	Post	"	Photo update.
PP Three Springs Hydro #4	292737	3973616	1	5/17/06	Pre	Three Springs Hydro #4	6m downstream of end of Hydro #4. 3m transect of Hydro #4 upstream.
PP Three Springs Hydro #4	292737	3973616	2	5/17/06	Pre	"	6m upstream of beginning of Hydro #4. Downstream view of Hydro #4.
PP Three Springs Hydro #4	292737	3973616	1	4/25/08	Post	"	Photo update.
PP Three Springs Hydro #4	292737	3973616	2	4/25/08	Post	"	Photo update.
PP Three Springs T1A End	291705	3973752	1	5/17/06	Pre	Three Springs T1A end point	Taken from 48m mark on the transect. View of skyline is distinct up transect from 48m mark.
PP Three Springs T1A End	291705	3973752	2	5/17/06	Pre	"	Taken from the 48m mark on the transect tape. Looking at the transect end from the 48m mark.
PP Three Springs T1A End	291705	3973752	A	5/17/06	Pre	"	Taken on a 1.5x1x.5m boulder near the edge of a bedrock slab on creek left about 10m from the end. Transect end is in PROGLA.
PP Three Springs T1A End	291705	3973752	B	5/17/06	Pre	"	Taken from 4m creek ????? from transect end. View of the transect end.
PP Three Springs T1A End	291705	3973752	C	5/17/06	Pre	"	Taken from Tapeats ledge about 40m down canyon of the transect end. Transect end point is where the guy in the white shirt is standing.
PP Three Springs T1A End	291705	3973752	1	4/25/08	Post	"	Photo update.
PP Three Springs T1A End	291705	3973752	2	4/25/08	Post	"	Photo update.
PP Three Springs T1A Start	291730	3973711	1	5/17/06	Pre	Three Springs T1A start point.	Looking down the transect line to the end.
PP Three Springs T1A Start	291730	3973711	2	5/17/06	Pre	"	View towards canyon wall and tributary left.
PP Three Springs T1A Start	291730	3973711	3	5/17/06	Pre	"	Taken from about 2.5m beyond the end of the transect. Looking upstream from the middle of the creek.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Three Springs T1A Start	291730	3973711	A	5/17/06	Pre	"	Taken from about 3m downstream of the start in the water channel. Looking at the start; stone at Mike's side is the start.
PP Three Springs T1A Start	291730	3973711	B	5/17/06	Pre	"	Taken from about 1.5m. Looking at the start stone close up.
PP Three Springs T1A Start	291730	3973711	C	5/17/06	Pre	"	Taken on bank, creek left about 15m upstream in line with the transect. Looking at the start.
PP Three Springs T1A Start	291730	3973711	D	5/17/06	Pre	"	Taken on creek left about 4m downstream. Looking at the start upstream.
PP Three Springs T1A Start	291730	3973711	1	4/25/08	Post	"	Photo update.
PP Three Springs T1A Start	291730	3973711	2	4/25/08	Post	"	Photo update.
PP Three Springs T1A Start	291730	3973711	3	4/25/08	Post	"	Photo update.
PP Three Springs T1B End	291774	3973504	1	5/17/06	Pre	Three Springs T1B End.	Looking upstream along the transect line through thick vegetation.
PP Three Springs T1B End	291774	3973504	2	5/17/06	Pre	"	Looking upstream along the transect line with the skyline included.
PP Three Springs T1B End	291774	3973504	3	5/17/06	Pre	"	Looking downstream from the endpoint. The skyline is included.
PP Three Springs T1B End	291774	3973504	A	5/17/06	Pre	"	Photo of endpoint from downstream and creek left. Photo of T1B endpoint with yellow box indicating the end.
PP Three Springs T1B End	291774	3973504	B	5/17/06	Pre	"	Photo of endpoint from upstream and creek left. Photo of T1B endpoint with yellow box as indicator for the end.
PP Three Springs T1B End	291774	3973504	C	5/17/06	Pre	"	Close up of end point from 1.5m creek right. Photo of T1B endpoint with yellow box indicating the end.
PP Three Springs T1B End	291774	3973504	1	4/25/08	Post	"	Photo update.
PP Three Springs T1B End	291774	3973504	2	4/25/08	Post	"	Photo update
PP Three Springs T1B End	291774	3973504	3	4/25/08	Post	"	Photo update.
PP Three Springs T1B Start	291820	3973481	1	5/17/06	Pre	Three Springs T1B start point.	Taken from T1B start point. Looking downstream along the creek left and transect tape through the thick vegetation.
PP Three Springs T1B Start	291820	3973481	2	5/17/06	Pre	"	Looking downstream along creek left and transect tape. Skyline is included.
PP Three Springs T1B Start	291820	3973481	3	5/17/06	Pre	"	Looking upstream form start point. Skyline is included.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Three Springs T1B Start	291820	3973481	A	5/17/06	Pre	"	Looking at photopoint on creek left from downstream. Photo of t1B photopoint. The yellow case is the start point.
PP Three Springs T1B Start	291820	3973481	B	5/17/06	Pre	"	Close-up of the photopoint in debris/ course woody and surrounded by ACAGRE.
PP Three Springs T1B Start	291820	3973481	1	4/25/08	Post	"	Photo update.
PP Three Springs T1B Start	291820	3973481	2	4/25/08	Post	"	Photo update.
PP Three Springs T1B Start	291820	3973481	3	4/25/08	Post	"	Photo update
PP Three Springs T2A End	292521	3973646	1	5/17/06	Pre	Three springs T2A End	Taken from T2A endpoint. Looking upstream along transect and creek right (skyline).
PP Three Springs T2A End	292521	3973646	2	5/17/06	Pre	"	Taken from T2A endpoint. Looking downstream along creek bed. (skyline included)
PP Three Springs T2A End	292521	3973646	A	5/17/06	Pre	"	Looking at endpoint from creek left. Photo of T2A end point, yellow box indicates endpoint.
PP Three Springs T2A End	292521	3973646	1	4/25/08	Post	"	Photo update.
PP Three Springs T2A End	292521	3973646	2	4/25/08	Post	"	Photo update.
PP Three Springs T2A Start	292534	3973645	1	5/17/06	Pre	Three Springs T2A start.	Taken from T2A start point. Looking downstream along creek bed and creek right along transect. (skyline)
PP Three Springs T2A Start	292534	3973645	1-2	5/17/06	Pre	"	Taken from where transect angles right. Looking upstream along creek right and transect line. This photo is where the transect takes a right turn.
PP Three Springs T2A Start	292534	3973645	2	5/17/06	Pre	"	Taken from T2A start point. Looking upstream from start point along creek bed. (skyline)
PP Three Springs T2A Start	292534	3973645	2-2	5/17/06	Pre	"	Taken from where transect angles to the right. Looking downstream through tamarisk along transect creek right. This photo is where the transect takes a right turn.
PP Three Springs T2A Start	292534	3973645	A	5/17/06	Pre	"	Looking at start point from downstream in creek bed (skyline). Photo of T2A start point. Yellow box indicated start.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Three Springs T2A Start	292534	3973645	A-2	5/17/06	Pre	"	Boulder where transect angles to the right. Taken from creek left. Where transect angles to the right. This photo is for where the transect angles right. Yellow box indicates this spot.
PP Three Springs T2A Start	292534	3973645	B	5/17/06	Pre	"	Looking at start point from upstream in creek bed. (skyline) Photo of T2A start point. Yellow box indicates start.
PP Three Springs T2A Start	292534	3973645	C	5/17/06	Pre	"	Looking close up at start point from creek left. Photo of T2A start point, yellow box indicates start.
PP Three Springs T2A Start	292534	3973645	1	4/25/08	Post	"	Photo update.
PP Three Springs T2A Start	292534	3973645	1-2	4/25/08	Post	"	Post work.
PP Three Springs T2A Start	292534	3973645	2	4/25/08	Post	"	Photo update
PP Three Springs T2A Start	292534	3973645	A-2	4/25/08	Post	"	Photo update.
PP Three Springs T2A Start	292534	3973645	C	4/25/08	Post	"	Photo update.
PP Three Springs T2B End	292477	3973639	1	5/17/06	Pre	Three Springs T2B end.	Taken from Three Springs T2B end. Looking up canyon toward the start of the transect.
PP Three Springs T2B End	292477	3973639	2	5/17/06	Pre	"	View across the main channel to creek left.
PP Three Springs T2B End	292477	3973639	3	5/17/06	Pre	"	View looking at large Acacia just past the transect end.
PP Three Springs T2B End	292477	3973639	A	5/17/06	Pre	"	Taken from creek right side of main channel. Showing the end point 1m from a 5-6m tall conglomerate wall.
PP Three Springs T2B End	292477	3973639	B	5/17/06	Pre	"	Taken from creek right side of main channel where the minor channel meets the main one. It show the distinctive up canyon boulder at the top of the conglomerate wall.
PP Three Springs T2B End	292477	3973639	C	5/17/06	Pre	"	Taken from the small B.A. shelf below the Acacia tree. Close up of the transect end.
PP Three Springs T2B End	292477	3973639	1	4/25/08	Post	"	Photo update.
PP Three Springs T2B End	292477	3973639	2	4/25/08	Post	"	Photo update.
PP Three Springs T2B End	292477	3973639	3	4/25/08	Post	"	Photo update.
PP Three Springs T2B Start	292547	3973671	1	5/17/06	Pre	The start point for Three Springs T2B is about 900m above the first transect pair before the B.A. shale narrows.	View looking down the transect toward the end.
PP Three Springs T2B Start	292547	3973671	2	5/17/06	Pre	"	Looking up canyon to the bend and B.A. shale narrows.
PP Three Springs T2B Start	292547	3973671	3	5/17/06	Pre	"	Looking across the drainage to the other channel with tamarisk transect.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Three Springs T2B Start	292547	3973671	B	5/17/06	Pre	"	Taken from 6m on Three Springs T2B. Looking up canyon to Amy at transect start-shows the B.A. in the background.
PP Three Springs T2B Start	292547	3973671	C	5/17/06	Pre	"	Start point for Three Springs. Close up of the cottonwood.
PP Three Springs T2B Start	292547	3973671	1	4/25/08	Post	"	Photo update.
PP Three Springs T2B Start	292547	3973671	2	4/25/08	Post	"	Photo update.
PP Three Springs T2B Start	292547	3973671	3	4/25/08	Post	"	Photo update. Not really sure what happened here. This does not look like a retake of view 3.
PP Three Springs T2B Start	292547	3973671	A	4/25/08	Post	"	75m up canyon looking at Akasha at start point.
PP Three Springs T3A End	292689	3973630	1	5/17/06	Pre	Transect endpoint is on a muav boulder about 25m upstream of a waterfall and bright angel shale narrows and next to a big CERORB.	Looking upstream toward transect start.
PP Three Springs T3A End	292689	3973630	2	5/17/06	Pre	"	Looking upstream and to creek left of the drainage channel.
PP Three Springs T3A End	292689	3973630	3	5/17/06	Pre	"	Looking downstream at muav wall where View B was taken from.
PP Three Springs T3A End	292689	3973630	A	5/17/06	Pre	"	From 45m mark at transect. Looking at Mike at transect end on a 1x1m limestone boulder.
PP Three Springs T3A End	292689	3973630	B	5/17/06	Pre	"	Opposite the transect end on creek left at the base of a muav wall 5m away. Transect tape and clipboard on muav boulder at transect end.
PP Three Springs T3A End	292689	3973630	1	4/25/08	Post	"	Photo update.
PP Three Springs T3A End	292689	3973630	2	4/25/08	Post	"	Photo update.
PP Three Springs T3A End	292689	3973630	3	4/25/08	Post	"	Photo update.
PP Three Springs T3A Start	292731	3973627	1	5/17/06	Pre	Transect start point is on the downstream end of Muav limestone boulder on creek right.	Down transect toward the transect end.
PP Three Springs T3A Start	292731	3973627	2	5/17/06	Pre	"	Looking across the drainage channel to creek left and distinctive BA shale outcrops.
PP Three Springs T3A Start	292731	3973627	3	5/17/06	Pre	"	Looking upstream.
PP Three Springs T3A Start	292731	3973627	A	5/17/06	Pre	"	standing 5m upstream of transect start on another Muav limestone adjacent to the boulder. Lori at transect start on muav limestone boulder 3x2x1.5m, on creek right of the drainage.
PP Three Springs T3A Start	292731	3973627	B	5/17/06	Pre	"	From 5m point on transect tape. Lori at transect start.
PP Three Springs T3A Start	292731	3973627	1	4/25/08	Post	"	Photo update.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Three Springs T3A Start	292731	3973627	2	4/25/08	Post	"	Photo update.
PP Three Springs T3A Start	292731	3973627	3	4/25/08	Post	"	Photo update.
PP Three Springs T3B End	292738	3973609	1	5/17/06	Pre	Three Springs T3B end point.	From transect end point. Upstream and up the tape toward the transect start.
PP Three Springs T3B End	292738	3973609	2	5/17/06	Pre	"	From transect end. Across creek drainage showing mature PROGLA and SALGOO mingling with TAMRAM.
PP Three Springs T3B End	292738	3973609	3	5/17/06	Pre	"	Taken from transect end. Photopoint shows boulder just downstream that is T3A transect start.
PP Three Springs T3B End	292738	3973609	A	5/17/06	Pre	"	Taken from 8m downstream of transect end point at a rock just next to T3A start point. Looking upstream at transect end.
PP Three Springs T3B End	292738	3973609	B	5/17/06	Pre	"	Taken from the 46m mark on the transect. Looking downstream at transect end.
PP Three Springs T3B End	292738	3973609	1	4/25/08	Post	"	Photo update.
PP Three Springs T3B End	292738	3973609	2	4/25/08	Post	"	Photo update.
PP Three Springs T3B End	292738	3973609	3	4/25/08	Post	"	Photo update.
PP Three Springs T3B Start	292784	3973621	1	5/17/06	Pre	Transect start point on limestone boulder 1x1.5m. T3B start.	Transect start point on limestone boulder. 1x1.5m. Down transect tape toward transect end.
PP Three Springs T3B Start	292784	3973621	2	5/17/06	Pre	"	Transect start. Upstream and to creek right side of drainage showing coyote willow thicket.
PP Three Springs T3B Start	292784	3973621	3	5/17/06	Pre	"	Upstream and to creek left of channel with conglomerate wall.
PP Three Springs T3B Start	292784	3973621	4	5/17/06	Pre	"	Downstream and creek left side of drainage with tamarisk on the upper terrace.
PP Three Springs T3B Start	292784	3973621	5	5/17/06	Pre	"	Downstream and creek left showing SALGOO standing tall.
PP Three Springs T3B Start	292784	3973621	A	5/17/06	Pre	"	Taken from 5m SW of transect start in stream channel. Kate on transect start boulder.
PP Three Springs T3B Start	292784	3973621	B	5/17/06	Pre	"	Taken from 5m point on transect. Looking upstream at Kate on transect start boulder.
PP Three Springs T3B Start	292784	3973621	1	4/25/08	Post	"	Photo update.
PP Three Springs T3B Start	292784	3973621	2	4/25/08	Post	"	Photo update.
PP Three Springs T3B Start	292784	3973621	3	4/25/08	Post	"	Photo update.
PP Three Springs T3B Start	292784	3973621	4	4/25/08	Post	"	Photo update.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Three Springs T3B Start	292784	3973621	5	4/25/08	Post	"	Photo update.
PP 217 Mile Middle East Fork 2	293624	3970010	1	10/11/06	Pre	Taken from a small schist boulder about 2x3m on drainage right next to an acacia grotto.	Looking down canyon at TAMRAM in drainage. Canyon has flashed since mapping and there are only a few TAMRAM left.
PP 217 Mile Middle East Fork 2	293624	3970010	A	10/11/06	Pre	"	Steve at photopoint.
PP 217 Mile Middle East Fork 2	293624	3970010	1	9/22/08	Post	"	Photo update.
PP Granite Springs 10	291546	3965232	1	10/12/06	Pre	Taken atop a pointy schist rock (4m tall) in the center of a narrow and dark windy schist drainage. This is about 4.4 km above the mouth of the canyon.	Looking downstream at a line of TAMRAM that line the bottom of the channel.
PP Granite Springs 10	291546	3965232	1	10/12/06	Post	"	Post work.
PP Granite Springs 10	291546	3965232	2	10/12/06	Post	"	Post work.
PP Granite Springs 10	291546	3965232	2	10/12/06	Pre	"	Looking upstream at mature TAMRAM with huge dark boulders of schist behind.
PP Granite Springs 10	291546	3965232	A	10/12/06	Pre	"	Pen points at photopoint. Taken at mature TAMRAM 10m downstream, looking back up.
PP Granite Springs 11	291663	3965203	1	10/12/06	Post	Taken from a 4x2x2m Tapeats boulder in schist drainage, 4.7 km above the river.	Post work.
PP Granite Springs 11	291663	3965203	1	10/12/06	Pre	"	Looking downstream at the schist wash at many TAMRAM.
PP Granite Springs 11	291663	3965203	2	10/12/06	Pre	"	Looking across the stream at 2 big matures on the right and left. A schist wall is behind.
PP Granite Springs 11	291663	3965203	2	10/12/06	Post	"	Post work.
PP Granite Springs 11	291663	3965203	3	10/12/06	Pre	"	Looking upstream at thicket of TAMRAM.
PP Granite Springs 11	291663	3965203	3	10/12/06	Post	"	Post work.
PP Granite Springs 11	291663	3965203	A	10/12/06	Pre	"	Pen points at photopoint rock. Taken 10m downstream of photopoint in the drainage bottom looking up.
PP Granite Springs 7	291205	3966259	1	10/12/06	Post	Just over 3km up the main drainage from the mouth, after some curvy sections there is a narrow schist spot with water. 20m above is a 1x1x1m gray boulder at creek left. This is the photopoint.	Post work.
PP Granite Springs 7	291205	3966259	1	10/12/06	Pre	"	Looking downstream towards the narrows at the first climby spot. TAMRAM is in the foreground.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP Granite Springs 7	291205	3966259	2	10/12/06	Pre	"	Looking across the stream at creek right granite wall. TAMRAM in the foreground.
PP Granite Springs 7	291205	3966259	2	10/12/06	Post	"	Post work.
PP Granite Springs 7	291205	3966259	3	10/12/06	Post	"	Post work.
PP Granite Springs 7	291205	3966259	3	10/12/06	Pre	"	Looking upstream at a big mature on the left mixing in with tall arrowhead.
PP Granite Springs 7	291205	3966259	A	10/12/06	Pre	"	Pen points at photopoint. Taken upstream 10m of the gray photopoint rock.
PP Granite Springs HA 4	291234	3966046	1	5/20/06	Pre	Keystone rock at the top of a waterfall, granite.	View downstream.
PP Granite Springs HA 4	291234	3966046	2	5/20/06	Pre	"	View upstream.
PP Granite Springs HA 4	291234	3966046	A	5/20/06	Pre	"	View upstream at Kevin on the photopoint.
PP 221 Mile 1	289497	3966157	1	10/13/06	Post	Taken atop a 1x1/2 m sandstone boulder, perched on the barren white slope below the spring 150m up 221 Mile Spring.	Post work.
PP 221 Mile 1	289497	3966157	1	10/13/06	Pre	"	Looking up at saplings buried in the spring.
PP 221 Mile 1	289497	3966157	A	10/13/06	Pre	"	Taken 10m upstream down at photopoint rock. Colorado River is behind.
PP 221 Mile 1	289497	3966157	1	9/22/08	Post	"	Photo update.
PP 221 Mile Spring HA 1	289493	3966156	1	5/20/06	Pre	On Tapeats boulder about 150m upstream from the mouth, just downstream of the wall seep near some purple tapeats stones.	Uphill at spring on creek left with whitish slope below that is barren.
PP 221 Mile Spring HA 1	289493	3966156	2	5/20/06	Pre	"	View downstream to tamarisk at river's edge. False Diamond Peak in the background.
PP 221 Mile Spring HA 1	289493	3966156	A	5/20/06	Pre	"	Uphill at spring creek left with whitish slope below that is barren.
PP 221.5 Mile 1	289546	3965532	1	10/13/06	Pre	Taken on top of Tapeats 1x1x1m boulder up the south fork. This is 5m below the dripping spring at the Tapeats/schist contact.	Looking upstream at a large mature; Tapeats is behind.
PP 221.5 Mile 1	289546	3965532	1	10/13/06	Post	"	Post work.
PP 221.5 Mile 1	289546	3965532	A	10/13/06	Pre	"	Taken 5m upstream of photopoint, looking down at purple boulder on creek left.
PP 221.5 Mile 1	289546	3965532	1	9/22/08	Post	"	Photo update.
PP 221.5 Mile Creek HA 1	289598	3965716	1	5/20/06	Pre	On creek left granite wall above the stream 100m from the mouth and river. Photopoint rock is about 8-10m away from a small waterfall, the 1st up canyon from the river.	Up canyon view at dense riparian vegetation in stream. Lovely!

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP 221.5 Mile Creek HA 1	289598	3965716	2	5/20/06	Pre	"	View down into a small cascade and pool.
PP 221.5 Mile Creek HA 1	289598	3965716	3	5/20/06	Pre	"	View downstream at the Colorado River.
PP 221.5 Mile Creek HA 1	289598	3965716	A	5/20/06	Pre	"	5m above, looking at Lori on granite with the river in the back.
PP 222 Mile 1	289592	3964870	1	10/12/06	Post	Standing on a large white boulder on creek right. Creek bed bends right and goes between a boulder and the granite wall.	Post work.
PP 222 Mile 1	289592	3964870	1	10/12/06	Pre	"	Looking upstream at one tammy behind ACAGRE.
PP 222 Mile 1	289592	3964870	2	10/12/06	Post	"	Post work.
PP 222 Mile 1	289592	3964870	2	10/12/06	Pre	"	Looking downstream at a lone tamarisk.
PP 222 Mile 1	289592	3964870	A	10/12/06	Pre	"	Loren at sitting at photopoint. Taken from upstream.
PP 222 Mile 1	289592	3964870	1	9/22/08	Post	"	Photo update.
PP 222 Mile 1	289592	3964870	2	9/22/08	Post	"	Photo update.
PP 222 Mile 2	289862	3964872	1	10/12/06	Pre	Standing on a small granite shelf on creek right. This is about 10' above the creek drainage.	Looking upstream down at the left bend in the creek. Staring into the corner pocket on lookers left.
PP 222 Mile 2	289862	3964872	1	10/12/06	Post	"	Post work.
PP 222 Mile 2	289862	3964872	2	10/12/06	Pre	"	Just lookers right of view #1 (with slight overlap). Looking right at the middle of a thicket. There is a rocky slope in the right of the picture.
PP 222 Mile 2	289862	3964872	2	10/12/06	Post	"	Post work.
PP 222 Mile 2	289862	3964872	A	10/12/06	Pre	"	Person at photopoint. Taken from below the small pouroff and pool looking up and across the stream at the photopoint.
PP 222 Mile 2	289862	3964872	1	6/23/08	Post	"	Photo update.
PP 222 Mile Canyon HA 1	289835	3964869	1	5/20/06	Pre	This spot is just below the flow of water at granite narrows in main fork with several mature tamarisk and thick acacia.	Upstream at dense thicket in granite with TAMRAM, ACAGRE, and spiky JUNCUS.
PP 222 Mile Canyon HA 1	289835	3964869	2	5/20/06	Pre	"	Downstream at dry creek bed. Acacia dominate.
PP 222 Mile Canyon HA 1	289835	3964869	A	5/20/06	Pre	"	Taken from 10m downstream, 20m below thicket with dense vegetation and spiky plants and tammies.
PP 222 Mile Canyon HA 2	289633	3964910	1	5/20/06	Pre	This photopoint is at a dense arrowweed patch almost 500m from the mouth of 222.	Downstream at arrow weed and wetter downstream with tamarisk.
PP 222 Mile Canyon HA 2	289633	3964910	2	5/20/06	Pre	"	Upstream at dry creek bed.

Site Name	UTM Easting	UTM Northing	View	Date	Pre or Post Treatment	Description of Photopoint	View from Photopoint
PP 222 Mile Canyon HA 2	289633	3964910	A	5/20/06	Pre	"	RV is on creek right, loose steep bank 10m above the dry creek bed. Up above the creek, looking at the photopoint on rock with arrow weed behind.
PP 224 Mile 1	288046	3962523	1	10/13/06	Pre	Standing on large brown outcrop on creek right above small seep pouroff.	Looking downstream at mouth of canyon and the river in the background.
PP 224 Mile 1	288046	3962523	1	10/13/06	Post	"	Post work.
PP 224 Mile 1	288046	3962523	2	10/13/06	Pre	"	Looking upstream and across the drainage - cobbly boulder in the foreground. There is a bib tamarisk in the center.
PP 224 Mile 1	288046	3962523	2	10/13/06	Post	"	Post work.
PP 224 Mile 1	288046	3962523	A	10/13/06	Pre	"	Loren at photopoint. Taken from upstream in the middle of tamarisk stumps that are in the middle of the drainage.
PP 224 Mile 1	288046	3962523	1	9/22/08	Post	"	Photo update.
PP 224 Mile 1	288046	3962523	2	9/22/08	Post	"	Photo update.
PP 224 Mile Canyon HA 1	288050	3962500	1	5/20/06	Pre	On top of prominent granite hump, 150m up from the mouth of 224 L. The river takes its first bend to the left and there is the biggest TAMRAM of 224 L 10m upstream of photopoint.	Up canyon view, at mature tammy and top of the Tapeats in the background.
PP 224 Mile Canyon HA 1	288050	3962500	2	5/20/06	Pre	"	Down canyon view at some tammies with the Colorado River in the background.
PP 224 Mile Canyon HA 1	288050	3962500	A	5/20/06	Pre	"	Taken from 18m upstream at the bottom of the drainage.

PP L Fork Horn 1

Photopoints printed on:
Friday, October 10, 2008

RM: 90 RS: L

Easting: 396584 Northing: 3993995 Height: 5'04 Project: Phase IIb

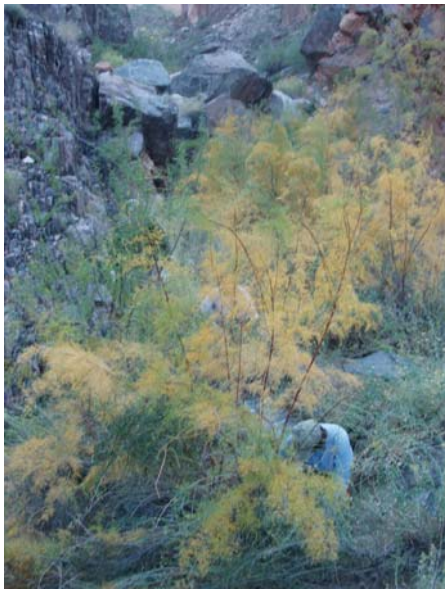
Photopoint Description: Granite/schist boulder on creek left about 50m up canyon from a large pourover. Cannot pass this pourover without a rope.

View # 1

Bearing: 185

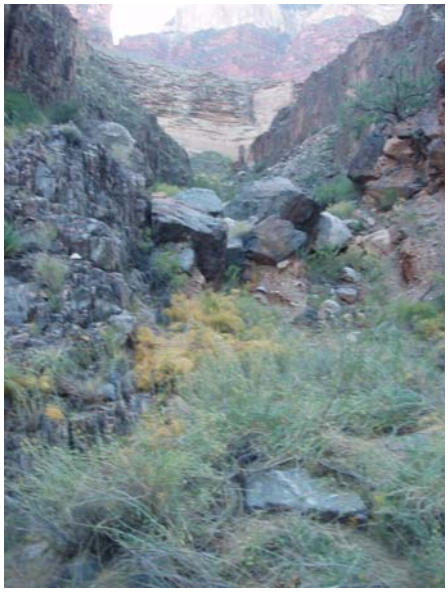
11/9/2006 3:20 PM Pre Treatment

Looking up drainage at TAMRAM thicket.



11/9/2006 4:14 PM Post Treatment

Post work.



View # 2

Bearing: 32

11/9/2006 3:22 PM Pre Treatment

Looking down canyon at pourover.



View # A

Bearing:

11/9/2006 4:11 PM Pre Treatment

Kari at photopoint rock.



PP R Fork Horn 1

Photopoints printed on:
Friday, October 10, 2008

RM: 90 RS: L

Easting: 396639 Northing: 3994020 Height: 5'04 Project: Phase IIb

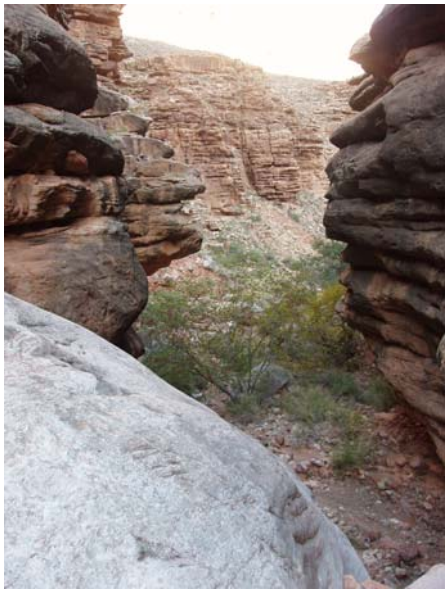
Photopoint Description: Sections starts at chockstone boulder in the drainage, impassable without rope.

View # 1

Bearing: 350

9/6/2000 9:35 AM Pre Treatment

Looking down canyon over chockstone boulder.



10/10/2007 10:45 AM Post Treatment

Photo update.



View # 2

Bearing: 145

11/9/2006 9:39 AM Pre Treatment

Looking up canyon from the start point of the right fork of Horn.



10/10/2007 10:45 AM Post Treatment

Photo update.



PP R Fork Horn 1

Photopoints printed on:
Friday, October 10, 2008

RM: 90 RS: L

Easting: 396639 Northing: 3994020 Height: 5'04 Project: Phase IIb

Photopoint Description: Sections starts at chockstone boulder in the drainage, impassable without rope.

View # A

Bearing: 8

11/9/2006 9:37 AM Pre Treatment

Kari's backpack at photopoint on creek left just before chockstone.



PP Salt Creek 2-1

Photopoints printed on:
Thursday, October 09, 2008

RM: 92.5 RS: L

Easting: 394761 Northing: 3995519 Height: 5'04 Project: Phase IIb

Photopoint Description: Beginning of Salt Creek section 2. Starts at pourover about 200 to 250 meters below the trail. No GPS coverage. UTMs taken from map.
11/07/2007: Photos taken from schist ledge on creek left in between two pouroffs and just below a Tapeats monolith.

View # 1

Bearing: 340

11/11/2006 9:50 AM Pre Treatment

Looking downstream at impassable pourover. Pourover is about 200 ft plus. Can't see the bottom.



11/7/2007 Post Treatment

View downstream at impassable pouroff.



View # 2

Bearing: 120

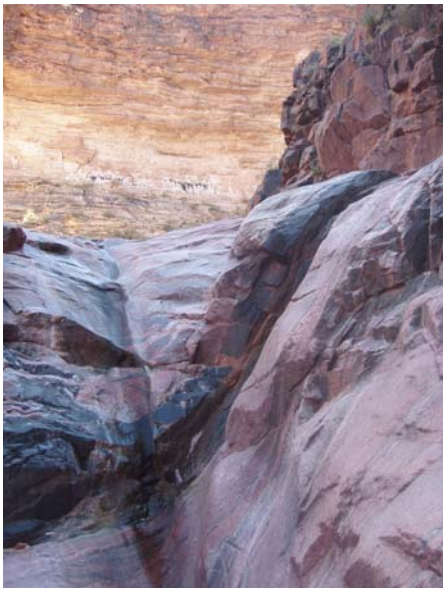
11/11/2006 9:56 AM Pre Treatment

Up canyon view.



11/7/2007 1:16 PM Post Treatment

View up canyon.



PP Salt Creek 2-1

Photopoints printed on:
Thursday, October 09, 2008

RM: 92.5 RS: L

Easting: 394761 Northing: 3995519 Height: 5'08 Project: Phase IIb

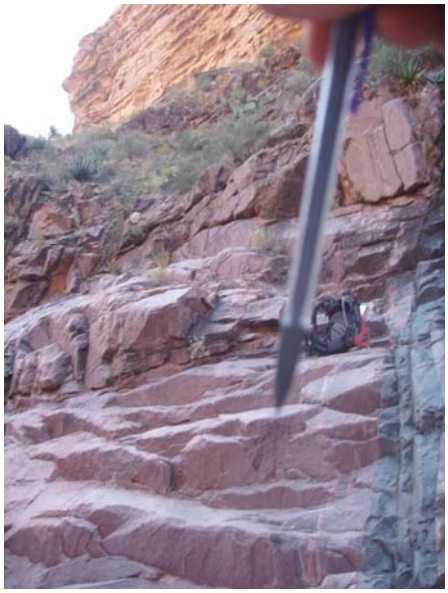
Photopoint Description: Beginning of Salt Creek section 2. Starts at pourover about 200 to 250 meters below the trail. No GPS coverage. UTMs taken from map.
11/07/2007: Photos taken from schist ledge on creek left in between two pouroffs and just below a Tapeats monolith.

View # A

Bearing: 180

11/7/2007 1:25 PM Pre Treatment

Pencil pointing at PP.



View # B

Bearing: 65

11/11/2006 10:40 AM Pre Treatment

Large monolith Tapeats structure to creek right of photopoint spot.



11/7/2007 1:15 PM Post Treatment

Large Tapeats momolith.



PP Cedar Spring 1

Photopoints printed on:
Thursday, October 09, 2008

RM: 93 RS: L

Easting: 393879 Northing: 3994533 Height: 5'08 Project: Phase IIb

Photopoint Description: Taken from a flat Tapeats and salmoned colored boulder that is the size of of a 19" TV. This is about 10 m downstream from a mature willow on creek left.

View # 1

Bearing: 301

11/8/2007 9:00 AM Pre Treatment

View downstream looking at TAMRAM.



11/8/2007 9:15 AM Post Treatment

Post work.

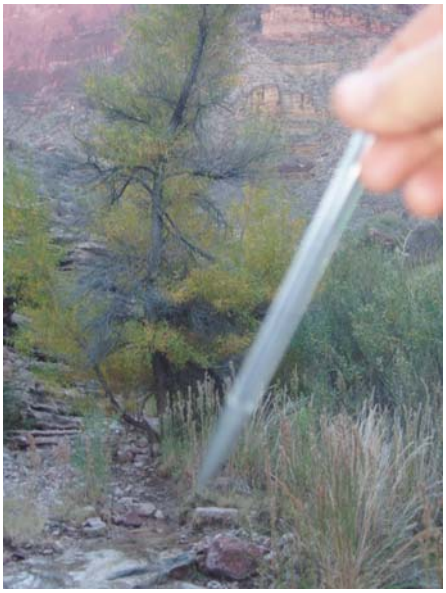


View # A

Bearing: 131

11/8/2007 8:58 AM Pre Treatment

Pen pointing at PP.



PP Topaz 8

Photopoints printed on:
Thursday, October 09, 2008

RM: 96.7 RS: L

Easting: 385505 Northing: 3995829 Height: 5'08 Project: Phase IIb

Photopoint Description: Taken from a medium size limestone reddish boulder in the middle of the drainage. There is a medium sized birchleaf buckthorn about 5m away.

View # 1

Bearing: 217

11/9/2006 3:33 PM Pre Treatment

Looking upstream, no TAMRAM.



4/14/2008 2:35 PM Post Treatment

Photo update.



View # 2

Bearing: 39

11/9/2006 3:35 PM Pre Treatment

Looking downstream.



4/14/2008 2:35 PM Post Treatment

Photo update.



PP Topaz 8

Photopoints printed on:
Thursday, October 09, 2008

RM: 96.7 RS: L

Easting: 385505 Northing: 3995829 Height: 5'08 Project: Phase IIb

Photopoint Description: Taken from a medium size limestone reddish boulder in the middle of the drainage. There is a medium sized birchleaf buckthorn about 5m away.

View # A

Bearing: 32

11/9/2006 3:30 PM Pre Treatment

Travis at photopoint. Taken from about 10m upstream.



PP Slate 2-1

Photopoints printed on:
Thursday, October 09, 2008

RM: 98.1 RS: L

Easting: 387667 Northing: 3999308 Height: 5'00 Project: Phase IIb

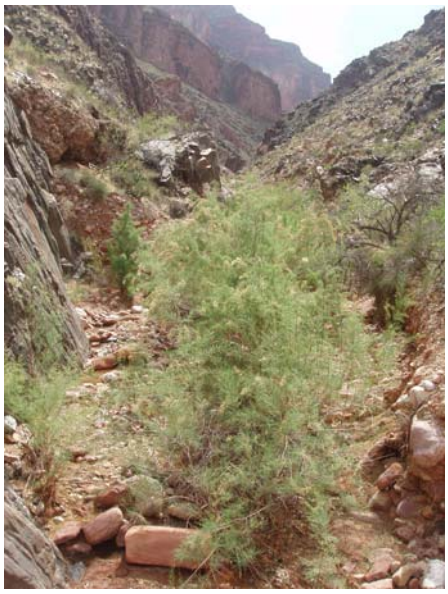
Photopoint Description: Taken from a schist outcropping on creek right above bedrock bottom between 2 TAMRAM thickets. Also about 500m up from the river. This is from the drainage bottom at the end of Slate 1 section and the beginning of Slate 2 section.

View # 1

Bearing: 225

4/23/2006 2:40 PM Pre Treatment

Looking up canyon at TAMRAM ticket. The Tapeats and Redwall are in view.



1/9/2007 2:15 PM Post Treatment

Post work.



View # 2

Bearing: 18

4/23/2006 2:48 PM Pre Treatment

Looking down canyon at TAMRAM and schist.



1/9/2007 2:15 PM Post Treatment

Post work.



PP Slate 2-1

Photopoints printed on:
Thursday, October 09, 2008

RM: 98.1 RS: L

Easting: 387667 Northing: 3999308 Height: 5'00 Project: Phase IIb

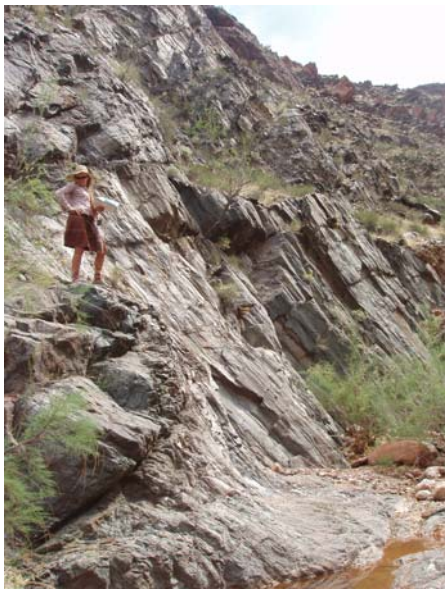
Photopoint Description: Taken from a schist outcropping on creek right above bedrock bottom between 2 TAMRAM thickets. Also about 500m up from the river. This is from the drainage bottom at the end of Slate 1 section and the beginning of Slate 2 section.

View # A

Bearing:

4/23/2006 Pre Treatment

Looking at Kari on the photopoint rock. Taken from about 5m downstream.



PP Agate 2

Photopoints printed on:
Thursday, October 09, 2008

RM: 101 RS: L

Easting: 384619 Northing: 3999921 Height: 6'00 Project: Phase IIb

Photopoint Description: Standing on a pink granite ledge some 15-20 feet above the drainage on creek right. This is roughly 30 m above the confluence.

View # 1

Bearing: 20

10/23/2007 3:45 PM Pre Treatment

Looking down the drainage.



View # 2

Bearing: 230

10/23/2007 3:45 PM Pre Treatment

Looking up the drainage.



10/24/2007 11:30 AM Post Treatment

Post work.



10/24/2007 11:30 AM Post Treatment

Post work.



PP Agate 2

Photopoints printed on:
Thursday, October 09, 2008

RM: 101 RS: L

Easting: 384619 Northing: 3999921 Height: 6'00 Project: Phase IIb

Photopoint Description: Standing on a pink granite ledge some 15-20 feet above the drainage on creek right. This is roughly 30 m above the confluence.

View # A

Bearing:

10/24/2007 11:45 AM Pre Treatment

Looking downstream toward PP.



PP Sapphire 3

Photopoints printed on:
Thursday, October 09, 2008

RM: 101 RS: L

Easting: 383483 Northing: 4000521 Height: 5'8 " Project: Phase IIb

Photopoint Description: Short bus-sized schist block-shaped 6x20x15m boulder at end of slab on creek right just before small pouroff.

View # 1

Bearing: 349

3/26/2008 9:05 AM Pre Treatment

View downstream of TAMRAM on creek R.



3/26/2008 9:23 AM Post Treatment

Post TAMRAM removal.



View # A

Bearing: 292

3/26/2008 9:01 AM Pre Treatment

View upstream taken middle of creek on small granite pour off about 50m from PP. Tapeats layer in background.



PP Turquoise 1

Photopoints printed on:
Thursday, October 09, 2008

RM: 102 RS: L

Easting: 381491 Northing: 4000913 Height: 2'5 " Project: Phase IIb

Photopoint Description: Sitting on white boulder centered in creek looking up canyon and small pouroff on creek left.

View # 1

Bearing: 265

3/27/2008 3:40 PM Pre Treatment

View upstream, middle of creek, from small boulder. Pouroff just to the creek right in picture.



View # 2

Bearing: 78

3/27/2008 3:40 PM Pre Treatment

View downstream with TAMRAM in center.



3/28/2008 11:36 AM Post Treatment

Post TAMRAM removal.



View # A

Bearing: 75

3/27/2008 3:40 PM Pre Treatment

Picture of photopoint, standing facing down creek.



PP Ruby 9

Photopoints printed on:
Thursday, October 09, 2008

RM: 105 RS: L

Easting: 379570 Northing: 4003650 Height: 5'06 Project: Phase IIb

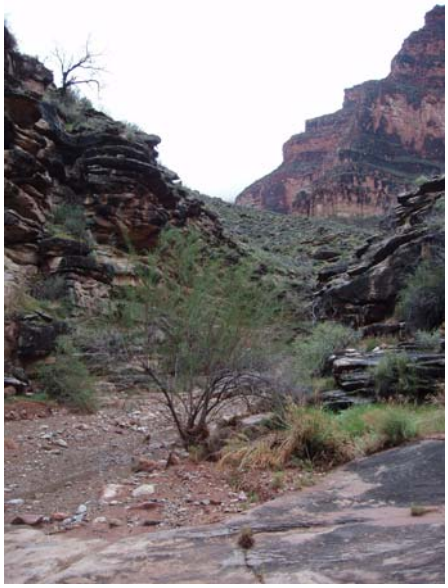
Photopoint Description: No UTMs recorded. Taken from a Tapeats ledge with a small waterfall about 100m from the Tonto (upstream). Entered UTM from the Ruby 9 exotics control data - not sure how close to the site it is.

View # 1

Bearing: 189

3/23/2007 4:15 PM Pre Treatment

Looking upstream.



3/23/2007 4:30 PM Post Treatment

Post work.



View # A

Bearing: 321

3/23/2007 4:17 PM Pre Treatment

Pen points at PP. Taken from upstream of PP.



PP Above Serpentine East Branch 1

Photopoints printed on:
Thursday, October 09, 2008

RM: 106 RS: L

Easting: 379307 Northing: 4006373 Height: 5'06 Project: Phase IIb

Photopoint Description: Taken from a short bus-sized sandstone boulder with creamy off-white and black swirls in the middle of the creek.

View # 1

Bearing: 235

3/25/2007 4:00 PM Post Treatment

Post work.



View # A

Bearing: 142

3/25/2007 3:45 PM Pre Treatment

Pen points at PP.



3/25/2007 3:47 PM Pre Treatment

View of TAMRAM.



PP Above Serpentine West Branch 1

Photopoints printed on:
Thursday, October 09, 2008

RM: 106 RS: L

Easting: 379339 Northing: 4006463 Height: 5'06 Project: Phase IIb

Photopoint Description: Taken from a house-sized boulder about 30m from below the pour off and the Tonto Trail in the middle of the drainage.

View # 1

Bearing: 278

3/25/2007 5:30 PM Post Treatment

Post work.



3/25/2007 5:15 PM Pre Treatment

View of TAMRAM.



View # A

Bearing: 149

3/25/2007 5:16 PM Pre Treatment

Pen points at PP.



PP White 1

Photopoints printed on:
Thursday, October 09, 2008

RM: 108 RS: R

Easting: 381045 Northing: 4013393 Height: 6'00 Project: Phase IIb

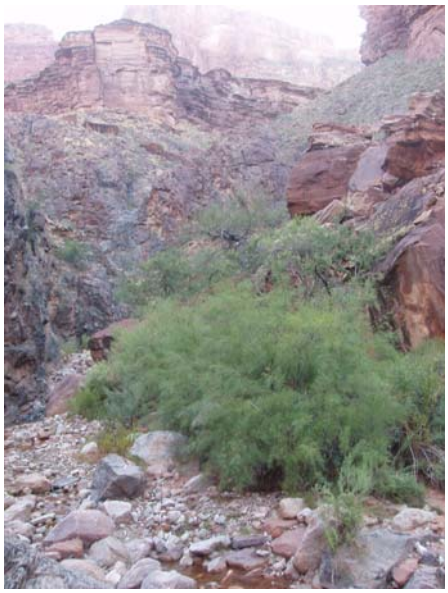
Photopoint Description: Standing on block boulder creek right, above a small bouldery pourover.

View # 1

Bearing: 75

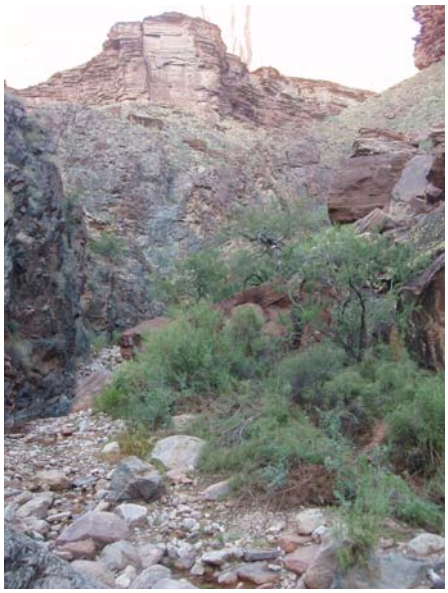
9/21/2006 8:15 AM Pre Treatment

Looking upstream and across creek. In view is a tapeats outcrop and a redwall bluff.



9/21/2006 8:15 AM Post Treatment

Post work.



View # A

Bearing: 280

9/21/2006 8:15 AM Pre Treatment

Loren dancing on the photopoint.



PP Flint 1

Photopoints printed on:
Thursday, October 09, 2008

RM: 108 RS: R

Easting: 382332 Northing: 4012365 Height: 6'00 Project: Phase IIb

Photopoint Description: Standing on a small boulder creek left about 200 m up from the confluence with Shinumo. This is just down from a group of cottonwoods.

View # 1

Bearing: 130

11/5/2007 11:00 AM Pre Treatment

Looking upstream.



View # 2

Bearing: 90

11/5/2007 11:00 AM Pre Treatment

looking across the drainage.



11/5/2007 12:30 PM Post Treatment

Post work.



11/5/2007 12:30 PM Post Treatment

Post work.



PP Flint 1

Photopoints printed on:
Thursday, October 09, 2008

RM: 108 RS: R

Easting: 382332 Northing: 4012365 Height: 6'00 Project: Phase IIb

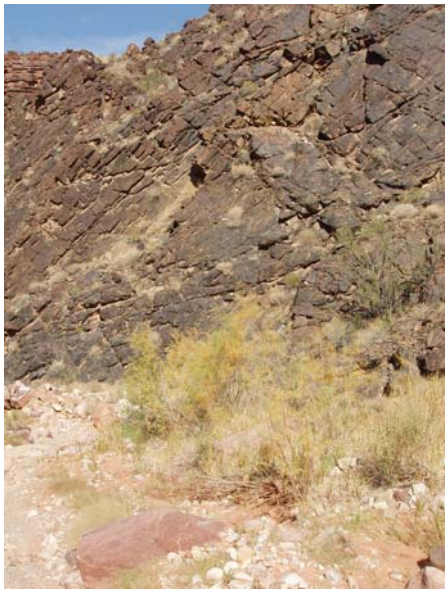
Photopoint Description: Standing on a small boulder creek left about 200 m up from the confluence with Shinumo. This is just down from a group of cottonwoods.

View # 3

Bearing: 355

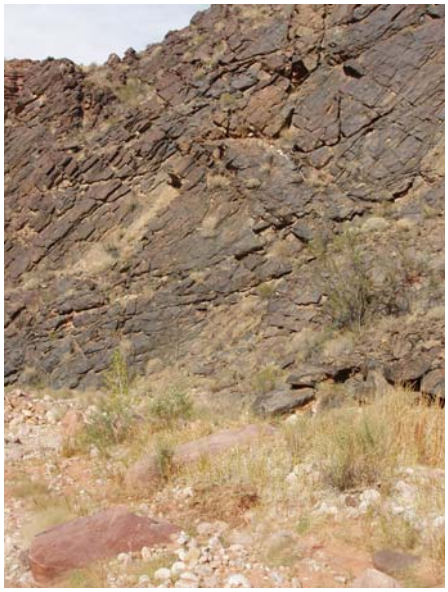
11/5/2007 11:00 AM Pre Treatment

Looking downstream.



11/5/2007 12:30 PM Post Treatment

Post work.



View # A

Bearing: 160

11/5/2007 12:30 PM Pre Treatment

Looking upstream from drainage center. Pen points to PP.



PP 122 Mile Canyon L 1

Photopoints printed on:
Thursday, October 09, 2008

RM: 122 RS: L

Easting: 365254 Northing: 4011346 Height: 3'00 Project: Phase IIb

Photopoint Description: Taken sitting on top of 15' boulder that has white and grey spots on creek left. Below 80' pouroff.

View # 1

Bearing: 30

10/3/2006 8:45 AM Pre Treatment

Looking downstream.



View # 2

Bearing: 184

10/3/2006 11:00 AM Post Treatment

Post work.



10/3/2006 11:00 AM Post Treatment

Post work.



10/3/2006 8:45 AM Pre Treatment

Looking upstream at pouroff.



PP 122 Mile Canyon L 1

Photopoints printed on:
Thursday, October 09, 2008

RM: 122 RS: L

Easting: 365254 Northing: 4011346 Height: 3'00 Project: Phase IIb

Photopoint Description: Taken sitting on top of 15' boulder that has white and grey spots on creek left. Below 80' pouroff.

View # A

Bearing: 210

10/3/2006 9:00 AM Pre Treatment

Person at photopoint. Taken from just downstream of the rock, looking upstream.



PP 140 Mile 1

Photopoints printed on:
Thursday, October 09, 2008

RM: 140 RS: L

Easting: 359419 Northing: 4029254 Height: 5'04 Project: Phase IIb

Photopoint Description: PP is a Redwall limestone boulder in the middle of the drainage (2x1x3m) located just at the point where you enter the drainage from the beach. This is just below the BA shale ledge on creek right.

View # 1

Bearing: 162

10/4/2006 10:55 AM Pre Treatment

Looking upstream at the greatest point of tamarisk infestation.



5/13/2007 10:35 AM Post Treatment

Looking upstream.



10/4/2006 1:36 PM Post Treatment

Looking upstream - postwork.



6/20/2008 10:25 AM Post Treatment

Photo update.



PP 140 Mile 1

Photopoints printed on:
Thursday, October 09, 2008

RM: 140 RS: L

Easting: 359419 Northing: 4029254 Height: 5'04 Project: Phase IIb

Photopoint Description: PP is a Redwall limestone boulder in the middle of the drainage (2x1x3m) located just at the point where you enter the drainage from the beach. This is just below the BA shale ledge on creek right.

View # 2

Bearing: 270

10/4/2006 1:38 PM Post Treatment

Looking downstream - postwork.



5/13/2007 10:35 AM Post Treatment

Looking downstream at a pool of water.



10/4/2006 10:57 AM Pre Treatment

Looking downstream at a pool of water and tamarisk on creek left.



6/20/2008 10:30 AM Post Treatment

Photo update.



PP 140 Mile 1

Photopoints printed on:
Thursday, October 09, 2008

RM: 140 RS: L

Easting: 359419 Northing: 4029254 Height: 5'04 Project: Phase IIb

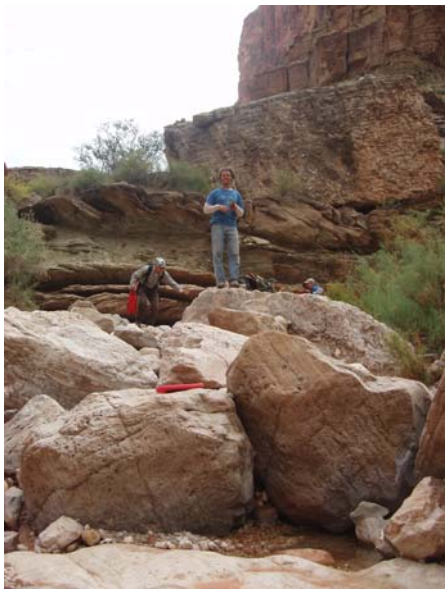
Photopoint Description: PP is a Redwall limestone boulder in the middle of the drainage (2x1x3m) located just at the point where you enter the drainage from the beach. This is just below the BA shale ledge on creek right.

View # A

Bearing: 106

10/4/2006 10:51 AM Pre Treatment

Steve at photopoint. Taken from 10m downstream of photopoint looking upstream.



PP 148.5 Mile Spring 1

Photopoints printed on:
Thursday, October 09, 2008

RM: 149 RS: R

Easting: 350117 Northing: 4023627 Height: Project: Phase I

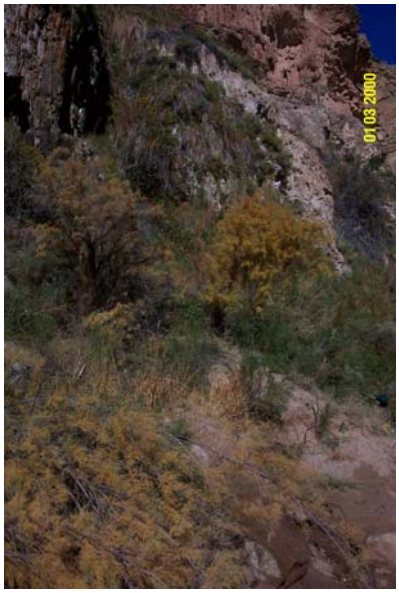
Photopoint Description: Taken from a big limestone rock just downstream of the spring. No GPS available. Spring is about 500m upstream of Matkatamiba creek.

View # 1

Bearing:

11/19/2002 Post Treatment

Post work.



6/9/2004 Post Treatment

Photo update.



9/18/2008 10:17 AM Post Treatment

Photo update.

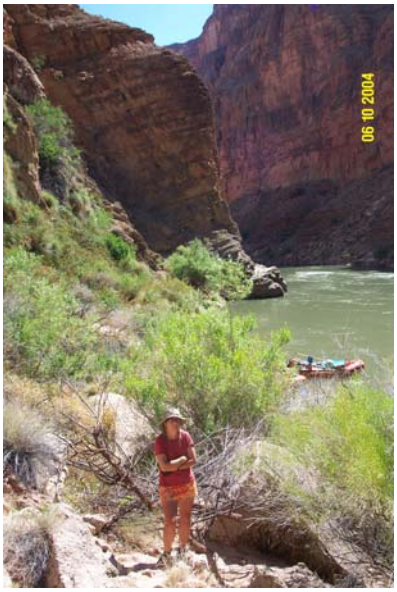


View # A

Bearing:

6/9/2004 12:00 PM Pre Treatment

Person at photopoint.



PP 148.5 Mile Spring 1

Photopoints printed on:
Thursday, October 09, 2008

RM: 149 RS: R

Easting: 350117 Northing: 4023627 Height: 5'4 " Project: Phase I

Photopoint Description: Taken from a big limestone rock just downstream of the spring. No GPS available. Spring is about 500m upstream of Matkatamiba creek.

View # B

Bearing:

3/3/2005 12:01 PM Pre Treatment

Alison at photopoint.



PP 148.5 Mile Spring 2

Photopoints printed on:
Thursday, October 09, 2008

RM: 149 RS: R

Easting: 350124 Northing: 4023639 Height: 5'00 Project: Phase I

Photopoint Description: No GPS available. Photopoint is behind spring on muav shelf. Spring is about 500m upstream of Matakamiba creek.

View # 1

Bearing:

11/19/2002 Post Treatment

Post work.



6/9/2004 Post Treatment

Photo update.



11/19/2002 11:45 AM Pre Treatment

Looking into spring.



9/18/2008 10:15 AM Post Treatment

Photo update.



PP 148.5 Mile Spring 2

Photopoints printed on:
Thursday, October 09, 2008

RM: 149 RS: R

Easting: 350124 Northing: 4023639 Height: 5'00 Project: Phase I

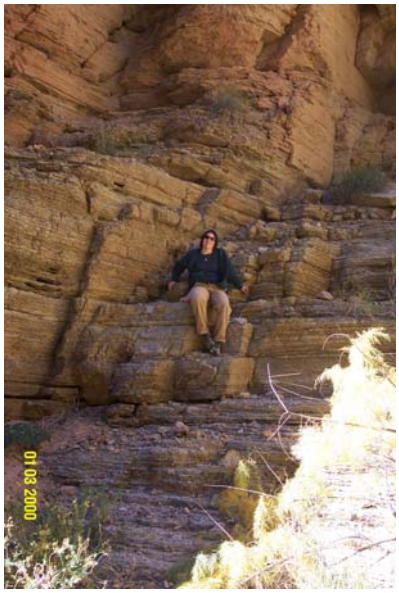
Photopoint Description: No GPS available. Photopoint is behind spring on muav shelf. Spring is about 500m upstream of Matakamiba creek.

View # A

Bearing: 280

11/19/2002 11:48 AM Pre Treatment

Kate on the muav shelf photopoint.

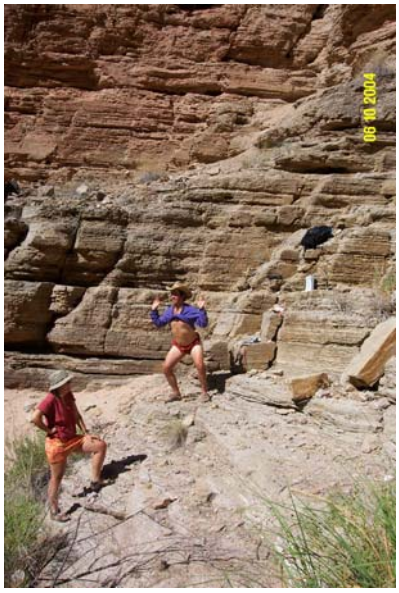


View # B

Bearing:

6/9/2004 Pre Treatment

Person at photopoint.



PP 151 Mile 1

Photopoints printed on:
Thursday, October 09, 2008

RM: 151 RS: R

Easting: 345916 Northing: 4023994 Height: 5'08 Project: Phase IIb

Photopoint Description: Taken from a 3x4x3m Redwall limestone boulder in between two large muav outcroppings. This is about 2.5 m from the water line. 1km upstream of upper ledges camp hidden in a small pocket obscured by muav point on right.

View # 1

Bearing: 60

2/25/2007 9:52 AM Pre Treatment

Looking at spring and TAMRAM.



2/25/2007 10:30 AM Post Treatment

Post work.



9/18/2008 12:04 PM Post Treatment

Photo update.



PP 151 Mile 1

Photopoints printed on:
Thursday, October 09, 2008

RM: 151 RS: R

Easting: 345916 Northing: 4023994 Height: 5'08 Project: Phase IIb

Photopoint Description: Taken from a 3x4x3m Redwall limestone boulder in between two large muav outcroppings. This is about 2.5 m from the water line. 1km upstream of upper ledges camp hidden in a small pocket obscured by muav point on right.

View # 2

Bearing: 93

2/25/2007 10:34 AM Post Treatment

Post work.



2/25/2007 9:58 AM Pre Treatment

Looking upstream at TAMRAM.



9/18/2008 12:05 PM Post Treatment

Photo update.



PP 151 Mile 1

Photopoints printed on:
Thursday, October 09, 2008

RM: 151 RS: R

Easting: 345916 Northing: 4023994 Height: 5'08 Project: Phase IIb

Photopoint Description: Taken from a 3x4x3m Redwall limestone boulder in between two large muav outcroppings. This is about 2.5 m from the water line. 1km upstream of upper ledges camp hidden in a small pocket obscured by muav point on right.

View # 3

Bearing: 248

2/25/2007 10:35 AM Post Treatment

Post work.



2/25/2007 10:10 AM Pre Treatment

Looking downstream at TAMRAM.



9/18/2008 12:06 PM Post Treatment

Photo update.



View # A

Bearing: 341

2/25/2007 9:50 AM Pre Treatment

Pen is pointing at photopoint.

PP National 2-2

Photopoints printed on:
Thursday, October 09, 2008

RM: 166 RS: L

Easting: 331144 Northing: 4013838 Height: 5'06 Project: Phase IIb

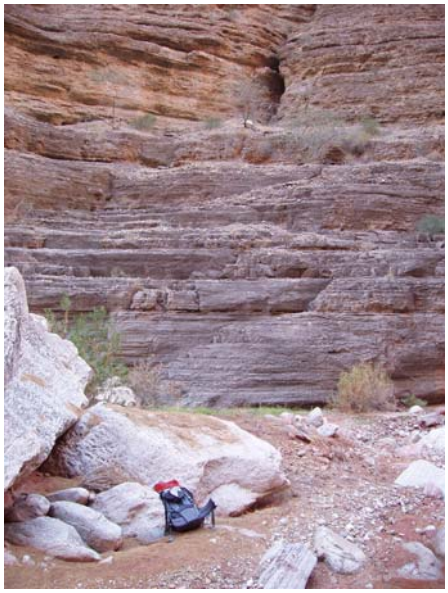
Photopoint Description: Taken 60m above where the traverse (after the climb) drops back down into National Canyon. Creek right on the bedrock near the Muav bench and near some fridge-sized boulders.

View # 1

Bearing: 210

2/26/2007 1:00 PM Post Treatment

Post work.



2/26/2007 11:00 AM Pre Treatment

Looking across the stream at large at a single mature TAMRAM.



4/20/2008 5:30 PM Post Treatment

Photo update.



PP National 2-2

Photopoints printed on:
Thursday, October 09, 2008

RM: 166 RS: L

Easting: 331144 Northing: 4013838 Height: 5'06 Project: Phase IIb

Photopoint Description: Taken 60m above where the traverse (after the climb) drops back down into National Canyon. Creek right on the bedrock near the Muav bench and near some fridge-sized boulders.

View # 2

Bearing: 160

2/26/2007 11:00 AM Pre Treatment

Looking across stream at a smaller, bare TAMRAM.



2/26/2007 1:00 PM Post Treatment

Post work.



4/20/2008 5:30 PM Post Treatment

Photo update.



PP National 2-2

Photopoints printed on:
Thursday, October 09, 2008

RM: 166 RS: L

Easting: 331144 Northing: 4013838 Height: 5'06 Project: Phase IIb

Photopoint Description: Taken 60m above where the traverse (after the climb) drops back down into National Canyon. Creek right on the bedrock near the Muav bench and near some fridge-sized boulders.

View # A

Bearing: 90

2/26/2007 11:00 AM Pre Treatment

Taken 7m downstream of PP in the creek bottom. Looking up at PP bench and sunny curve in the canyon behind.



4/20/2008 5:30 PM Post Treatment

Photo update.



PP Mohawk 4

Photopoints printed on:
Thursday, October 09, 2008

RM: 172 RS: L

Easting: 322211 Northing: 4008416 Height: 5'06 Project: Phase IIb

Photopoint Description: 150m below a huge Muav chockstone in upper Mohawk. This is near the mature redbuds on top of a 1x1m Muav gray boulder.

View # 1

Bearing: 200

10/6/2006 10:30 AM Post Treatment

Post work.



View # A

Bearing: 20

10/6/2006 9:45 AM Pre Treatment

Kate at photopoint. Taken up canyon 15m, midway between photo rock and the big mature TAMRAM, looking down canyon.



10/6/2006 9:45 AM Pre Treatment

Looking upstream at 1 smaller TAMRAM on the left and a big one on the right.



PP Honga 1

Photopoints printed on:
Thursday, October 09, 2008

RM: 177 RS: L

Easting: 315933 Northing: 4009270 Height: Project: Phase IIb

Photopoint Description: Recheck this GPS it may not be right. Taken from an enormous white boulder on creek right downstream of waterfall. Standing on flattest patch on southern part of rock (not the highest part of rock). Initially there were two PPs with the same UTM reading - combined into one - but left the Honga 2 name on some - re-do this whole site and fiture it out!

View # 1

Bearing: 131

3/3/2005 10:15 AM Pre Treatment

Looking toward waterfall along the creek, looking upstream. This may not be the right photo.



View # A

Bearing:

3/3/2005 10:15 AM Pre Treatment

Person at photopoint.



PP Honga HA 1

Photopoints printed on:
Thursday, October 09, 2008

RM: 177 RS: L

Easting: 316086 Northing: 4009160 Height: 5'6 " Project: Phase IIb

Photopoint Description: This photopoint is upper Honga, above the first waterfall and at the base of the second waterfall. Columbines and ferns are plentiful at this dripping falls. Photopoint is 5m below the pool.

View # 1

Bearing: 295

5/14/2006 9:50 AM Pre Treatment

Looking downstream at mature tamarisk and beyond.



View # 2

Bearing: 110

5/14/2006 9:50 AM Pre Treatment

Looking at the pool close by with flowering aquilegia.



View # 3

Bearing:

5/14/2006 9:50 AM Pre Treatment

Looking up towards the top of the waterfall.



View # A

Bearing: 60

5/14/2006 9:50 AM Pre Treatment

Taken from 10m downstream of pool at cliff bottom.



PP Honga Hydro #1

Photopoints printed on:
Thursday, October 09, 2008

RM: 177 RS: L

Easting: 315942 Northing: 4009196 Height: 6'0 " Project: Phase IIb

Photopoint Description: 5m from seep pourover about a small pool.

View # 1

Bearing: 73

5/14/2006 10:00 AM Pre Treatment

10m from seep pourover on canyon left. View of seep pourover and small pool.

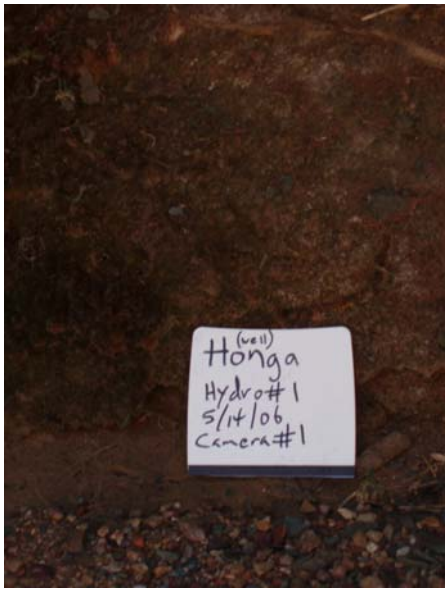


View # A

Bearing: 122

5/14/2006 10:00 AM Pre Treatment

Honga Hydro #1 photopoint label



PP Prospect 2

Photopoints printed on:
Thursday, October 09, 2008

RM: 179 RS: L

Easting: 313035 Northing: 4007329 Height: 5'06 Project: Phase IIb

Photopoint Description: About 800m from the mouth of Prospect at seepy spring by a loose dirt wall. In Muav limestone at a small yellowish patio. Photopoint boulder is gray (1x1x1xm) in the drainage bottom.

View # 1

Bearing: 140

10/8/2006 10:10 AM Post Treatment

Post work.



10/8/2006 9:45 AM Pre Treatment

Looking across stream at mature TAMRAM. Lava boulder at the left of photo.



View # 2

Bearing: 170

10/8/2006 9:45 AM Pre Treatment

One TAMRAM in the foreground. Looking up canyon.



10/8/2006 10:10 AM Post Treatment

Post work.



PP Prospect 2

Photopoints printed on:
Thursday, October 09, 2008

RM: 179 RS: L

Easting: 313035 Northing: 4007329 Height: 5'06 Project: Phase IIb

Photopoint Description: About 800m from the mouth of Prospect at seepy spring by a loose dirt wall. In Muav limestone at a small yellowish patio. Photopoint boulder is gray (1x1x1xm) in the drainage bottom.

View # A

Bearing: 40

10/8/2006 9:45 AM Pre Treatment

Kate at photopoint. Taken 5m upstream.



PP 190 Mile 2

Photopoints printed on:
Thursday, October 09, 2008

RM: 190 RS: L

Easting: 301911 Northing: 3998573 Height: 5'02 Project: Phase IIb

Photopoint Description: Photopoint is about 150m into 190 Mile 2, above a Tapeats climb. The canyon opens up in a seepy area. PP is on top of a pile of 4 limestone boulders. The biggest one is a beige 5x10m rock in the middle of the drainage.

View # 1

Bearing: 129

10/9/2006 9:05 AM Pre Treatment

Looking upstream at Tapeats shelves.



View # 2

Bearing: 200

10/9/2006 2:18 PM Post Treatment

Post work.



10/9/2006 2:17 PM Post Treatment

Post work.



10/9/2006 9:07 AM Pre Treatment

Looking upstream and at creek left with Nolina in the seep.



PP 190 Mile 2

Photopoints printed on:
Thursday, October 09, 2008

RM: 190 RS: L

Easting: 301911 Northing: 3998573 Height: 5'02 Project: Phase IIb

Photopoint Description: Photopoint is about 150m into 190 Mile 2, above a Tapeats climb. The canyon opens up in a seepy area. PP is on top of a pile of 4 limestone boulders. The biggest one is a beige 5x10m rock in the middle of the drainage.

View # 3

Bearing: 304

10/9/2006 2:20 PM Post Treatment

Post work.



10/9/2006 9:08 AM Pre Treatment

Looking downstream at main TAMRAM infestation.



View # A

Bearing: 120

10/9/2006 9:00 AM Pre Treatment

Photopoint is at red clipboard and yellow case. Taken from about 15m downstream of the photopoint.



PP Spring 1

Photopoints printed on:
Thursday, October 09, 2008

RM: 205 RS: R

Easting: 287814 Northing: 3988547 Height: 3'00 Project: Phase IIb

Photopoint Description: Taken sitting on a large white boulder on creek right about 150m below the spring source.

View # 1

Bearing: 40

3/1/2007 2:45 PM Pre Treatment

Looking downstream at mesquite with mistletoe.



View # 2

Bearing: 35

3/1/2007 2:45 PM Pre Treatment

Same view as 1, slightly shifted and horizontal to get more vegetation in the photo.



View # 3

Bearing: 240

3/1/2007 2:45 PM Pre Treatment

Looking upstream and to the left.



View # 4

Bearing: 270

3/1/2007 2:45 PM Pre Treatment

Looking upstream and to the right.



PP Spring 1

Photopoints printed on:
Thursday, October 09, 2008

RM: 205 RS: R

Easting: 287814 Northing: 3988547 Height: 3'00 Project: Phase IIb

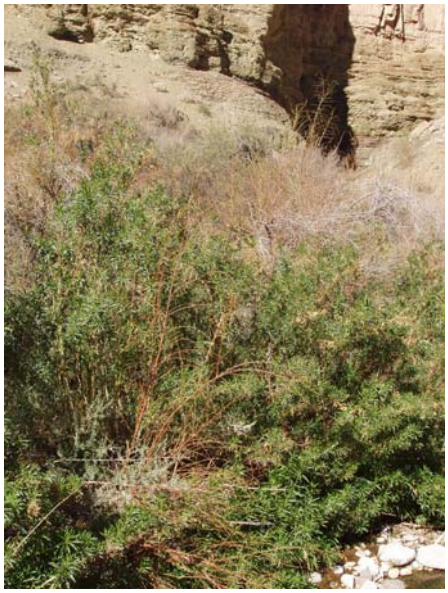
Photopoint Description: Taken sitting on a large white boulder on creek right about 150m below the spring source.

View # 5

Bearing: 330

3/1/2007 2:45 PM Pre Treatment

Looking across the creek.



View # A

Bearing:

3/1/2007 3:00 PM Pre Treatment

Pen points at PP. Taken from upstream looking down.



PP Granite Park 1

Photopoints printed on:
Friday, October 10, 2008

RM: 209 RS: L

Easting: 291496 Northing: 3982794 Height: 5'09 Project: Phase IIb

Photopoint Description: Approx. 250m into the section, a 3x3m Muav limestone boulder on creek right in the drainage. This is where an eroded bank is visible at about 10m high.

View # 1

Bearing: 324

10/10/2006 10:41 AM Pre Treatment

Looking downstream with a lava shelf in the background and a red outcrop on creek right.



5/20/2007 Post Treatment

Photo update.



10/10/2006 4:34 PM Post Treatment

Post work.



PP Granite Park 1

Photopoints printed on:
Friday, October 10, 2008

RM: 209 RS: L

Easting: 291496 Northing: 3982794 Height: 5'09 Project: Phase IIb

Photopoint Description: Approx. 250m into the section, a 3x3m Muav limestone boulder on creek right in the drainage. This is where an eroded bank is visible at about 10m high.

View # 2

Bearing: 146

10/10/2006 10:42 AM Pre Treatment

Looking upstream with Muav limestone walls forming a V and cottonwood tree in the distance.



5/20/2007 Post Treatment

Photo update.



10/10/2006 4:35 PM Post Treatment

Post work.



View # A

Bearing: 322

10/10/2006 10:40 AM Pre Treatment

Gary on photopoint rock with a downstream view.



PP Three Springs 1

Photopoints printed on:
Friday, October 10, 2008

RM: 216 RS: L

Easting: 291657 Northing: 3973754 Height: 5'08 Project: Phase IIb

Photopoint Description: Follow trail on upstream side of the canyon, as you begin to descend into the drainage the photopoint rock is about 30m down canyon from the trail.

View # 1

Bearing: 90

3/3/2007 10:40 AM Post Treatment

Post work.



4/25/2008 10:41 AM Post Treatment

Photo update.



3/3/2007 8:18 AM Pre Treatment

Looking upstream on creek right at a stand of trees. Mostly PROGLA and TAMRAM, with little to no foliage.



PP Three Springs 1

Photopoints printed on:
Friday, October 10, 2008

RM: 216 RS: L

Easting: 291657 Northing: 3973754 Height: 5'08 Project: Phase IIb

Photopoint Description: Follow trail on upstream side of the canyon, as you begin to descend into the drainage the photopoint rock is about 30m down canyon from the trail.

View # 2

Bearing: 125

3/3/2007 8:20 AM Pre Treatment

Looking at and across the creek at PHRAUS with interspersed TAMRAM.



4/25/2008 10:41 AM Post Treatment

Photo update.



3/3/2007 10:42 AM Post Treatment

Post work.



View # A

Bearing:

3/3/2007 8:15 AM Pre Treatment

Pen points to PP.



PP 217 Mile Middle East Fork 2

Photopoints printed on:
Thursday, October 09, 2008

RM: 217 RS: L

Easting: 293624 Northing: 3970010 Height: 5'00 Project: Phase IIb

Photopoint Description: Taken from a small schist boulder about 2x3m on drainage right next to an acacia grotto.

View # 1

Bearing: 275

10/11/2006 12:45 PM Pre Treatment

Looking down canyon at TAMRAM in drainage. Canyon has flashed since mapping and there are only a few TAMRAM left.



9/22/2008 2:34 PM Post Treatment

Photo update.



View # A

Bearing: 350

10/11/2006 12:42 PM Pre Treatment

Steve at photopoint.



PP Granite Springs 7

Photopoints printed on:
Thursday, October 09, 2008

RM: 220 RS: L

Easting: 291205 Northing: 3966259 Height: 5'06 Project: Phase IIb

Photopoint Description: Just over 3km up the main drainage from the mouth, after some curvy sections there is a narrow schist spot with water. 20m above is a 1x1x1m gray boulder at creek left. This is the photopoint.

View # 1

Bearing: 350

10/12/2006 10:07 AM Pre Treatment

Looking downstream towards the narrows at the first climby spot. TAMRAM is in the foreground.



View # 2

Bearing: 60

10/12/2006 10:07 AM Pre Treatment

Looking across the stream at creek right granite wall. TAMRAM in the foreground.



10/12/2006 10:45 AM Post Treatment

Post work.



10/12/2006 10:45 AM Post Treatment

Post work.



PP Granite Springs 7

Photopoints printed on:
Thursday, October 09, 2008

RM: 220 RS: L

Easting: 291205 Northing: 3966259 Height: 5'06 Project: Phase IIb

Photopoint Description: Just over 3km up the main drainage from the mouth, after some curvy sections there is a narrow schist spot with water. 20m above is a 1x1x1m gray boulder at creek left. This is the photopoint.

View # 3

Bearing: 140

10/12/2006 10:07 AM Pre Treatment

Looking upstream at a big mature on the left mixing in with tall arrowhead.



View # A

Bearing: 345

10/12/2006 10:07 AM Pre Treatment

Pen points at photopoint. Taken upstream 10m of the gray photopoint rock.



10/12/2006 10:45 AM Post Treatment

Post work.



PP 221 Mile 1

Photopoints printed on:
Thursday, October 09, 2008

RM: 221 RS: L

Easting: 289497 Northing: 3966157 Height: 5'06 Project: Phase IIb

Photopoint Description: Taken atop a 1x1/2 m sandstone boulder, perched on the barren white slope below the spring 150m up 221 Mile Spring.

View # 1

Bearing: 55

10/13/2006 8:45 AM Post Treatment

Post work.



9/22/2008 2:00 PM Post Treatment

Photo update.



10/13/2006 8:25 AM Pre Treatment

Looking up at saplings buried in the spring.



View # A

Bearing: 180

10/13/2006 8:25 AM Pre Treatment

Taken 10m upstream down at photopoint rock. Colorado River is behind.



PP 221 Mile Spring HA 1

Photopoints printed on:
Thursday, October 09, 2008

RM: 221 RS: L

Easting: 289493 Northing: 3966156 Height: 5'2 " Project: Phase IIb

Photopoint Description: On Tapeats boulder about 150m upstream from the mouth, just downstream of the wall seep near some purple tapeats stones.

View # 1

Bearing: 24

5/20/2006 9:00 AM Pre Treatment

Uphill at spring on creek left with whitish slope below that is barren.



View # A

Bearing: 0

5/20/2006 9:00 AM Pre Treatment

Uphill at spring creek left with whitish slope below that is barren.



View # 2

Bearing: 190

5/20/2006 9:00 AM Pre Treatment

View downstream to tamarisk at river's edge. False Diamond Peak in the background.



PP 221.5 Mile 1

Photopoints printed on:
Thursday, October 09, 2008

RM: 222 RS: L

Easting: 289546 Northing: 3965532 Height: 5'06 Project: Phase IIb

Photopoint Description: Taken on top of Tapeats 1x1x1m boulder up the south fork. This is 5m below the dripping spring at the Tapeats/schist contact.

View # 1

Bearing: 90

10/13/2006 9:45 AM Pre Treatment

Looking upstream at a large mature; Tapeats is behind.



9/22/2008 2:30 PM Post Treatment

Photo update.



10/13/2006 10:10 AM Post Treatment

Post work.



View # A

Bearing: 300

10/13/2006 9:45 AM Pre Treatment

Taken 5m upstream of photopoint, looking down at purple boulder on creek left.



PP 222 Mile 2

Photopoints printed on:
Thursday, October 09, 2008

RM: 222 RS: L

Easting: 289862 Northing: 3964872 Height: 6'00 Project: Phase IIb

Photopoint Description: Standing on a small granite shelf on creek right. This is about 10' above the creek drainage.

View # 1

Bearing: 110

10/12/2006 9:19 AM Pre Treatment

Looking upstream down at the left bend in the creek. Staring into the corner pocket on lookers left.



10/12/2006 10:00 AM Post Treatment

Post work.



6/23/2008 12:00 PM Post Treatment

Photo update.



PP 222 Mile 2

Photopoints printed on:
Thursday, October 09, 2008

RM: 222 RS: L

Easting: 289862 Northing: 3964872 Height: 6'0 " Project: Phase IIb

Photopoint Description: Standing on a small granite shelf on creek right. This is about 10' above the creek drainage.

View # 2

Bearing: 140

10/12/2006 9:20 AM Pre Treatment

Just lookers right of view #1 (with slight overlap). Looking right at the middle of a thicket. There is a rocky slope in the right of the picture.



10/12/2006 10:00 AM Post Treatment

Post work.



View # A

Bearing: 22

10/12/2006 9:27 AM Pre Treatment

Person at photopoint. Taken from below the small pouroff and pool looking up and across the stream at the photopoint.



PP 224 Mile 1

Photopoints printed on:
Thursday, October 09, 2008

RM: 224 RS: L

Easting: 288046 Northing: 3962523 Height: 6'0 " Project: Phase IIb

Photopoint Description: Standing on large brown outcrop on creek right above small seep pouroff.

View # 1

Bearing: 10

10/13/2006 11:55 AM Pre Treatment

Looking downstream at mouth of canyon and the river in the background.



9/22/2008 4:00 PM Post Treatment

Photo update.



10/13/2006 12:45 PM Post Treatment

Post work.



PP 224 Mile 1

Photopoints printed on:
Thursday, October 09, 2008

RM: 224 RS: L

Easting: 288046 Northing: 3962523 Height: 6'0 " Project: Phase IIb

Photopoint Description: Standing on large brown outcrop on creek right above small seep pouroff.

View # 2

Bearing: 194

10/13/2006 11:55 AM Pre Treatment

Looking upstream and across the drainage - cobbly boulder in the foreground. There is a bib tamarisk in the center.



10/13/2006 12:45 PM Post Treatment

Post work.



9/22/2008 4:00 PM Post Treatment

Photo update.



View # A

Bearing: 14

10/13/2006 12:40 PM Pre Treatment

Loren at photopoint. Taken from upstream in the middle of tamarisk stumps that are in the middle of the drainage.



Appendix C - Habitat Assessment Data

Park Area/Canyon:	**Horn Creek**			River mile:	90 L
Site/Polygon Name:	Horn HA 1			Project (Phase):	Phase IIb
	Start point	End point		Date:	11/9/2006
Easting	396639	0			
Northing	3994020	0			
GPS accuracy (m)	22				
Surface water within 25m	☑	Surface water type:	pothole	stream	
Soil moisture:	moist	Surface rocks:	limestone	sandstone	
Associated species:	Agave utahensis Engelm., Celtis laevigata Willd. var. reticulata (Torr.) L. Benson, Coleogyne ramosissima Torr., Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird, Fraxinus anomala Torr. ex S. Wats., Purshia mexicana (D. Don) Henrickson, Rhus trilobata Nutt., Salix exigua Nutt., Yucca baccata Torr.				
Dominant species:	Baccharis salicifolia (Ruiz & Pavón) Pers., Brickellia longifolia S. Wats., Gutierrezia sarothrae (Pursh) Britt. & Rusby				
Habitat type:	Riparian				
Vegetation density:	Low	Average height of vegetation (m): 1.5			
Tamarisk estimate:	Low				
Other info:					
SWIFL determination:	Not Southwestern Willow Flycatcher Habitat				

Park Area/Canyon:	**Salt Creek**			River mile:	92.5 L
Site/Polygon Name:	Salt Creek 2			Project (Phase):	Phase IIb
	Start point	End point		Date:	11/11/2006
Easting	394772	395167			
Northing	3995489	3995245			
GPS accuracy (m)	10				
Surface water within 25m	☐	Surface water type:			
Soil moisture:	dry	Surface rocks:	sandstone		
Associated species:	Baccharis salicifolia (Ruiz & Pavón) Pers., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Porophyllum gracile Benth.				
Dominant species:	Acacia greggii Gray, Agave utahensis Engelm.				
Habitat type:	Riparian		GB desert scrub		
Vegetation density:	Low	Average height of vegetation (m): 1			
Tamarisk estimate:	Moderate				
Other info:					
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat				

Park Area/Canyon:	**Cedar Spring**		River mile:	93 L
Site/Polygon Name:	Cedar Spring 1		Project (Phase):	Phase IIb
	Start point	End point	Date:	11/13/2006
Easting	393530	0		
Northing	3995393	0		
GPS accuracy (m)	10			
Surface water within 25m ☐		Surface water type:		
Soil moisture:	moist	Surface rocks:	sandstone	
Associated species:	Agave utahensis Engelm., Aloysia wrightii Heller ex Abrams, Imperata brevifolia Vasey, Mirabilis multiflora (Torr.) Gray			
Dominant species:	Acacia greggii Gray, Ephedra spp., Isocoma acradenia (Greene) Greene			
Habitat type:	Mojave desert scrub			
Vegetation density:	Sparse	Average height of vegetation (m): 0.5		
Tamarisk estimate:	Low			
Other info:				
SWIFL determination:	Not Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**Topaz Canyon**		River mile:	96.7 L
Site/Polygon Name:	Topaz 1		Project (Phase):	Phase IIb
	Start point	End point	Date:	4/24/2006
Easting	388327	387858		
Northing	3996950	3996902		
GPS accuracy (m)	5	8		
Surface water within 25m ☐		Surface water type:		
Soil moisture:	dry	Surface rocks:	schist	
Associated species:	Aristida purpurea Nutt., Ephedra fasciculata A. Nels., Galium aparine L., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Rhus trilobata Nutt., Salvia dorrii (Kellogg) Abrams ssp. dorrii var. dorrii			
Dominant species:	Acacia greggii Gray, Isocoma acradenia (Greene) Greene			
Habitat type:	Riparian			
Vegetation density:	Sparse	Average height of vegetation (m): 1		
Tamarisk estimate:	None			
Other info:	There was no groundwater or standing pools present, a dry creek bed.			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**Topaz Canyon**		River mile: 96.7 L
Site/Polygon Name:	Topaz 2		Project (Phase): Phase IIb
	Start point	End point	Date: 4/24/2006
Easting	387858	387422	
Northing	3996902	3996701	
GPS accuracy (m)	8	13	
Surface water within 25m	☑	Surface water type:	seep
Soil moisture:	dry	Surface rocks:	schist
Associated species:	Aristida purpurea Nutt., Baccharis emoryi Gray, Baccharis sergiloides Gray, Ephedra fasciculata A. Nels., Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird, Gutierrezia sarothrae (Pursh) Britt. & Rusby, Oenothera caespitosa Nutt., Phacelia spp.		
Dominant species:	Bromus rubens L., Isocoma acradenia (Greene) Greene, Tamarix ramosissima Ledeb.		
Habitat type:	Riparian		
Vegetation density:	Low	Average height of vegetation (m): 2	
Tamarisk estimate:	High		
Other info:	There was a half dozen pools of water in this section, a total of 5 gallons.		
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat		

Park Area/Canyon:	**Topaz Canyon**		River mile: 96.7 L
Site/Polygon Name:	Topaz 3		Project (Phase): Phase IIb
	Start point	End point	Date: 4/24/2006
Easting	387422	386977	
Northing	3996701	3996475	
GPS accuracy (m)	13	7	
Surface water within 25m	☐	Surface water type:	
Soil moisture:	dry	Surface rocks:	sandstone
Associated species:	Aristida purpurea Nutt., Cirsium arizonicum (Gray) Petrak, Galium aparine L., Mentzelia spp., Oenothera caespitosa Nutt., Porophyllum gracile Benth.		
Dominant species:	Acacia greggii Gray, Brickellia longifolia S. Wats., Bromus rubens L.		
Habitat type:	Riparian		
Vegetation density:	Sparse	Average height of vegetation (m): 1	
Tamarisk estimate:	None		
Other info:	This section runs through the scoured, dry Tapeats narrows in Topaz canyon.		
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat		

Park Area/Canyon:	**Topaz Canyon**		River mile: 96.7 L
Site/Polygon Name:	Topaz 4		Project (Phase): Phase IIb
	Start point	End point	Date: 4/24/2006
Easting	386977	386622	
Northing	3996475	3996355	
GPS accuracy (m)	7	5	
Surface water within 25m ☐		Surface water type:	
Soil moisture:	dry	Surface rocks:	sandstone
Associated species:	Baccharis sergiloides Gray, Bromus rubens L., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Juniperus osteosperma (Torr.) Little, Purshia mexicana (D. Don) Henrickson, Stanleya pinnata (Pursh) Britt., Thymophylla pentachaeta (DC.) Small, Yucca angustissima Engelm. ex Trel.		
Dominant species:	Acacia greggii Gray, Aristida purpurea Nutt., Brickellia longifolia S. Wats., Fraxinus anomala Torr. ex S. Wats., Purshia mexicana (D. Don) Henrickson, Rhus trilobata Nutt.		
Habitat type:	Riparian		
Vegetation density:	Low	Average height of vegetation (m): 2	
Tamarisk estimate:	None		
Other info:	This section starts at the top of the Tapeats and goes 500m up through the Bright Angel Shale.		
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat		

Park Area/Canyon:	**Topaz Canyon**		River mile: 96.7 L
Site/Polygon Name:	Topaz 5		Project (Phase): Phase IIb
	Start point	End point	Date: 4/24/2006
Easting	386622	386301	
Northing	3996355	3996162	
GPS accuracy (m)	5	5	
Surface water within 25m ☐		Surface water type:	
Soil moisture:	dry	Surface rocks:	shale
Associated species:	Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth, Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake, Oenothera caespitosa Nutt., Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb.		
Dominant species:	Brickellia longifolia S. Wats., Fraxinus anomala Torr. ex S. Wats., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Juniperus osteosperma (Torr.) Little, Purshia mexicana (D. Don) Henrickson, Rhus trilobata Nutt.		
Habitat type:	Riparian		
Vegetation density:	Low	Average height of vegetation (m): 1	
Tamarisk estimate:	None		
Other info:	This site starts at the first Utah juniper in the Bright Angel shale.		
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat		

Park Area/Canyon:	**Topaz Canyon**		River mile: 96.7 L
Site/Polygon Name:	Topaz 6		Project (Phase): Phase IIb
	Start point	End point	Date: 4/24/2006
Easting	386301	385900	
Northing	3996162	3996048	
GPS accuracy (m)	5	6	
Surface water within 25m ☐		Surface water type:	
Soil moisture:	dry	Surface rocks:	limestone
Associated species:	Oenothera caespitosa Nutt., Purshia mexicana (D. Don) Henrickson, Xylorhiza tortifolia (Torr. & Gray) Greene		
Dominant species:	Acacia greggii Gray, Brickellia longifolia S. Wats., Bromus rubens L., Fraxinus anomala Torr. ex S. Wats., Gutierrezia sarothrae (Pursh) Britt. & Rusby		
Habitat type:	Riparian		
Vegetation density:	Low	Average height of vegetation (m): 1	
Tamarisk estimate:	None		
Other info:	This site starts just below and works its way into the Muav.		
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat		

Park Area/Canyon:	**Topaz Canyon**		River mile: 96.7 L
Site/Polygon Name:	Topaz 7		Project (Phase): Phase IIb
	Start point	End point	Date: 4/24/2006
Easting	385900	385611	
Northing	3996048	3995928	
GPS accuracy (m)	6	10	
Surface water within 25m ☑		Surface water type:	stream
Soil moisture:	dry moist	Surface rocks:	limestone
Associated species:	Adiantum capillus-veneris L., Brickellia longifolia S. Wats., Bromus rubens L., Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Tamarix ramosissima Ledeb., Yucca baccata Torr.		
Dominant species:	Cercis occidentalis Torr. ex Gray, Fraxinus anomala Torr. ex S. Wats., Nolina microcarpa S. Wats., Rhus trilobata Nutt.		
Habitat type:	Riparian		
Vegetation density:	Low	Average height of vegetation (m): 2	
Tamarisk estimate:	None		
Other info:	This site begins at Muav narrows, where a small flowing stream appears and the plant community changes.		
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat		

Park Area/Canyon:	**Topaz Canyon**		River mile:	96.7 L
Site/Polygon Name:	Topaz 8		Project (Phase):	Phase IIb
	Start point	End point	Date:	4/24/2006
Easting	385611	385355		
Northing	3995928	3995666		
GPS accuracy (m)	10	8		
Surface water within 25m	☐	Surface water type:		
Soil moisture:	dry	Surface rocks:	limestone	
Associated species:	Amelanchier utahensis Koehne, Aristida purpurea Nutt., Rhus trilobata Nutt.			
Dominant species:	Bernardia incana Morton, Brickellia longifolia S. Wats., Bromus rubens L., Purshia mexicana (D. Don) Henrickson			
Habitat type:	Riparian			
Vegetation density:	Low	Average height of vegetation (m): 1		
Tamarisk estimate:	Sparse			
Other info:	This site begins above the muav boulders. There is a view of Redwall pour off up canyon.			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**Topaz Canyon**		River mile:	96.7 L
Site/Polygon Name:	Topaz 9		Project (Phase):	Phase IIb
	Start point	End point	Date:	4/24/2006
Easting	385355	0		
Northing	3995666	0		
GPS accuracy (m)	8			
Surface water within 25m	☑	Surface water type:	seep	
Soil moisture:	dry	Surface rocks:	limestone	
Associated species:	Adiantum capillus-veneris L., Bromus rubens L., Cirsium arizonicum (Gray) Petrak, Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm., Ptelea trifoliata L.			
Dominant species:	Brickellia longifolia S. Wats., Cercis occidentalis Torr. ex Gray, Frangula betulifolia (Greene) V. Grub. ssp. betulifolia, Fraxinus anomala Torr. ex S. Wats., Nolina microcarpa S. Wats.			
Habitat type:	Riparian			
Vegetation density:	Low	Average height of vegetation (m): 2		
Tamarisk estimate:	None			
Other info:	This site starts in the upper narrow limestone section of Topaz and ends at the insurmountable Redwall cliff. No GPS readings at endpoint.			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**Slate Creek**		River mile:	98.1 L
Site/Polygon Name:	Slate 1		Project (Phase):	Phase IIb
	Start point	End point	Date:	4/23/2006
Easting	387921	387667		
Northing	3999632	3999308		
GPS accuracy (m)	5	12		
Surface water within 25m	☑	Surface water type:	stream	
Soil moisture:	moist saturated	Surface rocks:	schist	
Associated species:	Acacia greggii Gray, Ambrosia artemisiifolia L., Bromus rubens L., Cryptantha spp., Encelia farinosa Gray ex Torr., Eriogonum inflatum Torr. & Frém., Isocoma acradenia (Greene) Greene			
Dominant species:	Tamarix ramosissima Ledeb.			
Habitat type:	Riparian			
Vegetation density:	Moderate	Average height of vegetation (m): 4		
Tamarisk estimate:	High			
Other info:	Water EC reading is off the chart.			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**Slate Creek**		River mile:	98.1 L
Site/Polygon Name:	Slate 10		Project (Phase):	Phase IIb
	Start point	End point	Date:	4/25/2006
Easting	384744	384298		
Northing	3998017	3997748		
GPS accuracy (m)	14	12		
Surface water within 25m	☐	Surface water type:		
Soil moisture:	dry	Surface rocks:	shale	
Associated species:	Acacia greggii Gray, Amelanchier utahensis Koehne, Artemisia ludoviciana Nutt., Brickellia longifolia S. Wats.			
Dominant species:	Cercis occidentalis Torr. ex Gray, Fallugia paradoxa (D. Don) Endl. ex Torr., Fraxinus anomala Torr. ex S. Wats., Populus fremontii S. Wats., Purshia mexicana (D. Don) Henrickson, Rhus trilobata Nutt.			
Habitat type:	Riparian			
Vegetation density:	Moderate	Average height of vegetation (m): 3		
Tamarisk estimate:	None			
Other info:				
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**Slate Creek**		River mile: 98.1 L
Site/Polygon Name:	Slate 11		Project (Phase): Phase IIb
	Start point	End point	Date: 4/25/2006
Easting	384298	383795	
Northing	3997748	3997398	
GPS accuracy (m)	12	13	
Surface water within 25m ☐		Surface water type:	
Soil moisture:	dry	Surface rocks:	limestone
Associated species:	Acacia greggii Gray, Artemisia ludoviciana Nutt., Oenothera caespitosa Nutt.		
Dominant species:	Brickellia longifolia S. Wats., Fraxinus anomala Torr. ex S. Wats., Ptelea trifoliata L., Rhus trilobata Nutt.		
Habitat type:	Riparian		
Vegetation density:	Low	Average height of vegetation (m): 3	
Tamarisk estimate:	Sparse		
Other info:	There are a couple of mature tamarisk and a few saplings growing in a moist area in this section. There are a few pools and seepy areas.		
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat		

Park Area/Canyon:	**Slate Creek**		River mile: 98.1 L
Site/Polygon Name:	Slate 12		Project (Phase): Phase IIb
	Start point	End point	Date: 4/25/2006
Easting	383795	383381	
Northing	3997398	3997170	
GPS accuracy (m)	13	18	
Surface water within 25m ☐		Surface water type:	
Soil moisture:	dry	Surface rocks:	limestone
Associated species:	Artemisia ludoviciana Nutt., Erigeron lobatus A. Nels., Phlox austromontana Coville		
Dominant species:	Fraxinus anomala Torr. ex S. Wats., Nolina microcarpa S. Wats., Ptelea trifoliata L.		
Habitat type:	Riparian		
Vegetation density:	Low	Average height of vegetation (m): 3	
Tamarisk estimate:	None		
Other info:	This site begins at an overhanging boulder with a cave that can be bypassed. There are two up and over detour climbs in this section where overhangs occur.		
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat		

Park Area/Canyon:	**Slate Creek**		River mile:	98.1 L
Site/Polygon Name:	Slate 13		Project (Phase):	Phase IIb
	Start point	End point	Date:	4/25/2006
Easting	383381	382855		
Northing	3997170	3996955		
GPS accuracy (m)	9	18		
Surface water within 25m ☐		Surface water type:		
Soil moisture:	dry	Surface rocks:	limestone	
Associated species:	Amelanchier utahensis Koehne, Artemisia ludoviciana Nutt., Bernardia incana Morton, Brickellia atractyloides Gray, Brickellia longifolia S. Wats., Cercocarpus intricatus S. Wats., Phlox austromontana Coville			
Dominant species:	Fraxinus anomala Torr. ex S. Wats., Ptelea trifoliata L., Rhus trilobata Nutt.			
Habitat type:	Riparian			
Vegetation density:	Moderate	Average height of vegetation (m): 4		
Tamarisk estimate:	None			
Other info:	This section ends at a chock stone that is about 40 ft from the top of the Redwall. This chock stone is impassable. The canyon is void of water.			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**Slate Creek**		River mile:	98.1 L
Site/Polygon Name:	Slate 2		Project (Phase):	Phase IIb
	Start point	End point	Date:	4/23/2006
Easting	387667	387274		
Northing	3999308	3999023		
GPS accuracy (m)	12	5		
Surface water within 25m ☑		Surface water type:	spring	
Soil moisture:	moist	Surface rocks:	schist	
Associated species:	Acacia greggii Gray, Agave utahensis Engelm. var. kaibabensis (McKelvey) Breitung, Aristida spp., Bromus rubens L., Encelia farinosa Gray ex Torr., Ephedra spp., Isocoma acradenia (Greene) Greene, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Opuntia chlorotica Engelm. & Bigelow, Prosopis glandulosa Torr., Stephanomeria minor (Hook.) Nutt. var. minor			
Dominant species:	Tamarix ramosissima Ledeb.			
Habitat type:	Riparian			
Vegetation density:	High	Average height of vegetation (m): 0		
Tamarisk estimate:	High			
Other info:	Salt residue prevalent. The water is super salty.			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**Slate Creek**		River mile: 98.1 L
Site/Polygon Name:	Slate 3		Project (Phase): Phase IIb
	Start point	End point	Date: 4/23/2006
Easting	387274	387019	
Northing	3999023	3998890	
GPS accuracy (m)	8		
Surface water within 25m ☐		Surface water type:	
Soil moisture:		Surface rocks:	
Associated species:	Acacia greggii Gray, Agave utahensis Engelm. var. kaibabensis (McKelvey) Breitung, Aristida spp., Bromus rubens L., Bromus tectorum L., Encelia farinosa Gray ex Torr., Ephedra spp., Isocoma acradenia (Greene) Greene, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Opuntia chlorotica Engelm. & Bigelow, Porophyllum gracile Benth., Stephanomeria minor (Hook.) Nutt. var. minor		
Dominant species:			
Habitat type:	Riparian		
Vegetation density:		Average height of vegetation (m): 4	
Tamarisk estimate:	High		
Other info:			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat		

Park Area/Canyon:	**Slate Creek**		River mile: 98.1 L
Site/Polygon Name:	Slate 4		Project (Phase): Phase IIb
	Start point	End point	Date: 4/23/2006
Easting	387019	386658	
Northing	3998890	3998735	
GPS accuracy (m)	2	1	
Surface water within 25m ☑		Surface water type:	spring
Soil moisture:	moist	Surface rocks:	mudstone
Associated species:	Artemisia ludoviciana Nutt., Atriplex canescens (Pursh) Nutt., Encelia farinosa Gray ex Torr., Ephedra torreyana S. Wats., Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Rhus trilobata Nutt., Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb.		
Dominant species:	Acacia greggii Gray, Brickellia longifolia S. Wats., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Isocoma acradenia (Greene) Greene		
Habitat type:	Riparian		
Vegetation density:	Moderate	Average height of vegetation (m): 2	
Tamarisk estimate:	High		
Other info:			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat		

Park Area/Canyon:	**Slate Creek**		River mile:	98.1 L
Site/Polygon Name:	Slate 6		Project (Phase):	Phase IIb
	Start point	End point	Date:	4/25/2006
Easting	386423	386130		
Northing	3998832	3998637		
GPS accuracy (m)	10	6		
Surface water within 25m	☑	Surface water type:	stream	
Soil moisture:		Surface rocks:	sandstone	
Associated species:	Bromus rubens L., Encelia farinosa Gray ex Torr., Fraxinus anomala Torr. ex S. Wats., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Isocoma acradenia (Greene) Greene, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Populus fremontii S. Wats.			
Dominant species:	Brickellia longifolia S. Wats., Cercis occidentalis Torr. ex Gray			
Habitat type:	Riparian			
Vegetation density:	Sparse	Average height of vegetation (m): 2		
Tamarisk estimate:	Low			
Other info:	This site begins in the schist at cairn where the detour around the waterfall and goes up and around.			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**Slate Creek**		River mile:	98.1 L
Site/Polygon Name:	Slate 7		Project (Phase):	Phase IIb
	Start point	End point	Date:	4/25/2006
Easting	386130	385696		
Northing	3998637	3998494		
GPS accuracy (m)	6	5		
Surface water within 25m	☑	Surface water type:	seep	
Soil moisture:	dry	Surface rocks:	sandstone	
Associated species:	Adiantum capillus-veneris L., Bromus rubens L., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Physalis hederifolia Gray			
Dominant species:	Baccharis salicifolia (Ruiz & Pavón) Pers., Brickellia longifolia S. Wats., Cercis occidentalis Torr. ex Gray, Populus fremontii S. Wats., Rhus trilobata Nutt., Salix exigua Nutt.			
Habitat type:	Riparian			
Vegetation density:	Sparse	Average height of vegetation (m): 1		
Tamarisk estimate:	Sparse			
Other info:	The site goes up through the Tapeats narrows and ends where the Tonto Trail meets Slate.			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**Slate Creek**			River mile:	98.1 L
Site/Polygon Name:	Slate 8			Project (Phase):	Phase IIb
	Start point	End point		Date:	4/25/2006
Easting	385696	385293			
Northing	3998494	3998223			
GPS accuracy (m)	5	6			
Surface water within 25m	☑	Surface water type:	stream		
Soil moisture:	dry moist	Surface rocks:	sandstone	shale	
Associated species:	Baccharis sergiloides Gray, Bothriochloa saccharoides (Sw.) Rydb., Bromus rubens L., Juniperus osteosperma (Torr.) Little, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Yucca elata (Engelm.) Engelm.				
Dominant species:	Brickellia longifolia S. Wats., Fraxinus anomala Torr. ex S. Wats., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Purshia mexicana (D. Don) Henrickson				
Habitat type:	Riparian				
Vegetation density:	Low	Average height of vegetation (m): 3			
Tamarisk estimate:	Sparse				
Other info:	There were 15 mature, 17 sapling and intermittent water flow.				
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat				

Park Area/Canyon:	**Slate Creek**			River mile:	98.1 L
Site/Polygon Name:	Slate 9			Project (Phase):	Phase IIb
	Start point	End point		Date:	4/25/2006
Easting	385293	384744			
Northing	3998223	3998017			
GPS accuracy (m)	6	14			
Surface water within 25m	☑	Surface water type:	stream		
Soil moisture:	moist	Surface rocks:	shale		
Associated species:	Amelanchier utahensis Koehne, Bothriochloa saccharoides (Sw.) Rydb., Bromus rubens L., Erigeron lobatus A. Nels., Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi				
Dominant species:	Baccharis emoryi Gray, Brickellia longifolia S. Wats., Fraxinus anomala Torr. ex S. Wats., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Populus fremontii S. Wats., Rhus trilobata Nutt.				
Habitat type:	Riparian				
Vegetation density:	Moderate	Average height of vegetation (m): 0			
Tamarisk estimate:	Sparse				
Other info:					
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat				

Park Area/Canyon:	**Agate Canyon**			River mile:	100.6 L
Site/Polygon Name:	Agate 1			Project (Phase):	Phase IIb
	Start point	End point		Date:	4/26/2006
Easting	384811	384602			
Northing	4000563	4000144			
GPS accuracy (m)	9.8	6			
Surface water within 25m	☑	Surface water type:	stream		
Soil moisture:	moist	Surface rocks:	schist	granite	
Associated species:	Aristida spp., Baccharis salicifolia (Ruiz & Pavón) Pers., Ephedra spp., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Isocoma acradenia (Greene) Greene, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Opuntia spp.				
Dominant species:	Tamarix ramosissima Ledeb.				
Habitat type:	Riparian				
Vegetation density:	Moderate	Average height of vegetation (m): 2			
Tamarisk estimate:	High				
Other info:	Water is in small pools and intermittent.				
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat				

Park Area/Canyon:	**Agate Canyon**			River mile:	100.6 L
Site/Polygon Name:	Agate 2			Project (Phase):	Phase IIb
	Start point	End point		Date:	4/26/2006
Easting	384602	384585			
Northing	4000144	3999816			
GPS accuracy (m)	6	6			
Surface water within 25m	☐	Surface water type:			
Soil moisture:	dry	Surface rocks:	granite	schist	
Associated species:	Acacia greggii Gray, Aristida spp., Bromus rubens L., Ephedra spp., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm., Stephanomeria exigua Nutt., Thymophylla pentachaeta (DC.) Small				
Dominant species:	Brickellia longifolia S. Wats.				
Habitat type:					
Vegetation density:	Moderate	Average height of vegetation (m): 1			
Tamarisk estimate:	High				
Other info:					
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat				

Park Area/Canyon:	**Agate Canyon**		River mile:	100.6 L
Site/Polygon Name:	Agate 3		Project (Phase):	Phase IIb
	Start point	End point	Date:	4/26/2006
Easting	384585	384367		
Northing	3999816	3999455		
GPS accuracy (m)	8	12		
Surface water within 25m ☐		Surface water type:		
Soil moisture:	dry	Surface rocks:	sandstone	schist
Associated species:				
Dominant species:				
Habitat type:	Riparian			
Vegetation density:	Moderate	Average height of vegetation (m): 1		
Tamarisk estimate:	None			
Other info:				
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**Agate Canyon**		River mile:	100.6 L
Site/Polygon Name:	Agate 4		Project (Phase):	Phase IIb
	Start point	End point	Date:	4/26/2006
Easting	384348	384039		
Northing	3999403	3999003		
GPS accuracy (m)	5	5		
Surface water within 25m ☐		Surface water type:		
Soil moisture:	dry	Surface rocks:	shale	
Associated species:	Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird, Purshia mexicana (D. Don) Henrickson, Rhus trilobata Nutt., Thamnosma montana Torr. & Frém.			
Dominant species:	Brickellia longifolia S. Wats., Cercis occidentalis Torr. ex Gray, Fallugia paradoxa (D. Don) Endl. ex Torr., Fraxinus anomala Torr. ex S. Wats., Gutierrezia sarothrae (Pursh) Britt. & Rusby			
Habitat type:	Riparian			
Vegetation density:	Low	Average height of vegetation (m): 0		
Tamarisk estimate:	Sparse			
Other info:	There is one small sapling in this section.			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**Agate Canyon**		River mile: 100.6 L
Site/Polygon Name:	Agate 5		Project (Phase): Phase IIb
	Start point	End point	Date: 4/26/2006
Easting	384039	383883	
Northing	3999003	3998606	
GPS accuracy (m)	5	7	
Surface water within 25m ☐		Surface water type:	
Soil moisture:	dry	Surface rocks: shale	
Associated species:	Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird, Purshia mexicana (D. Don) Henrickson, Rhus trilobata Nutt., Thamnosma montana Torr. & Frém.		
Dominant species:	Brickellia longifolia S. Wats., Fallugia paradoxa (D. Don) Endl. ex Torr., Fraxinus anomala Torr. ex S. Wats., Gutierrezia sarothrae (Pursh) Britt. & Rusby		
Habitat type:	Riparian		
Vegetation density:	Low	Average height of vegetation (m): 1	
Tamarisk estimate:			
Other info:	No water in this stretch.		
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat		

Park Area/Canyon:	**Agate Canyon**		River mile: 100.6 L
Site/Polygon Name:	Agate 6		Project (Phase): Phase IIb
	Start point	End point	Date: 4/26/2006
Easting	383883	383619	
Northing	3998606	3998218	
GPS accuracy (m)	7	9	
Surface water within 25m ☑		Surface water type: seep	
Soil moisture:	dry	Surface rocks: limestone	
Associated species:	Baccharis sergiloides Gray, Bernardia incana Morton, Ceanothus greggii Gray, Cercis occidentalis Torr. ex Gray, Hymenopappus filifolius Hook., Phlox austromontana Coville, Psilostrophe sparsiflora (Gray) A. Nels., Purshia mexicana (D. Don) Henrickson		
Dominant species:	Brickellia longifolia S. Wats., Cercocarpus intricatus S. Wats., Fraxinus anomala Torr. ex S. Wats., Ptelea trifoliata L., Rhus trilobata Nutt.		
Habitat type:	Riparian		
Vegetation density:	Low	Average height of vegetation (m): 3	
Tamarisk estimate:	Sparse		
Other info:	The seedlings were pulled! A phlox flower in this section had 7 petals.		
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat		

Park Area/Canyon:	**Agate Canyon**		River mile:	100.6 L
Site/Polygon Name:	Agate 7		Project (Phase):	Phase IIb
	Start point	End point	Date:	4/26/2006
Easting	383619	383368		
Northing	3998218	3997775		
GPS accuracy (m)	9	80		
Surface water within 25m	☑	Surface water type:	seep	
Soil moisture:	dry	Surface rocks:	limestone	
Associated species:	Ceanothus greggii Gray, Cercocarpus intricatus S. Wats., Fraxinus anomala Torr. ex S. Wats., Garrya wrightii Torr., Glossopetalon spinescens Gray var. aridum M.E. Jones, Nolina microcarpa S. Wats., Perityle congesta (M.E. Jones) Shinners, Petrophyton caespitosum (Nutt.) Rydb., Phlox austromontana Coville, Pinus edulis Engelm., Thamnosma montana Torr. & Frém.			
Dominant species:	Brickellia longifolia S. Wats., Ptelea trifoliata L., Rhus trilobata Nutt.			
Habitat type:	Riparian			
Vegetation density:	Moderate	Average height of vegetation (m): 4		
Tamarisk estimate:	None			
Other info:	There were 2 small potholes of water and 1 seepy wet area. These were the only water sources in this section.			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**Sapphire Canyon**		River mile:	101.2 L
Site/Polygon Name:	Sapphire 1		Project (Phase):	Phase IIb
	Start point	End point	Date:	4/27/2006
Easting	383543	383289		
Northing	4000351	4000176		
GPS accuracy (m)	11	18		
Surface water within 25m	☑	Surface water type:	stream	
Soil moisture:	dry	Surface rocks:	schist	
Associated species:	Baccharis salicifolia (Ruiz & Pavón) Pers., Bothriochloa saccharoides (Sw.) Rydb., Cercis occidentalis Torr. ex Gray, Encelia farinosa Gray ex Torr., Erigeron lobatus A. Nels., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Oenothera caespitosa Nutt., Typha spp.			
Dominant species:	Baccharis emoryi Gray, Brickellia longifolia S. Wats., Isocoma acradenia (Greene) Greene, Rhus trilobata Nutt., Tamarix ramosissima Ledeb.			
Habitat type:	Riparian			
Vegetation density:	Low	Average height of vegetation (m): 2		
Tamarisk estimate:	Low			
Other info:	Site starts at pour off in schist/granite narrows which can not be negotiated by any up and around route.			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**Sapphire Canyon**		River mile:	101.2 L
Site/Polygon Name:	Sapphire 2		Project (Phase):	Phase IIb
	Start point	End point	Date:	4/27/2006
Easting	383289	383048		
Northing	4000176	3999781		
GPS accuracy (m)	18	7		
Surface water within 25m	☑	Surface water type:	stream	
Soil moisture:	dry	Surface rocks:	sandstone	
Associated species:	Acacia greggii Gray, Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth, Bouteloua curtipendula (Michx.) Torr., Eriogonum inflatum Torr. & Frém., Funastrum cynanchoides (Dcne.) Schlechter, Gutierrezia sarothrae (Pursh) Britt. & Rusby			
Dominant species:	Aristida purpurea Nutt., Baccharis sergiloides Gray, Brickellia longifolia S. Wats., Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake, Oenothera caespitosa Nutt.			
Habitat type:	Riparian			
Vegetation density:	Low	Average height of vegetation (m): 1		
Tamarisk estimate:	None			
Other info:	Site runs through the dry Tapeats sandstone before the Tonto trail.			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**Sapphire Canyon**		River mile:	101.2 L
Site/Polygon Name:	Sapphire 3		Project (Phase):	Phase IIb
	Start point	End point	Date:	4/27/2006
Easting	383048	382811		
Northing	3999781	3999498		
GPS accuracy (m)	7	15		
Surface water within 25m	☑	Surface water type:	stream	
Soil moisture:	dry moist	Surface rocks:	sandstone shale	
Associated species:	Gutierrezia sarothrae (Pursh) Britt. & Rusby, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Nolina microcarpa S. Wats., Oenothera caespitosa Nutt., Populus fremontii S. Wats., Rhus trilobata Nutt.			
Dominant species:	Baccharis emoryi Gray, Cercis occidentalis Torr. ex Gray, Fallugia paradoxa (D. Don) Endl. ex Torr., Fraxinus anomala Torr. ex S. Wats., Purshia mexicana (D. Don) Henrickson, Tamarix ramosissima Ledeb.			
Habitat type:	Riparian			
Vegetation density:	Moderate	Average height of vegetation (m): 3		
Tamarisk estimate:	Sparse			
Other info:	This site begins at the Tonto crossing and winds 500m upstream where Bright Angel is exposed at the creek level.			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**Sapphire Canyon**		River mile: 101.2 L
Site/Polygon Name:	Sapphire 4		Project (Phase): Phase IIb
	Start point	End point	Date: 4/27/2006
Easting	382811	382500	
Northing	3999498	3999212	
GPS accuracy (m)	15	42	
Surface water within 25m ☐		Surface water type:	
Soil moisture:	dry	Surface rocks: shale	
Associated species:	Bromus rubens L., Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird, Gutierrezia sarothrae (Pursh) Britt. & Rusby, Oenothera caespitosa Nutt., Purshia mexicana (D. Don) Henrickson		
Dominant species:	Berberis spp, Brickellia longifolia S. Wats., Rhus trilobata Nutt.		
Habitat type:	Riparian		
Vegetation density:	Low	Average height of vegetation (m): 2	
Tamarisk estimate:			
Other info:	This site begins where Bright Angel shale is exposed and goes 500m up to a yellow Muav ledge on creek right.		
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat		

Park Area/Canyon:	**Sapphire Canyon**		River mile: 101.2 L
Site/Polygon Name:	Sapphire 5		Project (Phase): Phase IIb
	Start point	End point	Date: 4/27/2006
Easting	382811	382224	
Northing	3999212	3998888	
GPS accuracy (m)	42	28	
Surface water within 25m ☐		Surface water type:	
Soil moisture:	dry	Surface rocks: shale	
Associated species:	Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth, Berberis spp, Gutierrezia sarothrae (Pursh) Britt. & Rusby		
Dominant species:	Brickellia longifolia S. Wats., Ptelea trifoliata L., Purshia mexicana (D. Don) Henrickson, Rhus trilobata Nutt.		
Habitat type:	Riparian		
Vegetation density:	Low	Average height of vegetation (m): 1	
Tamarisk estimate:	None		
Other info:	This site goes to the top of the Bright Angel shale.		
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat		

Park Area/Canyon:	**Sapphire Canyon**		River mile: 101.2 L
Site/Polygon Name:	Sapphire 6		Project (Phase): Phase IIb
	Start point	End point	Date: 4/27/2006
Easting	382224	382042	
Northing	3998888	3998613	
GPS accuracy (m)	28	13	
Surface water within 25m ☐		Surface water type:	
Soil moisture:	dry	Surface rocks: limestone	
Associated species:	Amelanchier utahensis Koehne, Baccharis sergiloides Gray, Bromus rubens L., Cercis occidentalis Torr. ex Gray, Nolina microcarpa S. Wats., Porophyllum gracile Benth.		
Dominant species:	Berberis spp, Bernardia incana Morton, Brickellia longifolia S. Wats., Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Rhus trilobata Nutt.		
Habitat type:	Riparian		
Vegetation density:		Average height of vegetation (m): 1	
Tamarisk estimate:	None		
Other info:	This site begins at/near the start of muav and goes 500m upstream.		
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat		

Park Area/Canyon:	**Sapphire Canyon**		River mile: 101.2 L
Site/Polygon Name:	Sapphire 7		Project (Phase): Phase IIb
	Start point	End point	Date: 4/27/2006
Easting	382043	381888	
Northing	3998610	3998232	
GPS accuracy (m)	14	11	
Surface water within 25m ☐		Surface water type:	
Soil moisture:	dry moist	Surface rocks: shale	
Associated species:	Acacia greggii Gray, Agave utahensis Engelm. var. kaibabensis (McKelvey) Breitung, Artemisia ludoviciana Nutt., Astragalus spp., Baccharis sergiloides Gray, Cercis occidentalis Torr. ex Gray, Cleome lutea Hook., Cryptantha spp., Encelia frutescens (Gray) Gray, Nolina microcarpa S. Wats., Oenothera caespitosa Nutt., Penstemon eatonii Gray, Pinus edulis Engelm., Porophyllum gracile Benth., Stanleya pinnata (Pursh) Britt., Thymophylla pentachaeta (DC.) Small		
Dominant species:	Brickellia longifolia S. Wats.		
Habitat type:	Riparian		
Vegetation density:	Moderate	Average height of vegetation (m): 2	
Tamarisk estimate:	None		
Other info:			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat		

Park Area/Canyon:	**Sapphire Canyon**		River mile: 101.2 L
Site/Polygon Name:	Sapphire 8		Project (Phase): Phase IIb
	Start point	End point	Date: 4/27/2006
Easting	381888	381629	
Northing	3998232	3997855	
GPS accuracy (m)	11		
Surface water within 25m	☑	Surface water type:	spring
Soil moisture:	standing water	Surface rocks:	limestone

Associated species: Agave utahensis Engelm. var. kaibabensis (McKelvey) Breitung, Arctostaphylos Adans., Artemisia ludoviciana Nutt., Baccharis emoryi Gray, Baccharis salicifolia (Ruiz & Pavón) Pers., Baccharis sergiloides Gray, Berberis harrisoniana Kearney & Peebles, Berberis spp, Brickellia atractyloides Gray, Bromus rubens L., Cercis occidentalis Torr. ex Gray, Cladium californicum (S. Wats.) O'Neill, Cryptantha spp., Delphinium parishii Gray, Erigeron lobatus A. Nels., Galium stellatum Kellogg, Gutierrezia sarothrae (Pursh) Britt. & Rusby, Hedeoma spp., Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Nicotiana obtusifolia Mertens & Galeotti, Nolina microcarpa S. Wats., Oenothera caespitosa Nutt., Opuntia spp., Penstemon eatonii Gray, Perityle congesta (M.E. Jones) Shinners, Phlox austromontana Coville, Pleurocoronis pluriseta (Gray) King & H.E. Robins., Pluchea sericea (Nutt.) Coville, Poa spp., Psilostrophe sparsiflora (Gray) A. Nels., Ptelea trifoliata L., Purshia mexicana (D. Don) Henrickson, Rhus trilobata Nutt., Salix exigua Nutt., Salix gooddingii Ball, Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb., Thymophylla pentachaeta (DC.) Small

Dominant species: Adiantum capillus-veneris L., Baccharis sergiloides Gray, Brickellia longifolia S. Wats., Fraxinus anomala Torr. ex S. Wats., Garrya flavescens S. Wats., Typha spp.

Habitat type:	Riparian	Interior wetlands
Vegetation density:	High	Average height of vegetation (m): 3
Tamarisk estimate:	Low	

Other info: This section is very lush with little tamarisk. Can get further up canyon here but crew ran out of time.

SWIFL determination: Not Suitable or Potential Southwestern Willow Flycatcher Habitat

Park Area/Canyon:	**Turquoise Canyon**			River mile:	102 L
Site/Polygon Name:	Turquoise 1			Project (Phase):	Phase IIb
	Start point	End point		Date:	3/27/2008
Easting	381491	381426			
Northing	4000913	4000923			
GPS accuracy (m)	20	80			
Surface water within 25m	☑	Surface water type:	stream		
Soil moisture:	moist	Surface rocks:	granite	schist	
Associated species:					
Dominant species:	Acacia greggii Gray, Cercis orbiculata Greene, Salix gooddingii Ball, Tamarix ramosissima Ledeb.				
Habitat type:	Riparian				
Vegetation density:	Moderate	Average height of vegetation (m): 2			
Tamarisk estimate:	Moderate				
Other info:					
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat				

Park Area/Canyon:	**Turquoise Canyon**			River mile:	102 L
Site/Polygon Name:	Turquoise 2			Project (Phase):	Phase IIb
	Start point	End point		Date:	3/28/2008
Easting	381426	381281			
Northing	4000923	4000876			
GPS accuracy (m)	80	100			
Surface water within 25m	☑	Surface water type:	stream		
Soil moisture:	moist	Surface rocks:	granite	schist	
Associated species:	Salix gooddingii Ball, Tamarix ramosissima Ledeb.				
Dominant species:	Acacia greggii Gray, Cercis orbiculata Greene, Salix gooddingii Ball				
Habitat type:	Riparian				
Vegetation density:	Moderate	Average height of vegetation (m): 3			
Tamarisk estimate:	Moderate				
Other info:					
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat				

Park Area/Canyon:	**Ruby Canyon**			River mile:	104.5 L
Site/Polygon Name:	Ruby Canyon 7			Project (Phase):	Phase IIb
	Start point	End point		Date:	3/23/2007
Easting	379998	379808			
Northing	4004438	4004015			
GPS accuracy (m)		2.8			
Surface water within 25m	☑	Surface water type:	stream	spring	
Soil moisture:	moist	Surface rocks:	sandstone		
Associated species:	Cercis orbiculata Greene, Fraxinus anomala Torr. ex S. Wats., Nolina microcarpa S. Wats., Quercus turbinella Greene, Yucca baccata Torr.				
Dominant species:	Acacia greggii Gray, Fallugia paradoxa (D. Don) Endl. ex Torr., Tamarix ramosissima Ledeb.				
Habitat type:	Riparian				
Vegetation density:	Low	Average height of vegetation (m): 2			
Tamarisk estimate:	Low				
Other info:					
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat				

Park Area/Canyon:	**Above Serpentine**			River mile:	105.8 L
Site/Polygon Name:	Above Serpentine 1			Project (Phase):	Phase IIb
	Start point	End point		Date:	3/24/2007
Easting	379320	379350			
Northing	4006360	4006470			
GPS accuracy (m)	10	10			
Surface water within 25m	☑	Surface water type:	seep		
Soil moisture:	dry	Surface rocks:	shale		
Associated species:	Yucca baccata Torr.				
Dominant species:	Acacia greggii Gray, Encelia farinosa Gray ex Torr.				
Habitat type:	Riparian				
Vegetation density:	Low	Average height of vegetation (m): 1			
Tamarisk estimate:	Low				
Other info:					
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat				

Park Area/Canyon:	**White Creek**		River mile:	108 R
Site/Polygon Name:	White Creek 6		Project (Phase):	Phase IIb
	Start point	End point	Date:	9/22/2006
Easting	380917	380699		
Northing	4015313	4015414		
GPS accuracy (m)	32	6		
Surface water within 25m	☑	Surface water type:	pothole	
Soil moisture:	dry	Surface rocks:	sandstone	
Associated species:	Fraxinus anomala Torr. ex S. Wats., Nolina microcarpa S. Wats., Rhus trilobata Nutt., Thamnosma montana Torr. & Frém.			
Dominant species:	Acacia greggii Gray, Gutierrezia sarothrae (Pursh) Britt. & Rusby, Isocoma acradenia (Greene) Greene			
Habitat type:	Riparian			
Vegetation density:	Low	Average height of vegetation (m): 2		
Tamarisk estimate:	Low			
Other info:				
SWIFL determination:	Not Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**122 Mile Canyon L**		River mile:	122.3 L
Site/Polygon Name:	122 Mile 1		Project (Phase):	Phase IIb
	Start point	End point	Date:	5/9/2006
Easting	365280	365252		
Northing	4011932	4011477		
GPS accuracy (m)	10	10		
Surface water within 25m	☑	Surface water type:	stream	
Soil moisture:	dry	Surface rocks:	limestone	
Associated species:	Acacia greggii Gray, Ephedra viridis Coville, Porophyllum gracile Benth.			
Dominant species:	Isocoma acradenia (Greene) Greene			
Habitat type:	Riparian			
Vegetation density:	Low	Average height of vegetation (m): 1		
Tamarisk estimate:	Moderate			
Other info:				
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**140 Mile Canyon**			River mile: 140 L
Site/Polygon Name:	140 Mile 1			Project (Phase): Phase IIb
	Start point	End point		Date: 5/10/2006
Easting	359410	359333		
Northing	4029266	4028870		
GPS accuracy (m)	7	13		
Surface water within 25m	☑	Surface water type:	seep	
Soil moisture:	dry	Surface rocks:	shale	
Associated species:	Adiantum capillus-veneris L., Agrostis stolonifera L., Andropogon glomeratus (Walt.) B.S.P., Artemisia ludoviciana Nutt., Baccharis salicifolia (Ruiz & Pavón) Pers., Bernardia incana Morton, Brickellia longifolia S. Wats., Cladium californicum (S. Wats.) O'Neill, Epipactis gigantea Dougl. ex Hook., Parietaria hespera Hinton, Polypogon monspeliensis (L.) Desf., Typha latifolia L.			
Dominant species:	Acacia greggii Gray			
Habitat type:	GB desert scrub			
Vegetation density:	Low	Average height of vegetation (m): 2.5		
Tamarisk estimate:	Low			
Other info:	There are 2 large waterfalls at the upper end of this section.			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**140 Mile Canyon**			River mile: 140 L
Site/Polygon Name:	140 Mile 2			Project (Phase): Phase IIb
	Start point	End point		Date: 5/10/2006
Easting	359333	359517		
Northing	4028870	4028274		
GPS accuracy (m)	13	10		
Surface water within 25m	☐	Surface water type:		
Soil moisture:	dry	Surface rocks:	limestone	
Associated species:	Acacia greggii Gray, Acourtia wrightii (Gray) Reveal & King, Bromus rubens L., Cercis occidentalis Torr. ex Gray, Datura wrightii Regel, Rhus trilobata Nutt.			
Dominant species:	Brickellia longifolia S. Wats.			
Habitat type:	GB desert scrub			
Vegetation density:	Low	Average height of vegetation (m): 2		
Tamarisk estimate:	None			
Other info:				
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**140 Mile Canyon**		River mile:	140 L
Site/Polygon Name:	140 Mile 3		Project (Phase):	Phase IIb
	Start point	End point	Date:	5/10/2006
Easting	359517	360090		
Northing	4028274	4027761		
GPS accuracy (m)	10	13		
Surface water within 25m ☐		Surface water type:		
Soil moisture:	dry	Surface rocks:	limestone	
Associated species:	Acourtia wrightii (Gray) Reveal & King, Artemisia ludoviciana Nutt., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Rhus trilobata Nutt.			
Dominant species:	Acacia greggii Gray, Brickellia longifolia S. Wats.			
Habitat type:	GB desert scrub			
Vegetation density:	Low	Average height of vegetation (m): 2		
Tamarisk estimate:	None			
Other info:				
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**140 Mile Canyon**		River mile:	140 L
Site/Polygon Name:	140 Mile West Fork		Project (Phase):	Phase IIb
	Start point	End point	Date:	5/10/2006
Easting	359507	359308		
Northing	4028427	4027913		
GPS accuracy (m)	10	7		
Surface water within 25m ☐		Surface water type:		
Soil moisture:	dry	Surface rocks:	limestone	
Associated species:	Bromus spp., Opuntia spp.			
Dominant species:	Acacia greggii Gray, Baccharis spp.			
Habitat type:	GB desert scrub			
Vegetation density:	Low	Average height of vegetation (m): 2		
Tamarisk estimate:	None			
Other info:				
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**148.5 Mile Spring**		River mile:	148.5 R
Site/Polygon Name:	148.5 Mile Spring 1		Project (Phase):	Phase IIb
	Start point	End point	Date:	2/24/2007
Easting	330077	0		
Northing	4023620	0		
GPS accuracy (m)	10			
Surface water within 25m	☑	Surface water type:	spring	
Soil moisture:	moist	Surface rocks:	limestone	
Associated species:	Aquilegia L., Cercis orbiculata Greene, Imperata brevifolia Vasey			
Dominant species:	Adiantum capillus-veneris L., Baccharis spp., Equisetum ×ferrissii Clute (pro sp.), Nolina microcarpa S. Wats.			
Habitat type:	Riparian			
Vegetation density:	Moderate	Average height of vegetation (m): 2		
Tamarisk estimate:	Low			
Other info:	This is a beautiful spring in the corridor.			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**151 Mile Spring**		River mile:	151.2 R
Site/Polygon Name:	151 Mile Spring		Project (Phase):	Phase IIb
	Start point	End point	Date:	2/25/2007
Easting	345931	345916		
Northing	4024040	4023994		
GPS accuracy (m)	29			
Surface water within 25m	☑	Surface water type:	seep	river
Soil moisture:	moist	Surface rocks:	limestone	
Associated species:	Acacia greggii Gray, Alhagi maurorum Medik., Andropogon glomeratus (Walt.) B.S.P., Aristida purpurea Nutt., Baccharis emoryi Gray, Baccharis salicifolia (Ruiz & Pavón) Pers., Bothriochloa barbinodis (Lag.) Herter, Brickellia longifolia S. Wats., Camissonia walkeri (A. Nels.) Raven, Cynodon dactylon (L.) Pers., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Lobelia cardinalis L., Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Oenothera elata Kunth, Porophyllum gracile Benth., Schizachyrium scoparium (Michx.) Nash, Stephanomeria pauciflora (Torr.) A. Nels.			
Dominant species:	Acacia greggii Gray, Adiantum capillus-veneris L., Baccharis sergiloides Gray, Cladium californicum (S. Wats.) O'Neill, Flaveria macdougalii Theroux, Pinkava & Keil			
Habitat type:	Riparian			
Vegetation density:	Moderate	Average height of vegetation (m): 1		
Tamarisk estimate:	Sparse			
Other info:	McDougal's flaveria patch on the site.			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**National Canyon**		River mile:	166.3 L
Site/Polygon Name:	National - 3rd E fork		Project (Phase):	Phase IIb
	Start point	End point	Date:	5/12/2006
Easting	331560	0		
Northing	4011081	0		
GPS accuracy (m)	6.5			
Surface water within 25m	☑	Surface water type:	spring	
Soil moisture:	moist	Surface rocks:	limestone	
Associated species:	Andropogon glomeratus (Walt.) B.S.P., Baccharis salicifolia (Ruiz & Pavón) Pers., Bromus rubens L., Frangula betulifolia (Greene) V. Grub., Salix exigua Nutt., Typha domingensis Pers.			
Dominant species:	Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Tamarix ramosissima Ledeb.			
Habitat type:	Riparian			
Vegetation density:	Moderate	Average height of vegetation (m): 3		
Tamarisk estimate:	High			
Other info:	GPS unavailable at the endpoint.			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**National Canyon**		River mile:	166.3 L
Site/Polygon Name:	National 1		Project (Phase):	Phase IIb
	Start point	End point	Date:	5/12/2006
Easting	330188	0		
Northing	4013824	0		
GPS accuracy (m)	43			
Surface water within 25m	☑	Surface water type:	stream	
Soil moisture:	dry	Surface rocks:	limestone	
Associated species:	Brickellia longifolia S. Wats., Bromus rubens L., Camissonia multijuga (S. Wats.) Raven, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Salix gooddingii Ball, Sonchus asper (L.) Hill, Tamarix ramosissima Ledeb., Typha domingensis Pers.			
Dominant species:	Acacia greggii Gray, Baccharis salicifolia (Ruiz & Pavón) Pers.			
Habitat type:	Riparian		Mojave desert scrub	
Vegetation density:	Sparse	Average height of vegetation (m): 0		
Tamarisk estimate:	High			
Other info:				
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**National Canyon**		River mile: 166.3 L
Site/Polygon Name:	National 2		Project (Phase): Phase IIb
	Start point	End point	Date: 5/12/2006
Easting	331067	331567	
Northing	4013851	4013455	
GPS accuracy (m)	9.6	11	
Surface water within 25m	☑	Surface water type:	spring
Soil moisture:	moist	Surface rocks:	limestone
Associated species:	Acacia greggii Gray, Brickellia longifolia S. Wats., Bromus rubens L., Camissonia multijuga (S. Wats.) Raven, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Salix gooddingii Ball, Sonchus asper (L.) Hill, Typha domingensis Pers.		
Dominant species:	Baccharis salicifolia (Ruiz & Pavón) Pers., Tamarix ramosissima Ledeb.		
Habitat type:	Riparian		
Vegetation density:	Low	Average height of vegetation (m): 2	
Tamarisk estimate:	High		
Other info:			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat		

Park Area/Canyon:	**National Canyon**		River mile: 166.3 L
Site/Polygon Name:	National 3		Project (Phase): Phase IIb
	Start point	End point	Date: 5/12/2006
Easting	331567	331609	
Northing	4013455	4012915	
GPS accuracy (m)	11	24	
Surface water within 25m	☑	Surface water type:	spring
Soil moisture:	moist	Surface rocks:	limestone
Associated species:	Acacia greggii Gray, Baccharis sarothroides Gray, Centaurium arizonicum, Datura wrightii Regel, Lycium spp., Nolina microcarpa S. Wats., Parietaria hespera Hinton, Populus fremontii S. Wats., Salix gooddingii Ball, Typha domingensis Pers., Ziziphus obtusifolia (Hook. ex Torr. & Gray) Gray var. obtusifolia		
Dominant species:	Baccharis salicifolia (Ruiz & Pavón) Pers., Tamarix ramosissima Ledeb.		
Habitat type:	Riparian		
Vegetation density:	Moderate	Average height of vegetation (m): 2.5	
Tamarisk estimate:	High		
Other info:	The endpoint of this section is just below the first major fork.		
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat		

Park Area/Canyon:	**Mohawk Canyon**		River mile: 171.6 L
Site/Polygon Name:	Mohawk 1		Project (Phase): Phase IIb
	Start point	End point	Date: 5/13/2006
Easting	323440	323390	
Northing	4011310	4010930	
GPS accuracy (m)			
Surface water within 25m ☐		Surface water type:	
Soil moisture:	dry	Surface rocks:	limestone
Associated species:	Camissonia walkeri (A. Nels.) Raven, Isocoma acradenia (Greene) Greene, Nolina microcarpa S. Wats.		
Dominant species:	Acacia greggii Gray, Baccharis sarothroides Gray, Brickellia longifolia S. Wats.		
Habitat type:	Mojave desert scrub		
Vegetation density:	Low	Average height of vegetation (m): 3	
Tamarisk estimate:	None		
Other info:			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat		

Park Area/Canyon:	**Mohawk Canyon**		River mile: 171.6 L
Site/Polygon Name:	Mohawk 5		Project (Phase): Phase IIb
	Start point	End point	Date: 5/13/2006
Easting	323000	322850	
Northing	4009500	4006120	
GPS accuracy (m)			
Surface water within 25m ☑		Surface water type:	seep
Soil moisture:	dry	Surface rocks:	limestone
Associated species:	Baccharis salicifolia (Ruiz & Pavón) Pers., Camissonia walkeri (A. Nels.) Raven, Datura wrightii Regel, Funastrum cynanchoides (Dcne.) Schlechter, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Parietaria hespera Hinton, Stanleya pinnata (Pursh) Britt., Tamarix ramosissima Ledeb.		
Dominant species:	Acacia greggii Gray, Brickellia longifolia S. Wats., Cercis occidentalis Torr. ex Gray		
Habitat type:	Mojave desert scrub		
Vegetation density:	Low	Average height of vegetation (m): 2	
Tamarisk estimate:	Low		
Other info:			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat		

Park Area/Canyon:	**Honga Spring**		River mile: 177.2 L
Site/Polygon Name:	Honga 1		Project (Phase): Phase IIb
	Start point	End point	Date: 5/14/2006
Easting	315742	316086	
Northing	4009367	4009160	
GPS accuracy (m)	11	13	
Surface water within 25m	☑	Surface water type: seep	
Soil moisture:	moist	Surface rocks: limestone	
Associated species:	Allionia incarnata L., Andropogon glomeratus (Walt.) B.S.P., Apocynum cannabinum L., Aquilegia chrysantha Gray, Atriplex canescens (Pursh) Nutt., Bromus rubens L., Camissonia walkeri (A. Nels.) Raven, Encelia farinosa Gray ex Torr., Eucnide urens (Parry ex Gray) Parry, Lycium pallidum Miers, Machaeranthera pinnatifida (Hook.) Shinners, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Nicotiana obtusifolia Mertens & Galeotti var. obtusifolia, Opuntia whipplei Engelm. & Bigelow, Petrophyton caespitosum (Nutt.) Rydb., Physalis hederifolia Gray, Stanleya pinnata (Pursh) Britt., Stephanomeria parryi Gray		
Dominant species:	Acacia greggii Gray, Brickellia longifolia S. Wats., Isocoma acradenia (Greene) Greene, Nolina microcarpa S. Wats., Salix exigua Nutt.		
Habitat type:	Riparian		
Vegetation density:	Moderate	Average height of vegetation (m): 2	
Tamarisk estimate:	Low		
Other info:	No flowing water. There were only 2 small pools at the base of 2 pour offs.		
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat		

Park Area/Canyon:	**Prospect Canyon**		River mile: 179.3 L
Site/Polygon Name:	Prospect 1		Project (Phase): Phase IIb
	Start point	End point	Date: 5/14/2006
Easting	312804	312946	
Northing	4007814	4007454	
GPS accuracy (m)	9	10.3	
Surface water within 25m	☐	Surface water type:	
Soil moisture:	dry	Surface rocks: basalt	
Associated species:	Eucnide urens (Parry ex Gray) Parry, Lepidium lasiocarpum Nutt. var. lasiocarpum, Penstemon palmeri Gray, Sporobolus contractus A.S. Hitchc.		
Dominant species:	Acacia greggii Gray, Brickellia longifolia S. Wats., Camissonia walkeri (A. Nels.) Raven		
Habitat type:	Mojave desert scrub		
Vegetation density:	Sparse	Average height of vegetation (m): 1	
Tamarisk estimate:	None		
Other info:			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat		

Park Area/Canyon:	**Prospect Canyon**			River mile: 179.3 L
Site/Polygon Name:	Prospect 2			Project (Phase): Phase IIb
	Start point	End point		Date: 5/14/2006
Easting	312946	313076		
Northing	4007454	4007005		
GPS accuracy (m)	10.3	9		
Surface water within 25m	☑	Surface water type:	seep	
Soil moisture:	dry	Surface rocks:	limestone	
Associated species:	Baccharis salicifolia (Ruiz & Pavón) Pers., Baccharis sarothroides Gray, Isocoma acradenia (Greene) Greene			
Dominant species:	Acacia greggii Gray, Brickellia longifolia S. Wats.			
Habitat type:	Riparian			
Vegetation density:	Low	Average height of vegetation (m): 2		
Tamarisk estimate:	High			
Other info:				
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**Whitmore Wash**			River mile: 188.1 R
Site/Polygon Name:	Whitmore 1			Project (Phase): Phase IIb
	Start point	End point		Date: 5/15/2006
Easting	301801	301349		
Northing	4002296	4002513		
GPS accuracy (m)	5	9		
Surface water within 25m	☐	Surface water type:		
Soil moisture:	dry	Surface rocks:	shale	
Associated species:	Malcolmia africana (L.) Ait. f.			
Dominant species:	Acacia greggii Gray, Ambrosia dumosa (Gray) Payne, Camissonia walkeri (A. Nels.) Raven, Encelia farinosa Gray ex Torr., Larrea tridentata (Sessé & Moc. ex DC.) Coville			
Habitat type:	Mojave desert scrub			
Vegetation density:	Sparse	Average height of vegetation (m): 2		
Tamarisk estimate:	None			
Other info:				
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**Whitmore Wash**			River mile:	188.1 R
Site/Polygon Name:	Whitmore 2			Project (Phase):	Phase IIb
	Start point	End point		Date:	5/15/2006
Easting	301349	301328			
Northing	4002515	4003054			
GPS accuracy (m)	9	8			
Surface water within 25m	☐	Surface water type:			
Soil moisture:	dry	Surface rocks:	shale		
Associated species:	Malcolmia africana (L.) Ait. f.				
Dominant species:	Acacia greggii Gray, Baccharis sarothroides Gray, Brickellia longifolia S. Wats., Camissonia walkeri (A. Nels.) Raven, Encelia farinosa Gray ex Torr.				
Habitat type:	Mojave desert scrub				
Vegetation density:	Low	Average height of vegetation (m): 2			
Tamarisk estimate:	None				
Other info:					
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat				

Park Area/Canyon:	**190 Mile Canyon**			River mile:	190.3 L
Site/Polygon Name:	190 Mile 1			Project (Phase):	Phase IIb
	Start point	End point		Date:	5/15/2006
Easting	301483	302262			
Northing	3998858	3998545			
GPS accuracy (m)	5.2	9			
Surface water within 25m	☑	Surface water type:	seep		
Soil moisture:	moist	Surface rocks:	sandstone	shale	
Associated species:	Aristida purpurea Nutt., Bebbia juncea (Benth.) Greene var. aspera Greene, Cryptantha spp., Encelia farinosa Gray ex Torr., Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake, Gutierrezia spp., Isocoma acradenia (Greene) Greene, Typha spp.				
Dominant species:	Baccharis sarothroides Gray, Camissonia walkeri (A. Nels.) Raven, Tamarix ramosissima Ledeb.				
Habitat type:	Riparian				
Vegetation density:	Moderate	Average height of vegetation (m): 2			
Tamarisk estimate:	High				
Other info:	There are patches of dense TAMRAM around the seep areas.				
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat				

Park Area/Canyon:	**Spring Canyon**			River mile:	204.9 R
Site/Polygon Name:	Spring 1			Project (Phase):	Phase IIb
	Start point	End point		Date:	5/16/2006
Easting	288040	287769			
Northing	3988638	3988570			
GPS accuracy (m)	4	4			
Surface water within 25m	☑	Surface water type:	spring		stream
Soil moisture:	moist	Surface rocks:	shale		
Associated species:	Baccharis emoryi Gray, Baccharis sarothroides Gray, Typha spp.				
Dominant species:	Acacia greggii Gray, Pluchea sericea (Nutt.) Coville, Tamarix ramosissima Ledeb.				
Habitat type:	Riparian				
Vegetation density:	High	Average height of vegetation (m): 4			
Tamarisk estimate:	High				
Other info:	SWIFL habitat could improve if TAMRAM were removed. Due to the narrow nature of the canyon above the delta, this canyon does not contain suitable or potential SWIFL habitat. This information is revised by GRCA Wildlife Biologist on 12/7/06 following further review of the photographs and on-site information.				
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat				

Park Area/Canyon:	**Granite Park Canyon**			River mile:	208.8 L
Site/Polygon Name:	Granite Park 1			Project (Phase):	Phase IIb
	Start point	End point		Date:	5/16/2006
Easting	291291	291612			
Northing	3982856	3982542			
GPS accuracy (m)	9	5			
Surface water within 25m	☑	Surface water type:	stream		
Soil moisture:	moist	Surface rocks:	limestone		
Associated species:	Aristida purpurea Nutt., Baccharis salicifolia (Ruiz & Pavón) Pers., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Oenothera caespitosa Nutt., Polypogon monspeliensis (L.) Desf., Populus fremontii S. Wats., Prosopis glandulosa Torr., Thymophylla pentachaeta (DC.) Small				
Dominant species:	Acacia greggii Gray, Baccharis sarothroides Gray, Bebbia juncea (Benth.) Greene var. aspera Greene, Isocoma acradenia (Greene) Greene, Larrea tridentata (Sessé & Moc. ex DC.) Coville				
Habitat type:	Riparian				
Vegetation density:	High	Average height of vegetation (m): 3			
Tamarisk estimate:	High				
Other info:	There is a thick TAMRAM thicket with little flowing water.				
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat				

Park Area/Canyon:	**Granite Park Canyon**		River mile:	208.8 L
Site/Polygon Name:	Granite Park 2		Project (Phase):	Phase IIb
	Start point	End point	Date:	5/16/2006
Easting	291612	291728		
Northing	3982542	3982165		
GPS accuracy (m)	5	4		
Surface water within 25m	☑	Surface water type:	stream	
Soil moisture:	moist	Surface rocks:	limestone	
Associated species:	Bebbia juncea (Benth.) Greene var. aspera Greene, Pluchea sericea (Nutt.) Coville, Polypogon monspeliensis (L.) Desf., Porophyllum gracile Benth., Sonchus asper (L.) Hill			
Dominant species:	Baccharis sarothroides Gray, Bebbia juncea (Benth.) Greene var. aspera Greene, Isocoma acradenia (Greene) Greene, Larrea tridentata (Sessé & Moc. ex DC.) Coville			
Habitat type:	Riparian			
Vegetation density:	Moderate	Average height of vegetation (m): 2		
Tamarisk estimate:	Moderate			
Other info:	There is dense tall vegetation with a small amount of water. This stretch is only 40 meters long and above this stretch is dry.			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**Granite Park Canyon**		River mile:	208.8 L
Site/Polygon Name:	Granite Park 3		Project (Phase):	Phase IIb
	Start point	End point	Date:	5/16/2006
Easting	291728	0		
Northing	3982165	0		
GPS accuracy (m)	4			
Surface water within 25m	☐	Surface water type:		
Soil moisture:	dry	Surface rocks:	limestone	
Associated species:	Bromus rubens L., Camissonia walkeri (A. Nels.) Raven, Datura wrightii Regel, Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake, Heliomeris multiflora Nutt., Larrea tridentata (Sessé & Moc. ex DC.) Coville			
Dominant species:	Acacia greggii Gray, Brickellia longifolia S. Wats., Encelia farinosa Gray ex Torr., Eucnide urens (Parry ex Gray) Parry			
Habitat type:	Mojave desert scrub			
Vegetation density:	Sparse	Average height of vegetation (m): 1		
Tamarisk estimate:	None			
Other info:	Dry desert wash for the 3 miles surveyed. No GPS signal at the end point.			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**Three Springs Canyon**			River mile: 215.6 L
Site/Polygon Name:	Three Springs 1			Project (Phase): Phase IIb
	Start point	End point		Date: 5/17/2006
Easting	291613	391960		
Northing	3973737	3973706		
GPS accuracy (m)	10	12		
Surface water within 25m	☑	Surface water type:	stream	
Soil moisture:	dry	Surface rocks:	sandstone	
Associated species:	Mimulus cardinalis Dougl. ex Benth.			
Dominant species:	Acacia greggii Gray, Baccharis spp., Brickellia longifolia S. Wats., Phragmites australis (Cav.) Trin. ex Steud., Prosopis glandulosa Torr.			
Habitat type:	Riparian			
Vegetation density:	Moderate	Average height of vegetation (m): 0		
Tamarisk estimate:	High			
Other info:	Not suitable SWIFL habitat since the flash flood changed the water course and removed vegetation. Could be habitat with release of willows following TAMRAM removal.			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**Three Springs Canyon**			River mile: 215.6 L
Site/Polygon Name:	Three Springs 2			Project (Phase): Phase IIb
	Start point	End point		Date: 5/17/2006
Easting	391960	292307		
Northing	3973706	3973657		
GPS accuracy (m)	10	10		
Surface water within 25m	☑	Surface water type:	spring	
Soil moisture:	dry	Surface rocks:	shale	
Associated species:	Mimulus cardinalis Dougl. ex Benth.			
Dominant species:	Acacia greggii Gray, Baccharis spp., Brickellia longifolia S. Wats., Encelia farinosa Gray ex Torr., Larrea tridentata (Sessé & Moc. ex DC.) Coville, Prosopis glandulosa Torr.			
Habitat type:	Riparian			
Vegetation density:	Moderate	Average height of vegetation (m): 0		
Tamarisk estimate:	High			
Other info:	Could be SWIFL habitat with the release of willows after TAMRAM removal. Flash flood changed the water course and reduced the plant coverage.			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat			

Park Area/Canyon:	**Three Springs Canyon**			River mile:	215.6 L
Site/Polygon Name:	Three Springs 3			Project (Phase):	Phase IIb
	Start point	End point		Date:	5/17/2006
Easting	292307	293005			
Northing	3973657	3973763			
GPS accuracy (m)	10	39			
Surface water within 25m	☑	Surface water type:	spring		
Soil moisture:		Surface rocks:			
Associated species:	Mimulus cardinalis Dougl. ex Benth.				
Dominant species:	Acacia greggii Gray, Baccharis spp., Encelia farinosa Gray ex Torr., Prosopis glandulosa Torr.				
Habitat type:					
Vegetation density:	Moderate	Average height of vegetation (m): 0			
Tamarisk estimate:	High				
Other info:	Could be SWIFL habitat after TAMRAM removal and willows re-inhabit.				
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat				

Park Area/Canyon:	**217 Mile Canyon**			River mile:	217.4 L
Site/Polygon Name:	217 Mile 1			Project (Phase):	Phase IIb
	Start point	End point		Date:	5/18/2006
Easting	293090	293530			
Northing	3970204	3970042			
GPS accuracy (m)	4	11.1			
Surface water within 25m	☑	Surface water type:	seep		pothole
Soil moisture:	moist	Surface rocks:	schist		
Associated species:	Aristida arizonica Vasey, Brickellia longifolia S. Wats., Camissonia walkeri (A. Nels.) Raven, Encelia farinosa Gray ex Torr., Ferocactus cylindraceus (Engelm.) Orcutt var. cylindraceus, Galium stellatum Kellogg, Isocoma acradenia (Greene) Greene, Machaeranthera pinnatifida (Hook.) Shinners, Oenothera caespitosa Nutt., Porophyllum gracile Benth., Silene antirrhina L., Stephanomeria pauciflora (Torr.) A. Nels.				
Dominant species:	Acacia greggii Gray, Bebbia juncea (Benth.) Greene var. aspera Greene				
Habitat type:	Riparian		Mojave desert scrub		
Vegetation density:	Sparse	Average height of vegetation (m): 2			
Tamarisk estimate:	Moderate				
Other info:					
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat				

Park Area/Canyon:	**217 Mile Canyon**			River mile:	217.4 L
Site/Polygon Name:	217 Mile 2			Project (Phase):	Phase IIb
	Start point	End point		Date:	5/18/2006
Easting	293530	293867			
Northing	3970042	3970056			
GPS accuracy (m)	11	8.7			
Surface water within 25m	☑	Surface water type:	seep	pothole	
Soil moisture:	moist	Surface rocks:	schist		
Associated species:	Bothriochloa barbinodis (Lag.) Herter, Eriogonum fasciculatum Benth. var. polifolium (Benth.) Torr. & Gray, Fouquieria splendens Engelm., Mirabilis multiflora (Torr.) Gray, Phacelia crenulata Torr. ex S. Wats., Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb., Typha domingensis Pers., Vulpia octoflora (Walt.) Rydb.				
Dominant species:	Acacia greggii Gray, Encelia farinosa Gray ex Torr.				
Habitat type:	Riparian		Mojave desert scrub		
Vegetation density:	Sparse	Average height of vegetation (m): 2			
Tamarisk estimate:	Moderate				
Other info:					
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat				

Park Area/Canyon:	**Granite Spring Canyon**			River mile:	220.4 L
Site/Polygon Name:	Granite Springs 4			Project (Phase):	Phase IIb
	Start point	End point		Date:	5/20/2006
Easting	291103	291280			
Northing	3966419	3965913			
GPS accuracy (m)	5	6			
Surface water within 25m	☑	Surface water type:	spring		
Soil moisture:	moist	Surface rocks:	granite		
Associated species:	Baccharis spp., Populus fremontii S. Wats.				
Dominant species:	Acacia greggii Gray, Tamarix ramosissima Ledeb.				
Habitat type:	Riparian				
Vegetation density:	Moderate	Average height of vegetation (m): 3			
Tamarisk estimate:	High				
Other info:					
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat				

Park Area/Canyon:	**Granite Spring Canyon**		River mile: 220.4 L
Site/Polygon Name:	Granite Springs 8		Project (Phase): Phase IIb
	Start point	End point	Date: 5/20/2006
Easting	391855	292076	
Northing	3964997	3964754	
GPS accuracy (m)	5	16	
Surface water within 25m	☑	Surface water type:	seep
Soil moisture:	moist	Surface rocks:	granite
Associated species:	Baccharis spp., Populus fremontii S. Wats.		
Dominant species:	Acacia greggii Gray, Tamarix ramosissima Ledeb.		
Habitat type:	Riparian		
Vegetation density:	Moderate	Average height of vegetation (m): 2.5	
Tamarisk estimate:	High		
Other info:			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat		

Park Area/Canyon:	**221 Mile Spring**		River mile: 221 L
Site/Polygon Name:	221 Mile Spring		Project (Phase): Phase IIb
	Start point	End point	Date: 5/20/2006
Easting	289488	289497	
Northing	3965982	3966157	
GPS accuracy (m)	5	4	
Surface water within 25m	☑	Surface water type:	spring
Soil moisture:	moist	Surface rocks:	schist
Associated species:	Acacia greggii Gray, Ferocactus cylindraceus (Engelm.) Orcutt var. cylindraceus, Fouquieria splendens Engelm., Krameria erecta Willd. ex J.A. Schultes, Larrea tridentata (Sessé & Moc. ex DC.) Coville, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Opuntia basilaris Engelm. & Bigelow, Phragmites australis (Cav.) Trin. ex Steud., Plantago ovata Forsk., Vulpia octoflora (Walt.) Rydb.		
Dominant species:	Encelia farinosa Gray ex Torr., Isocoma acradenia (Greene) Greene, Pluchea sericea (Nutt.) Coville, Prosopis glandulosa Torr.		
Habitat type:	Riparian		Mojave desert scrub
Vegetation density:	Low	Average height of vegetation (m): 2	
Tamarisk estimate:	Sparse		
Other info:	There is a vegetation patch around the spring that is about 80 square meters. <mostly contains phragmites with just 2 mature TAMRAM.		
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat		

Park Area/Canyon:	**221.5 Mile Creek**		River mile: 221.5 L
Site/Polygon Name:	221.5 Mile Creek 1		Project (Phase): Phase IIb
	Start point	End point	Date: 5/20/2006
Easting	289598	289726	
Northing	3965716	3965789	
GPS accuracy (m)	4	4	
Surface water within 25m	☑	Surface water type:	stream
Soil moisture:	moist	Surface rocks:	granite
Associated species:	Cladium californicum (S. Wats.) O'Neill, Ephedra spp., Ferocactus cylindraceus (Engelm.) Orcutt var. cylindraceus, Fouquieria splendens Engelm., Juncus spp., Mammillaria grahamii Engelm. var. grahamii, Sporobolus airoides (Torr.) Torr.		
Dominant species:	Acacia greggii Gray, Bebbia juncea (Benth.) Greene var. aspera Greene, Isocoma acradenia (Greene) Greene, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Pluchea sericea (Nutt.) Coville		
Habitat type:	Riparian		
Vegetation density:	Moderate	Average height of vegetation (m): 2	
Tamarisk estimate:	Sparse		
Other info:	The stream is steep and cascades for about 150m; dry above.		
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat		

Park Area/Canyon:	**222 Mile Canyon**		River mile:	222 L
Site/Polygon Name:	222 Mile 1		Project (Phase):	Phase IIb
	Start point	End point	Date:	5/20/2006
Easting	289288	289734		
Northing	3964858	3964956		
GPS accuracy (m)	4.6	5		
Surface water within 25m	☑	Surface water type:	spring	
Soil moisture:	dry moist	Surface rocks:	schist	

Associated species: Aristida arizonica Vasey, Baccharis sarothroides Gray, Bromus rubens L., Cryptantha spp., Dasyochloa pulchella (Kunth) Willd. ex Rydb., Encelia farinosa Gray ex Torr., Ferocactus cylindraceus (Engelm.) Orcutt var. cylindraceus, Larrea tridentata (Sessé & Moc. ex DC.) Coville, Mammillaria grahamii Engelm. var. grahamii, Mirabilis multiflora (Torr.) Gray, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Nicotiana obtusifolia Mertens & Galeotti var. obtusifolia, Opuntia basilaris Engelm. & Bigelow, Opuntia phaeacantha Engelm., Perityle emoryi, Phacelia crenulata Torr. ex S. Wats., Physalis spp, Plantago ovata Forsk., Pluchea sericea (Nutt.) Coville, Polypogon monspeliensis (L.) Desf., Senna covesii (Gray) Irwin & Barneby, Silene antirrhina L., Tidestromia spp., Typha spp., Vulpia octoflora (Walt.) Rydb.

Dominant species: Acacia greggii Gray, Bebbia juncea (Benth.) Greene var. aspera Greene, Isocoma acradenia (Greene) Greene, Prosopis glandulosa Torr.

Habitat type:	Riparian		Mojave desert scrub
Vegetation density:	Low	Average height of vegetation (m):	1
Tamarisk estimate:	High		

Other info:

SWIFL determination: Not Suitable or Potential Southwestern Willow Flycatcher Habitat

Park Area/Canyon:	**222 Mile Canyon**		River mile: 222 L
Site/Polygon Name:	222 Mile 2		Project (Phase): Phase IIb
	Start point	End point	Date: 5/20/2006
Easting	289734	289856	
Northing	3964956	3964869	
GPS accuracy (m)	5	5	
Surface water within 25m	☑	Surface water type:	spring
Soil moisture:	moist	Surface rocks:	schist

Associated species: Aristida adscensionis L., Aristida arizonica Vasey, Baccharis salicifolia (Ruiz & Pavón) Pers., Baccharis sarothroides Gray, Bromus rubens L., Camissonia walkeri (A. Nels.) Raven, Cryptantha spp., Dasyochloa pulchella (Kunth) Willd. ex Rydb., Encelia farinosa Gray ex Torr., Ephedra spp., Ferocactus cylindraceus (Engelm.) Orcutt var. cylindraceus, Larrea tridentata (Sessé & Moc. ex DC.) Coville, Lycium spp., Machaeranthera pinnatifida (Hook.) Shinners, Mammillaria grahamii Engelm. var. grahamii, Mirabilis multiflora (Torr.) Gray, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Nicotiana obtusifolia Mertens & Galeotti var. obtusifolia, Opuntia basilaris Engelm. & Bigelow, Opuntia phaeacantha Engelm., Perityle emoryi, Phacelia crenulata Torr. ex S. Wats., Physalis spp, Plantago ovata Forsk., Pleurocoronis pluriseta (Gray) King & H.E. Robins., Pluchea sericea (Nutt.) Coville, Polypogon monspeliensis (L.) Desf., Porophyllum gracile Benth., Senna covesii (Gray) Irwin & Barneby, Silene antirrhina L., Sonchus asper (L.) Hill, Stylocline micropoides Gray, Tidestromia spp., Trixis californica Kellogg, Typha spp., Viguiera spp, Vulpia octoflora (Walt.) Rydb.

Dominant species: Acacia greggii Gray, Bebbia juncea (Benth.) Greene var. aspera Greene, Isocoma acradenia (Greene) Greene, Prosopis glandulosa Torr.

Habitat type: Riparian Mojave desert scrub

Vegetation density: Low Average height of vegetation (m): 1

Tamarisk estimate: Low

Other info: There are a few areas with dense vegetation.

SWIFL determination: Not Suitable or Potential Southwestern Willow Flycatcher Habitat

Park Area/Canyon:	**224 Mile Canyon**		River mile: 223.6 L
Site/Polygon Name:	224 Mile 1		Project (Phase): Phase IIb
	Start point	End point	Date: 5/20/2006
Easting	288075	288733	
Northing	3962622	3961881	
GPS accuracy (m)	8	18	
Surface water within 25m	☑	Surface water type:	stream
Soil moisture:	moist	Surface rocks:	sandstone
Associated species:	Aristida adscensionis L., Bromus rubens L., Cryptantha spp., Eucnide urens (Parry ex Gray) Parry, Ferocactus cylindraceus (Engelm.) Orcutt var. cylindraceus, Fouquieria splendens Engelm., Isocoma acradenia (Greene) Greene, Krameria erecta Willd. ex J.A. Schultes, Larrea tridentata (Sessé & Moc. ex DC.) Coville, Opuntia phaeacantha Engelm., Perityle emoryi, Plantago ovata Forsk., Polygala macradenia Gray, Porophyllum gracile Benth., Senna covesii (Gray) Irwin & Barneby, Silene antirrhina L., Sonchus asper (L.) Hill, Sporobolus cryptandrus (Torr.) Gray, Tidestromia spp., Typha spp., Vulpia octoflora (Walt.) Rydb.		
Dominant species:	Acacia greggii Gray, Bebbia juncea (Benth.) Greene var. aspera Greene, Encelia farinosa Gray ex Torr.		
Habitat type:	Riparian		
Vegetation density:	Sparse	Average height of vegetation (m): 1	
Tamarisk estimate:	Sparse		
Other info:			
SWIFL determination:	Not Suitable or Potential Southwestern Willow Flycatcher Habitat		

Appendix D - Hydrology Data

Date of Survey: 5/10/2006 Time Measurements Began: 12:55 Observer: FH Frank Hays

Canyon Name: 140 Mile Canyon Site/Polygon Name: 140 L Hydro 1

Project: Phase IIb

Measurement Location Details: At the top of the larger pool the seeps flow in a single channel for about 1.5m between an upper pool (1.5mx2.3m) and a short pourover about 1 meter into a larger pool (4mx10m).

UTM Easting: 359410 UTM Northing: 4029266 GPS Accuracy (m): 7

Type of Water Feature: stream Light Exposure: open

Elevation (m): 577 Slope (degrees): 40

Soil Type: Aspect: 296

Weather: clear, light wind

Weather over previous 3 days: partly cloudy, gusty winds, warm days, and cool nights

Current Temperature Air: 31 C Water: 25 C

Description of Water Source: Series of seeps coming out of Tapeats sandstones combine into one channel that connects the pools described above. A 1.5m long channel flows to pourover into larger pool.

Water Quality Measurements

Last Calibration--------> Date: 5/10/2006 **Time:** 13:45

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	26.3	26	25.9	26.1
pH	8.22	8.22	8.22	8.2
EC (mS)	852	846	850	849.3
TDS (ppm)	425	419	423	422.3

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 148.71

Additional Comments/Information:

Date of Survey: 5/14/2007 Time Measurements Began: 10:20 Observer: SJ Sam Jones

Canyon Name: 140 Mile Canyon Site/Polygon Name: 140 L Hydro 1

Project: Phase IIb

Measurement Location Details:

UTM Easting: 359410 UTM Northing: 4029266 GPS Accuracy (m): 7

Type of Water Feature: stream Light Exposure: open

Elevation (m): 577 Slope (degrees): 40

Soil Type: Aspect: 296

Weather: Hot, clear and sunny

Weather over previous 3 days: Hot clear and sunny

Current Temperature Air: 28 C Water: 23 C

Description of Water Source:

Water Quality Measurements

Last Calibration--------> Date: 5/14/2007 **Time:** 8:00

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	22.6	22.6	22.8	22.7
pH	7.8	8.23	8.24	8.1
EC (mS)	964	960	962	962.0
TDS (ppm)	483	480	480	481.0

Water Quantity Measurements

Discharge Type:

Average Discharge (m3/sec):

Additional Comments/Information:

Date of Survey: 4/26/2006 Time Measurements Began: 12:15 Observer: KW Kelly Williams

Canyon Name: Agate Canyon Site/Polygon Name: Agate Hydro 1

Project: Phase IIb

Measurement Location Details: Pool is directly up stream of overland route. There are waterfalls above and below the pool with about 7 mature TAMRAM within a 12m radius. There are 3 large boulders surrounding pool with schist bedrock sloping down a 1/2 mile upstream from pool.

UTM Easting: 384673 UTM Northing: 4000306 GPS Accuracy (m): 7

Type of Water Feature: stream Light Exposure: partial-shade

Elevation (m): 790 Slope (degrees): 4

Soil Type: sand Aspect: 12

Weather: clear skies, sunny, 85 degrees, no clouds visible, sun directly overhead.

Weather over previous 3 days: clear skies and sunny 80-95 degrees

Current Temperature Air: 30 C Water: 26 C

Description of Water Source: Pool is 2 ft x1 ft with 3 boulders surrounding pool. TAMRAM directly over head, pool is about 2 inches deep. Schist/granite bedrock with vegetation beside the pool on stream right. Sandy bottom with catis fly aquatics living in source,

Water Quality Measurements

Last Calibration--------> Date: 4/26/2006 **Time:** 12:40

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	23.4	23.1	23	23.2
pH	7.68	7.54	7.53	7.6
EC (mS)	2426	2479	2499	2468.0
TDS (ppm)	1201	1214	1255	1223.3

Water Quantity Measurements

Discharge Type:

Average Discharge (m3/sec):

Additional Comments/Information:

Date of Survey: 4/26/2006 Time Measurements Began: 11:15 Observer: KW Kelly Williams

Canyon Name: Agate Canyon Site/Polygon Name: Agate Hydro 2

Project: Phase IIb

Measurement Location Details: Last pool before about a 70 ft fall at the beginning of section 1. Schist/granite bedrock. TAMRAM the predominant species, open, slow stream feeding the pool.

UTM Easting: 384811 UTM Northing: 4000563 GPS Accuracy (m): 9

Type of Water Feature: stream Light Exposure: partial-shade

Elevation (m): 747 Slope (degrees): 4

Soil Type: sand Aspect: 10

Weather: clear skies with sun-directly overhead, no clouds visible, 80-85 degrees.

Weather over previous 3 days: clear skies and sunny, 80-95 degrees.

Current Temperature Air: 30 C Water: 30 C

Description of Water Source: 3ft x 1ft pool about 1.7 inches deep with sandy, cobble bottom. Surrounded by granite and schist polished rock. Pool is fed by a stream, there are also tadpoles and catis fly in the pool.

Water Quality Measurements

Last Calibration--------> Date: 4/26/2006 **Time:** 11:45

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	19.3	19.1	19.5	19.3
pH	7.99	7.95	8.93	8.3
EC (mS)	2810	2872	2877	2853.0
TDS (ppm)	1438	1410	1451	1433.0

Water Quantity Measurements

Discharge Type:

Average Discharge (m3/sec):

Additional Comments/Information:

Date of Survey: 4/26/2006 Time Measurements Began: Observer: ST Steve Till

Canyon Name: Agate Canyon Site/Polygon Name: Agate Hydro 5

Project: Phase IIb

Measurement Location Details: Taken from small pool about 500m up from the Tonto Trail.

UTM Easting: 384039 UTM Northing: 3999003 GPS Accuracy (m): 5

Type of Water Feature: pothole Light Exposure: open

Elevation (m): 999 Slope (degrees):

Soil Type: Aspect:

Weather: sunny, 80s

Weather over previous 3 days: sunny, 80s

Current Temperature Air: C Water: C

Description of Water Source: Small pool in the Bright Angel. There is no flowing water up or downstream.

Water Quality Measurements

Last Calibration--------> Date: 4/26/2006 **Time:** 6:30

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)				
pH	8.73	8.73	8.74	8.7
EC (mS)	919	917	911	915.7
TDS (ppm)				

Water Quantity Measurements

Discharge Type:

Average Discharge (m3/sec):

Additional Comments/Information:

Date of Survey: 5/16/2006 Time Measurements Began: 11:10 Observer: FH Frank Hays

Canyon Name: Granite Park Canyon Site/Polygon Name: Granite Park Hydro 1

Project: Phase IIb

Measurement Location Details: Two very small algae ridden pools. There was no running water downstream or anywhere near upstream. At the 11.5m mark of Granite Park 1A.

UTM Easting: 291484 UTM Northing: 3982798 GPS Accuracy (m): 2.3

Type of Water Feature: pothole Light Exposure: open

Elevation (m): 463 Slope (degrees): 6

Soil Type: loamy sand Aspect: 320

Weather: Overcast, calm.

Weather over previous 3 days: Clear and bloody hot until clouds came in 24 hours ago.

Current Temperature Air: 32 C Water: 30 C

Description of Water Source: Two very small pools in bottom of Granite Canyon. No flowing water above or below.

Water Quality Measurements

Last Calibration--------> Date: 5/16/2006 **Time:** 7:00

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	25.8	25.7	25.8	25.8
pH	7.22	7.22	7.22	7.2
EC (mS)	1068	1072	1071	1070.3
TDS (ppm)	531	526	527	528.0

Water Quantity Measurements

Discharge Type:

Average Discharge (m3/sec):

Additional Comments/Information:

Date of Survey: 5/20/2007 Time Measurements Began: 8:30 Observer: DH Dan Hall

Canyon Name: Granite Park Canyon Site/Polygon Name: Granite Park Hydro 1

Project: Phase IIb

Measurement Location Details: No water. 240m downcanyon of transect. See previous description.

UTM Easting: 291484 UTM Northing: 3982798 GPS Accuracy (m): 2.3

Type of Water Feature: pothole Light Exposure: open

Elevation (m): 463 Slope (degrees): 6

Soil Type: loamy sand Aspect: 320

Weather: Hot and sunny

Weather over previous 3 days: clear, hot and sunny

Current Temperature Air: 27 C Water: C

Description of Water Source: None

Water Quality Measurements

Last Calibration--------->	**Date:**			**Time:**
Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)				
pH				
EC (mS)				
TDS (ppm)				

Water Quantity Measurements

Discharge Type:

Average Discharge (m3/sec):

Additional Comments/Information:

Date of Survey: 5/16/2006 Time Measurements Began: 14:30 Observer: FH Frank Hays

Canyon Name: Granite Park Canyon Site/Polygon Name: Granite Park Hydro 2

Project: Phase IIb

Measurement Location Details: Stretch of stream at 24m of T2A in Granite Park Canyon. This area is just west of Zoroaster granite outcrop on the west side of T2A transect.

UTM Easting: 291578 UTM Northing: 3982597 GPS Accuracy (m): 3.5

Type of Water Feature: stream Light Exposure: partial-shade

Elevation (m): 459 Slope (degrees): 10

Soil Type: loamy sand Aspect: 344

Weather: Blasted furnace type of heat, but with the promise of a thunderstorm in the distance.

Weather over previous 3 days: Hot, calm - 2 days clear, 1 day overcast/sprinkles.

Current Temperature Air: 30 C Water: 30 C

Description of Water Source: 1.5 meter stretch of stream at 24 m mark of T2A in Granite Park Canyon. Stream is very intermittent only flowing for approx. 50m in this area. Transect is in longest, open, straight stretch.

Water Quality Measurements

Last Calibration--------> Date: 5/16/2006 **Time:** 7:00

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	25.6	25.5	25.3	25.5
pH	7.57	7.62	7.61	7.6
EC (mS)	846	850	849	848.3
TDS (ppm)	422	424	425	423.7

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 2019.06

Additional Comments/Information:

Date of Survey: 5/20/2007 Time Measurements Began: 8:10 Observer: DH Dan Hall

Canyon Name: Granite Park Canyon Site/Polygon Name: Granite Park Hydro 2

Project: Phase IIb

Measurement Location Details: 24m mark of T2A in Granite Park Canyon

UTM Easting: 291578 UTM Northing: 3982597 GPS Accuracy (m): 3.5

Type of Water Feature: stream Light Exposure: partial-shade

Elevation (m): 459 Slope (degrees): 10

Soil Type: loamy sand Aspect: 344

Weather: Sunny and clear

Weather over previous 3 days: Sunny and clear, but with wind

Current Temperature Air: 23 C Water: 20 C

Description of Water Source: 1.5m stretch of stream at 24m mark of T2A in Granite Park Canyon. Stream very intermittent, only flowing about 50m in this area.

Water Quality Measurements

Last Calibration--------> Date: 5/20/2007 **Time:** 8:10

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	19.4	19.4	19.3	19.4
pH	7.4	7.5	7.64	7.5
EC (mS)	732	736	705	724.3
TDS (ppm)	368	366	368	367.3

Water Quantity Measurements

Discharge Type:

Average Discharge (m3/sec):

Additional Comments/Information: No volume taken due to only standing water. Abundant aquatic invertebrates and bees present. Numerous cattails in standing water. Numerous tamarisk seedliongs in the area. Area appears to have experienced a flash flood. Polypogon appears to have flashed out.

Date of Survey: 5/14/2006 Time Measurements Began: 10:10 Observer: FH Frank Hays

Canyon Name: Honga Spring Site/Polygon Name: Honga Hydro 1

Project: Phase IIb

Measurement Location Details: At foot of first seep pour over in Honga Canyon. A small pool used for quality sample.

UTM Easting: 315942 UTM Northing: 4009196 GPS Accuracy (m): 6.9

Type of Water Feature: seep Light Exposure: partial-shade

Elevation (m): 443 Slope (degrees): 0

Soil Type: sand Aspect: 310

Weather: clear, calm, warm

Weather over previous 3 days: clear, calm, and hot

Current Temperature Air: 23 C Water: 20 C

Description of Water Source: Small pool at the foot of first seep pourover (15m) tall in Honga Canyon. Pool is 1.4m long x 0.7m wide x 12 cm deep. For flow we captured about 1/4 of the seep in the container - measured the 2 strongest drips on canyon left side of the seep. Leaving 2 other continuous seep and multiple dripping seeps not ?????? Seep 1.61 about 2 minutes about 0.8 L/min.

Water Quality Measurements

Last Calibration--------> Date: 5/14/2006 **Time:** 7:00

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	19	18.6	18.3	18.6
pH	8.22	8.38	8.39	8.3
EC (mS)	1466	1447	1465	1459.3
TDS (ppm)	730	725	729	728.0

Water Quantity Measurements

Discharge Type: Container

Average Discharge (m3/sec): 0.00

Additional Comments/Information:

Date of Survey: 5/13/2006 Time Measurements Began: 8:30 Observer: FH Frank Hays

Canyon Name: Mohawk Canyon Site/Polygon Name: Mohawk Hydro 1

Project: Phase IIb

Measurement Location Details: About 1m downstream from Mohawk 1A transect, in the channel above a short (0.5m) pourover. The measurable channel is only 2m long as stream is too shallow above to use the float method.

UTM Easting: 323157 UTM Northing: 4010593 GPS Accuracy (m): 41

Type of Water Feature: stream Light Exposure: partial-shade

Elevation (m): 781 Slope (degrees): 10

Soil Type: sand Aspect: 320

Weather: Clear, calm, warm.

Weather over previous 3 days: Clear, calm, warm to hot, no precipitation.

Current Temperature Air: 24 C Water: 21 C

Description of Water Source: Stream running over cobble/gravel laden canyon floor.

Water Quality Measurements

Last Calibration--------> Date: 5/31/2006 **Time:** 7:15

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	21.2	21.2	21.2	21.2
pH	8.1	8.24	8.25	8.2
EC (mS)	1733	1737	1737	1735.7
TDS (ppm)	866	868	868	867.3

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 1483.69

Additional Comments/Information:

Date of Survey: 5/16/2007 Time Measurements Began: 12:55 Observer: DH Dan Hall

Canyon Name: Mohawk Canyon Site/Polygon Name: Mohawk Hydro 1

Project: Phase IIb

Measurement Location Details: About 1m down from Mohawk T1A transect, in the channel, 2m. Stream too shallow for float method

UTM Easting: 323157 UTM Northing: 4010593 GPS Accuracy (m): 41

Type of Water Feature: stream Light Exposure: partial-shade

Elevation (m): 781 Slope (degrees): 10

Soil Type: sand Aspect: 320

Weather: Clear and warm

Weather over previous 3 days: Clear and warm, no precipitation

Current Temperature Air: C Water: 30 C

Description of Water Source: Stream mumuring over cobble/gravel laden floor. See 2006 description

Water Quality Measurements

Last Calibration--------> Date: 5/16/2007 **Time:** 12:55

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	30.2	20.1	20.3	23.5
pH	7.91	9.97	7.99	8.6
EC (mS)	1864	1864	1862	1863.3
TDS (ppm)	933	928	930	930.3

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 4666.67

Additional Comments/Information: Invertebrate life forms, tadpoles, various flies. A few tamarisk seedlings, pulled. The stream was only .3m across so we made our own little table and measurements.

Date of Survey: 5/13/2006 Time Measurements Began: 10:25 Observer: FH Frank Hays

Canyon Name: Mohawk Canyon Site/Polygon Name: Mohawk Hydro 2

Project: Phase IIb

Measurement Location Details: This is about 5m below a small pourover (2m) and 15m upstream from the beginning of T1A transect. This is adjacent to an up tilted block of Muav limestone - 1m stretch flowing over sand chosen because of use of float method. Downstream was too shallow and upstream is small pourover.

UTM Easting: 323127 UTM Northing: 4010686 GPS Accuracy (m): 4.4

Type of Water Feature: stream Light Exposure: partial-shade

Elevation (m): 593 Slope (degrees): 10

Soil Type: Aspect: 48

Weather: clear, calm, warm

Weather over previous 3 days: clear, calm, warm

Current Temperature Air: 32 C Water: 20 C

Description of Water Source: Stream flowing over cobbles and gravel with a number of small pourovers. Area of measurement is a 1 meter stretch of stream flowing over a sandy bottom adjacent to a up tilted block of muav limestone.

Water Quality Measurements

Last Calibration--------> Date: 5/13/2006 **Time:** 7:15

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	22.4	22.4	22.4	22.4
pH	8.12	8.28	8.31	8.2
EC (mS)	1724	1726	1728	1726.0
TDS (ppm)	862	863	864	863.0

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 17.31

Additional Comments/Information:

Date of Survey: 5/16/2007 Time Measurements Began: 13:20 Observer: DH Dan Hall

Canyon Name: Mohawk Canyon Site/Polygon Name: Mohawk Hydro 2

Project: Phase IIb

Measurement Location Details: same as May 2006

UTM Easting: 323127 UTM Northing: 4010686 GPS Accuracy (m): 4.4

Type of Water Feature: stream Light Exposure: partial-shade

Elevation (m): 593 Slope (degrees): 10

Soil Type: Aspect: 48

Weather:

Weather over previous 3 days: Clear, warm, no precip

Current Temperature Air: 40 C Water: 26 C

Description of Water Source: same as May 2006

Water Quality Measurements

Last Calibration--------> Date: 5/16/2007 **Time:** 13:20

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	26.2	26.1	26	26.1
pH	7.64	7.69	7.72	7.7
EC (mS)	1800	1807	1714	1773.7
TDS (ppm)	907	906	904	905.7

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 4126.98

Additional Comments/Information: Tadpole, damselfly larvae, dragon fly, hummingbird, taods, miscellaneous hydro invertebrates, all very active.

Date of Survey: 5/13/2006 Time Measurements Began: 12:45 Observer: FH Frank Hays

Canyon Name: Mohawk Canyon Site/Polygon Name: Mohawk Hydro 3

Project: Phase IIb

Measurement Location Details: Hydro #3 is located about 50 meters upstream from T1B transect along 2m stretch of a muav limestone ledge a few meters downstream of bowl shaped cascade in muav limestone that pours into a small pool.

UTM Easting: 323055 UTM Northing: 4010622 GPS Accuracy (m): 5.5

Type of Water Feature: seep Light Exposure: open

Elevation (m): 563 Slope (degrees): 10

Soil Type: loamy sand Aspect: 247

Weather: clear, very warm, light breeze

Weather over previous 3 days: clear, mostly calm, warm

Current Temperature Air: 30 C Water: 30 C

Description of Water Source: Stream in the bottom of Mohawk Canyon running over cobbles, grave, and generally very shallow. It is about 1m wide with several cascades or pourovers and small pools along the route.

Water Quality Measurements

Last Calibration--------> Date: 5/13/2006 **Time:** 7:15

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	29.9	29.7	29.5	29.7
pH	8.48	8.55	8.55	8.5
EC (mS)	1699	1710	1716	1708.3
TDS (ppm)	850	854	858	854.0

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 7003.12

Additional Comments/Information:

Date of Survey: 5/16/2007 Time Measurements Began: 14:50 Observer: DH Dan Hall

Canyon Name: Mohawk Canyon Site/Polygon Name: Mohawk Hydro 3

Project: Phase IIb

Measurement Location Details: same as 2006

UTM Easting: 323055 UTM Northing: 4010622 GPS Accuracy (m): 5.5

Type of Water Feature: seep Light Exposure: open

Elevation (m): 563 Slope (degrees): 10

Soil Type: loamy sand Aspect: 247

Weather: Clear and calm

Weather over previous 3 days: clear and calm, no precipitation

Current Temperature Air: 40 C Water: 33 C

Description of Water Source: same as 2006

Water Quality Measurements

Last Calibration--------> Date: 5/16/2007 **Time:** 14:50

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	33.1	33.3	33.3	33.2
pH	7.94	8	8.05	8.0
EC (mS)	1807	1937	1831	1858.3
TDS (ppm)	913	909	913	911.7

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec):

Additional Comments/Information: Tadpole, abundant aquatic invertebrates, seedling tamarisk (a dozen pulled) baccharis, bermuda grass, brickellia, coyote willow. 200m downstream of spring in the cave, salts one copious, but do not taste like sodium chloride at all. Not enough flow to do float test.

Date of Survey: 5/13/2006 Time Measurements Began: 13:03 Observer: FH Frank Hays

Canyon Name: Mohawk Canyon Site/Polygon Name: Mohawk Hydro 4

Project: Phase IIb

Measurement Location Details: Mohawk Hydro 4 is located 20 meters downstream of T2A transect on a 1.5 meter stretch after 2 forks of the stream unite and run along the edge of a Bright Angel/Muav ledge. A 2m limestone block is opposite ledge and at the beginning of 1.5m transect.

UTM Easting: 323023 UTM Northing: 4010317 GPS Accuracy (m): 14

Type of Water Feature: seep Light Exposure: partial-shade

Elevation (m): Slope (degrees): 10

Soil Type: sand Aspect: 75

Weather: sunny, hot, calm

Weather over previous 3 days: very sunny, hot, few clouds

Current Temperature Air: 30 C Water: 30 C

Description of Water Source: Stream running between BA shale and muav limestone ledge (appears to be contact point between the 2 formations) and a 2m limestone boulder. Run is right along 1.5 m stretch of ledge.

Water Quality Measurements

Last Calibration--------> Date: 5/13/2006 **Time:** 7:15

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	26.2	25.8	25.8	25.9
pH	8.34	8.33	8.34	8.3
EC (mS)	1667	1667	1670	1668.0
TDS (ppm)	832	833	835	833.3

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 2126.74

Additional Comments/Information:

Date of Survey: 5/16/2007 Time Measurements Began: 14:00 Observer: DH Dan Hall

Canyon Name: Mohawk Canyon Site/Polygon Name: Mohawk Hydro 4

Project: Phase IIb

Measurement Location Details: same as 2006

UTM Easting: 323023 UTM Northing: 4010317 GPS Accuracy (m): 14

Type of Water Feature: seep Light Exposure: partial-shade

Elevation (m): Slope (degrees): 10

Soil Type: sand Aspect: 75

Weather: calm, clear, no precip
calm, clear, no precip

Weather over previous 3 days: calm, clear, no precip

Current Temperature Air: 41 C Water: 27 C

Description of Water Source: same as 2006
same as 2006

Water Quality Measurements

Last Calibration--------> Date: 5/16/2007 **Time:** 14:00

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	27.5	27.4	2.3	19.1
pH	7.72	7.75	7.75	7.7
EC (mS)	1736	1737	1738	1737.0
TDS (ppm)	868	869	871	869.3

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 1523.81

Additional Comments/Information: Very striking. Damsel flie, greenback flies, monkey flowers (mimulus cardinalis), arrowweed, cleaer pools, tadpoles, adundant aquatic invertebrates, maiden hair ferns. New rock fall, 30m above weeping spring.

Date of Survey: 5/13/2006 Time Measurements Began: 15:30 Observer: FH Frank Hays

Canyon Name: Mohawk Canyon Site/Polygon Name: Mohawk Hydro 5

Project: Phase IIb

Measurement Location Details: Perpendicular from the beginning of T2B transect on 3m stretch parallel with large boulder on creek right. T2A and T2B overlap for about 20m so Hydro 5 falls within length of T2A.

UTM Easting: 323032 UTM Northing: 4010269 GPS Accuracy (m):

Type of Water Feature: seep Light Exposure: full-shade

Elevation (m): Slope (degrees): 10

Soil Type: sand Aspect: 60

Weather: clear, warm, breezy

Weather over previous 3 days: clear, hot

Current Temperature Air: 29 C Water: 20 C

Description of Water Source: Stream in bottom of Mohawk flowing over gravel and cobbles.

Water Quality Measurements

Last Calibration--------> Date: 5/13/2006 **Time:** 7:15

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	25.1	24.6	34.4	28.0
pH	8.12	8.12	8.12	8.1
EC (mS)	1863	1885	1890	1879.3
TDS (ppm)	936	941	947	941.3

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 2952.00

Additional Comments/Information:

Date of Survey: 5/17/2007 Time Measurements Began: 9:00 Observer: DH Dan Hall

Canyon Name: Mohawk Canyon Site/Polygon Name: Mohawk Hydro 5

Project: Phase IIb

Measurement Location Details: 150m upstream of salty rock matt spring.

UTM Easting: 323032 UTM Northing: 4010269 GPS Accuracy (m):

Type of Water Feature: seep Light Exposure: full-shade

Elevation (m): Slope (degrees): 10

Soil Type: sand Aspect: 60

Weather: Clear warm

Weather over previous 3 days: Clear

Current Temperature Air: 24 C Water: 22 C

Description of Water Source: Flowing steam over gravel/cobble

Water Quality Measurements

Last Calibration--------> Date: 5/17/2007 **Time:** 10:10

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	22.2	22	21.9	22.0
pH	7.54	7.54	7.54	7.5
EC (mS)	1974	1977	1977	1976.0
TDS (ppm)	990	983	984	985.7

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 4307.69

Additional Comments/Information:

Date of Survey: 5/13/2006 Time Measurements Began: 16:35 Observer: FH Frank Hays

Canyon Name: Mohawk Canyon Site/Polygon Name: Mohawk Hydro 6

Project: Phase IIb

Measurement Location Details: 3m length parallel to golden member of the Bright Angel shale, 10 m downstream of T3A, 25 m upstream of beginning of T3B transect. Measurement begins at downstream end of BA shale ledge and goes upstream for 3 meters.

UTM Easting: 322856 UTM Northing: 4009921 GPS Accuracy (m): 32

Type of Water Feature: seep Light Exposure:

Elevation (m): Slope (degrees): 10

Soil Type: loamy sand Aspect: 212

Weather: Pleasant, nice cool breeze on a hot day

Weather over previous 3 days: warm, clear, calm

Current Temperature Air: 29 C Water: 24 C

Description of Water Source: Stream flowing across gravel and sand in sluggish pool adjacent to golden member of BA shale ledge.

Water Quality Measurements

Last Calibration--------> Date: 5/13/2006 **Time:** 7:15

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	24.5	23.9	24	24.1
pH	8.06	8.06	8.02	8.0
EC (mS)	1884	1868	1866	1872.7
TDS (ppm)	930	937	936	934.3

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 2099.96

Additional Comments/Information:

Date of Survey: 5/17/2007 Time Measurements Began: 11:00 Observer: DH Dan Hall

Canyon Name: Mohawk Canyon Site/Polygon Name: Mohawk Hydro 6

Project: Phase IIb

Measurement Location Details: Just Upstream of first nice stone patio areas.

UTM Easting: 322856 UTM Northing: 4009921 GPS Accuracy (m): 32

Type of Water Feature: seep Light Exposure:

Elevation (m): Slope (degrees): 10

Soil Type: loamy sand Aspect: 212

Weather: Sunny and hot

Weather over previous 3 days: Clear and sunny

Current Temperature Air: 24 C Water: 30 C

Description of Water Source: Seep. Stream flowing across sand and gravel.

Water Quality Measurements

Last Calibration--------> Date: 5/17/2007 **Time:** 11:00

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	27.7	27.6	27.5	27.6
pH	8.2	8.18	8.19	8.2
EC (mS)	1952	1953	1955	1953.3
TDS (ppm)	977	977	975	976.3

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 7196.26

Additional Comments/Information: Baby toads, abundant aquatic invertebrates, dragonflies, damselflies

Date of Survey: 5/12/2006 Time Measurements Began: 7:55 Observer: FH Frank Hays

Canyon Name: National Canyon Site/Polygon Name: National Hydro 1

Project: Phase IIb

Measurement Location Details: 25 meters upstream from the end of reference transect. Measurement taken along 5m section that runs parallel to honeycombed muav limestone wall on the left side of the canyon. 5 meter stretch essentially cobble free and straight.

UTM Easting: 330364 UTM Northing: 4013868 GPS Accuracy (m): 15

Type of Water Feature: stream Light Exposure: partial-shade

Elevation (m): Slope (degrees): 10

Soil Type: loamy sand Aspect: 304

Weather: clear, calm

Weather over previous 3 days: mostly clear, some gusty winds

Current Temperature Air: 20 C Water: 20 C

Description of Water Source: Stream in National Canyon flowing along the left wall 25 meters upstream from the end of reference transect.

Water Quality Measurements

Last Calibration--------> Date: 5/12/2006 **Time:** 7:00

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	19.9	19.9	19.9	19.9
pH	7.98	8.09	8.1	8.1
EC (mS)	1943	1942	1943	1942.7
TDS (ppm)	970	971	972	971.0

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 5998.63

Additional Comments/Information:

Date of Survey: 4/20/2008 Time Measurements Began: 15:55 Observer: DH Dan Hall

Canyon Name: National Canyon Site/Polygon Name: National Hydro 1

Project: Phase IIb

Measurement Location Details:

UTM Easting: 330364 UTM Northing: 4013868 GPS Accuracy (m): 15

Type of Water Feature: stream Light Exposure: partial-shade

Elevation (m): Slope (degrees): 10

Soil Type: loamy sand Aspect: 304

Weather:

Weather over previous 3 days:

Current Temperature Air: 23 C Water: C

Description of Water Source:

Water Quality Measurements

Last Calibration--------> Date: 4/20/2008 **Time:** 15:55

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	15.5	15.2	14.9	15.2
pH	8.1	8.12	8.11	8.1
EC (mS)	1726	1668	1599	1664.3
TDS (ppm)	851	836	813	833.3

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 52109.38

Additional Comments/Information:

Date of Survey: 5/12/2006 Time Measurements Began: 11:40 Observer: FH Frank Hays

Canyon Name: National Canyon Site/Polygon Name: National Hydro 2

Project: Phase IIb

Measurement Location Details: Hydro #2 is located about 20m downstream from the end of National tamarisk transect # 1A. The measurement is at the end of 5m long channel through Muav limestone. End of tamarisk transect # 1A is a large flat Muav boulder. Hydro #2 transect begins about 30m downstream. The reading was taken at the end of deeper channel.

UTM Easting: 330441 UTM Northing: 4013819 GPS Accuracy (m): 15

Type of Water Feature: stream Light Exposure: open

Elevation (m): Slope (degrees): 10

Soil Type: Aspect: 242

Weather: clear, calm

Weather over previous 3 days: clear with some partly cloudy periods and mostly calm previous 2 days.

Current Temperature Air: 30 C Water: 25 C

Description of Water Source: National stream running through Muav limestone channels in this area. Hydro transect #2 is in deepest channel after wider sluggish channel downstream from the end of tamarisk transect #.

Water Quality Measurements

Last Calibration--------> Date: 5/12/2006 **Time:** 7:00

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	25.2	25	25	25.1
pH	8.25	8.37	8.38	8.3
EC (mS)	1905	1914	1916	1911.7
TDS (ppm)	954	957	958	956.3

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 4218.05

Additional Comments/Information:

Date of Survey: 4/20/2008 Time Measurements Began: 15:00 Observer: AP Amy Prince

Canyon Name: National Canyon Site/Polygon Name: National Hydro 2

Project: Phase IIb

Measurement Location Details:

UTM Easting: 330441 UTM Northing: 4013819 GPS Accuracy (m): 15

Type of Water Feature: stream Light Exposure: open

Elevation (m): Slope (degrees): 10

Soil Type: Aspect: 242

Weather: sunny, 80's, wind

Weather over previous 3 days:

Current Temperature Air: 30 C Water: C

Description of Water Source:

Water Quality Measurements

Last Calibration--------> Date: 4/20/2008 **Time:** 15:00

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	19.8	19.5	19.1	19.5
pH	8.17	8.05	8.06	8.1
EC (mS)	1695	1644	1678	1672.3
TDS (ppm)	843	827	840	836.7

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 107.76

Additional Comments/Information:

Date of Survey: 5/12/2006 Time Measurements Began: 12:55 Observer: FH Frank Hays

Canyon Name: National Canyon Site/Polygon Name: National Hydro 3

Project: Phase IIb

Measurement Location Details: Bottom of Hydro #3 is 7 meters upstream from a large boulder used for reference for beginning of National tamarisk transect #. Measurement is along 5 meter channel below muav limestone cliff on right side of National Canyon.

UTM Easting: 330759 UTM Northing: 4013779 GPS Accuracy (m): 7

Type of Water Feature: stream Light Exposure: open

Elevation (m): Slope (degrees): 10

Soil Type: loamy sand Aspect: 262

Weather: clear, calm

Weather over previous 3 days: clear with some partly cloudy periods, mostly calm with some gusty winds

Current Temperature Air: C Water: 22 C

Description of Water Source: Stream in National Canyon flowing along cliff of muav limestone on right side of National Canyon. This is 7m upstream from large reference boulder used in National tamarisk transect #.

Water Quality Measurements

Last Calibration--------> Date: 5/16/2006 **Time:** 7:00

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	22.3	22	21.9	22.1
pH	7.91	7.98	8	8.0
EC (mS)	1895	1905	1907	1902.3
TDS (ppm)	948	952	954	951.3

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 56.19

Additional Comments/Information:

Date of Survey: 4/20/2008 Time Measurements Began: 10:40 Observer: DH Dan Hall

Canyon Name: National Canyon Site/Polygon Name: National Hydro 3

Project: Phase IIb

Measurement Location Details:

UTM Easting: 330759 UTM Northing: 4013779 GPS Accuracy (m): 7

Type of Water Feature: stream Light Exposure: open

Elevation (m): Slope (degrees): 10

Soil Type: loamy sand Aspect: 262

Weather:

Weather over previous 3 days:

Current Temperature Air: 19 C Water: C

Description of Water Source:

Water Quality Measurements

Last Calibration--------> Date: 4/20/2008 **Time:** 10:40

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	13.9	13.6	13.5	13.7
pH	6.97	7.85	7.93	7.6
EC (mS)	1688	1687	1675	1683.3
TDS (ppm)	845	844	844	844.3

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec):

Additional Comments/Information:

Date of Survey: 5/14/2006 Time Measurements Began: 11:05 Observer: AP Amy Prince

Canyon Name: Prospect Canyon Site/Polygon Name: Prospect Hydro 1

Project: Phase IIb

Measurement Location Details: This is 750 to 800 meters up canyon on the right side, under a mossy overhang.

UTM Easting: 313041 UTM Northing: 4007180 GPS Accuracy (m): 15

Type of Water Feature: seep Light Exposure: full-shade

Elevation (m): 535 Slope (degrees): 7

Soil Type: loamy sand Aspect: 330

Weather: hot and very sunny - no clouds

Weather over previous 3 days: hot and sunny

Current Temperature Air: 20 C Water: C

Description of Water Source: Seep, mossy with white powdery stuff on moss and overhang. No running stream, no flow measured.

Water Quality Measurements

Last Calibration--------> Date: 5/13/2006 **Time:**

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	18.9	18.4	18.4	18.6
pH	8.17	8.2	8.13	8.2
EC (mS)	1658	1308	1340	1435.3
TDS (ppm)	698	688	684	690.0

Water Quantity Measurements

Discharge Type:

Average Discharge (m3/sec):

Additional Comments/Information:

Date of Survey: 4/26/2006 Time Measurements Began: 17:42 Observer: KSM Kari Malen

Canyon Name: Sapphire Canyon Site/Polygon Name: Sapphire Hydro 1

Project: Phase IIb

Measurement Location Details: Pool is in the Tapeats layer, near where Tonto Trail drops into drainage. The water disappears about 20m below pool/flow. Measurements were taken above tapeats ledges near a pinyon pine tree.

UTM Easting: 383040 UTM Northing: 3999787 GPS Accuracy (m): 11.6

Type of Water Feature: stream Light Exposure: open

Elevation (m): 927 Slope (degrees): 2

Soil Type: sand Aspect: 34

Weather: Partly cloudy and warm.

Weather over previous 3 days: Sunny, warm to hot, very little cloud cover, no precipitation, little wind.

Current Temperature Air: 30 C Water: 24 C

Description of Water Source: Clear, small stream flowing through cobbles and onto Tapeats ledges forming a small cascading set of pools. Ending in a pool then disappearing underground down canyon ~10m from ledges.

Water Quality Measurements

Last Calibration--------> Date: 4/26/2006 **Time:** 10:00

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	24	24	24	24.0
pH	8.26	8	8.26	8.2
EC (mS)	1206	1106	1106	1139.3
TDS (ppm)	603	507	507	539.0

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 305.87

Additional Comments/Information: The bottom pool is deep enough to sit in on hot days!

Date of Survey: 4/26/2006 Time Measurements Began: 18:13 Observer: Kate Kate Watters

Canyon Name: Sapphire Canyon Site/Polygon Name: Sapphire Hydro 2

Project: Phase IIb

Measurement Location Details: About 50 m up canyon from Hydro 1, in a puddle below Tapeats ledge next to BACSAL thicket.

UTM Easting: 382951 UTM Northing: 3999753 GPS Accuracy (m): 6.2

Type of Water Feature: pothole Light Exposure: open

Elevation (m): 927 Slope (degrees): 3

Soil Type: sand Aspect: 42

Weather: partly cloudy, warm

Weather over previous 3 days: warm to hot, little cloud cover, no precip, slight breeze.

Current Temperature Air: 30 C Water: 30 C

Description of Water Source: 3mx1m puddle, .leaf matter, gravel and tadpoles in puddle.

Water Quality Measurements

Last Calibration--------> Date: 4/26/2006 **Time:** 10:00

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	25.5	25.5	25.5	25.5
pH	7.92	7.87	7.86	7.9
EC (mS)	1327	1322	1321	1323.3
TDS (ppm)	651	653	650	651.3

Water Quantity Measurements

Discharge Type:

Average Discharge (m3/sec):

Additional Comments/Information:

Date of Survey: 4/25/2006 Time Measurements Began: 14:00 Observer: MAM Melissa McMaster

Canyon Name: Slate Creek Site/Polygon Name: Slate Hydro 1

Project: Phase IIb

Measurement Location Details: Schist is present and there is some sand and smaller rocks. TAMRAM is the dominant vegetation.

UTM Easting: 387667 UTM Northing: 3999308 GPS Accuracy (m): 12

Type of Water Feature: stream Light Exposure: open partial-shade

Elevation (m): 730 Slope (degrees): 2

Soil Type: loamy sand Aspect: 16

Weather:

Weather over previous 3 days:

Current Temperature Air: C Water: C

Description of Water Source: Pool is about 2m long X 3m wide and 0.5m deep. There is a slow, small stream feeding it. The sides of the pool are bordered by schist (bedrock) with sand deposits on the bottom. Small number of aquatic insects present.

Water Quality Measurements

Last Calibration--------> Date: 4/25/2006 **Time:** 13:55

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)				
pH	7.92	7.92	7.91	7.9
EC (mS)				
TDS (ppm)				

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 1240.50

Additional Comments/Information: EC & PPM were unavailable. After several re-calibrations, the readings in the pool were coming up as "error" (flashing 3999 for mS and 2000 for ppm). We also filtered water for drinking from this pool and it tasty very salty, as in gross-salty.

Date of Survey: 4/23/2006 Time Measurements Began: 13:55 Observer: MAM Melissa McMaster

Canyon Name: Slate Creek Site/Polygon Name: Slate Hydro 2

Project: Phase IIb

Measurement Location Details: About 50m up canyon from where the Tonto Trail meets the drainage, on a slick rock shelf.

UTM Easting: 385620 UTM Northing: 3998424 GPS Accuracy (m): 13

Type of Water Feature: pothole Light Exposure:

Elevation (m): 959 Slope (degrees): 5

Soil Type: sand Aspect:

Weather: Warm to hot, clear.

Weather over previous 3 days: Sunny, clear and warm.

Current Temperature Air: C Water: C

Description of Water Source: A 2.5m X 3m X 0.3m deep puddle in slick rock, origin unknown.

Water Quality Measurements

Last Calibration--------> Date: 4/23/2006 **Time:** 13:55

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	20	20	20	20.0
pH	8.32	8.21	8.23	8.3
EC (mS)	1576	1597	1583	1585.3
TDS (ppm)	789	785	781	785.0

Water Quantity Measurements

Discharge Type:

Average Discharge (m3/sec):

Additional Comments/Information: No water quantity data collection - no flowing water. Did not establish a photopoint, it was dark out. On next visit, please install permanent photopoint.

Date of Survey: 4/23/2006 Time Measurements Began: 16:08 Observer: MAM Melissa McMaster

Canyon Name: Slate Creek Site/Polygon Name: Slate Hydro 3

Project: Phase IIb

Measurement Location Details: About 150 meters up canyon from pourovers in section 5 about 20m upstream from where the up and over begins just above a medium sized pool. Granite and schist bedrock.

UTM Easting: 386387 UTM Northing: 3998841 GPS Accuracy (m): 10.5

Type of Water Feature: spring Light Exposure: open

Elevation (m): 831 Slope (degrees): 3

Soil Type: sandy loam Aspect: 90

Weather: sunny and hot

Weather over previous 3 days: sunny and warm, one day of clouds

Current Temperature Air: 26 C Water: 21 C

Description of Water Source: Stream slow moving, pools above and below about 4m of flowing stream, some sand, cobble and rock. Vegetation is TAMRAM, MUHASP, ISOACR. About 0.2m wide and 4m long and shallow.

Water Quality Measurements

Last Calibration--------> Date: 4/25/2006 **Time:** 13:55

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	21	21	21	21.0
pH	8.23	8.22	8.21	8.2
EC (mS)	1713	1773	1730	1738.7
TDS (ppm)	877	884	887	882.7

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 443.18

Additional Comments/Information:

Date of Survey: 5/16/2006 Time Measurements Began: 10:07 Observer: KD Kevin Dickinson

Canyon Name: Spring Canyon Site/Polygon Name: Spring Canyon Hydro 1

Project: Phase IIb

Measurement Location Details: Two springs emanating from Bright Angel shale on canyon left. They form one stream almost immediately then flow downstream.

UTM Easting: 287746 UTM Northing: 3988551 GPS Accuracy (m): 9

Type of Water Feature: spring Light Exposure: full-shade

Elevation (m): 471 Slope (degrees): 2

Soil Type: Aspect: 163

Weather: overcast

Weather over previous 3 days: sunny and hot, then overcast

Current Temperature Air: 27 C Water: 30 C

Description of Water Source:

Water Quality Measurements

Last Calibration--------> Date: Time:

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	27.5	27.5	27.2	27.4
pH	7.32	7.55	7.67	7.5
EC (mS)	650	690	692	677.3
TDS (ppm)	284	334	344	320.7

Water Quantity Measurements

Discharge Type:

Average Discharge (m3/sec):

Additional Comments/Information:

Date of Survey: 5/17/2006 Time Measurements Began: 10:45 Observer: FH Frank Hays

Canyon Name: Three Springs Canyon Site/Polygon Name: Three Springs Hydro 1

Project: Phase IIb

Measurement Location Details: Just downstream about 3m of a 4m tall pourover at the top of the Tapeats sandstone layer. Stream runs through flatter area just upstream about at the 18m mark of T1A transect and just 2m downstream of the end of T1B transect.

UTM Easting: 291702 UTM Northing: 3973711 GPS Accuracy (m): 7.5

Type of Water Feature: stream Light Exposure:

Elevation (m): 445 Slope (degrees): 12

Soil Type: loamy sand Aspect: 205

Weather: clear, warm, calm

Weather over previous 3 days: hot - thunderstorms in the afternoon

Current Temperature Air: 30 C Water: 20 C

Description of Water Source: Stream flowing over Tapeats sandstone.

Water Quality Measurements

Last Calibration--------> Date: 5/17/2006 **Time:** 7:30

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	24.7	24.6	24.6	24.6
pH	7.98	8.06	8.07	8.0
EC (mS)	475	476	476	475.7
TDS (ppm)	237	238	238	237.7

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 488.52

Additional Comments/Information:

Date of Survey: 4/25/2008 Time Measurements Began: 9:10 Observer: SJ Sam Jones

Canyon Name: Three Springs Canyon Site/Polygon Name: Three Springs Hydro 1

Project: Phase IIb

Measurement Location Details:

UTM Easting: 291702 UTM Northing: 3973711 GPS Accuracy (m): 7.5

Type of Water Feature: stream Light Exposure:

Elevation (m): 445 Slope (degrees): 12

Soil Type: loamy sand Aspect: 205

Weather: sunny, warm, and calm

Weather over previous 3 days:

Current Temperature Air: 21 C Water: C

Description of Water Source:

Water Quality Measurements

Last Calibration--------> Date: 4/25/2008 **Time:**

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	19.5	19.3	19.3	19.4
pH	7.64	7.66	7.6	7.6
EC (mS)	642	631	621	631.3
TDS (ppm)	321	315	312	316.0

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 9231.18

Additional Comments/Information:

Date of Survey: 5/17/2006 Time Measurements Began: 10:30 Observer: FH Frank Hays

Canyon Name: Three Springs Canyon Site/Polygon Name: Three Springs Hydro 2

Project: Phase IIb

Measurement Location Details: Three Springs Hydro 2 is perpendicular from the end of Hydro 2B. Transect is located in long straight stream section. After walking upstream an additional 20m the surface flow stops - source of flow at this point are several springs in the drainage.

UTM Easting: 291765 UTM Northing: 3973703 GPS Accuracy (m): 3.5

Type of Water Feature: stream Light Exposure: open

Elevation (m): 444 Slope (degrees): 12

Soil Type: loamy sand Aspect: 275

Weather: partly cloudy, very warm

Weather over previous 3 days: hot and thunderstorms

Current Temperature Air: 30 C Water: 20 C

Description of Water Source: Stream running through numerous SALEXI, TYPASP and mimulus - incised channel about 2m deep. Surface flow disappears 20m upstream from this location.

Water Quality Measurements

Last Calibration--------> Date: 5/17/2006 **Time:** 7:30

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	24.6	24.5	24.2	24.4
pH	7.55	7.58	7.58	7.6
EC (mS)	461	465	468	464.7
TDS (ppm)	231	233	234	232.7

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 228.59

Additional Comments/Information:

Date of Survey: 4/25/2008 Time Measurements Began: 10:50 Observer: SJ Sam Jones

Canyon Name: Three Springs Canyon Site/Polygon Name: Three Springs Hydro 2

Project: Phase IIb

Measurement Location Details:

UTM Easting: 291765 UTM Northing: 3973703 GPS Accuracy (m): 3.5

Type of Water Feature: stream Light Exposure: open

Elevation (m): 444 Slope (degrees): 12

Soil Type: loamy sand Aspect: 275

Weather: warm, clear, calm

Weather over previous 3 days:

Current Temperature Air: 24 C Water: C

Description of Water Source:

Water Quality Measurements

Last Calibration--------> Date: 4/25/2008 **Time:** 10:55

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	22	21.3	21.3	21.5
pH	7.13	7.18	7.14	7.1
EC (mS)	651	620	617	629.3
TDS (ppm)	323	311	309	314.3

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec):

Additional Comments/Information: Too shallow to get a float reading

Date of Survey: 5/17/2006 Time Measurements Began: 14:35 Observer: FH Frank Hays

Canyon Name: Three Springs Canyon Site/Polygon Name: Three Springs Hydro 3

Project: Phase IIb

Measurement Location Details: Four meter stretch about 4 meters below a pouroff at the top of the Bright Angel Shale, cut about 30 meters above T2A and B transects.

UTM Easting: 292649 UTM Northing: 3973654 GPS Accuracy (m): 7.6

Type of Water Feature: stream Light Exposure: partial-shade

Elevation (m): 504 Slope (degrees): 15

Soil Type: sand Aspect: 287

Weather: hot, hot, hot - even the rattlesnakes aren't out

Weather over previous 3 days: hot, hot, hot - thunderstorm on 5/16

Current Temperature Air: 33 C Water: 30 C

Description of Water Source: Intermittent stream in 3 Springs Canyon - good flow in many locations disappears in wide stretches of coarse sand, gravel and cobble.

Water Quality Measurements

Last Calibration--------> Date: 5/17/2006 **Time:** 7:30

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	27.2	26.9	26.5	26.9
pH	8.07	8.08	8.08	8.1
EC (mS)	431	437	440	436.0
TDS (ppm)	217	219	220	218.7

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 17178.95

Additional Comments/Information:

Date of Survey: 4/25/2008 Time Measurements Began: 10:34 Observer: SJ Sam Jones

Canyon Name: Three Springs Canyon Site/Polygon Name: Three Springs Hydro 3

Project: Phase IIb

Measurement Location Details:

UTM Easting: 292649 UTM Northing: 3973654 GPS Accuracy (m): 7.6

Type of Water Feature: stream Light Exposure: partial-shade

Elevation (m): 504 Slope (degrees): 15

Soil Type: sand Aspect: 287

Weather:

Weather over previous 3 days: mild

Current Temperature Air: 31 C Water: C

Description of Water Source:

Water Quality Measurements

Last Calibration--------> Date: 4/25/2008 **Time:** 10:55

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	21.4	21.1	21.4	21.3
pH	7.54	7.71	7.63	7.6
EC (mS)	603	577	547	575.7
TDS (ppm)	302	290	278	290.0

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 13975.69

Additional Comments/Information: Cork float time over 2 meters.

Date of Survey: 5/17/2006 Time Measurements Began: 16:00 Observer: FH Frank Hays

Canyon Name: Three Springs Canyon Site/Polygon Name: Three Springs Hydro 4

Project: Phase IIb

Measurement Location Details: Above transect T3 and perpendicular with end of T3B transect.

UTM Easting: 292737 UTM Northing: 3973616 GPS Accuracy (m): 7.4

Type of Water Feature: stream Light Exposure: open

Elevation (m): 481 Slope (degrees): 14

Soil Type: sand Aspect: 290

Weather: hot - but cooling down from heat of the day

Weather over previous 3 days: hot and a thunderstorm on 5/16

Current Temperature Air: C Water: 26 C

Description of Water Source: Intermittent stream (see descriptions for Hydro 1-3).

Water Quality Measurements

Last Calibration--------> Date: 5/17/2006 **Time:** 7:30

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	26.2	26.1	25.9	26.1
pH	7.74	7.73	7.72	7.7
EC (mS)	433	433	436	434.0
TDS (ppm)	217	217	218	217.3

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 7437.50

Additional Comments/Information:

Date of Survey: 4/25/2008 Time Measurements Began: 11:36 Observer: SJ Sam Jones

Canyon Name: Three Springs Canyon Site/Polygon Name: Three Springs Hydro 4

Project: Phase IIb

Measurement Location Details: Braided, shallow stream. Multiple flowing spots

UTM Easting: 292737 UTM Northing: 3973616 GPS Accuracy (m): 7.4

Type of Water Feature: stream Light Exposure: open

Elevation (m): 481 Slope (degrees): 14

Soil Type: sand Aspect: 290

Weather: clear, warm ,calm

Weather over previous 3 days:

Current Temperature Air: 31 C Water: C

Description of Water Source:

Water Quality Measurements

Last Calibration--------> Date: 4/25/2008 **Time:** 10:55

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	23.2	22.9	22.5	22.9
pH	7.71	7.66	7.6	7.7
EC (mS)	595	588	591	591.3
TDS (ppm)	297	295	295	295.7

Water Quantity Measurements

Discharge Type:

Average Discharge (m3/sec):

Additional Comments/Information: Creek flows through dense vegetation and has braided into multiple streams. Not possible to measure water flow or stream width.

Date of Survey: 4/23/2006 Time Measurements Began: 12:20 Observer: ST Steve Till

Canyon Name: Topaz Canyon Site/Polygon Name: Topaz Hydro 1

Project: Phase IIb

Measurement Location Details: Sample is perpendicular to the 23m mark on Topaz 1a transect.

UTM Easting: 387730 UTM Northing: 3996874 GPS Accuracy (m): 3.1

Type of Water Feature: stream Light Exposure: partial-shade

Elevation (m): 857 Slope (degrees): 3

Soil Type: sand Aspect: 60

Weather: Temperature in the 80s, sunny, blue skies with a few clouds.

Weather over previous 3 days: Sunny, no rain, mid 80s in day, upper 40s at night.

Current Temperature Air: 23 C Water: 18 C

Description of Water Source: Standing pool along Topaz 1a transect. It is not a pothole, but more of a small pool in sandy soil (~15cm deep and 35cm wide).

Water Quality Measurements

Last Calibration--------> Date: 4/23/2006 **Time:** 12:20

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	18	18	18	18.0
pH	7.18	7.1	7.07	7.1
EC (mS)	3211	3215	3220	3215.3
TDS (ppm)	1620	1623	1628	1623.7

Water Quantity Measurements

Discharge Type:

Average Discharge (m3/sec):

Additional Comments/Information: No flowing water for taking quantity data! Only a few small pools were present near the transect Topaz 1a.

Date of Survey: 4/24/2006 Time Measurements Began: Observer: MAM Melissa McMaster

Canyon Name: Topaz Canyon Site/Polygon Name: Topaz Hydro 6

Project: Phase IIb

Measurement Location Details:

UTM Easting: 386442 UTM Northing: 3996233 GPS Accuracy (m): 50

Type of Water Feature: pothole Light Exposure: full-shade

Elevation (m): 1166 Slope (degrees): 5

Soil Type: sand Aspect: 50

Weather: sun, 80s

Weather over previous 3 days: sun, 80s

Current Temperature Air: C Water: C

Description of Water Source: Small pool.

Water Quality Measurements

Last Calibration--------> Date: 4/24/2006 **Time:** 6:30

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)				
pH	7.85	8.25	8.02	8.0
EC (mS)	635	617	625	625.7
TDS (ppm)	327	324	320	323.7

Water Quantity Measurements

Discharge Type:

Average Discharge (m3/sec):

Additional Comments/Information:

Date of Survey: 4/14/2008 Time Measurements Began: 14:00 Observer: SJ Sam Jones

Canyon Name: Topaz Canyon Site/Polygon Name: Topaz Hydro 6

Project: Phase IIb

Measurement Location Details: small pool at base of dry falls

UTM Easting: 386442 UTM Northing: 3996233 GPS Accuracy (m): 50

Type of Water Feature: pothole Light Exposure: full-shade

Elevation (m): 1166 Slope (degrees): 5

Soil Type: sand Aspect: 50

Weather: sunny and calm

Weather over previous 3 days: sunny and calm

Current Temperature Air: 22 C Water: 16 C

Description of Water Source: small pool at base of the dry falls

Water Quality Measurements

Last Calibration--------> Date: 4/14/2008 **Time:** 14:00

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	16.6	15.6	15.7	16.0
pH	7.78	7.71	7.66	7.7
EC (mS)	671	654	657	660.7
TDS (ppm)	334	329	329	330.7

Water Quantity Measurements

Discharge Type:

Average Discharge (m3/sec):

Additional Comments/Information: Standing water. No flow.

Date of Survey: 4/24/2006 Time Measurements Began: Observer: MAM Melissa McMaster

Canyon Name: Topaz Canyon Site/Polygon Name: Topaz Hydro 7

Project: Phase IIb

Measurement Location Details:

UTM Easting: 385888 UTM Northing: 3996052 GPS Accuracy (m): 4.1

Type of Water Feature: Light Exposure:

Elevation (m): 1020 Slope (degrees): 4

Soil Type: sand Aspect: 56

Weather: sunny - 80s

Weather over previous 3 days: warm 75-85 degrees, sunny

Current Temperature Air: C Water: C

Description of Water Source: Small pool.

Water Quality Measurements

Last Calibration--------> Date: 4/24/2006 **Time:** 6:30

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)				
pH	8.33	8.18	8.08	8.2
EC (mS)	809	804	901	838.0
TDS (ppm)	419	420	419	419.3

Water Quantity Measurements

Discharge Type:

Average Discharge (m3/sec):

Additional Comments/Information: No temps were recorded for the pools in upper Topaz.

Date of Survey: 4/14/2008 Time Measurements Began: 12:25 Observer: SJ Sam Jones

Canyon Name: Topaz Canyon Site/Polygon Name: Topaz Hydro 7

Project: Phase IIb

Measurement Location Details: where the muav limestone contacts creek bottom

UTM Easting: 385888 UTM Northing: 3996052 GPS Accuracy (m): 4.1

Type of Water Feature: Light Exposure:

Elevation (m): 1020 Slope (degrees): 4

Soil Type: sand Aspect: 56

Weather: sunny and calm

Weather over previous 3 days: sunny and calm

Current Temperature Air: 26 C Water: 25 C

Description of Water Source: small pool in muav narrows

Water Quality Measurements

Last Calibration--------> Date: 4/14/2008 **Time:** 12:30

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	25	24.7	24.6	24.8
pH	8.43	8.45	8.45	8.4
EC (mS)	1073	1059	1069	1067.0
TDS (ppm)	533	531	534	532.7

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 2941.18

Additional Comments/Information:

Date of Survey: 4/24/2006 Time Measurements Began: Observer: MAM Melissa McMaster

Canyon Name: Topaz Canyon Site/Polygon Name: Topaz Hydro 8

Project: Phase IIb

Measurement Location Details:

UTM Easting: 385511 UTM Northing: 3995868 GPS Accuracy (m): 9

Type of Water Feature: stream Light Exposure:

Elevation (m): 1086 Slope (degrees): 4

Soil Type: sand Aspect: 44

Weather: sunny, 80s

Weather over previous 3 days: sunny, 80s

Current Temperature Air: C Water: C

Description of Water Source: Small pool.

Water Quality Measurements

Last Calibration--------> Date: 4/24/2006 **Time:** 6:30

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)				
pH	8.08	8.13	8.15	8.1
EC (mS)	732	716	730	726.0
TDS (ppm)	358	358	351	355.7

Water Quantity Measurements

Discharge Type:

Average Discharge (m3/sec):

Additional Comments/Information:

Date of Survey: 4/14/2008 Time Measurements Began: 13:00 Observer: SJ Sam Jones

Canyon Name: Topaz Canyon Site/Polygon Name: Topaz Hydro 8

Project: Phase IIb

Measurement Location Details: small pools next to shaley ledges. Canyon gets dense with vegetation. One starts to see many hackberry plants.

UTM Easting: 385511 UTM Northing: 3995868 GPS Accuracy (m): 9

Type of Water Feature: stream Light Exposure:

Elevation (m): 1086 Slope (degrees): 4

Soil Type: sand Aspect: 44

Weather: sunny, calm

Weather over previous 3 days: sunny, calm

Current Temperature Air: 32 C Water: C

Description of Water Source: pools near shaley deposits on creek left.

Water Quality Measurements

Last Calibration--------> Date: 4/14/2008 **Time:** 13:05

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)	27.9	27.1	27.1	27.4
pH	7.99	8.11	8.09	8.1
EC (mS)	803	786	744	777.7
TDS (ppm)	402	394	376	390.7

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec):

Additional Comments/Information: Standing water. No flow.

Date of Survey: 4/24/2006 Time Measurements Began: Observer: MAM Melissa McMaster

Canyon Name: Topaz Canyon Site/Polygon Name: Topaz Hydro 9

Project: Phase IIb

Measurement Location Details:

UTM Easting: 385082 UTM Northing: 3995387 GPS Accuracy (m): 14

Type of Water Feature: Light Exposure:

Elevation (m): 1133 Slope (degrees): 5

Soil Type: Aspect: 50

Weather: sun 80 degrees

Weather over previous 3 days: sun 80 degrees

Current Temperature Air: C Water: C

Description of Water Source: Small pool.

Water Quality Measurements

Last Calibration--------> Date: 4/24/2006 **Time:** 6:30

Meter Reading #	**1**	**2**	**3**	**Average**
Water Temp (C)				
pH	8.14	8.15	8.14	8.1
EC (mS)	356	319	350	341.7
TDS (ppm)	176	173	176	175.0

Water Quantity Measurements

Discharge Type:

Average Discharge (m3/sec):

Additional Comments/Information:

Appendix E - Monitoring Transect Data

Park Area/Canyon: 140 Mile Canyon River mile: 140 L Project (Phase): Phase IIb

Transect Name: 140 Mile L 1 Transect Type: Tamarisk Area

	Start point		**End point**
Easting:	359441	Easting:	359430
Northing:	4029214	Northing:	4029267
GPS accuracy (m):	6	GPS accuracy (m):	8
Elevation (m):		Elevation (m):	601
Bearing:	0		
Aspect (0-360):	350	Slope (degrees):	8

Transect description: Take the trail from pull in above the drainage and drop into drainage start point is just about 50m up canyon from where trail drops in on the west side of a 3x3m limestone boulder. The line goes under a SUV size boulder from 10-12m. At 31.6m the tape pivots to 340 degrees on a 1.5x1.2m gray boulder so that we could get a full 50m line in. The end is right in a BA shelf ~1.2m tall right in a vertical crack. There was a deep pool from 35-38m on tape, with dried algae around the edges. There is water from 35.8-36.2 on tape. Many small seedlings in this area. General location is about 300m from river.

Additional Info:: On the west side of the drainage up about 100m are seeps on a ledge near the top of the BA shale. There are TAMRAM up there but they look very inaccessible.

Geological layer: Bright Angel Shale

Habitat type: Riparian

Dominant species: Acacia greggii Gray, Brickellia longifolia S. Wats., Tamarix ramosissima Ledeb.

Associated species: Adiantum capillus-veneris L., Andropogon glomeratus (Walt.) B.S.P., Aristida purpurea Nutt., Astragalus praelongus Sheldon, Camissonia multijuga (S. Wats.) Raven, Cladium californicum (S. Wats.) O'Neill, Datura wrightii Regel, Ephedra fasciculata A. Nels., Epipactis gigantea Dougl. ex Hook., Erigeron lobatus A. Nels., Eriogonum spp., Eucnide urens (Parry ex Gray) Parry, Eurybia glauca (Nutt.) Nesom, Funastrum cynanchoides (Dcne.) Schlechter ssp. cynanchoides, Hedeoma nana (Torr.) Briq., Lycium torreyi Gray, Mimulus guttatus DC., Opuntia phaeacantha Engelm., Parietaria hespera Hinton, Pleuraphis jamesii Torr., Pluchea sericea (Nutt.) Coville, , Pseudognaphalium stramineum (Kunth) W.A. Weber, Scirpus spp., Thymophylla pentachaeta (DC.) Small

Surface water within 25m? ☑ Surface water type: seep

Landform: Drainage channel Surface rocks: limestone cobbles

Soil type: sand loamy sand Topo position: Interfluve

Light exposure: open partial-shade Soil moisture: dry

Park Area/Canyon: 140 Mile Canyon River mile: 140 L Project (Phase): Phase IIb

Transect Name: 140 Mile L 1 Transect Type: Tamarisk Area

Date: 5/10/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Lori Makarick Reader: Mike Kearsley

Wind Speed: Air Temp (F): Cloud Cover:

Weather: Samll wispy clouds-5%, sunny, 28.7 C

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	6
Boulder	21
Cobble	10
Gravel	26
Litter (duff)	18
Sand	11
Stone	9

Species	% Cover
Acacia greggii	3
Algae spp.	7
Brickellia longifolia	12
Bromus rubens	1
Funastrum cynanchoides	3
Tamarix ramosissima	32

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Coarse woody debris	3	6	3	5	1
Gravel	39	15	19	57	36
Bedrock	3	15	0	0	6
Sand	3	1	8	12	15
Litter (duff)	8	15	19	1	6
Cobble	18	1	8	12	15
Boulder	8	32	40	12	6
Stone	18	15	3	1	15

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%		25-50%	M	<1%		<1%		<1%	
Algae spp.	<0%		<0%		<0%		5-10%		<0%	
Artemisia ludoviciana	<1%		<1%		<0%		<0%		<1%	
Baccharis emoryi	<1%		<0%		1-5%		<0%		<0%	
Baccharis salicifolia	<0%		<0%		<0%		<1%		<0%	
Brickellia longifolia	5-10%		<1%		1-5%		<0%		5-10%	
Bromus rubens	<1%		<1%		<0%		<1%		<1%	

Park Area/Canyon: 140 Mile Canyon River mile: 140 L Project (Phase): Phase IIb

Transect Name: 140 Mile L 1 Transect Type: Tamarisk Area

Cryptantha spp.	<1%		<0%		<0%		<0%		<0%	
Hedeoma nana	<0%		<0%		<0%		<0%		<1%	
Lepidium lasiocarpum var. lasiocarpum	<1%		<1%		<0%		<1%		<0%	
Mimulus guttatus	<0%		<0%		<0%		<1%		<0%	
Nicotiana obtusifolia var. obtusifolia	<0%		1-5%		<0%		<0%		<1%	
Parietaria hespera	<1%		<0%		<0%		<0%		<0%	
Polypogon monspeliensis	<0%		<0%		<0%		<0%		<1%	
Porophyllum gracile	<1%		<0%		<0%		<0%		<0%	
Sarcostemma cynanchoides var. hartwegii	<0%		5-10%		1-5%		<0%		<0%	
Sporobolus spp.	<1%		<1%		<0%		<0%		<1%	
Stylocline micropoides	<1%		<0%		<0%		<0%		<0%	
Tamarix ramosissima	10-25%	M	25-50%	S+M	25-50%	M	5-10%	S+M	5-10%	S+M
Typha spp.	<0%		<0%		<0%		<1%		<0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Brickellia longifolia	12		
15	Tamarix ramosissima	13	9	

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Brickellia longifolia	2		
15	Acacia greggii			
15	Tamarix ramosissima	4	4	
45	Acacia greggii	1		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.46	977	9.37	863	8.37	990	8.73	943
15	8.49	1055	8.49	1060	8.48	1067	8.49	1061
25	8.96	104	8.92	104	8.91	106	8.93	105
35	8.85	381	8.85	384	8.84	389	8.85	385
45	8.64	1764	8.69	1756	8.7	1760	8.68	1760

Park Area/Canyon: 140 Mile Canyon River mile: 140 L Project (Phase): Phase IIb

Transect Name: 140 Mile L 1 Transect Type: Tamarisk Area

Date: 5/14/2007 Revisit? ☑ Post-tamarisk removal

Recorder: Kate Watters Reader: Amy Prince

Wind Speed: Air Temp (F): Cloud Cover: 0

Weather: Clear, sunny, hot 80F, high wispy clouds

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	15
Boulder	35
Cobble	13
Gravel	21
Litter (duff)	3
Sand	10
Stone	3

Species	% Cover
Acacia greggii	1
Baccharis salicifolia	1
Brickellia longifolia	5
Sarcostemma cynanchoides var. hartwegii	5
Tamarix ramosissima	5

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Cobble	20	4	21	7	20
Boulder	5	25	15	24	6
Bedrock	12	33	0	0	10
Sand	5	5	2	12	9
Crypto	0	0	0	2	0
Coarse woody debris	8	1	4	1	2
Gravel	27	19	31	41	38
Basal Veg	1	1	1	1	1
Litter (duff)	9	7	27	6	2
Stone	13	4	1	6	11
Woody debris structure	0	1	1	0	1

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S	10-25%	S+M	<1%	S	<1%	S	<1%	S
Algae spp.	<0%		<0%		<0%		<1%		<0%	
Artemisia ludoviciana	<1%		<0%		<0%		<1%		<1%	
Baccharis salicifolia	<0%		<0%		1-5%		<0%		<0%	
Brickellia longifolia	5-10%		1-5%		1-5%		<1%		<1%	
Bromus rubens	<0%		<0%		<0%		<0%		<1%	
Camissonia walkeri	<0%		<0%		<1%		<1%		<1%	
Cryptantha spp.	<0%		<0%		<1%		<1%		<1%	
Draba cuneifolia	<1%		<0%		<0%		<1%		<1%	
Galium bifolium	<0%		<0%		<0%		<0%		<1%	
Gilia spp.	<1%		<0%		<0%		<0%		<0%	
Hedeoma nana	<0%		<0%		<0%		<0%		<1%	

Isocoma acradenia	<0%	<0%	<0%	<1%	<0%
Lepidium fremontii	<0%	<0%	<0%	<0%	<1%
Lepidium lasiocarpum var. lasiocarpum	<0%	<0%	<0%	<1%	<1%
Mimulus guttatus	<0%	<0%	<0%	<1%	<0%
Nicotiana obtusifolia var. obtusifolia	<0%	<1%	<0%	<0%	<0%
Oenothera caespitosa	<0%	<0%	<0%	<0%	<1%
Parietaria hespera	<0%	<1%	<0%	<1%	<0%
Phacelia glechomifolia	<1%	<0%	<0%	<1%	<1%
Poa bigelovii	<0%	<0%	<0%	<1%	<1%
Polypogon monspeliensis	<0%	<0%	<0%	<1%	<1%
Sarcostemma cynanchoides var. hartwegii	<0%	1-5%	1-5%	<0%	<0%
Silene antirrhina	<1%	<0%	<0%	<1%	<0%
Stanleya pinnata	<0%	<0%	<0%	<0%	<1%
Stephanomeria pauciflora	<0%	<0%	<1%	<0%	<1%
Vulpia microstachys var. pauciflora	<1%	<0%	<0%	<0%	<1%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Brickellia longifolia	16		
15	Acacia greggii			

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Brickellia longifolia	7		
15	Acacia greggii			2

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.56	149	8.54	159	8.5	161	8.53	156
15	8.41	231	8.53	238	8.61	239	8.52	236
25	8.47	90	8.59	90	8.64	91	8.57	90
35	7.6	884	7.78	893	7.89	897	7.76	891
45	6.8	212	7.19	220	7.47	216	7.15	216

Park Area/Canyon: 140 Mile Canyon River mile: 140 L Project (Phase): Phase IIb

Transect Name: 140 Mile L 1 Transect Type: Tamarisk Area

Date: 5/10/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Lori Makarick Reader: Mike Kearsley

Wind Speed: Air Temp (F): Cloud Cover:

Weather: Samll wispy clouds-5%, sunny, 28.7 C

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	6
Boulder	21
Cobble	10
Gravel	26
Litter (duff)	18
Sand	11
Stone	9

Species	% Cover
Acacia greggii	3
Algae spp.	7
Brickellia longifolia	12
Bromus rubens	1
Funastrum cynanchoides	3
Tamarix ramosissima	32

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Coarse woody debris	3	6	3	5	1
Gravel	39	15	19	57	36
Bedrock	3	15	0	0	6
Sand	3	1	8	12	15
Litter (duff)	8	15	19	1	6
Cobble	18	1	8	12	15
Boulder	8	32	40	12	6
Stone	18	15	3	1	15

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%		25-50%	M	<1%		<1%		<1%	
Algae spp.	<0%		<0%		<0%		5-10%		<0%	
Artemisia ludoviciana	<1%		<1%		<0%		<0%		<1%	
Baccharis emoryi	<1%		<0%		1-5%		<0%		<0%	
Baccharis salicifolia	<0%		<0%		<0%		<1%		<0%	
Brickellia longifolia	5-10%		<1%		1-5%		<0%		5-10%	
Bromus rubens	<1%		<1%		<0%		<1%		<1%	

Cryptantha spp.	<1%		<0%		<0%		<0%		<0%	
Hedeoma nana	<0%		<0%		<0%		<0%		<1%	
Lepidium lasiocarpum var. lasiocarpum	<1%		<1%		<0%		<1%		<0%	
Mimulus guttatus	<0%		<0%		<0%		<1%		<0%	
Nicotiana obtusifolia var. obtusifolia	<0%		1-5%		<0%		<0%		<1%	
Parietaria hespera	<1%		<0%		<0%		<0%		<0%	
Polypogon monspeliensis	<0%		<0%		<0%		<0%		<1%	
Porophyllum gracile	<1%		<0%		<0%		<0%		<0%	
Sarcostemma cynanchoides var. hartwegii	<0%		5-10%		1-5%		<0%		<0%	
Sporobolus spp.	<1%		<1%		<0%		<0%		<1%	
Stylocline micropoides	<1%		<0%		<0%		<0%		<0%	
Tamarix ramosissima	10-25%	M	25-50%	S+M	25-50%	M	5-10%	S+M	5-10%	S+M
Typha spp.	<0%		<0%		<0%		<1%		<0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Brickellia longifolia	12		
15	Tamarix ramosissima	13	9	

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Brickellia longifolia	2		
15	Acacia greggii			
15	Tamarix ramosissima	4	4	
45	Acacia greggii	1		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.46	977	9.37	863	8.37	990	8.73	943
15	8.49	1055	8.49	1060	8.48	1067	8.49	1061
25	8.96	104	8.92	104	8.91	106	8.93	105
35	8.85	381	8.85	384	8.84	389	8.85	385
45	8.64	1764	8.69	1756	8.7	1760	8.68	1760

Park Area/Canyon: 140 Mile Canyon River mile: 140 L Project (Phase): Phase IIb

Transect Name: 140 Mile L 1 Transect Type: Tamarisk Area

Date: 5/14/2007 Revisit? ☑ Post-tamarisk removal

Recorder: Kate Watters Reader: Amy Prince

Wind Speed: Air Temp (F): Cloud Cover: 0

Weather: Clear, sunny, hot 80F, high wispy clouds

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	15
Boulder	35
Cobble	13
Gravel	21
Litter (duff)	3
Sand	10
Stone	3

Species	% Cover
Acacia greggii	1
Baccharis salicifolia	1
Brickellia longifolia	5
Sarcostemma cynanchoides var. hartwegii	5
Tamarix ramosissima	5

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Cobble	20	4	21	7	20
Boulder	5	25	15	24	6
Bedrock	12	33	0	0	10
Sand	5	5	2	12	9
Crypto	0	0	0	2	0
Coarse woody debris	8	1	4	1	2
Gravel	27	19	31	41	38
Basal Veg	1	1	1	1	1
Litter (duff)	9	7	27	6	2
Stone	13	4	1	6	11
Woody debris structure	0	1	1	0	1

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S	10-25%	S+M	<1%	S	<1%	S	<1%	S
Algae spp.	<0%		<0%		<0%		<1%		<0%	
Artemisia ludoviciana	<1%		<0%		<0%		<1%		<1%	
Baccharis salicifolia	<0%		<0%		1-5%		<0%		<0%	
Brickellia longifolia	5-10%		1-5%		1-5%		<1%		<1%	
Bromus rubens	<0%		<0%		<0%		<0%		<1%	
Camissonia walkeri	<0%		<0%		<1%		<1%		<1%	
Cryptantha spp.	<0%		<0%		<1%		<1%		<1%	
Draba cuneifolia	<1%		<0%		<0%		<1%		<1%	
Galium bifolium	<0%		<0%		<0%		<0%		<1%	
Gilia spp.	<1%		<0%		<0%		<0%		<0%	
Hedeoma nana	<0%		<0%		<0%		<0%		<1%	

Isocoma acradenia	<0%	<0%	<0%	<1%	<0%
Lepidium fremontii	<0%	<0%	<0%	<0%	<1%
Lepidium lasiocarpum var. lasiocarpum	<0%	<0%	<0%	<1%	<1%
Mimulus guttatus	<0%	<0%	<0%	<1%	<0%
Nicotiana obtusifolia var. obtusifolia	<0%	<1%	<0%	<0%	<0%
Oenothera caespitosa	<0%	<0%	<0%	<0%	<1%
Parietaria hespera	<0%	<1%	<0%	<1%	<0%
Phacelia glechomifolia	<1%	<0%	<0%	<1%	<1%
Poa bigelovii	<0%	<0%	<0%	<1%	<1%
Polypogon monspeliensis	<0%	<0%	<0%	<1%	<1%
Sarcostemma cynanchoides var. hartwegii	<0%	1-5%	1-5%	<0%	<0%
Silene antirrhina	<1%	<0%	<0%	<1%	<0%
Stanleya pinnata	<0%	<0%	<0%	<0%	<1%
Stephanomeria pauciflora	<0%	<0%	<1%	<0%	<1%
Vulpia microstachys var. pauciflora	<1%	<0%	<0%	<0%	<1%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Brickellia longifolia	16		
15	Acacia greggii			

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Brickellia longifolia	7		
15	Acacia greggii			2

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.56	149	8.54	159	8.5	161	8.53	156
15	8.41	231	8.53	238	8.61	239	8.52	236
25	8.47	90	8.59	90	8.64	91	8.57	90
35	7.6	884	7.78	893	7.89	897	7.76	891
45	6.8	212	7.19	220	7.47	216	7.15	216

Park Area/Canyon: 140 Mile Canyon River mile: 140 L Project (Phase): Phase IIb

Transect Name: 140 Mile L 1 Transect Type: Tamarisk Control

	Start point		End point
Easting:	359414	Easting:	359449
Northing:	4029161	Northing:	4029197
GPS accuracy (m):	5.1	GPS accuracy (m):	4.4
Elevation (m):	603	Elevation (m):	589
Bearing:	19		
Aspect (0-360):	24	Slope (degrees):	10

Transect description: Transect start is located ~75m upstream of T1A on creek R in the first big acacia grove. Car-sized boulders block the main channel of the drainage around the 10m mark of the transect forcing you to traverse to creek R to get to the start. The start is located at the base of a 2x2.5 wide limestone boulder flanked by acacias. Just upstream a sheer B.A. shale ledge enters the drainage on creek L.

Additional Info:: Transect end is located ~25m upstream of T1A next to lovely muav limestone overhang with maidenhair fern and perityle growing out of a seep.

Geological layer: Bright Angel Shale

Habitat type: Riparian Mojave desert scrub

Dominant species: Acacia greggii Gray, Brickellia longifolia S. Wats., Isocoma acradenia (Greene) Greene

Associated species: Adiantum capillus-veneris L., Agave Utahensis var. utahensis, Aloysia wrightii Heller ex Abrams, Camissonia walkeri (A. Nels.) Raven, Datura wrightii Regel, Echinocereus coccineus Engelm. var. coccineus, Echinocereus engelmannii (Parry ex Engelm.) Lem., Echinocereus triglochidiatus Engelm., Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake, Ferocactus cylindraceus (Engelm.) Orcutt var. cylindraceus, Fraxinus anomala Torr. ex S. Wats., Galium stellatum Kellogg, Hesperodoria salicina (Blake) Nesom, Perityle congesta (M.E. Jones) Shinners, Lycium pallidum Miers, Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm., Nicotiana obtusifolia Mertens & Galeotti, Nicotiana obtusifolia Mertens & Galeotti var. obtusifolia, Perityle congesta (M.E. Jones) Shinners, Perityle emoryi, , Sonchus asper (L.) Hill, Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb., Stanleya pinnata (Pursh) Britt.

Surface water within 25m? ☑ Surface water type: seep

Landform: Drainage channel Surface rocks: limestone sandstone

Soil type: sandy loam Topo position: Interfluve

Light exposure: open Soil moisture: dry

Park Area/Canyon: 140 Mile Canyon River mile: 140 L Project (Phase): Phase IIb

Transect Name: 140 Mile L 1 Transect Type: Tamarisk Control

Date: 5/10/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Kate Watters Reader: Lisa Hahn

Wind Speed: Air Temp (F): Cloud Cover:

Weather: Breezy, sunny, clear and ~ 90F

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	2
Boulder	20
Cobble	16
Gravel	10
Litter (duff)	19
Plant	1
Sand	17
Stone	15

Species	% Cover
Acacia greggii	19
Brickellia longifolia	6
Bromus rubens	2
Gutierrezia sarothrae	1
Stephanomeria pauciflora	1

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Boulder	19	15	16	5	32
Stone	8	6	16	11	33
Litter (duff)	19	3	3	5	3
Moss (ground)	1	0	0	0	0
Gravel	19	54	7	5	6
Cobble	8	15	16	23	15
Sand	3	6	34	11	7
Bedrock	19	0	0	36	0
Coarse woody debris	1	1	1	2	1
Bare Soil	1	1	7	2	3

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	50-75%	M	<1%	S+M	25-50%	S+M	50-75%	S+M	1-5%	S+P
Aloysia wrightii	<0%		<0%		<0%		<0%		<0%	
Artemisia ludoviciana	<1%		<0%		<0%		1-5%		<0%	
Aster spp.	<0%		<0%		<0%		<0%		<1%	
Brickellia longifolia	<0%		1-5%		1-5%		5-10%		10-25%	
Bromus rubens	1-5%		<0%		<1%		<1%		<1%	
Bromus tectorum	<0%		<0%		<0%		<1%		<0%	
Camissonia walkeri	<0%		<0%		<0%		<1%		<1%	
Cryptantha spp.	<0%		<0%		<0%		<0%		<1%	
Cryptobiotic soil	1-5%		<0%		<1%		<1%		<0%	

Datura wrightii	<0%	<0%	<0%	<1%	1-5%	
Ephedra fasciculata	<1%	<0%	<0%	<0%	<0%	
Eriogonum inflatum	<0%	<0%	<0%	<0%	<1%	
Erodium cicutarium	<0%	<0%	<0%	<0%	<1%	
Fraxinus anomala	<0%	<0%	<0%	<0%	<1%	S
Grass spp	<1%	<0%	<0%	<0%	<0%	
Gutierrezia sarothrae	<1%	<0%	<0%	<1%	<1%	
Hedeoma nana	<0%	<0%	<0%	<0%	<1%	
Isocoma acradenia	<0%	<0%	<0%	1-5%	1-5%	
Lepidium lasiocarpum var. lasiocarpum	<0%	<1%	<1%	<1%	<0%	
Lepidium spp.	<0%	<1%	<0%	<0%	<0%	
Maurandella antirrhiniflora	<0%	1-5%	<0%	<0%	<0%	
Muhlenbergia porteri	<0%	<0%	<0%	<0%	<1%	
Parietaria hespera	<0%	<1%	<1%	<1%	<1%	
Plantago patagonica	<0%	<0%	<0%	<1%	<0%	
Poa fendleriana	<1%	<0%	<0%	<0%	<1%	
Porophyllum gracile	<1%	<0%	<0%	<0%	<0%	
Sporobolus cryptandrus	<0%	<0%	<0%	<1%	<0%	
Stanleya pinnata	<0%	<0%	<1%	<0%	<0%	
Stephanomeria pauciflora	<1%	<0%	<0%	1-5%	1-5%	
Thymophylla pentachaeta var. belenidium	<0%	<0%	<0%	<1%	<0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Acacia greggii	2	2	2
35	Acacia greggii			

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Acacia greggii			
5	Bromus rubens	1		
35	Acacia greggii			
35	Isocoma acradenia	1		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.87	211	8.87	200	8.87	199	8.87	203
15	8.94	97	8.94	94	8.92	99	8.93	97
25	8.8	79	8.79	64	8.79	81	8.79	75
35	8.59	108	8.57	110	8.55	109	8.57	109

45	8.93	115	8.93	105	8.92	103	8.93	108

Park Area/Canyon: 140 Mile Canyon River mile: 140 L Project (Phase): Phase IIb

Transect Name: 140 Mile L 1 Transect Type: Tamarisk Control

Date: 5/14/2007 Revisit? ☑ Post-tamarisk removal

Recorder: Lori Makarick Reader: Steve Till

Wind Speed: Air Temp (F): Cloud Cover: 0

Weather: 0% clouds, 82 F, calm, very sunny

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	31
Cobble	6
Gravel	24
Litter (duff)	12
Sand	12
Stone	15

Species	% Cover
Acacia greggii	18
Brickellia longifolia	6
Bromus rubens	2
Elymus elymoides	1
Stephanomeria pauciflora	2

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Moss (ground)	2	0	0	0	0
Gravel	12	17	50	14	14
Basal Veg	1	1	1	1	1
Crypto	1	0	0	0	0
Cobble	10	18	14	14	16
Sand	7	11	23	20	20
Stone	12	20	6	29	15
Litter (duff)	10	1	2	4	10
Boulder	45	32	4	18	24

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	25-50%	S+M	25-50%	S	5-10%	S+M	10-25%	S+M	1-5%	S+P
Aloysia wrightii	<0%		<1%		<0%		<0%		<0%	
Artemisia ludoviciana	<1%		<0%		<0%		<1%		<0%	
Astragalus nuttallianus	<0%		<0%		<0%		<1%		<0%	
Brickellia longifolia	<0%		<1%		<0%		1-5%		5-10%	
Bromus rubens	<1%		<1%		<1%		<1%		<1%	
Bromus tectorum	<0%		<0%		<1%		<0%		<0%	
Camissonia spp.	<1%		<0%		<0%		<0%		<0%	
Camissonia walkeri	<0%		<1%		<0%		<1%		<1%	
Cercis occidentalis	<0%		<1%		<0%		<0%		<0%	
Cryptantha spp.	<1%		<0%		<1%		<0%		<1%	
Dasyochloa pulchella	<0%		<0%		<0%		<1%		<0%	
Datura wrightii	<0%		<0%		<0%		<1%		1-5%	
Descurainia pinnata	<1%		<0%		<0%		<0%		<1%	
Draba cuneifolia	<0%		<1%		<1%		<1%		<1%	

Elymus elymoides	<1%	<0%	<0%	<0%	<0%
Ephedra fasciculata	1-5%	<0%	<0%	<0%	<0%
Erodium cicutarium	<0%	<0%	<0%	<1%	<0%
Galium stellatum	<0%	<0%	<0%	<1%	<0%
Gilia spp.	<1%	<1%	<1%	<1%	<1%
Gutierrezia sarothrae	<0%	<0%	<0%	<0%	<1%
Hedeoma nana	<0%	<0%	<0%	<0%	<1%
Isocoma acradenia	<0%	<0%	<1%	1-5%	1-5%
Lepidium lasiocarpum var. lasiocarpum	<0%	<0%	<1%	<1%	<1%
Lepidium spp.	<0%	<1%	<0%	<1%	<1%
Parietaria hespera	<1%	<1%	<0%	<1%	<0%
Penstemon pachyphyllus var. congestus	<0%	<0%	<1%	<0%	<0%
Phacelia glechomifolia	<0%	<0%	<1%	<0%	<0%
Plantago patagonica	<0%	<0%	<0%	<1%	<0%
Solidago spp.	<0%	<0%	<0%	<0%	<1%
Stanleya pinnata	<0%	<0%	<0%	<1%	<0%
Stephanomeria pauciflora	<1%	<0%	<0%	<1%	<1%
Thymophylla pentachaeta var. belenidium	<0%	<0%	<0%	<1%	<0%
Vulpia octoflora	<1%	<0%	<1%	<1%	<1%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Acacia greggii	3		15
35	Acacia greggii		4	8

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Acacia greggii	3		8
35	Acacia greggii	2	5	6

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.6	176	8.83	183	8.86	142	8.76	167
15	8.96	52	9.04	52	9.09	53	9.03	52
25	9.04	40	9.11	40	9.11	42	9.09	41
35	8.9	47	8.88	53	8.84	48	8.87	49
45	8.69	87	8.86	87	8.94	88	8.83	87

Park Area/Canyon: 140 Mile Canyon River mile: 140 L Project (Phase): Phase IIb

Transect Name: 140 Mile L 1 Transect Type: Tamarisk Control

Date: 5/10/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Kate Watters Reader: Lisa Hahn

Wind Speed: Air Temp (F): Cloud Cover:

Weather: Breezy, sunny, clear and ~ 90F

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	2
Boulder	20
Cobble	16
Gravel	10
Litter (duff)	19
Plant	1
Sand	17
Stone	15

Species	% Cover
Acacia greggii	19
Brickellia longifolia	6
Bromus rubens	2
Gutierrezia sarothrae	1
Stephanomeria pauciflora	1

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Boulder	19	15	16	5	32
Stone	8	6	16	11	33
Litter (duff)	19	3	3	5	3
Moss (ground)	1	0	0	0	0
Gravel	19	54	7	5	6
Cobble	8	15	16	23	15
Sand	3	6	34	11	7
Bedrock	19	0	0	36	0
Coarse woody debris	1	1	1	2	1
Bare Soil	1	1	7	2	3

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	50-75%	M	<1%	S+M	25-50%	S+M	50-75%	S+M	1-5%	S+P
Aloysia wrightii	<0%		<0%		<0%		<0%		<0%	
Artemisia ludoviciana	<1%		<0%		<0%		1-5%		<0%	
Aster spp.	<0%		<0%		<0%		<0%		<1%	
Brickellia longifolia	<0%		1-5%		1-5%		5-10%		10-25%	
Bromus rubens	1-5%		<0%		<1%		<1%		<1%	
Bromus tectorum	<0%		<0%		<0%		<1%		<0%	
Camissonia walkeri	<0%		<0%		<0%		<1%		<1%	
Cryptantha spp.	<0%		<0%		<0%		<0%		<1%	
Cryptobiotic soil	1-5%		<0%		<1%		<1%		<0%	

Datura wrightii	<0%	<0%	<0%	<1%	1-5%	
Ephedra fasciculata	<1%	<0%	<0%	<0%	<0%	
Eriogonum inflatum	<0%	<0%	<0%	<0%	<1%	
Erodium cicutarium	<0%	<0%	<0%	<0%	<1%	
Fraxinus anomala	<0%	<0%	<0%	<0%	<1%	S
Grass spp	<1%	<0%	<0%	<0%	<0%	
Gutierrezia sarothrae	<1%	<0%	<0%	<1%	<1%	
Hedeoma nana	<0%	<0%	<0%	<0%	<1%	
Isocoma acradenia	<0%	<0%	<0%	1-5%	1-5%	
Lepidium lasiocarpum var. lasiocarpum	<0%	<1%	<1%	<1%	<0%	
Lepidium spp.	<0%	<1%	<0%	<0%	<0%	
Maurandella antirrhiniflora	<0%	1-5%	<0%	<0%	<0%	
Muhlenbergia porteri	<0%	<0%	<0%	<0%	<1%	
Parietaria hespera	<0%	<1%	<1%	<1%	<1%	
Plantago patagonica	<0%	<0%	<0%	<1%	<0%	
Poa fendleriana	<1%	<0%	<0%	<0%	<1%	
Porophyllum gracile	<1%	<0%	<0%	<0%	<0%	
Sporobolus cryptandrus	<0%	<0%	<0%	<1%	<0%	
Stanleya pinnata	<0%	<0%	<1%	<0%	<0%	
Stephanomeria pauciflora	<1%	<0%	<0%	1-5%	1-5%	
Thymophylla pentachaeta var. belenidium	<0%	<0%	<0%	<1%	<0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Acacia greggii	2	2	2
35	Acacia greggii			

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Acacia greggii			
5	Bromus rubens	1		
35	Acacia greggii			
35	Isocoma acradenia	1		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.87	211	8.87	200	8.87	199	8.87	203
15	8.94	97	8.94	94	8.92	99	8.93	97
25	8.8	79	8.79	64	8.79	81	8.79	75
35	8.59	108	8.57	110	8.55	109	8.57	109

45	8.93	115	8.93	105	8.92	103	8.93	108

Park Area/Canyon: 140 Mile Canyon River mile: 140 L Project (Phase): Phase IIb

Transect Name: 140 Mile L 1 Transect Type: Tamarisk Control

Date: 5/14/2007 Revisit? ☑ Post-tamarisk removal

Recorder: Lori Makarick Reader: Steve Till

Wind Speed: Air Temp (F): Cloud Cover: 0

Weather: 0% clouds, 82 F, calm, very sunny

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	31
Cobble	6
Gravel	24
Litter (duff)	12
Sand	12
Stone	15

Species	% Cover
Acacia greggii	18
Brickellia longifolia	6
Bromus rubens	2
Elymus elymoides	1
Stephanomeria pauciflora	2

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Moss (ground)	2	0	0	0	0
Gravel	12	17	50	14	14
Basal Veg	1	1	1	1	1
Crypto	1	0	0	0	0
Cobble	10	18	14	14	16
Sand	7	11	23	20	20
Stone	12	20	6	29	15
Litter (duff)	10	1	2	4	10
Boulder	45	32	4	18	24

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	25-50%	S+M	25-50%	S	5-10%	S+M	10-25%	S+M	1-5%	S+P
Aloysia wrightii	<0%		<1%		<0%		<0%		<0%	
Artemisia ludoviciana	<1%		<0%		<0%		<1%		<0%	
Astragalus nuttallianus	<0%		<0%		<0%		<1%		<0%	
Brickellia longifolia	<0%		<1%		<0%		1-5%		5-10%	
Bromus rubens	<1%		<1%		<1%		<1%		<1%	
Bromus tectorum	<0%		<0%		<1%		<0%		<0%	
Camissonia spp.	<1%		<0%		<0%		<0%		<0%	
Camissonia walkeri	<0%		<1%		<0%		<1%		<1%	
Cercis occidentalis	<0%		<1%		<0%		<0%		<0%	
Cryptantha spp.	<1%		<0%		<1%		<0%		<1%	
Dasyochloa pulchella	<0%		<0%		<0%		<1%		<0%	
Datura wrightii	<0%		<0%		<0%		<1%		1-5%	
Descurainia pinnata	<1%		<0%		<0%		<0%		<1%	
Draba cuneifolia	<0%		<1%		<1%		<1%		<1%	

Elymus elymoides	<1%	<0%	<0%	<0%	<0%
Ephedra fasciculata	1-5%	<0%	<0%	<0%	<0%
Erodium cicutarium	<0%	<0%	<0%	<1%	<0%
Galium stellatum	<0%	<0%	<0%	<1%	<0%
Gilia spp.	<1%	<1%	<1%	<1%	<1%
Gutierrezia sarothrae	<0%	<0%	<0%	<0%	<1%
Hedeoma nana	<0%	<0%	<0%	<0%	<1%
Isocoma acradenia	<0%	<0%	<1%	1-5%	1-5%
Lepidium lasiocarpum var. lasiocarpum	<0%	<0%	<1%	<1%	<1%
Lepidium spp.	<0%	<1%	<0%	<1%	<1%
Parietaria hespera	<1%	<1%	<0%	<1%	<0%
Penstemon pachyphyllus var. congestus	<0%	<0%	<1%	<0%	<0%
Phacelia glechomifolia	<0%	<0%	<1%	<0%	<0%
Plantago patagonica	<0%	<0%	<0%	<1%	<0%
Solidago spp.	<0%	<0%	<0%	<0%	<1%
Stanleya pinnata	<0%	<0%	<0%	<1%	<0%
Stephanomeria pauciflora	<1%	<0%	<0%	<1%	<1%
Thymophylla pentachaeta var. belenidium	<0%	<0%	<0%	<1%	<0%
Vulpia octoflora	<1%	<0%	<1%	<1%	<1%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Acacia greggii	3		15
35	Acacia greggii		4	8

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Acacia greggii	3		8
35	Acacia greggii	2	5	6

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.6	176	8.83	183	8.86	142	8.76	167
15	8.96	52	9.04	52	9.09	53	9.03	52
25	9.04	40	9.11	40	9.11	42	9.09	41
35	8.9	47	8.88	53	8.84	48	8.87	49
45	8.69	87	8.86	87	8.94	88	8.83	87

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 1 Transect Type: Tamarisk Area

	Start point		End point
Easting:	291497	Easting:	291461
Northing:	3982792	Northing:	3982831
GPS accuracy (m):	1.8	GPS accuracy (m):	3.6
Elevation (m):	457	Elevation (m):	459
Bearing:	317		
Aspect (0-360):	317	Slope (degrees):	1

Transect description: Start point is about 240m up canyon near the base of a 4m tall conglomerate ledge on creek right. Tape starts on a 2x2.5m slanted gray boulder near a small seep, right on the edge of the current drainage. The transect runs along creek right, crossing over a 3x2x1.5m reddish sandstone boulder at 45m. The end point is just past a whitish gray 1.5x1m boulder that is part of a piled area of boulders. Down canyon in the same bearing about 20m away is where a small ridge line comes into drainage with a 15m tall chocolately rock edge, a dip of the BA shale from above. This transect is located in a muav limestone outcropping within larger BA shale layer

Additional Info::

Geological layer: Muav limestone

Habitat type: Riparian Mojave desert scrub

Dominant species: Pluchea sericea (Nutt.) Coville, Tamarix ramosissima Ledeb.

Associated species: , Centaurium arizonicum, Cirsium neomexicanum Gray, Erigeron divergens Torr. & Gray, Krameria erecta Willd. ex J.A. Schultes, Melilotus officinalis (L.) Lam., Mirabilis bigelovii Gray, Oenothera caespitosa Nutt. ssp. marginata (Nutt. ex Hook. & Arn.) Munz, Pluchea sericea (Nutt.) Coville, Senna covesii (Gray) Irwin & Barneby, Sonchus oleraceus L., Stephanomeria pauciflora (Torr.) A. Nels., Tridens muticus (Torr.) Nash, Typha domingensis Pers.

Surface water within 25m? ☑ Surface water type: seep

Landform: Drainage channel Surface rocks: granite schist

Soil type: loamy sand Topo position: Interfluve

Light exposure: open Soil moisture: dry moist

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 1 Transect Type: Tamarisk Area

Date: 5/16/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Lori Makarick Reader: Amy Prince

Wind Speed: 1.0 Air Temp (F): 104.0 Cloud Cover: 25

Weather: Very light rain earlier, alternating completely calm with slight breeze to blisteringly hot.

Point Intercept Transect (50m)

Ground Cover	% Cover
Bare Soil	1
Boulder	7
Coarse woody debris	4
Cobble	3
Gravel	9
Litter (duff)	61
Sand	15

Species	% Cover
Acacia greggii	1
Encelia resinifera	1
Gutierrezia spp.	1
Isocoma acradenia	6
Melilotus officinalis	4
Pluchea sericea	18
Polypogon monspeliensis	3
Tamarix ramosissima	47

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Crypto	0	1	0	3	3
Gravel	23	40	38	55	3
Boulder	4	3	8	7	33
Litter (duff)	49	19	38	16	36
Coarse woody debris	1	0	0	0	7
Cobble	10	19	8	7	3
Woody debris structure	0	0	0	0	3
Stone	10	8	3	3	3
Sand	4	8	6	10	10

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<0%		<1%	S	1-5%	S+P	<0%		1-5%	P
Algae spp.	<0%		1-5%		<0%		<0%		<0%	
Aristida arizonica	<0%		<1%		<0%		<0%		<0%	
Artemisia dracunculus	<1%		<0%		<0%		<0%		<1%	
Baccharis emoryi	1-5%		<1%		<0%		1-5%		<1%	
Baccharis sarothroides	1-5%		<0%		<0%		<0%		<0%	
Bebbia juncea var. aspera	5-10%		5-10%		1-5%		<0%		<0%	
Brickellia longifolia	<1%		<0%		<0%		<0%		<1%	
Bromus rubens	<1%		<1%		<1%		<1%		<1%	
Camissonia walkeri	<1%		<0%		<0%		<0%		<0%	
Encelia farinosa	<1%		<1%		<1%		<1%		<1%	
Erigeron divergens	<1%		<0%		<0%		<0%		<0%	
Gutierrezia spp.	<0%		<1%		<0%		<1%		1-5%	

Isocoma acradenia	<1%		<1%		<1%		1-5%		<1%	
Juncus spp.	<0%		<0%		<1%		<0%		<0%	
Melilotus officinalis	1-5%		1-5%		<0%		<0%		<0%	
Oenothera caespitosa	<1%		<0%		<1%		<0%		<1%	
Pluchea sericea	10-25%		10-25%		5-10%		1-5%		5-10%	
Polypogon monspeliensis	<1%		1-5%		1-5%		<1%		<1%	
Polypogon viridis	<1%		<1%		<1%		<1%		<0%	
Porophyllum gracile	<0%		<0%		<0%		<1%		<0%	
Sonchus asper	<1%		<1%		<1%		<0%		<0%	
Sporobolus cryptandrus	<0%		<1%		<1%		<1%		1-5%	
Tamarix ramosissima	10-25%	S+M	5-10%	S+P	10-25%	S+P	10-25%	S+P	25-50%	S+M
Typha domingensis	<0%		<0%		<1%		<0%		<0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
25	Tamarix ramosissima	11	12	
35	Baccharis emoryi	1		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Tamarix ramosissima	3	1	
25	Polypogon monspeliensis	2		
25	Tamarix ramosissima	4	10	1
25	Vacant Space	4		
35	Baccharis emoryi	1		
35	Pluchea sericea	5		
35	Polypogon monspeliensis	2		
35	Tamarix ramosissima	4		
35	Vacant Space	3		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.83	745	8.83	736	8.81	773	8.82	751
15	8.63	1613	8.66	1603	8.68	1570	8.66	1595
25	8.78	1614	8.8	1645	8.79	1687	8.79	1649
35	8.91	1751	8.9	1697	8.9	1696	8.90	1715
45	9.1	374	9.03	376	9.04	383	9.06	378

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 1 Transect Type: Tamarisk Area

Date: 5/20/2007 Revisit? ☑ Post-tamarisk removal

Recorder: Amy Prince Reader: Kate Watters

Wind Speed: Air Temp (F): Cloud Cover: 0

Weather: No clouds, absolutely no cover from the scorchingly hot sun and not even the slightest breeze to stir up this stagnant air.

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	5
Boulder	12
Coarse woody debris	2
Cobble	6
Gravel	35
Litter (duff)	7
Plant	5
Sand	22
Stone	6

Species	% Cover
Baccharis salicifolia	3
Bothriochloa saccharoides	1
Forb spp	6
Mimulus guttatus	2
Pluchea sericea	9
Sporobolus cryptandrus	2
Tamarix ramosissima	8

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Woody debris structure	0	0	0	0	2
Litter (duff)	8	6	9	16	16
Woody debris structure	0	0	0	0	2
Coarse woody debris	1	1	1	1	5
Cobble	23	17	15	9	3
Basal Veg	1	1	1	1	1
Boulder	10	4	14	23	25
Stone	14	12	13	17	9
Sand	12	20	9	13	36
Gravel	31	39	37	29	3

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<0%		<0%		<1%		<0%		<1%	
Allionia incarnata	<0%		<1%		<0%		<0%		<0%	
Aristida adscensionis	<0%		<0%		<0%		<1%		<0%	
Aristida purpurea	<0%		<1%		<0%		<0%		<1%	
Artemisia ludoviciana	<1%		<0%		<0%		<0%		<0%	
Baccharis salicifolia	<0%		<1%		<0%		<1%		<1%	
Baccharis sarothroides	<1%		<0%		<0%		<1%		<0%	
Bebbia juncea var. aspera	<0%		<1%		<1%		<0%		<1%	

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 1 Transect Type: Tamarisk Area

Bothriochloa barbinodis	<0%		<0%		<1%		<0%		<0%	
Brickellia longifolia	<0%		<0%		<0%		<0%		<1%	
Bromus rubens	<0%		<1%		<1%		<0%		<1%	
Bromus tectorum	<0%		<0%		<0%		<0%		<1%	
Conyza canadensis	<1%		<0%		<0%		<0%		<1%	
Cryptantha spp.	<0%		<1%		<0%		<0%		<0%	
Datura wrightii	<0%		<0%		<1%		<0%		<0%	
Encelia farinosa	<1%		<0%		<0%		<0%		<1%	
Forb spp	<1%		<1%		<1%		<1%		<0%	
Isocoma acradenia	<1%		<0%		<1%		1-5%		<1%	
Lepidium fremontii	<1%		<0%		<0%		<0%		<0%	
Melilotus officinalis	<0%		<0%		<1%		<1%		<0%	
Oenothera caespitosa	<0%		<0%		<0%		<0%		<1%	
Pluchea sericea	<1%		1-5%		1-5%		5-10%		5-10%	
Polypogon monspeliensis	<1%		<1%		<1%		1-5%		<1%	
Polypogon viridis	<1%		<0%		<1%		<0%		<0%	
Prosopis glandulosa	<0%		<0%		<1%		<0%		<0%	
Sonchus asper	<0%		<1%		<0%		<0%		<0%	
Sporobolus contractus	<0%		<0%		<1%		<0%		<0%	
Sporobolus cryptandrus	<1%		<1%		<1%		<1%		<1%	
Sporobolus flexuosus	<1%		<1%		<0%		<0%		<0%	
Tamarix ramosissima	1-5%	S	<1%	S	<1%	S	<1%	S	<1%	M
Typha domingensis	<0%		<0%		<1%		<0%		<0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Tamarix ramosissima	3		
35	Pluchea sericea	2		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Tamarix ramosissima	6		
15	Forb spp	1		
15	Sporobolus cryptandrus	1		
15	Tamarix ramosissima	1		
15	Vacant Space	7		
35	Pluchea sericea	5		

Soil Data

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 1 Transect Type: Tamarisk Area

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	7.89	3999	7.9	3999	7.93	3999	7.91	3999
15	8.42	883	8.42	854	8.44	849	8.43	862
25	8.67	1740	8.68	1689	8.72	1654	8.69	1694
35	8.53	3999	8.56	3999	8.59	3999	8.56	3999
45	8.76	3999	8.78	3999	8.79	3999	8.78	3999

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 1 Transect Type: Tamarisk Area

Date: 5/16/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Lori Makarick Reader: Amy Prince

Wind Speed: 1.0 Air Temp (F): 104.0 Cloud Cover: 25

Weather: Very light rain earlier, alternating completely calm with slight breeze to blisteringly hot.

Point Intercept Transect (50m)

Ground Cover	% Cover
Bare Soil	1
Boulder	7
Coarse woody debris	4
Cobble	3
Gravel	9
Litter (duff)	61
Sand	15

Species	% Cover
Acacia greggii	1
Encelia resinifera	1
Gutierrezia spp.	1
Isocoma acradenia	6
Melilotus officinalis	4
Pluchea sericea	18
Polypogon monspeliensis	3
Tamarix ramosissima	47

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Crypto	0	1	0	3	3
Gravel	23	40	38	55	3
Boulder	4	3	8	7	33
Litter (duff)	49	19	38	16	36
Coarse woody debris	1	0	0	0	7
Cobble	10	19	8	7	3
Woody debris structure	0	0	0	0	3
Stone	10	8	3	3	3
Sand	4	8	6	10	10

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<0%		<1%	S	1-5%	S+P	<0%		1-5%	P
Algae spp.	<0%		1-5%		<0%		<0%		<0%	
Aristida arizonica	<0%		<1%		<0%		<0%		<0%	
Artemisia dracunculus	<1%		<0%		<0%		<0%		<1%	
Baccharis emoryi	1-5%		<1%		<0%		1-5%		<1%	
Baccharis sarothroides	1-5%		<0%		<0%		<0%		<0%	
Bebbia juncea var. aspera	5-10%		5-10%		1-5%		<0%		<0%	
Brickellia longifolia	<1%		<0%		<0%		<0%		<1%	
Bromus rubens	<1%		<1%		<1%		<1%		<1%	
Camissonia walkeri	<1%		<0%		<0%		<0%		<0%	
Encelia farinosa	<1%		<1%		<1%		<1%		<1%	
Erigeron divergens	<1%		<0%		<0%		<0%		<0%	
Gutierrezia spp.	<0%		<1%		<0%		<1%		1-5%	

Isocoma acradenia	<1%		<1%		<1%		1-5%		<1%	
Juncus spp.	<0%		<0%		<1%		<0%		<0%	
Melilotus officinalis	1-5%		1-5%		<0%		<0%		<0%	
Oenothera caespitosa	<1%		<0%		<1%		<0%		<1%	
Pluchea sericea	10-25%		10-25%		5-10%		1-5%		5-10%	
Polypogon monspeliensis	<1%		1-5%		1-5%		<1%		<1%	
Polypogon viridis	<1%		<1%		<1%		<1%		<0%	
Porophyllum gracile	<0%		<0%		<0%		<1%		<0%	
Sonchus asper	<1%		<1%		<1%		<0%		<0%	
Sporobolus cryptandrus	<0%		<1%		<1%		<1%		1-5%	
Tamarix ramosissima	10-25%	S+M	5-10%	S+P	10-25%	S+P	10-25%	S+P	25-50%	S+M
Typha domingensis	<0%		<0%		<1%		<0%		<0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
25	Tamarix ramosissima	11	12	
35	Baccharis emoryi	1		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Tamarix ramosissima	3	1	
25	Polypogon monspeliensis	2		
25	Tamarix ramosissima	4	10	1
25	Vacant Space	4		
35	Baccharis emoryi	1		
35	Pluchea sericea	5		
35	Polypogon monspeliensis	2		
35	Tamarix ramosissima	4		
35	Vacant Space	3		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.83	745	8.83	736	8.81	773	8.82	751
15	8.63	1613	8.66	1603	8.68	1570	8.66	1595
25	8.78	1614	8.8	1645	8.79	1687	8.79	1649
35	8.91	1751	8.9	1697	8.9	1696	8.90	1715
45	9.1	374	9.03	376	9.04	383	9.06	378

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 1 Transect Type: Tamarisk Area

Date: 5/20/2007 Revisit? ☑ Post-tamarisk removal

Recorder: Amy Prince Reader: Kate Watters

Wind Speed: Air Temp (F): Cloud Cover: 0

Weather: No clouds, absolutely no cover from the scorchingly hot sun and not even the slightest breeze to stir up this stagnant air.

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	5
Boulder	12
Coarse woody debris	2
Cobble	6
Gravel	35
Litter (duff)	7
Plant	5
Sand	22
Stone	6

Species	% Cover
Baccharis salicifolia	3
Bothriochloa saccharoides	1
Forb spp	6
Mimulus guttatus	2
Pluchea sericea	9
Sporobolus cryptandrus	2
Tamarix ramosissima	8

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Woody debris structure	0	0	0	0	2
Litter (duff)	8	6	9	16	16
Woody debris structure	0	0	0	0	2
Coarse woody debris	1	1	1	1	5
Cobble	23	17	15	9	3
Basal Veg	1	1	1	1	1
Boulder	10	4	14	23	25
Stone	14	12	13	17	9
Sand	12	20	9	13	36
Gravel	31	39	37	29	3

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<0%		<0%		<1%		<0%		<1%	
Allionia incarnata	<0%		<1%		<0%		<0%		<0%	
Aristida adscensionis	<0%		<0%		<0%		<1%		<0%	
Aristida purpurea	<0%		<1%		<0%		<0%		<1%	
Artemisia ludoviciana	<1%		<0%		<0%		<0%		<0%	
Baccharis salicifolia	<0%		<1%		<0%		<1%		<1%	
Baccharis sarothroides	<1%		<0%		<0%		<1%		<0%	
Bebbia juncea var. aspera	<0%		<1%		<1%		<0%		<1%	

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 1 Transect Type: Tamarisk Area

Bothriochloa barbinodis	<0%		<0%		<1%		<0%		<0%	
Brickellia longifolia	<0%		<0%		<0%		<0%		<1%	
Bromus rubens	<0%		<1%		<1%		<0%		<1%	
Bromus tectorum	<0%		<0%		<0%		<0%		<1%	
Conyza canadensis	<1%		<0%		<0%		<0%		<1%	
Cryptantha spp.	<0%		<1%		<0%		<0%		<0%	
Datura wrightii	<0%		<0%		<1%		<0%		<0%	
Encelia farinosa	<1%		<0%		<0%		<0%		<1%	
Forb spp	<1%		<1%		<1%		<1%		<0%	
Isocoma acradenia	<1%		<0%		<1%		1-5%		<1%	
Lepidium fremontii	<1%		<0%		<0%		<0%		<0%	
Melilotus officinalis	<0%		<0%		<1%		<1%		<0%	
Oenothera caespitosa	<0%		<0%		<0%		<0%		<1%	
Pluchea sericea	<1%		1-5%		1-5%		5-10%		5-10%	
Polypogon monspeliensis	<1%		<1%		<1%		1-5%		<1%	
Polypogon viridis	<1%		<0%		<1%		<0%		<0%	
Prosopis glandulosa	<0%		<0%		<1%		<0%		<0%	
Sonchus asper	<0%		<1%		<0%		<0%		<0%	
Sporobolus contractus	<0%		<0%		<1%		<0%		<0%	
Sporobolus cryptandrus	<1%		<1%		<1%		<1%		<1%	
Sporobolus flexuosus	<1%		<1%		<0%		<0%		<0%	
Tamarix ramosissima	1-5%	S	<1%	S	<1%	S	<1%	S	<1%	M
Typha domingensis	<0%		<0%		<1%		<0%		<0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Tamarix ramosissima	3		
35	Pluchea sericea	2		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Tamarix ramosissima	6		
15	Forb spp	1		
15	Sporobolus cryptandrus	1		
15	Tamarix ramosissima	1		
15	Vacant Space	7		
35	Pluchea sericea	5		

Soil Data

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 1 Transect Type: Tamarisk Area

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	7.89	3999	7.9	3999	7.93	3999	7.91	3999
15	8.42	883	8.42	854	8.44	849	8.43	862
25	8.67	1740	8.68	1689	8.72	1654	8.69	1694
35	8.53	3999	8.56	3999	8.59	3999	8.56	3999
45	8.76	3999	8.78	3999	8.79	3999	8.78	3999

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 1 Transect Type: Tamarisk Control

	Start point		End point
Easting:	291500	Easting:	291490
Northing:	3982728	Northing:	3982776
GPS accuracy (m):	1.5	GPS accuracy (m):	2.8
Elevation (m):	461	Elevation (m):	456
Bearing:	345		
Aspect (0-360):	358	Slope (degrees):	4

Transect description: T1B is about 40m upstream of T1A. Transect start is on the lip of a 1m high reddish-brown sandstone bedrock pourover in the center of the drainage. River is about 600m downcanyon. Tape runs cobble field on creek left and passes slightly to the right, or north side of a mesquite thicket. It crosses over the edge of an ISOACR, directly over a lone LARTRI and ends up in the middle of an ENCFAR, 2m south of a dead TAMRAM

Additional Info::

Geological layer: Red-brown GC Supergroup sandstone

Habitat type: Mojave desert scrub Riparian

Dominant species: Bebbia juncea (Benth.) Greene var. aspera Greene, Bromus rubens L., Cryptobiotic soil, Encelia farinosa Gray ex Torr., Isocoma acradenia (Greene) Greene, Sporobolus cryptandrus (Torr.) Gray, Thymophylla pentachaeta (DC.) Small var. belenidium (DC.) Strother

Associated species: Ambrosia dumosa (Gray) Payne, Baccharis salicifolia (Ruiz & Pavón) Pers., Datura wrightii Regel, Fouquieria splendens Engelm., Funastrum cynanchoides (Dcne.) Schlechter, Gutierrezia sarothrae (Pursh) Britt. & Rusby, Lycium spp., Opuntia engelmannii Salm-Dyck var. engelmannii, Opuntia whipplei Engelm. & Bigelow, Parietaria hespera Hinton, Pluchea sericea (Nutt.) Coville, Polypogon monspeliensis (L.) Desf., Senna covesii (Gray) Irwin & Barneby, Sonchus asper (L.) Hill, Tiquilia canescens (DC.) A. Richards., Tridens muticus (Torr.) Nash, Typha domingensis Pers.

Surface water within 25m? ☐ Surface water type:

Landform: Drainage channel Surface rocks: sandstone shale

Soil type: sand Topo position: Interfluve

Light exposure: open Soil moisture: dry

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 1 Transect Type: Tamarisk Control

Date: 5/16/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Kate Watters Reader: Lisa Hahn

Wind Speed: 2.0 Air Temp (F): 95.0 Cloud Cover: 30

Weather: Storm coulds begin to break just as we begin our transect, it is very hot; 90-95F. Very humid and stagnant air.

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	2
Coarse woody debris	1
Cobble	11
Gravel	15
Litter (duff)	50
Sand	2
Stone	9

Species	% Cover
Baccharis sarothroides	1
Bebbia juncea var. aspera	4
Bromus rubens	1
Cryptobiotic soil	13
Encelia farinosa	8
Isocoma acradenia	12
Larrea tridentata	6
Pluchea sericea	1
Polypogon viridis	1
Sporobolus cryptandrus	5
Stephanomeria pauciflora	2

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Coarse woody debris	3	1	3	7	4
Woody debris structure	1	0	0	0	0
Crypto	1	3	12	15	15
Litter (duff)	8	20	72	14	60
Gravel	18	22	4	14	4
Moss (ground)	0	0	0	3	1
Sand	7	9	3	3	4
Cobble	36	21	4	44	4
Stone	18	20	1	0	4
Boulder	8	4	1	0	4

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<0%		1-5%	P	<0%		<0%		1-5%	S+M
Allionia incarnata	1-5%		<1%		<1%		<0%		<0%	
Aristida adscensionis	<0%		<1%		<0%		<0%		<0%	
Aristida purpurea	1-5%		<1%		<0%		<1%		1-5%	
Aster spp.	<0%		<1%		<0%		<0%		<0%	
Baccharis sarothroides	<0%		<0%		<0%		<1%		<0%	
Bebbia juncea var. aspera	1-5%		5-10%		<0%		1-5%		1-5%	

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 1 Transect Type: Tamarisk Control

Bromus rubens	1-5%		1-5%		1-5%		<1%		1-5%
Camissonia walkeri	<0%		<1%		<1%		<1%		<0%
Dasyochloa pulchella	<1%		<0%		<0%		<0%		<1%
Encelia farinosa	1-5%		<1%		1-5%		5-10%		5-10%
Erigeron divergens	<1%		<0%		<0%		<0%		<0%
Isocoma acradenia	5-10%		1-5%		5-10%		10-25%		5-10%
Larrea tridentata	<0%		<0%		<0%		<1%		<0%
Oenothera caespitosa	<0%		<0%		<0%		<1%		<0%
Opuntia engelmannii var. engelmannii	<0%		<0%		1-5%		<1%		1-5%
Polypogon monspeliensis	<1%		<0%		<0%		<0%		<0%
Prosopis glandulosa	<0%		10-25%	M	<0%		<0%		<0%
Silene antirrhina	<1%		<0%		<0%		<0%		<0%
Sporobolus cryptandrus	1-5%		<1%		1-5%		1-5%		5-10%
Sporobolus flexuosus	<0%		1-5%		<0%		<0%		<1%
Stephanomeria pauciflora	<0%		<1%		<1%		<0%		<0%
Tamarix ramosissima	5-10%	S+P+M	<0%		1-5%	M	1-5%	P	<0%
Thymophylla pentachaeta	<0%		<1%		<1%		1-5%		<1%
Tiquilia canescens	<0%		<1%		<0%		<0%		<0%
Viguiera parishii	5-10%		<0%		<0%		<0%		<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Bromus rubens	4		
45	Isocoma acradenia	1		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Bromus rubens	1		
35	Isocoma acradenia		2	
45	Isocoma acradenia	3		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.3	3931	8.25	3805	8.27	3788	8.27	3841
15	8.44	288	8.35	300	8.33	302	8.37	297
25	8.65	69	8.62	76	8.62	128	8.63	91
35	8.04	2629	8.17	2087	8.24	1978	8.15	2231
45	8.45	253	8.43	263	8.46	270	8.45	262

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 1 Transect Type: Tamarisk Control

Date: 5/20/2007 Revisit? ☑ Post-tamarisk removal

Recorder: Lisa Hahn Reader: Steve Till

Wind Speed: 2.0 Air Temp (F): 95.0 Cloud Cover: 0

Weather: warming up nicely.

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	1
Boulder	2
Cobble	4
Gravel	11
Litter (duff)	34
Sand	43
Stone	5

Species	% Cover
Acacia greggii	1
Bebbia juncea var. aspera	2
Encelia farinosa	7
Ericameria paniculata	1
Isocoma acradenia	15
Larrea tridentata	3
Sporobolus contractus	4
Sporobolus cryptandrus	2

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Coarse woody debris	2	1	1	1	0
Bedrock	0	0	0	0	0
Boulder	6	1	0	0	1
Gravel	15	20	1	3	3
Sand	20	24	57	43	55
Cobble	25	35	1	3	2
Stone	10	10	1	0	2
Basal Veg	1	1	1	2	2
Litter (duff)	20	8	37	42	30
Woody debris structure	1	0	0	0	0
Crypto	0	0	1	1	5

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<0%		<1%	S	<0%		<1%	M	1-5%	S+M
Allionia incarnata	1-5%		1-5%		<1%		<0%		<0%	
Aristida purpurea	<0%		<0%		<0%		<0%		1-5%	
Bebbia juncea var. aspera	<1%		<0%		<0%		1-5%		1-5%	
Bromus rubens	<0%		<0%		<0%		<1%		<1%	
Cirsium arizonicum	<1%		<0%		<0%		<0%		<0%	
Dasyochloa pulchella	<0%		<0%		<0%		<0%		<1%	
Encelia farinosa	<0%		<0%		1-5%		1-5%		1-5%	
Erodium cicutarium	<1%		<0%		<0%		<0%		<0%	
Gutierrezia sarothrae	<0%		<0%		<0%		<0%		<1%	
Isocoma acradenia	<1%		1-5%		5-10%		10-25%		5-10%	

Larrea tridentata	<0%		<0%		<0%		1-5%	<0%
Lepidium fremontii	<1%		<0%		<0%		<0%	<0%
Muhlenbergia porteri	<1%		<0%		<0%		<0%	<0%
Oenothera caespitosa	<0%		<0%		<0%		<1%	<0%
Opuntia phaeacantha	<0%		<0%		<1%		<1%	<0%
Prosopis glandulosa	<0%		5-10%	M	<0%		<0%	<0%
Sporobolus contractus	<1%		<1%		1-5%		<1%	1-5%
Sporobolus cryptandrus	1-5%		<1%		<0%		<1%	<1%
Stephanomeria pauciflora	<0%		<0%		<0%		<1%	<0%
Tamarix ramosissima	<1%	S	<0%		1-5%	P	<1%	P <0%
Thymophylla pentachaeta	<0%		<0%		<0%		<1%	<0%
Verbesina encelioides	1-5%		<0%		<0%		<0%	<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
25	Sporobolus contractus	1		
35	Encelia farinosa	4		
45	Sporobolus cryptandrus	8		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
25	Sporobolus contractus	4		
35	Encelia farinosa	6		
35	Isocoma acradenia	2		
35	Vacant Space	2		
45	Isocoma acradenia	2		
45	Sporobolus contractus	1		
45	Sporobolus cryptandrus	3		
45	Vacant Space	6		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.32	127	8.49	99	8.58	97	8.46	108
15	8.41	105	8.4	106	8.36	94	8.39	102
25	8.36	97	8.34	101	8.33	104	8.34	101
35	8.73	122	8.78	116	8.78	111	8.76	116
45	7.84	7956	7.82	806	7.79	814	7.82	3192

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 1 Transect Type: Tamarisk Control

Date: 5/16/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Kate Watters Reader: Lisa Hahn

Wind Speed: 2.0 Air Temp (F): 95.0 Cloud Cover: 30

Weather: Storm coulds begin to break just as we begin our transect, it is very hot; 90-95F. Very humid and stagnant air.

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	2
Coarse woody debris	1
Cobble	11
Gravel	15
Litter (duff)	50
Sand	2
Stone	9

Species	% Cover
Baccharis sarothroides	1
Bebbia juncea var. aspera	4
Bromus rubens	1
Cryptobiotic soil	13
Encelia farinosa	8
Isocoma acradenia	12
Larrea tridentata	6
Pluchea sericea	1
Polypogon viridis	1
Sporobolus cryptandrus	5
Stephanomeria pauciflora	2

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Coarse woody debris	3	1	3	7	4
Woody debris structure	1	0	0	0	0
Crypto	1	3	12	15	15
Litter (duff)	8	20	72	14	60
Gravel	18	22	4	14	4
Moss (ground)	0	0	0	3	1
Sand	7	9	3	3	4
Cobble	36	21	4	44	4
Stone	18	20	1	0	4
Boulder	8	4	1	0	4

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<0%		1-5%	P	<0%		<0%		1-5%	S+M
Allionia incarnata	1-5%		<1%		<1%		<0%		<0%	
Aristida adscensionis	<0%		<1%		<0%		<0%		<0%	
Aristida purpurea	1-5%		<1%		<0%		<1%		1-5%	
Aster spp.	<0%		<1%		<0%		<0%		<0%	
Baccharis sarothroides	<0%		<0%		<0%		<1%		<0%	
Bebbia juncea var. aspera	1-5%		5-10%		<0%		1-5%		1-5%	

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 1 Transect Type: Tamarisk Control

Bromus rubens	1-5%		1-5%		1-5%		<1%		1-5%
Camissonia walkeri	<0%		<1%		<1%		<1%		<0%
Dasyochloa pulchella	<1%		<0%		<0%		<0%		<1%
Encelia farinosa	1-5%		<1%		1-5%		5-10%		5-10%
Erigeron divergens	<1%		<0%		<0%		<0%		<0%
Isocoma acradenia	5-10%		1-5%		5-10%		10-25%		5-10%
Larrea tridentata	<0%		<0%		<0%		<1%		<0%
Oenothera caespitosa	<0%		<0%		<0%		<1%		<0%
Opuntia engelmannii var. engelmannii	<0%		<0%		1-5%		<1%		1-5%
Polypogon monspeliensis	<1%		<0%		<0%		<0%		<0%
Prosopis glandulosa	<0%		10-25%	M	<0%		<0%		<0%
Silene antirrhina	<1%		<0%		<0%		<0%		<0%
Sporobolus cryptandrus	1-5%		<1%		1-5%		1-5%		5-10%
Sporobolus flexuosus	<0%		1-5%		<0%		<0%		<1%
Stephanomeria pauciflora	<0%		<1%		<1%		<0%		<0%
Tamarix ramosissima	5-10%	S+P+M	<0%		1-5%	M	1-5%	P	<0%
Thymophylla pentachaeta	<0%		<1%		<1%		1-5%		<1%
Tiquilia canescens	<0%		<1%		<0%		<0%		<0%
Viguiera parishii	5-10%		<0%		<0%		<0%		<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Bromus rubens	4		
45	Isocoma acradenia	1		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Bromus rubens	1		
35	Isocoma acradenia		2	
45	Isocoma acradenia	3		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.3	3931	8.25	3805	8.27	3788	8.27	3841
15	8.44	288	8.35	300	8.33	302	8.37	297
25	8.65	69	8.62	76	8.62	128	8.63	91
35	8.04	2629	8.17	2087	8.24	1978	8.15	2231
45	8.45	253	8.43	263	8.46	270	8.45	262

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 1 Transect Type: Tamarisk Control

Date: 5/20/2007 Revisit? ☑ Post-tamarisk removal

Recorder: Lisa Hahn Reader: Steve Till

Wind Speed: 2.0 Air Temp (F): 95.0 Cloud Cover: 0

Weather: warming up nicely.

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	1
Boulder	2
Cobble	4
Gravel	11
Litter (duff)	34
Sand	43
Stone	5

Species	% Cover
Acacia greggii	1
Bebbia juncea var. aspera	2
Encelia farinosa	7
Ericameria paniculata	1
Isocoma acradenia	15
Larrea tridentata	3
Sporobolus contractus	4
Sporobolus cryptandrus	2

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Coarse woody debris	2	1	1	1	0
Bedrock	0	0	0	0	0
Boulder	6	1	0	0	1
Gravel	15	20	1	3	3
Sand	20	24	57	43	55
Cobble	25	35	1	3	2
Stone	10	10	1	0	2
Basal Veg	1	1	1	2	2
Litter (duff)	20	8	37	42	30
Woody debris structure	1	0	0	0	0
Crypto	0	0	1	1	5

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<0%		<1%	S	<0%		<1%	M	1-5%	S+M
Allionia incarnata	1-5%		1-5%		<1%		<0%		<0%	
Aristida purpurea	<0%		<0%		<0%		<0%		1-5%	
Bebbia juncea var. aspera	<1%		<0%		<0%		1-5%		1-5%	
Bromus rubens	<0%		<0%		<0%		<1%		<1%	
Cirsium arizonicum	<1%		<0%		<0%		<0%		<0%	
Dasyochloa pulchella	<0%		<0%		<0%		<0%		<1%	
Encelia farinosa	<0%		<0%		1-5%		1-5%		1-5%	
Erodium cicutarium	<1%		<0%		<0%		<0%		<0%	
Gutierrezia sarothrae	<0%		<0%		<0%		<0%		<1%	
Isocoma acradenia	<1%		1-5%		5-10%		10-25%		5-10%	

Larrea tridentata	<0%		<0%		<0%		1-5%	<0%
Lepidium fremontii	<1%		<0%		<0%		<0%	<0%
Muhlenbergia porteri	<1%		<0%		<0%		<0%	<0%
Oenothera caespitosa	<0%		<0%		<0%		<1%	<0%
Opuntia phaeacantha	<0%		<0%		<1%		<1%	<0%
Prosopis glandulosa	<0%		5-10%	M	<0%		<0%	<0%
Sporobolus contractus	<1%		<1%		1-5%		<1%	1-5%
Sporobolus cryptandrus	1-5%		<1%		<0%		<1%	<1%
Stephanomeria pauciflora	<0%		<0%		<0%		<1%	<0%
Tamarix ramosissima	<1%	S	<0%		1-5%	P	<1%	P <0%
Thymophylla pentachaeta	<0%		<0%		<0%		<1%	<0%
Verbesina encelioides	1-5%		<0%		<0%		<0%	<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
25	Sporobolus contractus	1		
35	Encelia farinosa	4		
45	Sporobolus cryptandrus	8		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
25	Sporobolus contractus	4		
35	Encelia farinosa	6		
35	Isocoma acradenia	2		
35	Vacant Space	2		
45	Isocoma acradenia	2		
45	Sporobolus contractus	1		
45	Sporobolus cryptandrus	3		
45	Vacant Space	6		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.32	127	8.49	99	8.58	97	8.46	108
15	8.41	105	8.4	106	8.36	94	8.39	102
25	8.36	97	8.34	101	8.33	104	8.34	101
35	8.73	122	8.78	116	8.78	111	8.76	116
45	7.84	7956	7.82	806	7.79	814	7.82	3192

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 2 Transect Type: Tamarisk Area

	Start point		End point
Easting:	291597	Easting:	291566
Northing:	3982582	Northing:	3982617
GPS accuracy (m):	1.1	GPS accuracy (m):	1.9
Elevation (m):	467	Elevation (m):	466
Bearing:	315		
Aspect (0-360):	320	Slope (degrees):	2

Transect description: Transect is at the last tamarisk thicket just before a SW bend in the canyon and where the canyon starts to narrow. The start point is at the top of a huge pink granite intrusion at the base of the BA shale. The start is only about 4m from the creek bed on creek right. On creek left is a tall beautiful cottonwood tree. The end point is down canyon just past a nice large opuntia. Lisa Hahn was also a reader. There was also standing water in 2007.

Additional Info:: The tape bisected a large pond approximately 8m long by 3m wide and 0.6m deep. Water boatmen and tadpoles were seen in pond.

Geological layer: Zoroaster granite

Habitat type: Riparian

Dominant species: Baccharis salicifolia (Ruiz & Pavón) Pers., Baccharis sarothroides Gray, Pluchea sericea (Nutt.) Coville, Polypogon monspeliensis (L.) Desf., Tamarix ramosissima Ledeb., Typha domingensis Pers., Viguiera parishii Greene

Associated species: Allionia incarnata L., Artemisia ludoviciana Nutt., Baccharis sarothroides Gray, Bebbia juncea (Benth.) Greene var. aspera Greene, Centaurium calycosum (Buckl.) Fern., Dasyochloa pulchella (Kunth) Willd. ex Rydb., Encelia farinosa Gray ex Torr., Juncus torreyi Coville, Larrea tridentata (Sessé & Moc. ex DC.) Coville, Lepidium spp., Mammillaria grahamii Engelm. var. grahamii, Melilotus officinalis (L.) Lam., Oenothera caespitosa Nutt., Populus fremontii S. Wats., Porophyllum gracile Benth., Senna covesii (Gray) Irwin & Barneby, Sporobolus cryptandrus (Torr.) Gray, Thymophylla pentachaeta (DC.) Small, Thymophylla pentachaeta (DC.) Small var. belenidium (DC.) Strother

Surface water within 25m? ☑ Surface water type: stream

Landform: Drainage channel Surface rocks: granite

Soil type: loamy sand Topo position: Low Level

Light exposure: open partial-shade Soil moisture: dry moist

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 2 Transect Type: Tamarisk Area

Date: 5/16/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Mike Kearsley Reader: Kate Watters

Wind Speed: 0.0 Air Temp (F): 108.0 Cloud Cover: 25

Weather: HOT! Cloudy and humid with thunder from up canyon. Only 6 days left in the hell hole! Hot, stale, wind.

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	8
Coarse woody debris	1
Litter (duff)	81
Sand	2
Stone	2
Woody debris structure	4

Species	% Cover
Artemisia dracunculus	2
Baccharis salicifolia	11
Baccharis sergiloides	4
Bebbia juncea var. aspera	1
Bromus rubens	2
Chloracantha spinosa	2
Conyza canadensis	1
Cryptobiotic soil	1
Erigeron lobatus	1
Isocoma acradenia	10
Opuntia engelmannii var. engelmannii	10
Pluchea sericea	23
Polypogon monspeliensis	11
Polypogon viridis	4
Sporobolus cryptandrus	4
Tamarix ramosissima	41
Typha domingensis	4

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Moss (ground)	0	0	0	1	1
Bedrock	54	0	0	0	0
Cobble	1	2	1	4	1
Gravel	1	2	13	4	1
Coarse woody debris	1	2	5	10	6
Crypto	0	0	3	1	7
Woody debris structure	0	0	0	4	0
Sand	4	28	5	4	6
Litter (duff)	24	64	63	52	72
Boulder	11	0	5	4	6
Stone	4	2	5	10	6

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 2 Transect Type: Tamarisk Area

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S	<0%		<1%	S	1-5%	P	<1%	S
Artemisia dracunculus	<0%		1-5%		1-5%		<0%		<0%	
Artemisia ludoviciana	<1%		<1%		<1%		<1%		<1%	
Atriplex canescens	<0%		<0%		<0%		<0%		<1%	
Baccharis emoryi	<0%		<0%		<1%		<0%		1-5%	
Baccharis salicifolia	5-10%		5-10%		5-10%		<1%		<0%	
Baccharis sarothroides	<0%		<0%		1-5%		10-25%		10-25%	
Baccharis sergiloides	1-5%		1-5%		1-5%		<0%		<0%	
Bebbia juncea var. aspera	1-5%		<0%		<0%		<0%		<0%	
Brickellia longifolia	<0%		<1%		<0%		<0%		<0%	
Bromus rubens	<0%		<1%		<1%		<1%		1-5%	
Chloracantha spinosa	<1%		<0%		<0%		<0%		1-5%	
Cirsium neomexicanum	<1%		<0%		<0%		<0%		<0%	
Encelia farinosa	<0%		<1%		<0%		1-5%		<1%	
Erigeron lobatus	<0%		<1%		1-5%		<1%		<1%	
Glandularia gooddingii	<0%		<1%		<0%		<0%		<0%	
Heliomeris longifolia var. annua	<0%		<1%		<0%		<0%		<0%	
Isocoma acradenia	<0%		<0%		<0%		<0%		5-10%	
Juncus torreyi	<1%		<0%		<0%		<0%		<0%	
Maurandella antirrhiniflora	1-5%		<0%		<0%		<0%		<0%	
Oenothera caespitosa	1-5%		<1%		<1%		<1%		<0%	
Opuntia engelmannii var. engelmannii	<0%		<0%		<0%		<1%		5-10%	
Pluchea sericea	1-5%		5-10%		10-25%		<1%		<0%	
Polypogon monspeliensis	5-10%		5-10%		1-5%		<1%		<1%	
Polypogon viridis	<1%		<1%		<1%		<0%		<1%	
Sonchus asper	<0%		<1%		<0%		<0%		<0%	
Sporobolus cryptandrus	<0%		<0%		1-5%		1-5%		1-5%	
Sporobolus flexuosus	<0%		<0%		<0%		<0%		<1%	
Sporobolus giganteus	<1%		<0%		<0%		<0%		<0%	
Tamarix ramosissima	10-25%	S+P+M	10-25%	S+P+M	10-25%	S+P+M	10-25%	S+P+M	5-10%	S+P+M
Typha domingensis	1-5%		1-5%		<0%		<1%		<0%	
Viguiera parishii	1-5%		<0%		<1%		<0%		<0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Tamarix ramosissima	9		
15	Pluchea sericea	8		
15	Polypogon monspeliensis	4		

25	Tamarix ramosissima		2	8

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Tamarix ramosissima	4		
15	Baccharis salicifolia	2		
15	Pluchea sericea	8		
15	Polypogon monspeliensis	2		
15	Vacant Space	2		
25	Pluchea sericea	4	2	
25	Tamarix ramosissima		3	6
25	Vacant Space		5	
35	Tamarix ramosissima	2	3	

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.7	844	8.72	812	8.74	818	8.72	825
15	9.08	288	9.07	289	9.05	272	9.07	283
25	9.12	312	9.08	285	9.12	321	9.11	306
35	9.08	3999	9.14	3999	9.13	3999	9.12	3999
45	8.54	384	8.36	382	8.27	378	8.39	381

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 2 Transect Type: Tamarisk Area

Date: 5/20/2007 Revisit? ☑ Post-tamarisk removal

Recorder: Steve Till Reader: Lisa Hahn

Wind Speed: 2.0 Air Temp (F): 95.0 Cloud Cover: 0

Weather: Clear Blue sky, good thing it's early, it's going to be HOT!

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	8
Boulder	2
Coarse woody debris	3
Cobble	1
Gravel	4
Litter (duff)	52
Sand	27
Stone	3

Species	% Cover
Baccharis salicifolia	4
Encelia farinosa	1
Isocoma acradenia	4
Opuntia phaeacantha	4
Pluchea sericea	15
Sporobolus cryptandrus	6
Tamarix ramosissima	1
Typha domingensis	3

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Crypto	0	0	1	0	0
Woody debris structure	0	0	0	1	0
Basal Veg	1	1	1	1	2
Litter (duff)	7	13	50	49	70
Cobble	10	11	2	1	1
Boulder	8	6	6	5	0
Bedrock	20	20	0	0	0
Stone	9	14	8	2	0
Gravel	30	28	3	2	1
Coarse woody debris	1	0	4	9	10
Sand	14	12	25	30	16

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S	<0%		1-5%	S+P	1-5%	S+P	<1%	S
Allionia incarnata	<0%		<0%		<0%		<1%		<1%	
Aristida purpurea	<1%		<1%		<0%		<1%		<0%	
Baccharis salicifolia	1-5%		1-5%		1-5%		1-5%		<0%	
Baccharis sarothroides	1-5%		1-5%		1-5%		10-25%		10-25%	
Bebbia juncea var. aspera	<0%		<0%		<1%		<1%		<0%	
Bromus rubens	<1%		<1%		<0%		<0%		<0%	
Conyza canadensis	<1%		<1%		<1%		<0%		<0%	
Cryptantha spp.	<1%		<0%		<0%		<0%		<0%	

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 2 Transect Type: Tamarisk Area

Cylindropuntia Acanthocarpa	<0%		<0%		<0%		<0%	<1%
Encelia farinosa	<0%		<0%		<1%		<0%	<1%
Isocoma acradenia	<0%		<0%		1-5%		<0%	5-10%
Lepidium densiflorum	<1%		<0%		<0%		<0%	<1%
Lepidium fremontii	<1%		<0%		<0%		<0%	<0%
Maurandella antirrhiniflora	<1%		<0%		<0%		<0%	<0%
Melilotus officinalis	<0%		<0%		<1%		<0%	<0%
Nicotiana obtusifolia var. obtusifolia	<1%		<0%		<0%		<0%	<0%
Opuntia acanthocarpa	<0%		<0%		<0%		<0%	<1%
Opuntia engelmannii var. engelmannii	<0%		<0%		<0%		<0%	1-5%
Parietaria hespera	<1%		<1%		<0%		<0%	<0%
Plantago ovata	<0%		<1%		<0%		<0%	<0%
Pluchea sericea	<0%		1-5%		10-25%		1-5%	<0%
Polypogon monspeliensis	<1%		<1%		<1%		<0%	<0%
Polypogon viridis	<1%		1-5%		<0%		<0%	<0%
Schismus spp.	<1%		<0%		<0%		<0%	<0%
Sonchus asper	<0%		<1%		<1%		<0%	<0%
Sporobolus contractus	<1%		<0%		<0%		<0%	1-5%
Sporobolus cryptandrus	<0%		<0%		<1%		<1%	<1%
Tamarix ramosissima	1-5%	S+P	<1%	S	<1%	S+P	<1%	S+P <0%
Typha domingensis	<1%		1-5%		<0%		<0%	<0%
Viguiera parishii	1-5%		<0%		<0%		<0%	<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
15	Typha domingensis	7	1	
25	Pluchea sericea	8	8	

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
15	Typha domingensis	7	2	
25	Pluchea sericea	7	4	
45	Sporobolus contractus	3		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	6.86	578	7.12	559	7.26	564	7.08	567
15	8.09	3999	8.49	3999	8.64	3999	8.41	3999
25	8.06	976	8.06	1017	8.16	919	8.09	971
35	8.67	3999	8.69	3999	8.7	3999	8.69	3999

45	8.48	352	8.32	310	8.18	199	8.33	287

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 2 Transect Type: Tamarisk Area

Date: 5/16/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Mike Kearsley Reader: Kate Watters

Wind Speed: 0.0 Air Temp (F): 108.0 Cloud Cover: 25

Weather: HOT! Cloudy and humid with thunder from up canyon. Only 6 days left in the hell hole! Hot, stale, wind.

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	8
Coarse woody debris	1
Litter (duff)	81
Sand	2
Stone	2
Woody debris structure	4

Species	% Cover
Artemisia dracunculus	2
Baccharis salicifolia	11
Baccharis sergiloides	4
Bebbia juncea var. aspera	1
Bromus rubens	2
Chloracantha spinosa	2
Conyza canadensis	1
Cryptobiotic soil	1
Erigeron lobatus	1
Isocoma acradenia	10
Opuntia engelmannii var. engelmannii	10
Pluchea sericea	23
Polypogon monspeliensis	11
Polypogon viridis	4
Sporobolus cryptandrus	4
Tamarix ramosissima	41
Typha domingensis	4

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Moss (ground)	0	0	0	1	1
Bedrock	54	0	0	0	0
Cobble	1	2	1	4	1
Gravel	1	2	13	4	1
Coarse woody debris	1	2	5	10	6
Crypto	0	0	3	1	7
Woody debris structure	0	0	0	4	0
Sand	4	28	5	4	6
Litter (duff)	24	64	63	52	72
Boulder	11	0	5	4	6
Stone	4	2	5	10	6

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 2 Transect Type: Tamarisk Area

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S	<0%		<1%	S	1-5%	P	<1%	S
Artemisia dracunculus	<0%		1-5%		1-5%		<0%		<0%	
Artemisia ludoviciana	<1%		<1%		<1%		<1%		<1%	
Atriplex canescens	<0%		<0%		<0%		<0%		<1%	
Baccharis emoryi	<0%		<0%		<1%		<0%		1-5%	
Baccharis salicifolia	5-10%		5-10%		5-10%		<1%		<0%	
Baccharis sarothroides	<0%		<0%		1-5%		10-25%		10-25%	
Baccharis sergiloides	1-5%		1-5%		1-5%		<0%		<0%	
Bebbia juncea var. aspera	1-5%		<0%		<0%		<0%		<0%	
Brickellia longifolia	<0%		<1%		<0%		<0%		<0%	
Bromus rubens	<0%		<1%		<1%		<1%		1-5%	
Chloracantha spinosa	<1%		<0%		<0%		<0%		1-5%	
Cirsium neomexicanum	<1%		<0%		<0%		<0%		<0%	
Encelia farinosa	<0%		<1%		<0%		1-5%		<1%	
Erigeron lobatus	<0%		<1%		1-5%		<1%		<1%	
Glandularia gooddingii	<0%		<1%		<0%		<0%		<0%	
Heliomeris longifolia var. annua	<0%		<1%		<0%		<0%		<0%	
Isocoma acradenia	<0%		<0%		<0%		<0%		5-10%	
Juncus torreyi	<1%		<0%		<0%		<0%		<0%	
Maurandella antirrhiniflora	1-5%		<0%		<0%		<0%		<0%	
Oenothera caespitosa	1-5%		<1%		<1%		<1%		<0%	
Opuntia engelmannii var. engelmannii	<0%		<0%		<0%		<1%		5-10%	
Pluchea sericea	1-5%		5-10%		10-25%		<1%		<0%	
Polypogon monspeliensis	5-10%		5-10%		1-5%		<1%		<1%	
Polypogon viridis	<1%		<1%		<1%		<0%		<1%	
Sonchus asper	<0%		<1%		<0%		<0%		<0%	
Sporobolus cryptandrus	<0%		<0%		1-5%		1-5%		1-5%	
Sporobolus flexuosus	<0%		<0%		<0%		<0%		<1%	
Sporobolus giganteus	<1%		<0%		<0%		<0%		<0%	
Tamarix ramosissima	10-25%	S+P+M	10-25%	S+P+M	10-25%	S+P+M	10-25%	S+P+M	5-10%	S+P+M
Typha domingensis	1-5%		1-5%		<0%		<1%		<0%	
Viguiera parishii	1-5%		<0%		<1%		<0%		<0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Tamarix ramosissima	9		
15	Pluchea sericea	8		
15	Polypogon monspeliensis	4		

25	Tamarix ramosissima		2	8

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Tamarix ramosissima	4		
15	Baccharis salicifolia	2		
15	Pluchea sericea	8		
15	Polypogon monspeliensis	2		
15	Vacant Space	2		
25	Pluchea sericea	4	2	
25	Tamarix ramosissima		3	6
25	Vacant Space		5	
35	Tamarix ramosissima	2	3	

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.7	844	8.72	812	8.74	818	8.72	825
15	9.08	288	9.07	289	9.05	272	9.07	283
25	9.12	312	9.08	285	9.12	321	9.11	306
35	9.08	3999	9.14	3999	9.13	3999	9.12	3999
45	8.54	384	8.36	382	8.27	378	8.39	381

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 2 Transect Type: Tamarisk Area

Date: 5/20/2007 Revisit? ☑ Post-tamarisk removal

Recorder: Steve Till Reader: Lisa Hahn

Wind Speed: 2.0 Air Temp (F): 95.0 Cloud Cover: 0

Weather: Clear Blue sky, good thing it's early, it's going to be HOT!

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	8
Boulder	2
Coarse woody debris	3
Cobble	1
Gravel	4
Litter (duff)	52
Sand	27
Stone	3

Species	% Cover
Baccharis salicifolia	4
Encelia farinosa	1
Isocoma acradenia	4
Opuntia phaeacantha	4
Pluchea sericea	15
Sporobolus cryptandrus	6
Tamarix ramosissima	1
Typha domingensis	3

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Crypto	0	0	1	0	0
Woody debris structure	0	0	0	1	0
Basal Veg	1	1	1	1	2
Litter (duff)	7	13	50	49	70
Cobble	10	11	2	1	1
Boulder	8	6	6	5	0
Bedrock	20	20	0	0	0
Stone	9	14	8	2	0
Gravel	30	28	3	2	1
Coarse woody debris	1	0	4	9	10
Sand	14	12	25	30	16

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S	<0%		1-5%	S+P	1-5%	S+P	<1%	S
Allionia incarnata	<0%		<0%		<0%		<1%		<1%	
Aristida purpurea	<1%		<1%		<0%		<1%		<0%	
Baccharis salicifolia	1-5%		1-5%		1-5%		1-5%		<0%	
Baccharis sarothroides	1-5%		1-5%		1-5%		10-25%		10-25%	
Bebbia juncea var. aspera	<0%		<0%		<1%		<1%		<0%	
Bromus rubens	<1%		<1%		<0%		<0%		<0%	
Conyza canadensis	<1%		<1%		<1%		<0%		<0%	
Cryptantha spp.	<1%		<0%		<0%		<0%		<0%	

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 2 Transect Type: Tamarisk Area

Cylindropuntia Acanthocarpa	<0%		<0%		<0%		<0%	<1%
Encelia farinosa	<0%		<0%		<1%		<0%	<1%
Isocoma acradenia	<0%		<0%		1-5%		<0%	5-10%
Lepidium densiflorum	<1%		<0%		<0%		<0%	<1%
Lepidium fremontii	<1%		<0%		<0%		<0%	<0%
Maurandella antirrhiniflora	<1%		<0%		<0%		<0%	<0%
Melilotus officinalis	<0%		<0%		<1%		<0%	<0%
Nicotiana obtusifolia var. obtusifolia	<1%		<0%		<0%		<0%	<0%
Opuntia acanthocarpa	<0%		<0%		<0%		<0%	<1%
Opuntia engelmannii var. engelmannii	<0%		<0%		<0%		<0%	1-5%
Parietaria hespera	<1%		<1%		<0%		<0%	<0%
Plantago ovata	<0%		<1%		<0%		<0%	<0%
Pluchea sericea	<0%		1-5%		10-25%		1-5%	<0%
Polypogon monspeliensis	<1%		<1%		<1%		<0%	<0%
Polypogon viridis	<1%		1-5%		<0%		<0%	<0%
Schismus spp.	<1%		<0%		<0%		<0%	<0%
Sonchus asper	<0%		<1%		<1%		<0%	<0%
Sporobolus contractus	<1%		<0%		<0%		<0%	1-5%
Sporobolus cryptandrus	<0%		<0%		<1%		<1%	<1%
Tamarix ramosissima	1-5%	S+P	<1%	S	<1%	S+P	<1%	S+P <0%
Typha domingensis	<1%		1-5%		<0%		<0%	<0%
Viguiera parishii	1-5%		<0%		<0%		<0%	<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
15	Typha domingensis	7	1	
25	Pluchea sericea	8	8	

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
15	Typha domingensis	7	2	
25	Pluchea sericea	7	4	
45	Sporobolus contractus	3		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	6.86	578	7.12	559	7.26	564	7.08	567
15	8.09	3999	8.49	3999	8.64	3999	8.41	3999
25	8.06	976	8.06	1017	8.16	919	8.09	971
35	8.67	3999	8.69	3999	8.7	3999	8.69	3999

45	8.48	352	8.32	310	8.18	199	8.33	287

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 2 Transect Type: Tamarisk Control

	Start point		End point
Easting:	291573	Easting:	291607
Northing:	3982482	Northing:	3982521
GPS accuracy (m):	3.3	GPS accuracy (m):	3.5
Elevation (m):	462	Elevation (m):	461
Bearing:	34		
Aspect (0-360):	40	Slope (degrees):	4

Transect description: About 380m up canyon from last transect pair. It is just beyond the dense TAMRAM areas where it starts to get more narrow. The start point is just before a bend in the creek below a 15m tall limestone wall. It stays on creek left. Start is on the first ledge about 3m from the trunk of a very old PROGLA. The endpoint is jut past a large, prickly ACAGRE. This transect is located in a rampart limestone portion of the BA shale.

Additional Info::

Geological layer: Muav Limestone

Habitat type: Riparian Mojave desert scrub

Dominant species: Acacia greggii Gray, Baccharis sarothroides Gray, Bebbia juncea (Benth.) Greene var. aspera Greene, Prosopis glandulosa Torr.

Associated species: Astragalus nuttallianus DC., Camissonia walkeri (A. Nels.) Raven, Centaurium arizonicum, Cryptantha spp., Datura wrightii Regel, Erodium cicutarium (L.) L'Hér. ex Ait., Eucnide urens (Parry ex Gray) Parry, Lepidium lasiocarpum Nutt. var. lasiocarpum, Lepidium spp., Lycium spp., Melilotus officinalis (L.) Lam., Nicotiana obtusifolia Mertens & Galeotti var. obtusifolia, Parietaria hespera Hinton, Penstemon palmeri Gray, Phacelia crenulata Torr. ex S. Wats., Phacelia rotundifolia Torr. ex S. Wats., Physalis spp, Plantago patagonica Jacq., Polypogon viridis (Gouan) Breistr., Porophyllum gracile Benth., Psilostrophe sparsiflora (Gray) A. Nels., Sonchus asper (L.) Hill, Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb., Stephanomeria pauciflora (Torr.) A. Nels., Stylocline micropoides Gray, Tiquilia latior (I.M. Johnston) A. Richards., Ziziphus obtusifolia (Hook. ex Torr. & Gray) Gray var. obtusifolia

Surface water within 25m? ☐ Surface water type:

Landform: Drainage channel Surface rocks: limestone

Soil type: sand loamy sand Topo position: Interfluve

Light exposure: open Soil moisture: dry

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 2 Transect Type: Tamarisk Control

Date: 5/16/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Lori Makarick Reader: Amy Prince

Wind Speed: Air Temp (F): Cloud Cover:

Weather: Insanely war, 100F+, there are some clouds and we pray for more!

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	17
Coarse woody debris	2
Cobble	4
Gravel	3
Litter (duff)	48
Sand	20
Stone	4

Species	% Cover
Acacia greggii	26
Baccharis salicifolia	1
Baccharis sarothroides	18
Baccharis sergiloides	2
Bebbia juncea var. aspera	2
Cryptobiotic soil	2
Encelia farinosa	3
Ephedra spp.	1
Isocoma acradenia	7
Prosopis glandulosa	18
Sporobolus cryptandrus	2
Sporobolus flexuosus	1

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Boulder	5	23	20	9	10
Gravel	5	25	10	4	4
Crypto	7	1	7	3	0
Coarse woody debris	1	0	4	4	10
Cobble	10	11	4	4	4
Woody debris structure	0	0	4	1	4
Litter (duff)	52	4	9	44	52
Sand	10	11	20	9	6
Stone	10	25	22	22	10
		0	0	0	0

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	5-10%	S+M	<1%	S+M	1-5%	S+M	<1%	S+M	25-50%	S+M
Allionia incarnata	<0%		<0%		<1%		<1%		<1%	
Aristida arizonica	<0%		<0%		<1%		<1%		<1%	
Baccharis sarothroides	<0%		<0%		1-5%		10-25%		10-25%	
Bebbia juncea var. aspera	1-5%		1-5%		1-5%		5-10%		<0%	

Bromus rubens	<1%		<1%		<1%		<1%	<1%
Cryptantha spp.	<1%		<0%		<0%		<1%	<1%
Encelia farinosa	<1%		<0%		<0%		<1%	<0%
Ephedra spp.	<0%		<0%		<0%		<0%	<1%
Eriogonum inflatum	<0%		<1%		<0%		<0%	<0%
Gutierrezia spp.	<1%		<1%		1-5%		<1%	<1%
Isocoma acradenia	<1%		<0%		<0%		5-10%	5-10%
Lepidium lasiocarpum	<0%		<0%		<1%		<1%	<0%
Machaeranthera pinnatifida	<0%		<0%		<0%		<0%	<1%
Oenothera caespitosa	<0%		<1%		<0%		<0%	<0%
Opuntia phaeacantha	<1%		<0%		<0%		<0%	<0%
Prosopis glandulosa	25-50%	M	25-50%	M	1-5%	M	<0%	<0%
Sporobolus flexuosus	<0%		<1%		<1%		<1%	<0%
Stylocline micropoides	<1%		<0%		<0%		<0%	<0%
Thymophylla pentachaeta	<1%		<0%		<0%		<0%	<0%
Tridens muticus	<0%		<1%		<0%		<0%	<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Prosopis glandulosa	10		
35	Isocoma acradenia	15		
45	Baccharis sarothroides	22	17	3

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Prosopis glandulosa	6		
35	Isocoma acradenia	5		
45	Baccharis sarothroides	5	5	3

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.33	143	8.33	153	8.3	154	8.32	150
15	8.29	106	8.26	110	8.21	114	8.25	110
25	8.2	122	8.11	134	8.1	130	8.14	129
35	8.06	163	8.04	169	8.02	168	8.04	167
45	8.18	431	8.2	423	8.22	438	8.20	431

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 2 Transect Type: Tamarisk Control

Date: 5/20/2007 Revisit? ☑ Post-tamarisk removal

Recorder: Lori Makarick Reader: Kate Watters

Wind Speed: 1.0 Air Temp (F): 103.0 Cloud Cover: 0

Weather: Clear, still

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	2
Boulder	13
Coarse woody debris	1
Cobble	8
Gravel	2
Litter (duff)	12
Sand	59
Stone	3

Species	% Cover
Acacia greggii	16
Baccharis sarothroides	12
Bebbia juncea var. aspera	8
Gutierrezia sarothrae	2
Parietaria hespera	1
Prosopis glandulosa	3
Sporobolus cryptandrus	3

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Sand	38	36	40	38	19
Litter (duff)	22	6	6	14	45
Boulder	2	20	19	13	4
Basal Veg	1	1	1	1	2
Woody debris structure	0	0	0	1	0
Stone	22	17	14	13	6
Gravel	4	7	10	5	11
Coarse woody debris	2	1	2	7	4
Cobble	9	12	8	8	9

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	25-50%	S+M	<1%	S+P	1-5%	S+M	1-5%	S	10-25%	P+M
Allionia incarnata	<1%		<0%		1-5%		<1%		<0%	
Baccharis sarothroides	<1%		<0%		<1%		10-25%		25-50%	
Bebbia juncea var. aspera	<1%		1-5%		1-5%		1-5%		<1%	
Dasyochloa pulchella	<0%		<0%		<0%		<1%		<0%	
Encelia farinosa	<1%		<0%		<0%		1-5%		<0%	
Ephedra fasciculata	<0%		<0%		<0%		<0%		<1%	
Gutierrezia sarothrae	<1%		<1%		1-5%		<1%		<0%	
Heliomeris multiflora	<0%		<1%		<0%		<0%		<0%	
Isocoma acradenia	1-5%		<0%		<0%		1-5%		1-5%	
Opuntia phaeacantha	<1%		<0%		<0%		<0%		<0%	
Parietaria hespera	<0%		<0%		<0%		<0%		1-5%	

Prosopis glandulosa	10-25%	S+M	1-5%	M	<0%	<0%	<0%
Sphaeralcea ambigua	<0%		<0%		<1%	<0%	<0%
Sporobolus contractus	<0%		<0%		<0%	<1%	<0%
Sporobolus cryptandrus	<1%		1-5%		1-5%	1-5%	<0%
Tridens muticus	<0%		<1%		<1%	<0%	<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Bebbia juncea var. aspera	6		
45	Baccharis sarothroides	1		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Acacia greggii		2	
5	Bebbia juncea var. aspera	5		
5	Prosopis glandulosa	2		
35	Acacia greggii	1		
45	Acacia greggii			1
45	Baccharis sarothroides	4		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
0	8.03	163	8.09	170	8.11	166	8.08	166
0	8.19	104	8.17	112	8.29	115	8.22	110
0	8.19	430	8.19	420	8.18	440	8.19	430
0	8.21	125	8.2	132	8.22	130	8.21	129
0	8.22	145	8.21	150	8.17	152	8.20	149

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 2 Transect Type: Tamarisk Control

Date: 5/16/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Lori Makarick Reader: Amy Prince

Wind Speed: Air Temp (F): Cloud Cover:

Weather: Insanely war, 100F+, there are some clouds and we pray for more!

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	17
Coarse woody debris	2
Cobble	4
Gravel	3
Litter (duff)	48
Sand	20
Stone	4

Species	% Cover
Acacia greggii	26
Baccharis salicifolia	1
Baccharis sarothroides	18
Baccharis sergiloides	2
Bebbia juncea var. aspera	2
Cryptobiotic soil	2
Encelia farinosa	3
Ephedra spp.	1
Isocoma acradenia	7
Prosopis glandulosa	18
Sporobolus cryptandrus	2
Sporobolus flexuosus	1

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Boulder	5	23	20	9	10
Gravel	5	25	10	4	4
Crypto	7	1	7	3	0
Coarse woody debris	1	0	4	4	10
Cobble	10	11	4	4	4
Woody debris structure	0	0	4	1	4
Litter (duff)	52	4	9	44	52
Sand	10	11	20	9	6
Stone	10	25	22	22	10
		0	0	0	0

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	5-10%	S+M	<1%	S+M	1-5%	S+M	<1%	S+M	25-50%	S+M
Allionia incarnata	<0%		<0%		<1%		<1%		<1%	
Aristida arizonica	<0%		<0%		<1%		<1%		<1%	
Baccharis sarothroides	<0%		<0%		1-5%		10-25%		10-25%	
Bebbia juncea var. aspera	1-5%		1-5%		1-5%		5-10%		<0%	

Bromus rubens	<1%		<1%		<1%		<1%	<1%
Cryptantha spp.	<1%		<0%		<0%		<1%	<1%
Encelia farinosa	<1%		<0%		<0%		<1%	<0%
Ephedra spp.	<0%		<0%		<0%		<0%	<1%
Eriogonum inflatum	<0%		<1%		<0%		<0%	<0%
Gutierrezia spp.	<1%		<1%		1-5%		<1%	<1%
Isocoma acradenia	<1%		<0%		<0%		5-10%	5-10%
Lepidium lasiocarpum	<0%		<0%		<1%		<1%	<0%
Machaeranthera pinnatifida	<0%		<0%		<0%		<0%	<1%
Oenothera caespitosa	<0%		<1%		<0%		<0%	<0%
Opuntia phaeacantha	<1%		<0%		<0%		<0%	<0%
Prosopis glandulosa	25-50%	M	25-50%	M	1-5%	M	<0%	<0%
Sporobolus flexuosus	<0%		<1%		<1%		<1%	<0%
Stylocline micropoides	<1%		<0%		<0%		<0%	<0%
Thymophylla pentachaeta	<1%		<0%		<0%		<0%	<0%
Tridens muticus	<0%		<1%		<0%		<0%	<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Prosopis glandulosa	10		
35	Isocoma acradenia	15		
45	Baccharis sarothroides	22	17	3

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Prosopis glandulosa	6		
35	Isocoma acradenia	5		
45	Baccharis sarothroides	5	5	3

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.33	143	8.33	153	8.3	154	8.32	150
15	8.29	106	8.26	110	8.21	114	8.25	110
25	8.2	122	8.11	134	8.1	130	8.14	129
35	8.06	163	8.04	169	8.02	168	8.04	167
45	8.18	431	8.2	423	8.22	438	8.20	431

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 2 Transect Type: Tamarisk Control

Date: 5/20/2007 Revisit? ☑ Post-tamarisk removal

Recorder: Lori Makarick Reader: Kate Watters

Wind Speed: 1.0 Air Temp (F): 103.0 Cloud Cover: 0

Weather: Clear, still

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	2
Boulder	13
Coarse woody debris	1
Cobble	8
Gravel	2
Litter (duff)	12
Sand	59
Stone	3

Species	% Cover
Acacia greggii	16
Baccharis sarothroides	12
Bebbia juncea var. aspera	8
Gutierrezia sarothrae	2
Parietaria hespera	1
Prosopis glandulosa	3
Sporobolus cryptandrus	3

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Sand	38	36	40	38	19
Litter (duff)	22	6	6	14	45
Boulder	2	20	19	13	4
Basal Veg	1	1	1	1	2
Woody debris structure	0	0	0	1	0
Stone	22	17	14	13	6
Gravel	4	7	10	5	11
Coarse woody debris	2	1	2	7	4
Cobble	9	12	8	8	9

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	25-50%	S+M	<1%	S+P	1-5%	S+M	1-5%	S	10-25%	P+M
Allionia incarnata	<1%		<0%		1-5%		<1%		<0%	
Baccharis sarothroides	<1%		<0%		<1%		10-25%		25-50%	
Bebbia juncea var. aspera	<1%		1-5%		1-5%		1-5%		<1%	
Dasyochloa pulchella	<0%		<0%		<0%		<1%		<0%	
Encelia farinosa	<1%		<0%		<0%		1-5%		<0%	
Ephedra fasciculata	<0%		<0%		<0%		<0%		<1%	
Gutierrezia sarothrae	<1%		<1%		1-5%		<1%		<0%	
Heliomeris multiflora	<0%		<1%		<0%		<0%		<0%	
Isocoma acradenia	1-5%		<0%		<0%		1-5%		1-5%	
Opuntia phaeacantha	<1%		<0%		<0%		<0%		<0%	
Parietaria hespera	<0%		<0%		<0%		<0%		1-5%	

Park Area/Canyon: Granite Park Canyon River mile: 208.8 L Project (Phase): Phase IIb

Transect Name: Granite Park 2 Transect Type: Tamarisk Control

Prosopis glandulosa	10-25%	S+M	1-5%	M	<0%	<0%	<0%
Sphaeralcea ambigua	<0%		<0%		<1%	<0%	<0%
Sporobolus contractus	<0%		<0%		<0%	<1%	<0%
Sporobolus cryptandrus	<1%		1-5%		1-5%	1-5%	<0%
Tridens muticus	<0%		<1%		<1%	<0%	<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Bebbia juncea var. aspera	6		
45	Baccharis sarothroides	1		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Acacia greggii		2	
5	Bebbia juncea var. aspera	5		
5	Prosopis glandulosa	2		
35	Acacia greggii	1		
45	Acacia greggii			1
45	Baccharis sarothroides	4		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
0	8.03	163	8.09	170	8.11	166	8.08	166
0	8.19	104	8.17	112	8.29	115	8.22	110
0	8.19	430	8.19	420	8.18	440	8.19	430
0	8.21	125	8.2	132	8.22	130	8.21	129
0	8.22	145	8.21	150	8.17	152	8.20	149

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 1 Transect Type: Tamarisk Area

	Start point		End point
Easting:	323128	Easting:	323157
Northing:	4010702	Northing:	4010593
GPS accuracy (m):	4	GPS accuracy (m):	40.8
Elevation (m):	594	Elevation (m):	562
Bearing:	358		
Aspect (0-360):	17	Slope (degrees):	1

Transect description: Transect is on creek left, about 1 km up canyon. Transect just upstream from first Muav limestone narrows. Transect is located in first patch of TAMRAM on creek left side of the drainage, paralleling a Muav limestone shelf. Transect start is located on a 2x2x.5m conglomerate limestone white boulder. The start boulder is downslope of two rounded 3x3m limestone boulders that are propped on the muav limestone creek left shelf. Transect end is downstream at the hydro 1 pp on creek left bedrock, just about a 1m waterfall.

Additional Info:: Transect starts on Muav boulder 1m on creek left. Transect runs through TAMRAM and native veg along a shelf of Muav limestone that parallels the creek to creek left. Endpoint is on Muav limestone bedrock shelf on creek left before a series of small waterfalls.

Geological layer: Muav limestone

Habitat type: Riparian

Dominant species: Baccharis salicifolia (Ruiz & Pavón) Pers., Brickellia longifolia S. Wats., Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Tamarix ramosissima Ledeb.

Associated species: Acacia greggii Gray, Agave utahensis Engelm., Aristida purpurea Nutt., Artemisia ludoviciana Nutt., Baccharis sergiloides Gray, Bebbia juncea (Benth.) Greene var. aspera Greene, Bothriochloa barbinodis (Lag.) Herter, Brickellia longifolia S. Wats., Bromus rubens L., Camissonia walkeri (A. Nels.) Raven, Cryptantha maritima (Greene) Greene, Cryptantha recurvata Coville, Ephedra fasciculata A. Nels., Ferocactus cylindraceus (Engelm.) Orcutt var. cylindraceus, Galium stellatum Kellogg, Gilia clokeyi Mason, Gutierrezia sarothrae (Pursh) Britt. & Rusby, Hedeoma nana (Torr.) Briq., Hesperodoria salicina (Blake) Nesom, Isocoma acradenia (Greene) Greene, Linanthus demissus (Gray) Greene, Lycium spp., Mimulus cardinalis Dougl. ex Benth., Mortonia utahensis (Coville ex Gray) A. Nels., Oenothera caespitosa Nutt., Phacelia rotundifolia Torr. ex S. Wats., Pleurocoronis pluriseta (Gray) King & H.E. Robins., Salix exigua Nutt., , Silene antirrhina L., Sphaeralcea spp., Thymophylla pentachaeta (DC.) Small, Vulpia microstachys (Nutt.) Munro, Vulpia octoflora (Walt.) Rydb., Ziziphus obtusifolia (Hook. ex Torr. & Gray) Gray var. obtusifolia

Surface water within 25m? ☑ Surface water type: stream

Landform: Drainage channel Surface rocks: limestone

Soil type: sand Topo position: Low Level

Light exposure: full-shade partial-shade Soil moisture: moist dry

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 1 Transect Type: Tamarisk Area

Date: 5/13/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Pamela Walls Reader: Kate Watters

Wind Speed: 2.0 Air Temp (F): 75.0 Cloud Cover: 0

Weather: Clear skies, 75F.

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	6
Boulder	14
Cobble	10
Gravel	18
Litter (duff)	20
Sand	24
Stone	7
Woody debris structure	1

Species	% Cover
Baccharis salicifolia	5
Brickellia longifolia	2
Muhlenbergia asperifolia	1
Salix exigua	3
Tamarix ramosissima	11

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Bedrock	0	9	24	19	37
Cobble	53	46	4	19	18
Boulder	4	9	24	3	3
Gravel	24	22	10	39	18
Coarse woody debris	1	0	0	1	0
Woody debris structure	0	0	0	0	3
Litter (duff)	4	1	4	3	7
Stone	10	4	10	8	7
Sand	4	9	24	8	7

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S	<1%	S	<0%		<1%	S	<0%	
Baccharis salicifolia	<1%		1-5%		1-5%		<1%		1-5%	
Baccharis sergiloides	<0%		<0%		<0%		<1%		<0%	
Bebbia juncea var. aspera	<0%		<0%		<0%		<0%		<1%	
Brickellia longifolia	<0%		<0%		<1%		<1%		<1%	
Bromus rubens	<0%		1-5%		1-5%		1-5%		1-5%	
Camissonia walkeri	<0%		<0%		<1%		<1%		<0%	
Cercis orbiculata	<0%		<0%		<0%		<1%	S	<0%	

Draba cuneifolia	<1%		<0%		<0%		<0%	<0%	
Ephedra fasciculata	<0%		<0%		<0%		<0%	<1%	
Erodium cicutarium	<0%		<0%		<1%		<0%	<0%	
Gilia spp.	<1%		<1%		<0%		<0%	<0%	
Gutierrezia sarothrae	<0%		<0%		<0%		<1%	<0%	
Hedeoma nana	<1%		<0%		<1%		<0%	<0%	
Hesperodoria salicina	<0%		<0%		<1%		<0%	1-5%	
Isocoma acradenia	<0%		<0%		<0%		1-5%	1-5%	
Lepidium lasiocarpum var. lasiocarpum	<0%		<0%		<1%		<1%	<1%	
Linanthus spp.	<0%		<0%		<1%		<0%	<0%	
Muhlenbergia asperifolia	<1%		<0%		<1%		1-5%	5-10%	
Oenothera caespitosa	<0%		<0%		<0%		<1%	<1%	
Phacelia filiformis	<1%		<0%		<0%		<0%	<0%	
Poa bigelovii	<1%		<1%		<0%		<0%	<0%	
Polypogon viridis	<0%		<0%		<1%		<0%	<0%	
Salix exigua	<0%		<0%		1-5%		1-5%	<0%	
Setaria spp.	<0%		<1%		<0%		<0%	<0%	
Silene antirrhina	<1%		<0%		<0%		<0%	<0%	
Sporobolus spp.	<0%		<0%		<1%		<1%	<0%	
Stephanomeria pauciflora	<0%		<0%		<1%		<0%	<1%	
Tamarix ramosissima	5-10%	M	<1%	S	5-10%	M	5-10%	P	10-25%	S+M
Vulpia mictrostachys	<1%		<1%		<0%		<1%	<0%	
Vulpia octoflora	<1%		<1%		<1%		<0%	<0%	
Ziziphus obtusifolia var. obtusifolia	<0%		<0%		<0%		<0%	1-5%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
45	Baccharis salicifolia	6		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
35	Tamarix ramosissima	1		
45	Baccharis salicifolia	6		
45	Tamarix ramosissima	1	2	
45	Vacant Space	4		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.5	2351	8.72	2184	8.78	2288	8.67	2274
15	8.86	1437	8.74	1395	8.73	1337	8.78	1390
25	9.14	3999	9.19	3999	9.21	3999	9.18	3999

35	9.22	3999	9.19	3999	9.16	3999	9.19	3999
45	9.12	2829	9.06	2838	9.04	2888	9.07	2852

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 1 Transect Type: Tamarisk Area

Date: 5/17/2007 Revisit? ☑ Post-tamarisk removal

Recorder: Lisa Hahn Reader: Amy Prince

Wind Speed: 1.0 Air Temp (F): 105.0 Cloud Cover: 2

Weather: Clouds building at head of the canyon

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	11
Boulder	18
Coarse woody debris	1
Cobble	18
Gravel	25
Litter (duff)	7
Sand	16
Stone	4

Species	% Cover
Baccharis salicifolia	13
Brickellia longifolia	6
Chloracantha spinosa	1
Muhlenbergia asperifolia	10
Salix exigua	2
Tamarix ramosissima	1

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Cobble	29	12	7	18	7
Litter (duff)	4	13	11	9	10
Sand	12	16	17	15	10
Woody debris structure	0	1	0	0	2
Boulder	3	16	23	3	2
Basal Veg	1	1	1	1	1
Stone	10	5	6	11	7
Bedrock	1	5	8	9	40
Crypto	0	0	0	0	1
Coarse woody debris	0	3	2	2	1
Gravel	38	28	25	32	19

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Andropogon glomeratus	<1%		<0%		<1%		<0%		<0%	
Apocynum cannabinum	<0%		<0%		<0%		<1%		<0%	
Baccharis salicifolia	1-5%		5-10%		1-5%		1-5%		1-5%	
Baccharis sarothroides	<0%		<0%		<0%		<1%		<0%	
Baccharis sergiloides	<1%		<0%		<0%		<0%		<0%	
Brickellia longifolia	1-5%		1-5%		<1%		<1%		<1%	
Camissonia walkeri	<1%		<0%		<1%		<0%		<0%	
Cercis orbiculata	<0%		<0%		<0%		<1%	S	<0%	
Eucnide urens	<1%		<1%		<1%		<0%		<0%	

Gutierrezia sarothrae	<1%		<0%		<0%		<1%		<0%	
Hesperodoria salicina	<0%		<0%		<0%		<0%		1-5%	
Hesperostipa neomexicana	<0%		<1%		<0%		<0%		<0%	
Imperata brevifolia	<0%		<0%		<0%		<1%		<0%	
Isocoma acradenia	<0%		<0%		<0%		1-5%		1-5%	
Janusia gracilis	<0%		<0%		<0%		<0%		<1%	
Mimulus cardinalis	<1%		<0%		<0%		<1%		<0%	
Muhlenbergia asperifolia	1-5%		<1%		1-5%		1-5%		1-5%	
Oenothera caespitosa	<0%		<0%		<0%		<0%		<1%	
Polypogon viridis	<0%		<0%		<0%		<1%		<1%	
Salix exigua	<0%		<0%		1-5%		<1%		<0%	
Sphaeralcea grossulariifolia	<0%		<1%		<0%		<0%		<0%	
Sporobolus cryptandrus	<1%		<0%		<1%		<0%		<0%	
Stephanomeria pauciflora	<0%		<0%		<0%		<0%		<1%	
Tamarix ramosissima	<1%	S	<1%	S	<1%	S	<1%	S	<1%	S
Ziziphus obtusifolia var. canescens	<0%		<0%		<0%		<0%		1-5%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Brickellia longifolia	8		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Brickellia longifolia	4		
25	Baccharis salicifolia	2		
45	Baccharis salicifolia	1		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	7.77	1898	7.89	1897	8.17	1867	7.94	1887
15	8.63	3999	8.93	3999	8.92	3999	8.83	3999
25	8.77	2691	8.65	2703	8.54	2688	8.65	2694
35	8.66	3999	8.77	3999	8.73	3999	8.72	3999
45	8.62	1870	8.52	1888	8.44	1909	8.53	1889

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 1 Transect Type: Tamarisk Area

Date: 5/13/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Pamela Walls Reader: Kate Watters

Wind Speed: 2.0 Air Temp (F): 75.0 Cloud Cover: 0

Weather: Clear skies, 75F.

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	6
Boulder	14
Cobble	10
Gravel	18
Litter (duff)	20
Sand	24
Stone	7
Woody debris structure	1

Species	% Cover
Baccharis salicifolia	5
Brickellia longifolia	2
Muhlenbergia asperifolia	1
Salix exigua	3
Tamarix ramosissima	11

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Bedrock	0	9	24	19	37
Cobble	53	46	4	19	18
Boulder	4	9	24	3	3
Gravel	24	22	10	39	18
Coarse woody debris	1	0	0	1	0
Woody debris structure	0	0	0	0	3
Litter (duff)	4	1	4	3	7
Stone	10	4	10	8	7
Sand	4	9	24	8	7

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S	<1%	S	<0%		<1%	S	<0%	
Baccharis salicifolia	<1%		1-5%		1-5%		<1%		1-5%	
Baccharis sergiloides	<0%		<0%		<0%		<1%		<0%	
Bebbia juncea var. aspera	<0%		<0%		<0%		<0%		<1%	
Brickellia longifolia	<0%		<0%		<1%		<1%		<1%	
Bromus rubens	<0%		1-5%		1-5%		1-5%		1-5%	
Camissonia walkeri	<0%		<0%		<1%		<1%		<0%	
Cercis orbiculata	<0%		<0%		<0%		<1%	S	<0%	

Draba cuneifolia	<1%		<0%		<0%		<0%	<0%	
Ephedra fasciculata	<0%		<0%		<0%		<0%	<1%	
Erodium cicutarium	<0%		<0%		<1%		<0%	<0%	
Gilia spp.	<1%		<1%		<0%		<0%	<0%	
Gutierrezia sarothrae	<0%		<0%		<0%		<1%	<0%	
Hedeoma nana	<1%		<0%		<1%		<0%	<0%	
Hesperodoria salicina	<0%		<0%		<1%		<0%	1-5%	
Isocoma acradenia	<0%		<0%		<0%		1-5%	1-5%	
Lepidium lasiocarpum var. lasiocarpum	<0%		<0%		<1%		<1%	<1%	
Linanthus spp.	<0%		<0%		<1%		<0%	<0%	
Muhlenbergia asperifolia	<1%		<0%		<1%		1-5%	5-10%	
Oenothera caespitosa	<0%		<0%		<0%		<1%	<1%	
Phacelia filiformis	<1%		<0%		<0%		<0%	<0%	
Poa bigelovii	<1%		<1%		<0%		<0%	<0%	
Polypogon viridis	<0%		<0%		<1%		<0%	<0%	
Salix exigua	<0%		<0%		1-5%		1-5%	<0%	
Setaria spp.	<0%		<1%		<0%		<0%	<0%	
Silene antirrhina	<1%		<0%		<0%		<0%	<0%	
Sporobolus spp.	<0%		<0%		<1%		<1%	<0%	
Stephanomeria pauciflora	<0%		<0%		<1%		<0%	<1%	
Tamarix ramosissima	5-10%	M	<1%	S	5-10%	M	5-10%	P	10-25%	S+M
Vulpia mictrostachys	<1%		<1%		<0%		<1%	<0%	
Vulpia octoflora	<1%		<1%		<1%		<0%	<0%	
Ziziphus obtusifolia var. obtusifolia	<0%		<0%		<0%		<0%	1-5%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
45	Baccharis salicifolia	6		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
35	Tamarix ramosissima	1		
45	Baccharis salicifolia	6		
45	Tamarix ramosissima	1	2	
45	Vacant Space	4		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.5	2351	8.72	2184	8.78	2288	8.67	2274
15	8.86	1437	8.74	1395	8.73	1337	8.78	1390
25	9.14	3999	9.19	3999	9.21	3999	9.18	3999

35	9.22	3999	9.19	3999	9.16	3999	9.19	3999
45	9.12	2829	9.06	2838	9.04	2888	9.07	2852

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 1 Transect Type: Tamarisk Area

Date: 5/17/2007 Revisit? ☑ Post-tamarisk removal

Recorder: Lisa Hahn Reader: Amy Prince

Wind Speed: 1.0 Air Temp (F): 105.0 Cloud Cover: 2

Weather: Clouds building at head of the canyon

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	11
Boulder	18
Coarse woody debris	1
Cobble	18
Gravel	25
Litter (duff)	7
Sand	16
Stone	4

Species	% Cover
Baccharis salicifolia	13
Brickellia longifolia	6
Chloracantha spinosa	1
Muhlenbergia asperifolia	10
Salix exigua	2
Tamarix ramosissima	1

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Cobble	29	12	7	18	7
Litter (duff)	4	13	11	9	10
Sand	12	16	17	15	10
Woody debris structure	0	1	0	0	2
Boulder	3	16	23	3	2
Basal Veg	1	1	1	1	1
Stone	10	5	6	11	7
Bedrock	1	5	8	9	40
Crypto	0	0	0	0	1
Coarse woody debris	0	3	2	2	1
Gravel	38	28	25	32	19

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Andropogon glomeratus	<1%		<0%		<1%		<0%		<0%	
Apocynum cannabinum	<0%		<0%		<0%		<1%		<0%	
Baccharis salicifolia	1-5%		5-10%		1-5%		1-5%		1-5%	
Baccharis sarothroides	<0%		<0%		<0%		<1%		<0%	
Baccharis sergiloides	<1%		<0%		<0%		<0%		<0%	
Brickellia longifolia	1-5%		1-5%		<1%		<1%		<1%	
Camissonia walkeri	<1%		<0%		<1%		<0%		<0%	
Cercis orbiculata	<0%		<0%		<0%		<1%	S	<0%	
Eucnide urens	<1%		<1%		<1%		<0%		<0%	

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 1 Transect Type: Tamarisk Area

Gutierrezia sarothrae	<1%		<0%		<0%		<1%		<0%	
Hesperodoria salicina	<0%		<0%		<0%		<0%		1-5%	
Hesperostipa neomexicana	<0%		<1%		<0%		<0%		<0%	
Imperata brevifolia	<0%		<0%		<0%		<1%		<0%	
Isocoma acradenia	<0%		<0%		<0%		1-5%		1-5%	
Janusia gracilis	<0%		<0%		<0%		<0%		<1%	
Mimulus cardinalis	<1%		<0%		<0%		<1%		<0%	
Muhlenbergia asperifolia	1-5%		<1%		1-5%		1-5%		1-5%	
Oenothera caespitosa	<0%		<0%		<0%		<0%		<1%	
Polypogon viridis	<0%		<0%		<0%		<1%		<1%	
Salix exigua	<0%		<0%		1-5%		<1%		<0%	
Sphaeralcea grossulariifolia	<0%		<1%		<0%		<0%		<0%	
Sporobolus cryptandrus	<1%		<0%		<1%		<0%		<0%	
Stephanomeria pauciflora	<0%		<0%		<0%		<0%		<1%	
Tamarix ramosissima	<1%	S	<1%	S	<1%	S	<1%	S	<1%	S
Ziziphus obtusifolia var. canescens	<0%		<0%		<0%		<0%		1-5%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Brickellia longifolia	8		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Brickellia longifolia	4		
25	Baccharis salicifolia	2		
45	Baccharis salicifolia	1		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	7.77	1898	7.89	1897	8.17	1867	7.94	1887
15	8.63	3999	8.93	3999	8.92	3999	8.83	3999
25	8.77	2691	8.65	2703	8.54	2688	8.65	2694
35	8.66	3999	8.77	3999	8.73	3999	8.72	3999
45	8.62	1870	8.52	1888	8.44	1909	8.53	1889

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 1 Transect Type: Tamarisk Control

	Start point		End point
Easting:	323109	Easting:	323130
Northing:	4010627	Northing:	4010685
GPS accuracy (m):	3.2	GPS accuracy (m):	9
Elevation (m):	627	Elevation (m):	588
Bearing:	35		
Aspect (0-360):	20	Slope (degrees):	8

Transect description: Just around the bend and upstream of Mohawk T1A on creek right on a Muav limestone shelf. The straight stretch is about 75m long. Then does and "S" curve to creek left then back right just upstream. The obvious feature at that curve is a shale deposit several meters tall. The start point is on the top of a 3x2x2.5m limestone, whitish tan boulder with vertical intrusions. That boulder has a laying down sister right next to it. The end point is down stream and goes just to the left of a huge boulder pile and then on the creek edge of a large Acacia. Creek is running and nice.

Additional Info::

Geological layer: Muav limestone

Habitat type: Riparian

Dominant species: Baccharis salicifolia (Ruiz & Pavón) Pers., Baccharis sarothroides Gray, Bebbia juncea (Benth.) Greene var. aspera Greene, Brickellia longifolia S. Wats.

Associated species: Artemisia ludoviciana Nutt., Baccharis sarothroides Gray, Baccharis sergiloides Gray, Bothriochloa barbinodis (Lag.) Herter, Bromus tectorum L., Camissonia walkeri (A. Nels.) Raven, Conyza canadensis (L.) Cronq., Encelia farinosa Gray ex Torr., Galium stellatum Kellogg, Hesperodoria salicina (Blake) Nesom, Lycium spp., Oenothera caespitosa Nutt., Parietaria hespera Hinton, Rhus trilobata Nutt., Rhus trilobata Nutt. var. simplicifolia (Greene) Barkl., Salix exigua Nutt., Schismus spp., Silene antirrhina L., Sonchus asper (L.) Hill, Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb., Stephanomeria pauciflora (Torr.) A. Nels., Typha latifolia L., Viguiera parishii Greene

Surface water within 25m? ☑ Surface water type: stream

Landform: Drainage channel Surface rocks: limestone

Soil type: loamy sand Topo position: Low Level

Light exposure: partial-shade open Soil moisture: dry moist

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 1 Transect Type: Tamarisk Control

Date: 5/13/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Lisa Hahn Reader: Mike Kearsley

Wind Speed: 1.0 Air Temp (F): 107.0 Cloud Cover: 0

Weather: 0% clouds, very still. It's going to be brutally hot today!!!

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	20
Boulder	18
Coarse woody debris	2
Cobble	9
Gravel	28
Sand	17
Stone	6

Species	% Cover
Acacia greggii	9
Baccharis salicifolia	15
Brickellia longifolia	4

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Litter (duff)	3	0	5	3	3
Cobble	3	7	12	16	18
Gravel	3	7	12	55	18
Woody debris structure	0	0	1	0	0
Boulder	3	3	27	7	17
Bedrock	39	62	27	0	17
Sand	39	17	5	16	18
Coarse woody debris	1	0	5	0	1
Stone	8	3	5	3	8
Crypto	1	1	1	0	0

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S	<0%		<0%		25-50%	S+P+M	<0%	
Aster spp.	<1%		<0%		<0%		<0%		<0%	
Baccharis salicifolia	<0%		<0%		<1%		1-5%		10-25%	
Baccharis sarothroides	<0%		<1%		<0%		1-5%		<1%	
Bebbia juncea var. aspera	1-5%		<0%		1-5%		<0%		<0%	
Brickellia longifolia	1-5%		<1%		5-10%		<0%		<0%	
Bromus rubens	<1%		<1%		<1%		<1%		<1%	
Bromus tectorum	<0%		<0%		<0%		<0%		<1%	
Camissonia walkeri	<1%		<0%		<1%		<1%		<1%	

Cercis occidentalis	<0%	<0%	<0%		<1%	<0%
Cryptantha spp.	<1%	<0%	<0%		<1%	<1%
Draba cuneifolia	<0%	<0%	<0%		<1%	<1%
Encelia farinosa	<0%	<0%	<1%		<0%	<0%
Gilia spp.	<0%	<0%	<0%		<1%	<1%
Hedeoma nana	<0%	<0%	<0%		<1%	<0%
Hesperodoria salicina	<0%	<0%	<1%		<0%	<0%
Lepidium lasiocarpum	<1%	<0%	<0%		<1%	<0%
Machaeranthera spp.	<0%	<0%	<1%		<0%	<0%
Moss spp.	<1%	<1%	<1%		<0%	<0%
Parietaria hespera	<0%	<0%	<0%		<1%	<1%
Phacelia filiformis	<0%	<0%	<0%		<1%	<0%
Plantago patagonica	<1%	<0%	<0%		<0%	<1%
Pleurocoronis pluriseta	<0%	<0%	<1%		<0%	<0%
Polypogon viridis	<0%	<0%	<0%		<1%	<0%
Sonchus asper	<0%	<0%	<0%		<1%	<0%
Sphaeralcea grossulariifolia	<0%	<0%	<0%		<0%	<0%
Sporobolus cryptandrus	<1%	<0%	<0%		<0%	<0%
Stephanomeria pauciflora	1-5%	<0%	<1%		<0%	<1%
Tridens muticus	<0%	<0%	<0%		<1%	<0%
Ziziphus obtusifolia var. obtusifolia	<0%	<0%	<1%	M	<0%	<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
35	Acacia greggii			

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
35	Acacia greggii			

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	7.97	404	8.11	369	8.13	366	8.07	380
15	8.71	106	8.76	104	8.78	106	8.75	105
25	8.34	210	8.29	210	8.3	208	8.31	209
35	8.66	185	8.68	192	8.68	190	8.67	189
45	8.51	627	8.54	622	8.52	628	8.52	626

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 1 Transect Type: Tamarisk Control

Date: 5/17/2007 Revisit? ☑ Post-tamarisk removal

Recorder: Steve Till Reader: Lori Makarick

Wind Speed: 2.0 Air Temp (F): 104.0 Cloud Cover: 2

Weather: 2% clouds, very hot! Over 100F It's pretty brutal!

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	23
Boulder	22
Cobble	16
Gravel	19
Sand	16
Stone	4

Species	% Cover
Baccharis salicifolia	9
Brickellia longifolia	2
Polypogon viridis	2

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Woody debris structure	0	0	2	0	0
Litter (duff)	1	2	3	6	5
Basal Veg	1	1	1	1	1
Boulder	7	2	30	12	20
Bedrock	30	37	30	0	8
Crypto	2	0	0	0	1
Moss (ground)	1	1	0	0	0
Sand	38	20	10	11	3
Stone	12	8	9	11	10
Coarse woody debris	0	1	2	0	2
Gravel	2	20	7	45	35
Cobble	6	8	16	14	15

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S	<0%		<0%		5-10%	S+M	<1%	S
Adenophyllum porophylloides	<1%		<0%		<0%		<0%		<0%	
Baccharis salicifolia	<0%		1-5%		1-5%		10-25%		10-25%	
Bebbia juncea var. aspera	1-5%		<0%		<0%		<0%		<0%	
Brickellia longifolia	1-5%		<1%		1-5%		<0%		<0%	
Bromus rubens	<1%		<0%		<0%		<1%		<0%	
Eucnide urens	<0%		<0%		<0%		<1%		<0%	
Flaveria macdougalii	<0%		<0%		<0%		<0%		<1%	
Forb spp	<1%		<0%		<0%		<0%		<0%	
Grass spp	<1%		<0%		<0%		<0%		<0%	
Hedeoma nana	<0%		<0%		<0%		<1%		<1%	

Hesperodoria salicina	<0%	<1%		<0%		<0%		<0%	
Lepidium lasiocarpum var. lasiocarpum	<1%	<0%		<0%		<0%		<0%	
Muhlenbergia asperifolia	<0%	<1%		<0%		<0%		<1%	
Plantago patagonica	<1%	<0%		<0%		<0%		<0%	
Polypogon monspeliensis	<0%	<0%		<1%		<0%		<0%	
Polypogon viridis	<0%	<1%		<1%		<1%		<1%	
Salix exigua	<0%	<0%		<0%		<1%		<0%	
Sporobolus contractus	<1%	<0%		<0%		<1%		<0%	
Stephanomeria pauciflora	<1%	<0%		<0%		<0%		<0%	
Tamarix ramosissima	<0%	<1%	S	<1%	S	<1%	S	<1%	S
Thymophylla pentachaeta	<1%	<0%		<0%		<0%		<0%	

Vegetation Structure Data - Old

Vegetation Structure Data - New

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	7.54	713	7.85	621	7.91	631	7.77	655
15	8.3	3999	8.44	3999	8.61	3999	8.45	3999
25	8.58	654	8.26	617	8.04	647	8.29	639
35	8.25	3999	8.45	3999	8.58	3999	8.43	3999
45	8.66	1497	8.28	1449	8.14	1479	8.36	1475

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 1 Transect Type: Tamarisk Control

Date: 5/13/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Lisa Hahn Reader: Mike Kearsley

Wind Speed: 1.0 Air Temp (F): 107.0 Cloud Cover: 0

Weather: 0% clouds, very still. It's going to be brutally hot today!!!

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	20
Boulder	18
Coarse woody debris	2
Cobble	9
Gravel	28
Sand	17
Stone	6

Species	% Cover
Acacia greggii	9
Baccharis salicifolia	15
Brickellia longifolia	4

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Litter (duff)	3	0	5	3	3
Cobble	3	7	12	16	18
Gravel	3	7	12	55	18
Woody debris structure	0	0	1	0	0
Boulder	3	3	27	7	17
Bedrock	39	62	27	0	17
Sand	39	17	5	16	18
Coarse woody debris	1	0	5	0	1
Stone	8	3	5	3	8
Crypto	1	1	1	0	0

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S	<0%		<0%		25-50%	S+P+M	<0%	
Aster spp.	<1%		<0%		<0%		<0%		<0%	
Baccharis salicifolia	<0%		<0%		<1%		1-5%		10-25%	
Baccharis sarothroides	<0%		<1%		<0%		1-5%		<1%	
Bebbia juncea var. aspera	1-5%		<0%		1-5%		<0%		<0%	
Brickellia longifolia	1-5%		<1%		5-10%		<0%		<0%	
Bromus rubens	<1%		<1%		<1%		<1%		<1%	
Bromus tectorum	<0%		<0%		<0%		<0%		<1%	
Camissonia walkeri	<1%		<0%		<1%		<1%		<1%	

Cercis occidentalis	<0%	<0%	<0%		<1%	<0%
Cryptantha spp.	<1%	<0%	<0%		<1%	<1%
Draba cuneifolia	<0%	<0%	<0%		<1%	<1%
Encelia farinosa	<0%	<0%	<1%		<0%	<0%
Gilia spp.	<0%	<0%	<0%		<1%	<1%
Hedeoma nana	<0%	<0%	<0%		<1%	<0%
Hesperodoria salicina	<0%	<0%	<1%		<0%	<0%
Lepidium lasiocarpum	<1%	<0%	<0%		<1%	<0%
Machaeranthera spp.	<0%	<0%	<1%		<0%	<0%
Moss spp.	<1%	<1%	<1%		<0%	<0%
Parietaria hespera	<0%	<0%	<0%		<1%	<1%
Phacelia filiformis	<0%	<0%	<0%		<1%	<0%
Plantago patagonica	<1%	<0%	<0%		<0%	<1%
Pleurocoronis pluriseta	<0%	<0%	<1%		<0%	<0%
Polypogon viridis	<0%	<0%	<0%		<1%	<0%
Sonchus asper	<0%	<0%	<0%		<1%	<0%
Sphaeralcea grossulariifolia	<0%	<0%	<0%		<0%	<0%
Sporobolus cryptandrus	<1%	<0%	<0%		<0%	<0%
Stephanomeria pauciflora	1-5%	<0%	<1%		<0%	<1%
Tridens muticus	<0%	<0%	<0%		<1%	<0%
Ziziphus obtusifolia var. obtusifolia	<0%	<0%	<1%	M	<0%	<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
35	Acacia greggii			

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
35	Acacia greggii			

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	7.97	404	8.11	369	8.13	366	8.07	380
15	8.71	106	8.76	104	8.78	106	8.75	105
25	8.34	210	8.29	210	8.3	208	8.31	209
35	8.66	185	8.68	192	8.68	190	8.67	189
45	8.51	627	8.54	622	8.52	628	8.52	626

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 1 Transect Type: Tamarisk Control

Date: 5/17/2007 Revisit? ☑ Post-tamarisk removal

Recorder: Steve Till Reader: Lori Makarick

Wind Speed: 2.0 Air Temp (F): 104.0 Cloud Cover: 2

Weather: 2% clouds, very hot! Over 100F It's pretty brutal!

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	23
Boulder	22
Cobble	16
Gravel	19
Sand	16
Stone	4

Species	% Cover
Baccharis salicifolia	9
Brickellia longifolia	2
Polypogon viridis	2

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Woody debris structure	0	0	2	0	0
Litter (duff)	1	2	3	6	5
Basal Veg	1	1	1	1	1
Boulder	7	2	30	12	20
Bedrock	30	37	30	0	8
Crypto	2	0	0	0	1
Moss (ground)	1	1	0	0	0
Sand	38	20	10	11	3
Stone	12	8	9	11	10
Coarse woody debris	0	1	2	0	2
Gravel	2	20	7	45	35
Cobble	6	8	16	14	15

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S	<0%		<0%		5-10%	S+M	<1%	S
Adenophyllum porophylloides	<1%		<0%		<0%		<0%		<0%	
Baccharis salicifolia	<0%		1-5%		1-5%		10-25%		10-25%	
Bebbia juncea var. aspera	1-5%		<0%		<0%		<0%		<0%	
Brickellia longifolia	1-5%		<1%		1-5%		<0%		<0%	
Bromus rubens	<1%		<0%		<0%		<1%		<0%	
Eucnide urens	<0%		<0%		<0%		<1%		<0%	
Flaveria macdougalii	<0%		<0%		<0%		<0%		<1%	
Forb spp	<1%		<0%		<0%		<0%		<0%	
Grass spp	<1%		<0%		<0%		<0%		<0%	
Hedeoma nana	<0%		<0%		<0%		<1%		<1%	

Hesperodoria salicina	<0%	<1%		<0%		<0%		<0%	
Lepidium lasiocarpum var. lasiocarpum	<1%	<0%		<0%		<0%		<0%	
Muhlenbergia asperifolia	<0%	<1%		<0%		<0%		<1%	
Plantago patagonica	<1%	<0%		<0%		<0%		<0%	
Polypogon monspeliensis	<0%	<0%		<1%		<0%		<0%	
Polypogon viridis	<0%	<1%		<1%		<1%		<1%	
Salix exigua	<0%	<0%		<0%		<1%		<0%	
Sporobolus contractus	<1%	<0%		<0%		<1%		<0%	
Stephanomeria pauciflora	<1%	<0%		<0%		<0%		<0%	
Tamarix ramosissima	<0%	<1%	S	<1%	S	<1%	S	<1%	S
Thymophylla pentachaeta	<1%	<0%		<0%		<0%		<0%	

Vegetation Structure Data - Old

Vegetation Structure Data - New

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	7.54	713	7.85	621	7.91	631	7.77	655
15	8.3	3999	8.44	3999	8.61	3999	8.45	3999
25	8.58	654	8.26	617	8.04	647	8.29	639
35	8.25	3999	8.45	3999	8.58	3999	8.43	3999
45	8.66	1497	8.28	1449	8.14	1479	8.36	1475

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 2 Transect Type: Tamarisk Area

	Start point		End point
Easting:	323043	Easting:	323084
Northing:	4010288	Northing:	4010315
GPS accuracy (m):	4.3	GPS accuracy (m):	5.8
Elevation (m):	598	Elevation (m):	594
Bearing:	57		
Aspect (0-360):	40	Slope (degrees):	3

Transect description: Transect is located just up canyon from the large beautiful lush grotto on creek right. The end point is about 1m from shaley ledge about 10m up canyon from last of the maiden fern patches in upstream part of the grotto. The start point is at the base of a 4x3x4m angled gray limestone boulder. The start of the tape is wrapped around a SALEXI tree. At 2m on the tape is a 5m tall dead SALEXI. The tape goes through a rather dense patch of TAMRAM.

Additional Info::

Geological layer: Muav Limestone

Habitat type: Riparian Mojave desert scrub

Dominant species: Baccharis salicifolia (Ruiz & Pavón) Pers., Salix exigua Nutt., Tamarix ramosissima Ledeb.

Associated species: Acourtia wrightii (Gray) Reveal & King, Agave Utahensis var. utahensis, Artemisia ludoviciana Nutt., Baccharis sarothroides Gray, Erigeron divergens Torr. & Gray, Gilia clokeyi Mason, Hedeoma nana (Torr.) Briq., Lepidium montanum Nutt., , Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm., Phacelia crenulata Torr. ex S. Wats., Phacelia filiformis Brand, Plantago patagonica Jacq., Pleurocoronis pluriseta (Gray) King & H.E. Robins., Rhus trilobata Nutt. var. simplicifolia (Greene) Barkl., Solanum douglasii Dunal, Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb., Vulpia octoflora (Walt.) Rydb.

Surface water within 25m? ☑ Surface water type: stream

Landform: Drainage channel Lower slope

Surface rocks: limestone shale

Soil type: sandy loam loamy sand

Topo position: Low Level

Light exposure: partial-shade

Soil moisture: moist dry

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 2 Transect Type: Tamarisk Area

Date: 5/13/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Lori Makarick Reader: Mike Kearsley

Wind Speed: 1.0 Air Temp (F): 90.0 Cloud Cover: 1

Weather: 1% wispy clouds and very hot, approahing brutal.

Point Intercept Transect (50m)

Ground Cover	% Cover
Coarse woody debris	2
Cobble	3
Gravel	13
Litter (duff)	54
Sand	25
Stone	3

Species	% Cover
Baccharis salicifolia	24
Frangula betulifolia	1
Imperata brevifolia	3
Isocoma acradenia	2
Muhlenbergia asperifolia	2
Salix exigua	14
Sporobolus spp.	1
Tamarix aphylla	1
Tamarix ramosissima	35

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Moss (ground)	3	1	1	1	0
Boulder	0	5	1	9	4
Cobble	23	1	10	4	9
Woody debris structure	0	0	1	0	0
Crypto	12	12	3	3	3
Coarse woody debris	4	10	10	9	4
Litter (duff)	18	56	43	40	45
Stone	4	5	4	4	4
Sand	18	5	23	21	9
Gravel	18	5	4	9	22

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S	<1%	S	<0%		<1%	S	<0%	
Baccharis salicifolia	5-10%		10-25%		1-5%		10-25%		10-25%	
Bebbia juncea var. aspera	<1%		1-5%		<0%		<0%		<0%	
Brickellia longifolia	<0%		<1%		<1%		<0%		<0%	
Bromus rubens	1-5%		5-10%		10-25%		5-10%		1-5%	
Bromus tectorum	<0%		<1%		<0%		<0%		<0%	
Camissonia walkeri	<1%		<0%		<0%		<0%		<0%	
Chloracantha spinosa	<0%		<0%		<0%		<0%		<0%	

Cryptantha spp.	<0%		<1%		<0%		<0%	<1%	
Datura wrightii	<0%		<1%		<1%		<0%	<0%	
Encelia farinosa	<0%		<0%		1-5%		<0%	<0%	
Erodium cicutarium	<0%		<1%		<0%		<0%	<0%	
Frangula betulifolia	1-5%		1-5%		1-5%		<0%	<0%	
Funastrum cynanchoides	<1%		<1%		<0%		<0%	<0%	
Gilia spp.	<0%		<0%		<0%		<1%	<0%	
Gutierrezia spp.	<0%		<1%		1-5%		<0%	<0%	
Imperata brevifolia	<1%		1-5%		<0%		<0%	1-5%	
Isocoma acradenia	<0%		<0%		<0%		<0%	1-5%	
Lepidium lasiocarpum var. lasiocarpum	<0%		<1%		<0%		<0%	<0%	
Machaeranthera spp.	<1%		<0%		<0%		<0%	<0%	
Maurandella antirrhiniflora	<0%		<0%		<1%		<0%	<0%	
Muhlenbergia asperifolia	<1%		<1%		1-5%		1-5%	1-5%	
Nicotiana obtusifolia var. obtusifolia	<0%		<1%		<1%		<1%	<0%	
Oenothera elata	<0%		<0%		<1%		<0%	<0%	
Opuntia phaeacantha	<0%		<1%		<0%		<0%	<0%	
Parietaria hespera	<0%		<0%		<0%		<1%	<1%	
Polypogon viridis	<1%		<0%		<0%		<0%	<0%	
Salix exigua	5-10%		1-5%		<0%		<0%	5-10%	
Setaria spp.	<0%		<0%		<0%		1-5%	<0%	
Sphaeralcea grossulariifolia	<0%		<1%		<1%		<0%	<1%	
Sporobolus cryptandrus	<0%		<1%		<0%		<0%	<0%	
Stanleya pinnata	<0%		<0%		<0%		<1%	<0%	
Stephanomeria pauciflora	<0%		<1%		<1%		<0%	<0%	
Tamarix ramosissima	1-5%	S+M	25-50%	S+M	10-25%	S+M	25-50%	<1%	S
Ziziphus obtusifolia var. canescens	<0%		<0%		<0%		<1%	P <0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Baccharis salicifolia	5		
15	Baccharis salicifolia	9	1	
15	Tamarix ramosissima		16	7
25	Tamarix ramosissima		19	
35	Tamarix ramosissima		1	15
45	Baccharis salicifolia		7	
45	Isocoma acradenia	4		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Baccharis salicifolia	6		

15	Baccharis salicifolia	8	2	
15	Tamarix ramosissima		9	2
15	Vacant Space		1	
25	Tamarix ramosissima		7	
35	Tamarix ramosissima		3	5
45	Baccharis salicifolia		3	
45	Isocoma acradenia	2		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	7.94	2036	7.97	2036	7.99	2001	7.97	2024
15	8.12	285	8.06	283	8.09	282	8.09	283
25	8.06	2369	7.97	2385	7.97	2363	8.00	2372
35	8.23	3074	8.33	3099	8.41	3248	8.32	3140
45	8.8	1631	8.39	1667	8.34	1669	8.51	1656

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 2 Transect Type: Tamarisk Area

Date: 5/17/2007 Revisit? ☑ Post-tamarisk removal

Recorder: Steve Till Reader: Lori Makarick

Wind Speed: 1.0 Air Temp (F): 70.0 Cloud Cover: 0

Weather: Warm!

Point Intercept Transect (50m)

Ground Cover	% Cover
Coarse woody debris	7
Cobble	2
Crypto	3
Gravel	6
Lichen	1
Litter (duff)	62
Sand	16
Stone	1
Woody debris structure	2

Species	% Cover
Acacia greggii	1
Adenophyllum porophylloides	1
Baccharis salicifolia	22
Bebbia juncea var. aspera	1
Bromus rubens	1
Gutierrezia sarothrae	2
Imperata brevifolia	6
Isocoma acradenia	5
Rhamnus betulifolia var. obovata	2
Salix exigua	17
Salvia aethiopis	1
Sporobolus contractus	1
Tiquilia latior	1

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Crypto	7	6	3	2	3
Coarse woody debris	8	20	15	4	2
Gravel	30	1	4	5	14
Moss (ground)	1	2	0	3	5
Sand	13	8	24	15	12
Cobble	8	4	5	4	10
Stone	2	3	3	4	7
Litter (duff)	30	51	37	56	41
Basal Veg	1	1	0	1	1
Bedrock	0	0	0	0	4
Woody debris structure	0	1	3	2	0
Boulder	0	3	3	5	1

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	1-5%	S+M	<1%	S	<1%	P	<1%	S	<1%	S
Adenophyllum porophylloides	<1%		<1%		<0%		<0%		<0%	
Baccharis salicifolia	10-25%		5-10%		1-5%		1-5%		25-50%	
Bebbia juncea var. aspera	<1%		<0%		<0%		<0%		<0%	

Brickellia longifolia	1-5%		<0%		<1%	<0%		<0%
Bromus rubens	<1%		<0%		1-5%	1-5%		<0%
Camissonia walkeri	<0%		<0%		<0%	<0%		<1%
Datura wrightii	<0%		<1%		<1%	<0%		<0%
Encelia farinosa	1-5%		<1%		1-5%	<0%		<0%
Ephedra fasciculata	1-5%		<0%		<0%	<0%		<0%
Frangula betulifolia	1-5%		1-5%		<1%	<0%		<0%
Gutierrezia sarothrae	<1%		<0%		<1%	<1%		<0%
Imperata brevifolia	1-5%		<0%		<0%	1-5%		1-5%
Isocoma acradenia	<0%		<0%		<0%	<0%		1-5%
Muhlenbergia asperifolia	1-5%		<0%		<1%	1-5%		5-10%
Oenothera caespitosa	<1%		<0%		<0%	<1%		<0%
Oenothera elata	<1%		<0%		<0%	<0%		<0%
Opuntia chlorotica	<0%		1-5%		<0%	<0%		<0%
Pleurocoronis pluriseta	<0%		<0%		<0%	<0%		<1%
Salix exigua	5-10%		<0%		<0%	<0%		1-5%
Sarcostemma cynanchoides var. hartwegii	<1%		<0%		<0%	<0%		<0%
Sphaeralcea grossulariifolia	<0%		<0%		<0%	<1%		<1%
Sporobolus contractus	<0%		<1%		<1%	<1%		<0%
Stanleya pinnata	<0%		<0%		<0%	<0%		<1%
Stephanomeria pauciflora	<1%		<0%		<1%	<0%		<1%
Tamarix ramosissima	<1%	S	1-5%	S+P	<0%	<1%	S+P	<0%
Thymophylla pentachaeta	<0%		<0%		<0%	<0%		<1%
Ziziphus obtusifolia var. canescens	<0%		<0%		<0%	1-5%		<1%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Baccharis salicifolia		4	
5	Salix exigua	8		
45	Baccharis salicifolia	9	3	
45	Isocoma acradenia	5		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Baccharis salicifolia		2	
5	Salix exigua	2		
15	Sporobolus contractus	4		
45	Baccharis salicifolia	3	2	
45	Isocoma acradenia	7	2	
45	Vacant Space	0		

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 2 Transect Type: Tamarisk Area

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	6.74	399	7.24	3999	7.49	3999	7.16	2799
15	8.63	116	8.71	121	8.74	122	8.69	120
25	8.36	309	8.31	8	8.11	35	8.26	117
35	8.15	3051	8.44	3386	8.56	3368	8.38	3268
45	9.18	187	9.06	189	8.99	192	9.08	189

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 2 Transect Type: Tamarisk Area

Date: 5/13/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Lori Makarick Reader: Mike Kearsley

Wind Speed: 1.0 Air Temp (F): 90.0 Cloud Cover: 1

Weather: 1% wispy clouds and very hot, approahing brutal.

Point Intercept Transect (50m)

Ground Cover	% Cover
Coarse woody debris	2
Cobble	3
Gravel	13
Litter (duff)	54
Sand	25
Stone	3

Species	% Cover
Baccharis salicifolia	24
Frangula betulifolia	1
Imperata brevifolia	3
Isocoma acradenia	2
Muhlenbergia asperifolia	2
Salix exigua	14
Sporobolus spp.	1
Tamarix aphylla	1
Tamarix ramosissima	35

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Moss (ground)	3	1	1	1	0
Boulder	0	5	1	9	4
Cobble	23	1	10	4	9
Woody debris structure	0	0	1	0	0
Crypto	12	12	3	3	3
Coarse woody debris	4	10	10	9	4
Litter (duff)	18	56	43	40	45
Stone	4	5	4	4	4
Sand	18	5	23	21	9
Gravel	18	5	4	9	22

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S	<1%	S	<0%		<1%	S	<0%	
Baccharis salicifolia	5-10%		10-25%		1-5%		10-25%		10-25%	
Bebbia juncea var. aspera	<1%		1-5%		<0%		<0%		<0%	
Brickellia longifolia	<0%		<1%		<1%		<0%		<0%	
Bromus rubens	1-5%		5-10%		10-25%		5-10%		1-5%	
Bromus tectorum	<0%		<1%		<0%		<0%		<0%	
Camissonia walkeri	<1%		<0%		<0%		<0%		<0%	
Chloracantha spinosa	<0%		<0%		<0%		<0%		<0%	

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 2 Transect Type: Tamarisk Area

Cryptantha spp.	<0%		<1%		<0%		<0%	<1%	
Datura wrightii	<0%		<1%		<1%		<0%	<0%	
Encelia farinosa	<0%		<0%		1-5%		<0%	<0%	
Erodium cicutarium	<0%		<1%		<0%		<0%	<0%	
Frangula betulifolia	1-5%		1-5%		1-5%		<0%	<0%	
Funastrum cynanchoides	<1%		<1%		<0%		<0%	<0%	
Gilia spp.	<0%		<0%		<0%		<1%	<0%	
Gutierrezia spp.	<0%		<1%		1-5%		<0%	<0%	
Imperata brevifolia	<1%		1-5%		<0%		<0%	1-5%	
Isocoma acradenia	<0%		<0%		<0%		<0%	1-5%	
Lepidium lasiocarpum var. lasiocarpum	<0%		<1%		<0%		<0%	<0%	
Machaeranthera spp.	<1%		<0%		<0%		<0%	<0%	
Maurandella antirrhiniflora	<0%		<0%		<1%		<0%	<0%	
Muhlenbergia asperifolia	<1%		<1%		1-5%		1-5%	1-5%	
Nicotiana obtusifolia var. obtusifolia	<0%		<1%		<1%		<1%	<0%	
Oenothera elata	<0%		<0%		<1%		<0%	<0%	
Opuntia phaeacantha	<0%		<1%		<0%		<0%	<0%	
Parietaria hespera	<0%		<0%		<0%		<1%	<1%	
Polypogon viridis	<1%		<0%		<0%		<0%	<0%	
Salix exigua	5-10%		1-5%		<0%		<0%	5-10%	
Setaria spp.	<0%		<0%		<0%		1-5%	<0%	
Sphaeralcea grossulariifolia	<0%		<1%		<1%		<0%	<1%	
Sporobolus cryptandrus	<0%		<1%		<0%		<0%	<0%	
Stanleya pinnata	<0%		<0%		<0%		<1%	<0%	
Stephanomeria pauciflora	<0%		<1%		<1%		<0%	<0%	
Tamarix ramosissima	1-5%	S+M	25-50%	S+M	10-25%	S+M	25-50%	<1%	S
Ziziphus obtusifolia var. canescens	<0%		<0%		<0%		<1%	P <0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Baccharis salicifolia	5		
15	Baccharis salicifolia	9	1	
15	Tamarix ramosissima		16	7
25	Tamarix ramosissima		19	
35	Tamarix ramosissima		1	15
45	Baccharis salicifolia		7	
45	Isocoma acradenia	4		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Baccharis salicifolia	6		

15	Baccharis salicifolia	8	2	
15	Tamarix ramosissima		9	2
15	Vacant Space		1	
25	Tamarix ramosissima		7	
35	Tamarix ramosissima		3	5
45	Baccharis salicifolia		3	
45	Isocoma acradenia	2		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	7.94	2036	7.97	2036	7.99	2001	7.97	2024
15	8.12	285	8.06	283	8.09	282	8.09	283
25	8.06	2369	7.97	2385	7.97	2363	8.00	2372
35	8.23	3074	8.33	3099	8.41	3248	8.32	3140
45	8.8	1631	8.39	1667	8.34	1669	8.51	1656

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 2 Transect Type: Tamarisk Area

Date: 5/17/2007 Revisit? ☑ Post-tamarisk removal

Recorder: Steve Till Reader: Lori Makarick

Wind Speed: 1.0 Air Temp (F): 70.0 Cloud Cover: 0

Weather: Warm!

Point Intercept Transect (50m)

Ground Cover	% Cover
Coarse woody debris	7
Cobble	2
Crypto	3
Gravel	6
Lichen	1
Litter (duff)	62
Sand	16
Stone	1
Woody debris structure	2

Species	% Cover
Acacia greggii	1
Adenophyllum porophylloides	1
Baccharis salicifolia	22
Bebbia juncea var. aspera	1
Bromus rubens	1
Gutierrezia sarothrae	2
Imperata brevifolia	6
Isocoma acradenia	5
Rhamnus betulifolia var. obovata	2
Salix exigua	17
Salvia aethiopis	1
Sporobolus contractus	1
Tiquilia latior	1

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Crypto	7	6	3	2	3
Coarse woody debris	8	20	15	4	2
Gravel	30	1	4	5	14
Moss (ground)	1	2	0	3	5
Sand	13	8	24	15	12
Cobble	8	4	5	4	10
Stone	2	3	3	4	7
Litter (duff)	30	51	37	56	41
Basal Veg	1	1	0	1	1
Bedrock	0	0	0	0	4
Woody debris structure	0	1	3	2	0
Boulder	0	3	3	5	1

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	1-5%	S+M	<1%	S	<1%	P	<1%	S	<1%	S
Adenophyllum porophylloides	<1%		<1%		<0%		<0%		<0%	
Baccharis salicifolia	10-25%		5-10%		1-5%		1-5%		25-50%	
Bebbia juncea var. aspera	<1%		<0%		<0%		<0%		<0%	

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 2 Transect Type: Tamarisk Area

Brickellia longifolia	1-5%		<0%		<1%	<0%		<0%
Bromus rubens	<1%		<0%		1-5%	1-5%		<0%
Camissonia walkeri	<0%		<0%		<0%	<0%		<1%
Datura wrightii	<0%		<1%		<1%	<0%		<0%
Encelia farinosa	1-5%		<1%		1-5%	<0%		<0%
Ephedra fasciculata	1-5%		<0%		<0%	<0%		<0%
Frangula betulifolia	1-5%		1-5%		<1%	<0%		<0%
Gutierrezia sarothrae	<1%		<0%		<1%	<1%		<0%
Imperata brevifolia	1-5%		<0%		<0%	1-5%		1-5%
Isocoma acradenia	<0%		<0%		<0%	<0%		1-5%
Muhlenbergia asperifolia	1-5%		<0%		<1%	1-5%		5-10%
Oenothera caespitosa	<1%		<0%		<0%	<1%		<0%
Oenothera elata	<1%		<0%		<0%	<0%		<0%
Opuntia chlorotica	<0%		1-5%		<0%	<0%		<0%
Pleurocoronis pluriseta	<0%		<0%		<0%	<0%		<1%
Salix exigua	5-10%		<0%		<0%	<0%		1-5%
Sarcostemma cynanchoides var. hartwegii	<1%		<0%		<0%	<0%		<0%
Sphaeralcea grossulariifolia	<0%		<0%		<0%	<1%		<1%
Sporobolus contractus	<0%		<1%		<1%	<1%		<0%
Stanleya pinnata	<0%		<0%		<0%	<0%		<1%
Stephanomeria pauciflora	<1%		<0%		<1%	<0%		<1%
Tamarix ramosissima	<1%	S	1-5%	S+P	<0%	<1%	S+P	<0%
Thymophylla pentachaeta	<0%		<0%		<0%	<0%		<1%
Ziziphus obtusifolia var. canescens	<0%		<0%		<0%	1-5%		<1%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Baccharis salicifolia		4	
5	Salix exigua	8		
45	Baccharis salicifolia	9	3	
45	Isocoma acradenia	5		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Baccharis salicifolia		2	
5	Salix exigua	2		
15	Sporobolus contractus	4		
45	Baccharis salicifolia	3	2	
45	Isocoma acradenia	7	2	
45	Vacant Space	0		

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 2 Transect Type: Tamarisk Area

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	6.74	399	7.24	3999	7.49	3999	7.16	2799
15	8.63	116	8.71	121	8.74	122	8.69	120
25	8.36	309	8.31	8	8.11	35	8.26	117
35	8.15	3051	8.44	3386	8.56	3368	8.38	3268
45	9.18	187	9.06	189	8.99	192	9.08	189

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 2 Transect Type: Tamarisk Control

	Start point		End point
Easting:	323019	Easting:	323044
Northing:	4010277	Northing:	4010316
GPS accuracy (m):	6.6	GPS accuracy (m):	6.9
Elevation (m):	589	Elevation (m):	599
Bearing:	46		
Aspect (0-360):	40	Slope (degrees):	9

Transect description: Transect start is located about 580m upstream of T1B and about 100m past a lovely hanging garden with Petrophyton on creek right. Transect is on creek left on top of a 2m wide muav-colored triangular Muav limestone boulder. Behind this boulder stand a 5m+ white limestone boulder.

Additional Info:: Transect end is in a large patch of imperata, look for a 10x5m red wall limestone boulder that transect tape passes over at 27.5m.

Geological layer: Muav limestone

Habitat type: Riparian Mojave desert scrub

Dominant species: Baccharis salicifolia (Ruiz & Pavón) Pers., Chloracantha spinosa (Benth.) Nesom, Imperata brevifolia Vasey, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Salix exigua Nutt.

Associated species: Bebbia juncea (Benth.) Greene var. aspera Greene, Encelia farinosa Gray ex Torr., Equisetum hyemale L., Fouquieria splendens Engelm., Mammillaria grahamii Engelm. var. grahamii, Mortonia utahensis (Coville ex Gray) A. Nels., Nolina microcarpa S. Wats., Parietaria hespera Hinton, Polypogon monspeliensis (L.) Desf.

Surface water within 25m? ☑ Surface water type: stream

Landform: Side slope Drainage channel Surface rocks: limestone

Soil type: silt loam Topo position: Low Level

Light exposure: open partial-shade Soil moisture: dry moist

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 2 Transect Type: Tamarisk Control

Date: 5/13/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Kate Watters Reader: Amy Prince

Wind Speed: 0.0 Air Temp (F): 90.0 Cloud Cover: 20

Weather: Hot, stinkin'so! High clouds, no breeze, about 90F.

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	10
Coarse woody debris	1
Cobble	1
Gravel	2
Litter (duff)	66
Sand	14
Stone	2
Woody debris structure	3

Species	% Cover
Baccharis salicifolia	20
Chloracantha spinosa	32
Equisetum hyemale	3
Funastrum cynanchoides	1
Galium stellatum	1
Imperata brevifolia	22
Muhlenbergia asperifolia	11
Salix exigua	26
Tamarix ramosissima	3

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Crypto	0	0	3	0	3
Woody debris structure	0	1	0	0	0
Boulder	11	4	34	1	14
Litter (duff)	56	47	56	70	50
Stone	4	4	0	1	15
Bedrock	0	22	7	0	0
Gravel	1	4	0	9	6
Cobble	1	4	0	9	3
Bare Soil	0	0	0	0	3
Sand	26	10	0	1	3
Coarse woody debris	1	4	0	9	3

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<0%		<1%	P	<0%		<0%		<0%	
Baccharis salicifolia	1-5%		<1%		<1%		5-10%		1-5%	
Baccharis sergiloides	<0%		<0%		<0%		<0%		1-5%	
Bebbia juncea var. aspera	1-5%		<1%		<0%		<0%		<0%	
Bromus rubens	<0%		<1%		<0%		<0%		<1%	
Camissonia walkeri	<0%		<1%		<0%		<0%		<0%	
Chloracantha spinosa	<0%		<0%		25-50%		10-25%		10-25%	
Cryptantha spp.	<0%		<0%		<0%		<0%		<1%	
Descurainia pinnata	<0%		<1%		<0%		<0%		<0%	

Draba cuneifolia	<0%		<0%	<0%	<0%		<1%	
Encelia farinosa	<0%		<1%	<1%	<0%		<0%	
Equisetum hyemale	<0%		<0%	<0%	<0%		1-5%	
Erigeron lobatus	<0%		<0%	<0%	<0%		<1%	
Funastrum cynanchoides	<1%		<1%	1-5%	<1%		<0%	
Galium stellatum	<0%		<0%	<1%	<0%		<0%	
Gilia spp.	<0%		<0%	<1%	<0%		<0%	
Gutierrezia sarothrae	<0%		<0%	<1%	<0%		1-5%	
Hedeoma nana	<0%		<1%	<0%	<0%		<1%	
Imperata brevifolia	10-25%		5-10%	1-5%	<0%		25-50%	
Lepidium lasiocarpum var. lasiocarpum	<0%		<0%	<0%	<0%		<1%	
Mortonia scabrella	<0%		<1%	<0%	<0%		<0%	
Muhlenbergia asperifolia	1-5%		5-10%	<1%	1-5%		<1%	
Oenothera caespitosa	<0%		<1%	<0%	<0%		<0%	
Polypogon viridis	<0%		<1%	<0%	<1%		<0%	
Salix exigua	10-25%		5-10%	1-5%	25-50%		5-10%	
Silene antirrhina	<0%		<0%	<0%	<1%		<0%	
Stephanomeria pauciflora	<0%		<1%	<0%	<0%		<0%	
Tamarix ramosissima	1-5%	P	<0%	<0%	1-5%	S+P	1-5%	P
Thymophylla pentachaeta	<0%		<1%	<0%	<0%		<0%	
Vulpia mictrostachys	<0%		<0%	<0%	<0%		<1%	
Vulpia octoflora	<0%		<0%	<1%	<1%		<1%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Imperata brevifolia	4		
5	Salix exigua		8	
15	Baccharis salicifolia	5	2	
25	Chloracantha spinosa	11		
35	Chloracantha spinosa	9	1	
35	Salix exigua			50
45	Chloracantha spinosa	5	2	
45	Imperata brevifolia	5		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Imperata brevifolia	2		
5	Salix exigua		8	
15	Baccharis salicifolia	4	1	

25	Chloracantha spinosa	7		
35	Chloracantha spinosa	5	2	
35	Salix exigua		10	10
35	Vacant Space		0	
45	Chloracantha spinosa	5	1	
45	Imperata brevifolia	4		
45	Vacant Space	1		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	9.02	3999	9.06	3999	9.06	3999	9.05	3999
15	9.05	3999	9.09	3999	9.1	3999	9.08	3999
25	8.55	218	8.34	2189	8.17	2225	8.35	1544
35	8.68	1136	8.7	1277	8.75	1327	8.71	1247
45	8.48	2508	8.51	2534	8.49	2592	8.49	2545

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 2 Transect Type: Tamarisk Control

Date: 5/17/2007 Revisit? ☑ Post-tamarisk removal

Recorder: Kate Watters Reader: Amy Prince

Wind Speed: 0.0 Air Temp (F): 70.0 Cloud Cover: 0

Weather: Clear morning, shady, still cool morning.

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	12
Coarse woody debris	2
Crypto	2
Litter (duff)	80
Sand	1
Stone	3

Species	% Cover
Acacia greggii	1
Baccharis salicifolia	26
Chloracantha spinosa	21
Equisetum hyemale	1
Imperata brevifolia	38
Muhlenbergia asperifolia	21
Salix exigua	28
Sarcostemma cynanchoides var. hartwegii	2

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Moss (ground)	0	0	2	2	4
Woody debris structure	1	1	0	0	0
Gravel	4	8	2	31	20
Crypto	1	3	2	1	0
Coarse woody debris	1	2	3	2	2
Boulder	15	13	45	4	9
Stone	5	11	0	4	4
Basal Veg	2	1	2	1	2
Sand	15	16	2	6	18
Litter (duff)	53	39	41	43	34
Cobble	3	5	1	6	7

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<0%		<0%		<1%	S	<0%		<0%	
Andropogon glomeratus	<0%		<0%		<0%		<1%		<0%	
Aristida arizonica	<0%		<0%		<1%		<0%		<0%	
Baccharis salicifolia	1-5%		5-10%		1-5%		1-5%		1-5%	
Baccharis sarothroides	<0%		<0%		<0%		<0%		<1%	
Bebbia juncea var. aspera	1-5%		1-5%		<0%		<0%		<0%	
Bothriochloa barbinodis	<0%		<0%		<1%		<0%		<0%	
Camissonia walkeri	<0%		<0%		<1%		<0%		<1%	
Chloracantha spinosa	<0%		<0%		25-50%		1-5%		1-5%	
Datura wrightii	<0%		<0%		<0%		<1%		<0%	
Encelia farinosa	<0%		<1%		<1%		<0%		<0%	

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 2 Transect Type: Tamarisk Control

Equisetum hyemale	<0%		<0%		<0%		<0%	<1%	
Galium stellatum	<0%		<0%		<1%		<0%	<0%	
Gutierrezia sarothrae	<0%		<0%		<1%		<0%	<0%	
Imperata brevifolia	10-25%		5-10%		1-5%		<1%	10-25%	
Isocoma acradenia	1-5%		1-5%		<0%		<0%	<0%	
Muhlenbergia asperifolia	5-10%		5-10%		1-5%		1-5%	<1%	
Oenothera caespitosa	<0%		<1%		<0%		<0%	<0%	
Polypogon viridis	<0%		<1%		<0%		<1%	<1%	
Porophyllum gracile	<0%		<0%		<1%		<0%	<0%	
Salix exigua	5-10%		5-10%		1-5%		10-25%	5-10%	
Sarcostemma cynanchoides var. hartwegii	1-5%		<1%		1-5%		<1%	<1%	
Stephanomeria pauciflora	<0%		<1%		<0%		<0%	<0%	
Tamarix ramosissima	<1%	S	<0%		<1%	S	<1%	S	<1%	S+P

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Imperata brevifolia	11		
15	Baccharis salicifolia	4	4	
15	Imperata brevifolia	3		
15	Muhlenbergia asperifolia	7		
25	Chloracantha spinosa	12		
35	Baccharis salicifolia	10	1	
35	Chloracantha spinosa	5		
35	Muhlenbergia asperifolia	5		
35	Salix exigua		2	8
45	Chloracantha spinosa	3		
45	Imperata brevifolia	3		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Imperata brevifolia	7		
5	Muhlenbergia asperifolia	3		
5	Salix exigua		2	
5	Vacant Space	0		
15	Baccharis salicifolia	6	5	
15	Imperata brevifolia	8		
15	Muhlenbergia asperifolia	2		

15	Vacant Space	0		
25	Chloracantha spinosa	7		
35	Baccharis salicifolia	5	2	
35	Muhlenbergia asperifolia	2		
35	Salix exigua		8	10
35	Vacant Space		0	
45	Chloracantha spinosa	3		
45	Imperata brevifolia	10		
45	Vacant Space	0		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	9.02	3999	8.9	3999	8.86	3999	8.93	3999
15	8.63	3999	8.78	3999	8.83	3999	8.75	3999
25	8.84	2804	8.79	2486	8.6	2714	8.74	2668
35	8.82	3999	8.42	3999	8.89	3999	8.71	3999
45	8.05	3999	8.42	3999	8.54	3999	8.34	3999

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 2 Transect Type: Tamarisk Control

Date: 5/13/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Kate Watters Reader: Amy Prince

Wind Speed: 0.0 Air Temp (F): 90.0 Cloud Cover: 20

Weather: Hot, stinkin'so! High clouds, no breeze, about 90F.

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	10
Coarse woody debris	1
Cobble	1
Gravel	2
Litter (duff)	66
Sand	14
Stone	2
Woody debris structure	3

Species	% Cover
Baccharis salicifolia	20
Chloracantha spinosa	32
Equisetum hyemale	3
Funastrum cynanchoides	1
Galium stellatum	1
Imperata brevifolia	22
Muhlenbergia asperifolia	11
Salix exigua	26
Tamarix ramosissima	3

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Crypto	0	0	3	0	3
Woody debris structure	0	1	0	0	0
Boulder	11	4	34	1	14
Litter (duff)	56	47	56	70	50
Stone	4	4	0	1	15
Bedrock	0	22	7	0	0
Gravel	1	4	0	9	6
Cobble	1	4	0	9	3
Bare Soil	0	0	0	0	3
Sand	26	10	0	1	3
Coarse woody debris	1	4	0	9	3

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<0%		<1%	P	<0%		<0%		<0%	
Baccharis salicifolia	1-5%		<1%		<1%		5-10%		1-5%	
Baccharis sergiloides	<0%		<0%		<0%		<0%		1-5%	
Bebbia juncea var. aspera	1-5%		<1%		<0%		<0%		<0%	
Bromus rubens	<0%		<1%		<0%		<0%		<1%	
Camissonia walkeri	<0%		<1%		<0%		<0%		<0%	
Chloracantha spinosa	<0%		<0%		25-50%		10-25%		10-25%	
Cryptantha spp.	<0%		<0%		<0%		<0%		<1%	
Descurainia pinnata	<0%		<1%		<0%		<0%		<0%	

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 2 Transect Type: Tamarisk Control

Draba cuneifolia	<0%		<0%	<0%	<0%		<1%	
Encelia farinosa	<0%		<1%	<1%	<0%		<0%	
Equisetum hyemale	<0%		<0%	<0%	<0%		1-5%	
Erigeron lobatus	<0%		<0%	<0%	<0%		<1%	
Funastrum cynanchoides	<1%		<1%	1-5%	<1%		<0%	
Galium stellatum	<0%		<0%	<1%	<0%		<0%	
Gilia spp.	<0%		<0%	<1%	<0%		<0%	
Gutierrezia sarothrae	<0%		<0%	<1%	<0%		1-5%	
Hedeoma nana	<0%		<1%	<0%	<0%		<1%	
Imperata brevifolia	10-25%		5-10%	1-5%	<0%		25-50%	
Lepidium lasiocarpum var. lasiocarpum	<0%		<0%	<0%	<0%		<1%	
Mortonia scabrella	<0%		<1%	<0%	<0%		<0%	
Muhlenbergia asperifolia	1-5%		5-10%	<1%	1-5%		<1%	
Oenothera caespitosa	<0%		<1%	<0%	<0%		<0%	
Polypogon viridis	<0%		<1%	<0%	<1%		<0%	
Salix exigua	10-25%		5-10%	1-5%	25-50%		5-10%	
Silene antirrhina	<0%		<0%	<0%	<1%		<0%	
Stephanomeria pauciflora	<0%		<1%	<0%	<0%		<0%	
Tamarix ramosissima	1-5%	P	<0%	<0%	1-5%	S+P	1-5%	P
Thymophylla pentachaeta	<0%		<1%	<0%	<0%		<0%	
Vulpia mictrostachys	<0%		<0%	<0%	<0%		<1%	
Vulpia octoflora	<0%		<0%	<1%	<1%		<1%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Imperata brevifolia	4		
5	Salix exigua		8	
15	Baccharis salicifolia	5	2	
25	Chloracantha spinosa	11		
35	Chloracantha spinosa	9	1	
35	Salix exigua			50
45	Chloracantha spinosa	5	2	
45	Imperata brevifolia	5		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Imperata brevifolia	2		
5	Salix exigua		8	
15	Baccharis salicifolia	4	1	

25	Chloracantha spinosa	7		
35	Chloracantha spinosa	5	2	
35	Salix exigua		10	10
35	Vacant Space		0	
45	Chloracantha spinosa	5	1	
45	Imperata brevifolia	4		
45	Vacant Space	1		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	9.02	3999	9.06	3999	9.06	3999	9.05	3999
15	9.05	3999	9.09	3999	9.1	3999	9.08	3999
25	8.55	218	8.34	2189	8.17	2225	8.35	1544
35	8.68	1136	8.7	1277	8.75	1327	8.71	1247
45	8.48	2508	8.51	2534	8.49	2592	8.49	2545

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 2 Transect Type: Tamarisk Control

Date: 5/17/2007 Revisit? ☑ Post-tamarisk removal

Recorder: Kate Watters Reader: Amy Prince

Wind Speed: 0.0 Air Temp (F): 70.0 Cloud Cover: 0

Weather: Clear morning, shady, still cool morning.

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	12
Coarse woody debris	2
Crypto	2
Litter (duff)	80
Sand	1
Stone	3

Species	% Cover
Acacia greggii	1
Baccharis salicifolia	26
Chloracantha spinosa	21
Equisetum hyemale	1
Imperata brevifolia	38
Muhlenbergia asperifolia	21
Salix exigua	28
Sarcostemma cynanchoides var. hartwegii	2

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Moss (ground)	0	0	2	2	4
Woody debris structure	1	1	0	0	0
Gravel	4	8	2	31	20
Crypto	1	3	2	1	0
Coarse woody debris	1	2	3	2	2
Boulder	15	13	45	4	9
Stone	5	11	0	4	4
Basal Veg	2	1	2	1	2
Sand	15	16	2	6	18
Litter (duff)	53	39	41	43	34
Cobble	3	5	1	6	7

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<0%		<0%		<1%	S	<0%		<0%	
Andropogon glomeratus	<0%		<0%		<0%		<1%		<0%	
Aristida arizonica	<0%		<0%		<1%		<0%		<0%	
Baccharis salicifolia	1-5%		5-10%		1-5%		1-5%		1-5%	
Baccharis sarothroides	<0%		<0%		<0%		<0%		<1%	
Bebbia juncea var. aspera	1-5%		1-5%		<0%		<0%		<0%	
Bothriochloa barbinodis	<0%		<0%		<1%		<0%		<0%	
Camissonia walkeri	<0%		<0%		<1%		<0%		<1%	
Chloracantha spinosa	<0%		<0%		25-50%		1-5%		1-5%	
Datura wrightii	<0%		<0%		<0%		<1%		<0%	
Encelia farinosa	<0%		<1%		<1%		<0%		<0%	

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 2 Transect Type: Tamarisk Control

Equisetum hyemale	<0%		<0%		<0%		<0%	<1%	
Galium stellatum	<0%		<0%		<1%		<0%	<0%	
Gutierrezia sarothrae	<0%		<0%		<1%		<0%	<0%	
Imperata brevifolia	10-25%		5-10%		1-5%		<1%	10-25%	
Isocoma acradenia	1-5%		1-5%		<0%		<0%	<0%	
Muhlenbergia asperifolia	5-10%		5-10%		1-5%		1-5%	<1%	
Oenothera caespitosa	<0%		<1%		<0%		<0%	<0%	
Polypogon viridis	<0%		<1%		<0%		<1%	<1%	
Porophyllum gracile	<0%		<0%		<1%		<0%	<0%	
Salix exigua	5-10%		5-10%		1-5%		10-25%	5-10%	
Sarcostemma cynanchoides var. hartwegii	1-5%		<1%		1-5%		<1%	<1%	
Stephanomeria pauciflora	<0%		<1%		<0%		<0%	<0%	
Tamarix ramosissima	<1%	S	<0%		<1%	S	<1%	S	<1%	S+P

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Imperata brevifolia	11		
15	Baccharis salicifolia	4	4	
15	Imperata brevifolia	3		
15	Muhlenbergia asperifolia	7		
25	Chloracantha spinosa	12		
35	Baccharis salicifolia	10	1	
35	Chloracantha spinosa	5		
35	Muhlenbergia asperifolia	5		
35	Salix exigua		2	8
45	Chloracantha spinosa	3		
45	Imperata brevifolia	3		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Imperata brevifolia	7		
5	Muhlenbergia asperifolia	3		
5	Salix exigua		2	
5	Vacant Space	0		
15	Baccharis salicifolia	6	5	
15	Imperata brevifolia	8		
15	Muhlenbergia asperifolia	2		

15	Vacant Space	0		
25	Chloracantha spinosa	7		
35	Baccharis salicifolia	5	2	
35	Muhlenbergia asperifolia	2		
35	Salix exigua		8	10
35	Vacant Space		0	
45	Chloracantha spinosa	3		
45	Imperata brevifolia	10		
45	Vacant Space	0		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	9.02	3999	8.9	3999	8.86	3999	8.93	3999
15	8.63	3999	8.78	3999	8.83	3999	8.75	3999
25	8.84	2804	8.79	2486	8.6	2714	8.74	2668
35	8.82	3999	8.42	3999	8.89	3999	8.71	3999
45	8.05	3999	8.42	3999	8.54	3999	8.34	3999

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 3 Transect Type: Tamarisk Area

	Start point		End point
Easting:	322924	Easting:	322848
Northing:	4009740	Northing:	4009907
GPS accuracy (m):	29	GPS accuracy (m):	2402
Elevation (m):	625	Elevation (m):	379
Bearing:	8		
Aspect (0-360):	16	Slope (degrees):	4

Transect description: Transect is located about 500m upstream of T2B on creek left side of drainage in a Frangula and Cercis jungle about 20m downstream of a creek left Muav seep with lots of Mimulus and adiantum. Transect start is on a 6x2m slanted, gray, Muav boulder.

Additional Info:: Transect end is just upstream of a golden member of the Bright Angel Shale bedrock shelf on creek right. Transect end is at the base of a mature TAMRAM. In 2007, also saturated soil and standing water.

Geological layer: Muav Limestone

Habitat type: Riparian

Dominant species: Baccharis salicifolia (Ruiz & Pavón) Pers., Brickellia longifolia S. Wats., Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Salix exigua Nutt., Tamarix ramosissima Ledeb.

Associated species: Acacia greggii Gray, Adiantum capillus-veneris L., Brickellia longifolia S. Wats., Bromus rubens L., Cercis orbiculata Greene, Descurainia pinnata (Walt.) Britt., Draba cuneifolia Nutt. ex Torr. & Gray, Frangula betulifolia (Greene) V. Grub., Hedeoma nana (Torr.) Briq., Larrea tridentata (Sessé & Moc. ex DC.) Coville, Lepidium lasiocarpum Nutt. var. lasiocarpum, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Opuntia phaeacantha Engelm., Parietaria hespera Hinton, Phacelia filiformis Brand, Poa bigelovii Vasey & Scribn., Pseudognaphalium spp, Ptelea trifoliata L., Typha latifolia L.

Surface water within 25m? ☑ Surface water type: stream

Landform: Drainage channel Side slope

Surface rocks: limestone

Soil type: sand sandy loam

Topo position: Interfluve

Light exposure: partial-shade

Soil moisture: moist saturated

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 3 Transect Type: Tamarisk Area

Date: 5/13/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Kate Watters Reader: Amy Prince

Wind Speed: 1.0 Air Temp (F): 90.0 Cloud Cover: 0

Weather: Clear and sunny.

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	24
Cobble	2
Gravel	35
Litter (duff)	21
Sand	6
Stone	12

Species	% Cover
Algae spp.	6
Baccharis salicifolia	10
Polypogon viridis	1
Salix exigua	2
Tamarix ramosissima	31

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Coarse woody debris	1	0	0	0	3
Boulder	78	29	7	32	18
Litter (duff)	1	49	7	0	8
Sand	10	0	7	6	18
Cobble	4	6	16	32	18
Stone	4	0	7	15	18
Bedrock	0	2	0	0	0
Gravel	1	14	56	15	18
Bare Soil	1	0	0	0	1

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<0%		<1%	S	<1%	S	<0%		<0%	
Adiantum capillus-veneris	<1%		<0%		<0%		<0%		<0%	
Algae spp.	<1%		<0%		5-10%		5-10%		5-10%	
Andropogon glomeratus	<0%		<0%		1-5%		<0%		<0%	
Baccharis salicifolia	10-25%		10-25%		5-10%		<1%		<1%	
Brickellia longifolia	<1%		<0%		<0%		<0%		<1%	
Bromus rubens	<0%		<0%		<1%		<1%		<1%	
Cercis orbiculata	<0%		1-5%	S+M	<0%		<0%		<0%	
Cryptantha spp.	<0%		<0%		<0%		<1%		<0%	
Descurainia pinnata	<1%		<0%		<0%		<0%		<0%	
Draba cuneifolia	<1%		<1%		<0%		<1%		<0%	

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 3 Transect Type: Tamarisk Area

Frangula betulifolia	<0%	<0%	<1%	S+P	<0%	<0%	
Funastrum cynanchoides	<1%						
Hedeoma nana	<0%	<1%	<0%		<0%	<0%	
Mimulus cardinalis	<0%	<0%	<0%		<0%	<1%	
Muhlenbergia asperifolia	<0%	<0%	<1%		<0%	1-5%	
Parietaria hespera	<0%	<0%	<1%		<0%	<0%	
Phacelia filiformis					<1%	<1%	
Poa bigelovii	<1%	<1%	<1%		<1%	<1%	
Polypogon viridis	<0%	1-5%	25-50%		<0%	<1%	
Pseudognaphalium canescens ssp. canescens	<0%	<0%	<1%		<0%	<0%	
Salix exigua	<0%	<0%	5-10%		<1%	5-10%	
Solidago species	<0%	<0%	<0%		<0%	<1%	
Sonchus asper	<0%	<0%	<0%		<1%	<0%	
Tamarix ramosissima	<0%	50-75%	5-10%	S+M	<0%	5-10%	S+M
Typha domingensis	<0%	<0%	1-5%		<0%	<0%	
Vulpia mictrostachys	<0%	<0%	<0%		<1%	<1%	
Vulpia octoflora	<0%	<0%	<1%		<0%	<0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
15	Tamarix ramosissima	21	27	40

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
15	Tamarix ramosissima	4	8	8

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.82	287	8.8	278	8.76	285	8.79	283
15	8.73	2122	8.79	2161	8.79	2177	8.77	2153
25	8.81	626	8.73	650	8.7	692	8.75	656
35	8.4	421	8.7	788	8.7	823	8.60	677
45	8.98	1066	9.05	1304	9.04	1358	9.02	1243

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 3 Transect Type: Tamarisk Area

Date: 5/16/2007 Revisit? ☑ Post-tamarisk removal

Recorder: Amy Prince Reader: Kate Watters

Wind Speed: 2.0 Air Temp (F): 90.0 Cloud Cover: 0

Weather: HOT! Clear blue sky overhead with very few clouds on the horizon and a light wind

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	24
Coarse woody debris	4
Cobble	13
Gravel	7
Litter (duff)	24
Plant	3
Sand	22
Stone	3

Species	% Cover
Algae spp.	2
Baccharis salicifolia	24
Brickellia longifolia	5
Mimulus cardinalis	3
Muhlenbergia asperifolia	1
Polypogon viridis	11
Salix exigua	5
Sonchus asper	1
Tamarix ramosissima	1
Typha domingensis	3

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Bedrock	0	0	0	0	5
Woody debris structure	1	2	0	0	0
Basal Veg	1	1	1	1	1
Sand	12	10	14	20	12
Boulder	36	23	4	32	22
Cobble	7	6	13	14	13
Stone	13	4	5	9	10
Coarse woody debris	4	8	0	0	1
Moss (ground)	0	0	3	0	1
Gravel	9	6	45	19	26
Crypto	1	0	0	0	1
Litter (duff)	8	40	15	5	8

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<0%		<1%	S	<1%	M	<0%		<0%	
Adiantum capillus-veneris	<0%		<0%		<1%		<0%		<0%	
Andropogon glomeratus	<1%		<1%		1-5%		<1%		1-5%	
Baccharis salicifolia	5-10%		1-5%		5-10%		1-5%		1-5%	
Brickellia longifolia	1-5%		1-5%		1-5%		<0%		1-5%	
Bromus rubens	<1%		<1%		<1%		<1%		<0%	

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 3 Transect Type: Tamarisk Area

Camissonia walkeri	<1%		<0%		<0%		<0%		<0%	
Cercis orbiculata	<0%		1-5%	M	<0%		<0%		<0%	
Chara spp	<0%		<0%		<1%		<1%		<1%	
Encelia farinosa	<1%		<0%		<0%		<0%		<0%	
Frangula betulifolia	<0%		<1%	S	1-5%	S+P	<0%		<1%	S
Hedeoma nana	<0%		<1%		<0%		<0%		<0%	
Imperata brevifolia	<0%		<0%		1-5%		<1%		<0%	
Melilotus officinalis	<0%		<1%		<0%		<0%		<0%	
Mimulus cardinalis	<0%		<0%		<1%		<1%		1-5%	
Muhlenbergia asperifolia	<1%		<0%		<1%		1-5%		1-5%	
Parietaria hespera	<0%		<1%		<0%		<0%		<0%	
Polypogon viridis	<1%		<1%		5-10%		1-5%		1-5%	
Pseudognaphalium stramineum	<0%		<0%		<1%		<0%		<0%	
Salix exigua	<0%		<0%		1-5%		<1%		5-10%	
Sarcostemma cynanchoides var. hartwegii	<1%		<0%		<0%		<0%		<0%	
Solanum spp.	<0%		<0%		<0%		<0%		<1%	
Sonchus asper	<0%		<1%		<1%		<1%		<0%	
Tamarix ramosissima	<1%	S	<1%	S	<1%	S	<1%	S	<1%	S
Typha domingensis	<0%		<0%		1-5%		<1%		<1%	
Vulpia octoflora	<1%		<0%		<0%		<0%		<0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
25	Typha domingensis	5		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Baccharis salicifolia	1		
15	Polypogon viridis	2		
25	Polypogon viridis	1		
25	Typha domingensis	2		
25	Vacant Space	8		
45	Baccharis salicifolia	1		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	7.54	1444	7.81	1477	7.66	1369	7.67	1430
15	7.9	2800	7.76	2808	7.88	2757	7.85	2788
25	7.78	520	7.6	502	7.5	465	7.63	496

35	7.74	1949	7.4	2042	7.38	1955	7.51	1982
45	7.83	462	7.79	433	7.74	398	7.79	431

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 3 Transect Type: Tamarisk Area

Date: 5/13/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Kate Watters Reader: Amy Prince

Wind Speed: 1.0 Air Temp (F): 90.0 Cloud Cover: 0

Weather: Clear and sunny.

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	24
Cobble	2
Gravel	35
Litter (duff)	21
Sand	6
Stone	12

Species	% Cover
Algae spp.	6
Baccharis salicifolia	10
Polypogon viridis	1
Salix exigua	2
Tamarix ramosissima	31

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Coarse woody debris	1	0	0	0	3
Boulder	78	29	7	32	18
Litter (duff)	1	49	7	0	8
Sand	10	0	7	6	18
Cobble	4	6	16	32	18
Stone	4	0	7	15	18
Bedrock	0	2	0	0	0
Gravel	1	14	56	15	18
Bare Soil	1	0	0	0	1

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<0%		<1%	S	<1%	S	<0%		<0%	
Adiantum capillus-veneris	<1%		<0%		<0%		<0%		<0%	
Algae spp.	<1%		<0%		5-10%		5-10%		5-10%	
Andropogon glomeratus	<0%		<0%		1-5%		<0%		<0%	
Baccharis salicifolia	10-25%		10-25%		5-10%		<1%		<1%	
Brickellia longifolia	<1%		<0%		<0%		<0%		<1%	
Bromus rubens	<0%		<0%		<1%		<1%		<1%	
Cercis orbiculata	<0%		1-5%	S+M	<0%		<0%		<0%	
Cryptantha spp.	<0%		<0%		<0%		<1%		<0%	
Descurainia pinnata	<1%		<0%		<0%		<0%		<0%	
Draba cuneifolia	<1%		<1%		<0%		<1%		<0%	

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 3 Transect Type: Tamarisk Area

Frangula betulifolia	<0%	<0%	<1%	S+P	<0%	<0%	
Funastrum cynanchoides	<1%						
Hedeoma nana	<0%	<1%	<0%		<0%	<0%	
Mimulus cardinalis	<0%	<0%	<0%		<0%	<1%	
Muhlenbergia asperifolia	<0%	<0%	<1%		<0%	1-5%	
Parietaria hespera	<0%	<0%	<1%		<0%	<0%	
Phacelia filiformis					<1%	<1%	
Poa bigelovii	<1%	<1%	<1%		<1%	<1%	
Polypogon viridis	<0%	1-5%	25-50%		<0%	<1%	
Pseudognaphalium canescens ssp. canescens	<0%	<0%	<1%		<0%	<0%	
Salix exigua	<0%	<0%	5-10%		<1%	5-10%	
Solidago species	<0%	<0%	<0%		<0%	<1%	
Sonchus asper	<0%	<0%	<0%		<1%	<0%	
Tamarix ramosissima	<0%	50-75%	5-10%	S+M	<0%	5-10%	S+M
Typha domingensis	<0%	<0%	1-5%		<0%	<0%	
Vulpia mictrostachys	<0%	<0%	<0%		<1%	<1%	
Vulpia octoflora	<0%	<0%	<1%		<0%	<0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
15	Tamarix ramosissima	21	27	40

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
15	Tamarix ramosissima	4	8	8

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.82	287	8.8	278	8.76	285	8.79	283
15	8.73	2122	8.79	2161	8.79	2177	8.77	2153
25	8.81	626	8.73	650	8.7	692	8.75	656
35	8.4	421	8.7	788	8.7	823	8.60	677
45	8.98	1066	9.05	1304	9.04	1358	9.02	1243

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 3 Transect Type: Tamarisk Area

Date: 5/16/2007 Revisit? ☑ Post-tamarisk removal

Recorder: Amy Prince Reader: Kate Watters

Wind Speed: 2.0 Air Temp (F): 90.0 Cloud Cover: 0

Weather: HOT! Clear blue sky overhead with very few clouds on the horizon and a light wind

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	24
Coarse woody debris	4
Cobble	13
Gravel	7
Litter (duff)	24
Plant	3
Sand	22
Stone	3

Species	% Cover
Algae spp.	2
Baccharis salicifolia	24
Brickellia longifolia	5
Mimulus cardinalis	3
Muhlenbergia asperifolia	1
Polypogon viridis	11
Salix exigua	5
Sonchus asper	1
Tamarix ramosissima	1
Typha domingensis	3

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Bedrock	0	0	0	0	5
Woody debris structure	1	2	0	0	0
Basal Veg	1	1	1	1	1
Sand	12	10	14	20	12
Boulder	36	23	4	32	22
Cobble	7	6	13	14	13
Stone	13	4	5	9	10
Coarse woody debris	4	8	0	0	1
Moss (ground)	0	0	3	0	1
Gravel	9	6	45	19	26
Crypto	1	0	0	0	1
Litter (duff)	8	40	15	5	8

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<0%		<1%	S	<1%	M	<0%		<0%	
Adiantum capillus-veneris	<0%		<0%		<1%		<0%		<0%	
Andropogon glomeratus	<1%		<1%		1-5%		<1%		1-5%	
Baccharis salicifolia	5-10%		1-5%		5-10%		1-5%		1-5%	
Brickellia longifolia	1-5%		1-5%		1-5%		<0%		1-5%	
Bromus rubens	<1%		<1%		<1%		<1%		<0%	

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 3 Transect Type: Tamarisk Area

Camissonia walkeri	<1%		<0%		<0%		<0%		<0%	
Cercis orbiculata	<0%		1-5%	M	<0%		<0%		<0%	
Chara spp	<0%		<0%		<1%		<1%		<1%	
Encelia farinosa	<1%		<0%		<0%		<0%		<0%	
Frangula betulifolia	<0%		<1%	S	1-5%	S+P	<0%		<1%	S
Hedeoma nana	<0%		<1%		<0%		<0%		<0%	
Imperata brevifolia	<0%		<0%		1-5%		<1%		<0%	
Melilotus officinalis	<0%		<1%		<0%		<0%		<0%	
Mimulus cardinalis	<0%		<0%		<1%		<1%		1-5%	
Muhlenbergia asperifolia	<1%		<0%		<1%		1-5%		1-5%	
Parietaria hespera	<0%		<1%		<0%		<0%		<0%	
Polypogon viridis	<1%		<1%		5-10%		1-5%		1-5%	
Pseudognaphalium stramineum	<0%		<0%		<1%		<0%		<0%	
Salix exigua	<0%		<0%		1-5%		<1%		5-10%	
Sarcostemma cynanchoides var. hartwegii	<1%		<0%		<0%		<0%		<0%	
Solanum spp.	<0%		<0%		<0%		<0%		<1%	
Sonchus asper	<0%		<1%		<1%		<1%		<0%	
Tamarix ramosissima	<1%	S	<1%	S	<1%	S	<1%	S	<1%	S
Typha domingensis	<0%		<0%		1-5%		<1%		<1%	
Vulpia octoflora	<1%		<0%		<0%		<0%		<0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
25	Typha domingensis	5		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Baccharis salicifolia	1		
15	Polypogon viridis	2		
25	Polypogon viridis	1		
25	Typha domingensis	2		
25	Vacant Space	8		
45	Baccharis salicifolia	1		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	7.54	1444	7.81	1477	7.66	1369	7.67	1430
15	7.9	2800	7.76	2808	7.88	2757	7.85	2788
25	7.78	520	7.6	502	7.5	465	7.63	496

35	7.74	1949	7.4	2042	7.38	1955	7.51	1982
45	7.83	462	7.79	433	7.74	398	7.79	431

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 3 Transect Type: Tamarisk Control

	Start point		End point
Easting:	322910	Easting:	322927
Northing:	4009811	Northing:	4009859
GPS accuracy (m):	150	GPS accuracy (m):	150
Elevation (m):		Elevation (m):	
Bearing:	29		
Aspect (0-360):	44	Slope (degrees):	6

Transect description: Transect start is 500m above T2A on stream left. Transect starts on red rocks/cliff and goes downstream along the canyon wall over a large, 4x4x3mpolished muav white boulder. It is below T3A, and both transects are below the curves downstream of a 70m tall petrophyta covered wall.

Additional Info:: We could not get GPS readings, so the transect start and end points were estimated from GIS. Please look at the photos to find the transect area and start point.

Geological layer: Muav limestone with conglomerate

Habitat type: Riparian

Dominant species: Acacia greggii Gray, Baccharis salicifolia (Ruiz & Pavón) Pers., Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Salix exigua Nutt.

Associated species: Adiantum capillus-veneris L., Baccharis sergiloides Gray, Brickellia longifolia S. Wats., Bromus rubens L., Conyza canadensis (L.) Cronq., Encelia farinosa Gray ex Torr., Funastrum cynanchoides (Dcne.) Schlechter, Lycium spp., Mimulus cardinalis Dougl. ex Benth., Oenothera caespitosa Nutt., Plantago patagonica Jacq., Polypogon viridis (Gouan) Breistr., Tamarix ramosissima Ledeb., Typha domingensis Pers.

Surface water within 25m? ☑ Surface water type: stream

Landform: Drainage channel Surface rocks: limestone

Soil type: sand loamy sand Topo position: Unknown

Light exposure: partial-shade Soil moisture: moist

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 3 Transect Type: Tamarisk Control

Date: 5/13/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Lori Makarick Reader: Mike Kearsley

Wind Speed: 0.0 Air Temp (F): 90.0 Cloud Cover: 0

Weather: Clear, calm and no clouds.

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	8
Boulder	14
Coarse woody debris	2
Cobble	10
Gravel	4
Litter (duff)	41
Plant	1
Sand	14
Stone	6

Species	% Cover
Acacia greggii	2
Baccharis salicifolia	35
Muhlenbergia asperifolia	18
Porophyllum gracile	1
Salix exigua	23
Stanleya pinnata	1
Tamarix ramosissima	5

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Crypto	1	3	0	1	1
Gravel	5	11	20	4	8
Sand	5	11	8	4	3
Bedrock	60	4	3	4	0
Moss (ground)	1	0	1	1	0
Boulder	5	24	20	47	20
Litter (duff)	12	11	8	23	20
Coarse woody debris	1	1	1	4	8
Cobble	5	11	20	4	8
Woody debris structure	0	0	0	4	8
Stone	5	24	1	4	3

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	5-10%	M	<0%		<1%	S	1-5%	M	<1%	S
Baccharis salicifolia	10-25%		10-25%		5-10%		1-5%		25-50%	
Bebbia juncea var. aspera	<0%		<0%		<0%		1-5%		<0%	
Brickellia longifolia	1-5%		<0%		1-5%		<1%		1-5%	
Bromus rubens	1-5%		<1%		<1%		<1%		<1%	
Camissonia walkeri	<1%		<1%		<1%		<1%		<1%	
Chloracantha spinosa	<0%		<0%		<0%		<0%		<0%	
Cryptantha spp.	<1%		<0%		<0%		<0%		<0%	

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 3 Transect Type: Tamarisk Control

Datura wrightii	<1%		<0%		<0%		<0%		<0%
Encelia farinosa	<1%		<0%		<0%		<0%		<0%
Epipactis gigantea	<0%		<0%		<0%		<1%		<0%
Eucnide urens	<0%		<0%		<1%		<0%		1-5%
Flaveria macdougalii	<0%		<0%		<0%		1-5%		<0%
Frangula betulifolia	<0%		<0%		<0%		<1%	S	<0%
Gutierrezia sarothrae	1-5%		<0%		<1%		<0%		<0%
Hedeoma nana	<0%		<0%		<1%		<0%		<0%
Hesperodoria salicina	<1%		<0%		<0%		<0%		<0%
Imperata brevifolia	<1%		<0%		<0%		<0%		<0%
Isocoma acradenia	<0%		1-5%		<1%		<0%		<0%
Lepidium lasiocarpum var. lasiocarpum	<0%		<0%		<0%		<0%		<1%
Lycium spp.	<0%		<1%		<0%		<0%		<0%
Muhlenbergia asperifolia	25-50%		25-50%		5-10%		<1%		<0%
Nicotiana obtusifolia var. obtusifolia	<0%		<0%		<0%		<0%		<1%
Porophyllum gracile	<1%		<0%		<0%		<0%		<0%
Salix exigua	1-5%		10-25%		1-5%		25-50%		<0%
Stanleya pinnata	<0%		<1%		<0%		<0%		1-5%
Tamarix ramosissima	<0%		1-5%	S+P	<1%	P	<1%	P	<0%
Typha domingensis	<0%		<0%		1-5%		<0%		<0%
Ziziphus obtusifolia var. obtusifolia	<1%	P	1-5%	M	1-5%	M	<1%	M	<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Baccharis salicifolia		1	
5	Muhlenbergia asperifolia	4		
15	Baccharis salicifolia		2	
35	Brickellia longifolia	2		
35	Salix exigua		3	5
45	Baccharis salicifolia	3	6	

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Baccharis salicifolia		4	
5	Muhlenbergia asperifolia	1		
15	Baccharis salicifolia	1	2	
15	Muhlenbergia asperifolia	2		
15	Vacant Space	7		
25	Baccharis salicifolia	2		

35	Baccharis salicifolia	3		
35	Brickellia longifolia	2		
35	Salix exigua		3	8
35	Vacant Space	5		
45	Baccharis salicifolia	2	5	

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	9.02	3999	9.04	3999	9.04	3999	9.03	3999
15	8.86	2650	8.86	2619	8.82	2585	8.85	2618
25	8.8	2188	8.76	2144	8.77	2295	8.78	2209
35	9.1	3999	9.08	3999	9.09	3999	9.09	3999
45	8.37	1168	7.95	1219	8.1	1165	8.14	1184

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 3 Transect Type: Tamarisk Control

Date: 5/16/2007 Revisit? ☑ Post-tamarisk removal

Recorder: Lori Makarick Reader: Steve Till

Wind Speed: 1.0 Air Temp (F): 89.0 Cloud Cover: 10

Weather: Beautiful day.

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	11
Boulder	11
Cobble	1
Gravel	2
Litter (duff)	63
Sand	9
Stone	2
Woody debris structure	1

Species	% Cover
Acacia greggii	5
Baccharis salicifolia	31
Brickellia longifolia	4
Muhlenbergia asperifolia	39
Porophyllum gracile	1
Salix exigua	19
Tamarix ramosissima	4

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Basal Veg	1	1	1	1	1
Crypto	4	1	0	1	1
Stone	4	10	11	6	7
Litter (duff)	26	30	8	35	30
Moss (ground)	3	0	0	0	0
Bedrock	36	6	10	10	0
Gravel	8	14	12	2	5
Coarse woody debris	1	0	0	1	5
Cobble	7	9	23	3	4
Boulder	7	22	33	34	37
Sand	3	7	2	5	6
Woody debris structure	0	0	0	2	4

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	5-10%	S+M	<0%		<1%	S+P	5-10%	S+M	<1%	S
Baccharis salicifolia	10-25%		5-10%		1-5%		5-10%		25-50%	
Bebbia juncea var. aspera	<0%		<0%		<0%		1-5%		<1%	
Brickellia longifolia	<0%		<1%		1-5%		1-5%		1-5%	
Encelia farinosa	<1%		<0%		<0%		<0%		<0%	
Eucnide urens	<0%		<0%		<0%		<1%		1-5%	
Forb spp	<1%		<0%		<1%		<0%		<0%	
Frangula betulifolia	<0%		<0%		<0%		<1%		<0%	

Galium stellatum	<1%		<0%		<0%		<0%	<0%
Gutierrezia sarothrae	<0%		<0%		<1%		<1%	<0%
Hesperodoria salicina	1-5%		<0%		<0%		<1%	<0%
Hesperostipa neomexicana	<0%		<0%		<1%		<0%	<0%
Imperata brevifolia	<1%		<0%		<0%		<0%	<0%
Isocoma acradenia	<0%		1-5%		1-5%		<1%	<0%
Lycium spp.	<0%		<0%		<0%		<1%	<0%
Machaeranthera pinnatifida	<0%		<0%		<0%		<0%	<1%
Mammillaria grahamii var. grahamii	<0%		<0%		<1%		<0%	<0%
Maurandella antirrhiniflora	<0%		<0%		1-5%		<0%	<0%
Muhlenbergia asperifolia	10-25%		25-50%		5-10%		1-5%	<0%
Nicotiana obtusifolia var. obtusifolia	<0%		<0%		<0%		<0%	<1%
Porophyllum gracile	<1%		<0%		<0%		<0%	<0%
Salix exigua	1-5%		10-25%		5-10%		25-50%	<0%
Stanleya pinnata								1-5%
Tamarix ramosissima	1-5%	S+P	<1%	S+P	5-10%	S+P	<1%	<0%
Thymophylla pentachaeta	<1%		<0%		<0%		<0%	<0%
Typha domingensis	<0%		<0%		<1%		<0%	<0%
Ziziphus obtusifolia var. canescens	<0%		1-5%		<1%		<0%	<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
15	Baccharis salicifolia	4	2	
15	Muhlenbergia asperifolia	10		
35	Baccharis salicifolia	5		
45	Baccharis salicifolia		19	
45	Brickellia longifolia	4		
45	Muhlenbergia asperifolia	1		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
15	Baccharis salicifolia	4	0	
15	Muhlenbergia asperifolia	2		
15	Vacant Space	5		
35	Baccharis salicifolia	3		
35	Muhlenbergia asperifolia	1		
35	Vacant Space	6		
45	Baccharis salicifolia	1	10	
45	Brickellia longifolia	3		

45	Muhlenbergia asperifolia	1
45	Vacant Space	6

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	8.39	3999	8.51	3999	8.52	3999	8.47	3999
15	8.18	2419	8.1	2433	8.09	2454	8.12	2435
25	8.53	3999	8.55	3999	8.55	3999	8.54	3999
35	8.3	3999	8.33	3999	8.34	3999	8.32	3999
45	8.27	441	8.15	448	8.09	453	8.17	447

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 3 Transect Type: Tamarisk Control

Date: 5/13/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Lori Makarick Reader: Mike Kearsley

Wind Speed: 0.0 Air Temp (F): 90.0 Cloud Cover: 0

Weather: Clear, calm and no clouds.

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	8
Boulder	14
Coarse woody debris	2
Cobble	10
Gravel	4
Litter (duff)	41
Plant	1
Sand	14
Stone	6

Species	% Cover
Acacia greggii	2
Baccharis salicifolia	35
Muhlenbergia asperifolia	18
Porophyllum gracile	1
Salix exigua	23
Stanleya pinnata	1
Tamarix ramosissima	5

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Crypto	1	3	0	1	1
Gravel	5	11	20	4	8
Sand	5	11	8	4	3
Bedrock	60	4	3	4	0
Moss (ground)	1	0	1	1	0
Boulder	5	24	20	47	20
Litter (duff)	12	11	8	23	20
Coarse woody debris	1	1	1	4	8
Cobble	5	11	20	4	8
Woody debris structure	0	0	0	4	8
Stone	5	24	1	4	3

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	5-10%	M	<0%		<1%	S	1-5%	M	<1%	S
Baccharis salicifolia	10-25%		10-25%		5-10%		1-5%		25-50%	
Bebbia juncea var. aspera	<0%		<0%		<0%		1-5%		<0%	
Brickellia longifolia	1-5%		<0%		1-5%		<1%		1-5%	
Bromus rubens	1-5%		<1%		<1%		<1%		<1%	
Camissonia walkeri	<1%		<1%		<1%		<1%		<1%	
Chloracantha spinosa	<0%		<0%		<0%		<0%		<0%	
Cryptantha spp.	<1%		<0%		<0%		<0%		<0%	

Datura wrightii	<1%		<0%		<0%		<0%		<0%
Encelia farinosa	<1%		<0%		<0%		<0%		<0%
Epipactis gigantea	<0%		<0%		<0%		<1%		<0%
Eucnide urens	<0%		<0%		<1%		<0%		1-5%
Flaveria macdougalii	<0%		<0%		<0%		1-5%		<0%
Frangula betulifolia	<0%		<0%		<0%		<1%	S	<0%
Gutierrezia sarothrae	1-5%		<0%		<1%		<0%		<0%
Hedeoma nana	<0%		<0%		<1%		<0%		<0%
Hesperodoria salicina	<1%		<0%		<0%		<0%		<0%
Imperata brevifolia	<1%		<0%		<0%		<0%		<0%
Isocoma acradenia	<0%		1-5%		<1%		<0%		<0%
Lepidium lasiocarpum var. lasiocarpum	<0%		<0%		<0%		<0%		<1%
Lycium spp.	<0%		<1%		<0%		<0%		<0%
Muhlenbergia asperifolia	25-50%		25-50%		5-10%		<1%		<0%
Nicotiana obtusifolia var. obtusifolia	<0%		<0%		<0%		<0%		<1%
Porophyllum gracile	<1%		<0%		<0%		<0%		<0%
Salix exigua	1-5%		10-25%		1-5%		25-50%		<0%
Stanleya pinnata	<0%		<1%		<0%		<0%		1-5%
Tamarix ramosissima	<0%		1-5%	S+P	<1%	P	<1%	P	<0%
Typha domingensis	<0%		<0%		1-5%		<0%		<0%
Ziziphus obtusifolia var. obtusifolia	<1%	P	1-5%	M	1-5%	M	<1%	M	<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Baccharis salicifolia		1	
5	Muhlenbergia asperifolia	4		
15	Baccharis salicifolia		2	
35	Brickellia longifolia	2		
35	Salix exigua		3	5
45	Baccharis salicifolia	3	6	

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Baccharis salicifolia		4	
5	Muhlenbergia asperifolia	1		
15	Baccharis salicifolia	1	2	
15	Muhlenbergia asperifolia	2		
15	Vacant Space	7		
25	Baccharis salicifolia	2		

35	Baccharis salicifolia	3		
35	Brickellia longifolia	2		
35	Salix exigua		3	8
35	Vacant Space	5		
45	Baccharis salicifolia	2	5	

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	9.02	3999	9.04	3999	9.04	3999	9.03	3999
15	8.86	2650	8.86	2619	8.82	2585	8.85	2618
25	8.8	2188	8.76	2144	8.77	2295	8.78	2209
35	9.1	3999	9.08	3999	9.09	3999	9.09	3999
45	8.37	1168	7.95	1219	8.1	1165	8.14	1184

Park Area/Canyon: Mohawk Canyon River mile: 171.6 L Project (Phase): Phase IIb

Transect Name: Mohawk Canyon 3 Transect Type: Tamarisk Control

Date: 5/16/2007 Revisit? ☑ Post-tamarisk removal

Recorder: Lori Makarick Reader: Steve Till

Wind Speed: 1.0 Air Temp (F): 89.0 Cloud Cover: 10

Weather: Beautiful day.

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	11
Boulder	11
Cobble	1
Gravel	2
Litter (duff)	63
Sand	9
Stone	2
Woody debris structure	1

Species	% Cover
Acacia greggii	5
Baccharis salicifolia	31
Brickellia longifolia	4
Muhlenbergia asperifolia	39
Porophyllum gracile	1
Salix exigua	19
Tamarix ramosissima	4

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Basal Veg	1	1	1	1	1
Crypto	4	1	0	1	1
Stone	4	10	11	6	7
Litter (duff)	26	30	8	35	30
Moss (ground)	3	0	0	0	0
Bedrock	36	6	10	10	0
Gravel	8	14	12	2	5
Coarse woody debris	1	0	0	1	5
Cobble	7	9	23	3	4
Boulder	7	22	33	34	37
Sand	3	7	2	5	6
Woody debris structure	0	0	0	2	4

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	5-10%	S+M	<0%		<1%	S+P	5-10%	S+M	<1%	S
Baccharis salicifolia	10-25%		5-10%		1-5%		5-10%		25-50%	
Bebbia juncea var. aspera	<0%		<0%		<0%		1-5%		<1%	
Brickellia longifolia	<0%		<1%		1-5%		1-5%		1-5%	
Encelia farinosa	<1%		<0%		<0%		<0%		<0%	
Eucnide urens	<0%		<0%		<0%		<1%		1-5%	
Forb spp	<1%		<0%		<1%		<0%		<0%	
Frangula betulifolia	<0%		<0%		<0%		<1%		<0%	

Galium stellatum	<1%		<0%		<0%		<0%	<0%
Gutierrezia sarothrae	<0%		<0%		<1%		<1%	<0%
Hesperodoria salicina	1-5%		<0%		<0%		<1%	<0%
Hesperostipa neomexicana	<0%		<0%		<1%		<0%	<0%
Imperata brevifolia	<1%		<0%		<0%		<0%	<0%
Isocoma acradenia	<0%		1-5%		1-5%		<1%	<0%
Lycium spp.	<0%		<0%		<0%		<1%	<0%
Machaeranthera pinnatifida	<0%		<0%		<0%		<0%	<1%
Mammillaria grahamii var. grahamii	<0%		<0%		<1%		<0%	<0%
Maurandella antirrhiniflora	<0%		<0%		1-5%		<0%	<0%
Muhlenbergia asperifolia	10-25%		25-50%		5-10%		1-5%	<0%
Nicotiana obtusifolia var. obtusifolia	<0%		<0%		<0%		<0%	<1%
Porophyllum gracile	<1%		<0%		<0%		<0%	<0%
Salix exigua	1-5%		10-25%		5-10%		25-50%	<0%
Stanleya pinnata								1-5%
Tamarix ramosissima	1-5%	S+P	<1%	S+P	5-10%	S+P	<1%	<0%
Thymophylla pentachaeta	<1%		<0%		<0%		<0%	<0%
Typha domingensis	<0%		<0%		<1%		<0%	<0%
Ziziphus obtusifolia var. canescens	<0%		1-5%		<1%		<0%	<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
15	Baccharis salicifolia	4	2	
15	Muhlenbergia asperifolia	10		
35	Baccharis salicifolia	5		
45	Baccharis salicifolia		19	
45	Brickellia longifolia	4		
45	Muhlenbergia asperifolia	1		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
15	Baccharis salicifolia	4	0	
15	Muhlenbergia asperifolia	2		
15	Vacant Space	5		
35	Baccharis salicifolia	3		
35	Muhlenbergia asperifolia	1		
35	Vacant Space	6		
45	Baccharis salicifolia	1	10	
45	Brickellia longifolia	3		

45	Muhlenbergia asperifolia	1
45	Vacant Space	6

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	8.39	3999	8.51	3999	8.52	3999	8.47	3999
15	8.18	2419	8.1	2433	8.09	2454	8.12	2435
25	8.53	3999	8.55	3999	8.55	3999	8.54	3999
35	8.3	3999	8.33	3999	8.34	3999	8.32	3999
45	8.27	441	8.15	448	8.09	453	8.17	447

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 1 Transect Type: Tamarisk Area

	Start point		End point
Easting:	330508	Easting:	330458
Northing:	4013818	Northing:	4013806
GPS accuracy (m):	50	GPS accuracy (m):	50
Elevation (m):		Elevation (m):	
Bearing:	268		
Aspect (0-360):	260	Slope (degrees):	3

Transect description: Transect starts on a gray boulder 30m down from a climb over in the lower section of the canyon about 500m from the mouth of the river. The transect runs along creek left and ends at a clump of mature TAMRAM in the middle of the drainage. No GPS reading available as it is in a narrow Muav gorge. Mike Kearsley was also a reader in 2006.

Additional Info:: Easy access from the river. The upper transects of National Canyon are above a tricky climb. This one is below and can be walked to from the river in 20 minutes. Please use photographs to find this transect - we could not get GPS readings, so the start and end point were generated from GIS and might not be accurate.

Geological layer: Muav Limestone

Habitat type: Riparian

Dominant species: Acacia greggii Gray, Baccharis salicifolia (Ruiz & Pavón) Pers.

Associated species: , Artemisia ludoviciana Nutt., Brickellia coulteri Gray, Brickellia longifolia S. Wats., Camissonia walkeri (A. Nels.) Raven, Cheilanthes feei T. Moore, Erigeron lobatus A. Nels., Funastrum cynanchoides (Dcne.) Schlechter, Funastrum cynanchoides (Dcne.) Schlechter ssp. cynanchoides, Galium proliferum Gray, Hedeoma nana (Torr.) Briq., Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm., Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, , Parietaria hespera Hinton, Perityle emoryi, Phacelia crenulata Torr. ex S. Wats., Pleurocoronis pluriseta (Gray) King & H.E. Robins., Polypogon monspeliensis (L.) Desf., Polypogon viridis (Gouan) Breistr., Salvia davidsonii Greenm., Solanum douglasii Dunal, Sonchus asper (L.) Hill, Stephanomeria pauciflora (Torr.) A. Nels.

Surface water within 25m? ☑ Surface water type: stream

Landform: Drainage channel Surface rocks: limestone

Soil type: sand Topo position: Unknown

Light exposure: partial-shade Soil moisture: moist

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 1 Transect Type: Tamarisk Area

Date: 5/11/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Amy Prince Reader: Steve Till

Wind Speed: 3.0 Air Temp (F): 104.0 Cloud Cover: 20

Weather: Partly could and very warm.

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	13
Boulder	17
Coarse woody debris	2
Cobble	16
Gravel	13
Litter (duff)	27
Plant	1
Sand	3
Stone	7
Woody debris structure	1

Species	% Cover
Acacia greggii	3
Funastrum cynanchoides	4
Tamarix ramosissima	42

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Stone	3	3	5	4	6
Boulder	17	72	0	4	38
Sand	18	3	5	1	16
Gravel	17	9	27	4	6
Litter (duff)	7	3	5	74	17
Cobble	38	9	58	9	16
Coarse woody debris	0	1	0	4	1

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S	5-10%	M	<1%	S	1-5%	M	<1%	S+P
Algae spp.	<1%		<1%		<1%		<0%		<0%	
Baccharis salicifolia	<1%		<1%		<0%		<0%		1-5%	
Brickellia longifolia	<0%		<0%		<0%		<0%		1-5%	
Bromus rubens	<1%		<0%		<0%		<1%		<1%	
Cryptantha spp.	<0%		<0%		<0%		<0%		<1%	
Encelia farinosa	<0%		<0%		<0%		<0%		<1%	

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 1 Transect Type: Tamarisk Area

Erigeron lobatus	<1%		<0%		<0%		<0%		<1%	
Funastrum cynanchoides	<0%		<0%		<0%		<0%		10-25%	
Machaeranthera gracilis	<0%		<0%		<0%		<0%		<1%	
Nicotiana obtusifolia var. obtusifolia	<0%		<0%		<1%		<0%		<0%	
Parietaria hespera	1-5%		<1%		<1%		<1%		<0%	
Polypogon viridis	1-5%		<1%		<0%		<0%		<1%	
Porophyllum gracile	<0%		<0%		<0%		<0%		1-5%	
Silene antirrhina	<0%		<1%		<0%		<0%		<0%	
Tamarix ramosissima	5-10%	S+M	<0%		50-75%	M	25-50%	S+M	5-10%	S+M

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
25	Tamarix ramosissima			

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
25	Tamarix ramosissima			
35	Tamarix ramosissima	3	4	

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.69	3633	8.77	3631	8.79	3614	8.75	3626
15	8.82	612	8.75	614	8.7	616	8.76	614
25	8.8	1969	8.93	1988	8.95	1984	8.89	1980
35	8.95	3999	9.06	3999	9.05	3999	9.02	3999
45	8.45	1073	8	1183	7.79	1235	8.08	1164

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 1 Transect Type: Tamarisk Area

Date: 4/20/2008 Revisit? ☑ Post-tamarisk removal

Recorder: Amy Prince Reader: Amy Prince

Wind Speed: 2.0 Air Temp (F): 80.0 Cloud Cover: 0

Weather: clear, warm

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	34
Cobble	16
Gravel	12
Litter (duff)	12
Sand	17
Stone	9

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Bare Soil	0	0	0	0	0
Moss (ground)	1	0	0	0	1
Basal Veg	1	0	1	1	1
Woody debris structure	1	0	0	3	2
Coarse woody debris	1	3	0	3	5
Litter (duff)	2	2	1	25	21
Boulder	20	70	2	8	36
Stone	4	5	9	17	6
Cobble	19	6	41	21	9
Gravel	29	9	26	11	4
Sand	22	5	21	11	15

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<0%		1-5%	M	<1%	S	<0%		1-5%	P+M
Baccharis salicifolia	1-5%		<0%		<0%		<0%		5-10%	
Brickellia longifolia	<0%		<0%		<0%		<0%		<1%	
Bromus rubens	<0%		<0%		<0%		<1%		1-5%	
Cryptantha spp.	<0%		<0%		<0%		<1%		<0%	
Descurainia pinnata	<0%		<0%		<0%		<1%		<0%	
Erigeron lobatus	<0%		<0%		<0%		<1%		<0%	
Gilia spp.	<0%		<0%		<0%		<1%		<0%	
Grass spp	<1%		<0%		<1%		<0%		<0%	
Hesperodoria salicina	<0%		<0%		<0%		<0%		<1%	
Machaeranthera pinnatifida	<0%		<0%		<0%		<0%		<1%	
Maurandella antirrhiniflora	<0%		<0%		<0%		<1%		<0%	
Nicotiana obtusifolia										

Oenothera caespitosa	<0%	<0%	<0%		<1%		<0%
Parietaria hespera	<1%	<0%	<1%		<0%		1-5%
Polypogon viridis	<0%	<0%	<0%		<1%		<0%
Porophyllum gracile	<0%	<0%	<0%		<0%		1-5%
Sarcostemma cynanchoides var. hartwegii	<0%	<0%	<0%		<0%		50-75%
Schismus arabicus	<0%	<0%	<0%		<0%		1-5%
Sonchus asper	<0%	<0%	<0%		<1%		<0%
Tamarix ramosissima	<0%	<0%	<1%	S	<1%	M	<0%
Typha spp.	<0%	<0%	<0%		<0%		<1%

Vegetation Structure Data - Old

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
45	Baccharis brachyphylla	2		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.6	298	8.72	299	8.64	292	8.65	296
15	8.38	499	8.39	490	8.4	8	8.39	332
25	8.58	591	8.53	592	8.49	596	8.53	593
35	8.54	1122	8.4	1041	8.6	1048	8.51	1070
45	7.81	1105	8.09	945	8.04	1033	7.98	1028

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 1 Transect Type: Tamarisk Area

Date: 5/11/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Amy Prince Reader: Steve Till

Wind Speed: 3.0 Air Temp (F): 104.0 Cloud Cover: 20

Weather: Partly could and very warm.

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	13
Boulder	17
Coarse woody debris	2
Cobble	16
Gravel	13
Litter (duff)	27
Plant	1
Sand	3
Stone	7
Woody debris structure	1

Species	% Cover
Acacia greggii	3
Funastrum cynanchoides	4
Tamarix ramosissima	42

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Stone	3	3	5	4	6
Boulder	17	72	0	4	38
Sand	18	3	5	1	16
Gravel	17	9	27	4	6
Litter (duff)	7	3	5	74	17
Cobble	38	9	58	9	16
Coarse woody debris	0	1	0	4	1

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S	5-10%	M	<1%	S	1-5%	M	<1%	S+P
Algae spp.	<1%		<1%		<1%		<0%		<0%	
Baccharis salicifolia	<1%		<1%		<0%		<0%		1-5%	
Brickellia longifolia	<0%		<0%		<0%		<0%		1-5%	
Bromus rubens	<1%		<0%		<0%		<1%		<1%	
Cryptantha spp.	<0%		<0%		<0%		<0%		<1%	
Encelia farinosa	<0%		<0%		<0%		<0%		<1%	

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 1 Transect Type: Tamarisk Area

Erigeron lobatus	<1%		<0%		<0%		<0%		<1%	
Funastrum cynanchoides	<0%		<0%		<0%		<0%		10-25%	
Machaeranthera gracilis	<0%		<0%		<0%		<0%		<1%	
Nicotiana obtusifolia var. obtusifolia	<0%		<0%		<1%		<0%		<0%	
Parietaria hespera	1-5%		<1%		<1%		<1%		<0%	
Polypogon viridis	1-5%		<1%		<0%		<0%		<1%	
Porophyllum gracile	<0%		<0%		<0%		<0%		1-5%	
Silene antirrhina	<0%		<1%		<0%		<0%		<0%	
Tamarix ramosissima	5-10%	S+M	<0%		50-75%	M	25-50%	S+M	5-10%	S+M

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
25	Tamarix ramosissima			

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
25	Tamarix ramosissima			
35	Tamarix ramosissima	3	4	

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.69	3633	8.77	3631	8.79	3614	8.75	3626
15	8.82	612	8.75	614	8.7	616	8.76	614
25	8.8	1969	8.93	1988	8.95	1984	8.89	1980
35	8.95	3999	9.06	3999	9.05	3999	9.02	3999
45	8.45	1073	8	1183	7.79	1235	8.08	1164

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 1 Transect Type: Tamarisk Area

Date: 4/20/2008 Revisit? ☑ Post-tamarisk removal

Recorder: Amy Prince Reader: Amy Prince

Wind Speed: 2.0 Air Temp (F): 80.0 Cloud Cover: 0

Weather: clear, warm

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	34
Cobble	16
Gravel	12
Litter (duff)	12
Sand	17
Stone	9

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Bare Soil	0	0	0	0	0
Moss (ground)	1	0	0	0	1
Basal Veg	1	0	1	1	1
Woody debris structure	1	0	0	3	2
Coarse woody debris	1	3	0	3	5
Litter (duff)	2	2	1	25	21
Boulder	20	70	2	8	36
Stone	4	5	9	17	6
Cobble	19	6	41	21	9
Gravel	29	9	26	11	4
Sand	22	5	21	11	15

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<0%		1-5%	M	<1%	S	<0%		1-5%	P+M
Baccharis salicifolia	1-5%		<0%		<0%		<0%		5-10%	
Brickellia longifolia	<0%		<0%		<0%		<0%		<1%	
Bromus rubens	<0%		<0%		<0%		<1%		1-5%	
Cryptantha spp.	<0%		<0%		<0%		<1%		<0%	
Descurainia pinnata	<0%		<0%		<0%		<1%		<0%	
Erigeron lobatus	<0%		<0%		<0%		<1%		<0%	
Gilia spp.	<0%		<0%		<0%		<1%		<0%	
Grass spp	<1%		<0%		<1%		<0%		<0%	
Hesperodoria salicina	<0%		<0%		<0%		<0%		<1%	
Machaeranthera pinnatifida	<0%		<0%		<0%		<0%		<1%	
Maurandella antirrhiniflora	<0%		<0%		<0%		<1%		<0%	
Nicotiana obtusifolia										

Oenothera caespitosa	<0%	<0%	<0%		<1%		<0%
Parietaria hespera	<1%	<0%	<1%		<0%		1-5%
Polypogon viridis	<0%	<0%	<0%		<1%		<0%
Porophyllum gracile	<0%	<0%	<0%		<0%		1-5%
Sarcostemma cynanchoides var. hartwegii	<0%	<0%	<0%		<0%		50-75%
Schismus arabicus	<0%	<0%	<0%		<0%		1-5%
Sonchus asper	<0%	<0%	<0%		<1%		<0%
Tamarix ramosissima	<0%	<0%	<1%	S	<1%	M	<0%
Typha spp.	<0%	<0%	<0%		<0%		<1%

Vegetation Structure Data - Old

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
45	Baccharis brachyphylla	2		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.6	298	8.72	299	8.64	292	8.65	296
15	8.38	499	8.39	490	8.4	8	8.39	332
25	8.58	591	8.53	592	8.49	596	8.53	593
35	8.54	1122	8.4	1041	8.6	1048	8.51	1070
45	7.81	1105	8.09	945	8.04	1033	7.98	1028

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 1 Transect Type: Tamarisk Control

	Start point		End point
Easting:	330390	Easting:	330342
Northing:	4013866	Northing:	4013885
GPS accuracy (m):	75	GPS accuracy (m):	16.5
Elevation (m):		Elevation (m):	610
Bearing:	265		
Aspect (0-360):	258	Slope (degrees):	4

Transect description: About 500m up canyon from mouth in a 7-10m wide section with really nice mature Acacia on north side of drainage (about 6m above drainage bottom). Drainage curves to the SE just past the start point. The start point is on a fairly distinctive muav shelf opposite a large dead acacia on the south side of the drainage, just before the bend. End point is down canyon, staying on slightly raised bench above creek, heading through very young, newly established plants. Due to somewhat recent flooding this is the best reference at this time.

Additional Info:: Both transects are below the climb to the upper part of National. This reference transect is within 150 meters downcanyon from the tamarisk transect. Please use photographs to find this transect - we could not get GPS readings, so the start and end points were generated from GIS and might not be accurate.

Geological layer: Muav limestone

Habitat type: Riparian

Dominant species:

Associated species: , Centaurium arizonicum, Erigeron spp., Nicotiana obtusifolia Mertens & Galeotti var. obtusifolia, Schismus arabicus Nees

Surface water within 25m? ☑ Surface water type: stream

Landform: Drainage channel Surface rocks: limestone

Soil type: sandy loam Topo position: Unknown

Light exposure: partial-shade Soil moisture: dry moist

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 1 Transect Type: Tamarisk Control

Date: 5/11/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Pamela Walls Reader: Lisa Hahn

Wind Speed: 1.0 Air Temp (F): 104.0 Cloud Cover: 2

Weather: Hazy, very still, 80 degrees F was a very warm day.

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	1
Boulder	4
Cobble	12
Gravel	30
Litter (duff)	8
Sand	38
Stone	7

Species	% Cover
	0
Muhlenbergia asperifolia	2

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Litter (duff)	1	5	1	3	3
Sand	8	11	18	7	7
Boulder	0	5	0	17	7
Bedrock	41	12	39	17	0
Gravel	40	27	18	35	38
Cobble	8	27	18	17	38
Stone	1	12	3	3	7
Crypto	1	1	1	1	0

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S	<1%	S	1-5%	S+M	1-5%	S+M	1-5%	S
Aristida spp.	<0%		<0%		<1%		<1%		1-5%	
Baccharis emoryi	<0%		<1%		<1%		<0%		<1%	
Brickellia longifolia	<0%		<0%		<1%		<1%		1-5%	
Bromus rubens	<1%		<1%		<1%		<1%		1-5%	
Bromus tectorum	<0%		<0%		<0%		<0%		1-5%	
Camissonia walkeri	<1%		1-5%		<1%		<1%		1-5%	
Cryptantha spp.	<0%		<1%		<1%		<1%		<1%	
Dasyochloa pulchella	<0%		<0%		<0%		<0%		<1%	
Erigeron lobatus	<1%		<0%		<0%		<0%		<0%	

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 1 Transect Type: Tamarisk Control

Galium bifolium	<1%	<1%		<0%		<0%		<0%	
Gilia spp.	<1%	<0%		<1%		<0%		<0%	
Hedeoma nana	<0%	<1%		<0%		<0%		<0%	
Muhlenbergia asperifolia	<1%	<1%		<1%		1-5%		<1%	
Muhlenbergia spp.	<0%	<0%		<1%		<0%		<0%	
Phacelia crenulata	<0%	<0%		<0%		<1%		<0%	
Polypogon monspeliensis	<1%	<1%		<1%		<1%		<1%	
Polypogon viridis	<1%	<1%		1-5%		1-5%		<1%	
Sonchus asper	<0%	<0%		1-5%		<0%		<0%	
Sphaeralcea grossulariifolia	<0%	<0%		<0%		<1%		<0%	
Tamarix ramosissima	<0%	<1%	P	<1%	P	<1%	P	<1%	S
Thymophylla pentachaeta var. belenidium	<0%	<0%		<1%		<0%		<0%	
Vulpia octoflora	<1%	<1%		<1%		<0%		<0%	

Vegetation Structure Data - Old

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
25	Acacia greggii		2	

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.7	132	8.69	133	8.69	135	8.69	133
15	8.28	932	8.27	936	8.27	942	8.27	937
25	8.93	2632	7.92	2675	7.91	2670	8.25	2659
35	8.2	1771	8.35	1784	8.37	1791	8.31	1782
45	7.28	2048	7.21	2116	7.3	2077	7.26	2080

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 1 Transect Type: Tamarisk Control

Date: 4/20/2008 Revisit? ☑ Post-tamarisk removal

Recorder: Amy Prince Reader: Amy Prince

Wind Speed: 2.0 Air Temp (F): 80.0 Cloud Cover:

Weather:

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	1
Boulder	4
Cobble	18
Gravel	46
Sand	26
Stone	5

Species	% Cover
Camissonia walkeri	1

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Litter (duff)	1	1	1	1	0
Bedrock	23	3	35	10	0
Boulder	0	3	0	18	8
Stone	6	5	3	5	12
Cobble	29	25	14	9	21
Gravel	26	56	33	8	31
Sand	15	7	14	49	28

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<0%		<1%		<0%		1-5%		<0%	
Bromus rubens	<0%		<0%		<0%		<1%		<1%	
Cryptantha spp.	<0%		<0%		<0%		<0%		<1%	
Gilia spp.	<0%		<0%		<0%		<0%		<1%	
Grass spp	<0%		<1%		<0%		<0%		<0%	
Hedeoma nana	<0%		<1%		<0%		<0%		<1%	
Parietaria hespera	<0%		<0%		<0%		<0%		<1%	
Poa bigelovii	<0%		<0%		<0%		<1%		<1%	

Vegetation Structure Data - Old

Vegetation Structure Data - New

Soil Data

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 1 Transect Type: Tamarisk Control

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	9.09	298	8.99	314	9.07	304	9.05	305
15	8.81	256	8.81	262	8.79	256	8.80	258
25	8.71	1792	8.77	1698	8.81	1776	8.76	1755
35	8.68	485	8.69	469	8.7	481	8.69	478
45	8.34	930	8.29	940	8.3	941	8.31	937

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 1 Transect Type: Tamarisk Control

Date: 5/11/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Pamela Walls Reader: Lisa Hahn

Wind Speed: 1.0 Air Temp (F): 104.0 Cloud Cover: 2

Weather: Hazy, very still, 80 degrees F was a very warm day.

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	1
Boulder	4
Cobble	12
Gravel	30
Litter (duff)	8
Sand	38
Stone	7

Species	% Cover
	0
Muhlenbergia asperifolia	2

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Litter (duff)	1	5	1	3	3
Sand	8	11	18	7	7
Boulder	0	5	0	17	7
Bedrock	41	12	39	17	0
Gravel	40	27	18	35	38
Cobble	8	27	18	17	38
Stone	1	12	3	3	7
Crypto	1	1	1	1	0

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S	<1%	S	1-5%	S+M	1-5%	S+M	1-5%	S
Aristida spp.	<0%		<0%		<1%		<1%		1-5%	
Baccharis emoryi	<0%		<1%		<1%		<0%		<1%	
Brickellia longifolia	<0%		<0%		<1%		<1%		1-5%	
Bromus rubens	<1%		<1%		<1%		<1%		1-5%	
Bromus tectorum	<0%		<0%		<0%		<0%		1-5%	
Camissonia walkeri	<1%		1-5%		<1%		<1%		1-5%	
Cryptantha spp.	<0%		<1%		<1%		<1%		<1%	
Dasyochloa pulchella	<0%		<0%		<0%		<0%		<1%	
Erigeron lobatus	<1%		<0%		<0%		<0%		<0%	

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 1 Transect Type: Tamarisk Control

Galium bifolium	<1%	<1%		<0%		<0%		<0%		
Gilia spp.	<1%	<0%		<1%		<0%		<0%		
Hedeoma nana	<0%	<1%		<0%		<0%		<0%		
Muhlenbergia asperifolia	<1%	<1%		<1%		1-5%		<1%		
Muhlenbergia spp.	<0%	<0%		<1%		<0%		<0%		
Phacelia crenulata	<0%	<0%		<0%		<1%		<0%		
Polypogon monspeliensis	<1%	<1%		<1%		<1%		<1%		
Polypogon viridis	<1%	<1%		1-5%		1-5%		<1%		
Sonchus asper	<0%	<0%		1-5%		<0%		<0%		
Sphaeralcea grossulariifolia	<0%	<0%		<0%		<1%		<0%		
Tamarix ramosissima	<0%	<1%	P	<1%	P	<1%	P	<1%	S	
Thymophylla pentachaeta var. belenidium	<0%	<0%		<1%		<0%		<0%		
Vulpia octoflora	<1%	<1%		<1%		<0%		<0%		

Vegetation Structure Data - Old

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
25	Acacia greggii		2	

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.7	132	8.69	133	8.69	135	8.69	133
15	8.28	932	8.27	936	8.27	942	8.27	937
25	8.93	2632	7.92	2675	7.91	2670	8.25	2659
35	8.2	1771	8.35	1784	8.37	1791	8.31	1782
45	7.28	2048	7.21	2116	7.3	2077	7.26	2080

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 1 Transect Type: Tamarisk Control

Date: 4/20/2008 Revisit? ☑ Post-tamarisk removal

Recorder: Amy Prince Reader: Amy Prince

Wind Speed: 2.0 Air Temp (F): 80.0 Cloud Cover:

Weather:

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	1
Boulder	4
Cobble	18
Gravel	46
Sand	26
Stone	5

Species	% Cover
Camissonia walkeri	1

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Litter (duff)	1	1	1	1	0
Bedrock	23	3	35	10	0
Boulder	0	3	0	18	8
Stone	6	5	3	5	12
Cobble	29	25	14	9	21
Gravel	26	56	33	8	31
Sand	15	7	14	49	28

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<0%		<1%		<0%		1-5%		<0%	
Bromus rubens	<0%		<0%		<0%		<1%		<1%	
Cryptantha spp.	<0%		<0%		<0%		<0%		<1%	
Gilia spp.	<0%		<0%		<0%		<0%		<1%	
Grass spp	<0%		<1%		<0%		<0%		<0%	
Hedeoma nana	<0%		<1%		<0%		<0%		<1%	
Parietaria hespera	<0%		<0%		<0%		<0%		<1%	
Poa bigelovii	<0%		<0%		<0%		<1%		<1%	

Vegetation Structure Data - Old

Vegetation Structure Data - New

Soil Data

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 1 Transect Type: Tamarisk Control

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	9.09	298	8.99	314	9.07	304	9.05	305
15	8.81	256	8.81	262	8.79	256	8.80	258
25	8.71	1792	8.77	1698	8.81	1776	8.76	1755
35	8.68	485	8.69	469	8.7	481	8.69	478
45	8.34	930	8.29	940	8.3	941	8.31	937

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 2 Transect Type: Tamarisk Area

	Start point		End point
Easting:	331229	Easting:	331167
Northing:	4013717	Northing:	4013825
GPS accuracy (m):	5.5	GPS accuracy (m):	6.9
Elevation (m):	531	Elevation (m):	591
Bearing:	260		
Aspect (0-360):	230	Slope (degrees):	5

Transect description: Transect is located just above where the trail drops into National 2. This section starts above the climb at the end of National 1, which is described in tamarisk mapping form. You need ropes set, there is exposure. The start point is about 80m from where the trail above the exposed climb drops you back into the drainage. The tape start is a small vertical crack on creek right in the muav limestone shelf, about 2m up creek from a Gooding's Willow. The tape goes up over a 2x2x3m vehicle-sized limestone boulder at 19m, it stays on creek right of current active water channel. End point is about .5m upcreek from a massive house-sized boulder.

Additional Info:: Did not get to do the hydrology in this area.

Geological layer: Muav Limestone

Habitat type: Riparian

Dominant species: Baccharis emoryi Gray, Ephedra spp., Machaeranthera pinnatifida (Hook.) Shinners, Porophyllum gracile Benth., Tamarix ramosissima Ledeb.

Associated species: Aristida purpurea Nutt., Aristida spp., Encelia resinifera C. Clark ssp. tenuifolia C. Clark

Surface water within 25m? ☑ Surface water type: stream

Landform: Drainage channel Surface rocks: limestone

Soil type: loamy sand Topo position: Unknown

Light exposure: open Soil moisture: moist saturated

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 2 Transect Type: Tamarisk Area

Date: 5/12/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Lisa Hahn Reader: Lori Makarick

Wind Speed: 2.0 Air Temp (F): 86.0 Cloud Cover: 0

Weather: clear skies sun just crested the run

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	4
Boulder	11
Coarse woody debris	1
Cobble	3
Gravel	37
Litter (duff)	31
Sand	9
Stone	4

Species	% Cover
Aristida spp.	1
Baccharis emoryi	8
Brickellia longifolia	7
Muhlenbergia asperifolia	4
Polypogon viridis	3
Salix gooddingii	2
Sonchus oleraceus	1
Tamarix ramosissima	54

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
	0	0	0	0	0
Stone	3	3	3	1	8
Coarse woody debris	0	0	1	0	0
Cobble	3	7	8	8	8
Gravel	40	77	19	69	70
Boulder	3	3	0	0	3
Bare Soil	0	0	0	0	0
Litter (duff)	8	3	65	3	3
Bedrock	40	7	0	0	0
Sand	3	0	3	19	8

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	1-5%	P	<1%	S	<1%	S	<1%	S	<1%	S
Aristida spp.	<0%		<0%		<0%		<0%		<0%	
Baccharis emoryi	1-5%		<1%		10-25%		<1%		<1%	
Brickellia longifolia	1-5%		1-5%		<1%		<1%		<0%	
Bromus rubens	<0%		<1%		<1%		<1%		<1%	
Camissonia walkeri	<0%		<0%		<0%		<0%		<1%	
Cryptantha spp.	<0%				<1%		<0%		<1%	
Erigeron lobatus	<0%		<1%		<1%		<0%		<0%	
Gilia spp.	<0%		<0%		<0%		<1%		<1%	

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 2 Transect Type: Tamarisk Area

Hedeoma nana	<0%			<1%		<0%		<1%	
Lepidium lasiocarpum var. lasiocarpum	<0%		<1%	<0%		<0%		<0%	
Muhlenbergia asperifolia	10-25%		1-5%	1-5%		<0%		<1%	
Parietaria hespera	<0%		<0%	<1%		<1%		<1%	
Phacelia rotundifolia	<0%			<0%		<0%		<1%	
Physalis spp.	<0%		<0%	<1%		<0%		<1%	
Physaria chambersii	<0%			<0%		<0%		<0%	
Polypogon monspeliensis	<1%		<1%	<1%		<1%		<1%	
Polypogon viridis	1-5%		1-5%	1-5%		1-5%		1-5%	
Salix gooddingii	1-5%	P	<0%	<0%		<0%		<0%	
Sonchus asper	<0%		<0%	<0%		<1%		<1%	
Sonchus oleraceus	<1%		<0%	<0%		<0%		<0%	
Tamarix ramosissima	10-25%	S+P	1-5%	S+P+M	75-100%	S+P+M	10-25%	S+P	10-25%	S+P+M
Typha domingensis	<0%		1-5%	<0%		<0%		<0%	
Vulpia octoflora	<1%		<0%	<1%		<1%		<0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Muhlenbergia asperifolia	14		
5	Tamarix ramosissima	20	1	
25	Tamarix ramosissima	7	4	7
35	Tamarix ramosissima	16	38	

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Muhlenbergia asperifolia	6		
5	Tamarix ramosissima	7	1	
5	Vacant Space	3		
25	Tamarix ramosissima	4	6	7
35	Tamarix ramosissima	10	7	

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.13	952	8.14	904	8.14	959	8.14	938
15	8.63	494	8.72	488	8.76	482	8.70	488
25	8.55	3999	8.56	3999	8.56	3999	8.56	3999
35	8.79	571	8.62	580	8.55	583	8.65	578
45	8.81	232	8.8	288	8.79	188	8.80	236

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 2 Transect Type: Tamarisk Area

Date: 4/20/2008 Revisit? ☑ Post-tamarisk removal

Recorder: Reader: Akasha Faist

Wind Speed: 4.0 Air Temp (F): 84.0 Cloud Cover: 0

Weather:

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	2
Boulder	1
Coarse woody debris	1
Cobble	12
Gravel	57
Litter (duff)	2
Plant	4
Sand	12
Stone	9

Species	% Cover
??? Spp unkown grass	3
Baccharis salicifolia	14
Muhlenbergia asperifolia	2

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Basal Veg	1	1	1	1	1
Litter (duff)	3	2	1	1	1
Bedrock	27	24	1	0	0
Boulder	2	9	0	0	9
Stone	3	3	4	6	12
Cobble	15	25	28	31	34
Gravel	42	32	57	40	34
Sand	7	4	8	21	9

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S+P	<0%		<0%		<0%		<0%	
Allionia spp.	<0%		<0%		<0%		<1%		<0%	
Baccharis salicifolia	5-10%		1-5%		5-10%		<0%		<0%	
Brickellia longifolia	<0%		<0%		<1%		<0%		<0%	
Bromus rubens	<1%		<1%		<1%		<1%		<0%	
Camissonia walkeri	<0%		<0%		<0%		<0%		<1%	
Cryptantha spp.	<0%		<0%		<0%		<1%		<0%	
Draba spp.	<0%		<0%		<0%		<1%		<1%	
Eucrypta chrysanthemifolia	<0%		<0%		<1%		<0%		<0%	
Galium spp.	<0%		<0%		<0%		<0%		<1%	
Gilia spp.	<0%		<0%		<1%		<1%		<0%	
Grass spp	1-5%		1-5%		<1%		<1%		<1%	

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 2 Transect Type: Tamarisk Area

Hedeoma nana	<0%		<0%		<0%		<0%		<1%
Lepidium lasiocarpum	<0%		<1%		<0%		<0%		<1%
Linanthus bigelovii	<0%		<0%		<0%		<1%		<0%
Muhlenbergia asperifolia	10-25%		<1%		<0%		<0%		<0%
Parietaria hespera	<1%		<1%		<1%		<0%		<0%
Phacelia filiformis									
Poa bigelovii	<0%		<0%		<1%		<0%		<1%
Sonchus oleraceus	<1%		<0%		<0%		<0%		<0%
Tamarix ramosissima	<1%	M	<1%	M	<1%	M	<0%		<0%
Typha domingensis	<0%		<1%		<0%		<0%		<0%
Vulpia octoflora	<0%		<0%		<1%		<0%		<1%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Grass spp	19		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Grass spp	4		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	7.93	973	7.96	976	7.99	1001	7.96	983
15	7.96	1702	8.1	1709	7.99	1638	8.02	1683
25	8.59	1250	8.6	1287	8.6	1280	8.60	1272
35	8.78	2515	8.85	2507	8.83	2610	8.82	2544
45	9.08	985	9.07	1018	9.07	1021	9.07	1008

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 2 Transect Type: Tamarisk Area

Date: 5/12/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Lisa Hahn Reader: Lori Makarick

Wind Speed: 2.0 Air Temp (F): 86.0 Cloud Cover: 0

Weather: clear skies sun just crested the run

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	4
Boulder	11
Coarse woody debris	1
Cobble	3
Gravel	37
Litter (duff)	31
Sand	9
Stone	4

Species	% Cover
Aristida spp.	1
Baccharis emoryi	8
Brickellia longifolia	7
Muhlenbergia asperifolia	4
Polypogon viridis	3
Salix gooddingii	2
Sonchus oleraceus	1
Tamarix ramosissima	54

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
	0	0	0	0	0
Stone	3	3	3	1	8
Coarse woody debris	0	0	1	0	0
Cobble	3	7	8	8	8
Gravel	40	77	19	69	70
Boulder	3	3	0	0	3
Bare Soil	0	0	0	0	0
Litter (duff)	8	3	65	3	3
Bedrock	40	7	0	0	0
Sand	3	0	3	19	8

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	1-5%	P	<1%	S	<1%	S	<1%	S	<1%	S
Aristida spp.	<0%		<0%		<0%		<0%		<0%	
Baccharis emoryi	1-5%		<1%		10-25%		<1%		<1%	
Brickellia longifolia	1-5%		1-5%		<1%		<1%		<0%	
Bromus rubens	<0%		<1%		<1%		<1%		<1%	
Camissonia walkeri	<0%		<0%		<0%		<0%		<1%	
Cryptantha spp.	<0%				<1%		<0%		<1%	
Erigeron lobatus	<0%		<1%		<1%		<0%		<0%	
Gilia spp.	<0%		<0%		<0%		<1%		<1%	

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 2 Transect Type: Tamarisk Area

Hedeoma nana	<0%			<1%		<0%		<1%	
Lepidium lasiocarpum var. lasiocarpum	<0%		<1%	<0%		<0%		<0%	
Muhlenbergia asperifolia	10-25%		1-5%	1-5%		<0%		<1%	
Parietaria hespera	<0%		<0%	<1%		<1%		<1%	
Phacelia rotundifolia	<0%			<0%		<0%		<1%	
Physalis spp.	<0%		<0%	<1%		<0%		<1%	
Physaria chambersii	<0%			<0%		<0%		<0%	
Polypogon monspeliensis	<1%		<1%	<1%		<1%		<1%	
Polypogon viridis	1-5%		1-5%	1-5%		1-5%		1-5%	
Salix gooddingii	1-5%	P	<0%	<0%		<0%		<0%	
Sonchus asper	<0%		<0%	<0%		<1%		<1%	
Sonchus oleraceus	<1%		<0%	<0%		<0%		<0%	
Tamarix ramosissima	10-25%	S+P	1-5%	S+P+M	75-100%	S+P+M	10-25%	S+P	10-25% S+P+M
Typha domingensis	<0%		1-5%	<0%		<0%		<0%	
Vulpia octoflora	<1%		<0%	<1%		<1%		<0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Muhlenbergia asperifolia	14		
5	Tamarix ramosissima	20	1	
25	Tamarix ramosissima	7	4	7
35	Tamarix ramosissima	16	38	

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Muhlenbergia asperifolia	6		
5	Tamarix ramosissima	7	1	
5	Vacant Space	3		
25	Tamarix ramosissima	4	6	7
35	Tamarix ramosissima	10	7	

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.13	952	8.14	904	8.14	959	8.14	938
15	8.63	494	8.72	488	8.76	482	8.70	488
25	8.55	3999	8.56	3999	8.56	3999	8.56	3999
35	8.79	571	8.62	580	8.55	583	8.65	578
45	8.81	232	8.8	288	8.79	188	8.80	236

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 2 Transect Type: Tamarisk Area

Date: 4/20/2008 Revisit? ☑ Post-tamarisk removal

Recorder: Reader: Akasha Faist

Wind Speed: 4.0 Air Temp (F): 84.0 Cloud Cover: 0

Weather:

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	2
Boulder	1
Coarse woody debris	1
Cobble	12
Gravel	57
Litter (duff)	2
Plant	4
Sand	12
Stone	9

Species	% Cover
??? Spp unkown grass	3
Baccharis salicifolia	14
Muhlenbergia asperifolia	2

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Basal Veg	1	1	1	1	1
Litter (duff)	3	2	1	1	1
Bedrock	27	24	1	0	0
Boulder	2	9	0	0	9
Stone	3	3	4	6	12
Cobble	15	25	28	31	34
Gravel	42	32	57	40	34
Sand	7	4	8	21	9

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S+P	<0%		<0%		<0%		<0%	
Allionia spp.	<0%		<0%		<0%		<1%		<0%	
Baccharis salicifolia	5-10%		1-5%		5-10%		<0%		<0%	
Brickellia longifolia	<0%		<0%		<1%		<0%		<0%	
Bromus rubens	<1%		<1%		<1%		<1%		<0%	
Camissonia walkeri	<0%		<0%		<0%		<0%		<1%	
Cryptantha spp.	<0%		<0%		<0%		<1%		<0%	
Draba spp.	<0%		<0%		<0%		<1%		<1%	
Eucrypta chrysanthemifolia	<0%		<0%		<1%		<0%		<0%	
Galium spp.	<0%		<0%		<0%		<0%		<1%	
Gilia spp.	<0%		<0%		<1%		<1%		<0%	
Grass spp	1-5%		1-5%		<1%		<1%		<1%	

Hedeoma nana	<0%		<0%		<0%		<0%	<1%	
Lepidium lasiocarpum	<0%		<1%		<0%		<0%	<1%	
Linanthus bigelovii	<0%		<0%		<0%		<1%	<0%	
Muhlenbergia asperifolia	10-25%		<1%		<0%		<0%	<0%	
Parietaria hespera	<1%		<1%		<1%		<0%	<0%	
Phacelia filiformis									
Poa bigelovii	<0%		<0%		<1%		<0%	<1%	
Sonchus oleraceus	<1%		<0%		<0%		<0%	<0%	
Tamarix ramosissima	<1%	M	<1%	M	<1%	M	<0%	<0%	
Typha domingensis	<0%		<1%		<0%		<0%	<0%	
Vulpia octoflora	<0%		<0%		<1%		<0%	<1%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Grass spp	19		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Grass spp	4		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	7.93	973	7.96	976	7.99	1001	7.96	983
15	7.96	1702	8.1	1709	7.99	1638	8.02	1683
25	8.59	1250	8.6	1287	8.6	1280	8.60	1272
35	8.78	2515	8.85	2507	8.83	2610	8.82	2544
45	9.08	985	9.07	1018	9.07	1021	9.07	1008

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 2 Transect Type: Tamarisk Control

	Start point		End point
Easting:	331266	Easting:	331291
Northing:	4013598	Northing:	4013660
GPS accuracy (m):	5.3	GPS accuracy (m):	5.2
Elevation (m):	937	Elevation (m):	673
Bearing:	301		
Aspect (0-360):	218	Slope (degrees):	1

Transect description: T2B starts on stream right just after stream makes a right curve as you walking upstream. T2B crosses stream at about 10m into a clump of BACSAL. About 150m upstream from T2A.

Additional Info:: About 200m above scramble/climb.

Geological layer: Muav limestone

Habitat type: Riparian

Dominant species: Baccharis salicifolia (Ruiz & Pavón) Pers., Brickellia longifolia S. Wats., Polypogon monspeliensis (L.) Desf., Polypogon viridis (Gouan) Breistr., Tamarix ramosissima Ledeb.

Associated species: Acacia greggii Gray, Anulocaulis leiosolenus (Torr.) Standl. var. leiosolenus, Fouquieria splendens Engelm., Tamarix ramosissima Ledeb., Typha latifolia L.

Surface water within 25m? ☑ Surface water type: stream

Landform: Drainage channel Surface rocks: limestone

Soil type: sand Topo position: Unknown

Light exposure: full-shade Soil moisture: moist

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 2 Transect Type: Tamarisk Control

Date: 5/12/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Amy Prince Reader: Steve Till

Wind Speed: 1.0 Air Temp (F): 88.0 Cloud Cover: 0

Weather: Sunny and warm, upper 80's, no clouds.

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	2
Cobble	7
Gravel	53
Litter (duff)	21
Sand	14
Stone	2

Species	% Cover
Algae spp.	2
Baccharis salicifolia	37
Muhlenbergia asperifolia	12
Polypogon viridis	6
Tamarix ramosissima	3

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Stone	0	3	9	10	1
Sand	8	8	20	23	4
Cobble	3	8	20	10	10
Boulder	0	1	3	10	0
Gravel	87	42	20	23	84
Litter (duff)	1	19	19	23	1
Bedrock	1	19	9	1	0

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<0%		<0%		<1%	S	<0%		<0%	
Agave utahensis var. utahensis	<0%		<0%		<1%		<0%		<0%	
Algae spp.	1-5%		<0%		<0%		<0%		1-5%	
Aristida purpurea	<0%		<1%		<0%		<0%		<0%	
Baccharis salicifolia	1-5%		25-50%		10-25%		5-10%		1-5%	
Brickellia longifolia	<0%		<0%		1-5%		1-5%		<0%	
Bromus rubens	<1%		<0%		<0%		<0%		<1%	
Camissonia walkeri	<0%		<0%		<0%		<0%		<1%	
Cryptantha spp.	<1%		<0%		<0%		<0%		<0%	
Cryptobiotic soil	<0%		<0%		<0%		<0%		<0%	
Draba cuneifolia	<0%		<0%		<0%		<0%		<1%	
Galium aparine	<0%		<0%		<0%		<1%		<0%	

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 2 Transect Type: Tamarisk Control

Hedeoma nana	<0%		<1%		<0%		<1%	<0%	
Layia glandulosa	<0%		<0%		<0%		<0%	<1%	
Lepidium lasiocarpum var. lasiocarpum	<0%		<0%		<0%		<0%	<1%	
Lichen spp.	<0%		<0%		<0%		<0%	<0%	
Maurandella antirrhiniflora	<0%		<1%		<0%		<1%	<0%	
Muhlenbergia asperifolia	1-5%		<1%		5-10%		25-50%	1-5%	
Parietaria hespera	<0%		<0%		<0%		<0%	<1%	
Pleurocoronis pluriseta	<0%		<0%		<0%		<1%	<0%	
Poa spp.	<0%		<0%		<0%		<0%	<1%	
Polypogon monspeliensis	<1%		<1%		<0%		1-5%	<0%	
Polypogon viridis	1-5%		<1%		<1%		1-5%	1-5%	
Tamarix ramosissima	<1%	S+M	1-5%	S+P	1-5%	S+P	10-25%	M	1-5%	M
Typha domingensis	<0%		<0%		<0%		1-5%	<0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Polypogon viridis	1		
35	Muhlenbergia asperifolia	20		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Polypogon viridis	1		
25	Muhlenbergia asperifolia	2		
35	Muhlenbergia asperifolia	4		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.78	459	8.77	441	8.77	463	8.77	454
15	8.4	3999	8.45	3999	8.45	3999	8.43	3999
25	8.6	3677	8.6	3737	8.59	3763	8.60	3726
35	8.4	1512	8.37	1519	8.34	1512	8.37	1514
45	8.64	481	8.64	484	8.65	486	8.64	484

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 2 Transect Type: Tamarisk Control

Date: 4/20/2008 Revisit? ☑ Post-tamarisk removal

Recorder: Akasha Faist Reader: Jane Cipra

Wind Speed: 1.0 Air Temp (F): 71.0 Cloud Cover: 0

Weather:

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	6
Boulder	4
Cobble	8
Gravel	49
Litter (duff)	16
Plant	1
Sand	13
Stone	3

Species	% Cover
Acacia greggii	1
Baccharis salicifolia	35
Brickellia longifolia	3
Muhlenbergia asperifolia	12

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Basal Veg	1	2	1	1	1
Coarse woody debris	0	0	0	1	0
Litter (duff)	0	4	7	15	1
Bedrock	5	39	40	29	6
Boulder	0	2	1	7	0
Stone	4	3	3	9	1
Cobble	16	18	15	5	10
Gravel	66	26	28	19	67
Sand	8	6	5	14	18

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S	<0%		<1%	S	<1%	S	<1%	S
Arabis spp.	<1%		<0%		<0%		<0%		<0%	
Baccharis salicifolia	1-5%		25-50%		10-25%		10-25%		1-5%	
Brickellia longifolia	<1%		<0%		<0%		5-10%		<0%	
Camissonia walkeri	<0%		<0%		<0%		<1%		<0%	
Cryptantha spp.	<0%		<0%		<0%		<1%		<0%	
Draba cuneifolia	<1%		<0%		<0%		<0%		<0%	
Eucrypta micrantha	<0%		<0%		<0%		<1%		<0%	
Galium aparine	<0%		<0%		<0%		<1%		<0%	
Lappula occidentalis var. occidentalis	<1%		<0%		<0%		<0%		<0%	
Lepidium lasiocarpum	<1%		<0%		<0%		<0%		<0%	
Maurandella antirrhiniflora	<0%		<0%		<0%		<1%		<0%	

Muhlenbergia asperifolia	<0%	<0%		5-10%		10-25%		1-5%
Parietaria hespera	<1%	<0%		<1%		<1%		<0%
Phacelia spp.	<1%	<0%		<0%		<1%		<0%
Poa bigelovii	<1%	<0%		<1%		<1%		<0%
Polypogon spp	<1%	<0%		<0%		<0%		<0%
Sphaeralcea grossulariifolia	<0%	<0%		<0%		<1%		<0%
Tamarix ramosissima	<0%	<1%	S+M	<1%	P	<1%	S+P	<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
15	Baccharis salicifolia	15		
25	Baccharis salicifolia		1	

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
15	Baccharis salicifolia	7		
25	Baccharis salicifolia	1	2	2

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.3	700	8.42	1328	8.5	1044	8.41	1024
15	8.05	1340	8.11	1282	8.1	1350	8.09	1324
25	8.5	225	8.57	227	8.56	225	8.54	226
35	8.28	1640	8.27	1700	8.3	1769	8.28	1703
45	8.58	615	8.59	589	8.68	629	8.62	611

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 2 Transect Type: Tamarisk Control

Date: 5/12/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Amy Prince Reader: Steve Till

Wind Speed: 1.0 Air Temp (F): 88.0 Cloud Cover: 0

Weather: Sunny and warm, upper 80's, no clouds.

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	2
Cobble	7
Gravel	53
Litter (duff)	21
Sand	14
Stone	2

Species	% Cover
Algae spp.	2
Baccharis salicifolia	37
Muhlenbergia asperifolia	12
Polypogon viridis	6
Tamarix ramosissima	3

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Stone	0	3	9	10	1
Sand	8	8	20	23	4
Cobble	3	8	20	10	10
Boulder	0	1	3	10	0
Gravel	87	42	20	23	84
Litter (duff)	1	19	19	23	1
Bedrock	1	19	9	1	0

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<0%		<0%		<1%	S	<0%		<0%	
Agave utahensis var. utahensis	<0%		<0%		<1%		<0%		<0%	
Algae spp.	1-5%		<0%		<0%		<0%		1-5%	
Aristida purpurea	<0%		<1%		<0%		<0%		<0%	
Baccharis salicifolia	1-5%		25-50%		10-25%		5-10%		1-5%	
Brickellia longifolia	<0%		<0%		1-5%		1-5%		<0%	
Bromus rubens	<1%		<0%		<0%		<0%		<1%	
Camissonia walkeri	<0%		<0%		<0%		<0%		<1%	
Cryptantha spp.	<1%		<0%		<0%		<0%		<0%	
Cryptobiotic soil	<0%		<0%		<0%		<0%		<0%	
Draba cuneifolia	<0%		<0%		<0%		<0%		<1%	
Galium aparine	<0%		<0%		<0%		<1%		<0%	

Hedeoma nana	<0%		<1%		<0%		<1%	<0%	
Layia glandulosa	<0%		<0%		<0%		<0%	<1%	
Lepidium lasiocarpum var. lasiocarpum	<0%		<0%		<0%		<0%	<1%	
Lichen spp.	<0%		<0%		<0%		<0%	<0%	
Maurandella antirrhiniflora	<0%		<1%		<0%		<1%	<0%	
Muhlenbergia asperifolia	1-5%		<1%		5-10%		25-50%	1-5%	
Parietaria hespera	<0%		<0%		<0%		<0%	<1%	
Pleurocoronis pluriseta	<0%		<0%		<0%		<1%	<0%	
Poa spp.	<0%		<0%		<0%		<0%	<1%	
Polypogon monspeliensis	<1%		<1%		<0%		1-5%	<0%	
Polypogon viridis	1-5%		<1%		<1%		1-5%	1-5%	
Tamarix ramosissima	<1%	S+M	1-5%	S+P	1-5%	S+P	10-25%	M	1-5%	M
Typha domingensis	<0%		<0%		<0%		1-5%	<0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Polypogon viridis	1		
35	Muhlenbergia asperifolia	20		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Polypogon viridis	1		
25	Muhlenbergia asperifolia	2		
35	Muhlenbergia asperifolia	4		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.78	459	8.77	441	8.77	463	8.77	454
15	8.4	3999	8.45	3999	8.45	3999	8.43	3999
25	8.6	3677	8.6	3737	8.59	3763	8.60	3726
35	8.4	1512	8.37	1519	8.34	1512	8.37	1514
45	8.64	481	8.64	484	8.65	486	8.64	484

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 2 Transect Type: Tamarisk Control

Date: 4/20/2008 Revisit? ☑ Post-tamarisk removal

Recorder: Akasha Faist Reader: Jane Cipra

Wind Speed: 1.0 Air Temp (F): 71.0 Cloud Cover: 0

Weather:

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	6
Boulder	4
Cobble	8
Gravel	49
Litter (duff)	16
Plant	1
Sand	13
Stone	3

Species	% Cover
Acacia greggii	1
Baccharis salicifolia	35
Brickellia longifolia	3
Muhlenbergia asperifolia	12

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Basal Veg	1	2	1	1	1
Coarse woody debris	0	0	0	1	0
Litter (duff)	0	4	7	15	1
Bedrock	5	39	40	29	6
Boulder	0	2	1	7	0
Stone	4	3	3	9	1
Cobble	16	18	15	5	10
Gravel	66	26	28	19	67
Sand	8	6	5	14	18

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S	<0%		<1%	S	<1%	S	<1%	S
Arabis spp.	<1%		<0%		<0%		<0%		<0%	
Baccharis salicifolia	1-5%		25-50%		10-25%		10-25%		1-5%	
Brickellia longifolia	<1%		<0%		<0%		5-10%		<0%	
Camissonia walkeri	<0%		<0%		<0%		<1%		<0%	
Cryptantha spp.	<0%		<0%		<0%		<1%		<0%	
Draba cuneifolia	<1%		<0%		<0%		<0%		<0%	
Eucrypta micrantha	<0%		<0%		<0%		<1%		<0%	
Galium aparine	<0%		<0%		<0%		<1%		<0%	
Lappula occidentalis var. occidentalis	<1%		<0%		<0%		<0%		<0%	
Lepidium lasiocarpum	<1%		<0%		<0%		<0%		<0%	
Maurandella antirrhiniflora	<0%		<0%		<0%		<1%		<0%	

Muhlenbergia asperifolia	<0%	<0%		5-10%		10-25%		1-5%
Parietaria hespera	<1%	<0%		<1%		<1%		<0%
Phacelia spp.	<1%	<0%		<0%		<1%		<0%
Poa bigelovii	<1%	<0%		<1%		<1%		<0%
Polypogon spp	<1%	<0%		<0%		<0%		<0%
Sphaeralcea grossulariifolia	<0%	<0%		<0%		<1%		<0%
Tamarix ramosissima	<0%	<1%	S+M	<1%	P	<1%	S+P	<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
15	Baccharis salicifolia	15		
25	Baccharis salicifolia		1	

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
15	Baccharis salicifolia	7		
25	Baccharis salicifolia	1	2	2

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.3	700	8.42	1328	8.5	1044	8.41	1024
15	8.05	1340	8.11	1282	8.1	1350	8.09	1324
25	8.5	225	8.57	227	8.56	225	8.54	226
35	8.28	1640	8.27	1700	8.3	1769	8.28	1703
45	8.58	615	8.59	589	8.68	629	8.62	611

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 3 Transect Type: Tamarisk Area

	Start point		End point
Easting:	331492	Easting:	331453
Northing:	4013184	Northing:	4013237
GPS accuracy (m):	18	GPS accuracy (m):	38
Elevation (m):	629	Elevation (m):	623
Bearing:	28		
Aspect (0-360):	24	Slope (degrees):	3

Transect description: Transect is on creek right. It begins on a large whitish boulder and runs through tamarisk and native vegetation. Transect ends on creek right of a small waterfall and pool. Transect is approximately 40m above T3B.

Additional Info:: Transect is about 1/5 km upstream from the Colorado river. It is difficult to access with 2 hard climbs and traverses. One requires the use of ropes. The surrounding bedrock is the Muav Limestone.

Geological layer: Muav

Habitat type: Riparian

Dominant species: Acacia greggii Gray, Baccharis salicifolia (Ruiz & Pavón) Pers., Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Tamarix ramosissima Ledeb.

Associated species: Adiantum capillus-veneris L., Aloysia wrightii Heller ex Abrams, Baccharis sergiloides Gray, Brickellia longifolia S. Wats., Bromus rubens L., Camissonia walkeri (A. Nels.) Raven, Centaurium arizonicum, Eriogonum inflatum Torr. & Frém., Frangula betulifolia (Greene) V. Grub. ssp. obovata (Kearney & Peebles) Kartesz & Gandhi, Fraxinus anomala Torr. ex S. Wats., Funastrum cynanchoides (Dcne.) Schlechter, Oenothera caespitosa Nutt., Parietaria hespera Hinton, Pinus monophylla Torr. & Frém., Polypogon viridis (Gouan) Breistr., Populus fremontii S. Wats., Salix gooddingii Ball, Solanum americanum P. Mill., Sonchus asper (L.) Hill, Stanleya pinnata (Pursh) Britt., Tamarix ramosissima Ledeb., Typha domingensis Pers., Ziziphus obtusifolia var. canescens (Gray) M.C. Johnston

Surface water within 25m? ☑ Surface water type: stream

Landform: Drainage channel Surface rocks: limestone

Soil type: sand Topo position: Unknown

Light exposure: partial-shade Soil moisture: moist

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 3 Transect Type: Tamarisk Area

Date: 5/12/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Pamela Walls Reader: Steve Till

Wind Speed: 1.0 Air Temp (F): 87.0 Cloud Cover: 0

Weather: Blue skies, no clouds, 87 F, and rising.

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	21
Cobble	5
Gravel	7
Litter (duff)	27
Sand	22
Stone	11

Species	% Cover
	2
Baccharis salicifolia	4
Baccharis sarothroides	2
Baccharis sergiloides	1
Brickellia longifolia	4
Cryptobiotic soil	7
Fraxinus anomala	2
Funastrum cynanchoides	6
Muhlenbergia asperifolia	3
Solidago spp.	3
Tamarix ramosissima	20

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Crypto	3	7	7	3	1
Gravel	4	1	4	4	23
Coarse woody debris	1	4	0	0	0
Boulder	47	42	21	46	48
Sand	1	10	10	4	10
Litter (duff)	20	22	21	10	4
Stone	20	10	23	23	4
Cobble	4	4	10	10	10
Woody debris structure	0	0	4	0	0

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S	1-5%	P	1-5%	S+M	<1%	S	<1%	S+P
Andropogon glomeratus	<1%		<0%		<0%		<0%		<0%	
Baccharis salicifolia	5-10%		10-25%		1-5%		1-5%		5-10%	
Bothriochloa barbinodis	<0%		<1%		<0%		<0%		<0%	
Brickellia longifolia	5-10%		5-10%		1-5%		1-5%		5-10%	

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 3 Transect Type: Tamarisk Area

Bromus rubens	<0%	<0%	<0%		<0%		<1%	
Echinocereus triglochidiatus	<0%	<0%	<1%		<0%		<0%	
Encelia farinosa	<0%	<1%	<0%		<0%		<0%	
Fraxinus anomala	<0%	<0%	1-5%	P	<0%		<0%	
Funastrum cynanchoides	<1%	5-10%	<1%		<0%		<0%	
Galium stellatum	<0%	<0%	<1%		<0%		<0%	
Hedeoma nana	<0%	<1%	1-5%		<1%		<0%	
Lepidium spp.	<0%	<0%	<1%		<0%		<0%	
Machaeranthera pinnatifida	<0%	<0%	<1%		<0%		<0%	
Maurandella antirrhiniflora	<0%	<1%	<0%		<0%		<0%	
Muhlenbergia asperifolia	1-5%	<1%	<1%		5-10%		1-5%	
Oenothera caespitosa	<0%	<0%	<1%		<1%		<0%	
Penstemon spp.	<0%	<0%	<0%		<1%		<0%	
Pleurocoronis pluriseta	<0%	<0%	<1%		<0%		<0%	
Polypogon monspeliensis	<0%	<0%	<0%		<0%		<1%	
Polypogon viridis	<0%	<0%	<0%		1-5%		<1%	
Porophyllum gracile	<0%	<0%	<0%		<1%		<0%	
Solidago spp.	<0%	<0%	1-5%		5-10%		1-5%	
Sporobolus cryptandrus	<0%	<1%	<1%		<1%		<0%	
Stephanomeria pauciflora	<1%	<0%	<1%		<1%		<0%	
Tamarix ramosissima	25-50%	<0%	1-5%	M	<1%	S	5-10%	S+M
Tiquilia latior	<0%	<1%	<0%		<0%		<0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Tamarix ramosissima	0	3	

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Tamarix ramosissima	4	8	2
15	Baccharis salicifolia	2	3	
25	Fraxinus anomala		2	
45	Baccharis salicifolia		1	

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.6	605	8.66	599	8.68	607	8.65	604
15	8.69	168	8.65	170	8.61	172	8.65	170
25	8.65	183	8.66	183	8.66	183	8.66	183
35	8.42	2018	8.81	2023	8.56	2034	8.60	2025

45	9.09	318	9.1	318	9.12	323	9.10	320

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 3 Transect Type: Tamarisk Area

Date: 4/20/2008 Revisit? ☑ Post-tamarisk removal

Recorder: Reader: Akasha Faist

Wind Speed: 4.0 Air Temp (F): 83.0 Cloud Cover: 0

Weather:

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	28
Coarse woody debris	2
Cobble	5
Gravel	15
Litter (duff)	11
Plant	1
Sand	28
Stone	10

Species	% Cover
Baccharis salicifolia	9
Baccharis sergiloides	1
Brickellia longifolia	2
Bromus rubens	6
Cryptobiotic soil	9
Flaveria macdougalii	3
Hesperostipa neomexicana	1
Muhlenbergia asperifolia	10
Sarcostemma cynanchoides var. hartwegii	7
Sporobolus cryptandrus	1

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Moss (ground)	1	1	5	1	0
Crypto	5	31	22	3	0
Basal Veg	1	1	1	1	1
Woody debris structure	1	2	2	0	0
Coarse woody debris	3	8	1	1	0
Litter (duff)	15	11	8	4	1
Boulder	52	28	21	26	30
Stone	10	11	12	11	6
Cobble	5	3	8	9	32
Gravel	3	1	8	11	20
Sand	4	3	12	33	10
Bare Soil	0	0	0	0	0

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S+P	1-5%	P	<1%	S+P	<0%		<0%	
Agave spp.	<1%		<0%		1-5%		<0%		<0%	
Agoseris heterophylla	<0%		<1%		<0%		<0%		<0%	
Amsonia tomentosa	<0%		<1%		<0%		<0%		<0%	
Andropogon glomeratus	1-5%		<0%		<0%		<0%		<0%	
Aristida adscensionis	<0%		<0%		<1%		<0%		<0%	
Baccharis salicifolia	5-10%		5-10%		1-5%		1-5%		5-10%	
Baccharis sarothroides	1-5%		<0%		1-5%		<0%		<0%	

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 3 Transect Type: Tamarisk Area

Bothriochloa barbinodis	<0%	<1%	<1%	<0%	<0%
Brickellia longifolia	5-10%	1-5%	<1%	<1%	<0%
Bromus rubens	<1%	1-5%	<1%	<0%	<1%
Camissonia walkeri	<1%	<0%	<1%	<0%	<0%
Cryptantha spp.	<1%	<1%	<1%	<0%	<0%
Draba spp.	<1%	<0%	<0%	<0%	<0%
Echinocereus triglochidiatus	<0%	<0%	<1%	<0%	<0%
Encelia farinosa	<0%	<1%	<0%	<0%	<0%
Eucrypta micrantha	<0%	<1%	<0%	<0%	<0%
Flaveria macdougalii	<0%	<0%	10-25%	5-10%	1-5%
Fraxinus anomala	<0%	<0%	1-5% P	<0%	<0%
Galium stellatum	<1%	<0%	<1%	<0%	<1%
Gilia spp.	<1%	<0%	<0%	<0%	<0%
Hedeoma nana	<0%	<1%	<1%	<0%	<0%
Hesperostipa neomexicana	<0%	<0%	<1%	<0%	<0%
Lactuca spp	<0%	<1%	<0%	<0%	<0%
Lepidium lasiocarpum	<1%	<1%	<1%	<0%	<0%
Maurandella antirrhiniflora	<0%	<0%	<1%	<0%	<0%
Muhlenbergia asperifolia	1-5%	1-5%	<1%	5-10%	1-5%
Nicotinia spp	<1%	<0%	<0%	<0%	<0%
Oenothera caespitosa	<1%	<1%	<1%	<0%	<0%
Opuntia spp.	<0%	<1%	<0%	<0%	<0%
Parietaria hespera	<0%	<1%	<0%	<0%	<0%
Phacelia filiformis	<1%	<0%	<1%	<0%	<0%
Plantago patagonica	<0%	<0%	<1%	<0%	<0%
Poa bigelovii	<0%	<1%	<0%	<0%	<0%
Polypogon spp	<0%	<1%	<0%	<0%	<0%
Porophyllum gracile	<0%	<1%	<0%	<0%	<0%
Sarcostemma cynanchoides var. hartwegii	<1%	1-5%	<1%	<0%	<0%
Sporobolus cryptandrus	<1%	<0%	<1%	<0%	<0%
Stephanomeria pauciflora	<1%	<1%	<1%	<1%	<0%
Stylocline micropoides	<0%	<1%	<0%	<0%	<0%
Tiquilia latior	<0%	<1%	<0%	<0%	<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
15	Sarcostemma cynanchoides var. hartwegii	1		
25	Baccharis salicifolia	2		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
15	Baccharis salicifolia	6		

15	Sarcostemma cynanchoides var. hartwegii	2
15	Vacant Space	2
25	Baccharis salicifolia	1

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	7.97	673	7.97	673	7.97	673	7.97	673
15	8.34	419	8.34	419	8.34	419	8.34	419
25	8.33	374	8.33	374	8.33	374	8.33	374
35	8.35	3999	8.35	3999	8.35	3999	8.35	3999
45	8.56	1404	8.56	1404	8.56	1404	8.56	1404

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 3 Transect Type: Tamarisk Area

Date: 5/12/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Pamela Walls Reader: Steve Till

Wind Speed: 1.0 Air Temp (F): 87.0 Cloud Cover: 0

Weather: Blue skies, no clouds, 87 F, and rising.

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	21
Cobble	5
Gravel	7
Litter (duff)	27
Sand	22
Stone	11

Species	% Cover
	2
Baccharis salicifolia	4
Baccharis sarothroides	2
Baccharis sergiloides	1
Brickellia longifolia	4
Cryptobiotic soil	7
Fraxinus anomala	2
Funastrum cynanchoides	6
Muhlenbergia asperifolia	3
Solidago spp.	3
Tamarix ramosissima	20

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Crypto	3	7	7	3	1
Gravel	4	1	4	4	23
Coarse woody debris	1	4	0	0	0
Boulder	47	42	21	46	48
Sand	1	10	10	4	10
Litter (duff)	20	22	21	10	4
Stone	20	10	23	23	4
Cobble	4	4	10	10	10
Woody debris structure	0	0	4	0	0

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S	1-5%	P	1-5%	S+M	<1%	S	<1%	S+P
Andropogon glomeratus	<1%		<0%		<0%		<0%		<0%	
Baccharis salicifolia	5-10%		10-25%		1-5%		1-5%		5-10%	
Bothriochloa barbinodis	<0%		<1%		<0%		<0%		<0%	
Brickellia longifolia	5-10%		5-10%		1-5%		1-5%		5-10%	

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 3 Transect Type: Tamarisk Area

Bromus rubens	<0%	<0%	<0%		<0%		<1%	
Echinocereus triglochidiatus	<0%	<0%	<1%		<0%		<0%	
Encelia farinosa	<0%	<1%	<0%		<0%		<0%	
Fraxinus anomala	<0%	<0%	1-5%	P	<0%		<0%	
Funastrum cynanchoides	<1%	5-10%	<1%		<0%		<0%	
Galium stellatum	<0%	<0%	<1%		<0%		<0%	
Hedeoma nana	<0%	<1%	1-5%		<1%		<0%	
Lepidium spp.	<0%	<0%	<1%		<0%		<0%	
Machaeranthera pinnatifida	<0%	<0%	<1%		<0%		<0%	
Maurandella antirrhiniflora	<0%	<1%	<0%		<0%		<0%	
Muhlenbergia asperifolia	1-5%	<1%	<1%		5-10%		1-5%	
Oenothera caespitosa	<0%	<0%	<1%		<1%		<0%	
Penstemon spp.	<0%	<0%	<0%		<1%		<0%	
Pleurocoronis pluriseta	<0%	<0%	<1%		<0%		<0%	
Polypogon monspeliensis	<0%	<0%	<0%		<0%		<1%	
Polypogon viridis	<0%	<0%	<0%		1-5%		<1%	
Porophyllum gracile	<0%	<0%	<0%		<1%		<0%	
Solidago spp.	<0%	<0%	1-5%		5-10%		1-5%	
Sporobolus cryptandrus	<0%	<1%	<1%		<1%		<0%	
Stephanomeria pauciflora	<1%	<0%	<1%		<1%		<0%	
Tamarix ramosissima	25-50%	<0%	1-5%	M	<1%	S	5-10%	S+M
Tiquilia latior	<0%	<1%	<0%		<0%		<0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Tamarix ramosissima	0	3	

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Tamarix ramosissima	4	8	2
15	Baccharis salicifolia	2	3	
25	Fraxinus anomala		2	
45	Baccharis salicifolia		1	

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.6	605	8.66	599	8.68	607	8.65	604
15	8.69	168	8.65	170	8.61	172	8.65	170
25	8.65	183	8.66	183	8.66	183	8.66	183
35	8.42	2018	8.81	2023	8.56	2034	8.60	2025

45	9.09	318	9.1	318	9.12	323	9.10	320

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 3 Transect Type: Tamarisk Area

Date: 4/20/2008 Revisit? ☑ Post-tamarisk removal

Recorder: Reader: Akasha Faist

Wind Speed: 4.0 Air Temp (F): 83.0 Cloud Cover: 0

Weather:

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	28
Coarse woody debris	2
Cobble	5
Gravel	15
Litter (duff)	11
Plant	1
Sand	28
Stone	10

Species	% Cover
Baccharis salicifolia	9
Baccharis sergiloides	1
Brickellia longifolia	2
Bromus rubens	6
Cryptobiotic soil	9
Flaveria macdougalii	3
Hesperostipa neomexicana	1
Muhlenbergia asperifolia	10
Sarcostemma cynanchoides var. hartwegii	7
Sporobolus cryptandrus	1

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Moss (ground)	1	1	5	1	0
Crypto	5	31	22	3	0
Basal Veg	1	1	1	1	1
Woody debris structure	1	2	2	0	0
Coarse woody debris	3	8	1	1	0
Litter (duff)	15	11	8	4	1
Boulder	52	28	21	26	30
Stone	10	11	12	11	6
Cobble	5	3	8	9	32
Gravel	3	1	8	11	20
Sand	4	3	12	33	10
Bare Soil	0	0	0	0	0

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S+P	1-5%	P	<1%	S+P	<0%		<0%	
Agave spp.	<1%		<0%		1-5%		<0%		<0%	
Agoseris heterophylla	<0%		<1%		<0%		<0%		<0%	
Amsonia tomentosa	<0%		<1%		<0%		<0%		<0%	
Andropogon glomeratus	1-5%		<0%		<0%		<0%		<0%	
Aristida adscensionis	<0%		<0%		<1%		<0%		<0%	
Baccharis salicifolia	5-10%		5-10%		1-5%		1-5%		5-10%	
Baccharis sarothroides	1-5%		<0%		1-5%		<0%		<0%	

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 3 Transect Type: Tamarisk Area

Bothriochloa barbinodis	<0%	<1%	<1%	<0%	<0%
Brickellia longifolia	5-10%	1-5%	<1%	<1%	<0%
Bromus rubens	<1%	1-5%	<1%	<0%	<1%
Camissonia walkeri	<1%	<0%	<1%	<0%	<0%
Cryptantha spp.	<1%	<1%	<1%	<0%	<0%
Draba spp.	<1%	<0%	<0%	<0%	<0%
Echinocereus triglochidiatus	<0%	<0%	<1%	<0%	<0%
Encelia farinosa	<0%	<1%	<0%	<0%	<0%
Eucrypta micrantha	<0%	<1%	<0%	<0%	<0%
Flaveria macdougalii	<0%	<0%	10-25%	5-10%	1-5%
Fraxinus anomala	<0%	<0%	1-5% P	<0%	<0%
Galium stellatum	<1%	<0%	<1%	<0%	<1%
Gilia spp.	<1%	<0%	<0%	<0%	<0%
Hedeoma nana	<0%	<1%	<1%	<0%	<0%
Hesperostipa neomexicana	<0%	<0%	<1%	<0%	<0%
Lactuca spp	<0%	<1%	<0%	<0%	<0%
Lepidium lasiocarpum	<1%	<1%	<1%	<0%	<0%
Maurandella antirrhiniflora	<0%	<0%	<1%	<0%	<0%
Muhlenbergia asperifolia	1-5%	1-5%	<1%	5-10%	1-5%
Nicotinia spp	<1%	<0%	<0%	<0%	<0%
Oenothera caespitosa	<1%	<1%	<1%	<0%	<0%
Opuntia spp.	<0%	<1%	<0%	<0%	<0%
Parietaria hespera	<0%	<1%	<0%	<0%	<0%
Phacelia filiformis	<1%	<0%	<1%	<0%	<0%
Plantago patagonica	<0%	<0%	<1%	<0%	<0%
Poa bigelovii	<0%	<1%	<0%	<0%	<0%
Polypogon spp	<0%	<1%	<0%	<0%	<0%
Porophyllum gracile	<0%	<1%	<0%	<0%	<0%
Sarcostemma cynanchoides var. hartwegii	<1%	1-5%	<1%	<0%	<0%
Sporobolus cryptandrus	<1%	<0%	<1%	<0%	<0%
Stephanomeria pauciflora	<1%	<1%	<1%	<1%	<0%
Stylocline micropoides	<0%	<1%	<0%	<0%	<0%
Tiquilia latior	<0%	<1%	<0%	<0%	<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
15	Sarcostemma cynanchoides var. hartwegii	1		
25	Baccharis salicifolia	2		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
15	Baccharis salicifolia	6		

15	Sarcostemma cynanchoides var. hartwegii	2
15	Vacant Space	2
25	Baccharis salicifolia	1

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	7.97	673	7.97	673	7.97	673	7.97	673
15	8.34	419	8.34	419	8.34	419	8.34	419
25	8.33	374	8.33	374	8.33	374	8.33	374
35	8.35	3999	8.35	3999	8.35	3999	8.35	3999
45	8.56	1404	8.56	1404	8.56	1404	8.56	1404

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 3 Transect Type: Tamarisk Control

	Start point		End point
Easting:	331511	Easting:	331533
Northing:	4013234	Northing:	4013282
GPS accuracy (m):	100	GPS accuracy (m):	12.9
Elevation (m):		Elevation (m):	1295
Bearing:	27		
Aspect (0-360):	10	Slope (degrees):	6

Transect description: Transect is just above the second tricky climb, which is on creek right just below where there is a huge chockstone. Trail heads up a steep Muav slot on creek right, then you traverse along the Muav shelves above the creek. It is very exposed and steep. After you drop into the drainage again, you go up a 7ft. climb up a boulder. Right after that is a straight stretch with lots of huge Nolina on creek right. The start is wedged between a 2.5x2.5x2.5m boulder and a smaller one. The transect stays on creek right and aims directly for the uppermost point on the HUGE house-sized limestone boulder with 2 smaller sized ones right next to it upstream. This is the downstream one. Endpoint is about 3m upstream of the large (4x2x3m) flat topped boulder.

Additional Info:: Need to do rare plant monitoring forms for species next time in the canyon. Did not get to do hydrology in this area either. Please use photographs and descriptions to relocate this transect. Got the GPS readings from GIS, so they may not be accurate.

Geological layer: Muav limestone

Habitat type: Riparian

Dominant species:

Associated species: Flaveria macdougalii Theroux, Pinkava & Keil, Nolina microcarpa S. Wats., Opuntia engelmannii Salm-Dyck var. engelmannii, Phacelia crenulata Torr. ex S. Wats., Trixis californica Kellogg

Surface water within 25m? ☑ Surface water type: stream

Landform: Drainage channel Surface rocks: limestone

Soil type: loamy sand Topo position: Unknown

Light exposure: partial-shade Soil moisture: dry moist

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 3 Transect Type: Tamarisk Control

Date: 5/12/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Lisa Hahn Reader: Lori Makarick

Wind Speed: Air Temp (F): Cloud Cover:

Weather: Very hot-95F- and very calm. No clouds.

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	2
Boulder	24
Coarse woody debris	2
Cobble	4
Gravel	13
Litter (duff)	17
Sand	23
Stone	10

Species	% Cover
Acacia greggii	2
Baccharis emoryi	6
Brickellia longifolia	24
Bromus rubens	2
Cryptobiotic soil	5
Ephedra spp.	2
Funastrum cynanchoides	16
Hedeoma nana	1
Maurandella antirrhiniflora	3
Polypogon monspeliensis	2
Stephanomeria pauciflora	4

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Sand	4	4	11	30	21
Stone	21	4	27	12	21
Gravel	9	25	27	12	1
Litter (duff)	21	4	12	5	9
Boulder	21	52	11	29	46
Coarse woody debris	20	10	11	12	1

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	5-10%	S+M	<0%		5-10%	S+M	1-5%	P	1-5%	S+M
Aristida spp.	<0%		<1%		<0%		<1%		<0%	
Baccharis emoryi	<0%		1-5%		<1%		1-5%		<0%	
Baccharis sarothroides	<0%		<0%		<1%		<0%		<0%	
Brickellia longifolia	10-25%		10-25%		5-10%		10-25%		10-25%	
Bromus rubens	1-5%		1-5%		<1%		<1%		<1%	
Camissonia walkeri	<0%		<1%		<0%		<0%		<0%	
Cirsium spp.	<0%		<0%		<1%		<0%		<0%	

Cryptantha spp.	<0%	<0%	<0%	<1%	<0%
Cryptobiotic soil	5-10%	1-5%	5-10%	1-5%	5-10%
Encelia farinosa	<0%	<0%	<0%	<0%	<1%
Ephedra spp.	1-5%	<0%	<0%	<0%	<0%
Festuca spp.	<0%	<0%	1-5%	<0%	<0%
Galium stellatum	<1%	<0%	<0%	<1%	<0%
Hedeoma nana	<1%	<1%	<1%	1-5%	1-5%
Hesperodoria salicina	1-5%	<0%	<0%	<0%	<0%
Isocoma acradenia	<1%	1-5%	1-5%	<0%	<1%
Lactuca serriola	<0%	<0%	<0%	<1%	<0%
Lichen spp.	<0%	<0%	<0%	<0%	<0%
Machaeranthera pinnatifida	<0%	<0%	<0%	<0%	<1%
Maurandella antirrhiniflora	1-5%	<0%	<0%	1-5%	1-5%
Moss spp.	<0%	<0%	1-5%	<0%	1-5%
Muhlenbergia asperifolia	<0%	<0%	<1%	<0%	<0%
Nicotiana obtusifolia var. obtusifolia	<0%	<0%	<0%	<0%	<1%
Oenothera caespitosa	<0%	<0%	<1%	<0%	<0%
Packera werneriifolia	<0%	<0%	<0%	<0%	<1%
Parietaria hespera	<0%	<1%	<0%	<0%	<0%
Polypogon viridis	<0%	<0%	<1%	<1%	<0%
Porophyllum gracile	<0%	<0%	<0%	<1%	<0%
Sonchus oleraceus	<0%	<0%	<0%	<0%	<0%
Sporobolus cryptandrus	<0%	<0%	<0%	<0%	<1%
Stephanomeria pauciflora	5-10%	<1%	<1%	1-5%	<0%
Stylocline micropoides	<0%	<0%	<0%	<1%	<0%
Tamarix ramosissima	<0%	<0%	<0%	<1%	S <0%
Thymophylla pentachaeta var. belenidium	<1%	<1%	<0%	<0%	<1%
Trixis californica	<0%	<0%	<0%	<1%	<0%

Vegetation Structure Data - Old

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Brickellia longifolia	5	2	
15	Brickellia longifolia	2		
25	Brickellia longifolia	1		
45	Brickellia longifolia	1		

Soil Data

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 3 Transect Type: Tamarisk Control

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	8.56	232	8.53	233	8.52	222	8.54	229
15	8.88	63	8.91	65	8.89	60	8.89	63
25	8.5	2446	8.5	2430	8.48	2433	8.49	2436
35	8.53	865	8.5	866	8.53	867	8.52	866
45	8.79	118	8.76	116	8.74	119	8.76	118

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 3 Transect Type: Tamarisk Control

Date: 4/20/2008 Revisit? ☑ Post-tamarisk removal

Recorder: Reader: Akasha Faist

Wind Speed: 2.0 Air Temp (F): 72.0 Cloud Cover: 0

Weather:

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	25
Cobble	9
Gravel	13
Litter (duff)	10
Sand	20
Stone	23

Species	% Cover
Baccharis salicifolia	1
Brickellia longifolia	19
Bromus rubens	1
Gutierrezia sarothrae	1
Isocoma acradenia	5
Muhlenbergia asperifolia	2
Poa bigelovii	1
Sarcostemma cynanchoides var. hartwegii	6
Stephanomeria pauciflora	1

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Lichen	0	0	1	0	0
Moss (ground)	2	0	2	0	2
Crypto	7	3	5	1	1
Bare Soil	1	1	1	1	1
Woody debris structure	0	1	0	0	0
Coarse woody debris	2	1	0	2	0
Litter (duff)	13	6	4	3	7
Bedrock	0	0	0	0	0
Boulder	45	54	12	14	44
Stone	11	11	17	20	12
Cobble	8	8	14	19	5
Gravel	5	7	30	12	2
Sand	6	8	14	28	26

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	5-10%	S+P+M	<1%	S+M	1-5%	S+P+M	<1%	S	1-5%	S+M
Aristida spp.	<1%		<0%		<1%		<0%		<0%	
Baccharis salicifolia	<0%		1-5%		<1%		1-5%		<0%	
Baccharis sarothroides	<1%		<0%		<0%		<0%		<0%	
Brickellia longifolia	10-25%		5-10%		10-25%		5-10%		10-25%	
Bromus rubens	<1%		<1%		<1%		<1%		<1%	
Camissonia walkeri	<0%		<0%		<1%		<0%		<0%	
Cirsium spp.	<0%		<1%		<0%		<0%		<0%	

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 3 Transect Type: Tamarisk Control

Cryptantha spp.	<1%	<1%	<1%	<0%	<1%
Descurainia pinnata	<0%	<0%	<0%	<0%	<1%
Draba cuneifolia	<0%	<0%	<0%	<0%	<1%
Ephedra spp.	1-5%	<0%	<0%	<0%	<0%
Erodium cicutarium	<0%	<0%	<0%	<1%	<0%
Eucrypta micrantha	<1%	<1%	<0%	<0%	<0%
Galium stellatum	<1%	<0%	<0%	<0%	<0%
Gilia spp.	<0%	<1%	<0%	<0%	<1%
Gutierrezia sarothrae	<0%	<1%	<1%	<0%	<0%
Hedeoma nana	<1%	<1%	<1%	<1%	<1%
Hesperodoria salicina	1-5%	<0%	<0%	<0%	<0%
Hesperostipa neomexicana	<1%	<0%	1-5%	<1%	<0%
Isocoma acradenia	1-5%	1-5%	1-5%	<1%	<0%
Lactuca serriola	<0%	<0%	<0%	<0%	<1%
Lappula occidentalis var. occidentalis	<0%	<0%	<0%	<0%	<1%
Lepidium lasiocarpum	<1%	<1%	<1%	<1%	<1%
Linanthus bigelovii	<0%	<0%	<0%	<0%	<1%
Maurandella antirrhiniflora	<0%	<0%	<0%	<0%	<1%
Muhlenbergia asperifolia	<0%	<0%	<1%	<0%	<0%
Muhlenbergia microsperma	<0%	<1%	<0%	<0%	<0%
Oenothera caespitosa	<0%	<1%	<0%	<0%	<0%
Parietaria hespera	<1%	<0%	<1%	<0%	<0%
Plantago ovata	<0%	<0%	<1%	<0%	<0%
Pleurocoronis pluriseta	<1%	<0%	<0%	<0%	<0%
Poa bigelovii	<1%	<1%	<1%	<1%	<1%
Porophyllum gracile	<1%	<0%	<1%	<1%	<1%
Sarcostemma cynanchoides var. hartwegii	1-5%	<1%	<1%	<1%	<1%
Senecio spp	<1%	<0%	<0%	<0%	<0%
Sporobolus spp.	<0%	<0%	<0%	<0%	<1%
Stephanomeria pauciflora	1-5%	<1%	<1%	<1%	<0%
Stylocline micropoides	<1%	<1%	<1%	<0%	<0%
Thymophylla pentachaeta	<1%	<1%	<0%	<0%	<0%
Trixis californica	<0%	<0%	<0%	<1%	<0%
Vulpia octoflora	<0%	<0%	<0%	<1%	<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Brickellia longifolia	5		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Brickellia longifolia	7		

5	Sarcostemma cynanchoides var. hartwegii	1
5	Vacant Space	2
35	Forb spp	1

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	8.14	774	8.14	774	8.14	774	8.14	774
15	7.51	1013	7.51	1013	7.51	1013	7.51	1013
25	8.25	729	8.25	729	8.25	729	8.25	729
35	8.09	839	8.08	839	8.09	839	8.09	839
45	8.39	789	8.39	789	8.39	789	8.39	789

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 3 Transect Type: Tamarisk Control

Date: 5/12/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Lisa Hahn Reader: Lori Makarick

Wind Speed: Air Temp (F): Cloud Cover:

Weather: Very hot-95F- and very calm. No clouds.

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	2
Boulder	24
Coarse woody debris	2
Cobble	4
Gravel	13
Litter (duff)	17
Sand	23
Stone	10

Species	% Cover
Acacia greggii	2
Baccharis emoryi	6
Brickellia longifolia	24
Bromus rubens	2
Cryptobiotic soil	5
Ephedra spp.	2
Funastrum cynanchoides	16
Hedeoma nana	1
Maurandella antirrhiniflora	3
Polypogon monspeliensis	2
Stephanomeria pauciflora	4

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Sand	4	4	11	30	21
Stone	21	4	27	12	21
Gravel	9	25	27	12	1
Litter (duff)	21	4	12	5	9
Boulder	21	52	11	29	46
Coarse woody debris	20	10	11	12	1

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	5-10%	S+M	<0%		5-10%	S+M	1-5%	P	1-5%	S+M
Aristida spp.	<0%		<1%		<0%		<1%		<0%	
Baccharis emoryi	<0%		1-5%		<1%		1-5%		<0%	
Baccharis sarothroides	<0%		<0%		<1%		<0%		<0%	
Brickellia longifolia	10-25%		10-25%		5-10%		10-25%		10-25%	
Bromus rubens	1-5%		1-5%		<1%		<1%		<1%	
Camissonia walkeri	<0%		<1%		<0%		<0%		<0%	
Cirsium spp.	<0%		<0%		<1%		<0%		<0%	

Cryptantha spp.	<0%	<0%	<0%	<1%	<0%
Cryptobiotic soil	5-10%	1-5%	5-10%	1-5%	5-10%
Encelia farinosa	<0%	<0%	<0%	<0%	<1%
Ephedra spp.	1-5%	<0%	<0%	<0%	<0%
Festuca spp.	<0%	<0%	1-5%	<0%	<0%
Galium stellatum	<1%	<0%	<0%	<1%	<0%
Hedeoma nana	<1%	<1%	<1%	1-5%	1-5%
Hesperodoria salicina	1-5%	<0%	<0%	<0%	<0%
Isocoma acradenia	<1%	1-5%	1-5%	<0%	<1%
Lactuca serriola	<0%	<0%	<0%	<1%	<0%
Lichen spp.	<0%	<0%	<0%	<0%	<0%
Machaeranthera pinnatifida	<0%	<0%	<0%	<0%	<1%
Maurandella antirrhiniflora	1-5%	<0%	<0%	1-5%	1-5%
Moss spp.	<0%	<0%	1-5%	<0%	1-5%
Muhlenbergia asperifolia	<0%	<0%	<1%	<0%	<0%
Nicotiana obtusifolia var. obtusifolia	<0%	<0%	<0%	<0%	<1%
Oenothera caespitosa	<0%	<0%	<1%	<0%	<0%
Packera werneriifolia	<0%	<0%	<0%	<0%	<1%
Parietaria hespera	<0%	<1%	<0%	<0%	<0%
Polypogon viridis	<0%	<0%	<1%	<1%	<0%
Porophyllum gracile	<0%	<0%	<0%	<1%	<0%
Sonchus oleraceus	<0%	<0%	<0%	<0%	<0%
Sporobolus cryptandrus	<0%	<0%	<0%	<0%	<1%
Stephanomeria pauciflora	5-10%	<1%	<1%	1-5%	<0%
Stylocline micropoides	<0%	<0%	<0%	<1%	<0%
Tamarix ramosissima	<0%	<0%	<0%	<1%	S <0%
Thymophylla pentachaeta var. belenidium	<1%	<1%	<0%	<0%	<1%
Trixis californica	<0%	<0%	<0%	<1%	<0%

Vegetation Structure Data - Old

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Brickellia longifolia	5	2	
15	Brickellia longifolia	2		
25	Brickellia longifolia	1		
45	Brickellia longifolia	1		

Soil Data

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 3 Transect Type: Tamarisk Control

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	8.56	232	8.53	233	8.52	222	8.54	229
15	8.88	63	8.91	65	8.89	60	8.89	63
25	8.5	2446	8.5	2430	8.48	2433	8.49	2436
35	8.53	865	8.5	866	8.53	867	8.52	866
45	8.79	118	8.76	116	8.74	119	8.76	118

Park Area/Canyon: National Canyon River mile: 166.3 L Project (Phase): Phase IIb

Transect Name: National Canyon 3 Transect Type: Tamarisk Control

Date: 4/20/2008 Revisit? ☑ Post-tamarisk removal

Recorder: Reader: Akasha Faist

Wind Speed: 2.0 Air Temp (F): 72.0 Cloud Cover: 0

Weather:

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	25
Cobble	9
Gravel	13
Litter (duff)	10
Sand	20
Stone	23

Species	% Cover
Baccharis salicifolia	1
Brickellia longifolia	19
Bromus rubens	1
Gutierrezia sarothrae	1
Isocoma acradenia	5
Muhlenbergia asperifolia	2
Poa bigelovii	1
Sarcostemma cynanchoides var. hartwegii	6
Stephanomeria pauciflora	1

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Lichen	0	0	1	0	0
Moss (ground)	2	0	2	0	2
Crypto	7	3	5	1	1
Bare Soil	1	1	1	1	1
Woody debris structure	0	1	0	0	0
Coarse woody debris	2	1	0	2	0
Litter (duff)	13	6	4	3	7
Bedrock	0	0	0	0	0
Boulder	45	54	12	14	44
Stone	11	11	17	20	12
Cobble	8	8	14	19	5
Gravel	5	7	30	12	2
Sand	6	8	14	28	26

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	5-10%	S+P+M	<1%	S+M	1-5%	S+P+M	<1%	S	1-5%	S+M
Aristida spp.	<1%		<0%		<1%		<0%		<0%	
Baccharis salicifolia	<0%		1-5%		<1%		1-5%		<0%	
Baccharis sarothroides	<1%		<0%		<0%		<0%		<0%	
Brickellia longifolia	10-25%		5-10%		10-25%		5-10%		10-25%	
Bromus rubens	<1%		<1%		<1%		<1%		<1%	
Camissonia walkeri	<0%		<0%		<1%		<0%		<0%	
Cirsium spp.	<0%		<1%		<0%		<0%		<0%	

Cryptantha spp.	<1%	<1%	<1%	<0%	<1%
Descurainia pinnata	<0%	<0%	<0%	<0%	<1%
Draba cuneifolia	<0%	<0%	<0%	<0%	<1%
Ephedra spp.	1-5%	<0%	<0%	<0%	<0%
Erodium cicutarium	<0%	<0%	<0%	<1%	<0%
Eucrypta micrantha	<1%	<1%	<0%	<0%	<0%
Galium stellatum	<1%	<0%	<0%	<0%	<0%
Gilia spp.	<0%	<1%	<0%	<0%	<1%
Gutierrezia sarothrae	<0%	<1%	<1%	<0%	<0%
Hedeoma nana	<1%	<1%	<1%	<1%	<1%
Hesperodoria salicina	1-5%	<0%	<0%	<0%	<0%
Hesperostipa neomexicana	<1%	<0%	1-5%	<1%	<0%
Isocoma acradenia	1-5%	1-5%	1-5%	<1%	<0%
Lactuca serriola	<0%	<0%	<0%	<0%	<1%
Lappula occidentalis var. occidentalis	<0%	<0%	<0%	<0%	<1%
Lepidium lasiocarpum	<1%	<1%	<1%	<1%	<1%
Linanthus bigelovii	<0%	<0%	<0%	<0%	<1%
Maurandella antirrhiniflora	<0%	<0%	<0%	<0%	<1%
Muhlenbergia asperifolia	<0%	<0%	<1%	<0%	<0%
Muhlenbergia microsperma	<0%	<1%	<0%	<0%	<0%
Oenothera caespitosa	<0%	<1%	<0%	<0%	<0%
Parietaria hespera	<1%	<0%	<1%	<0%	<0%
Plantago ovata	<0%	<0%	<1%	<0%	<0%
Pleurocoronis pluriseta	<1%	<0%	<0%	<0%	<0%
Poa bigelovii	<1%	<1%	<1%	<1%	<1%
Porophyllum gracile	<1%	<0%	<1%	<1%	<1%
Sarcostemma cynanchoides var. hartwegii	1-5%	<1%	<1%	<1%	<1%
Senecio spp	<1%	<0%	<0%	<0%	<0%
Sporobolus spp.	<0%	<0%	<0%	<0%	<1%
Stephanomeria pauciflora	1-5%	<1%	<1%	<1%	<0%
Stylocline micropoides	<1%	<1%	<1%	<0%	<0%
Thymophylla pentachaeta	<1%	<1%	<0%	<0%	<0%
Trixis californica	<0%	<0%	<0%	<1%	<0%
Vulpia octoflora	<0%	<0%	<0%	<1%	<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Brickellia longifolia	5		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Brickellia longifolia	7		

5	Sarcostemma cynanchoides var. hartwegii	1
5	Vacant Space	2
35	Forb spp	1

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	8.14	774	8.14	774	8.14	774	8.14	774
15	7.51	1013	7.51	1013	7.51	1013	7.51	1013
25	8.25	729	8.25	729	8.25	729	8.25	729
35	8.09	839	8.08	839	8.09	839	8.09	839
45	8.39	789	8.39	789	8.39	789	8.39	789

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 1 Transect Type: Tamarisk Area

	Start point		End point
Easting:	291730	Easting:	291705
Northing:	3973711	Northing:	3973752
GPS accuracy (m):	8	GPS accuracy (m):	8
Elevation (m):	466	Elevation (m):	441
Bearing:	327		
Aspect (0-360):	260	Slope (degrees):	1

Transect description: From where the trail from the river drops into the drainage, walk up the creek to a 2m waterfall with a 1x1x1m square-ish boulder stuck in front of it. From the top of the waterfall, start point is 19.2m up creek on creek right. Transect is nearly perpendicular to the creek. End point is near a large mesquite towards the base of Ocotillo covered Tapeats slope.

Additional Info:: Transect is VERY, VERY, VERY, dense and prickly (cirsium) riparian thicket. Would be great to have thick pants and long sleeves - make a note of this and bring additional PPE.

Geological layer: Tapeats

Habitat type: Riparian

Dominant species: Cirsium mohavense, Prosopis glandulosa Torr., Tamarix ramosissima Ledeb.

Associated species: Acacia greggii Gray, Andropogon glomeratus (Walt.) B.S.P., Baccharis salicifolia (Ruiz & Pavón) Pers., Baccharis sarothroides Gray, Centaurium arizonicum, , Eleocharis spp, Encelia farinosa Gray ex Torr., Ferocactus cylindraceus (Engelm.) Orcutt var. cylindraceus, Gutierrezia spp., Isocoma acradenia (Greene) Greene, Mammillaria spp., Pseudognaphalium spp, Salix exigua Nutt., Thymophylla pentachaeta (DC.) Small

Surface water within 25m? ☑ Surface water type: stream

Landform: Drainage channel Surface rocks: sandstone

Soil type: sandy loam Topo position: Unknown

Light exposure: open Soil moisture: moist

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 1 Transect Type: Tamarisk Area

Date: 5/17/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Amy Prince Reader: Lori Makarick

Wind Speed: 2.0 Air Temp (F): 105.0 Cloud Cover: 5

Weather: Ridiculously hot. Occ. Clouds.

Point Intercept Transect (50m)

Ground Cover	% Cover
Coarse woody debris	5
Cobble	1
Gravel	3
Litter (duff)	74
Sand	9
Stone	1
Woody debris structure	7

Species	% Cover
Baccharis emoryi	3
Centaurium arizonicum	1
Cirsium mohavense	19
Datura wrightii	1
Encelia farinosa	1
Isocoma acradenia	12
Mimulus cardinalis	5
Phragmites australis	35
Physaria chambersii	1
Pluchea sericea	10
Polypogon viridis	1
Prosopis glandulosa	4
Salix exigua	4
Sphaeralcea spp.	1
Tamarix aphylla	2
Tamarix ramosissima	15
Typha domingensis	3

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Crypto	0	0	0	3	3
Coarse woody debris	6	33	14	16	7
Sand	34	0	2	16	40
Cobble	6	0	2	7	18
Gravel	33	0	2	35	18
Woody debris structure	1	33	0	0	0
Stone	6	0	0	7	7
Litter (duff)	14	34	80	16	7

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Baccharis salicifolia	1-5%		5-10%		<0%		<0%		<0%	
Baccharis sergiloides	<1%		<0%		<0%		<0%		<0%	
Bromus rubens	<0%		<0%		<0%		<1%		<0%	

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 1 Transect Type: Tamarisk Area

Carex spp.	<1%		<0%		<0%		<0%	1-5%		
Cirsium mohavense	5-10%		5-10%		50-75%		10-25%	1-5%		
Datura wrightii	<0%		1-5%		<0%		<0%	<0%		
Encelia farinosa	<1%		<0%		<0%		<0%	1-5%		
Isocoma acradenia	<1%		<0%		<0%		10-25%	10-25%		
Juncus spp.	<1%		<0%		<0%		<0%	<0%		
Larrea tridentata	<0%		<0%		<0%		1-5%	<0%		
Mimulus cardinalis	1-5%		<0%		<0%		<0%	<0%		
Phragmites australis	25-50%		75-100%		10-25%		<0%	<0%		
Pluchea sericea	<0%		<1%		10-25%		1-5%	<0%		
Polypogon monspeliensis	1-5%		<0%		<0%		<0%	<0%		
Polypogon viridis	<1%		<0%		<0%		<0%	<0%		
Prosopis glandulosa	<0%		<0%		1-5%	M	<0%	<1%		
Salix exigua	1-5%		<0%		<0%		<0%	<0%		
Sphaeralcea spp.	<0%		<0%		<0%		<0%	1-5%		
Tamarix ramosissima	1-5%	M	10-25%	M	<0%		<0%	1-5%		M
Typha domingensis	1-5%		<0%		<0%		<0%	<0%		

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
15	Tamarix ramosissima		12	60
25	Cirsium mohavense	4		
45	Sporobolus cryptandrus	3		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Phragmites australis	3	2	
15	Tamarix ramosissima	3	10	8
25	Cirsium mohavense	4		
25	Pluchea sericea		3	
35	Bromus rubens	2		
35	Isocoma acradenia	2		
35	Vacant Space	8		
45	Sporobolus cryptandrus	5		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.31	466	8.42	447	8.43	455	8.39	456
15	8.12	773	8.1	804	8.09	815	8.10	797

25	8.57	3999	8.59	3999	8.57	3999	8.58	3999
35	8.55	3999	8.54	3999	5.55	3999	7.55	3999
45	8.64	3999	8.64	3999	8.64	3999	8.64	3999

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 1 Transect Type: Tamarisk Area

Date: 4/25/2008 Revisit? ☑ Pre-tamarisk removal

Recorder: Reader: Amy Prince

Wind Speed: 2.0 Air Temp (F): 83.0 Cloud Cover: 2

Weather:

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	1
Gravel	2
Litter (duff)	81
Plant	2
Sand	4

Species	% Cover
Andropogon glomeratus	1
Baccharis emoryi	2
Baccharis sarothroides	2
Bromus rubens	1
Cirsium mohavense	20
Isocoma acradenia	22
Mimulus cardinalis	1
Parietaria hespera	1
Phoradendron californicum	1
Phragmites australis	39
Pluchea sericea	20
Prosopis glandulosa	12
Salix exigua	2
Sonchus asper	3
Sonchus oleraceus	1

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Crypto	0	0	0	2	0
Basal Veg	3	1	2	1	1
Woody debris structure	0	4	0	0	0
Coarse woody debris	1	5	3	2	5
Litter (duff)	90	90	88	59	18
Stone	1	0	0	0	5
Cobble	0	0	0	2	4
Gravel	1	0	0	6	9
Sand	4	0	7	28	58

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Adiantum capillus-veneris	<1%		<0%		<0%		<0%		<0%	
Amsonia tomentosa	<0%		<0%		<0%		<1%		<0%	
Andropogon glomeratus	1-5%		<0%		<0%		<0%		<0%	
Baccharis emoryi	1-5%		<0%		<0%		<0%		<0%	
Baccharis salicifolia	1-5%		5-10%		<0%		<0%		<0%	

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 1 Transect Type: Tamarisk Area

Baccharis sarothroides	5-10%	<0%		<0%		<0%		<0%	
Bromus rubens	<0%	<0%		<1%		1-5%		<1%	
Cirsium mohavense	5-10%	<0%		5-10%		<1%		<1%	
Descurainia pinnata	<0%	<0%		<0%		<1%		<0%	
Encelia farinosa	<0%	<0%		<0%		<0%		1-5%	
Gilia spp.	<0%	<0%		<0%		<1%		<0%	
Hedeoma nana	<1%	<0%		<0%		<0%		<0%	
Isocoma acradenia	<0%	<0%		<0%		10-25%		5-10%	
Larrea tridentata	<0%	<0%		<0%		1-5%		<0%	
Mimulus cardinalis	<1%	<0%		<0%		<0%		<0%	
Parietaria hespera	<0%	<0%		<1%		<0%		<0%	
Phacelia crenulata	<0%	<0%		<0%		<1%		<1%	
Phragmites australis	50-75%	<0%		1-5%		<0%		<0%	
Pluchea sericea	<0%	1-5%		5-10%		<1%		<0%	
Poa bigelovii	<0%	<0%		<0%		<1%		<0%	
Prosopis glandulosa	<0%	<0%		5-10%	M	<1%	M	1-5%	M
Salix exigua	1-5%	<0%		<0%		<0%		<0%	
Sonchus asper	<0%	<0%		<1%		<1%		<1%	
Sonchus oleraceus	<0%	<0%		<0%		<0%		<1%	
Sporobolus cryptandrus	<0%	<0%		<0%		<0%		<1%	
Stylocline micropoides	<0%	<0%		<0%		<1%		<0%	
Tamarix ramosissima	<0%	1-5%	M	<0%		<0%		<0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Phragmites australis	7	2	
15	Phragmites australis	1		
25	Cirsium mohavense	7		
25	Pluchea sericea	2	2	
35	Isocoma acradenia	9		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Phragmites australis	10	8	
15	Phragmites australis	2		
25	Cirsium mohavense	4		
25	Pluchea sericea	4	5	
25	Vacant Space	2		
35	Descurainia pinnata	2		

35	Isocoma acradenia	6
35	Sonchus asper	2
35	Vacant Space	1
45	Isocoma acradenia	1

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	8.1	411	8.06	427	8.02	429	8.06	422
15	8.23	721	8.23	660	8.23	649	8.23	677
25	7.83	725	7.81	724	7.76	726	7.80	725
35	7.76	1984	7.73	1702	7.79	1724	7.76	1803
45	8.61	3490	8.59	2813	8.6	3617	8.60	3307

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 1 Transect Type: Tamarisk Area

Date: 5/17/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Amy Prince Reader: Lori Makarick

Wind Speed: 2.0 Air Temp (F): 105.0 Cloud Cover: 5

Weather: Ridiculously hot. Occ. Clouds.

Point Intercept Transect (50m)

Ground Cover	% Cover
Coarse woody debris	5
Cobble	1
Gravel	3
Litter (duff)	74
Sand	9
Stone	1
Woody debris structure	7

Species	% Cover
Baccharis emoryi	3
Centaurium arizonicum	1
Cirsium mohavense	19
Datura wrightii	1
Encelia farinosa	1
Isocoma acradenia	12
Mimulus cardinalis	5
Phragmites australis	35
Physaria chambersii	1
Pluchea sericea	10
Polypogon viridis	1
Prosopis glandulosa	4
Salix exigua	4
Sphaeralcea spp.	1
Tamarix aphylla	2
Tamarix ramosissima	15
Typha domingensis	3

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Crypto	0	0	0	3	3
Coarse woody debris	6	33	14	16	7
Sand	34	0	2	16	40
Cobble	6	0	2	7	18
Gravel	33	0	2	35	18
Woody debris structure	1	33	0	0	0
Stone	6	0	0	7	7
Litter (duff)	14	34	80	16	7

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Baccharis salicifolia	1-5%		5-10%		<0%		<0%		<0%	
Baccharis sergiloides	<1%		<0%		<0%		<0%		<0%	
Bromus rubens	<0%		<0%		<0%		<1%		<0%	

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 1 Transect Type: Tamarisk Area

Carex spp.	<1%		<0%		<0%		<0%	1-5%		
Cirsium mohavense	5-10%		5-10%		50-75%		10-25%	1-5%		
Datura wrightii	<0%		1-5%		<0%		<0%	<0%		
Encelia farinosa	<1%		<0%		<0%		<0%	1-5%		
Isocoma acradenia	<1%		<0%		<0%		10-25%	10-25%		
Juncus spp.	<1%		<0%		<0%		<0%	<0%		
Larrea tridentata	<0%		<0%		<0%		1-5%	<0%		
Mimulus cardinalis	1-5%		<0%		<0%		<0%	<0%		
Phragmites australis	25-50%		75-100%		10-25%		<0%	<0%		
Pluchea sericea	<0%		<1%		10-25%		1-5%	<0%		
Polypogon monspeliensis	1-5%		<0%		<0%		<0%	<0%		
Polypogon viridis	<1%		<0%		<0%		<0%	<0%		
Prosopis glandulosa	<0%		<0%		1-5%	M	<0%	<1%		
Salix exigua	1-5%		<0%		<0%		<0%	<0%		
Sphaeralcea spp.	<0%		<0%		<0%		<0%	1-5%		
Tamarix ramosissima	1-5%	M	10-25%	M	<0%		<0%	1-5%		M
Typha domingensis	1-5%		<0%		<0%		<0%	<0%		

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
15	Tamarix ramosissima		12	60
25	Cirsium mohavense	4		
45	Sporobolus cryptandrus	3		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Phragmites australis	3	2	
15	Tamarix ramosissima	3	10	8
25	Cirsium mohavense	4		
25	Pluchea sericea		3	
35	Bromus rubens	2		
35	Isocoma acradenia	2		
35	Vacant Space	8		
45	Sporobolus cryptandrus	5		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.31	466	8.42	447	8.43	455	8.39	456
15	8.12	773	8.1	804	8.09	815	8.10	797

25	8.57	3999	8.59	3999	8.57	3999	8.58	3999
35	8.55	3999	8.54	3999	5.55	3999	7.55	3999
45	8.64	3999	8.64	3999	8.64	3999	8.64	3999

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 1 Transect Type: Tamarisk Area

Date: 4/25/2008 Revisit? ☑ Pre-tamarisk removal

Recorder: Reader: Amy Prince

Wind Speed: 2.0 Air Temp (F): 83.0 Cloud Cover: 2

Weather:

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	1
Gravel	2
Litter (duff)	81
Plant	2
Sand	4

Species	% Cover
Andropogon glomeratus	1
Baccharis emoryi	2
Baccharis sarothroides	2
Bromus rubens	1
Cirsium mohavense	20
Isocoma acradenia	22
Mimulus cardinalis	1
Parietaria hespera	1
Phoradendron californicum	1
Phragmites australis	39
Pluchea sericea	20
Prosopis glandulosa	12
Salix exigua	2
Sonchus asper	3
Sonchus oleraceus	1

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Crypto	0	0	0	2	0
Basal Veg	3	1	2	1	1
Woody debris structure	0	4	0	0	0
Coarse woody debris	1	5	3	2	5
Litter (duff)	90	90	88	59	18
Stone	1	0	0	0	5
Cobble	0	0	0	2	4
Gravel	1	0	0	6	9
Sand	4	0	7	28	58

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Adiantum capillus-veneris	<1%		<0%		<0%		<0%		<0%	
Amsonia tomentosa	<0%		<0%		<0%		<1%		<0%	
Andropogon glomeratus	1-5%		<0%		<0%		<0%		<0%	
Baccharis emoryi	1-5%		<0%		<0%		<0%		<0%	
Baccharis salicifolia	1-5%		5-10%		<0%		<0%		<0%	

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 1 Transect Type: Tamarisk Area

Baccharis sarothroides	5-10%		<0%		<0%		<0%		<0%	
Bromus rubens	<0%		<0%		<1%		1-5%		<1%	
Cirsium mohavense	5-10%		<0%		5-10%		<1%		<1%	
Descurainia pinnata	<0%		<0%		<0%		<1%		<0%	
Encelia farinosa	<0%		<0%		<0%		<0%		1-5%	
Gilia spp.	<0%		<0%		<0%		<1%		<0%	
Hedeoma nana	<1%		<0%		<0%		<0%		<0%	
Isocoma acradenia	<0%		<0%		<0%		10-25%		5-10%	
Larrea tridentata	<0%		<0%		<0%		1-5%		<0%	
Mimulus cardinalis	<1%		<0%		<0%		<0%		<0%	
Parietaria hespera	<0%		<0%		<1%		<0%		<0%	
Phacelia crenulata	<0%		<0%		<0%		<1%		<1%	
Phragmites australis	50-75%		<0%		1-5%		<0%		<0%	
Pluchea sericea	<0%		1-5%		5-10%		<1%		<0%	
Poa bigelovii	<0%		<0%		<0%		<1%		<0%	
Prosopis glandulosa	<0%		<0%		5-10%	M	<1%	M	1-5%	M
Salix exigua	1-5%		<0%		<0%		<0%		<0%	
Sonchus asper	<0%		<0%		<1%		<1%		<1%	
Sonchus oleraceus	<0%		<0%		<0%		<0%		<1%	
Sporobolus cryptandrus	<0%		<0%		<0%		<0%		<1%	
Stylocline micropoides	<0%		<0%		<0%		<1%		<0%	
Tamarix ramosissima	<0%		1-5%	M	<0%		<0%		<0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Phragmites australis	7	2	
15	Phragmites australis	1		
25	Cirsium mohavense	7		
25	Pluchea sericea	2	2	
35	Isocoma acradenia	9		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Phragmites australis	10	8	
15	Phragmites australis	2		
25	Cirsium mohavense	4		
25	Pluchea sericea	4	5	
25	Vacant Space	2		
35	Descurainia pinnata	2		

35	Isocoma acradenia	6
35	Sonchus asper	2
35	Vacant Space	1
45	Isocoma acradenia	1

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	8.1	411	8.06	427	8.02	429	8.06	422
15	8.23	721	8.23	660	8.23	649	8.23	677
25	7.83	725	7.81	724	7.76	726	7.80	725
35	7.76	1984	7.73	1702	7.79	1724	7.76	1803
45	8.61	3490	8.59	2813	8.6	3617	8.60	3307

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 1 Transect Type: Tamarisk Control

	Start point		End point
Easting:	291757	Easting:	291708
Northing:	3973688	Northing:	3973705
GPS accuracy (m):	1.7	GPS accuracy (m):	2.3
Elevation (m):	446	Elevation (m):	451
Bearing:	292		
Aspect (0-360):	270	Slope (degrees):	2

Transect description: T1B at Three Springs ENDS (downstream) on a tapeats bedrock, about 15m and perpendicular to the pretty little waterfall that is near where the trail descend down to the creek. It's about 150-200m from the mouth/river. The transect runs along, parallel to creek left, starting up in a dead wood filled, 'open', area near some acacia. Still about 10-15m away (south) of the creek.

Additional Info:: Start at the end and run the 0 end of the tape up through the hateful thicket of phragmites. T1A is across the creek and runs nearly perpendicular to the reference. The start is a log of old dead acacia at a small clearing in the thicket. The End is a Tapeats boulder 14m away and creek left of the little waterfall.

Geological layer: Top of Tapeats and bottom of Bright Angel Shale.

Habitat type: Riparian

Dominant species: Acacia greggii Gray, Baccharis salicifolia (Ruiz & Pavón) Pers., Phragmites australis (Cav.) Trin. ex Steud., Pluchea sericea (Nutt.) Coville, Salix exigua Nutt.

Associated species: Aristida purpurea Nutt., Bothriochloa barbinodis (Lag.) Herter, Centaurium arizonicum, Cirsium mohavense, Conyza canadensis (L.) Cronq., Eriogonum fasciculatum Benth. var. polifolium (Benth.) Torr. & Gray, Gutierrezia sarothrae (Pursh) Britt. & Rusby, Hedeoma nana (Torr.) Briq., Isocoma acradenia (Greene) Greene

Surface water within 25m? ☑ Surface water type: stream

Landform: Lower slope Surface rocks: sandstone shale

Soil type: sand Topo position: Unknown

Light exposure: open Soil moisture: dry

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 1 Transect Type: Tamarisk Control

Date: 5/17/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Steve Till Reader: Pamela Walls

Wind Speed: Air Temp (F): Cloud Cover:

Weather: Sunny, blue skies. Low 90's-upper 80's.

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	5
Coarse woody debris	2
Litter (duff)	94

Species	% Cover
Acacia greggii	6
Gutierrezia sarothrae	1
Phragmites australis	27
Pluchea odorata var. odorata	2
Pluchea sericea	27
Salix exigua	5

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Woody debris structure	23	13	0	0	0
Coarse woody debris	52	13	0	0	14
Bedrock	0	0	0	0	35
Sand	2	0	0	30	14
Boulder	0	0	0	0	2
Litter (duff)	23	75	100	70	35

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	10-25%	M	5-10%	M	<0%		<0%		<0%	
Baccharis salicifolia	<0%		<0%		<0%		<0%		25-50%	
Baccharis sarothroides	1-5%		<0%		<0%		<0%		<0%	
Datura wrightii	<1%		1-5%		<0%		<0%		<0%	
Phragmites australis	<0%		50-75%		25-50%		25-50%		1-5%	
Pluchea sericea	5-10%		10-25%		50-75%		25-50%		10-25%	
Salix exigua	<0%		5-10%		10-25%		10-25%		10-25%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Acacia greggii	1		
15	Phragmites australis	1		
15	Pluchea sericea	3		
15	Vacant Space	6		
35	Phragmites australis	1		
35	Pluchea odorata var. odorata	1		
35	Pluchea sericea		4	

35	Vacant Space	8

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Acacia greggii	2		
15	Phragmites australis	1	1	1
15	Pluchea sericea	5		
15	Vacant Space	4		
25	Pluchea sericea	4	3	
35	Phragmites australis	4		
35	Pluchea sericea	4	6	
35	Vacant Space	3		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	9.02	48	9.02	49	9	48	9.01	48
15	8.96	133	8.96	138	8.93	135	8.95	135
25	9.21	66	9.13	67	9.12	67	9.15	67
35	8.4	124	8.36	123	8.32	125	8.36	124
45	8.82	76	8.81	79	8.81	80	8.81	78

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 1 Transect Type: Tamarisk Control

Date: 4/25/2008 Revisit? ☑ Post-tamarisk removal

Recorder: Hattie Oswald Reader: Cheryl Decker

Wind Speed: 4.0 Air Temp (F): 81.0 Cloud Cover: 0

Weather:

Point Intercept Transect (50m)

Ground Cover	% Cover
Coarse woody debris	6
Litter (duff)	84
Plant	1
Sand	6
Woody debris structure	3

Species	% Cover
Acacia greggii	10
Amsonia tomentosa	4
Bromus rubens	11
Descurainia pinnata	1
Lathyrus graminifolius	1
Parietaria hespera	5
Phacelia filiformis	1
Phragmites australis	12
Pluchea sericea	41
Salix exigua	3
Sarcostemma cynanchoides var. hartwegii	3

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Crypto	0	0	2	0	0
Basal Veg	2	3	0	3	2
Woody debris structure	11	3	0	5	8
Coarse woody debris	40	1	0	2	4
Litter (duff)	45	88	98	88	54
Bedrock	0	0	0	0	26
Stone	1	0	0	0	0
Gravel	0	0	0	0	0
Sand	1	5	0	2	5

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	10-25%	M	1-5%	M	<0%		<0%		1-5%	P+M
Amsonia tomentosa	1-5%		<1%		<0%		<0%		<1%	
Baccharis salicifolia	<0%		<0%		<0%		<0%		5-10%	
Baccharis sarothroides	1-5%		<0%		<0%		<0%		<0%	
Bromus carinatus	<0%		<0%		<0%		<0%		<1%	
Bromus rubens	<1%		<0%		<0%		1-5%		10-25%	
Claytonia perfoliata	<0%		<1%		<0%		<0%		<0%	
Conyza canadensis	<0%		<1%		<0%		<0%		<0%	
Cryptantha spp.	<0%		<1%		<0%		<0%		<1%	
Datura wrightii	<1%		<0%		<0%		<0%		<0%	

Descurainia pinnata	<1%	<1%	<0%	<0%	<1%
Eucrypta micrantha	<0%	<0%	<0%	<0%	<1%
Galium spp.	<1%	<1%	<0%	<1%	<1%
Gilia spp.	<0%	<0%	<0%	<0%	<1%
Lepidium lasiocarpum	<0%	<0%	<0%	<0%	<1%
Parietaria hespera	5-10%	1-5%	<0%	<1%	<1%
Phacelia filiformis	<1%	<1%	<0%	<1%	<1%
Phoradendron juniperinum	<1%	<0%	<0%	<0%	<0%
Phragmites australis	<0%	25-50%	25-50%	10-25%	<0%
Pluchea sericea	25-50%	25-50%	50-75%	50-75%	25-50%
Poa bigelovii	<1%	<0%	<0%	<0%	<1%
Salix exigua	<0%	1-5%	1-5%	10-25%	<0%
Sonchus asper	<1%	<1%	<0%	<1%	<1%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Pluchea sericea	12		
15	Parietaria hespera	1		
15	Phragmites australis	2		
15	Pluchea sericea	2		
25	Phragmites australis	1	1	

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Pluchea sericea	10	6	
15	Parietaria hespera	2		
15	Phragmites australis	8	6	
15	Pluchea sericea	3		
15	Vacant Space	0		
25	Phragmites australis	3	7	1
45	Bromus rubens	3		
45	Descurainia pinnata	1		
45	Salix exigua	1		
45	Vacant Space	7		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	7.94	220	7.77	205	7.72	206	7.81	210

15	7.73	208	7.63	208	7.67	180	7.68	199
25	7.78	428	7.58	457	7.8	452	7.72	446
35	7.55	820	7.49	819	7.59	713	7.54	784
45	7.7	220	7.64	229	7.62	211	7.65	220

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 1 Transect Type: Tamarisk Control

Date: 5/17/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Steve Till Reader: Pamela Walls

Wind Speed: Air Temp (F): Cloud Cover:

Weather: Sunny, blue skies. Low 90's-upper 80's.

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	5
Coarse woody debris	2
Litter (duff)	94

Species	% Cover
Acacia greggii	6
Gutierrezia sarothrae	1
Phragmites australis	27
Pluchea odorata var. odorata	2
Pluchea sericea	27
Salix exigua	5

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Woody debris structure	23	13	0	0	0
Coarse woody debris	52	13	0	0	14
Bedrock	0	0	0	0	35
Sand	2	0	0	30	14
Boulder	0	0	0	0	2
Litter (duff)	23	75	100	70	35

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	10-25%	M	5-10%	M	<0%		<0%		<0%	
Baccharis salicifolia	<0%		<0%		<0%		<0%		25-50%	
Baccharis sarothroides	1-5%		<0%		<0%		<0%		<0%	
Datura wrightii	<1%		1-5%		<0%		<0%		<0%	
Phragmites australis	<0%		50-75%		25-50%		25-50%		1-5%	
Pluchea sericea	5-10%		10-25%		50-75%		25-50%		10-25%	
Salix exigua	<0%		5-10%		10-25%		10-25%		10-25%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Acacia greggii	1		
15	Phragmites australis	1		
15	Pluchea sericea	3		
15	Vacant Space	6		
35	Phragmites australis	1		
35	Pluchea odorata var. odorata	1		
35	Pluchea sericea		4	

35	Vacant Space	8

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Acacia greggii	2		
15	Phragmites australis	1	1	1
15	Pluchea sericea	5		
15	Vacant Space	4		
25	Pluchea sericea	4	3	
35	Phragmites australis	4		
35	Pluchea sericea	4	6	
35	Vacant Space	3		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	9.02	48	9.02	49	9	48	9.01	48
15	8.96	133	8.96	138	8.93	135	8.95	135
25	9.21	66	9.13	67	9.12	67	9.15	67
35	8.4	124	8.36	123	8.32	125	8.36	124
45	8.82	76	8.81	79	8.81	80	8.81	78

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 1 Transect Type: Tamarisk Control

Date: 4/25/2008 Revisit? ☑ Post-tamarisk removal

Recorder: Hattie Oswald Reader: Cheryl Decker

Wind Speed: 4.0 Air Temp (F): 81.0 Cloud Cover: 0

Weather:

Point Intercept Transect (50m)

Ground Cover	% Cover
Coarse woody debris	6
Litter (duff)	84
Plant	1
Sand	6
Woody debris structure	3

Species	% Cover
Acacia greggii	10
Amsonia tomentosa	4
Bromus rubens	11
Descurainia pinnata	1
Lathyrus graminifolius	1
Parietaria hespera	5
Phacelia filiformis	1
Phragmites australis	12
Pluchea sericea	41
Salix exigua	3
Sarcostemma cynanchoides var. hartwegii	3

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Crypto	0	0	2	0	0
Basal Veg	2	3	0	3	2
Woody debris structure	11	3	0	5	8
Coarse woody debris	40	1	0	2	4
Litter (duff)	45	88	98	88	54
Bedrock	0	0	0	0	26
Stone	1	0	0	0	0
Gravel	0	0	0	0	0
Sand	1	5	0	2	5

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	10-25%	M	1-5%	M	<0%		<0%		1-5%	P+M
Amsonia tomentosa	1-5%		<1%		<0%		<0%		<1%	
Baccharis salicifolia	<0%		<0%		<0%		<0%		5-10%	
Baccharis sarothroides	1-5%		<0%		<0%		<0%		<0%	
Bromus carinatus	<0%		<0%		<0%		<0%		<1%	
Bromus rubens	<1%		<0%		<0%		1-5%		10-25%	
Claytonia perfoliata	<0%		<1%		<0%		<0%		<0%	
Conyza canadensis	<0%		<1%		<0%		<0%		<0%	
Cryptantha spp.	<0%		<1%		<0%		<0%		<1%	
Datura wrightii	<1%		<0%		<0%		<0%		<0%	

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 1 Transect Type: Tamarisk Control

Descurainia pinnata	<1%	<1%	<0%	<0%	<1%
Eucrypta micrantha	<0%	<0%	<0%	<0%	<1%
Galium spp.	<1%	<1%	<0%	<1%	<1%
Gilia spp.	<0%	<0%	<0%	<0%	<1%
Lepidium lasiocarpum	<0%	<0%	<0%	<0%	<1%
Parietaria hespera	5-10%	1-5%	<0%	<1%	<1%
Phacelia filiformis	<1%	<1%	<0%	<1%	<1%
Phoradendron juniperinum	<1%	<0%	<0%	<0%	<0%
Phragmites australis	<0%	25-50%	25-50%	10-25%	<0%
Pluchea sericea	25-50%	25-50%	50-75%	50-75%	25-50%
Poa bigelovii	<1%	<0%	<0%	<0%	<1%
Salix exigua	<0%	1-5%	1-5%	10-25%	<0%
Sonchus asper	<1%	<1%	<0%	<1%	<1%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Pluchea sericea	12		
15	Parietaria hespera	1		
15	Phragmites australis	2		
15	Pluchea sericea	2		
25	Phragmites australis	1	1	

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Pluchea sericea	10	6	
15	Parietaria hespera	2		
15	Phragmites australis	8	6	
15	Pluchea sericea	3		
15	Vacant Space	0		
25	Phragmites australis	3	7	1
45	Bromus rubens	3		
45	Descurainia pinnata	1		
45	Salix exigua	1		
45	Vacant Space	7		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	7.94	220	7.77	205	7.72	206	7.81	210

15	7.73	208	7.63	208	7.67	180	7.68	199
25	7.78	428	7.58	457	7.8	452	7.72	446
35	7.55	820	7.49	819	7.59	713	7.54	784
45	7.7	220	7.64	229	7.62	211	7.65	220

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 2 Transect Type: Tamarisk Area

	Start point		End point
Easting:	292563	Easting:	292521
Northing:	3973667	Northing:	3973641
GPS accuracy (m):	4	GPS accuracy (m):	0.9
Elevation (m):	491	Elevation (m):	488
Bearing:	230		
Aspect (0-360):	235	Slope (degrees):	3

Transect description: Transect 2a begins in the drainage bottom, 150m below a small waterfall in the mustard yellow narrows about 1km above the river. It runs 50m downstream, taking a turn to the right at 36m. Continuing to follow a line of TAMRAM. The bend (junction) is at a boulder in the creek bottom amidst tamarisk. Reference plot 2B parallel 2A and runs in a back channel about 30m away.

Additional Info:: The bearing at 0-36m is 230 and from 36-50 it is 267. The start of the transect is in the cobble creek bottom. The end of the transect is on creek right at a mature TAMRAM and Acacia that overhangs the creek.

Geological layer: Yellow limestone, a member of the BA Shale?

Habitat type: Riparian

Dominant species: Isocoma acradenia (Greene) Greene, Penstemon palmeri Gray, Tamarix ramosissima Ledeb., Viguiera parishii Greene

Associated species: Acacia greggii Gray, Baccharis salicifolia (Ruiz & Pavón) Pers., Bebbia juncea (Benth.) Greene var. aspera Greene, Brickellia longifolia S. Wats., Bromus rubens L., Cirsium arizonicum (Gray) Petrak, Cirsium mohavense, Dasyochloa pulchella (Kunth) Willd. ex Rydb., Datura wrightii Regel, Eucnide urens (Parry ex Gray) Parry, Ferocactus cylindraceus (Engelm.) Orcutt var. cylindraceus, Heterotheca villosa (Pursh) Shinners, Mimulus cardinalis Dougl. ex Benth., Nicotiana obtusifolia Mertens & Galeotti var. obtusifolia, Penstemon eatonii Gray, Phacelia filiformis Brand, Populus fremontii S. Wats., Porophyllum gracile Benth., Salix exigua Nutt., Sonchus oleraceus L., Typha latifolia L.

Surface water within 25m? ☑ Surface water type: stream

Landform: Drainage channel Surface rocks: limestone

Soil type: sand Topo position: Unknown

Light exposure: open Soil moisture: dry

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 2 Transect Type: Tamarisk Area

Date: 5/17/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Steve Till Reader: Pamela Walls

Wind Speed: Air Temp (F): Cloud Cover:

Weather: Scattered clouds, low 90's. Hot.

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	5
Cobble	11
Gravel	40
Litter (duff)	30
Sand	11
Stone	3

Species	% Cover
	2
Brickellia longifolia	3
Camissonia walkeri	2
Datura wrightii	7
Encelia farinosa	2
Isocoma acradenia	3
Mimulus cardinalis	5
Nicotiana obtusifolia var. obtusifolia	2
Polypogon monspeliensis	1
Salix exigua	3
Tamarix ramosissima	36
Typha spp.	1

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Litter (duff)	1	3	7	7	16
Boulder	3	0	3	17	7
Coarse woody debris	0	0	1	0	0
Sand	3	3	7	17	3
Stone	3	3	7	17	3
Gravel	83	57	60	17	34
Cobble	7	34	16	38	33
Woody debris structure	0	0	1	0	0

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	1-5%	S+M	<1%	S	<1%	S	1-5%	S+P+M	1-5%	M
Aloysia wrightii	<0%		<0%		<1%		<0%		<0%	
Aristida purpurea	<1%		<0%		<1%		<0%		<0%	
Artemisia ludoviciana	<0%		1-5%		<0%		<0%		<0%	
Bebbia juncea var. aspera	<0%		<0%		1-5%		<0%		<0%	
Brickellia longifolia	<0%		5-10%		1-5%		<1%		<0%	
Bromus rubens	<1%		<1%		<1%		<1%		<1%	
Camissonia walkeri	1-5%		1-5%		<1%		<1%		<0%	
Cercis occidentalis	<0%		<0%		<0%		<1%	S	<0%	

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 2 Transect Type: Tamarisk Area

Cirsium mohavense	<0%	1-5%		<0%		<0%		<0%	
Cryptantha spp.	<1%	<0%		<1%		<0%		<1%	
Datura wrightii	<0%	5-10%		10-25%		<0%		<0%	
Erigeron divergens	<1%	<0%		<0%		<0%		<0%	
Gutierrezia spp.	<0%	1-5%		<0%		<0%		1-5%	
Hedeoma nana	<0%	<0%		<0%		<0%		<1%	
Isocoma acradenia	<0%	1-5%		1-5%		1-5%		1-5%	
Lepidium lasiocarpum var. lasiocarpum	<1%	<0%		<0%		<0%		<0%	
Maurandella antirrhiniflora	<0%	<1%		<0%		<1%		<0%	
Mimulus cardinalis	<0%	<0%		<0%		1-5%		10-25%	
Nicotiana obtusifolia	<0%	<1%		<0%		<1%		5-10%	
Oenothera caespitosa	<0%	<0%		<0%		<1%		<0%	
Parietaria hespera	<0%	<1%		<1%		<1%		<0%	
Penstemon eatonii	<0%	<0%		<0%		<1%		<0%	
Penstemon palmeri	<0%	<1%		<1%		<0%		<1%	
Phacelia crenulata	<1%	<0%		<0%		<1%		<0%	
Plantago patagonica	<0%	<0%		<1%		<0%		<0%	
Polemonium spp.	<1%	<0%		<0%		<0%		<0%	
Polypogon monspeliensis	<0%	<1%		<0%		<0%		<0%	
Salix exigua	<0%	<0%		<0%		5-10%		<0%	
Salix gooddingii	<0%	<0%		<0%		1-5%	P	<0%	
Sonchus oleraceus	<1%	<1%		<1%		<1%		<0%	
Sphaeralcea grossulariifolia	<0%	<1%		<0%		<0%		<0%	
Sporobolus cryptandrus	<0%	<0%		1-5%		1-5%		<0%	
Stephanomeria pauciflora	<0%	<0%		<1%		<1%		<0%	
Tamarix ramosissima	<0%	5-10%	S+P	5-10%	S+P	10-25%	S+P+M	25-50%	S+P+M
Thymophylla pentachaeta	<0%	<0%		<1%		<0%		<0%	
Typha spp.	<0%	<0%		<0%		1-5%		<0%	
Verbena spp.	<0%	<1%		<0%		<0%		<0%	
Viguiera dentata	<0%	1-5%		<0%		<0%		<0%	
Vulpia octoflora	<0%	<0%		<0%		<1%		<1%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
25	Datura wrightii	8	4	
35	Salix exigua		10	
45	Tamarix ramosissima	30	8	

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
15	Acacia greggii		3	
25	Datura wrightii	8	2	

35	Salix exigua		4
45	Tamarix ramosissima	10	3

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	9.06	121	9.06	121	9.04	124	9.05	122
15	8.92	990	8.91	1045	8.91	1064	8.91	1033
25	8.31	551	8.27	528	8.33	514	8.30	531
35	9.04	90	9.05	91	9.07	94	9.05	92
45	8.75	213	8.75	215	8.75	216	8.75	215

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 2 Transect Type: Tamarisk Area

Date: 4/25/2008 Revisit? ☑ Post-tamarisk removal

Recorder: Jane Cipra Reader: Lori Makarick

Wind Speed: 2.0 Air Temp (F): 71.0 Cloud Cover: 0

Weather:

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	5
Cobble	24
Gravel	38
Litter (duff)	13
Sand	16
Stone	4

Species	% Cover
Cryptantha spp.	1
Encelia farinosa	5
Isocoma acradenia	2

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Basal Veg	1	1	1	1	1
Woody debris structure	0	1	0	0	1
Coarse woody debris	1	1	2	0	1
Litter (duff)	2	4	9	3	6
Boulder	0	0	3	23	23
Stone	7	7	13	20	11
Cobble	25	26	31	19	20
Gravel	55	46	29	25	26
Sand	9	14	12	9	14

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	M	<0%		<1%	S	1-5%	M	<1%	S
Allionia incarnata	<0%		<0%		<1%		<0%		<0%	
Bebbia juncea var. aspera	<0%		<0%		<1%		<0%		<0%	
Brickellia longifolia	<0%		<0%		1-5%		1-5%		<0%	
Bromus carinatus	<0%		<0%		<1%		<0%		<0%	
Bromus rubens	<1%		<1%		<1%		<0%		<1%	
Camissonia walkeri	<1%		<1%		<1%		<1%		<1%	
Cryptantha spp.	<1%		<1%		<1%		<1%		<1%	
Datura wrightii	<0%		<0%		1-5%		<0%		<0%	
Draba cuneifolia	<0%		<1%		<1%		<0%		<0%	
Encelia farinosa	<0%		<0%		<1%		<0%		<0%	
Eucrypta micrantha	<0%		<1%		<0%		<0%		<0%	
Gilia spp.	<1%		<1%		<1%		<1%		<0%	
Grass spp	<1%		<0%		<0%		<0%		<0%	
Isocoma acradenia	<0%		<1%		1-5%		<1%		<1%	

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 2 Transect Type: Tamarisk Area

Nicotiana obtusifolia	<0%	<0%	<0%	<1%	<0%	
Parietaria hespera	<0%	<1%	<1%	<0%	<0%	
Penstemon palmeri	<0%	<1%	<0%	<1%	<0%	
Phacelia spp.	<1%	<1%	<1%	<0%	<0%	
Poa bigelovii	<1%	<0%	<0%	<0%	<0%	
Sonchus asper	<1%	<1%	<1%	<0%	<1%	
Sphaeralcea ambigua	<0%	<0%	<0%	<1%	<0%	
Sphaeralcea grossulariifolia	<0%	<1%	<0%	<0%	<0%	
Sporobolus cryptandrus	<0%	<0%	<1%	<1%	<0%	
Stephanomeria pauciflora	<0%	<1%	<1%	<0%	<1%	
Tamarix ramosissima	<0%	<0%	<0%	<0%	1-5%	S+M

Vegetation Structure Data - Old

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
15	Stephanomeria pauciflora	2		
25	Cryptantha spp.	2		
45	Cryptantha spp.	1		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.28	239	8.64	244	8.53	250	8.48	244
15	7.97	163	7.87	130	7.83	162	7.89	152
25	8.52	107	8	127	8.18	137	8.23	124
35	8.4	91	8.05	96	8.01	105	8.15	97
45	8.07	93	8.01	108	8.95	110	8.34	104

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 2 Transect Type: Tamarisk Area

Date: 5/17/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Steve Till Reader: Pamela Walls

Wind Speed: Air Temp (F): Cloud Cover:

Weather: Scattered clouds, low 90's. Hot.

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	5
Cobble	11
Gravel	40
Litter (duff)	30
Sand	11
Stone	3

Species	% Cover
	2
Brickellia longifolia	3
Camissonia walkeri	2
Datura wrightii	7
Encelia farinosa	2
Isocoma acradenia	3
Mimulus cardinalis	5
Nicotiana obtusifolia var. obtusifolia	2
Polypogon monspeliensis	1
Salix exigua	3
Tamarix ramosissima	36
Typha spp.	1

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Litter (duff)	1	3	7	7	16
Boulder	3	0	3	17	7
Coarse woody debris	0	0	1	0	0
Sand	3	3	7	17	3
Stone	3	3	7	17	3
Gravel	83	57	60	17	34
Cobble	7	34	16	38	33
Woody debris structure	0	0	1	0	0

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	1-5%	S+M	<1%	S	<1%	S	1-5%	S+P+M	1-5%	M
Aloysia wrightii	<0%		<0%		<1%		<0%		<0%	
Aristida purpurea	<1%		<0%		<1%		<0%		<0%	
Artemisia ludoviciana	<0%		1-5%		<0%		<0%		<0%	
Bebbia juncea var. aspera	<0%		<0%		1-5%		<0%		<0%	
Brickellia longifolia	<0%		5-10%		1-5%		<1%		<0%	
Bromus rubens	<1%		<1%		<1%		<1%		<1%	
Camissonia walkeri	1-5%		1-5%		<1%		<1%		<0%	
Cercis occidentalis	<0%		<0%		<0%		<1%	S	<0%	

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 2 Transect Type: Tamarisk Area

Cirsium mohavense	<0%	1-5%		<0%		<0%		<0%	
Cryptantha spp.	<1%	<0%		<1%		<0%		<1%	
Datura wrightii	<0%	5-10%		10-25%		<0%		<0%	
Erigeron divergens	<1%	<0%		<0%		<0%		<0%	
Gutierrezia spp.	<0%	1-5%		<0%		<0%		1-5%	
Hedeoma nana	<0%	<0%		<0%		<0%		<1%	
Isocoma acradenia	<0%	1-5%		1-5%		1-5%		1-5%	
Lepidium lasiocarpum var. lasiocarpum	<1%	<0%		<0%		<0%		<0%	
Maurandella antirrhiniflora	<0%	<1%		<0%		<1%		<0%	
Mimulus cardinalis	<0%	<0%		<0%		1-5%		10-25%	
Nicotiana obtusifolia	<0%	<1%		<0%		<1%		5-10%	
Oenothera caespitosa	<0%	<0%		<0%		<1%		<0%	
Parietaria hespera	<0%	<1%		<1%		<1%		<0%	
Penstemon eatonii	<0%	<0%		<0%		<1%		<0%	
Penstemon palmeri	<0%	<1%		<1%		<0%		<1%	
Phacelia crenulata	<1%	<0%		<0%		<1%		<0%	
Plantago patagonica	<0%	<0%		<1%		<0%		<0%	
Polemonium spp.	<1%	<0%		<0%		<0%		<0%	
Polypogon monspeliensis	<0%	<1%		<0%		<0%		<0%	
Salix exigua	<0%	<0%		<0%		5-10%		<0%	
Salix gooddingii	<0%	<0%		<0%		1-5%	P	<0%	
Sonchus oleraceus	<1%	<1%		<1%		<1%		<0%	
Sphaeralcea grossulariifolia	<0%	<1%		<0%		<0%		<0%	
Sporobolus cryptandrus	<0%	<0%		1-5%		1-5%		<0%	
Stephanomeria pauciflora	<0%	<0%		<1%		<1%		<0%	
Tamarix ramosissima	<0%	5-10%	S+P	5-10%	S+P	10-25%	S+P+M	25-50%	S+P+M
Thymophylla pentachaeta	<0%	<0%		<1%		<0%		<0%	
Typha spp.	<0%	<0%		<0%		1-5%		<0%	
Verbena spp.	<0%	<1%		<0%		<0%		<0%	
Viguiera dentata	<0%	1-5%		<0%		<0%		<0%	
Vulpia octoflora	<0%	<0%		<0%		<1%		<1%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
25	Datura wrightii	8	4	
35	Salix exigua		10	
45	Tamarix ramosissima	30	8	

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
15	Acacia greggii		3	
25	Datura wrightii	8	2	

35	Salix exigua		4
45	Tamarix ramosissima	10	3

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	9.06	121	9.06	121	9.04	124	9.05	122
15	8.92	990	8.91	1045	8.91	1064	8.91	1033
25	8.31	551	8.27	528	8.33	514	8.30	531
35	9.04	90	9.05	91	9.07	94	9.05	92
45	8.75	213	8.75	215	8.75	216	8.75	215

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 2 Transect Type: Tamarisk Area

Date: 4/25/2008 Revisit? ☑ Post-tamarisk removal

Recorder: Jane Cipra Reader: Lori Makarick

Wind Speed: 2.0 Air Temp (F): 71.0 Cloud Cover: 0

Weather:

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	5
Cobble	24
Gravel	38
Litter (duff)	13
Sand	16
Stone	4

Species	% Cover
Cryptantha spp.	1
Encelia farinosa	5
Isocoma acradenia	2

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Basal Veg	1	1	1	1	1
Woody debris structure	0	1	0	0	1
Coarse woody debris	1	1	2	0	1
Litter (duff)	2	4	9	3	6
Boulder	0	0	3	23	23
Stone	7	7	13	20	11
Cobble	25	26	31	19	20
Gravel	55	46	29	25	26
Sand	9	14	12	9	14

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	M	<0%		<1%	S	1-5%	M	<1%	S
Allionia incarnata	<0%		<0%		<1%		<0%		<0%	
Bebbia juncea var. aspera	<0%		<0%		<1%		<0%		<0%	
Brickellia longifolia	<0%		<0%		1-5%		1-5%		<0%	
Bromus carinatus	<0%		<0%		<1%		<0%		<0%	
Bromus rubens	<1%		<1%		<1%		<0%		<1%	
Camissonia walkeri	<1%		<1%		<1%		<1%		<1%	
Cryptantha spp.	<1%		<1%		<1%		<1%		<1%	
Datura wrightii	<0%		<0%		1-5%		<0%		<0%	
Draba cuneifolia	<0%		<1%		<1%		<0%		<0%	
Encelia farinosa	<0%		<0%		<1%		<0%		<0%	
Eucrypta micrantha	<0%		<1%		<0%		<0%		<0%	
Gilia spp.	<1%		<1%		<1%		<1%		<0%	
Grass spp	<1%		<0%		<0%		<0%		<0%	
Isocoma acradenia	<0%		<1%		1-5%		<1%		<1%	

Nicotiana obtusifolia	<0%	<0%	<0%	<1%	<0%	
Parietaria hespera	<0%	<1%	<1%	<0%	<0%	
Penstemon palmeri	<0%	<1%	<0%	<1%	<0%	
Phacelia spp.	<1%	<1%	<1%	<0%	<0%	
Poa bigelovii	<1%	<0%	<0%	<0%	<0%	
Sonchus asper	<1%	<1%	<1%	<0%	<1%	
Sphaeralcea ambigua	<0%	<0%	<0%	<1%	<0%	
Sphaeralcea grossulariifolia	<0%	<1%	<0%	<0%	<0%	
Sporobolus cryptandrus	<0%	<0%	<1%	<1%	<0%	
Stephanomeria pauciflora	<0%	<1%	<1%	<0%	<1%	
Tamarix ramosissima	<0%	<0%	<0%	<0%	1-5%	S+M

Vegetation Structure Data - Old

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
15	Stephanomeria pauciflora	2		
25	Cryptantha spp.	2		
45	Cryptantha spp.	1		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.28	239	8.64	244	8.53	250	8.48	244
15	7.97	163	7.87	130	7.83	162	7.89	152
25	8.52	107	8	127	8.18	137	8.23	124
35	8.4	91	8.05	96	8.01	105	8.15	97
45	8.07	93	8.01	108	8.95	110	8.34	104

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 2 Transect Type: Tamarisk Control

	Start point		End point
Easting:	292548	Easting:	292504
Northing:	3973669	Northing:	3973666
GPS accuracy (m):	2.6	GPS accuracy (m):	3.9
Elevation (m):	488	Elevation (m):	506
Bearing:	273		
Aspect (0-360):	275	Slope (degrees):	8

Transect description: Transect is about 900m up canyon from T1 pair. The transect start about 50m above a distinctive BA shale wall, where the canyon bends to the South. Above the start begins the 3-5m wide BA narrows. This transect runs along the creek left side of the creek right minor channel. Start point is at a 2m tall cottonwood tree. Transect end point is about 3m from the end of the minor channel, where it joins the main channel. The end is about 3m from large acacia's and below a small barrel cactus poised on the 5m tall conglomerate (creek right) edge of the channel. Mike Kearsley was also a reader for this transect.

Additional Info::

Geological layer: BA shale

Habitat type: Riparian

Dominant species:

Associated species: Cirsium mohavense, Machaeranthera pinnatifida (Hook.) Shinners, Polypogon monspeliensis (L.) Desf.

Surface water within 25m? ☑ Surface water type: stream

Landform: Drainage channel Surface rocks: shale

Soil type: loamy sand Topo position: Unknown

Light exposure: partial-shade Soil moisture:

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 2 Transect Type: Tamarisk Control

Date: 5/17/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Amy Prince Reader: Lori Makarick

Wind Speed: Air Temp (F): 108.0 Cloud Cover: 5

Weather: 5% Clouds, very slight wind periodically but mostly DEATHLY calm.

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	1
Coarse woody debris	5
Cobble	13
Gravel	54
Litter (duff)	18
Sand	7
Stone	1
Woody debris structure	1

Species	% Cover
Acacia greggii	31
Bromus rubens	3
Camissonia walkeri	2
Encelia farinosa	1
Erigeron divergens	1
Isocoma acradenia	2
Nicotiana obtusifolia var. obtusifolia	1
Polypogon monspeliensis	1
Populus fremontii	1
Sonchus asper	1

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Sand	3	2	4	3	1
Stone	32	13	22	1	4
Cobble	15	27	9	7	9
Boulder	7	2	4	1	0
Gravel	32	27	47	84	73
Litter (duff)	7	14	9	3	0
Coarse woody debris	3	13	4	1	9
Woody debris structure	1	2	1	0	4

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	25-50%	P+M	25-50%	P+M	50-75%		10-25%	S+M	75-100%	
Artemisia ludoviciana	<0%		1-5%		<1%		<0%		<0%	
Bromus rubens	<1%		1-5%		5-10%		<0%		5-10%	
Camissonia walkeri	<1%		<0%		<1%		1-5%		1-5%	
Cirsium mohavense	<0%		<0%		1-5%		<0%		<0%	
Conyza canadensis	<1%		<1%		1-5%		<1%		<0%	
Cryptantha spp.	<0%		<1%		<1%		<1%		<1%	
Datura wrightii	<0%		<1%		<0%		<0%		<0%	
Encelia farinosa	1-5%		<1%		<0%		<1%		<1%	
Ephedra spp.	<0%		5-10%		<0%		<0%		<0%	
Erigeron divergens	<0%		<1%		<0%		<0%		<0%	
Hedeoma nana	<0%		<0%		<0%		<0%		<1%	

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 2 Transect Type: Tamarisk Control

Isocoma acradenia	<0%		1-5%		5-10%		<0%		1-5%
Larrea tridentata	<0%		<0%		<0%		<1%		<0%
Maurandella antirrhiniflora	<0%		<0%		<0%		<0%		1-5%
Mimulus cardinalis	<0%		1-5%		<0%		<0%		<0%
Mirabilis multiflora	<1%		<0%		<0%		<0%		<0%
Nicotiana obtusifolia var. obtusifolia	<1%		1-5%		1-5%		<1%		<0%
Phacelia crenulata	<0%		<0%		<0%		<1%		<1%
Piptatherum miliaceum	<1%		<0%		<0%		<0%		<0%
Polypogon viridis	<0%		<1%		<0%		<0%		<0%
Salix exigua	10-25%		<0%		<0%		<1%		<0%
Salix gooddingii	1-5%		<0%		<0%		<1%		<0%
Sonchus asper	<0%		<1%		<1%		<1%		1-5%
Tamarix ramosissima	<1%	S	<1%	S	1-5%	S+P	1-5%	S	<0%
Thymophylla pentachaeta	<0%		<0%		<1%		<0%		<0%
Viguiera parishii	<0%		<0%		<1%		<0%		<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
15	Isocoma acradenia	2		
25	Acacia greggii			12
35	Tamarix ramosissima	3		
45	Acacia greggii		4	5
45	Isocoma acradenia	1		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Acacia greggii		3	
15	Isocoma acradenia	5		
25	Acacia greggii			6
35	Tamarix ramosissima	2		
45	Acacia greggii		3	2
45	Isocoma acradenia	1		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.56	94	8.46	91	8.42	87	8.48	91
15	9.04	107	9.05	114	9.01	104	9.03	108
25	8.38	255	8.34	276	8.32	274	8.35	268
35	8.83	135	8.86	143	8.85	147	8.85	142

45	8.65	326	8.64	353	8.61	354	8.63	344

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 2 Transect Type: Tamarisk Control

Date: 4/25/2008 Revisit? ☑ Post-tamarisk removal

Recorder: Akasha Faist Reader: Amy Prince

Wind Speed: 1.0 Air Temp (F): 82.0 Cloud Cover: 0

Weather:

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	2
Coarse woody debris	1
Cobble	8
Gravel	49
Litter (duff)	26
Sand	7
Stone	6
Woody debris structure	1

Species	% Cover
Acacia greggii	47
Nicotiana obtusifolia	3
Populus fremontii	1
Prosopis glandulosa	3
Salix gooddingii	3
Tamarix ramosissima	4

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Basal Veg	1	1	1	1	1
Woody debris structure	2	4	3	0	0
Coarse woody debris	2	4	3	1	1
Litter (duff)	28	21	12	2	28
Boulder	7	12	14	2	1
Stone	22	24	18	13	11
Cobble	13	14	11	13	12
Gravel	17	10	28	60	37
Sand	8	10	10	8	9

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	10-25%	S	10-25%	P+M	25-50%	S+M	10-25%	M	50-75%	
Amsonia tomentosa	<1%		<1%		<0%		<0%		<1%	
Artemisia ludoviciana	<0%		<1%		1-5%		<0%		<0%	
Brickellia longifolia	<0%		5-10%		<0%		<0%		<0%	
Bromus rubens	1-5%		1-5%		1-5%		<1%		<1%	
Camissonia walkeri	<0%		<1%		<1%		<1%		<1%	
Cirsium mohavense	<0%		<0%		<1%		<0%		<1%	
Conyza canadensis	<0%		<1%		<1%		<0%		<0%	
Cryptantha spp.	<1%		<1%		<0%		<1%		<0%	
Descurainia pinnata	<1%		<1%		<1%		<0%		<0%	
Encelia farinosa	1-5%		<0%		<0%		<1%		<1%	
Ephedra spp.	<0%		1-5%		<0%		<0%		<0%	

Galium spp.	<1%		<1%		<0%	<0%	<0%
Gilia spp.	<0%		<0%		<0%	<0%	<1%
Gutierrezia sarothrae	<0%		<0%		<1%	<0%	<0%
Isocoma acradenia	<0%		1-5%		5-10%	<1%	10-25%
Lactuca serriola	<1%		<1%		<1%	<0%	<1%
Larrea tridentata	<0%		<0%		<0%	<1%	<0%
Maurandella antirrhiniflora	<0%		<0%		<0%	<0%	<1%
Mirabilis bigelovii	<1%		<1%		<0%	<0%	<0%
Muhlenbergia thurberi	<0%		<0%		<1%	<0%	<0%
Nicotiana obtusifolia	<1%		<0%		1-5%	1-5%	<0%
Parietaria hespera	<1%		<1%		<1%	<1%	<1%
Phoradendron californicum	<0%		1-5%		<1%	<0%	<1%
Poa bigelovii	<1%		<1%		<1%	<0%	<0%
Prosopis glandulosa	10-25%	M	1-5%	M	<0%	<0%	<0%
Salix exigua	1-5%		<1%		<0%	<0%	<0%
Sonchus asper	<0%		<1%		<1%	<0%	<1%
Sphaeralcea ambigua	1-5%		<0%		<0%	<0%	<0%
Sporobolus cryptandrus	<0%		<1%		<0%	<0%	<0%
Stephanomeria pauciflora	<1%		<0%		<0%	<0%	<0%
Tamarix ramosissima	<0%		<0%		1-5%	<0%	<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Prosopis glandulosa	4	1	
25	Acacia greggii			1
25	Bromus rubens	1		
45	Acacia greggii	5	7	

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Prosopis glandulosa	2	3	
5	Salix exigua		1	
25	Acacia greggii		3	5
25	Bromus rubens	1		
45	Acacia greggii	6	6	3

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	7.61	113	7.8	97	7.65	119	7.69	110

15	7.35	166	7.28	163	7.26	178	7.30	169
25	7.54	134	7.5	156	7.45	132	7.50	141
35	7.43	93	8.37	96	8.31	100	8.04	96
45	8.57	199	8.49	158	8.44	154	8.50	170

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 2 Transect Type: Tamarisk Control

Date: 5/17/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Amy Prince Reader: Lori Makarick

Wind Speed: Air Temp (F): 108.0 Cloud Cover: 5

Weather: 5% Clouds, very slight wind periodically but mostly DEATHLY calm.

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	1
Coarse woody debris	5
Cobble	13
Gravel	54
Litter (duff)	18
Sand	7
Stone	1
Woody debris structure	1

Species	% Cover
Acacia greggii	31
Bromus rubens	3
Camissonia walkeri	2
Encelia farinosa	1
Erigeron divergens	1
Isocoma acradenia	2
Nicotiana obtusifolia var. obtusifolia	1
Polypogon monspeliensis	1
Populus fremontii	1
Sonchus asper	1

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Sand	3	2	4	3	1
Stone	32	13	22	1	4
Cobble	15	27	9	7	9
Boulder	7	2	4	1	0
Gravel	32	27	47	84	73
Litter (duff)	7	14	9	3	0
Coarse woody debris	3	13	4	1	9
Woody debris structure	1	2	1	0	4

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	25-50%	P+M	25-50%	P+M	50-75%		10-25%	S+M	75-100%	
Artemisia ludoviciana	<0%		1-5%		<1%		<0%		<0%	
Bromus rubens	<1%		1-5%		5-10%		<0%		5-10%	
Camissonia walkeri	<1%		<0%		<1%		1-5%		1-5%	
Cirsium mohavense	<0%		<0%		1-5%		<0%		<0%	
Conyza canadensis	<1%		<1%		1-5%		<1%		<0%	
Cryptantha spp.	<0%		<1%		<1%		<1%		<1%	
Datura wrightii	<0%		<1%		<0%		<0%		<0%	
Encelia farinosa	1-5%		<1%		<0%		<1%		<1%	
Ephedra spp.	<0%		5-10%		<0%		<0%		<0%	
Erigeron divergens	<0%		<1%		<0%		<0%		<0%	
Hedeoma nana	<0%		<0%		<0%		<0%		<1%	

Isocoma acradenia	<0%		1-5%		5-10%		<0%		1-5%
Larrea tridentata	<0%		<0%		<0%		<1%		<0%
Maurandella antirrhiniflora	<0%		<0%		<0%		<0%		1-5%
Mimulus cardinalis	<0%		1-5%		<0%		<0%		<0%
Mirabilis multiflora	<1%		<0%		<0%		<0%		<0%
Nicotiana obtusifolia var. obtusifolia	<1%		1-5%		1-5%		<1%		<0%
Phacelia crenulata	<0%		<0%		<0%		<1%		<1%
Piptatherum miliaceum	<1%		<0%		<0%		<0%		<0%
Polypogon viridis	<0%		<1%		<0%		<0%		<0%
Salix exigua	10-25%		<0%		<0%		<1%		<0%
Salix gooddingii	1-5%		<0%		<0%		<1%		<0%
Sonchus asper	<0%		<1%		<1%		<1%		1-5%
Tamarix ramosissima	<1%	S	<1%	S	1-5%	S+P	1-5%	S	<0%
Thymophylla pentachaeta	<0%		<0%		<1%		<0%		<0%
Viguiera parishii	<0%		<0%		<1%		<0%		<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
15	Isocoma acradenia	2		
25	Acacia greggii			12
35	Tamarix ramosissima	3		
45	Acacia greggii		4	5
45	Isocoma acradenia	1		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Acacia greggii		3	
15	Isocoma acradenia	5		
25	Acacia greggii			6
35	Tamarix ramosissima	2		
45	Acacia greggii		3	2
45	Isocoma acradenia	1		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.56	94	8.46	91	8.42	87	8.48	91
15	9.04	107	9.05	114	9.01	104	9.03	108
25	8.38	255	8.34	276	8.32	274	8.35	268
35	8.83	135	8.86	143	8.85	147	8.85	142

45	8.65	326	8.64	353	8.61	354	8.63	344

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 2 Transect Type: Tamarisk Control

Date: 4/25/2008 Revisit? ☑ Post-tamarisk removal

Recorder: Akasha Faist Reader: Amy Prince

Wind Speed: 1.0 Air Temp (F): 82.0 Cloud Cover: 0

Weather:

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	2
Coarse woody debris	1
Cobble	8
Gravel	49
Litter (duff)	26
Sand	7
Stone	6
Woody debris structure	1

Species	% Cover
Acacia greggii	47
Nicotiana obtusifolia	3
Populus fremontii	1
Prosopis glandulosa	3
Salix gooddingii	3
Tamarix ramosissima	4

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Basal Veg	1	1	1	1	1
Woody debris structure	2	4	3	0	0
Coarse woody debris	2	4	3	1	1
Litter (duff)	28	21	12	2	28
Boulder	7	12	14	2	1
Stone	22	24	18	13	11
Cobble	13	14	11	13	12
Gravel	17	10	28	60	37
Sand	8	10	10	8	9

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	10-25%	S	10-25%	P+M	25-50%	S+M	10-25%	M	50-75%	
Amsonia tomentosa	<1%		<1%		<0%		<0%		<1%	
Artemisia ludoviciana	<0%		<1%		1-5%		<0%		<0%	
Brickellia longifolia	<0%		5-10%		<0%		<0%		<0%	
Bromus rubens	1-5%		1-5%		1-5%		<1%		<1%	
Camissonia walkeri	<0%		<1%		<1%		<1%		<1%	
Cirsium mohavense	<0%		<0%		<1%		<0%		<1%	
Conyza canadensis	<0%		<1%		<1%		<0%		<0%	
Cryptantha spp.	<1%		<1%		<0%		<1%		<0%	
Descurainia pinnata	<1%		<1%		<1%		<0%		<0%	
Encelia farinosa	1-5%		<0%		<0%		<1%		<1%	
Ephedra spp.	<0%		1-5%		<0%		<0%		<0%	

Galium spp.	<1%		<1%		<0%	<0%	<0%
Gilia spp.	<0%		<0%		<0%	<0%	<1%
Gutierrezia sarothrae	<0%		<0%		<1%	<0%	<0%
Isocoma acradenia	<0%		1-5%		5-10%	<1%	10-25%
Lactuca serriola	<1%		<1%		<1%	<0%	<1%
Larrea tridentata	<0%		<0%		<0%	<1%	<0%
Maurandella antirrhiniflora	<0%		<0%		<0%	<0%	<1%
Mirabilis bigelovii	<1%		<1%		<0%	<0%	<0%
Muhlenbergia thurberi	<0%		<0%		<1%	<0%	<0%
Nicotiana obtusifolia	<1%		<0%		1-5%	1-5%	<0%
Parietaria hespera	<1%		<1%		<1%	<1%	<1%
Phoradendron californicum	<0%		1-5%		<1%	<0%	<1%
Poa bigelovii	<1%		<1%		<1%	<0%	<0%
Prosopis glandulosa	10-25%	M	1-5%	M	<0%	<0%	<0%
Salix exigua	1-5%		<1%		<0%	<0%	<0%
Sonchus asper	<0%		<1%		<1%	<0%	<1%
Sphaeralcea ambigua	1-5%		<0%		<0%	<0%	<0%
Sporobolus cryptandrus	<0%		<1%		<0%	<0%	<0%
Stephanomeria pauciflora	<1%		<0%		<0%	<0%	<0%
Tamarix ramosissima	<0%		<0%		1-5%	<0%	<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Prosopis glandulosa	4	1	
25	Acacia greggii			1
25	Bromus rubens	1		
45	Acacia greggii	5	7	

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Prosopis glandulosa	2	3	
5	Salix exigua		1	
25	Acacia greggii		3	5
25	Bromus rubens	1		
45	Acacia greggii	6	6	3

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	7.61	113	7.8	97	7.65	119	7.69	110

15	7.35	166	7.28	163	7.26	178	7.30	169
25	7.54	134	7.5	156	7.45	132	7.50	141
35	7.43	93	8.37	96	8.31	100	8.04	96
45	8.57	199	8.49	158	8.44	154	8.50	170

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 3 Transect Type: Tamarisk Area

	Start point		End point
Easting:	292731	Easting:	292689
Northing:	3973627	Northing:	3973630
GPS accuracy (m):	4	GPS accuracy (m):	7.9
Elevation (m):	495	Elevation (m):	464
Bearing:	286		
Aspect (0-360):	305	Slope (degrees):	3

Transect description: Transect starts above the BA shale narrows, about 80m up on creek right on a 3x2.5x1.5m grayish pocked muav limestone boulder with a slanotted flat top. The boulder is just on the down canyon end of a phragmites thicket. The end point is down canyon above the waterfall at the top end of BA narrows. Transect stays on creek right with 10m of flowing creek.

Additional Info::

Geological layer: Bright Angel Shale

Habitat type: Riparian

Dominant species:

Associated species: Astragalus nuttallianus DC., Bothriochloa barbinodis (Lag.) Herter, Cirsium mohavense, , Penstemon palmeri Gray, Phacelia rotundifolia Torr. ex S. Wats., Phragmites australis (Cav.) Trin. ex Steud., Sporobolus contractus A.S. Hitchc., Sporobolus cryptandrus (Torr.) Gray

Surface water within 25m? ☑ Surface water type: stream

Landform: Drainage channel Surface rocks: shale

Soil type: sand Topo position: Unknown

Light exposure: open Soil moisture: moist

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 3 Transect Type: Tamarisk Area

Date: 5/17/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Amy Prince Reader: Mike Kearsley

Wind Speed: 4.0 Air Temp (F): 102.0 Cloud Cover: 20

Weather: 20% Clouds, chance of rain, brreze has picked up. Still 100F+

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	2
Cobble	5
Gravel	59
Litter (duff)	25
Sand	4
Stone	2
Woody debris structure	3

Species	% Cover
Apocynum cannabinum	4
Brickellia longifolia	2
Camissonia walkeri	1
Cirsium mohavense	2
Datura wrightii	4
Encelia farinosa	3
Nicotiana obtusifolia var. obtusifolia	3
Phragmites australis	9
Salix exigua	2
Salix gooddingii	1
Sonchus asper	5
Sporobolus contractus	3
Tamarix ramosissima	35

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Coarse woody debris	3	0	1	1	13
Boulder	3	0	0	0	5
Sand	3	3	8	19	1
Stone	3	3	8	3	5
Cobble	3	3	8	8	13
Litter (duff)	9	7	3	3	29
Gravel	68	84	72	66	29
Woody debris structure	8	0	0	0	5

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Apocynum cannabinum	5-10%		<0%		<0%		<0%		<0%	
Aristida purpurea	<0%		<0%		<1%		<0%		<0%	
Artemisia ludoviciana	<1%		1-5%		<0%		<0%		<0%	
Baccharis sergiloides	<0%		1-5%		<0%		<0%		1-5%	
Brickellia longifolia	1-5%		1-5%		<0%		<0%		<0%	
Bromus rubens	<1%		<1%		<1%		<1%		1-5%	
Camissonia walkeri	<0%		1-5%		1-5%		1-5%		1-5%	
Cercis occidentalis	<0%		<1%		<0%		<0%		10-25%	

Cirsium mohavense	<1%		1-5%		<0%		1-5%	5-10%	
Conyza canadensis	<1%		<0%		<0%		<0%	<0%	
Cryptantha spp.	<0%		<0%		<1%		<0%	<0%	
Datura wrightii	<0%		1-5%		1-5%		<0%	<0%	
Draba cuneifolia	<0%		<0%		<0%		<0%	<1%	
Encelia farinosa	<1%		<1%		<0%		<0%	<0%	
Gutierrezia spp.	<0%		<0%		<1%		<0%	<0%	
Mimulus cardinalis	5-10%		5-10%		1-5%		5-10%	10-25%	
Nicotiana obtusifolia var. obtusifolia	<1%		<0%		5-10%		1-5%	5-10%	
Phragmites australis	<0%		<0%		<1%		1-5%	1-5%	
Piptatherum miliaceum	<0%		<0%		<0%		<0%	1-5%	
Polypogon monspeliensis	1-5%		<1%		<1%		1-5%	<1%	
Polypogon viridis	<0%		<0%		<0%		<0%	<1%	
Salix exigua	5-10%		1-5%		10-25%		5-10%	<1%	
Salix gooddingii	<0%		1-5%		1-5%		5-10%	<0%	
Silene antirrhina	<1%		<0%		<0%		<0%	<0%	
Sonchus asper	1-5%		<1%		1-5%		5-10%	5-10%	
Sphaeralcea spp.	<0%		<0%		<0%		<1%	<0%	
Sporobolus contractus	<0%		<0%		<0%		<0%	1-5%	
Sporobolus cryptandrus	<0%		<0%		<0%		<1%	<0%	
Tamarix ramosissima	10-25%	S+P	10-25%	S+P	5-10%	S+P	10-25%	S+P	5-10%	S+M
Vulpia octoflora	<0%		<0%		<0%		<1%	<0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Tamarix ramosissima	3	3	
25	Datura wrightii	1		
35	Tamarix ramosissima	48		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Tamarix ramosissima	6	4	
15	Tamarix ramosissima	4		
25	Datura wrightii	2		
25	Sonchus asper	1		
25	Vacant Space	7		
35	Tamarix ramosissima	10		
45	Cirsium mohavense	1		

Soil Data

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 3 Transect Type: Tamarisk Area

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	9.03	387	8.99	385	8.99	379	9.00	384
15	9.15	253	9.14	255	9.13	260	9.14	256
25	8.49	106	8.47	414	8.47	405	8.48	308
35	8.64	509	8.65	525	8.64	510	8.64	515
45	8.82	2352	8.83	2279	8.84	2302	8.83	2311

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 3 Transect Type: Tamarisk Area

Date: 4/25/2008 Revisit? ☑ Post-tamarisk removal

Recorder: Jane Cipra Reader: Lori Makarick

Wind Speed: 2.0 Air Temp (F): 71.0 Cloud Cover: 0

Weather:

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	1
Cobble	9
Gravel	17
Litter (duff)	34
Plant	2
Sand	30
Stone	5
Woody debris structure	2

Species	% Cover
Baccharis salicifolia	1
Baccharis sarothroides	6
Bromus rubens	3
Cercis occidentalis	6
Cirsium mohavense	25
Isocoma acradenia	2
Mimulus cardinalis	19
Phragmites australis	11
Piptatherum miliaceum	3
Polypogon monspeliensis	3
Polypogon viridis	4
Salix exigua	13
Salix gooddingii	1
Tamarix ramosissima	11

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Moss (ground)	2	1	1	0	0
Basal Veg	3	3	3	3	2
Woody debris structure	5	0	0	0	2
Coarse woody debris	2	0	2	1	4
Litter (duff)	25	19	25	23	52
Boulder	0	0	2	0	2
Stone	8	6	7	14	5
Cobble	12	20	16	33	6
Gravel	32	40	30	19	12
Sand	11	11	14	7	15

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S	<0%		<1%	S	<1%	S	<1%	S
Apocynum cannabinum	1-5%		<0%		<0%		<1%		<0%	
Artemisia ludoviciana	<1%		<1%		<0%		<0%		<0%	
Baccharis salicifolia	<0%		<0%		1-5%		<0%		<0%	
Baccharis sarothroides	<0%		<0%		<0%		<0%		1-5%	

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 3 Transect Type: Tamarisk Area

Baccharis sergiloides	<0%		<1%		<0%		<0%		<0%
Bromus rubens	<1%		<1%		<1%		<1%		1-5%
Camissonia walkeri	<0%		<1%		<0%		<1%		<0%
Cercis occidentalis	<0%		<1%		<0%		<0%		10-25%
Cirsium mohavense	10-25%		10-25%		5-10%		10-25%		10-25%
Conyza canadensis	<1%		<1%		<1%		<0%		<0%
Encelia farinosa	<1%		<0%		<0%		<0%		<0%
Galium spp.	<0%		<0%		<1%		<0%		<0%
Isocoma acradenia	<0%		<0%		1-5%		5-10%		<0%
Mimulus cardinalis	25-50%		25-50%		10-25%		10-25%		5-10%
Nicotiana obtusifolia	<0%		<1%		<0%		<0%		<0%
Penstemon palmeri	<1%		<0%		<0%		<0%		<0%
Phragmites australis	<1%		<1%		1-5%		1-5%		1-5%
Piptatherum miliaceum	<0%		<0%		<0%		<0%		5-10%
Polypogon monspeliensis	<1%		1-5%		<1%		<1%		<1%
Polypogon viridis	<0%		<1%		1-5%		<0%		<0%
Salix exigua	5-10%		5-10%		10-25%		1-5%		1-5%
Salix gooddingii	1-5%		5-10%		<0%		10-25%		<0%
Scirpus spp.	1-5%		<0%		<0%		<0%		<0%
Sonchus asper	<1%		<0%		<0%		<1%		<1%
Tamarix ramosissima	1-5%	S+P	1-5%	S+P	1-5%	S+P	1-5%	S+P	<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Salix gooddingii	11		
15	Polypogon monspeliensis	4		
25	Conyza canadensis	1		
25	Mimulus cardinalis	2		
25	Polypogon viridis	1		
25	Salix exigua	1		
25	Vacant Space	8		
45	Piptatherum miliaceum	2		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Salix gooddingii	4		4
15	Mimulus cardinalis	4		
15	Polypogon monspeliensis	7		
15	Salix exigua	2		

15	Vacant Space	1
25	Conyza canadensis	4
25	Mimulus cardinalis	1
25	Polypogon viridis	5
25	Salix exigua	4
25	Vacant Space	5
35	Cirsium mohavense	2
35	Tamarix ramosissima	1
45	Bromus rubens	2
45	Cirsium mohavense	1
45	Piptatherum miliaceum	4
45	Vacant Space	5

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	8.86	213	8.8	195	8.74	222	8.80	210
15	7.48	866	7.5	854	7.52	850	7.50	857
25	7.9	289	7.88	288	7.87	287	7.88	288
35	8.85	261	8.83	260	8.8	254	8.83	258
45	8.59	909	8.59	886	8.58	862	8.59	886

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 3 Transect Type: Tamarisk Area

Date: 5/17/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Amy Prince Reader: Mike Kearsley

Wind Speed: 4.0 Air Temp (F): 102.0 Cloud Cover: 20

Weather: 20% Clouds, chance of rain, brreze has picked up. Still 100F+

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	2
Cobble	5
Gravel	59
Litter (duff)	25
Sand	4
Stone	2
Woody debris structure	3

Species	% Cover
Apocynum cannabinum	4
Brickellia longifolia	2
Camissonia walkeri	1
Cirsium mohavense	2
Datura wrightii	4
Encelia farinosa	3
Nicotiana obtusifolia var. obtusifolia	3
Phragmites australis	9
Salix exigua	2
Salix gooddingii	1
Sonchus asper	5
Sporobolus contractus	3
Tamarix ramosissima	35

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Coarse woody debris	3	0	1	1	13
Boulder	3	0	0	0	5
Sand	3	3	8	19	1
Stone	3	3	8	3	5
Cobble	3	3	8	8	13
Litter (duff)	9	7	3	3	29
Gravel	68	84	72	66	29
Woody debris structure	8	0	0	0	5

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Apocynum cannabinum	5-10%		<0%		<0%		<0%		<0%	
Aristida purpurea	<0%		<0%		<1%		<0%		<0%	
Artemisia ludoviciana	<1%		1-5%		<0%		<0%		<0%	
Baccharis sergiloides	<0%		1-5%		<0%		<0%		1-5%	
Brickellia longifolia	1-5%		1-5%		<0%		<0%		<0%	
Bromus rubens	<1%		<1%		<1%		<1%		1-5%	
Camissonia walkeri	<0%		1-5%		1-5%		1-5%		1-5%	
Cercis occidentalis	<0%		<1%		<0%		<0%		10-25%	

Cirsium mohavense	<1%		1-5%		<0%		1-5%	5-10%	
Conyza canadensis	<1%		<0%		<0%		<0%	<0%	
Cryptantha spp.	<0%		<0%		<1%		<0%	<0%	
Datura wrightii	<0%		1-5%		1-5%		<0%	<0%	
Draba cuneifolia	<0%		<0%		<0%		<0%	<1%	
Encelia farinosa	<1%		<1%		<0%		<0%	<0%	
Gutierrezia spp.	<0%		<0%		<1%		<0%	<0%	
Mimulus cardinalis	5-10%		5-10%		1-5%		5-10%	10-25%	
Nicotiana obtusifolia var. obtusifolia	<1%		<0%		5-10%		1-5%	5-10%	
Phragmites australis	<0%		<0%		<1%		1-5%	1-5%	
Piptatherum miliaceum	<0%		<0%		<0%		<0%	1-5%	
Polypogon monspeliensis	1-5%		<1%		<1%		1-5%	<1%	
Polypogon viridis	<0%		<0%		<0%		<0%	<1%	
Salix exigua	5-10%		1-5%		10-25%		5-10%	<1%	
Salix gooddingii	<0%		1-5%		1-5%		5-10%	<0%	
Silene antirrhina	<1%		<0%		<0%		<0%	<0%	
Sonchus asper	1-5%		<1%		1-5%		5-10%	5-10%	
Sphaeralcea spp.	<0%		<0%		<0%		<1%	<0%	
Sporobolus contractus	<0%		<0%		<0%		<0%	1-5%	
Sporobolus cryptandrus	<0%		<0%		<0%		<1%	<0%	
Tamarix ramosissima	10-25%	S+P	10-25%	S+P	5-10%	S+P	10-25%	S+P	5-10%	S+M
Vulpia octoflora	<0%		<0%		<0%		<1%	<0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Tamarix ramosissima	3	3	
25	Datura wrightii	1		
35	Tamarix ramosissima	48		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Tamarix ramosissima	6	4	
15	Tamarix ramosissima	4		
25	Datura wrightii	2		
25	Sonchus asper	1		
25	Vacant Space	7		
35	Tamarix ramosissima	10		
45	Cirsium mohavense	1		

Soil Data

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 3 Transect Type: Tamarisk Area

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	9.03	387	8.99	385	8.99	379	9.00	384
15	9.15	253	9.14	255	9.13	260	9.14	256
25	8.49	106	8.47	414	8.47	405	8.48	308
35	8.64	509	8.65	525	8.64	510	8.64	515
45	8.82	2352	8.83	2279	8.84	2302	8.83	2311

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 3 Transect Type: Tamarisk Area

Date: 4/25/2008 Revisit? ☑ Post-tamarisk removal

Recorder: Jane Cipra Reader: Lori Makarick

Wind Speed: 2.0 Air Temp (F): 71.0 Cloud Cover: 0

Weather:

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	1
Cobble	9
Gravel	17
Litter (duff)	34
Plant	2
Sand	30
Stone	5
Woody debris structure	2

Species	% Cover
Baccharis salicifolia	1
Baccharis sarothroides	6
Bromus rubens	3
Cercis occidentalis	6
Cirsium mohavense	25
Isocoma acradenia	2
Mimulus cardinalis	19
Phragmites australis	11
Piptatherum miliaceum	3
Polypogon monspeliensis	3
Polypogon viridis	4
Salix exigua	13
Salix gooddingii	1
Tamarix ramosissima	11

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Moss (ground)	2	1	1	0	0
Basal Veg	3	3	3	3	2
Woody debris structure	5	0	0	0	2
Coarse woody debris	2	0	2	1	4
Litter (duff)	25	19	25	23	52
Boulder	0	0	2	0	2
Stone	8	6	7	14	5
Cobble	12	20	16	33	6
Gravel	32	40	30	19	12
Sand	11	11	14	7	15

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S	<0%		<1%	S	<1%	S	<1%	S
Apocynum cannabinum	1-5%		<0%		<0%		<1%		<0%	
Artemisia ludoviciana	<1%		<1%		<0%		<0%		<0%	
Baccharis salicifolia	<0%		<0%		1-5%		<0%		<0%	
Baccharis sarothroides	<0%		<0%		<0%		<0%		1-5%	

Baccharis sergiloides	<0%		<1%		<0%		<0%		<0%
Bromus rubens	<1%		<1%		<1%		<1%		1-5%
Camissonia walkeri	<0%		<1%		<0%		<1%		<0%
Cercis occidentalis	<0%		<1%		<0%		<0%		10-25%
Cirsium mohavense	10-25%		10-25%		5-10%		10-25%		10-25%
Conyza canadensis	<1%		<1%		<1%		<0%		<0%
Encelia farinosa	<1%		<0%		<0%		<0%		<0%
Galium spp.	<0%		<0%		<1%		<0%		<0%
Isocoma acradenia	<0%		<0%		1-5%		5-10%		<0%
Mimulus cardinalis	25-50%		25-50%		10-25%		10-25%		5-10%
Nicotiana obtusifolia	<0%		<1%		<0%		<0%		<0%
Penstemon palmeri	<1%		<0%		<0%		<0%		<0%
Phragmites australis	<1%		<1%		1-5%		1-5%		1-5%
Piptatherum miliaceum	<0%		<0%		<0%		<0%		5-10%
Polypogon monspeliensis	<1%		1-5%		<1%		<1%		<1%
Polypogon viridis	<0%		<1%		1-5%		<0%		<0%
Salix exigua	5-10%		5-10%		10-25%		1-5%		1-5%
Salix gooddingii	1-5%		5-10%		<0%		10-25%		<0%
Scirpus spp.	1-5%		<0%		<0%		<0%		<0%
Sonchus asper	<1%		<0%		<0%		<1%		<1%
Tamarix ramosissima	1-5%	S+P	1-5%	S+P	1-5%	S+P	1-5%	S+P	<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Salix gooddingii	11		
15	Polypogon monspeliensis	4		
25	Conyza canadensis	1		
25	Mimulus cardinalis	2		
25	Polypogon viridis	1		
25	Salix exigua	1		
25	Vacant Space	8		
45	Piptatherum miliaceum	2		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Salix gooddingii	4		4
15	Mimulus cardinalis	4		
15	Polypogon monspeliensis	7		
15	Salix exigua	2		

15	Vacant Space	1
25	Conyza canadensis	4
25	Mimulus cardinalis	1
25	Polypogon viridis	5
25	Salix exigua	4
25	Vacant Space	5
35	Cirsium mohavense	2
35	Tamarix ramosissima	1
45	Bromus rubens	2
45	Cirsium mohavense	1
45	Piptatherum miliaceum	4
45	Vacant Space	5

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	8.86	213	8.8	195	8.74	222	8.80	210
15	7.48	866	7.5	854	7.52	850	7.50	857
25	7.9	289	7.88	288	7.87	287	7.88	288
35	8.85	261	8.83	260	8.8	254	8.83	258
45	8.59	909	8.59	886	8.58	862	8.59	886

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 3 Transect Type: Tamarisk Control

	Start point		End point
Easting:	292784	Easting:	292744
Northing:	3973621	Northing:	3973670
GPS accuracy (m):	19	GPS accuracy (m):	29
Elevation (m):	485	Elevation (m):	480
Bearing:	292		
Aspect (0-360):	292	Slope (degrees):	3

Transect description: This transect begins about 200m above the waterfall that is in the yellowed cliff narrows about 1km from the river. It runs along the creek's right side, first though a MIMCAR patch, then through coyote willow, then through phragmities and then into a dry wash at the end. T3A, the tamarisk cousin of T3B, lies just downstream about 50m on creek right. Pam Walls and Lisa Hahn were also readers for the lovely Steve Till.

Additional Info:: This spot is about 500m down from the source of 3 Springs creek. The water still flows here and for another 250m downstream. Transect start point is on a 1x1x1mboulder in a Mimulus patch on creek right. Transect end is located in a cobbly creek bottom next to a patch of Monster Mohave thistle. There was no soil data collected.

Geological layer: Bright Angel shale. Yellow cliff band of limestone with in the BA?

Habitat type: Riparian

Dominant species: Acacia greggii Gray, Mimulus cardinalis Dougl. ex Benth., Phragmites australis (Cav.) Trin. ex Steud., Salix exigua Nutt., Salix gooddingii Ball

Associated species: Apocynum cannabinum L., Baccharis emoryi Gray, Brickellia coulteri Gray, Brickellia longifolia S. Wats., Bromus rubens L., Camissonia walkeri (A. Nels.) Raven, Cirsium mohavense, Conyza canadensis (L.) Cronq., Datura wrightii Regel, Encelia farinosa Gray ex Torr., Erigeron lobatus A. Nels., Lactuca serriola L., Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm., Nicotiana obtusifolia Mertens & Galeotti var. obtusifolia, Parietaria hespera Hinton, Polypogon monspeliensis (L.) Desf., Tamarix ramosissima Ledeb., Viguiera parishii Greene

Surface water within 25m? ☑ Surface water type: stream

Landform: Drainage channel Surface rocks: limestone shale

Soil type: sand Topo position: Unknown

Light exposure: open Soil moisture: moist

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 3 Transect Type: Tamarisk Control

Date: 5/17/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Steve Till Reader: Kate Watters

Wind Speed: 2.0 Air Temp (F): 88.0 Cloud Cover: 15

Weather: Scattered clouds, upper 80's.

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	1
Cobble	2
Gravel	30
Litter (duff)	16

Species	% Cover
	0
Apocynum cannabinum	1
Baccharis emoryi	1
Baccharis salicifolia	1
Bromus rubens	3
Encelia farinosa	1
Lactuca serriola	9
Mimulus cardinalis	26
Phragmites australis	14
Polypogon monspeliensis	2
Salix exigua	19
Salix gooddingii	7
Sonchus asper	2
Tamarix ramosissima	19

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Sand	1	4	1	3	2
Coarse woody debris	12	0	5	3	2
Gravel	62	70	56	65	49
Cobble	5	20	11	8	14
Stone	5	3	1	3	2
Woody debris structure	5	0	0	0	0
Boulder	5	0	0	0	0
Litter (duff)	5	3	26	18	31

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S	<1%	S	<1%	S	<1%	S	<1%	S
Adiantum capillus-veneris	<0%		<0%		<0%		<1%		<0%	
Apocynum cannabinum	<0%		<0%		<0%		<1%		5-10%	
Baccharis emoryi	<0%		<0%		<0%		1-5%		1-5%	
Baccharis sergiloides	<0%		<0%		<0%		1-5%		<0%	
Bromus rubens	<1%		1-5%		<1%		<1%		<1%	

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 3 Transect Type: Tamarisk Control

Bromus spp.	<0%		<0%		<1%		<0%	<0%	
Camissonia walkeri	<0%		<1%		<1%		1-5%	<1%	
Cirsium mohavense	1-5%		<0%		<0%		1-5%	1-5%	
Conyza canadensis	<0%		<1%		<1%		<1%	<1%	
Cryptantha spp.	<0%		<1%		<1%		<1%	<1%	
Encelia farinosa	<0%		<0%		<1%		1-5%	<0%	
Erigeron lobatus	<0%		<0%		<0%		<1%	<0%	
Funastrum cynanchoides	1-5%		<0%		<0%		<0%	<0%	
Hedeoma nana	<0%		<1%		<0%		<0%	<0%	
Heliomeris multiflora	<0%		<0%		<0%		1-5%	<0%	
Lactuca serriola	<1%		1-5%		1-5%		1-5%	1-5%	
Lepidium lasiocarpum var. lasiocarpum	<0%		<0%		<1%		<0%	<1%	
Mimulus cardinalis	25-50%		5-10%		10-25%		<1%	1-5%	
Muhlenbergia porteri	<0%		<0%		<1%		<0%	<0%	
Nicotiana obtusifolia var. obtusifolia	<0%		1-5%		1-5%		1-5%	<0%	
Parietaria hespera	<1%		<1%		<1%		<0%	<1%	
Perityle emoryi	<0%		<1%		<0%		<0%	<0%	
Phragmites australis	<0%		1-5%		10-25%		10-25%	25-50%	
Poa bigelovii	<0%		<0%		<1%		<0%	<0%	
Polypogon monspeliensis	<1%		1-5%		<1%		<1%	<1%	
Polypogon viridis	<0%		<1%		<0%		<0%	<0%	
Salix exigua	10-25%		5-10%		5-10%		5-10%	<0%	
Salix gooddingii	1-5%	P	1-5%	P	1-5%	P	1-5% S+P	<1%	S
Silene antirrhina	<0%		<1%		<1%		<0%	<0%	
Sonchus asper	1-5%		1-5%		<1%		<1%	<1%	
Sporobolus cryptandrus	<0%		<1%		<0%		<0%	<0%	
Sporobolus spp.	<0%		<0%		<0%		<1%	<0%	
Tamarix ramosissima	1-5%	S	5-10%	S+P	5-10%	S+P	<1% S	1-5%	S
Viguiera dentata	<0%		<0%		<0%		1-5%	<0%	
Vulpia octoflora	<0%		<1%		<1%		<1%	<1%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Mimulus cardinalis	9		
25	Mimulus cardinalis	3		
35	Lactuca serriola	2		
35	Phragmites australis	5		
45	Baccharis emoryi	1		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Mimulus cardinalis	8		

15	Bromus rubens	1	
15	Mimulus cardinalis	1	
15	Sonchus asper	1	
15	Vacant Space	9	
25	Mimulus cardinalis	8	
35	Lactuca serriola	2	
35	Phragmites australis	8	3
35	Vacant Space	1	
45	Baccharis emoryi	2	
45	Lactuca serriola	1	
45	Vacant Space	7	

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	9.14	155	9.08	144	9.1	145	9.11	148
15	9.23	98	9.24	99	9.21	108	9.23	102
25	9.24	434	9.29	444	9.27	455	9.27	444
35	8.97	3602	9.01	3550	9.03	3596	9.00	3583
45	8.93	3999	8.94	3999	8.95	3999	8.94	3999

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 3 Transect Type: Tamarisk Control

Date: 4/25/2008 Revisit? ☑ Post-tamarisk removal

Recorder: Akasha Faist Reader: Amy Prince

Wind Speed: 1.0 Air Temp (F): 79.0 Cloud Cover: 0

Weather:

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	1
Coarse woody debris	3
Cobble	2
Gravel	27
Litter (duff)	49
Plant	7
Sand	7
Stone	4

Species	% Cover
Baccharis salicifolia	7
Bebbia juncea var. aspera	1
Brickellia longifolia	7
Bromus diandrus	1
Bromus rubens	2
Cirsium mohavense	27
Conyza canadensis	8
Datura wrightii	1
Lactuca serriola	1
Maurandella antirrhiniflora	3
Mimulus cardinalis	61
Muhlenbergia thurberi	1
Nicotiana obtusifolia	1
Phragmites australis	3
Salix exigua	5
Salix gooddingii	14
Tamarix ramosissima	1

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Basal Veg	4	3	2	2	2
Woody debris structure	11	0	0	0	0
Coarse woody debris	9	0	0	0	0
Litter (duff)	59	46	46	23	36
Boulder	0	1	0	0	0
Stone	0	9	3	9	16
Cobble	4	6	5	13	13
Gravel	11	19	35	39	13
Sand	2	16	9	14	19

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<0%		<0%		<0%		<1%	P	<0%	
Apocynum cannabinum	<0%		<0%		<0%		<0%		1-5%	

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 3 Transect Type: Tamarisk Control

Baccharis emoryi	<0%	<0%	<0%		<0%	<1%	
Baccharis salicifolia	1-5%	1-5%	<0%		1-5%	1-5%	
Baccharis salicifolia	<0%	<0%	<0%		1-5%	<0%	
Bebbia juncea var. aspera	<0%	<0%	<0%		<0%	<1%	
Brickellia longifolia	<0%	<0%	<1%		<1%	5-10%	
Bromus diandrus	<0%	<0%	<0%		<1%	<1%	
Bromus rubens	<0%	<0%	<1%		<1%	<1%	
Camissonia multijuga	<0%	<0%	<0%		<1%	<0%	
Cirsium mohavense	<1%	10-25%	5-10%		5-10%	5-10%	
Conyza canadensis	<0%	<1%	1-5%		1-5%	<1%	
Datura wrightii	<0%	<0%	<0%		<0%	<1%	
Isocoma acradenia	<0%	<0%	<0%		1-5%	<0%	
Lactuca serriola	<0%	<0%	<1%		<0%	1-5%	
Maurandella antirrhiniflora	<1%	<0%	<0%		<0%	5-10%	
Mimulus cardinalis	50-75%	25-50%	25-50%		10-25%	5-10%	
Muhlenbergia thurberi	<0%	<0%	<0%		<1%	<1%	
Nicotiana obtusifolia	<0%	<0%	<0%		<1%	<1%	
Phragmites australis	<0%	<1%	1-5%		1-5%	<0%	
Polypogon monspeliensis	<0%	<1%	<0%		<1%	<1%	
Polypogon viridis	<0%	<0%	<0%		<1%	<0%	
Salix exigua	10-25%	5-10%	5-10%		1-5%	<0%	
Salix gooddingii	10-25%	<0%	<0%		<1%	25-50%	
Sarcostemma cynanchoides var. hartwegii	<1%	<0%	<0%		<0%	<0%	
Tamarix ramosissima	<0%	<0%	<1%	S+P	<0%	<1%	S+P
Viguiera dentata	<0%	<0%	<0%		1-5%	<0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Maurandella antirrhiniflora	1		
5	Mimulus cardinalis	9		
5	Salix gooddingii	0		
5	Vacant Space	0		
15	Cirsium mohavense	1	1	
25	Cirsium mohavense	8		
25	Mimulus cardinalis	2		
25	Vacant Space	2		
35	Mimulus cardinalis	8		
45	Bromus rubens	2		
45	Salix gooddingii	0	3	5

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 3 Transect Type: Tamarisk Control

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Maurandella antirrhiniflora	7		
5	Mimulus cardinalis	10		
5	Salix gooddingii		4	3
15	Cirsium mohavense	5	4	
25	Cirsium mohavense	8		
25	Mimulus cardinalis	3		
25	Vacant Space	2		
35	Baccharis salicifolia	4		
35	Mimulus cardinalis	10		
35	Salix exigua	2		
35	Vacant Space	0		
45	Bromus rubens	2		
45	Cirsium mohavense	6		
45	Salix gooddingii		3	7
45	Vacant Space	3		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.09	211	8.15	220	8.13	216	8.12	216
15	8.51	217	8.51	219	8.46	218	8.49	218
25	8.19	258	5.14	256	8.13	248	7.15	254
35	8.14	416	8.17	416	8.15	410	8.15	414
45	8.7	498	8.67	504	8.69	504	8.69	502

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 3 Transect Type: Tamarisk Control

Date: 5/17/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Steve Till Reader: Kate Watters

Wind Speed: 2.0 Air Temp (F): 88.0 Cloud Cover: 15

Weather: Scattered clouds, upper 80's.

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	1
Cobble	2
Gravel	30
Litter (duff)	16

Species	% Cover
	0
Apocynum cannabinum	1
Baccharis emoryi	1
Baccharis salicifolia	1
Bromus rubens	3
Encelia farinosa	1
Lactuca serriola	9
Mimulus cardinalis	26
Phragmites australis	14
Polypogon monspeliensis	2
Salix exigua	19
Salix gooddingii	7
Sonchus asper	2
Tamarix ramosissima	19

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Sand	1	4	1	3	2
Coarse woody debris	12	0	5	3	2
Gravel	62	70	56	65	49
Cobble	5	20	11	8	14
Stone	5	3	1	3	2
Woody debris structure	5	0	0	0	0
Boulder	5	0	0	0	0
Litter (duff)	5	3	26	18	31

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	S	<1%	S	<1%	S	<1%	S	<1%	S
Adiantum capillus-veneris	<0%		<0%		<0%		<1%		<0%	
Apocynum cannabinum	<0%		<0%		<0%		<1%		5-10%	
Baccharis emoryi	<0%		<0%		<0%		1-5%		1-5%	
Baccharis sergiloides	<0%		<0%		<0%		1-5%		<0%	
Bromus rubens	<1%		1-5%		<1%		<1%		<1%	

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 3 Transect Type: Tamarisk Control

Bromus spp.	<0%		<0%		<1%		<0%	<0%	
Camissonia walkeri	<0%		<1%		<1%		1-5%	<1%	
Cirsium mohavense	1-5%		<0%		<0%		1-5%	1-5%	
Conyza canadensis	<0%		<1%		<1%		<1%	<1%	
Cryptantha spp.	<0%		<1%		<1%		<1%	<1%	
Encelia farinosa	<0%		<0%		<1%		1-5%	<0%	
Erigeron lobatus	<0%		<0%		<0%		<1%	<0%	
Funastrum cynanchoides	1-5%		<0%		<0%		<0%	<0%	
Hedeoma nana	<0%		<1%		<0%		<0%	<0%	
Heliomeris multiflora	<0%		<0%		<0%		1-5%	<0%	
Lactuca serriola	<1%		1-5%		1-5%		1-5%	1-5%	
Lepidium lasiocarpum var. lasiocarpum	<0%		<0%		<1%		<0%	<1%	
Mimulus cardinalis	25-50%		5-10%		10-25%		<1%	1-5%	
Muhlenbergia porteri	<0%		<0%		<1%		<0%	<0%	
Nicotiana obtusifolia var. obtusifolia	<0%		1-5%		1-5%		1-5%	<0%	
Parietaria hespera	<1%		<1%		<1%		<0%	<1%	
Perityle emoryi	<0%		<1%		<0%		<0%	<0%	
Phragmites australis	<0%		1-5%		10-25%		10-25%	25-50%	
Poa bigelovii	<0%		<0%		<1%		<0%	<0%	
Polypogon monspeliensis	<1%		1-5%		<1%		<1%	<1%	
Polypogon viridis	<0%		<1%		<0%		<0%	<0%	
Salix exigua	10-25%		5-10%		5-10%		5-10%	<0%	
Salix gooddingii	1-5%	P	1-5%	P	1-5%	P	1-5% S+P	<1%	S
Silene antirrhina	<0%		<1%		<1%		<0%	<0%	
Sonchus asper	1-5%		1-5%		<1%		<1%	<1%	
Sporobolus cryptandrus	<0%		<1%		<0%		<0%	<0%	
Sporobolus spp.	<0%		<0%		<0%		<1%	<0%	
Tamarix ramosissima	1-5%	S	5-10%	S+P	5-10%	S+P	<1% S	1-5%	S
Viguiera dentata	<0%		<0%		<0%		1-5%	<0%	
Vulpia octoflora	<0%		<1%		<1%		<1%	<1%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Mimulus cardinalis	9		
25	Mimulus cardinalis	3		
35	Lactuca serriola	2		
35	Phragmites australis	5		
45	Baccharis emoryi	1		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Mimulus cardinalis	8		

15	Bromus rubens	1	
15	Mimulus cardinalis	1	
15	Sonchus asper	1	
15	Vacant Space	9	
25	Mimulus cardinalis	8	
35	Lactuca serriola	2	
35	Phragmites australis	8	3
35	Vacant Space	1	
45	Baccharis emoryi	2	
45	Lactuca serriola	1	
45	Vacant Space	7	

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	9.14	155	9.08	144	9.1	145	9.11	148
15	9.23	98	9.24	99	9.21	108	9.23	102
25	9.24	434	9.29	444	9.27	455	9.27	444
35	8.97	3602	9.01	3550	9.03	3596	9.00	3583
45	8.93	3999	8.94	3999	8.95	3999	8.94	3999

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 3 Transect Type: Tamarisk Control

Date: 4/25/2008 Revisit? ☑ Post-tamarisk removal

Recorder: Akasha Faist Reader: Amy Prince

Wind Speed: 1.0 Air Temp (F): 79.0 Cloud Cover: 0

Weather:

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	1
Coarse woody debris	3
Cobble	2
Gravel	27
Litter (duff)	49
Plant	7
Sand	7
Stone	4

Species	% Cover
Baccharis salicifolia	7
Bebbia juncea var. aspera	1
Brickellia longifolia	7
Bromus diandrus	1
Bromus rubens	2
Cirsium mohavense	27
Conyza canadensis	8
Datura wrightii	1
Lactuca serriola	1
Maurandella antirrhiniflora	3
Mimulus cardinalis	61
Muhlenbergia thurberi	1
Nicotiana obtusifolia	1
Phragmites australis	3
Salix exigua	5
Salix gooddingii	14
Tamarix ramosissima	1

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Basal Veg	4	3	2	2	2
Woody debris structure	11	0	0	0	0
Coarse woody debris	9	0	0	0	0
Litter (duff)	59	46	46	23	36
Boulder	0	1	0	0	0
Stone	0	9	3	9	16
Cobble	4	6	5	13	13
Gravel	11	19	35	39	13
Sand	2	16	9	14	19

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<0%		<0%		<0%		<1%	P	<0%	
Apocynum cannabinum	<0%		<0%		<0%		<0%		1-5%	

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 3 Transect Type: Tamarisk Control

Baccharis emoryi	<0%	<0%	<0%		<0%	<1%	
Baccharis salicifolia	1-5%	1-5%	<0%		1-5%	1-5%	
Baccharis salicifolia	<0%	<0%	<0%		1-5%	<0%	
Bebbia juncea var. aspera	<0%	<0%	<0%		<0%	<1%	
Brickellia longifolia	<0%	<0%	<1%		<1%	5-10%	
Bromus diandrus	<0%	<0%	<0%		<1%	<1%	
Bromus rubens	<0%	<0%	<1%		<1%	<1%	
Camissonia multijuga	<0%	<0%	<0%		<1%	<0%	
Cirsium mohavense	<1%	10-25%	5-10%		5-10%	5-10%	
Conyza canadensis	<0%	<1%	1-5%		1-5%	<1%	
Datura wrightii	<0%	<0%	<0%		<0%	<1%	
Isocoma acradenia	<0%	<0%	<0%		1-5%	<0%	
Lactuca serriola	<0%	<0%	<1%		<0%	1-5%	
Maurandella antirrhiniflora	<1%	<0%	<0%		<0%	5-10%	
Mimulus cardinalis	50-75%	25-50%	25-50%		10-25%	5-10%	
Muhlenbergia thurberi	<0%	<0%	<0%		<1%	<1%	
Nicotiana obtusifolia	<0%	<0%	<0%		<1%	<1%	
Phragmites australis	<0%	<1%	1-5%		1-5%	<0%	
Polypogon monspeliensis	<0%	<1%	<0%		<1%	<1%	
Polypogon viridis	<0%	<0%	<0%		<1%	<0%	
Salix exigua	10-25%	5-10%	5-10%		1-5%	<0%	
Salix gooddingii	10-25%	<0%	<0%		<1%	25-50%	
Sarcostemma cynanchoides var. hartwegii	<1%	<0%	<0%		<0%	<0%	
Tamarix ramosissima	<0%	<0%	<1%	S+P	<0%	<1%	S+P
Viguiera dentata	<0%	<0%	<0%		1-5%	<0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Maurandella antirrhiniflora	1		
5	Mimulus cardinalis	9		
5	Salix gooddingii	0		
5	Vacant Space	0		
15	Cirsium mohavense	1	1	
25	Cirsium mohavense	8		
25	Mimulus cardinalis	2		
25	Vacant Space	2		
35	Mimulus cardinalis	8		
45	Bromus rubens	2		
45	Salix gooddingii	0	3	5

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L Project (Phase): Phase IIb

Transect Name: Three Springs 3 Transect Type: Tamarisk Control

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Maurandella antirrhiniflora	7		
5	Mimulus cardinalis	10		
5	Salix gooddingii		4	3
15	Cirsium mohavense	5	4	
25	Cirsium mohavense	8		
25	Mimulus cardinalis	3		
25	Vacant Space	2		
35	Baccharis salicifolia	4		
35	Mimulus cardinalis	10		
35	Salix exigua	2		
35	Vacant Space	0		
45	Bromus rubens	2		
45	Cirsium mohavense	6		
45	Salix gooddingii		3	7
45	Vacant Space	3		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.09	211	8.15	220	8.13	216	8.12	216
15	8.51	217	8.51	219	8.46	218	8.49	218
25	8.19	258	5.14	256	8.13	248	7.15	254
35	8.14	416	8.17	416	8.15	410	8.15	414
45	8.7	498	8.67	504	8.69	504	8.69	502

Park Area/Canyon: Topaz Canyon River mile: 96.7 L Project (Phase): Phase IIb

Transect Name: Topaz Canyon 1 Transect Type: Tamarisk Area

	Start point		End point
Easting:	387717	Easting:	387766
Northing:	3996876	Northing:	3996873
GPS accuracy (m):	2.1	GPS accuracy (m):	2.9
Elevation (m):	847	Elevation (m):	848
Bearing:	60		
Aspect (0-360):	60	Slope (degrees):	3

Transect description: About 500m up Topaz Canyon from the Topaz Boucher confluence. Just below the Tapeats narrows.

Additional Info:: A couple of prominent tapeats boulders stick out of and overhang the dry creekbed near the transect start point. A small amount of water flows for about 50m starting near the lower portion of the transect. The water sample (standing pool) taken for Topaz T1A was 2m away from the tape at the 23m mark.

Geological layer: Schist, covered by Tapeats boulders and debris.

Habitat type: Riparian Mojave desert scrub

Dominant species: Isocoma acradenia (Greene) Greene, Tamarix ramosissima Ledeb.

Associated species: Acacia greggii Gray, Aristida purpurea Nutt., Baccharis emoryi Gray, Bromus rubens L., Encelia farinosa Gray ex Torr., Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Yucca angustissima Engelm. ex Trel.

Surface water within 25m? ☑ Surface water type: seep

Landform: Drainage channel Surface rocks: schist

Soil type: sand Topo position: Low Slope

Light exposure: open Soil moisture: dry

Park Area/Canyon: Topaz Canyon River mile: 96.7 L Project (Phase): Phase IIb

Transect Name: Topaz Canyon 1 Transect Type: Tamarisk Area

Date: 4/23/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Kelly Williams Reader: Steve Till

Wind Speed: 2.0 Air Temp (F): 85.0 Cloud Cover: 20

Weather: Blue skies with a slight breeze, 80's. The clouds rolled in at noon. A slight sprinkle followed.

Point Intercept Transect (50m)

Ground Cover	% Cover
Bare Soil	1
Boulder	22
Cobble	10
Gravel	11
Litter (duff)	26
Sand	9
Stone	18
Woody debris structure	2

Species	% Cover
Isocoma acradenia	20
Moss spp.	1
Muhlenbergia asperifolia	7
Tamarix ramosissima	32

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Moss (ground)	0	0	0	5	4
Coarse woody debris	2	0	3	4	3
Boulder	14	33	15	4	38
Cobble	29	33	6	9	20
Stone	29	6	32	20	20
Gravel	6	16	6	8	8
Sand	6	6	6	4	3
Litter (duff)	14	6	32	40	20
Bare Soil	0	0	0	3	1
Crypto	0	0	0	4	0

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<0%		<0%		<1%	S	<0%		<0%	
Bromus rubens	<0%		<0%		<0%		<0%		<1%	
Isocoma acradenia	10-25%		5-10%		10-25%		25-50%		10-25%	
Muhlenbergia asperifolia	<0%		<0%		<0%		<0%		5-10%	
Rhus trilobata var. simplicifolia	<0%		<0%		<0%		1-5%		<0%	
Tamarix ramosissima	25-50%	M	10-25%	P+M	25-50%	S+P+M	10-25%	M	5-10%	P+M

Vegetation Structure Data - Old

Park Area/Canyon: Topaz Canyon River mile: 96.7 L Project (Phase): Phase IIb

Transect Name: Topaz Canyon 1 Transect Type: Tamarisk Area

Point	Species	<1m	1-2m	2-3m
5	Tamarix ramosissima	3	2	
15	Isocoma acradenia	7		
15	Tamarix ramosissima	2	2	
25	Isocoma acradenia	1		
25	Tamarix ramosissima	8		
35	Isocoma acradenia	9		
45	Muhlenbergia asperifolia	3		

Vegetation Structure Data - New

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.39	637	8.81	609	8.84	735	8.68	660
15	8.91	2181	9	2317	9.03	2308	8.98	2269
25	8.69	3485	8.54	3412	8.53	3618	8.59	3505
35	9.02	1532	8.08	1539	8.03	1704	8.38	1592
45	8	715	8.08	720	8.19	713	8.09	716

Park Area/Canyon: Topaz Canyon River mile: 96.7 L Project (Phase): Phase IIb

Transect Name: Topaz Canyon 1 Transect Type: Tamarisk Area

Date: 4/14/2008 Revisit? ☑ Post-tamarisk removal

Recorder: Akasha Faist Reader: Lori Makarick

Wind Speed: 2.0 Air Temp (F): 89.0 Cloud Cover: 0

Weather:

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	1
Boulder	17
Cobble	16
Gravel	28
Litter (duff)	14
Sand	17
Stone	7

Species	% Cover
Isocoma acradenia	11
Muhlenbergia asperifolia	3
Tamarix ramosissima	7

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Lichen	0	0	0	1	0
Moss (ground)	0	0	0	3	2
Crypto	0	0	0	2	2
Basal Veg	1	1	1	1	1
Woody debris structure	0	0	0	0	4
Coarse woody debris	1	1	0	3	2
Litter (duff)	2	2	2	8	12
Boulder	12	27	9	2	30
Stone	18	8	40	20	7
Cobble	33	12	15	25	16
Gravel	33	41	27	26	30
Sand	10	8	7	9	4

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Agoseris Spp	<0%		<0%		<0%		<0%		<0%	
Aristida purpurea	<0%		<1%		<0%		<0%		<0%	
Bromus rubens	<0%		<0%		<0%		<1%		1-5%	
Cryptantha spp.	<1%		<0%		<0%		<1%		<1%	
Erioneuron pilosum	<0%		<0%		<0%		<0%		<1%	
Hesperostipa comata	<1%		<0%		<0%		<0%		<0%	
Isocoma acradenia	<1%		1-5%		<1%		25-50%		10-25%	
Lepidium lasiocarpum	<0%		<0%		<0%		<1%		<1%	
Lepidium lasiocarpum	<0%		<0%		<0%		<0%		<1%	
Muhlenbergia asperifolia	<0%		<0%		<0%		<0%		1-5%	

Park Area/Canyon: Topaz Canyon River mile: 96.7 L Project (Phase): Phase IIb

Transect Name: Topaz Canyon 1 Transect Type: Tamarisk Area

Parietaria hespera	<0%	<0%		<0%		<0%		<1%	
Pleuraphis jamesii	<0%	<0%		<0%		<1%		<0%	
Poa spp.	<0%	<0%		<0%		<1%		<1%	
Sporobolus cryptandrus	<0%	<0%		<0%		<0%		<1%	
Tamarix ramosissima	<0%	<1%	P	1-5%	S+P	<1%	S+P	<1%	M
Tridens muticus	<0%	<1%		<0%		<0%		<0%	
Vulpia octoflora	<0%	<0%		<0%		<1%		<0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
45	Isocoma acradenia	9		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
45	Isocoma acradenia	7		
45	Muhlenbergia asperifolia	2		
45	Vacant Space	3		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	7.78	586	7.77	573	7.78	584	7.78	581
15	8.39	827	8.68	831	8.7	820	8.59	826
25	9.63	434	9.81	456	9.67	459	9.70	450
35	9.45	1462	9.97	1384	10.16	1560	9.86	1469
45	10.51	414	10.59	366	10.54	377	10.55	386

Park Area/Canyon: Topaz Canyon River mile: 96.7 L Project (Phase): Phase IIb

Transect Name: Topaz Canyon 1 Transect Type: Tamarisk Area

Date: 4/23/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Kelly Williams Reader: Steve Till

Wind Speed: 2.0 Air Temp (F): 85.0 Cloud Cover: 20

Weather: Blue skies with a slight breeze, 80's. The clouds rolled in at noon. A slight sprinkle followed.

Point Intercept Transect (50m)

Ground Cover	% Cover
Bare Soil	1
Boulder	22
Cobble	10
Gravel	11
Litter (duff)	26
Sand	9
Stone	18
Woody debris structure	2

Species	% Cover
Isocoma acradenia	20
Moss spp.	1
Muhlenbergia asperifolia	7
Tamarix ramosissima	32

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Moss (ground)	0	0	0	5	4
Coarse woody debris	2	0	3	4	3
Boulder	14	33	15	4	38
Cobble	29	33	6	9	20
Stone	29	6	32	20	20
Gravel	6	16	6	8	8
Sand	6	6	6	4	3
Litter (duff)	14	6	32	40	20
Bare Soil	0	0	0	3	1
Crypto	0	0	0	4	0

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<0%		<0%		<1%	S	<0%		<0%	
Bromus rubens	<0%		<0%		<0%		<0%		<1%	
Isocoma acradenia	10-25%		5-10%		10-25%		25-50%		10-25%	
Muhlenbergia asperifolia	<0%		<0%		<0%		<0%		5-10%	
Rhus trilobata var. simplicifolia	<0%		<0%		<0%		1-5%		<0%	
Tamarix ramosissima	25-50%	M	10-25%	P+M	25-50%	S+P+M	10-25%	M	5-10%	P+M

Vegetation Structure Data - Old

Park Area/Canyon: Topaz Canyon River mile: 96.7 L Project (Phase): Phase IIb

Transect Name: Topaz Canyon 1 Transect Type: Tamarisk Area

Point	Species	<1m	1-2m	2-3m
5	Tamarix ramosissima	3	2	
15	Isocoma acradenia	7		
15	Tamarix ramosissima	2	2	
25	Isocoma acradenia	1		
25	Tamarix ramosissima	8		
35	Isocoma acradenia	9		
45	Muhlenbergia asperifolia	3		

Vegetation Structure Data - New

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.39	637	8.81	609	8.84	735	8.68	660
15	8.91	2181	9	2317	9.03	2308	8.98	2269
25	8.69	3485	8.54	3412	8.53	3618	8.59	3505
35	9.02	1532	8.08	1539	8.03	1704	8.38	1592
45	8	715	8.08	720	8.19	713	8.09	716

Park Area/Canyon: Topaz Canyon River mile: 96.7 L Project (Phase): Phase IIb

Transect Name: Topaz Canyon 1 Transect Type: Tamarisk Area

Date: 4/14/2008 Revisit? ☑ Post-tamarisk removal

Recorder: Akasha Faist Reader: Lori Makarick

Wind Speed: 2.0 Air Temp (F): 89.0 Cloud Cover: 0

Weather:

Point Intercept Transect (50m)

Ground Cover	% Cover
Bedrock	1
Boulder	17
Cobble	16
Gravel	28
Litter (duff)	14
Sand	17
Stone	7

Species	% Cover
Isocoma acradenia	11
Muhlenbergia asperifolia	3
Tamarix ramosissima	7

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Lichen	0	0	0	1	0
Moss (ground)	0	0	0	3	2
Crypto	0	0	0	2	2
Basal Veg	1	1	1	1	1
Woody debris structure	0	0	0	0	4
Coarse woody debris	1	1	0	3	2
Litter (duff)	2	2	2	8	12
Boulder	12	27	9	2	30
Stone	18	8	40	20	7
Cobble	33	12	15	25	16
Gravel	33	41	27	26	30
Sand	10	8	7	9	4

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Agoseris Spp	<0%		<0%		<0%		<0%		<0%	
Aristida purpurea	<0%		<1%		<0%		<0%		<0%	
Bromus rubens	<0%		<0%		<0%		<1%		1-5%	
Cryptantha spp.	<1%		<0%		<0%		<1%		<1%	
Erioneuron pilosum	<0%		<0%		<0%		<0%		<1%	
Hesperostipa comata	<1%		<0%		<0%		<0%		<0%	
Isocoma acradenia	<1%		1-5%		<1%		25-50%		10-25%	
Lepidium lasiocarpum	<0%		<0%		<0%		<1%		<1%	
Lepidium lasiocarpum	<0%		<0%		<0%		<0%		<1%	
Muhlenbergia asperifolia	<0%		<0%		<0%		<0%		1-5%	

Parietaria hespera	<0%	<0%		<0%		<0%		<1%	
Pleuraphis jamesii	<0%	<0%		<0%		<1%		<0%	
Poa spp.	<0%	<0%		<0%		<1%		<1%	
Sporobolus cryptandrus	<0%	<0%		<0%		<0%		<1%	
Tamarix ramosissima	<0%	<1%	P	1-5%	S+P	<1%	S+P	<1%	M
Tridens muticus	<0%	<1%		<0%		<0%		<0%	
Vulpia octoflora	<0%	<0%		<0%		<1%		<0%	

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
45	Isocoma acradenia	9		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
45	Isocoma acradenia	7		
45	Muhlenbergia asperifolia	2		
45	Vacant Space	3		

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	7.78	586	7.77	573	7.78	584	7.78	581
15	8.39	827	8.68	831	8.7	820	8.59	826
25	9.63	434	9.81	456	9.67	459	9.70	450
35	9.45	1462	9.97	1384	10.16	1560	9.86	1469
45	10.51	414	10.59	366	10.54	377	10.55	386

Park Area/Canyon: Topaz Canyon River mile: 96.7 L Project (Phase): Phase IIb

Transect Name: Topaz Canyon 1 Transect Type: Tamarisk Control

	Start point		End point
Easting:	387785	Easting:	387830
Northing:	3996854	Northing:	3996874
GPS accuracy (m):	1.2	GPS accuracy (m):	3.5
Elevation (m):	845	Elevation (m):	840
Bearing:	68		
Aspect (0-360):	72	Slope (degrees):	3

Transect description: Transect starts about 400m up from the Topaz/Boucher confluence. The start point is a large 4x4x2m limestone boulder on creek right, only 20m downstream of the end of Topaz T1A. The endpoint is perpendicular to a small 2m pouroff of schist bedrock that is in the creek bottom 10m away.

Additional Info::

Geological layer: schist

Habitat type: Riparian

Dominant species: Aristida purpurea Nutt., Brickellia longifolia S. Wats., Isocoma acradenia (Greene) Greene

Associated species: Acacia greggii Gray, Agave Utahensis var. utahensis, Baccharis emoryi Gray, Baccharis sergiloides Gray, Bromus rubens L., Encelia farinosa Gray ex Torr., Ephedra fasciculata A. Nels., Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird, Galium aparine L., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Oenothera caespitosa Nutt., Opuntia chlorotica Engelm. & Bigelow, Phacelia spp., Plantago patagonica Jacq., Porophyllum gracile Benth., Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb., Stephanomeria pauciflora (Torr.) A. Nels., Thamnosma montana Torr. & Frém., Thymophylla pentachaeta (DC.) Small

Surface water within 25m? ☐ Surface water type:

Landform: Drainage channel Surface rocks: schist limestone

Soil type: sand Topo position: Unknown

Light exposure: open Soil moisture: dry

Park Area/Canyon: Topaz Canyon River mile: 96.7 L Project (Phase): Phase IIb

Transect Name: Topaz Canyon 1 Transect Type: Tamarisk Control

Date: 4/23/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Steve Till Reader: Kari Malen

Wind Speed: 5.0 Air Temp (F): 82.0 Cloud Cover: 15

Weather: Windy gusts, partly cloudy skies

Point Intercept Transect (50m)

Ground Cover	% Cover
Bare Soil	1
Boulder	17
Coarse woody debris	1
Cobble	9
Gravel	6
Litter (duff)	31
Sand	19
Stone	16

Species	% Cover
Aristida purpurea	1
Brickellia longifolia	10
Bromus rubens	3
Cryptobiotic soil	2
Ephedra fasciculata	2
Gutierrezia sarothrae	5
Isocoma acradenia	28
Moss spp.	1
Stephanomeria pauciflora	2

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Moss (ground)	3	3	1	1	1
Crypto	1	0	1	3	8
Litter (duff)	8	8	9	3	24
Bare Soil	1	1	1	1	1
Boulder	8	19	44	9	5
Cobble	18	19	9	19	5
Stone	19	38	9	20	24
Gravel	40	3	4	40	5
Sand	1	8	21	3	22
Coarse woody debris	1	1	1	1	5

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	P	<0%		<0%		<0%		<1%	S
Aristida purpurea	10-25%		<1%		1-5%		<1%		1-5%	
Baccharis sergiloides	1-5%		<0%		<0%		<0%		<0%	
Brickellia longifolia	1-5%		5-10%		5-10%		<1%		1-5%	
Bromus rubens	<1%		<1%		1-5%		<1%		1-5%	
Ephedra fasciculata	1-5%		<1%		<1%		<0%		<0%	
Ericameria nauseosa	<0%		<0%		<0%		1-5%		<0%	
Galium aparine	<0%		<0%		<1%		<0%		<0%	
Gutierrezia sarothrae	5-10%		1-5%		<0%		1-5%		1-5%	

Hesperostipa comata ssp. comata	<0%	<0%	<1%	<0%	<0%
Isocoma acradenia	10-25%	5-10%	10-25%	5-10%	10-25%
Oenothera caespitosa	<0%	<0%	<0%	<0%	<1%
Opuntia chlorotica	<0%	<0%	<0%	<0%	<1%
Porophyllum gracile	<1%	<0%	<0%	<0%	<0%
Sphaeralcea grossulariifolia	<0%	<0%	<0%	<1%	<0%
Stephanomeria pauciflora	1-5%	<0%	<1%	<1%	<0%
Thamnosma montana	<0%	<0%	<0%	<0%	<1%
Thymophylla pentachaeta	1-5%	<0%	<0%	<1%	<0%
Vulpia octoflora	<0%	<0%	<0%	<1%	<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Acacia greggii	2		
5	Bromus rubens	1		
5	Isocoma acradenia	7		
15	Brickellia longifolia	8		
35	Isocoma acradenia	3		
45	Isocoma acradenia	8		

Vegetation Structure Data - New

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.18	144	8.24	168	8.1	172	8.17	161
15	8.78	380	8.79	385	8.8	386	8.79	384
25	8.73	54	8.84	55	8.84	56	8.80	55
35	8.13	319	8.09	375	8.16	415	8.13	370
45	8.34	58	8.56	69	8.58	64	8.49	64

Park Area/Canyon: Topaz Canyon River mile: 96.7 L Project (Phase): Phase IIb

Transect Name: Topaz Canyon 1 Transect Type: Tamarisk Control

Date: 4/14/2008 Revisit? ☑ Post-tamarisk removal

Recorder: Akasha Faist Reader: Lori Makarick

Wind Speed: 1.0 Air Temp (F): 80.0 Cloud Cover: 0

Weather:

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	17
Cobble	12
Gravel	10
Litter (duff)	26
Plant	3
Sand	18
Stone	14

Species	% Cover
Acacia greggii	1
Aristida purpurea	6
Brickellia longifolia	12
Bromus rubens	3
Cryptobiotic soil	3
Ephedra fasciculata	2
Gutierrezia sarothrae	4
Isocoma acradenia	35
Lepidium lasiocarpum	1
Moss spp.	3
Silene spp.	1
Stephanomeria pauciflora	2

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Lichen	2	0	0	0	0
Moss (ground)	12	7	5	6	3
Crypto	7	0	0	2	6
Basal Veg	1	1	1	7	1
Woody debris structure	0	0	1	0	0
Coarse woody debris	1	0	1	0	1
Litter (duff)	10	4	10	9	25
Boulder	11	29	0	28	8
Stone	14	23	18	12	13
Cobble	9	19	9	22	15
Gravel	30	17	13	18	6
Sand	2	9	8	11	22

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<0%		<0%		<0%		<1%	S	<0%	
Allium SPP	<0%		<1%		<0%		<0%		<0%	
Aristida purpurea	5-10%		1-5%		1-5%		<1%		<1%	
Astragalus spp.	<0%		<1%		<1%		<0%		<0%	
Baccharis sergiloides	1-5%		<1%		<0%		<0%		<0%	

Park Area/Canyon: Topaz Canyon River mile: 96.7 L Project (Phase): Phase IIb

Transect Name: Topaz Canyon 1 Transect Type: Tamarisk Control

Bouteloua eriopoda	<1%	<0%	<0%	<0%	<0%
Brickellia longifolia	1-5%	5-10%	5-10%	75-100%	1-5%
Bromus rubens	1-5%	1-5%	1-5%	<1%	<1%
Camissonia walkeri	<0%	<0%	<1%	<1%	<0%
Cryptantha spp.	<1%	<1%	<0%	<1%	<1%
Delphinium spp.	<0%	<1%	<0%	<0%	<0%
Draba cuneifolia	<0%	<0%	<1%	<0%	<0%
Ephedra fasciculata	1-5%	1-5%	<1%	<0%	<0%
Ericameria nauseosa	<0%	<0%	<0%	1-5%	<0%
Eriogonum spp.	<0%	<0%	<0%	<1%	<0%
Erodium cicutarium	<1%	<1%	<0%	<0%	<1%
Gilia spp.	<1%	<1%	<0%	<1%	<1%
Gutierrezia sarothrae	1-5%	1-5%	1-5%	1-5%	1-5%
Hesperostipa comata	<0%	<0%	<1%	<1%	<0%
Isocoma acradenia	5-10%	1-5%	10-25%	10-25%	10-25%
Malacothrix glabrata	<0%	<0%	<0%	<0%	<1%
Mammillaria grahamii var. grahamii	<1%	<0%	<0%	<0%	<0%
Oenothera caespitosa	<0%	<0%	<0%	<0%	<1%
Opuntia erinacea	<0%	<0%	<0%	<0%	<1%
Pholistoma auritum	<0%	<1%	<1%	<0%	<0%
Poa spp.	<1%	<0%	<0%	<1%	<0%
Porophyllum gracile	1-5%	<1%	<0%	<1%	<0%
Sphaeralcea grossulariifolia	<0%	<0%	<0%	<0%	<0%
Stephanomeria pauciflora	1-5%	<1%	1-5%	1-5%	<1%
Thamnosma montana	<0%	<0%	<0%	<0%	5-10%
Thymophylla pentachaeta	<1%	<0%	<0%	<0%	<0%
Vulpia octoflora	<1%	<0%	<1%	<0%	<1%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Acacia greggii	5		
5	Isocoma acradenia	11		
15	Brickellia longifolia	2		
45	Isocoma acradenia	19		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Acacia greggii	4		
5	Gutierrezia sarothrae	4		
5	Isocoma acradenia	4		
5	Vacant Space	5		

15	Brickellia longifolia	6
35	Isocoma acradenia	2
45	Isocoma acradenia	5

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	10.4	63	10.3	84	10.23	72	10.31	73
15	10.43	77	10.44	84	10.4	83	10.42	81
25	10.76	62	10.67	62	10.6	56	10.68	60
35	10.52	290	10.28	310	10.44	284	10.41	295
45	10.48	470	10.29	432	10.44	503	10.40	468

Park Area/Canyon: Topaz Canyon River mile: 96.7 L Project (Phase): Phase IIb

Transect Name: Topaz Canyon 1 Transect Type: Tamarisk Control

Date: 4/23/2006 Revisit? ☐ Pre-tamarisk removal

Recorder: Steve Till Reader: Kari Malen

Wind Speed: 5.0 Air Temp (F): 82.0 Cloud Cover: 15

Weather: Windy gusts, partly cloudy skies

Point Intercept Transect (50m)

Ground Cover	% Cover
Bare Soil	1
Boulder	17
Coarse woody debris	1
Cobble	9
Gravel	6
Litter (duff)	31
Sand	19
Stone	16

Species	% Cover
Aristida purpurea	1
Brickellia longifolia	10
Bromus rubens	3
Cryptobiotic soil	2
Ephedra fasciculata	2
Gutierrezia sarothrae	5
Isocoma acradenia	28
Moss spp.	1
Stephanomeria pauciflora	2

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Moss (ground)	3	3	1	1	1
Crypto	1	0	1	3	8
Litter (duff)	8	8	9	3	24
Bare Soil	1	1	1	1	1
Boulder	8	19	44	9	5
Cobble	18	19	9	19	5
Stone	19	38	9	20	24
Gravel	40	3	4	40	5
Sand	1	8	21	3	22
Coarse woody debris	1	1	1	1	5

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<1%	P	<0%		<0%		<0%		<1%	S
Aristida purpurea	10-25%		<1%		1-5%		<1%		1-5%	
Baccharis sergiloides	1-5%		<0%		<0%		<0%		<0%	
Brickellia longifolia	1-5%		5-10%		5-10%		<1%		1-5%	
Bromus rubens	<1%		<1%		1-5%		<1%		1-5%	
Ephedra fasciculata	1-5%		<1%		<1%		<0%		<0%	
Ericameria nauseosa	<0%		<0%		<0%		1-5%		<0%	
Galium aparine	<0%		<0%		<1%		<0%		<0%	
Gutierrezia sarothrae	5-10%		1-5%		<0%		1-5%		1-5%	

Hesperostipa comata ssp. comata	<0%	<0%	<1%	<0%	<0%
Isocoma acradenia	10-25%	5-10%	10-25%	5-10%	10-25%
Oenothera caespitosa	<0%	<0%	<0%	<0%	<1%
Opuntia chlorotica	<0%	<0%	<0%	<0%	<1%
Porophyllum gracile	<1%	<0%	<0%	<0%	<0%
Sphaeralcea grossulariifolia	<0%	<0%	<0%	<1%	<0%
Stephanomeria pauciflora	1-5%	<0%	<1%	<1%	<0%
Thamnosma montana	<0%	<0%	<0%	<0%	<1%
Thymophylla pentachaeta	1-5%	<0%	<0%	<1%	<0%
Vulpia octoflora	<0%	<0%	<0%	<1%	<0%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Acacia greggii	2		
5	Bromus rubens	1		
5	Isocoma acradenia	7		
15	Brickellia longifolia	8		
35	Isocoma acradenia	3		
45	Isocoma acradenia	8		

Vegetation Structure Data - New

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	pH	EC	pH	EC	pH	EC	pH	EC
5	8.18	144	8.24	168	8.1	172	8.17	161
15	8.78	380	8.79	385	8.8	386	8.79	384
25	8.73	54	8.84	55	8.84	56	8.80	55
35	8.13	319	8.09	375	8.16	415	8.13	370
45	8.34	58	8.56	69	8.58	64	8.49	64

Park Area/Canyon: Topaz Canyon River mile: 96.7 L Project (Phase): Phase IIb

Transect Name: Topaz Canyon 1 Transect Type: Tamarisk Control

Date: 4/14/2008 Revisit? ☑ Post-tamarisk removal

Recorder: Akasha Faist Reader: Lori Makarick

Wind Speed: 1.0 Air Temp (F): 80.0 Cloud Cover: 0

Weather:

Point Intercept Transect (50m)

Ground Cover	% Cover
Boulder	17
Cobble	12
Gravel	10
Litter (duff)	26
Plant	3
Sand	18
Stone	14

Species	% Cover
Acacia greggii	1
Aristida purpurea	6
Brickellia longifolia	12
Bromus rubens	3
Cryptobiotic soil	3
Ephedra fasciculata	2
Gutierrezia sarothrae	4
Isocoma acradenia	35
Lepidium lasiocarpum	1
Moss spp.	3
Silene spp.	1
Stephanomeria pauciflora	2

Daubenmire Scale Cover Data

Ground Cover	5m	15m	25m	35m	45m
Lichen	2	0	0	0	0
Moss (ground)	12	7	5	6	3
Crypto	7	0	0	2	6
Basal Veg	1	1	1	7	1
Woody debris structure	0	0	1	0	0
Coarse woody debris	1	0	1	0	1
Litter (duff)	10	4	10	9	25
Boulder	11	29	0	28	8
Stone	14	23	18	12	13
Cobble	9	19	9	22	15
Gravel	30	17	13	18	6
Sand	2	9	8	11	22

Species	5m	Age	15m	Age	25m	Age	35m	Age	45m	Age
Acacia greggii	<0%		<0%		<0%		<1%	S	<0%	
Allium SPP	<0%		<1%		<0%		<0%		<0%	
Aristida purpurea	5-10%		1-5%		1-5%		<1%		<1%	
Astragalus spp.	<0%		<1%		<1%		<0%		<0%	
Baccharis sergiloides	1-5%		<1%		<0%		<0%		<0%	

Bouteloua eriopoda	<1%	<0%	<0%	<0%	<0%
Brickellia longifolia	1-5%	5-10%	5-10%	75-100%	1-5%
Bromus rubens	1-5%	1-5%	1-5%	<1%	<1%
Camissonia walkeri	<0%	<0%	<1%	<1%	<0%
Cryptantha spp.	<1%	<1%	<0%	<1%	<1%
Delphinium spp.	<0%	<1%	<0%	<0%	<0%
Draba cuneifolia	<0%	<0%	<1%	<0%	<0%
Ephedra fasciculata	1-5%	1-5%	<1%	<0%	<0%
Ericameria nauseosa	<0%	<0%	<0%	1-5%	<0%
Eriogonum spp.	<0%	<0%	<0%	<1%	<0%
Erodium cicutarium	<1%	<1%	<0%	<0%	<1%
Gilia spp.	<1%	<1%	<0%	<1%	<1%
Gutierrezia sarothrae	1-5%	1-5%	1-5%	1-5%	1-5%
Hesperostipa comata	<0%	<0%	<1%	<1%	<0%
Isocoma acradenia	5-10%	1-5%	10-25%	10-25%	10-25%
Malacothrix glabrata	<0%	<0%	<0%	<0%	<1%
Mammillaria grahamii var. grahamii	<1%	<0%	<0%	<0%	<0%
Oenothera caespitosa	<0%	<0%	<0%	<0%	<1%
Opuntia erinacea	<0%	<0%	<0%	<0%	<1%
Pholistoma auritum	<0%	<1%	<1%	<0%	<0%
Poa spp.	<1%	<0%	<0%	<1%	<0%
Porophyllum gracile	1-5%	<1%	<0%	<1%	<0%
Sphaeralcea grossulariifolia	<0%	<0%	<0%	<0%	<0%
Stephanomeria pauciflora	1-5%	<1%	1-5%	1-5%	<1%
Thamnosma montana	<0%	<0%	<0%	<0%	5-10%
Thymophylla pentachaeta	<1%	<0%	<0%	<0%	<0%
Vulpia octoflora	<1%	<0%	<1%	<0%	<1%

Vegetation Structure Data - Old

Point	Species	<1m	1-2m	2-3m
5	Acacia greggii	5		
5	Isocoma acradenia	11		
15	Brickellia longifolia	2		
45	Isocoma acradenia	19		

Vegetation Structure Data - New

Point	Species	<1m	1-2m	2-3m
5	Acacia greggii	4		
5	Gutierrezia sarothrae	4		
5	Isocoma acradenia	4		
5	Vacant Space	5		

15	Brickellia longifolia	6
35	Isocoma acradenia	2
45	Isocoma acradenia	5

Soil Data

	Reading 1		Reading 2		Reading 3		Average	
Point	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**	**pH**	**EC**
5	10.4	63	10.3	84	10.23	72	10.31	73
15	10.43	77	10.44	84	10.4	83	10.42	81
25	10.76	62	10.67	62	10.6	56	10.68	60
35	10.52	290	10.28	310	10.44	284	10.41	295
45	10.48	470	10.29	432	10.44	503	10.40	468

Grand Canyon National Park, Vegetation Program Exotic Plant Management Data

☐ Check if same as previous site ☐ Check after entered in database

Date of Survey:_____ Observer (s):_____Canyon Name: _____

Location Description: _____ (e.g. Kwagunt 1, Verkamps) River Mile: _____ River Side? R L

Revisit? Y N UTM Easting: ___ ___ ___ ___ ___ ___ UTM Northing: ___ ___ ___ ___ ___ ___ ___ GPS Accuracy (m) _____

Species Code:_____ Habitat type:_____ Elevation (m): _____

Coordinates of population (within larger site): UTM Easting: ___ ___ ___ ___ ___ ___ UTM Northing: ___ ___ ___ ___ ___ ___ ___
GPS Accuracy (m) _____ Elevation (m): _____

Surface water within 25m? Y N Circle one: seep spring stream pothole river Land form: _____

Slope (degrees): _____ ° Aspect (0-360): _____ Light exposure: open full-shade partial-shade

Soil moisture: dry moist saturated standing water Surface rocks: _____

Soil type: sand loamy sand sandy loam silt loam loam sandy clay loam silty clay loam clay loam sandy clay clay silty clay

Associated species: _____

_____

Gross Infested Area (m^2): (From Map)_____ Area Cover: _____ ** See table below for SWEMP codes*

Infested Area (m^2): _____ % Cover: _____ **See table below for SWEMP codes*

Of Plants:_____ Treatment (circle one): A=No Action D=Mechanical E=Chemical

Plants flowering:_____ % Plants Fruiting: _____ % Vegetative state:_____% *(*This row should total 100%)*

For TREES: Seedlings # _____ Saplings # _____ Mature # _____

Control method: Pulled_____ Combo cut/girdle _____Girdle_____ Basal bark _____ Cut stump_____

Control notes/comments: _____

_____

Site notes/comments: _____

_____

☐ Check if same as previous site ☐ Check after entered in database

Date of Survey:_____ Observer (s):_____Canyon Name: _____

Location Description: _____ (e.g. Kwagunt 1, Verkamps) River Mile: _____ River Side? R L

Revisit? Y N UTM Easting: ___ ___ ___ ___ ___ ___ UTM Northing: ___ ___ ___ ___ ___ ___ ___ GPS Accuracy (m) _____

Species Code:_____ Habitat type:_____ Elevation (m): _____

Coordinates of population (within larger site): UTM Easting: ___ ___ ___ ___ ___ ___ UTM Northing: ___ ___ ___ ___ ___ ___ ___
GPS Accuracy (m) _____ Elevation (m): _____

Surface water within 25m? Y N Circle one: seep spring stream pothole river Land form: _____

Slope (degrees): _____ ° Aspect (0-360): _____ Light exposure: open full-shade partial-shade

Soil moisture: dry moist saturated standing water Surface rocks: _____

Soil type: sand loamy sand sandy loam silt loam loam sandy clay loam silty clay loam clay loam sandy clay clay silty clay

Associated species: _____

_____

Gross Infested Area (m^2): (From Map)_____ Area Cover: _____ ** See table below for SWEMP codes*

Infested Area (m^2): _____ % Cover: _____ **See table below for SWEMP codes*

Of Plants:_____ Treatment (circle one): A=No Action D=Mechanical E=Chemical

Plants flowering:_____ % Plants Fruiting: _____ % Vegetative state:_____% *(*This row should total 100%)*

For TREES: Seedlings # _____ Saplings # _____ Mature # _____

Control method: Pulled_____ Combo cut/girdle _____Girdle_____ Basal bark _____ Cut stump_____

Control notes/comments: _____

_____

Site notes/comments: _____

_____

SWEMP CODES

% Cover of Species (in survey area): T ≤ 1%, L=1-5%, M=5-25%, H=25-100%

Area Cover (Acreage): A ≤ 0.1, B=0.1-1, C=1-5, D>5

SWEMP CONVERSION TABLE

	% COVER OF SPECIES IN SURVEY AREA (same as infested area m2)			
AREA COVER sq *m* (same as gross infested area)	T sq *m*	L sq *m*	M sq *m*	H sq *m*
A ≤ 400	≤ 4	5-20	21-100	101-400
B = 400-4050	≤ 40	41-200	201-1000	1001-4050
C = 4050-20200	≤ 200	201-1000	1001-5050	5051-20200
D > 20200 -50000	≤500	501-2500	2501-12500	>12500

DESCRIPTION KEYS

SURFACE ROCKS:
Basalt
Limestone
Sandstone
Mudstone
Conglomerate
Shale
Schist
Other _____

LANDFORM:
Rockpile: uplands composed primarily of jiointed and efoliating granitic outcrops
Drainage channel: bottom not side slope of a drainage confined by banks or a canyon
Valley Bottom Fill: usually level places
Side Slope: side of drainage channel
Lower Slope: lower better watered portion of a slope
Mid Slope: central portion of a slope
Upper Slope: the upper driest portion of a slope
Interfluve: the area between small drainage channels
Ridge: high ground between two opposing slopes
Slick rock: large exposed expanses of bedrock
Terrace: level or gently sloping shelf perched on a slope, often caused by down-cutting rivers
Mesa: level or gently sloping ground surrounded on 3 or more sides by steep down slopes and capped
Butte: similar to a mesa, except with a top that does not have a flat configuration
Cliff: very steep rock slopes
Talus: unsorted material resulting from mass wasting of steep mountain slopes
Sand Dune/Sand Sheet: large accumulations of sand, may be stable or unstable (moving)
Plateau: flat area of great extent and elevation; specifically an extensive land region; considerably elevated (more than 100 meters) above adjacent lower-lying terrain

SOIL TAXONOMY:
1. Place soil in hand, remove pebbles, and add water very slowly, until it has the potential to have the consistency of putty. Add more soil or water as needed.
    a. If the soil does not remain in a ball, circle "sand"
2. If the soil remains in a ball, squeeze the ball between your thumb and forefinger, attempting to make a ribbon of uniform thickness and width pushing up and over your forefinger until it breaks from its own weight.
    a. If no ribbon is formed, record "loamy sand"
3. If ribbon forms but breaks before it is 2.5 cm, rub the soil between fingers.
    a. If very gritty, record "sandy loam"
    b. If very smooth, record "silt loam"
    c. If neither gritty or smooth, record "loam"
4. If ribbon breaks between 2.5 and 5 cm, rub the soil between fingers.
    a. If very gritty, record "sandy clay loam"
    b. If very smooth, record "silty clay loam"
    c. If neither gritty or smooth, record "clay loam"
5. If ribbon breaks when it is >5 cm, rub the soil between fingers.
    a. If very gritty, record "sandy clay"
    b. If very smooth, record "clay"
    c. If neither gritty or smooth, record "silty clay"

HABITAT TYPES: Adapted from Brown et al. (1998)

Habitat Type	**Description**
Subalpine conifer forest	Engelmann spruce-alpine fir, bristlecone pine-limber pine
Mixed conifer	Douglas and white fir, ponderosa pine, aspen
Ponderosa pine forest	ponderosa pine, Gambel oak, white fir
Great Basin montane scrub	oak-scrub, mountain mahogany, brittlebush, serviceberry
Great Basin conifer woodland	pinyon-juniper series
Great Basin desertscrub	sagebrush, blackbrush, rabbitbrush, winterfat, saltbrush
Mojave desertscrub	creosote, blackbrush, mesquite, saltbush
Alpine/subalpine grassland	bunchgrass (AZ fescue) and sedge-forb-grass association
Semi-desert grassland	grama grass-scrub (*Bouteloua/Pleuraphis*), mixed shrub
Interior wetlands	Cattail, rushes, sedges, willows
Riparian	cottonwood-willow, mixed deciduous broadleaf

GRAND CANYON VEG CREW PHOTODOCUMENTATION FORM

PP NAME:_____ **DATE:**_____ **CAMERA #** _____

UTM Easting: __ __ __ __ __ __ **UTM Northing:** __ __ __ __ __ __ __ **ACCURACY:** _____ **M**

circle one **ELEVATION:** _____**M**

PREWORK **POSTWORK** **CAMERA HEIGHT:** ____' ____"

DESCRIPTION OF PHOTOPOINT: _____

VIEW #	TIME	V OR H	BEARING	VIEW FROM PHOTOPOINT

GRAND CANYON VEG CREW PHOTODOCUMENTATION FORM

PP NAME:_____ **DATE:**_____ **CAMERA #** _____

UTM Easting: __ __ __ __ __ __ **UTM Northing:** __ __ __ __ __ __ __ **ACCURACY:** _____ **M**

circle one **ELEVATION:** _____**M**

PREWORK **POSTWORK** **CAMERA HEIGHT:** ____' ____"

DESCRIPTION OF PHOTOPOINT: _____

VIEW #	TIME	V OR H	BEARING	VIEW FROM PHOTOPOINT

PHOTODOCUMENTATION BASICS

PROJECT SIGNIFICANCE

For this project, you will be re-visiting past restoration project sites in the inner canyon and re-taking photographs (i.e. photodocumentation) – or you might also be installing new sites. These repeat photographs will allow park vegetation managers to not only look at the current conditions at the site, but also determine which restoration and/or invasive plant management methods worked and which failed. The photographs will allow Park staff to monitor the change in vegetation and site characteristics over time, and develop supplemental management plans as needed. The most important thing to remember is to be **VERY AWARE** of the impact you have on the site. Many of these photopoints are located in areas that have been restored over the past few decades – be very careful of your footprints and only take the minimum number of people needed to accomplish this valuable work.

STEP BY STEP INSTRUCTIONS

This is very straightforward and simple. **First**, here are the items you should take out with you to the project site: Camera, compass, GPS unit, clipboard and data sheets, the original prints/slides from the site, extra batteries for the GPS unit and camera, extra camera disks and batteries

Second, here are some key things you need to know and protocols you must follow:

- Before you take any pictures at the site, write the location and date on a sheet of paper **(or use the dry erase board)** and then **TAKE A PHOTO OF THE SHEET.** This will help with labeling and organizing the photographs following the trip since the person will know that the series of photos following that "location photo" are of the site listed on the sheet.
- Make sure that the compass is declinated to 13 east (this should already be done, but check)
- Make sure the GPS unit is set to NAD 83 (CONUS) and metric.
- As you re-take the photographs, you will keep the photo-log which you should also have with you. **Please write VERY neatly since someone else will be entering these data.**
- The photopoint name should be the name of the side canyon or campsite – followed by a number. If there are already photopoints installed in the area, use the next consecutive number.
- Keep in mind that there may be more than one view (i.e. different bearings) from the same photopoint – those views would be labeled 1, 2, etc. in the view # column. If you are retaking *old* photographs, which may have used a different labeling system, adapt those photos to this system. Example: At Hance, photos from the same place on the ground were called Hance 5, Hance 6, Hance 7 – under the new system, they would be Hance 5 view 1, Hance 5 view 2, Hance 5, view 3, etc. Please write what the *old* photopoint name was in the description column.
- Please take a photo of a person at the photopoint to help relocate it (there is typically one associated with each of the photopoints) – this is the reference photo, denoted by an "A" in the view column (**Hance 2 View A** would be a photo of a person standing at Hance 2 photopoint).
- For the description of photopoint – please be as detailed as possible, keeping in mind to include key site characteristics that are of a permanent nature (e.g. rocks, large trees). Be VERY detailed if you cannot get a GPS reading – and if you can define the point in relation to something visible on a GIS layer or another point, we should be able to place it on a map.
- For the view from photopoint – please also be detailed about what you are looking at and describe what you are seeing (e.g. river in lower left corner, trail obliteration doing up sand dune).
- Keep in mind that this work will become part of the Park's files and archives – your work will be used by future Park managers and resource specialists.
- **For retaking photopoints** you will have a print out of the page. Write RETAKE and the date clearly right above the photopoint name and the CAMERA # you are using. Take a photo of the page with the photopoint name (ie PP Carbon 1). Then retake the photos in the order that they are on the page. You do not have to retake View A. This is only a reference photo to help you locate the photopoint. Neatly cross out the time and write the new time you are retaking the photo. Cross out pre and write post treatment. Check the bearings and descriptions and edit them as necessary.

TAMARISK MAPPING BASICS

Those of you reading this hopefully know about the ongoing tamarisk management and tributary restoration project within Grand Canyon. In order to plan for future project work, it is essential to have accurate information about the distribution of tamarisk in the park's side canyons and tributaries. That's where you, the mappers and surveyors, come in!

If you would like more information about the project, please feel free to contact me prior to embarking on your trip. As you complete these tasks, please keep in mind that the project areas begin in the actual tributary, above the old high-water line or above the mouth of the canyon – do not count tamarisk in the main river corridor. Please set your GPS units to NAD 83 – also make sure you write what UTM units you use on each data sheet.

STEP BY STEP INSTRUCTIONS

Here is some tips on how to fill out the tamarisk mapping data sheet:

- **GPS Information** – Write the beginning and ending Easting and Northing for each distinct clump or overall tamarisk area. When we are surveying a new area, we collect these data every 500 meters as a standard.
- **Location Description** – Please label this with the Canyon name and a consecutive number beginning at the river with 1.
- **Site Description** – Please include information about the site itself – narrow, wide, dense vegetation, etc. It really helps to know whether there is water present at a site, so take note of that as well. Please also include information as to whether this site is up a fork, steep, etc.
- **Site Access** – Please include any information about waterfalls, climbs, or other hazards. Include specific details.
- **Tamarisk Distribution Description** – Any details that will help once we return to the area to complete the work, please be specific. Is the distribution spotty, clumped, distributed throughout the whole stretch, etc?
- **Tamarisk Numbers** – Count the seedlings, saplings and mature trees in the area.
    - Seedling – Newly emerged plants up to 1m tall
    - Sapling – Plants with less than 5cm diameter at base of the trunk-over 1m tall
    - Mature – Plants with greater than 5cm diameter at the base of the trunk, or with multiple branching at the base.
- **Tamarisk Control Information** – Please include any information about control that might be useful. Do you think 5 people can complete the work in a few hours or would it take 12 people 4 days? Make your best guess.
- Please also include a final reading of where you surveyed to in each canyon.

Please DO NOT do anything dangerous. If you think it seems sketchy, that probably means you shouldn't keep going. Once you complete your trip, please just make sure these data sheets get back to me so that I can map what you have found!

Thanks so much – this contribution to the tamarisk management project is **invaluable** - enjoy the trip, the hikes, the beautiful wildflowers, and the water (and the shade you'll find beneath tamarisk trees) as they won't be there to enjoy for long!

Lori J. Makarick
Inner Canyon Vegetation Program Manager
Lori_Makarick@nps.gov
928-226-0165

GRAND CANYON NATIONAL PARK
Tamarisk Mapping Data

Data Collector: _____ Date: _____

Canyon Name: _____ Location Description: _____

River Mile: _____ R L Time Spent on Survey: _____ minutes

Begin Easting: ___ ___ ___ ___ ___ ___ End Easting: ___ ___ ___ ___ ___ ___
Begin Northing: ___ ___ ___ ___ ___ ___ ___ End Northing: ___ ___ ___ ___ ___ ___ ___
GPS Accuracy: _____ m GPS Accuracy: _____ m
Elevation: _____ m Elevation: _____ m
Site Description: _____

_____

_____

Site Access / Safety: _____

_____

Tamarisk Distribution Description: _____

_____

_____

Tamarisk Numbers: Seedlings: _____ Saplings: _____ Mature: _____

Tamarisk Control Information: _____

_____

Data Collector: _____ Date: _____

Canyon Name: _____ Location Description: _____

River Mile: _____ R L Time Spent on Survey: _____ minutes

Begin Easting: ___ ___ ___ ___ ___ ___ End Easting: ___ ___ ___ ___ ___ ___
Begin Northing: ___ ___ ___ ___ ___ ___ ___ End Northing: ___ ___ ___ ___ ___ ___ ___
GPS Accuracy: _____ m GPS Accuracy: _____ m
Elevation: _____ m Elevation: _____ m
Site Description: _____

_____

_____

Site Access / Safety: _____

_____

Tamarisk Distribution Description: _____

_____

_____

Tamarisk Numbers: Seedlings: _____ Saplings: _____ Mature: _____

Tamarisk Control Information: _____

_____

_____

***Write associated species for each section on the back of the form!**

Grand Canyon/AWPF Tamarisk Transect Monitoring Protocols

Quantitative Monitoring

The standard transect length is 50m, with one transect placed approximately in the middle of a treatment area and one in a nearby area with similar substrate and aspect in which no tamarisk occurs. Both transect lines will run parallel to the drainage channel. There will be 1-3 transect pairs per selected project area. Point intercept, cover within 3m- radius circles, and total vegetation volume measurements will be recorded. Transects should be oriented with the 0 or start at upstream.

Environmental Site Information

Do a really good job describing the site and directions to the site. Make sure the description is clear enough for someone to find the location without you along. Include major landmarks in your description and try to capture those in the photopoints.

Aspect Record this as the slope of the drainage and flow of the water. This should probably be pretty close to the bearing of the transect.

Slope Take at least 3 and as many as 5 measurements (at the same time as soil perhaps, at 5, 15, 25, 35, 45) then average them.

Daubenmire Scale in 3m radius

In order to further describe the composition of plant species present along the transects, we will collect ground cover and vegetation cover data on all plant species present in a 3m- radius circle at five points along the transect (5m, 15m, 25m, 35m, and 45 m).

Plant Species Cover: We will record vegetative cover for all species present in a cylinder from the ground surface to the sky. Identify plants to species when possible, within a reasonable time frame to expedite the process. Identify plants to genus when characteristics are not available, (i.e. lacking mature seed in Cryptantha plants will be listed as sp.). To minimize observer biases and increase the speed of the surveys, we will record cover in seven broad cover classes for the plant species cover. Because points on the transect are not independent of each other, cover scale values will be converted to the mid-point of the class ranges and averaged before being analyzed so that there is only a single value for each species recorded on the transect.

Ground Cover: These substrate categories need to total 100% and should be recorded to the nearest 1% rather than using the cover categories. In addition to the rock sizes, we will also include the categories of moss (on ground), lichen (on ground), microbiotic soil crust, water, and basal veg in the ground cover sections. (Please note that you will also count all mosses and lichens in the plant cover section also). For basal vegetation, imagine that all of the plants are cut so that just the basal stem remains, and then you clump them all together. In this area, this number will usually be less than 1%. For comparison, the absolute maximum basal cover in very dense forests with huge tress is 10%. We suggest doing the smaller classes first.

Litter is considered dead plant material less than 3 cm in diameter. Dead plant material connected to a LIVING perennial plant is considered a live plant and should be recorded as such. Dead annual plants from the previous year can be specified to genus and species if they can be easily identified on site.

Calculating cover classes for **sand** versus **bare soil** can be tricky if there is a combination of sand and soil. For soil types of sandy loam and loamy sand, sandy clay loam and sandy clay assume 50% is sand and 50% is soil.

Aging is only done for trees. The age class is based on height/diameter same as for tamarisk age class. **Seedling**-single stem under 1m tall. **Sapling**-over 2m tall but largest trunk is under 5cm in diameter. **Mature**-Largest trunk is over 5cm in diameter. A tree is a woody plant having one well-defined trunk at least two inches in diameter, a height class of at least 10 feet, and a somewhat definitely formed crown of foliage. Coyote willow is a shrub and Acacia and tamarisk are trees.

Vegetation Structure

In order to understand how the vegetation recorded in the cover data is distributed vertically at each point, we will also record the three-dimensional structure, measured as total vegetation volume (TVV: Mills et al. 1991). At the center of each circle, a survey rod will be held vertically and the number of 10cm (or 1 decimeter) segments in each meter sections above the ground with contacts with live vegetation will be recorded. Imagine a 20 cm wide cylinder around the pole. For each height category (e.g. 1-2 m) record each plant species that enters the cylinder and the number of cylindrical decimeter sections that the species occurs in. If there are more than one species present in a given tenth-meter increment, we will only count it once. So the maximum # of occurrences per height category is 10. The TVV measure for a particular point is the count of all tenth-meter increments occupied over that point. The TVV measures at each point will be summed to generate a transect measure, since individual points on the same transect cannot be considered independent for statistical purposes. If two or more species occur at one point also record total number of segments that are vacant. Do not include dead plant material.

In 2005 we sampled the vegetation structure slightly differently due to a misunderstanding of the protocols, we now read both an old and a new category. Under the new row record as described above. Under the old row, you count every plant part, dead or alive, that hit within a segment – this could lead up to a number much great than 10.

Point Intercept

The point intercept method will be used to characterize substrates and document the major plant species present along the transect lines. We will use a 0.75cm diameter, 2m tall point and take a reading every 0.5m along the 50m transect, providing 100 points per transect. We will note the species identity of all live plants in contact with the pole and also characterize ground cover substrate in one of nine categories (including plant). To read, stand on the left and read the pole on the right facing downstream from 0 point or beginning of transect.

The installation of transects in 25% of the 35 project areas will provide an adequate measure of the change in cover. Since this monitoring plan aims to detect change in vegetative cover over time, each transect will be compared to itself and its pair in future years. In Phase I of this project, crews installed transects in 25% of the total project areas and the data were sufficient to determine the vegetation cover changes.

Soil Survey

Take soil sample from within the 3 meter releve, near the point on the meter tape, but not exactly at the point on the meter tape line where the point intercept data will be sampled. For soil readings, mix 2 parts DI water with 1 part soil to make a slurry. Shake sample in DI water for 30 seconds and then let sample settle for 1 minute before taking reading with probe**.** Obtain 3 readings for pH and EC. Rinse probe with DI or distilled water between samples.

Qualitative monitoring

Photopoints

Each transect should have photopoints installed at both transect start and end points. Photopoints should be named Bright Angel T1A Start, Bright Angel T1A End, etc. View A is the view of the photopoint (in this case the Transect Start point, showing a picture of a person at the photopoint. We encourage you to take multiple views of the photopoint in order to help others relocate the start as precisely as possible. View B, C and D would be photos of the photopoint taken from yet a different angle.

- Before you take any pictures at the site, write the canyon name, transect # and label it start or end with the date on the dry erase board and then **TAKE A PHOTO OF IT!!**. This will help with labeling and organizing the photographs following the trip since the person will know that the series of photos following that "location photo" are of the site listed on the sheet. You have absolutely no idea how invaluable this is until you have hundreds of photos to label.
- The photopoint name should be the name of the Transect (i.e. Bright Angel T1A Start) plus specify whether it is start or end.
- Keep in mind that there may be more than one view (i.e. different bearings) from the same photopoint – those views would be labeled 1, 2, etc. in the view # column. View A is always a photo of the person at the photopoint.
- Please take a photo of a person at the transect start or end to help relocate it – this is the reference photo, denoted by an "A" in the view column (**Bright Angel T1A Start View A** would be a photo of a person standing at the beginning of that transect. Add different views (B, C, D) of photos taken from other angles to best describe the start of the transect. Photos of the rocks where the transect tape start is lying can be indispensable for those relocating, especially if you weren't there!
- For the description of photopoint – please be as detailed as possible, keeping in mind to include key site characteristics that are of a permanent nature (e.g. rocks, large trees). Please describe the color, size of any boulder / rock you might be on or near. Just saying "rock in middle of creek" is not enough. Be VERY detailed if you cannot get a GPS reading – and if you can define the point in relation to something visible on a GIS layer or another point, we should be able to place it on a map.
- For the view from photopoint – please also be detailed about what you are looking at and describe what you are seeing (e.g. river in lower left corner, trail obliteration doing up sand dune).
- Please remember the following for your descriptions: "Creek Right" is on the right as you are heading down the creek – just like on the river.
- Keep in mind that this work will become part of the Park's files and archives – your work will be used by future Park managers and resource specialists.

If you are re-taking photographs…. You will have the photos and information printed from the database. Rather than filling out a photodocumentation form, you can just write the "new" information directly onto that sheet. You need to write the date, the photographer's name, camera height, time of day, updates/improvements on descriptions, and pre- or post-work. You still need to take the photo of the board and keep everything super organized – but this will save you some writing!

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Grand Canyon Tamarisk Project Transect Data 2007

Canyon Name: Transect # **Circle ONE:** A: Tamarisk Area B: Reference Area	Date:	Recorder: Reader:	Weather Notes:	
Transect Start Point Information	Easting	Northing	GPS Accuracy Elevation	Bearing: _____º
Transect End Point Information:	Easting	Northing	GPS Accuracy Elevation	Circle ONE: Pre-tamarisk removal Post-tamarisk removal
Transect General Description:				Geological Layer: Slope (degrees):_____ ° Aspect (0-360):_____

Location Description/Transect Name: _____(e.g. Soap Camp T1C)

GCMRC River Mile _____ River Side? **R L** Revisit? **Y N**

Additional Location Details: _____
_____
_____

Dominant Plant Species: _____
_____

Associated Plant Species:_____
_____
_____

**ONLY include plant species not hit on the transect here!*

Surface water within 25m? **Y N** Circle: seep spring stream pothole river

Habitat Type:	**Land form:**	**Topographic Position:**
Ponderosa Pine Forest GB Mountain Scrub GB Conifer Woodland GB Desertscrub Mojave Desertscrub Interior Wetlands Riparian Other_____	Rockpile Drainage Channel Valley Bottom Fill Ridge Slickrock Terrace Mesa Butte Cliff Talus Sand Dune Plateau Other_____	High level High Slope Mid Slope Low Slope Backslope Step in Slope Toe Slope Low Level Interfluve

Surface rocks:	**Soil type:**	**Light exposure:**	**Soil moisture:**
Basalt Conglomerate Limestone Mudstone Sandstone Shale Schist Other _____	sand loamy sand sandy loam silt loam loam sandy clay loam silty clay loam clay loam sandy clay clay silty clay	open full-shade partial-shade	dry moist saturated standing water

DESCRIPTION KEYS

SURFACE ROCKS:

Basalt	**Conglomerate**	**Limestone**	**Sandstone**	**Shale**
Granite	**Mudstone**	**Other**		

LANDFORM:

Rockpile: uplands composed primarily of jointed and efoliating granitic outcrops
Drainage channel: bottom not side slope of a drainage confined by banks or a canyon
Valley Bottom Fill: usually level places
Interfluve: the area between small drainage channels
Ridge: high ground between two opposing slopes
Slick rock: large exposed expanses of bedrock
Terrace: level or gently sloping shelf perched on a slope, often caused by down-cutting rivers
Mesa: level or gently sloping ground surrounded on 3 or more sides by steep down slopes and capped
Butte: similar to a mesa, except with a top that does not have a flat configuration
Cliff: very steep rock slopes
Talus: unsorted material resulting from mass wasting of steep mountain slopes
Sand Dune/Sand Sheet: large accumulations of sand, may be stable or unstable (moving)
Plateau: flat area of great extent and elevation;; considerably elevated (>100 m) above adjacent lower-lying terrain

SOIL TAXONOMY:

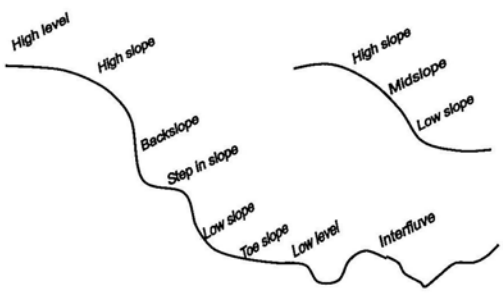
1. Place soil in hand, remove pebbles, and add water very slowly, until it has the potential to have the consistency of putty. Add more soil or water as needed.
    a. If the soil does not remain in a ball, circle "**sand**"
2. If the soil remains in a ball, squeeze the ball between your thumb and forefinger, attempting to make a ribbon of uniform thickness and width pushing up and over your forefinger until it breaks from its own weight.
    a. If no ribbon is formed, record "**loamy sand**"
3. If ribbon forms but breaks before it is 2.5 cm, rub the soil between fingers.
    a. If very gritty, record "**sandy loam**"
    b. If very smooth, record "**silt loam**"
    c. If neither gritty or smooth, record "**loam**"
4. If ribbon breaks between 2.5 and 5 cm, rub the soil between fingers.
    a. If very gritty, record "**sandy clay loam**"
    b. If very smooth, record "**silty clay loam**"
    c. If neither gritty or smooth, record "**clay loam**"
5. If ribbon breaks when it is >5 cm, rub the soil between fingers.
    a. If very gritty, record "**sandy clay**"
    b. If very smooth, record "**clay**"
    c. If neither gritty or smooth, record "**silty clay**"

HABITAT TYPES: Adapted from Brown et al. (1998)

Habitat Type	Description
Ponderosa pine forest	ponderosa pine, Gambel oak, white fir
Great Basin montane scrub	oak-scrub, mountain mahogany, brittlebush, serviceberry
Great Basin conifer woodland	pinyon-juniper series
Great Basin desertscrub	sagebrush, blackbrush, rabbitbrush, winterfat, saltbrush
Mojave desertscrub	creosote, blackbrush, mesquite, saltbush
Alpine/subalpine grassland	bunchgrass (AZ fescue) and sedge-forb-grass association
Semi-desert grassland	grama grass-scrub (*Bouteloua/Pleuraphis*), mixed shrub
Interior wetlands	Cattail, rushes, sedges, willows
Riparian	cottonwood-willow, mixed deciduous broadleaf

Ground Cover Classes	
Bare soil	<0.1 mm (smaller than sand)
Sand	0.1 - 2mm
Gravel	2 mm – 6.4 cm
Cobble	6.4 cm – 19 cm
Stone	19 - 61 cm
Boulder	> 61cm
Bedrock	Solid rock surface, non-boulder
Litter (duff)	Dead plant material < 3cm diameter
Coarse woody debris	Dead wood 3-10 cm diameter
Woody debris structure	Woody material > 10 cm in depth and width
Basal Vegetation	Visually clump all basal stems together. This should be between 1-10%, NEVER higher!

Topographic Position



Canyon Name:_____ Transect #: _____ **A**=tamarisk **B**=reference Date:_____

Daubenmire Scale Cover Data from 50m Transects

GROUND COVER (TO NEAREST % - SUM MUST = 100%)

	5	Age	15	Age	25	Age	35	Age	45	Age
Bare soil										
Sand										
Gravel										
Cobble										
Stone										
Boulder										
Bedrock										
Litter (duff)										
Coarse woody										
Woody debris										
Basal Veg										
Crypto										
Moss (ground)										
Lichen										
Water										

PLANT SPECIES BELOW THIS LINE:

Species	**5**	**Age**	**15**	**Age**	**25**	**Age**	**35**	**Age**	**45**	**Age**

Soil pH and EC Data for Transects						
Point	**Reading #1**		**Reading #2**		**Reading #3**	
	pH	**EC**	**pH**	**EC**	**pH**	**EC**
5 m						
15 m						
25 m						
35 m						
45 m						

For soil readings, move leaf litter aside and take a small amount of topsoil. Mix 2 parts DI or distilled water with 1 part soil to make a slurry (you only need a small amount).
Obtain 3 readings for pH and EC. Rinse probe with DI or distilled water between samples.

Substrate Categories:

Ground cover substrate classes used along transects	
Category	Description
Bare soil	<0.1 mm (smaller than sand)
Sand	0.1 - 2mm
Gravel	2 mm – 6.4 cm
Cobble	6.4 cm – 19 cm
Stone	19 - 61 cm
Boulder	> 61cm
Bedrock	Solid rock surface, non-boulder
Litter (duff)	Dead plant material < 3cm diameter
Coarse woody debris	Dead wood 3-10 cm diameter
Woody debris structure	Woody material > 10 cm in depth and width

Campsite Name:_____ Transect #: _____ **A**=tamarisk **B**=reference Date:_____

VEGETATION STRUCTURE *Imagine a 20 cm wide cylinder that exists around your pole. For each height category (e.g., 1-2 meters), record each plant species that enters the cylinder and the number of cylindrical decimeter sections that the species occurs in.* ***Since each height category only has 10 dm sections the maximum # of hits per category is 10.*** **NOTE:** *Under the OLD row, please count the total number of times each species hits the pole itself. This number can be greater than 10.*

Point / Height	< 1 meter		1 - 2 meter		2 - 3 meter		3 - 4 meter		4 - 5 meter		5-6 meter		6+ meter	
	Species Code	# of hits	Species Code	# of hits	Species Code	# of hits	Species Code	# of hits	Species Code	# of hits	Species Code	# of hits	Species Code	# of hits
5m OLD METHOD														
5m NEW METHOD														
15m OLD METHOD														
15m NEW METHOD														
25 m OLD METHOD														
25m NEW METHOD														
35 m OLD METHOD														
35m NEW METHOD														
45 m OLD METHOD														
45m NEW METHOD														

Point Intercept Data Canyon Name: Transect #: **A**=tamarisk area **B**=reference Date:

|----------GROUND COVER CATEGORIES----------| | ----------PLANT SPECIES----------|

Data Point	Bare Soil	Sand	Gravel	Cobble	Stone	Boulder	Bedrock	Litter (duff)	Coarse woody	Woody debris	Plant																					
0.5																																
1																																
1.5																																
2																																
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Ground Cover Categories												Plant Species																							
Data Point	Bare Soil	Sand	Gravel	Cobble	Stone	Boulder	Bedrock	Litter (duff)	Coarse woody	Woody debris	Plant																								
25																																			
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WATER QUALITY AND QUANTITY INSTRUCTIONS

What you need to carry with you:

- ☺ Hanna probe and instructions
- ☺ Thermometer
- ☺ 50 meter tape (you really only need a smaller one, but it's training)
- ☺ Ruler for depth measurements
- ☺ Data sheets – blank ones and the printouts from the previous site visit
- ☺ Photopoint sheets
- ☺ Maps
- ☺ Watch with ability to clock seconds
- ☺ Large bottle of DI water for rinsing
- ☺ Small packets of ph7 buffer, ph4 buffer and EC calibration solution (or not if you buffer in the morning
- ☺ Tech box with camera, compass and GPS unit

Some basic things to remember….

- ➢ Write really neatly – seriously.
- ➢ You will be re-visiting previously installed hydrology sites, so make sure you take the data printouts, maps, photopoint sheets, and maps from the previous visits.
- ➢ Re-take the hydrology measurements from the same points. Fill out that sheet accordingly.
- ➢ Re-take the photographs. You can write the new information right on the printed out photopoint sheets.
- ➢ Air temperature – take this in the shade. Water temperature – leave it in a pool!
- ➢ For some small seeps, you can't get water quantity information – just describe that / why and still take water quality data.
- ➢ Remember to keep the Hanna probe sponge wet in pH 7 solution! (it's in the cap)
- ➢ Calibrate each morning before heading out – this needs to be done once a day.
- ➢ Get to know the probe – instruction in box and clipboard – and understand how it works.

Hanna probe calibration

Before you can take the measurements, you need to calibrate the probe. Basically you need to do this once a day. Refer to the instructions for the detailed information, but here are some basics.

How to calibrate for pH (*we use 2 point calibration method):*

1. Rinse small plastic container with pH 7 – or just use the silver packets!
2. Select the pH mode using the mode button, then press and hold the ⓪ / Mode button a few seconds until CAL is displayed on lower LCD. *It will seem like you are shutting the unit down – don't stress – the CAL will show up on the screen! Release the button. The LCD will display pH 7.01 USE and the CAL tag will blink on the LCD.
3. Rinse the meter 3 times with pH 7 solution, then place the electrode in pH 7.01 solution.
4. The meter will recognize the buffer and then it'll display pH 4.01 USE on the LCD.
5. Rinse the meter 3 times with the pH 4 solution (*you can also use pH10, which we sometimes do- it is OK)* then place the electrode in pH 10 solution.
6. After the second buffer is recognized, the LCD will display OK for 1 second and the meter will return to normal measuring mode. The CAL symbol on the LCD means that the meter is calibrated.

FYI – a normal pH in this area will be high 7 or low 8

How to calibrate for EC*:*

1. Select the EC mode using the Set/Hold button. It is the mS option as you scroll through. From the measurement mode, press and hold the ⓪ / MODE button until CAL is displayed on the lower LCD.
2. Release the button and immerse the probe in the proper EC calibration solution.
3. Once the calibration has been automatically performed, the LCD will display OK for 1 second and the meter will return to normal measurement mode.

FYI – EC should be less than 1,000
Electrical conductivity (EC) estimates the amount of total dissolved salts (TDS), or the total amount of dissolved ions in the water.

Grand Canyon National Park, Water Quality/Discharge Data for Tamarisk Project

Check after entered in database ☐
Date of Survey:_____ Time Measurements Began: _____ Observers (s):_____
Canyon Name: _____ Location Description: _____ (e.g. South Hydro 1)
Measurement Location Details: _____

_____

_____

_____

UTM Easting: ___ ___ ___ ___ ___ ___ UTM Northing: ___ ___ ___ ___ ___ ___ ___ GPS Accuracy (m) _____
Circle one: seep spring stream pothole river Light exposure: open full-shade partial-shade
Elevation (m): _____ Slope (degrees): _____ ° Aspect (0-360): _____
Soil type: sand loamy sand sandy loam silt loam loam sandy clay loam silty clay loam clay loam sandy clay clay silty clay
Weather (descriptive):_____
Weather over previous 3 days:_____
Current Temperature: Air = _____C Water = _____C
Description of Water Source:_____

_____

_____

Water Quality Measurements

Last Calibration ⟶ Date: _____ Time: _____

Meter Reading #	1	2	3	Average of 3 *(We'll get from database)*
Water Temp (C)				
pH:				
EC (mS)				
TDS (ppm)				

Water Quantity Measurements

Type: _____ (C=Container, P=Pygmy, W=Weir, F=Flume, FL=Float) **Use float method as the standard, container tables on back if needed*

Channel Width (Wetted Area): _____ (cm)

Measurement Distance: _____(m)
*Use 5m as the standard measurement distance, but alter as needed

Channel Dimensions Table

Meter Mark (m)	Depth (cm)
0.2	
0.4	
0.6	
0.8	
1	
1.2	
1.4	
1.6	
1.8	
2.0	

Water Velocity Table

Reading #	Time (Seconds)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

*For the FLOAT METHOD – use the black plastic rod in the hydrology probe box, but **DO NOT LOSE IT**!*
Don't forget to take photographs of the measurement area and fill out a photodocumentation form!

C:\Documents and Settings\lmakarick\My Documents\Blank Field Forms\Hydrology Data Final 4-17-06.doc

Container Volume (for non-float methods only): _____

	Fill time (mm:ss)	Sample Quality (1=good, 2=fair, 3=poor)
Sample 1		
Sample 2		
Sample 3		
Sample 4		
Sample 5		
Sample 6		
Sample 7		
Sample 8		
Sample 9		
Sample 10		
AVERAGE		

Alkalinity Measurements:

**Note – Check with Lori to see if you should be taking alkalinity measurements.*

Reading 1		**Reading 2**		**Reading 3**	
Grey	Pink	Grey	Pink	Grey	Pink

Additional Comments / Information:_____

_____

_____

_____

_____

_____

_____

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_____

_____

GRAND CANYON NATIONAL PARK PLANT COLLECTION FIELD SHEET 2007

Collector(s): _____ **Date:** _____

Collection#	**Genus/species:**	**Common name:**	**#Specimens**
2007-____	_____	_____	_____
2007-____	_____	_____	_____
2007-____	_____	_____	_____
2007-____	_____	_____	_____
2007-____	_____	_____	_____

Assoc. Sp:_____
_____
_____
_____

Circle One: North Rim South Rim Inner Canyon River Corridor Mile:_____ **R L**
Canyon Name:_____
Location Description: _____
Habitat: _____
_____**Elev (m):** _____
UTM E: ___ ___ ___ ___ ___ ___ **UTM N:** ___ ___ ___ ___ ___ ___ ___ **GPS Acc (m):** _____

Comments: _____
_____
_____

GRAND CANYON NATIONAL PARK PLANT COLLECTION FIELD SHEET 2007

Collector(s): _____ **Date:** _____

Collection#	**Genus/species:**	**Common name:**	**#Specimens**
2007-____	_____	_____	_____
2007-____	_____	_____	_____
2007-____	_____	_____	_____
2007-____	_____	_____	_____
2007-____	_____	_____	_____

Assoc. Sp:_____
_____
_____
_____

Circle One: North Rim South Rim Inner Canyon River Corridor Mile:_____ **R L**
Canyon Name:_____
Location Description: _____
Habitat: _____
_____**Elev (m):** _____
UTM E: ___ ___ ___ ___ ___ ___ **UTM N:** ___ ___ ___ ___ ___ ___ ___ **GPS Acc (m):** _____

Comments: _____
_____
_____



Grand Canyon National Park, Vegetation Management Program
RARE PLANT SURVEY FORM

DATE OF SURVEY: _____ OBSERVER(S): _____

SCIENTIFIC NAME: _____ COMMON NAME: _____
CANYON AREA (circle): Inner Canyon Colorado River Corridor North Rim South Rim
LOCATION DESCRIPTION:_____ *6 letter species code and consecutive numbers for species
UTM Easting: ___ ___ ___ ___ ___ ___ UTM Northing: ___ ___ ___ ___ ___ ___ ___ GPS Accuracy (m) _____
LAND OWNERSHIP/MANAGEMENT (if not NPS): _____
SITE NOTES (description / directions): _____
_____

ENVIRONMENTAL DESCRIPTION (see description keys at back of form):
SLOPE (in degrees):_____° ASPECT (0-360°): _____ ELEVATION (m): _____
SURFACE ROCKS: _____ LAND FORM:_____
HABITAT TYPE: _____
SURFACE WATER WITHIN 25m? Y N Circle one: seep spring stream pothole river
LIGHT EXPOSURE: open full-shade partial-shade SOIL MOISTURE: dry moist saturated standing water
SOIL TYPE: Sand loamy sand sandy loam silt loam loam sandy clay loam silty clay loam clay loam sandy clay clay silty clay
DOMINANT PLANT SPECIES: _____
_____
ASSOCIATED PLANT SPECIES: _____
_____
_____

VEGETATION STRUCTURE WITHIN POPULATION AREA

Table 1. Cover classes	
Class	Cover Range
0	0%
1	<1%
2	1-5%
3	5-10%
4	10-25%
5	25% - 50%
6	50% - 75%
7	> 75%

COVER CLASS ESTIMATE
TREE: _____
SHRUB: _____
FORB:_____
GRAMINOID: _____
MOSS:_____
LICHEN: _____
BARE GROUND:_____
MICROBIOTIC SOIL CRUST: _____

PHENOLOGY
FLOWERING _____%
FRUITING _____%
VEGETATIVE _____%
**These must add to 100%*

POPULATION SIZE
ESTIMATED # OF INDIVIDUALS (exact count if feasible; when plants spreading vegetatively, include aerial stem count):
_____
NUMBER OF SUB POPULATIONS (if applicable): _____
SIZE OF AREA COVERED BY POPULATION (sq. meters):_____
If the area occupied is long, narrow and less than 12.5 meters wide, please indicate: Length:_____(m) Width: _____(m)

ANIMAL USE EVIDENCE:
___ Burrows ___ Wildlife Trailing ___ Nests ___ Browsing
___ Scat ___ Vegetation Damage ___ Animal Sighting ___ Bedding Site
Other: _____
_____

NATURAL AND ANTHROPOGENIC DISTURBANCE:
___ Campsite Evidence ___ Microbiotic Soil Crust Damage ___ Erosion ___ Flooding
___ Trails ___ Vegetation Damage (natural) ___ Archeological Feature ___ Grazing
___ Rock Cairns ___ Vegetation Damage (human) ___ Historic Structure ___ Fire
Other:_____
_____

EVIDENCE OF REPRODUCTIVE SUCCESS (evidence of seed dispersal and establishment):_____
_____

EVIDENCE OF SYMBIOTIC OR PARASITIC RELATIONSHIPS (e.g. pollinators observed)?

_____

_____

EVIDENCE OF DISEASE, PREDATION OR INJURY?

_____

_____

DOCUMENTATION:

PHOTOGRAPH TAKEN? Y N PHOTOGRAPHER_____ REPOSITORY_____

SPECIMEN TAKEN? Y N COLLECTOR_____COLLECTION # _____

COMMENTS (Include observations, monitoring or research needs):_____

_____

DESCRIPTION KEYS: Habitat Types adapted from Brown et al. (1998)

Habitat Type	Description
Subalpine conifer forest	Engelmann spruce-alpine fir, bristlecone pine-limber pine
Mixed conifer	Douglas and white fir, ponderosa pine, aspen
Ponderosa pine forest	ponderosa pine, Gambel oak, white fir
Great Basin montane scrub	oak-scrub, mountain mahogany, brittlebush, serviceberry
Great Basin conifer woodland	pinyon-juniper series
Great Basin desertscrub	sagebrush, blackbrush, rabbitbrush, winterfat, saltbrush
Mojave desertscrub	creosote, blackbrush, mesquite, saltbush
Alpine/subalpine grassland	bunchgrass (AZ fescue) and sedge-forb-grass association
Semi-desert grassland	grama grass-scrub (*Bouteloua/Pleuraphis*), mixed shrub
Interior wetlands	Cattail, rushes, sedges, willows
Riparian	cottonwood-willow, mixed deciduous broadleaf

SURFACE ROCKS
Basalt
Sandstone
Limestone
Mudstone
Shale
Conglomerate
Other

LANDFORM

Rockpile: uplands composed primarily of jiointed and efoliating granitic outcrops
Drainage channel: bottom not side slope of a drainage confined by banks or a canyon
Valley Bottom Fill: usually level places
Side Slope: side of drainage channel
Lower Slope: lower better watered portion of a slope
Mid Slope: central portion of a slope
Upper Slope: the upper driest portion of a slope
Interfluve: the area between small drainage channels
Ridge: high ground between two opposing slopes
Slick rock: large exposed expanses of bedrock
Terrace: level or gently sloping shelf perched on a slope, often caused by down-cutting rivers
Mesa: level or gently sloping ground surrounded on 3 or more sides by steep down slopes and capped
Butte: similar to a mesa, except with a top that does not have a flat configuration
Cliff: very steep rock slopes
Talus: unsorted material resulting from mass wasting of steep mountain slopes
Sand Dune/Sand Sheet: large accumulations of sand, may be stable or unstable (moving)
Plateau: flat area of great extent and elevation; specifically an extensive land region; considerably elevated (more than 100 meters) above adjacent lower-lying terrain

SOIL TAXONOMY:

1. Place soil in hand, remove pebbles, and add water very slowly, until it has the potential to have the consistency of putty. Add more soil or water as needed.
    a. If the soil does not remain in a ball, circle "**sand**"
2. If the soil remains in a ball, squeeze the ball between your thumb and forefinger, attempting to make a ribbon of uniform thickness and width pushing up and over your forefinger until it breaks from its own weight.
    a. If no ribbon is formed, record "**loamy sand**"
3. If ribbon forms but breaks before it is 2.5 cm, rub the soil between fingers.
    a. If very gritty, record "**sandy loam**"
    b. If very smooth, record "**silt loam**"
    c. If neither gritty or smooth, record "**loam**"
4. If ribbon breaks between 2.5 and 5 cm, rub the soil between fingers.
    a. If very gritty, record "**sandy clay loam**"
    b. If very smooth, record "**silty clay loam**"
    c. If neither gritty or smooth, record "**clay loam**"
5. If ribbon breaks when it is >5 cm, rub the soil between fingers.
    a. If very gritty, record "**sandy clay**"
    b. If very smooth, record "**clay**"
    c. If neither gritty or smooth, record "**silty clay**"

Inner Canyon Vegetation Program
Volunteer and Matching Hours 2007

		FILL DATE INTO GRAY BOX, THEN IN EACH ROW WRITE # OF HOURS FOR EACH PERSON																		Totals
NAME	**N, P or V**																			

NPS matching hours

PAID hours

NO FILL - Volunteer Hours

**Don't worry about filling in the colors - I'll do that!*

Total Volunteer Hours
Total Paid Hours
Total NPS Hours

Total Project Hours

CODES:
N = NPS (Lori, sometimes Kate, sometimes boatmen)
P = PAID hours (Loren, Steve, Melissa, Kari, Hillary, etc. are the AWPF paid people)
V = VOLUNTEER (interns fall into this category)

WILDLIFE OBSERVATIONS - 2007

DATE	OBSERVER	LOCATION	WILDLIFE SPECIES	ACTIVITY

**Note - For bighorn, eagles and redtails you still fill out the OTHER, more detailed, wildlife observation sheet.*

Grand Canyon National Park - Vegetation Program

Herbicide Use Log

Date	Species Code	Canyon Name	Site Name	Herbicide Name	Herbicide Mixture	Amount (oz.)	Comments	Initials

Volunteer for inner canyon reveg projects

In the coming months, Grand Canyon Volunteers plan a series of tamarisk removal projects in the inner canyon.

Grand Canyon Volunteers programs are made possible with the support of the Grand Canyon Trust and the Grand Canyon National Park Foundation. These organizations work together to assist in preserving the lands of the Grand Canyon National Park and its surrounding area. Through their cooperation, they help maintain and restore public lands administered by the National Park Service, the U.S. Forest Service, and the Bureau of Land Management as well as contributing to the programs of the Arizona Game and Fish Department and restoring sites held by the Grand Canyon Trust.

Upcoming tamarisk removal projects

Monday, March 12-Friday, March 16 – South Canyon

Wednesday, March 21-Wednesday, March 28 – South Bass Trail, Turquoise Creek, Ruby Creek

Groups are also invited to volunteer for special trips tailored for their organization. Visit www.gcvolunteers.org for more information or to sign up.

Grand Canyon Williams News
Jan 31 - Feb 6, 2007

Volunteers needed to help fight invaders

By Terra L. Crampton
Director, Corporate Outreach/Volunteer Services, Grand Canyon National Park Foundation

Grand Canyon National Park is home to over 1,750 vascular plant species, more than any other national park. However, a growing number of exotic, or non-native plant species have encroached on the park and now comprise over 10 percent of the overall flora. The number of exotic plant species increased from only nine reported species in 1930, to over 170 exotic plant species known to occur in the park today. Exotic plant species pose a significant threat to natural ecosystems – and are particularly threatening to the relatively pristine environments of our national parks.

Of the 177 exotic plant species at Grand Canyon National Park, approximately 30 of these are considered to be invasive species, or those that pose a high threat to natural resources. Invasive plants aggressively invade native habitat and undermine the integrity and function of ecosystems. The direct result is often the displacement of native species. Not only are native plants at risk, but also native insects, fish, birds, and other animals whose life cycles are closely intertwined. The spread of invasive plants is one of the greatest threats to biodiversity and the preservation of intact, native ecosystems. Preventing their spread is now considered to be one of the most important issues facing natural resource managers across the nation.

NPS policy mandates direct biologists to give priority to minimizing and controlling the spread of these invasive plants, but funding shortfalls do not allow for control of all of the top 30 invasive species while it is still feasible. As with many conservation projects, education and active participation with the public is the key to success. The Grand Canyon National Park Foundation and the Arizona Water Protection Fund support expanded monitoring and the Grand Canyon National Park Foundation directs a volunteer "hands-on" work experience to preserve and restore native plants at the Grand Canyon.

The park prioritized these 30 invasive species based on their ability to disrupt native ecosystems and the feasibility of the control in such a vast landscape as the Grand Canyon. Tamarisk, (Tamarix ramosissima), rose to the top of the list.

Tamarisk first reached the greater Grand Canyon area during the late 1920s, and became the dominant riparian zone species along the Colorado River following completion of the Glen Canyon Dam in 1963, which eliminated highly variable flows and so promoted tamarisk.

The tributaries and side canyons of the Colorado River, and the seeps and springs within Grand Canyon National Park, are among the most pristine watersheds and desert riparian habitat remaining in the United States, but the encroachment of tamarisk from the river corridor into these tributaries now poses a significant threat to the integrity of natural ecosystems within the Park.

Tamarisk spreads quickly in riparian areas – often developing monoculture stands, and altering water tables. Dense thickets of tamarisk trees crowd out native vegetation, damages wildlife habitat, and negatively affect the hydrology of riparian areas. In the Southwest, riparian areas generally provide biologically diverse and productive ecosystems; these areas typically account for less than 2 percent of the land, yet over 65 percent of the region's wildlife depend on riparian habitat.



Submitted photo
Volunteers from the Grand Canyon National Park Foundation assist with tamarisk removal. More volunteers are needed for upcoming projects.

How you can help the effort

You may think this is a hopeless situation but the fact is that you can do something to help! Next month marks the beginning of the fifth year of the Tamarisk Management and Tributary Restoration Project. To date, volunteer crews have removed over 200,000 tamarisk trees from over 100 side canyons. Volunteers are critical to making this project a success and have donated over 20,000 hours, kneeling beneath dense canopies with handsaws in action. The work is hard, backpacking skills are mandatory, and the days are long, but the sense of community and accomplishment are great.

The National Park Service is looking for volunteers! Students, families, individuals, corporate work-groups, conservation clubs, civic organizations...each person who contributes their time to the Backcountry Vegetation Program makes a huge difference. Contact Terra Crampton at 928-774-1760 or terra@gcnpf.org at the Grand Canyon National Park Foundation or visit the volunteer Web site to learn about opportunities to help: www.gcvolunteers.org. Trips occur almost weekly from September through March and comprise a number of levels of difficulty so there is a trip for almost everyone.

2006 Polk intern to work in vegetation management

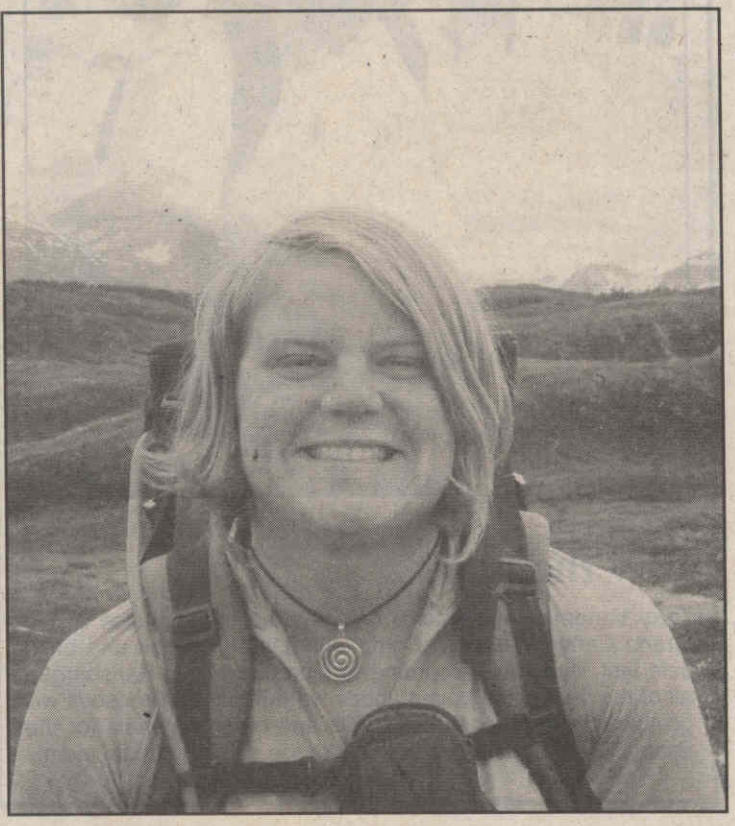
Ohio native Kelly McGrath is the 2006 Eugene Polk Science Intern at Grand Canyon National Park.

McGrath, a graduate of Kent State University, is the sixth recipient of the highly regarded internship, created by the Grand Canyon National Park Foundation in 2000.

This position will support the park's backcountry vegetation management program, which coordinates a range of activities including vegetation inventory and monitoring, exotic plant management and native habitat restoration.

McGrath will primarily focus on exotic plant management and control of high-priority invasive species in concert with the Science Center staff. She will gain experience with all facets of invasive species management, from planning and logistics to hands-on control. She will spend at least nine weeks in the field.

McGrath has studied outdoor education at Mt. Hood Community College. She is also a graduate of the National Outdoor Leadership School. Kelly has led Montana wildlife expeditions as well as managed outdoor programs for at-risk high school students. She first became "enthralled with the Grand Canyon" when she sponsored a group of 12 volunteer students to do work in the Canyon. Of this opportunity she says, "It's pretty incredible to be part of all of this. I look forward to gaining new skills, contributing to the Grand Canyon, and I am really excited about the field work."



Kelly McGrath

The Eugene Polk Science Fellowship, sponsored by the Grand Canyon National Park Foundation, was established in 2000 in honor of the Foundation's *chair emeritus,* Eugene P. Polk.

The fellowship provides experienced staff support to the Science Center division, guarantees top-level university students the opportunity to conduct in-depth fieldwork for key research projects at Grand Canyon National Park and encourages young scientists and researchers to consider careers with the National Park Service.

The Grand Canyon National Park Foundation works to build the ethic of stewardship for the Grand Canyon National Park through private philanthropy, volunteer leadership, and public outreach. The Foundation has raised over $15 million to support projects that protect and preserve the Canyon's irreplaceable natural, cultural, and historic resources while enhancing the visitor experience. For more information about the Foundation visit www.gcnpf.org.

INVASIVE WEED AWARENESS COALITION (IWAC)

Taking Back The Grand Canyon from Tamarisk (Saltcedar) Infestation



Removing saltcedar in the Grand Canyon.

Grand Canyon National Park has some of the nation's last remaining native desert riparian ecosystems. The side canyons and tributaries that line the Colorado River are especially valuable to hundreds of wildlife species. Since the 1930s, when tamarisk (*Tamarix ramosissima*), more commonly referred to as saltcedar, reached the Grand Canyon area and started growing densely along the river's slopes, this precious ecosystem has been jeopardized.



The National Park Service has been managing saltcedar in Grand Canyon National Park since 2002.

Challenge:

Saltcedar, a non-native shrub from Asia and Africa, is a highly aggressive invasive species. The average saltcedar tree produces 600,000 seeds, and one acre of living saltcedar trees consumes 977,553 gallons of water per year. Because saltcedar has been growing in Grand Canyon National Park for more than 70 years, it has impacted water availability in side canyons and tributaries to the Colorado River, as well as crowded out native riparian plant species, such as willow and cottonwood.

Solution:

In 2000, the Grand Canyon Park Service staff conducted an environmental assessment to evaluate the impact of saltcedar in the park. The assessment revealed the devastation of saltcedar on the biodiversity in the area, which led to a tamarisk management and tributary restoration project. The Arizona Water Protection Fund Commission funded all or a portion of this project. Work crews comprised of staff and volunteers began monitoring saltcedar infestation locations and levels. In 2002, teams began removing saltcedar through a combination of mechanical and chemical means, including manual removal and various single-plant targeted herbicide application methods. The labor-intensive work continues today from September to March every year, thanks to the efforts of hundreds of volunteers from all over the country.



One acre of living saltcedar trees consumes 977,553 gallons of water per year.

Result:

Since beginning the saltcedar management effort, Grand Canyon staff and volunteers have removed 119,498 seedlings, 42,892 saplings and 13,294 mature plants, for a grand total of 175,684 removed saltcedar trees and a 99 percent reduction of saltcedar coverage in the project areas. The staff also closely monitors any impact to other vegetation, wildlife, water or soil in the area. Preliminary results show a resurgence of native plant species. Using the saltcedar removal project as a model for future projects, Grand Canyon staff has begun controlling other invasive exotic species within the main Colorado River Corridor. They hope to manage these infestations before they spread into the adjoining side canyons.

NIWAW
NATIONAL INVASIVE WEED AWARENESS WEEK

Learn More:
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To learn from other success stories, visit www.weedcenter.org and www.nawma.org
For more weeds information, visit www.blm.gov

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Grand Canyon – A Case Study for the

By Wendy C. Hodgson, Curator of the Herbarium and Research Botanist

Over five million visitors each year gaze in wonder over the great chasm called Grand Canyon. It is considered one of the seven natural wonders of the world, and was declared a national park in 1919, only three years after the National Park Service was created. People are awed, inspired, or even moved to tears by the views of the Canyon's immensity and beauty. So it is easy to understand that visitors to the Canyon tend to overlook the great diversity of plants that lies within this park's borders. Yet, upon further discovery and investigation, one finds that a vast array of trees, shrubs, cacti and other succulents, herbs, and ephemerals is living, reproducing, and evolving in the Canyon.



Photograph by Dave Ganci

Grand Canyon—a region of tremendous inspiration and botanical research possibilities.

What is plant diversity?

Plant diversity is often defined as the total number of plant species within a given area. However, Quentin Wheeler (1995) and others believe that in order to fully understand biodiversity, one must take into account both number of species and the evolutionary diversity that they represent. For example, two different areas may have the same number of species, but they may differ in the number and kinds of families and genera they contain.

How diverse is the Canyon compared to other national parks and monuments?

As indicated in Table 1, the Grand Canyon has approximately 1,750 taxa (which includes varieties and subspecies), a number that appears to be higher than that of any other national park or monument in the U.S., representing 112 families and more than 570 genera. In addition, the number of plant species found in the Canyon represents a large percentage of Arizona's flora. Nearly 45 percent of the plants found in Arizona can be found in Grand Canyon National Park. This is significant considering that Arizona ranks fourth in the country for total number of plant species. At least 15 plant species are found only in the Park, while far more are considered rare. An even higher number of species is expected to eventually be recorded in the Grand Canyon region, which includes the adjacent Havasupai and Hualapai reservations, Grand Canyon-Parashant (and even Vermillion Cliffs) National Monument, and lands administered by both the Bureau of Land Management and the U.S. Forest Service.

Table 1. A Comparison of U.S. National Parks

Park	Size (acres)	Number of Taxa/State's Flora (Approximate numbers)	% of Flora
Denali	6,075,000	500/2,100 (Alaska)	24%
Death Valley	3,340,000	970/7,000 (California)	14%
Yellowstone	2,220,000	1,360/2,800+ (Wyoming, Montana, Idaho)*	
Mohave	1,530,000	750/7,000 (California)	11%
Everglades	1,508,508	1,000/3,820 (Florida)	26%
Kings Canyon	866,000	1,400/7,000 (California)	20%
Big Bend	801,000	1,200/5,300 (Texas)	22%
Yosemite	761,000	1,576/7,000 (California)	22%
Great Smoky	521,500	1,500/4,000+ (> 1 state)	37%
Grand Teton	310,000	1,000/2,800 (Wyoming)	36%
Rocky Mountain	267,000	1,000/3,100 (Colorado)	33%
Mt. Rainier	237,000	890/3,750 (Washington)	24%
Great Basin	77,200	411/3,000 (Nevada)	14%
Grand Canyon	**1,217,403**	**1,750/3,900 (Arizona)**	**45%**

*Number of species for Montana and Idaho not known

Importance of Plant Studies and Plant Documentation

Why is the Canyon so botanically diverse and how do we determine its diversity?

There are a number of factors that affect, or contribute towards, the Canyon's botanical richness. The Grand Canyon is situated on the Colorado Plateau, one of four major physiographic provinces (regions that are geologically and topographically distinct from other parts of the West), which is characterized by a high degree of endemism and species diversity. Three of the five North American deserts occur in the greater Grand Canyon region: the Mohave, Great Basin and Painted Deserts.

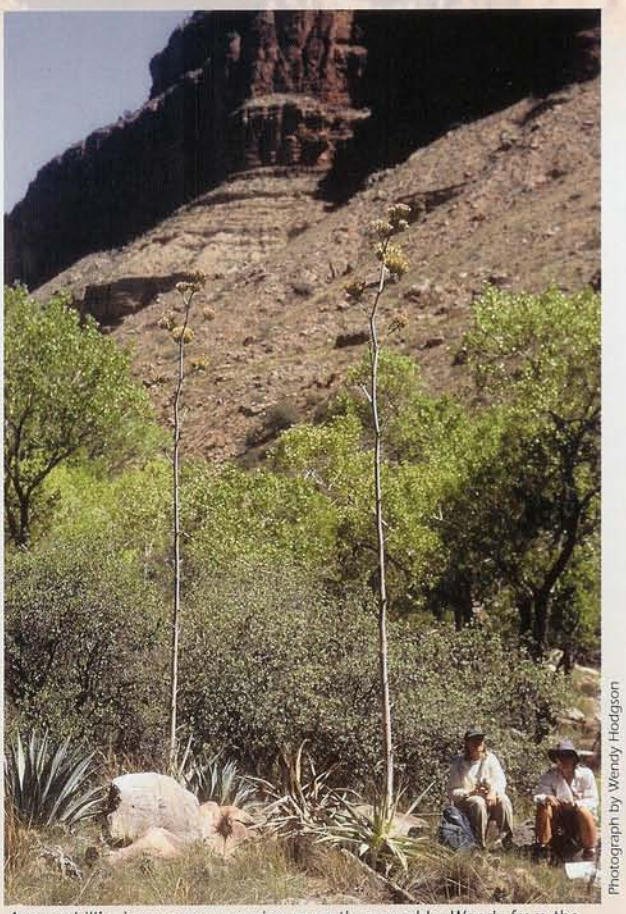
The Canyon region encompasses an area of over 1,217,400 acres, with elevations ranging from approximately 740 meters (2,400 feet) above sea level at the Colorado River, to over 2,600 meters (8,500 feet) on the North Rim—five biomes are represented in a short distance. Such varied topography provides many climatologically different conditions and numerous opportunities for contact among species that are otherwise often separated by many kilometers, increasing the chance of gene exchange between related species. The vast canyon network, including north-facing walls that are shaded during the summer heat, and its range of elevations provides areas of plant refugia—areas where more mesic- or cool-adapted plants can persist in a climate that continues to become warmer and drier.

The Canyon's geology is diverse as well, with numerous formations and soil types represented, providing varied ecological niches. The main river system, the Colorado, also acts as a corridor for plant (and gene) dispersal. In addition, nearly 60 other perennial water sources, and numerous seeps and springs occur in the Park, providing special habitat for hundreds of species.

Finally, humans have occupied the Grand Canyon region for more than 12,000 years, and, particularly during the last millennium, have influenced plant distributions by agricultural and non-agricultural practices. The determination of the Canyon's, or any other defined region's diversity, requires the careful inventory and documentation of its plants by making herbarium specimens (see Dr. McAuliffe's article on the roles of herbaria, including the Garden's, in the March 2007 issue of *The Sonoran Quarterly*).

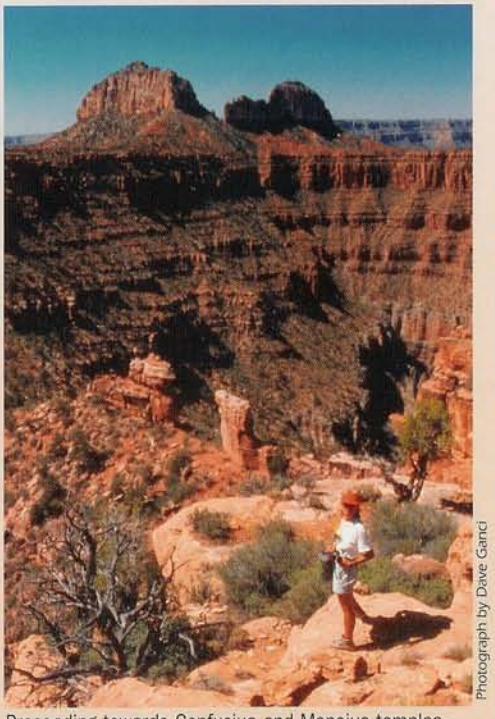
A brief history of botanical exploration in the Grand Canyon.

Botanical exploration in the Grand Canyon began in the last half of the 1800s (Phillips, et al. 1987). Prior to the 1930s, collections from along the main trails provided the most information about plants living in the Canyon below the rims. By 1947, a revised plant checklist of the Canyon listed about 900 species. In more recent years, the Inner Gorge (the area between the Tonto Platform[1] and the Colorado River) has received the most attention. In 1938, Dr. Elzada Clover and her graduate assistant, Lois Jotter, botanists from the University of Michigan, made the first serious collections along the river (and were the first women to successfully travel its entire length). In the 1970s, additional surveys were conducted along the river by Museum of Northern Arizona botanists and others, resulting in numerous collections which added to the Park's known species. As a result of recent work involving the monitoring and extraction of invasive plant



Photograph by Wendy Hodgson

Agave phillipsiana, a new species recently named by Wendy from the Grand Canyon.



Photograph by Dave Ganci

Proceeding towards Confucius and Mencius temples.

[1] Formed by erosion of soft Bright Angel Shale leaving harder Tapeats sandstone atop schist and granite

species in numerous side canyons along the Colorado River, National Park and Desert Botanical Garden staff and volunteers have documented hundreds of Canyon plants, including species not previously reported from the Canyon. However, much of the Grand Canyon, particularly the areas below the rim in the backcountry far removed from trails, remains botanically unexplored (Phillips, et al. 1987).

The challenge of collecting plants in the Grand Canyon.

As beautiful as the Canyon is, documenting its plants poses considerable challenges. Traveling in the Canyon is not for the faint-hearted. Conducting botanical inventories by foot or raft (and more rarely, by helicopter) requires careful planning, canyon backcountry experience, stamina, and luck. Plant collecting in the Canyon, particularly cacti, was not easy for Elzada Clover and Lois Jotter in 1938, nor is it easy today. We are faced with the same challenges: how to 1) effectively dry and press the specimens, especially on extended back-country trips, 2) keep them dry (if on the river), 3) keep the plants from developing mold in plant presses, 4) transport them (backpack, mule, raft, or helicopter), and 5) collect ample material when space or strength is limited. Poorly pressed, severely damaged or incomplete specimens do little to increase our understanding of the plants in question. In addition, some of the most under-collected areas in the Canyon are those that are relatively inaccessible, requiring a good dose of courage and field savvy to preserve life and limb, as well as the specimens. Also, climatic conditions change without warning, going from blistering heat to hypothermic cold, further testing the plant collector's stamina. Despite these challenges, there are those of us who are eager to look for and document the Canyon's botanical richness.

The *Vascular Plants of Arizona* project, Grand Canyon and the importance of documentation.

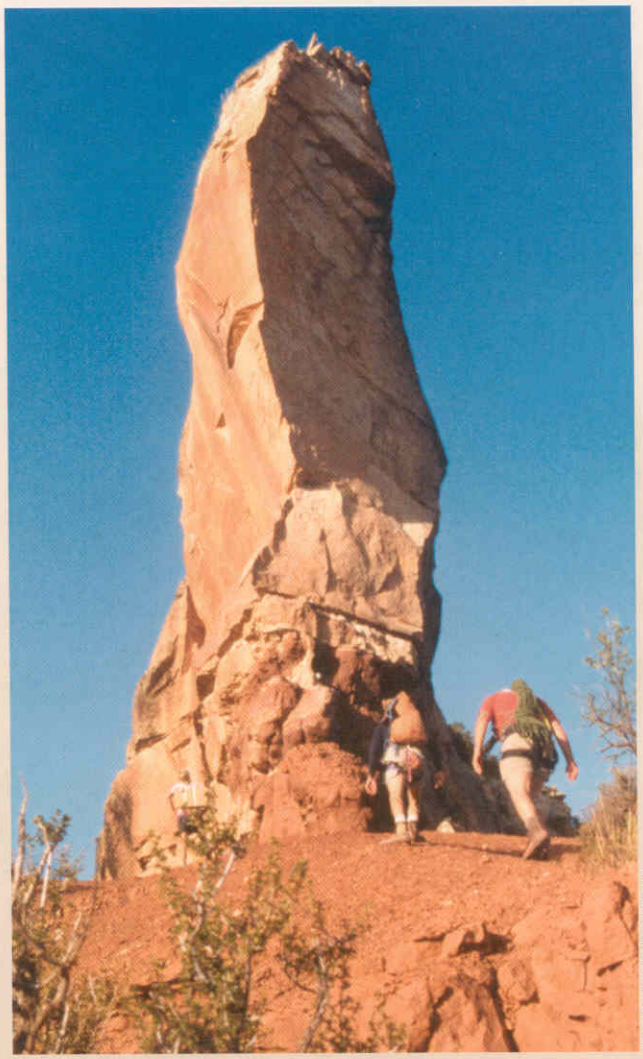
To best understand Arizona's extremely diverse plant life, the *Vascular Plants of Arizona* project was initiated in 1987, for the purpose of updating the important *Arizona Flora* by Thomas Kearney and Robert Peebles, published in 1964. Various contributors, including many of the Garden's research staff, have provided their expertise to the *Vascular Plants of Arizona* project.

Documentation of plant descriptions and distribution is based solely on herbarium specimens—every dot on a distribution map indicates the presence of a species as documented by a voucher specimen. When plants are not documented by a specimen, gaps in distribution information may result. For example, buckhorn cholla (*Cylindropuntia acanthocarpa*) and teddy-bear cholla (*Cylindropuntia bigelovii var. bigelovii*) are common cacti in the west



Photograph by Wendy Hodgson

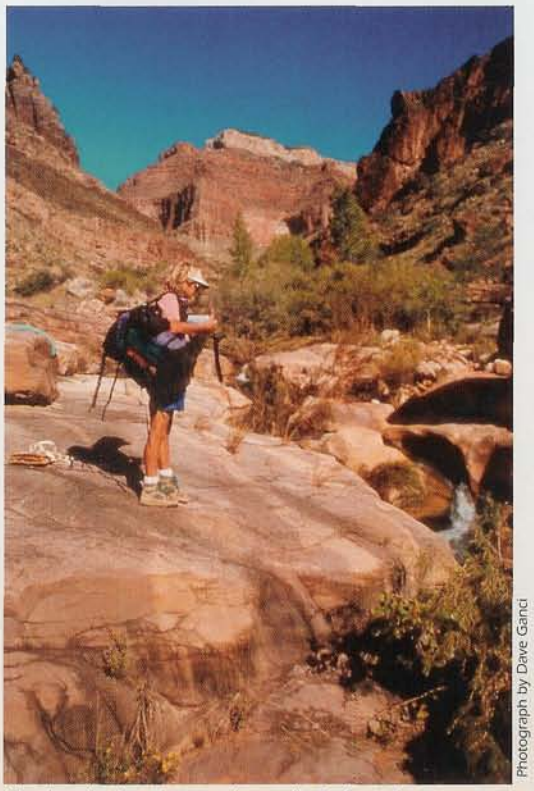
First-ever documented hybrid involving dry-fruit yucca (*Yucca angustissma*) and fleshy-fruited yucca (*Yucca baccata*) in the Grand Canyon.



Photograph by Dave Ganci

Rock formation before reaching Buddha Temple.

end of the Grand Canyon. Unfortunately, few if any specimens of either had been collected (until recently by Garden and Park staff). Therefore, no specimen was available for study by Dr. Donald Pinkava, cactus expert and director emeritus at ASU herbarium, who published the *Cylindropuntia* treatment for the *Vascular Plants of Arizona*, as well as *Flora of North America*. The resulting distribution map inaccurately reflected no presence for either species anywhere near the Grand Canyon region. Another cholla, *Cylindropuntia abyssi*, was formerly known only from a location near Peach Springs, located south of the Grand Canyon. As a result of just one recent river trip, however, Garden staff collected additional material in the Canyon itself, adding that species to the ever-growing list of Canyon plants, and providing additional significant insight about this rare plant's origin and relationship to other chollas. Another example is ocotillo (*Fouquieria splendens*), a conspicuous but difficult to press plant, that is common in the west end of the Canyon. Until recently (when one trip by Garden and Park staff increased the number of collections by 300 percent) ocotillo was collected, once from the canyon, and a conspicuous gap in mapping its distribution in the new the *Vascular Plants of Arizona* project resulted.



Photograph by Dave Ganci

Wendy collecting plants and recording information.

Other challenges in understanding the Canyon's plants and plant communities.

Often, limited understanding of the importance of funding taxonomic research and collections is the major stumbling block in combating what Wheeler (1995) calls "bio-ignorance." For instance, despite its being a prominent national park and natural wonder of the world, financial support for plant-based research is woefully lacking at Grand Canyon National Park, causing it to rely heavily on outside assistance for funding as well as for the actual work.

An important need of the Park, for increasing knowledge of its plants and plant communities, is funding a botanist position. The majority of parks and monuments listed in Table 1 (most of which have smaller budgets) have a botanist on staff. Since 2001 Grand Canyon National Park has not staffed a botanist. Grand Canyon Natural History Association, whose membership supported numerous collections, research programs and publications, funded the first botanist for the Park, Rose Collom, in 1932. Her job included the overseeing and development of the Park's herbarium.

In addition to staffing a botanist, support and funding for plant inventory work, under the coordination of the Park's botanist, would provide tremendous benefits. As David Charlet (2000) said, "We need to convince management and funding agencies that species inventories are beneficial; not only inventories of vulnerable species, but also of the dominant, common, and uncommon species."

Considerable money has been allotted to vegetation-mapping—projects that concern themselves mainly with mapping dominant plant species, with any information regarding specific species restricted primarily to those that are considered rare (Charlet 2000). Unfortunately, many vegetation-mapping studies fail to include herbarium specimens of the species being mapped. As a result, this information is largely unverifiable, or verifiable only with great effort. How many so-called "common" species in the Grand Canyon (and elsewhere) are misidentified in the field and may actually represent new entities? Grand Canyon National Park was recently awarded major funding for a vegetation-mapping project. Hopefully, sufficient documentation in the form of herbarium specimens of as many plant species as possible, common or not, is part of the project. Is this an impossible task? No. For example, in an effort to document plants not already represented in Arches and Bryce Canyon National Parks' herbaria, four vegetation "mappers" found, and documented with herbarium specimens, 71 new plant records for these parks, including such common shrubs as greasewood (*Sarcobatus vermiculatus*) and shadscale (*Atriplex confertifolia*), in five months (Topp 2007).

Research and the Grand Canyon.

The botanical research possibilities for this Park are as immense as the Canyon itself. However, basic plant inventories, with concomitant voucher specimens, are required to provide the basis for understanding plant geography, speciation, ecology, and population dynamics—areas that beg for investigation—this in a region that is rivaled by few others in terms of its diverse natural and cultural features. The Garden's staff has contributed greatly towards better understanding Grand Canyon's plants and plant communities, particularly cacti and other succulents, along with those plants found in the more inaccessible and less frequented areas. Some of the more recent plant collection expeditions by Garden staff have been made possible (and easier) by the Park's Tamarisk Management and Tributary Restoration project, which is funded in large part by the Arizona Water Protection



Penny-royal scorpion-weed, *Phacelina glechomifolia* herbarium specimen and botanical drawing by Sally Boyles.

Fund and coordinated by Lori Makarick, Grand Canyon Vegetation Program Manager. Although Ms. Makarick's program focuses on extensive monitoring, assessment, and removal of invasive species from approximately 140 side canyons, herbarium specimens are collected at every possible opportunity. During 2006, Garden and National Park staff and volunteers collected 13 species new to the Park's flora in only 17 days. Grand Canyon plant studies continue thanks to the passion of a handful of devoted people, of which the Garden's staff is a part. This small group works on many large projects: the beautifully illustrated and informative guide book, *River and Desert Plants of the Grand Canyon* (Huisinga et al., 2006), *Flora of Grand Canyon National Park* (an update of the important 1987 flora by Phillips, et al.), *Rare Plants of the Grand Canyon* (illustrated, in part, by the Garden's own Botanical Art and Illustration Program students), continued species inventories of selected areas within the Park with concomitant documentation as herbarium specimens, and continued studies of selected taxa, which may result in the discovery of new species. All these projects and activities build on previous work by dedicated passionate individuals with the hope of sparking new interest in, and appreciation for, plants by people at all levels, whether it is the general public, National Park Service, politicians, or scientists. It is the least we can do for this magnificent place of sheer wonder, the Grand Canyon.

Literature Cited.

Charlet, D. 2000. Coupling species-level inventories with vegetation mapping. Madroño 47(4): 259-264.

Huisinga, K., L. Makarick, and K. Watters. 2006. *River and Desert Plants of the Grand Canyon*. Mountain Press Publishing Company, Missoula.

McAuliffe, J. 2006. The Garden's herbarium—not just a collection of pretty pressed plants. Sonoran Quarterly 61(1): 4-7.

Phillips, B., A. Phillips III, and M. Bernzott. 1987. Annotated Checklist of Vascular Plants of Grand Canyon National Park. Grand Canyon Natural History Association Monograph Number 7.

Topp, S. 2007. Veg mappers find "new" plants for Utah national parks. Sego Lily (Newsletter of the Utah Native Plant Society) 30(2): 8-9.

Wheeler, Q. 1995. Systematics, the scientific basis for inventories of biodiversity. Biodiversity and Conservation 4: 476-489.

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INSIDE OUTSIDE SOUTHWEST

MARCH/APRIL 2007

KILLERS WANTED!

The enemy is spreading fast, sucking the lifeblood from the West. Thousands of the invaders are killed each year but the battle rages against *Tamarix ramosissima* — and time is running out!

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ORDEALS OF CHOICE

Down The Green River With WILLIAM LEE MANLY 20 Years Before JOHN WESLEY POWELL

FORT PEABODY

Why a machine gun nest was built on a San Juan mountain

A local's guide to what's really up in the Four Corners

Killing The Creep

by Loren Bell

More than 4 million people visit Grand Canyon National Park each year. Most come to take a quick peek into the abyss, snap a few photos and maybe buy a T-shirt. But some come to kill, claiming as many as 70,000 lives a year.



Deep in the recesses of the Inner Canyon, the battles rage. There are no embedded reporters to witness the invasion, and no medals awarded. The combatants travel in small groups in relative obscurity, taking the fight to the enemy invaders. Mostly volunteers on leave from regular jobs, the combatants fight for a cause they believe in, seeking no fanfare. Grants and donations finance the effort, and future funding is uncertain. Strange, considering the battle is for the life-blood of the Southwest — WATER — and time is running out.

Our crew has descended 4,000 feet into the depths of Nankoweap Canyon to engage the enemy. Our backpacks each contain more than 50 lbs. of gear, food, water, tools and toys needed to spend a week below the rim. The weight is worth it though. Come lunch time, food bags explode bagels, cheese, fresh veggies, tuna, hummus, horseradish sauce, cookies and chocolate. We, the killers, must eat well.

Eyes closed for a quick post-lunch siesta, I can almost hear the enemy in the drainage below: growing, spreading and slurping up precious desert water. *Tamarix ramosissima*, the invader, is a pernicious force that threatens the riparian ecosystems of the entire Southwest.

One of a hundred species known commonly as salt cedar, or tamarisk, *ramosissima* has been crawling across the Southwest since its introduction to California from Eurasia as early as 1805. Intentionally planted to help stabilize eroding creek banks, the water-loving shrub spreads at an alarming rate, diminishing plant and animal diversity and draining some streams dry. At a temperature of only 80 degrees Fahrenheit, tamarisk transfers an amount of water equal to the weight of its foliage to the desert air, every hour — almost twice the rate of native vegetation. In simpler terms, the annual water loss to tamarisk in the Southwest equals twice the amount of water used by California's major cities during the same period.

Without the predators of its original home to keep it in check, tamarisk is free to employ an effective strategy for riparian domination. By concentrating salts in the soil around it, and creating a dense canopy overhead, tamarisk poisons and shades out native plants, creating a monoculture. Forcing out arrow-weed, willow, baccharis, cottonwoods and other native plants that usually inhabit healthy riparian ecosystems, these thickets of tamarisk support fewer ani-

All photography this story by Tyler Williams

mal species, and often let no water escape their sprawling roots. Additionally, the highly flammable tamarisk introduces fire to these wet areas, and quickly re-sprouts from its network of roots before native plants can recover.

Tamarisk is now a problem in at least 13 states from California to Louisiana, and north to Montana. Even Tennessee incongruously houses an outpost. The Four Corners area provides tamarisk a perfect growing climate, and is home to impressive forests of tamarisk. Travel from Cortez, Colo., to Cameron, Ariz., or head through the canyon-lands of southern Utah, and in nearly every drainage you will see tamarisk competing for supremacy only with Russian olive (another vicious invasive species). Once tamarisk arrives, it is almost impossible to stop it. Almost. This is where we come in.

"WHAT A HIKE. You guys are nuts!" exclaims Kate Watters, the Backcountry Vegetation Program Leader, to our crack squad of tamarisk slaughterers. Dropping her pack at the base of a sprawling cottonwood tree, she lays out a plan of attack. "Find a home for the next six days, relax for a bit and come back here in about an hour ready to kill. The last crew stopped just up the creek, so we can hike from here every day."

Kate serves as the field commander for tamarisk operations. She, along with a small team, takes crews of motivated volunteers into the far reaches of the park's Inner Canyon to engage the enemy. The goal: to find and destroy all tamarisk, effectively setting back the invasion into the Park by 50 years.

"Grand Canyon National Park contains some of Arizona's few remaining pristine riparian areas," Kate says. "These lush strips of land along waterways account for less than two percent of the land in Arizona, yet 65 percent of the region's wildlife species depend on them for survival."

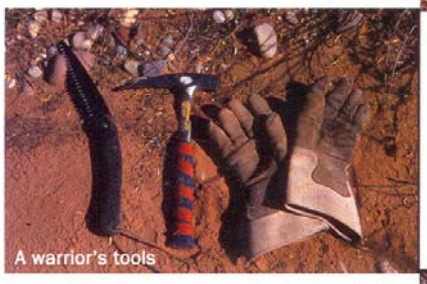
Fortunately, tamarisk was not able to gain a foothold inside the park boundaries until a recent 40 years ago. Before then, the narrow Colorado River corridor would experience floods with enough volume and frequency to scour out the tamarisk before it could establish. Glen Canyon Dam tamed the water, when soon after tamarisk stormed the beaches and secured strongholds along the river. From the river, the tamarisk marches up pristine side-canyons at an unhurried, but steady rate.

Recognizing the need to act before tamarisk permanently altered these ecosystems, National Park biologists developed a battle plan. Led by Lori Makarick, the Park's Restoration Biologist, they invoked the Park Service-wide mandate to "maintain . . . the natural abundance, diversity, and genetic and ecological integrity of the plant and animal species" found within park boundaries. In short, if eradication is possible, the National Park Service is obligated to act.

However, despite this obligation, and a more than $18 million annual budget, Grand Canyon provides scant funding for the project. The balance of the money comes from an Arizona Water Protection Fund grant secured by the Grand Canyon National Park Foundation, and volunteers looking for a way to give back to their public lands complete the balance of the field work. Collectively, these volunteers have donated more than $386,300 worth of their time, and have helped clear tamarisk out of more than 130 sidecanyons. In return for their hard work, they get free food and a T-shirt.

After a brief discussion about killing methods and tool safety, our team of pro-bono back-packing tammy-whackers heads upstream geared for battle: long sleeves, closed-toed shoes, safety glasses, gloves, sun hats and a gallon of water apiece. We each carry a hand saw, a few have small geology picks to help excavate flood debris, and some wield loppers for the smaller plants. There are a couple of longer 22-inch saws strapped to backpacks for use on the "mother-ships": those 40-year-old trees, the first arm of the invasion, that sometimes grow more than a foot in diameter.





A warrior's tools

The goal: to find and destroy all tamarisk, effectively setting back the invasion into the park by 50 years.



Finding where last year's crew stopped working is simple. Behind us, an occasional tamarisk carcass is noticeable, and maybe an old stump, but otherwise there is no indicator of "treatment" — the work of previous killers. In front of us, healthy tamarisk trees poke above willows, and surround cottonwoods. At our feet, a line is clear, and beyond it several thousand tamarisk seedlings, no more than a foot tall, clog the creek channel. We intend to kill every one of them.

"If you need a break from destroying some big monsters, have a go at these," I tell the crew, indicating the carpet of seedlings, "It is quite satisfying to pop them out roots and all. But a lot of these will get flooded out with the monsoons, so focus on the big guys

(Continued on page 46)

Killing The Creep — *(Continued from page 45)*

— they are producing more seeds as we speak."

Eager to cut their teeth on some tamarisk, the new crew sets upon the foe in small groups, and almost immediately, the sound of slain trees crashing to the ground provides a rhythm for the day.

The work is cathartic, and free from the chaos and stress normally associated with a war of this magnitude. One moment, I might be working alone on a tree next to the creek, surrounded by the beauty of the canyon, meditating on life to the singing of the hand saw. In the next, a group of fellow killers could attack the tree from all angles, belting out old sailing songs, show tunes or bad '80s pop.

"I think we are all really just failed Broadway singers," Kate mused, "and we ended up killing tammys for lack of anywhere else to turn."

SPEND ANY AMOUNT OF TIME working on the tamarisk problem and you will develop a respect for the plant's tenacity to equal your enthusiasm for its destruction. Burn, bulldoze or chain-saw it, and you only succeed in pissing off the plant. Almost immediately after "killing" one, it sends up a cluster of shoots even denser than before. In the wake of flash floods, buried branches take root and grow a new complex of plants. Meanwhile, a healthy mature tree can produce hundreds of thousands of air- and water-borne seeds each year.

Land managers utilize several methods to combat the spread of tamarisk, with varying success. Most commonly, they involve ripping the plants out by the roots, utilizing biological controls, or applying herbicide. None of these is a magic bullet, and all have their shortcomings.

Mechanically digging up the plant is accessible to anyone but is extremely labor intensive. In order to ensure that a plant does not grow back, you must remove the root crown, which can lie anywhere from the surface to many feet below dirt, boulders and flood debris. The process is time consuming, and may require a tractor or tripod-mounted winch.

More controversial is the introduction of biological agents such as an exotic beetle that eats tamarisk. The Saltcedar leaf beetle (*Diorhabda elongata deserticola*) is a native of tamarisk's home turf where the two co-evolved. These bugs can defoliate acres of tamarisk in a single season. Although not enough to kill the plant, the disturbance can prevent tamarisk from reproducing and spreading.

Theoretically, when tamarisk populations dwindle the beetle will obligingly die off rather than change its diet and become another invasive species. According to an optimistic report, 10 years of force-feeding studies found that, "only three of 191 young insects were able to complete development on only one [out of 58 tested] native species of plant." At first blush, this sounds promising, but survival is a powerful motivating goal of any breeding population, and three is a crowd when it comes to the business of procreation.

Others are concerned that an introduced food source could result in population explosions of predators that may feed on the beetle. This will have unknown consequences both up and down the food chain as the predator populations spike, and create pressures on other food sources. If we have learned one lesson repeatedly, it is that natural systems are surprisingly more complex than we anticipate.

However, despite the concerns, managers in several locations throughout the West have already released the beetles into the wild. Only time will tell us the wisdom of this decision.

Rather than risk introducing another non-native into the Grand Canyon ecosystem, managers there have chosen to exclusively use a combination of mechanical and chemical controls. Crews use hand saws to cut a tree flush with the ground, and almost immediately certified pesticide applicators apply herbicide to the cut at close range using sprayers that look alarmingly like one-quart latte steamers.

The herbicide, known as *triclopyr*, mimics natural plant growth hormones that cause the cells in the tamarisk to elongate and burst, effectively disrupting nutrient supply chains throughout the tree. When applied correctly, this technique results in a better than 90 percent kill rate.

Of course, the application of herbicide in these sensitive riparian areas has caused concern as well. Although the danger to humans is minimal, and the herbicide readily binds to clay in the soil, reducing runoff, there is potential impact on aquatic animal species if applied indiscriminately.

These concerns have caused some to conclude that we should simply stand back and let nature run its course. The tamarisk will always be here, they argue, and besides, if we do remove the tamarisk, another invasive will take its place in short time. They argue that we can never win this war.

"**SURE,** these areas will require constant upkeep," Kate admits, "There are currently no plans to remove tamarisk from the main Colorado River corridor, so for a time there will be a seed source. But these creeks are so critical to the entire community of plants and animals, and the changes we have seen in the wake of our work are so compelling, that it is worth the effort."

And she is not alone in her belief. Across the war zone, tamarisk removal programs have been making headway against the invasion with lasting success. In Coachella Valley Preserve in southern California, tamarisk eradication began almost a decade ago. Within hours of the first major removal efforts, a spring that had not flowed in years began to run again. Today, one can hardly tell tamarisk was ever present.

The BLM, along with the Grand Canyon Trust, has mapped the location of tamarisk along the Paria River in preparation for an assault, and the Forest Service is looking into removing it from Kanab Creek. Volunteers for Outdoor Colorado, one of many organizations tackling the tamarisk, treated 17.7 acres of riparian habitat near La Junta during one weekend last April, and were at it again in September on the San Miguel River. Communities are beginning to wake up to the urgency, and private land owners are getting on board with the efforts. Meanwhile the nonprofit Tamarisk Coalition works year round in support of riparian restoration efforts in many forms and on many fronts.

Each tree removed may only represent a drop of water in the creek, but if enough drops are returned, the creeks will flow freely again.

DURING THE NEXT FOUR DAYS, our crew will beat the tamarisk in Nankoweap back another two miles. And five months later, on the final trip of the killing season, an army of volunteers will win the campaign and remove the last tree from the canyon, restoring Nankoweap to its pristine state. Regardless of what the future holds for the war against tamarisk in the Grand Canyon, or the Southwest, for now this area is secure.

"For me, it is not about the entire Southwest," reflects Debbie, the executive director of Wilderness Volunteers, who has joined our trip for a personal vendetta against the tamarisk. "Twenty years ago I hiked Nankoweap canyon, and there wasn't a tamarisk around. If things can go so wrong in such a short amount of time, then they can go right too. For me, it's about this bend in the creek, or this cottonwood that just got a new lease on life. Here we *are* making a difference."

For more information about the Grand Canyon Backcountry Vegetation Program, log on to *www.gcvolunteers.org.*

Loren Bell splits his year between killing tamarisk in the Grand Canyon and cleaning campsites in the San Juan Mountains. He currently writes from Flagstaff, Arizona.

Deserts, Stone, Plants, and Rivers—A Story of Change and Inspiration from a Grand Canyon Float Trip

Text and Photos by Chris Murphy

Like tributaries that feed a great river, four of the Southwest's colorful and diverse deserts each add unique botanical elements to the Grand Canyon's flora and vegetation. Here, over myriads of plant generations in the depths of this sun baked gorge, desert plant species have flowed together to form unique combinations of vegetation and new species. The plants and their communities often segregate themselves by being specially adapted to growing on only specific rock layers. This gives various sedimentary rock layers, already easily distinguished by the river runner or canyon hiker by their characteristic hues and erosion patterns, another special quality—like a subtle, but unique botanical jacket worn by certain rock layers that even the budding naturalist can recognize.



Thickets of tamarisk, catclaw acacia, honey mesquite, and Gooding's willow characterize the canyon bottom at Furnace Flats.

From the ecologic extremes of the Great Basin Desert to the northwest and upstream from the Colorado Plateau's windblown and stark, but picturesque, Painted Desert come species allied with pinyon-juniper, big sagebrush, blackbrush, rabbitbrush, and saltbrush vegetation, including broom snakeweed, mormon tea species, and Apache plume. The Mojave Desert to the west feeds botanical elements associated with blackbrush, creosote, desert holly saltbrush, and white bursage communities, including pygmy cedar, indigo bush, bladder sage, burrobush, desert almond, rock nettle, and species of yucca and prickly pear cactus. Despite the northern latitude, elements of the Sonoran Desert find refuge in the realms of the lower Grand Canyon, especially downstream of the aptly named Furnace Flats. Some of the Sonoran species that persist in the hot canyon are relicts of an even warmer time (not too distant) when the hot deserts were more extensive than they are today. Sonoran Desert creosote and brittlebush communities creep up river into the Grand Canyon and support characteristic species such as catclaw acacia, honey mesquite, crucifixion thorn, teddybear cholla, ocotillo, ratany, janusia, sweetbush, trixis, various barrel cacti, and others at the northern edge of their range.

The incredible floristic diversity of the Grand Canyon also results in part from the numerous life zones represented in the 8,000 foot elevation change from the arid canyon bottom along the Colorado River up to the highest point on the North Rim. The composition and distribution of the many plant communities are also influenced by climate, geology, and geomorphology in multiple geographic dimensions. But, of course, the most important ecologic driver in a desert environment is the presence or absence of water. Drifting along the Colorado River and hiking up its tributary canyons, a complex riparian community can be found. Coyote willow, Gooding's willow, arrowweed, numerous seep willow species, honey mesquite, catclaw acacia, haploppapus, and tamarisk are the characteristic shrubs. Hidden in the cool alcoves of sandstone, illuminated by sunlight that has seemingly sliced the stone slot canyon in which you stand, are trickling waterfalls, seeps, and springs. Colorful hanging gardens of yellow and pink columbines, red monkeyflowers, and green maidenhair ferns, as well as uncommon plants such as the redbud trees, flavaria, and giant helleborine, find refuge on these cool moist cliffs.

Viewed from a sandy beach, with the dark Precambrian core rock radiating the day's heat to the surrounding desert scrub and river runner's camps, the gnarled forms of pinyon pine and Utah juniper are silhouetted in the hazy light of a evening desert sun a few thousand feet above bathed in a cool breeze. Perched atop broad promenades of limestone and sandstone, this woodland may be cooler than the inner gorge, but it is by no means an easy environment for plants. Cold winter nights, sometimes bearing snow, give way to searing early summer heat and drought, followed by late summer's thunderstorms and flashfloods that can readily peel

the scant soil off the smooth rock. Within this woodland one can find big sagebrush, broom snakeweed, Mormon tea, Utah agave, banana and narrowleaf yucca, winterfat, Indian ricegrass, dropseed species, and needlegrass species. Above the pinyon-juniper, on the higher canyon rims, vegetation typical of the southern Rocky Mountains occupies cooler environs. Some of the most extensive ponderosa pine forests in the world grow here at elevations between 6,500 feet and 8,200 feet. Additional species such as Gambel oak, New Mexico locust, mountain mahogany, elderberry, creeping mahonia, muhly, Fendler's muttongrass, and fescue species also occur. Meadows and grassland communities are rare, but typified by grasses including blue and black grama, big galleta, Indian ricegrass, and three-awns in dry meadows, and sedges and forbs in wet, frosty basins. If that wasn't enough, above 8,200 feet on the north rim, spruce-fir forests characterized by Englemann spruce, blue spruce, Douglas-fir, white fir, and aspen, along with several species of perennial grasses, groundsels, yarrow, cinquefoil, lupines, sedges, and asters, thrive in this habitat of deep winter snow. All told, the resultant botanical diversity is mind boggling (see box below).

According to National Park Service botanists, Grand Canyon National Park is habitat for approximately:

- 1,750 known vascular plant species, about 10 percent of which are exotic
- 170 species of fungi
- 65 species of moss species
- 195 species of lichen species
- 12 endemic plants (species known only within the National Park's boundaries)
- 60 special status, or rare, plants species
- 130 plant communities

For many of the fortunate who live and work in the canyon as botanists, ecologists, biologists, geologists, river guides, trail and fire crew workers, resource managers, and tourism and recreation-related employees, the Grand Canyon is not just a magical river trip that must end at a take-out. The same inspiration and love of place experienced on the 17-day river trip I joined as a National Park Service volunteer in May 2005, is integrated into their livelihoods and commitment to preserving and restoring the Grand Canyon. One such person is Lori Makarick, Backcountry Vegetation Program Manager and Restoration Biologist for Grand Canyon National Park. Despite its natural and botanical grandeur, the Grand Canyon is threatened. One of the most troublesome threats is the invasion of natural communities by exotic plant species, the most notorious being tamarisk or salt cedar.



Typical Mojave Desert community in central canyon, with prickly pear, yucca, and desert shrubs.

Native to Eurasia, tamarisk was introduced to North America in the 19th century for controlling stream bank erosion. Since introduction this evergreen shrub to small tree has colonized riparian corridors throughout lower elevations of the arid and semi-arid West, including the Snake River and its tributaries in southern Idaho. The result has been major changes to natural ecosystems. According to the National Park Service, tamarisk reached the Grand Canyon area during the early 1930s and become a dominant riparian species along the Colorado River following completion of Glen Canyon Dam in 1963 and the subsequent alteration of natural flows. It has since colonized side canyon tributaries and springs. Able to establish in suitably moist habitats ranging from intermittent washes and arroyos, to seeps an springs, to floodplains of small streams or the largest rivers, it typically persists and eventually spreads to form

dense stands. An average tamarisk produces about 600,000 seeds, but a large mature tree can produce over 250 million wind and water dispersed seeds. Although river runners seek its shade from the relentless desert sun and some wildlife species use it for shelter, food, or nesting habitat, tamarisk negatively alters the function of native ecosystems wherever it invades. When tamarisk invades beaches, side canyons, and seeps and springs as it has in the Grand Canyon, it causes a cascade of negative effects by crowding out native vegetation, usurping scarce water, and displacing organisms at all levels of the ecosystem (from insects to birds to mammals). Tolerant of saline conditions, tamarisk concentrates salts in the surface soil layers thus creating an environment more suitable for its own success while deterring or eliminating native plants less tolerant of saline soils. These salts eventually make their way into the aquatic ecosystems, changing water chemistry.

Lori Makarick is the leader of the Grand Canyon "Tamarisk Management and Tributary Restoration" project. Lori and a hard working, dedicated team of restorationists "seek 1) to prevent further loss or degradation of the existing native flora and fauna, and 2) to restore more natural conditions, thereby protecting the park's riparian areas, some of the nation's last intact examples of these rare desert ecosystems." After extensive environmental review, it was deemed that control is prudent and feasible, and the exotic species interferes with natural processes and the perpetuation of natural features, native species, or natural habitats the control of tamarisk in side canyons, tributaries, developed areas, and springs above the pre-dam water level of the Colorado River. Tamarisk is controlled through a combination of mechanical, chemical, and other restoration methods including manual removal, herbicide lance injection, hack and squirt method, cut stump method, and basal bark application. The method selected is specific to each site and is determined by the restoration biologist or project leader. It is truly hard, hot work that only those with commitment as solid as the canyon's ancient igneous core can successfully accomplish. More than 12,000 hours of volunteer time have been donated to this project so far.

According to Makarick, Phase I of the project, supported by the Arizona Water Protection Fund, the Colorado River Fund, the Grand Canyon National Park Foundation, the Grand Canyon Wildlands Council, and the National Park Service began in 2002. To date, crews have completed work in more than 90 project areas. In over three years, crews have removed more than 140,000 tamarisk trees from 1,819 hectares (4,496 acres) of the park's inner canyon, with only 7% of the initially controlled trees requiring follow-up treatment. Prior to project implementation, biologists installed a long-term monitoring system that includes 22 vegetation transects and 376 fixed photo points in the first 63 project areas. When re-reading the vegetation transects in 2004, a 99% reduction of tamarisk cover and an increase in native plants were observed. Park biologists will continue to monitor Phase I project areas for 5-10 years. All of the initial results reveal the success of this project.



Arrowweed, a common riparian shrub of the southwest deserts, abundant in the lower Grand Canyon.

The Arizona Water Protection Fund recently provided funding to expand this project into 35 side canyons during 2005-06 and another 30 side canyons during 2006-07. It was for this phase of the project that fellow Idaho Conservation Data Center botanist/riparian ecologist Lisa Hahn and I were blessed with the opportunity to volunteer for this important project . . . in exchange, of course, for an epic guided raft trip through the grandest of canyons. During the 17 day trip, our crew of fun-loving restorationists implemented pre-tamarisk removal

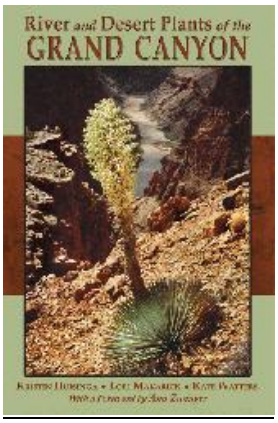
monitoring, including reading vegetation transects, water quality sampling, and completing habitat assessments for federally listed southwestern willow flycatchers (which sometimes frequent dense, tamarisk-Gooding willow communities targeted for treatment).

Lori and her botanical comrades are members of a rare tribe of naturalists . . . those never ceasing in their dedication to place, never ending in their quest for knowledge, always grinding away like water eroding stone until the project is complete, yet, always waking the next day with a smile to start the next task. Not satisfied with just removing tamarisk and restoring the *Grand* Canyon, organizing dozens of volunteers and logistically complex rafting expeditions, they want to document the whole damn flora too! In our journey down the river we were fortunate enough to be joined by two professional botanists with probably the most working knowledge of the canyon's flora of anyone alive, Wendy Hodgson and Tina Ayers. Wendy Hodgson, Curator of the Collections and Director of the Herbarium at the Desert Botanical Garden in Phoenix, Arizona, has been involved in floristic surveys of plants in the Southwest and northern Mexico, ranging from the Grand Canyon National Park and Agua Fria National Monument, to Baja and northern Sonora, Mexico. She is an expert on systematics and ethnobotany of the genera *Agave* and *Yucca*, including pre-Columbian agave cultivation. Her book, *Food Plants of the Sonoran Desert* (2001, University of Arizona Press) won the 2002 Klingler Book Award, presented by the Society of Economic Botany. Dr. Tina J. Ayers is an Associate Professor of plant systematics, phylogenetics, biogeography, and floristics, and curator of the Deaver Herbarium at Northern Arizona University. The Deaver Herbarium is the primary collection of plants from the southern Colorado Plateau, including the Grand Canyon, and adjacent deserts. Together with several volunteers, they are further documenting the flora. Much of their work, combined with photos of canyon plants by David Edwards and others, contributed to a recently completed field guide of the inner canyon flora by Makarick and botanists Kate Watters and Kristin Huisinga. David Edwards, a professional photographer who travels to corners of the globe, such as Mongolia, to glimpse intact cultures through the lens, was also one of our expert and fun-loving river guides.

For botanically inclined river runners such as us, time spent floating down the Grand Canyon during the fine spring bloom of April 2005 was paradise—an adventure of a lifetime. As we rode the giant frothy waves of dozens of rapids—an act usually culminating in clutching our rafts and ducking our heads as we crashed through walls of whitewater—the adrenaline got our hearts beating. Between rapids we drifted, quietly, or happily chatting about stories of the stone, the flora and fauna, the rapids, or the people that lived and traveled the canyon before us. Floating through the vertical-walled chasms of colorful ancient rock on glassy, peaceful water as it swirled and lapped the canyon walls, slicing downward through millions of years of rock layers while the diversity of the desert flora subtly and constantly changed, stirred our hearts in different ways. Even with our modern river running gear and conveniences, the wild river inspired us and created a passion for exploring the canyon in what must have been similar to those which drove John Wesley Powell, John Charles Fremont, and others to risk their lives exploring and scientifically documenting its untamed core. We shared some of the same passion for the place that drove Ed Abbey, David Brower, and many others to tirelessly and unselfishly fight for (and won) the preservation of the canyon when it was faced with the construction of a massive dam the likes of those which choked the Colorado in Glen Canyon and the Granite gorge near Las Vegas. And we felt a sense of connection with those that have explored the canyon before us—from the Native Americans, who lived there, tended wild "gardens" of native food plants, and considered the canyon sacred, to the early botanists and river runners.

Species mentioned in this article are described in the following field guide, an excellent reference for the Grand Canyon:

"River and Desert Plants of the Grand Canyon," by Kristin Huisinga, Lori Makarick, Kate Watters, with a Foreword by Ann Zwinger



NATIONAL PARK SERVICE
U.S. DEPARTMENT OF THE INTERIOR

GRAND CANYON NATIONAL PARK
ARIZONA

Invasive Plant Species Observation

You can make a difference! Of the more than 170 exotic plant species found in Grand Canyon National Park, about 60 are "target" species because of the threats they pose to native plants, animals, and ecosystems. You can help the National Park Service control these invaders by documenting how many invasive plants you see and exactly where they are located. With help from you we can compile information and quickly respond to sites infested with these plants. Please contact the park's Backcountry Vegetation Program Manager for additional paperwork and training if you are willing to help manually remove these plants. Even skilled botanists can confuse these exotic plants with some of our well-loved, native species, so we want to make sure you have the necessary information to help us with this battle.

Early identification is one of our strongest tools in fighting the invasion! Visitors to Grand Canyon play an integral role in protecting our national park from invasive species. The National Park Service thanks you for your voluntary participation in this program and your interest in protecting native plants and animals. Please use the format below when gathering information. If you are not sure of a plant's name or status, take a picture and send it along with your collected data.

Send your postcard and any pictures to:

Grand Canyon National Park / Backcountry Vegetation Program Manager
823 North San Francisco, Suite B / Flagstaff, AZ 86001-3265
phone (928) 226-0165 fax (928) 226-0170 / email: Lori_Makarick@nps.gov

SAMPLE REPLY POSTCARD

Please note the following when you see an invasive plant species.

Date of observation _____

Name of plant species _____ # of individuals at the site _____

Location (the more precise you can be, the easier it will be for us to find the site)

River mile _____ River right or left _____ Name of camp or side canyon _____

Descriptive place name along a trail? _____ GPS coordinates and datum _____

Did you take any action ? Yes No

If yes, did you pull the plants? Yes No How many did you pull? _____

Was the plant flowering? Yes No

If there was more than one plant of the same species, what percent were flowering? _____ %

Were there ripe seeds on the plant? Yes No

Did it appear that some of the seeds had already dropped? Yes No

Comments

Camelthorn *(Alhagi maurorum)*

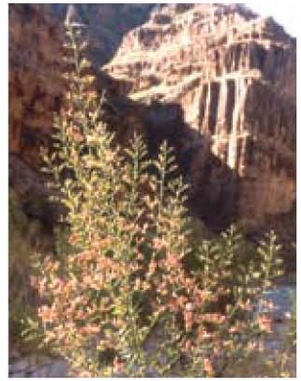
Camelthorn, a member of the pea family, is native to the Mediterranean and Asia. It was accidentally introduced into the United States in 1915 via contaminated alfalfa seed, but is now found throughout Arizona and in 34 other states.

Identifying characteristics

- Shrub, 1-4 feet tall, intricately branched, with yellow-tipped spines
- Leaves small, alternate, wedge-shaped, with hairy undersides
- Flowers pink to magenta, on upper part of branches
- Seedpods slender, spine-tipped, brown to maroon

Why is this plant a threat?

Camelthorn is notorious for taking over Grand Canyon's already limited beaches. Its hardy roots and stems can reach a depth of 45 feet and extend more than 24 feet from the plant, giving it plenty of reserves to survive during hard times. The extensive underground system allows it to spread rapidly, tap into the groundwater, and steal nutrients and moisture from native vegetation.



PHOTOS: GLENN RINK

Top: mature plant; bottom: flowers.

Management of camelthorn

Currently, the only tributary camelthorn grows in is the Little Colorado River (LCR), but it thrives along the main river corridor from the confluence downstream. In order to curtail the empire it is creating, park biologists need to know immediately if this species is found in other side canyons or anywhere upstream of the LCR. Due to its widespread distribution in the river corridor, current control efforts focus on just a few sites, including Unkar Delta and Crystal Camp. Park staff and volunteers pull camelthorn from these sites several times a year, keeping count of the number of plants pulled each time to see if this method will control this species. If you are interested in pulling camelthorn at these sites, please contact the park's Backcountry Vegetation Program Manager before heading into the field to get the latest information on the project.

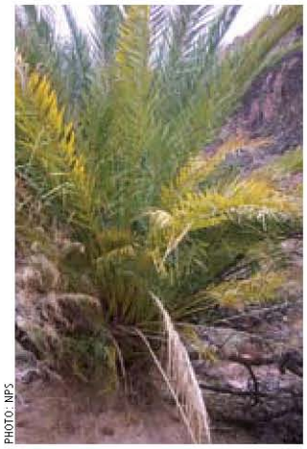


PHOTO: NPS

Mature plant.

Date palm *(Phoenix dactylifera)*

Originally from North Africa and the Middle East, date palms were first brought to the United States in the mid-18th century by Jesuit and Franciscan missionaries. Today most date palms in Arizona, California and Nevada grow in landscaped settings, with some renegades escaping into the wild.

Identifying characteristics

- Medium-sized tree, 10-40 feet tall, with woody sheaths on trunk
- Leaves to 20 feet long, blue-green, clustered, leaflets folded lengthwise
- Flowers white, clustered, fragrant
- Fruits known as dates, dark-brown to yellowish-brown when they are ripe

Why is this plant a threat?

The easily identified date palm reproduces from seeds and roots, tending to form dense stands. This invader uses vast quantities of water. Date palms have been known to dry up precious desert springs relied on by wildlife, native plants, and humans.

Management of date palm

Before 2004, only a small number of date palms grew in Grand Canyon. Recently, vegetation managers noticed the number of palm trees increasing and even found trees with fruit and viable seed near Phantom Ranch. Knowing that humans and animals could potentially spread the seed far and wide, park biologists took action. Crews labored to remove the trees with shovels and small saws and then meticulously re-contoured the sites to minimize the ground disturbance. Any new date palms will be removed from the park, so please let us know if you see these trees.



PHOTO: ©BARRY RICE/THE NATURE CONSERVANCY PHOTO: NPS

Top: mature plants; bottom: leaves.

Perennial pepperweed *(Lepidium latifolium)*

Originally from Eurasia, perennial pepperweed may have been accidentally introduced to North America via contaminated sugar beet seed at the turn of the 20th century. It is now found throughout coastal New England and in all states west of the Rocky Mountains.

Identifying characteristics

- Perennial herb, 3-8 feet tall, forming dense stands
- Leaves alternate around stem, green to gray-green, waxy, with toothed edges
- Flowers white, with 4 petals, clustered at the branch tips
- Plants appear as a rosette for the first few weeks in early spring

There are 2 native pepperweeds in the Inner Canyon: mountain pepperweed (*L. montanum*) and bush pepperweed (*L. fremontii*). Bush pepperweed is more common at higher elevations, while mountain pepperweed grows in abundance in the river corridor. Look for toothed margins on broad leaves of perennial pepperweed and its more showy and open flowering stalk.

Why is this plant a threat?

Once established, perennial pepperweed forms dense stands that make it difficult for native plants to survive. Its ability to bring salts from deep in the soil to the surface and the copious litter it produces further limits native plant germination and survival. Each perennial pepperweed plant can produce thousands of seeds. New plants can also grow from small pieces of broken rootstock. It flourishes in a wide variety of habitats, even on relatively dry sites, making it suitable to creep into the park's side canyons.

Management of perennial pepperweed

This plant is only known to occur in the river corridor, but the number of populations is increasing every year. At this time, park biologists are mapping populations and determining the best strategy for control. Please record any sites in the Inner Canyon where you see this species.

Ravenna grass *(Saccharum ravennae)*
Pampus grass *(Cortaderia* spp.*)*

Ravenna grass is a large bunchgrass from Eurasia and pampus grass is an even larger bunchgrass from South America. Both were originally imported as ornamentals, but have escaped into natural areas, thriving and adapting to the arid Southwest.


PHOTO: NPS

PHOTO: NPS

Top: Ravenna grass with seedhead; bottom: pampus grass seedhead.

Identifying characteristics of Ravenna grass:

- Perennial bunchgrass, to more than 6 feet tall and wide
- Leaves have the following characteristics:
  - very fine, short hairs along blade with long, dense visible hairs clustered at the base
  - v-shaped when viewed in cross-section, white vein running along the underside from tip to base
  - edges have serrated teeth that will grab the skin if rubbed from tip to base
  - turn tan-brown, often with red streaks, curl as they dry
- Flower stalks to 12 feet, with silvery, plume-like seed clusters

Pampus grass is even larger than Ravenna grass—up to 9 feet tall with very long leaf blades. The flowering stalk appears more feathery, delicate, and white, up to 15 feet tall.

Why are these plants a threat?

Highly competitive with the ability to produce large numbers of wind-dispersed seeds, both bunchgrasses rapidly colonize riparian habitats, displacing native plants. Both currently occur only in the Colorado River corridor, with pampus grass found only at a few locations. Ravenna grass has been found on upper, drier terraces, indicating that it could be expanding its range within the park.

Management of ravenna and pampus grasses

Ravenna grass has been the target of an ongoing control program since the early 1990s, with voluteers removing more than 20,000 individual plants between Lees Ferry and Diamond Creek. Only a few pampus grass plants have been found in the park, and those were immediately removed. Annual surveys locate any new plants, which are removed prior to seed set. It is critical to the program's success for more people to be able to identify these plants! We need to know where these plants are so we can focus our control efforts each fall. Please send in your information!


PHOTO: J. SCOTT PETERSON

Mature Russian olive tree.

Russian olive *(Elaeagnus angustifolia)*

Originally from Eurasia, Russian olive was brought to North America during colonial times as a much-loved ornamental tree. Used for erosion control and as a windbreak, it is still sold today in many nurseries. If you have traveled in the Southwest, you have seen this tree.

Identifying characteristics

- Tree to 45 feet tall, with a dark brown, deeply furrowed trunk
- Branches smooth, reddish brown, with long thorns
- Leaves narrow, 2-3 inches long, silvery-green
- Flowers creamy yellow, in clusters, highly aromatic

Why is this plant a threat?

Russian olive aggressively invades riparian habitats and, once established, provides inferior wildlife habitat compared to native trees. Like other invasive species, Russian olive uses copious amounts of water. Its thorny thickets can make camping and hiking along waterways a challenge.

Management of Russian olive

Only a limited number of Russian olive trees have been found within the park. Park biologists have removed them due to their aggressive nature; however, more may be out there. The earlier we locate these trees, the easier they will be to control. Please scan the shorelines as you are floating down the river—look for the silvery hue. From a distance, buffalo berry (*Sheperdia rotundifolia*) and young netleaf hackberry (*Celtis laevigata* var. *reticulata*) resemble Russian olive trees, so get closer and look at the leaves before filling out the site description postcard!


PHOTO: PAUL WRAY

Russian olive flowers and leaves.


PHOTO: NPS


PHOTO: MARY ELLEN HARTE

Top: mature plant; bottom: seedling.

Russian thistle *(Salsola tragus)*

Russian thistle first arrived in North America from Eurasia in 1873 through contaminated flaxseed. Commonly known as "tumbleweed," mature plants pull free from the soil and blow away, spreading their seeds across the land.

Identifying characteristics

- Shrub, 1-4 feet tall, very branched and round
- Stems with distinct reddish stripes when young
- Leaves alternate, linear, fleshy when young
- Flowers small, papery, without petals with 5 pink to greenish white sepals

Why is this plant a threat?

Since the late 1800s botanists have been concerned with the ability of Russian thistle to dominate disturbed soil in drought conditions. One plant can produce up to 250,000 seeds, increasing this species' ability to spread and dominate. It can cause allergies in humans. This plant can crowd out native plants and also impact recreation, overgrowing beaches prized for camping.

Management of Russian thistle

Until very recently, Russian thistle was relatively uncommon in the park's Inner Canyon. However, this plant can now be seen on virtually every beach and in many side canyons. Volunteers and biologists manually remove the young plants before they produce seed. The plants are left on site to dry. Each site requires several visits since the seed can remain viable for several years. This is a plant we could use help pulling, so please contact the park's Backcountry Vegetation Program Manager if you are interested in lending a hand.



Sahara mustard basal rosette.

Sahara mustard *(Brassica tournefortii)*

Sahara mustard is native to Mediterranean areas, thriving in the broad desert belt from northwestern Africa to the Saudi Arabian peninsula, preferring sandy and gravelly soils. Fully adapted to arid regions, the southwestern U.S. reminds this plant of home, allowing it to settle in and feel very comfortable. It spread exponentially during the moist spring of 2005—earning it the nickname "tsunami mustard."

Identifying characteristics

- Annual or biennial herb, to 4 feet tall and 3 feet wide
- Basal leaves deeply lobed, with rounded tips
- Stem leaves small, linear, with stiff hairs
- Flowers dull yellow with 4 petals

Two other similar mustards occur in Grand Canyon: London rocket (*Sisymbrium irio)* and tumble mustard *(S. altissimum*). London rocket usually only grows to 2 feet tall, with more slender, curved upright seedpods than Sahara mustard. Tumble mustard is common throughout the U.S., growing to about 3 feet tall. Its leaves are reduced and more linear toward the top of the plant, but the seed pod can grow to 5 inches long, even longer than that of Sahara mustard.



PHOTO: MARY ELLEN HARTE

Tumble mustard.



PHOTO: NPS

London rocket.

Why is this plant a threat?

Sahara mustard sprouts earlier than most native plants and its enormous basal leaves can smother surrounding plants and rob them of early spring moisture. It also coats its seeds with a sticky gel, helping them to cling to animals and catch a ride. As these giants die back in early spring, their large, dry bodies act like tumbleweeds, acrobatically rolling across the landscape, spreading seed far and wide and providing tinder for future fires.

Management of Sahara mustard

Sahara mustard is found in great numbers in both Glen Canyon and Lake Mead National Recreation Areas, surrounding Grand Canyon and poising itself for an advance. Park biologists and volunteers began an aggressive control program in the spring of 2004, with a primary focus on the Lees Ferry area. We now need all the help we can get to start searching for this plant in the river corridor and side canyons.

Sowthistles *(Sonchus* spp.*)*

Originally from Europe and Asia, sowthistles are now widely distributed throughout the United States. Three species of sowthistles grow in Grand Canyon: common sowthistle (*Sonchus oleraceus)*, spiny sowthistle (*Sonchus asper*), and perennial sowthistle (*Sonchus arvensis*). These species prosper in moist soils along rivers and springs. Flowerheads appear very similar to common dandelion.



PHOTO: JAMES H. MILLER

Perennial sowthistle flower/seedhead.



PHOTO: CHRIS EVANS

Common sowthistle.

Identifying characteristics for all 3 species:

- Plants about 1-6 feet tall but begin life as a small rosette
- Stems and leaves exude a milky sap when broken
- Yellow flowers mature into fluffy, dandelion-like seed heads

Common and spiny sowthistle characteristics:

- An erect and unbranched stem
- Alternately-arranged, bluish-green, hairless, toothed leaves

Spiny sowthistle characteristics:

- Leaves are much more prickly than those of common sowthistle

Perennial sowthistle characteristics:

- A smooth, unbranched lower stem, but a branched upper stem
- Alternately-arranged, shiny, green leaves
- Upper leaves smaller and fewer than lower leaves

Why are these plants a threat?

Sowthistles can displace native vegetation by invading disturbed and undisturbed sites. All species have seeds the wind can carry great distances, aiding their ability to spread. Usually you find hundreds of sowthistles growing at a site, not just a handful.

Management of sowthistles

Once you get a search image for these species, you start to see them everywhere. Current control focuses only at seeps, springs and side canyons in the Inner Canyon because these plants are so widespread in the river corridor. We need information about where they are in the side canyons. How widespread are they beyond the river corridor? How many plants are found in each location? You can help us get this information!



PHOTO: CHRIS EVANS

Spiny sowthistle.





PHOTOS: NPS

Top: mature tree; bottom: flowers.

Tamarisk *(Tamarix ramosissima)*

Originally from Eurasia, settlers introduced tamarisk into the western United States in the early 19th century. It was used as both an ornamental tree and for erosion control along riversides and in fields. It reached Grand Canyon during the early 1930s, but did not become a dominant plant along the Colorado River until after completion of Glen Canyon Dam in 1963.

Identifying characteristics

- Deciduous shrub or small tree, 12-15 feet tall, often forming dense thickets
- Leaves are alternate, gray-green, scaly
- Flowers are pink to white, appearing nearly year round
- Young branches and saplings have smooth, reddish-brown bark

Why is this plant a threat?

Tamarisk forms dense stands that usurp water and can quickly crowd out native vegetation such as willow and cottonwood trees. Once established, tamarisk trees create dense piles of leaf litter below their canopy, making it tough for native plant seedlings to establish. This litter also increases salt levels in the soils, making it difficult for native plants to survive.

Management of tamarisk

Although tamarisk is well-established along the Colorado River corridor, it is succumbing to efforts aimed at controlling its spread in Grand Canyon's side canyons. Through the Tamarisk Management and Tributary Restoration Program, staff and volunteers use herbicides and hand saws to fight this persistent invader. This ongoing project, which began in fall 2002, has resulted in a 99 percent reduction of tamarisk coverage in treated areas and native plants are returning and thriving. We need help mapping and pulling tamarisk seedlings in select side canyons, so please let us know if you are interested in joining the team.

Tree of heaven *(Ailanthus altissima)*

Native to China, tree of heaven was introduced to the United States in the late 18th century, moving west during the California gold rush. Today, it can be found in 42 states from Maine to Florida and west to California, often in dense patches with few other native plants.



PHOTO: NPS



PHOTO: JAMES H. MILLER

Top: mature plant, bottom: leaves.

Identifying characteristics

- Deciduous tree to 80 feet tall and 6 feet wide
- Bark light gray, cracked, and branches gray, smooth and glossy
- Leaves large, compound, 1-4 feet long, leaflets to 7 inches long
- Flowers small, greenish-yellow, with 5 petals, appearing from April to June
- All parts of the tree emit a strong, offensive odor
- Fruit flat, papery, wing-shaped, with twisted tips

Why is this plant a threat?

Tree of heaven spreads rapidly, often forming dense thickets and displacing native vegetation. It can grow from seed but most often spreads through its well-developed rhizomes and roots. It outcompetes native plants by releasing toxins that inhibit the growth of other plants.

Management of tree of heaven

This aggressive tree has only been found at one location within the park, less than a mile up Kanab Creek from the river. It was quickly removed the same year a boatman informed park biologists about it. It is very likely that there are more tree of heaven in the park, which is why your help is needed. Please learn to identify this tree and notify park biologists if and where you find one.

The Grand Canyon National Park Foundation works to build the ethic of stewardship for Grand Canyon through private philanthropy, volunteer leadership, and public outreach. Donations to the Foundation support projects that protect and preserve the Canyon's irreplaceable natural, cultural, and historic resources while enhancing the visitor experience.

625 North Beaver Street Flagstaff, AZ 86001 ph 928.774.1760 fx 928.774.1240 www.gcnpf.org

The Arizona Water Protection Fund Commission has funded a portion of this brochure. The views presented are the Grantee's and do not necessarily represent those of the Commission, the State, or the Arizona Department of Water Resources.

DESIGN: MARY BETH

FEBRUARY 2004

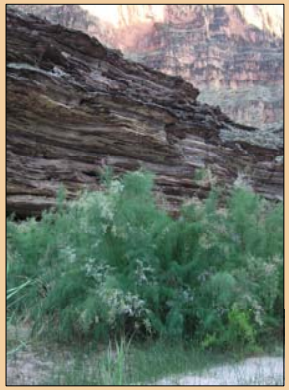
TAMARISK MANAGEMENT AND TRIBUTARY RESTORATION

WHY IS TAMARISK ON THE *LEAST WANTED* LIST?

Dense thickets of tamarisk trees (*Tamarix ramosissima*) crowd out native vegetation, dominate many riparian habitats, damage wildlife habitat, and negatively affect the hydrology of riparian areas.



Native riparian habitats are threatened by tamarisk



Tamarisk monoculture



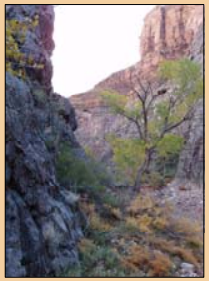
In the Southwest, riparian areas provide diverse and productive ecosystems. These areas typically account for less than 2% of the land, yet more than 65% of the region's wildlife depend on riparian habitat.

PROJECT HISTORY

The removal of tamarisk from tributaries of the Colorado River in Grand Canyon National Park and monitoring the success of the tamarisk management both pre- and post-removal began in 2000.



Side canyon pre- tamarisk removal

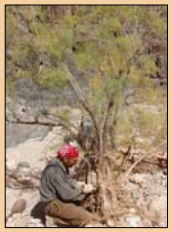


Side canyon post- tamarisk removal



Monitoring native vegetation

The size of the plant determines how it is removed. Methods include pulling, cutting to near ground level and applying herbicide, or girdling and leaving the dead tree standing as wildlife habitat. Using hand tools and herbicide ensures maximum effectiveness with minimum impact to visitors and the environment. Crews have completed work in 130 project areas, removing 250,000 individual trees from 6,000 acres of the park's inner canyon. Only 12% of the controlled trees required follow-up treatment.



Manual removal with hand saws



Cut stumps sprayed with herbicide

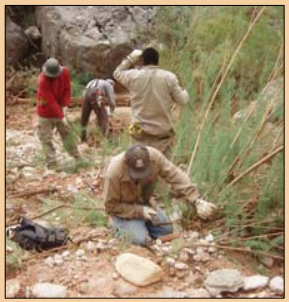


Native plant regrowth

HOW YOU CAN HELP!

The tamarisk management project is extremely labor intensive and time consuming. The hard work of volunteers, who have donated 30,000 hours over the last six years, ensures the success of this project.

We thank all of the volunteers for making this project a success!







Want to volunteer?

Contact the Grand Canyon National Park Foundation: (928) 774-1760

Or visit: www.gcvolunteers.org

The Arizona Water Protection Fund, Colorado River Fund, Grand Canyon National Park Foundation, Grand Canyon Wildlands Council, and the National Park Service generously supported this project.

All photos: NPS collection

Grand Canyon

National Park Service
U.S. Department of the Interior

Grand Canyon National Park
Arizona

Tamarisk Management and Tributary Restoration



Tamarisk (on left) growing near a water source

Tamarisk (Tamarix ramosissima), also known as salt cedar, is a highly invasive plant native to Eurasia. Introduced to the U.S. in the 19th century for erosion control, it has spread throughout the West, causing major changes to natural environments. Tamarisk reached the Grand Canyon area during the early 1930s, becoming a dominant in the riparian zone along the Colorado River following completion of Glen Canyon Dam in 1963. The side canyons, seeps and springs within Grand Canyon National Park are among the most pristine watersheds and desert riparian habitat remaining in the United States. The encroachment of tamarisk into these tributaries now poses a significant threat to the integrity of natural ecosystems within the Park.

Why is tamarisk undesirable?

Although wildlife species use this plant for shelter, food, or nesting habitat, and people rely on it for shade, tamarisk threatens the park's native ecosystems. A large mature tree produces close to a million seeds which are dispersed by wind and water, making tamarisk an aggressive invader. Tamarisk spreads quickly in riparian areas and often develops into monoculture stands. Dense thickets of tamarisk trees crowd out native vegetation, reduce suitable wildlife habitat, increase fire frequency, and decrease the water available for native plants and animals.

National Park Service policies call for managing non-native species "if control is prudent and feasible, and the exotic species interferes with natural processes and the perpetuation of natural features, native species, or natural habitats." Tamarisk in tributaries of the Colorado River meets these criteria. The Tamarisk Management and Tributary Restoration project seeks to prevent further loss or degradation of the existing native flora and fauna and to restore more natural conditions. This project protects the park's riparian areas, some of the nation's last intact examples of these rare desert ecosystems.

Project history and methods

Through a public review process, called an Environmental Assessment / Assessment of Effect, park management evaluated the impacts to natural, cultural and wilderness resources, and solicited public comments. Managers selected the environmentally preferred alternative that includes the control of tamarisk in side canyons, tributaries, developed areas, and springs above the pre-dam water level of the Colorado River.

Crews remove tamarisk through a combination of mechanical and chemical controls, allowing for native vegetation to recover. Methods include pulling, cutting to stump level and applying herbicide, or girdling to leave the dead tree standing for wildlife habitat. The combination of hand tools and herbicide ensures maximum effectiveness with minimum impact to visitors and the environment. The particular method used is specific to each site and determined by the restoration biologist or on-site project leader.

Project update

Phase I of the project, supported by the Arizona Water Protection Fund (AWPF), the Colorado River Fund (CRF), the Grand Canyon National Park Foundation (GCNPF), the Grand Canyon Wildlands Council (GWC), and the National Park Service (NPS) began in 2002 with 63 side canyons. The AWPF provided funding for the NPS and GCNPF to expand this project into 35 additional side canyons during 2005-06 (Phase IIa), and another 30 side canyons during 2006-08 (Phase IIb). Some Phase IIb project areas lie on Hualapai Tribal lands, and combined NPS and Hualapai crews work cooperatively in these areas.

To date, crews have completed work in 130 project areas, removing more than 256,000 tamarisk trees from over 5,000 acres of the park's inner canyon. Only 12 percent of the controlled trees require follow-up treatment.

Prior to treating areas, biologists assess areas for potential habitat of the endangered southwestern willow flycatcher and install long-term monitoring components. The monitoring includes 35 vegetation transects and more than 1000 fixed photo points. Post treatment assessment of vegetation transects in 2004, showed a 99 percent reduction of tamarisk cover and an increase in the presence of native plants. Park biologists will continue to monitor project areas for 5-10 years.

Upcoming work

From September 2008 through March 2009, crews will be working in side canyons along the Colorado River. They will be revisiting sites in which tamarisk was previously controlled and initiating the cyclic maintenance phase of the project.

For project reports and the Environmental Assessment/Assessment of Effect for this work please refer to the park's webpage: **www.nps.gov/grca**

If you would like additional information about this project, please contact the park's Vegetation Program Manager and Project Coordinator at: **Lori_Makarick@nps.gov**

If you would like to volunteer to help with this effort, please contact Grand Canyon Trust at (928)774-7488.

Or visit **www.gcvoluteers.org**

Special thanks



The tamarisk management project is extremely labor intensive and time consuming. The enormous progress made over the last six years is largely due to the hard work of volunteers who have collectively donated more nearly 40,000 hours of their time to this project.

We thank all of the individual volunteers for making this project a success!



NOTICE

Tamarisk control work is ongoing from September-March each year. You may encounter work crews or notice cut stumps as you visit the Inner Canyon. In addition to removing smaller trees with hand tools, certified herbicide applicators selectively spray the herbicide Garlon, which is low in toxicity, directly onto the cut stumps, but not into creek or water sources. If you are in area while crews are working or 1-2 days after the work is completed, you may notice a varnish odor from the oil mixed with the herbicide.

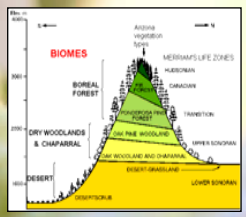
Grand Canyon National Park Vegetation Program

National Park Service
U.S. Department of the Interior
Grand Canyon National Park
Arizona

INVASIVE PLANT SPECIES MANAGEMENT: PAST CHALLENGES, CURRENT EFFORTS, AND FUTURE DIRECTION

OVERVIEW OF FLORAL DIVERSITY

Grand Canyon National Park (GRCA) contains over 1750 plant species, exceeding the diversity of other national park units. The park provides refuge for 9 endemic species, which are found no where else in the world, and an additional 23 endemic species that extend just outside of park boundaries. Three of the four major North American deserts intersect here, providing a dynamic, diverse and expansive landscape for evolution and speciation to occur.

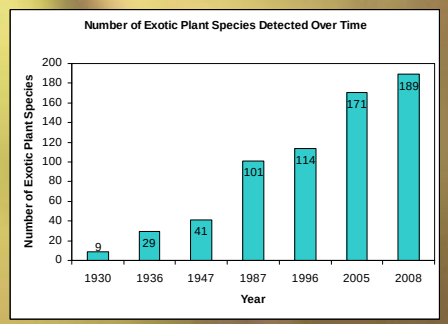


GRCA contains 5 of the 6 life zones proposed by C. Hart Merriam in 1889. The plant diversity from the North Rim to the bottom of the canyon is similar to what you would experience along the coast from Mexico all the way into Canada.

Grand Canyon contains some of the nation's best remaining examples of desert riparian habitats. These areas harbor diverse and productive ecosystems, which typically account for less than 2% of the land, but they provide critical shade, water, and food in desert landscapes, with up to 90% of all bird species and 80% of all mammal species routinely using these areas. The park also contains old growth forest and woodland ecosystems, pristine mountain meadows, and some plant communities found no where else in the world.

EXOTIC PLANT HISTORY

Vegetation program staff reviewed floral inventories dating back to 1930 to determine the history of exotic plants in the park. While some of the increases in exotic plant species are due to the limited extent of early inventories, recent increases reflect the encroachment and invasion of new plant species into the park.



As part of regular vegetation and research program activities, staff document new species in the park through specimen collection and program managers update the park's exotic plant species list several times each year.


Barrel Cactus


Spruce Fir Forest


Grand Canyon Agave


Desert Riparian Area


Desert Refuge


Volunteers Mounting Plant Specimens in GRCA Herbarium


Desert Botanical Garden Partner Collecting Plant Specimens

HOW DO WE PRIORITIZE ACTIONS?

NPS Management Policies (2006) direct park managers to give high priority to control and management of exotic species that can be **easily managed** and have **substantial impacts** on park resources. In 1999, GRCA biologists used the Alien Plant Ranking System (APRS) to rank 132 of the 145 species based on:

- Level of impact
- Feasibility of control
- Innate ability of species to become a pest

In 2005, GRCA biologists re-ranked species to incorporate new species, change in distribution, and data from recent Arizona state planning efforts. The park's program focuses management efforts on the species that aggressively invade natural areas, negatively altering native wildlife habitat and ecosystem structure and function. Efforts currently focus on the 79 exotic plant species that are considered **invasive**. Efforts also focus on high priority ecosystems, disturbance corridors, park boundaries, and relict areas.

COMPLIANCE AND WORK PLANS

Park staff are preparing a programmatic Environmental Assessment to cover all exotic plant management activities. The document will be available for public review in a few weeks. Previously, compliance was completed for individual species (e.g. tamarisk), small project areas, or programmatically but with less opportunity for the public input.

In addition to the compliance document, program staff prepare an annual work plan. The plan includes a description of proposed activities in the park's developed and natural zones, goals and objectives for the year, a summary of the prioritization process, specific actions planned, and a detailed schedule. The annual work plan is provided to the park's Cultural Resource staff to ensure protection of the park's historic and archeological resources.

PROGRAM COMPONENTS

The park's program was modeled after the NPS Strategic Plan for Managing Non-Native Plants on NPS Lands and includes:

- Educating the public about prevention and increasing overall awareness of the issue.
- Using hand tools and a lot of volunteers (manual methods).
- Spreading mulch and native plant seed (cultural methods).
- Applying herbicide to those plants which do not respond well to manual removal (chemical methods).
- Developing partnerships and coordinating with surrounding land managers.
- Completing invasive plant surveys as part of all park projects.
- Implementing monitoring methodology to evaluate trends.


Crew Leader Giving Project Orientation


Monitoring Vegetation


Using GIS Layers to Create Field Maps


Clipping and Bagging Seeds


Digging Ravenna Grass


Manual Seedling Removal


Challenging Site Access


Russian Olive Along Colorado River


Digging Date Palm


Removing Camelthorn

TAMARISK MANAGEMENT PROGRAM

The removal of tamarisk (*Tamarix ramosissima*) from tributaries of the Colorado River in GRCA began in 2000. Tamarisk control methods include pulling, cutting and applying herbicide, or girdling and leaving the dead trees for wildlife habitat. Crews use only hand tools and non-mechanized equipment, often carried in heavy packs on the backs of hearty volunteers, in an effort to preserve wilderness qualities of the park's remote backcountry.


Volunteers Cutting Tamarisk


Crews Hauling Brush


Crews Accessing Work Site

Crews have completed work in over 130 project areas, removing 256,000 individual trees from 6,000 acres. In 2005, the program expanded to include a partnership with the Hualapai Tribe in an effort to work at the watershed level. Project managers provide public access to all project results on the park's website.

This large-scale project has been supported by $659,000 from the Arizona Water Protection Fund, in addition to other funds secured by project partners. Beginning in 2008, NPS funds will provide essential support for the cyclic maintenance of project areas and the continuation and expansion of this successful and nationally recognized project.

VOLUNTEERS AND PARTNERSHIPS

Invasive plant management is extremely labor intensive and time consuming. The enormous progress made since 2000 is largely due to the hard work of volunteers, who have donated 136,522 hours of their time to the park's vegetation program, for a total matching contribution of $2,562,518. Park managers hope to expand volunteer opportunities in 2008 and 2009, with a goal of doubling the number of volunteer hours.


Young Volunteer with Sahara Mustard


Young Volunteer with Woolly Mullein


Family Volunteering to Remove Invasive Plants

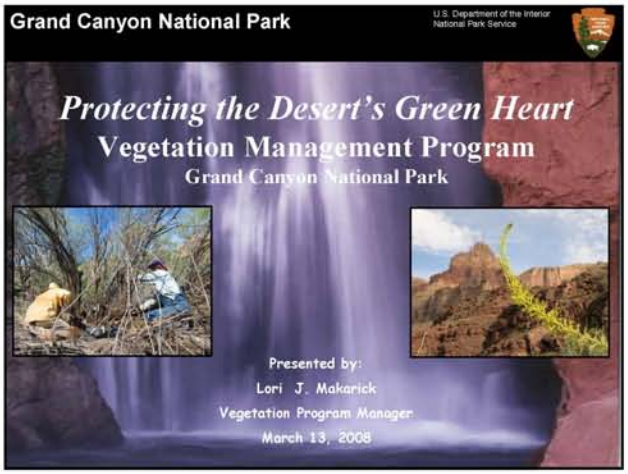
Know someone that might want to lend a hand?

Opportunities are listed at: www.gcvolunteers.org

Poster Prepared by: Lori J. Makarick, Vegetation Program Manager, (928)226-0165

Grand Canyon National Park

U.S. Department of the Interior
National Park Service



Protecting the Desert's Green Heart

Vegetation Management Program

Grand Canyon National Park

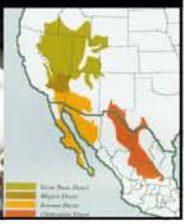
Presented by:
Lori J. Makarick
Vegetation Program Manager
March 13, 2008

Floral Diversity In Grand Canyon

- 1750 plant species (up from 1500 in Checklist)
- Most species of any national park
- 9 endemic plant species (23 more endemic to region)
- 42% of AZ's flora represented

Isolation
Corridors
Barriers

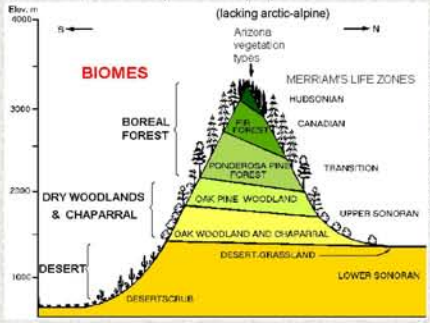
Diverse topography
Elevation
Deserts Converging



Merriam Life Zones

Grand Canyon has 5 of the 6 life zones originally proposed in 1889

Broad belts of animals and plants similarly expressed with increases in altitude and latitude



- Climatic gradients, especially temperature, determined vegetative communities.
- Gradients are a function of latitude and elevation.
- As you increase elevation, temperatures decrease and precipitation increases.

His work was a milestone for early ecology!

Hudsonian Life Zone

Spruce Fir Forest



Common plants:
- Engelmann spruce
- White fir
- Quaking aspen
- Creeping barberry
- Lichens and mosses

Common animals:
- Mountain lions
- Grouse
- Wild turkeys
- Porcupines
- Chipmunks

Canadian Life Zone

Mixed Conifer Forest



Common plants:
- White fir
- Blue spruce
- Douglas fir
- Ponderosa pine
- Sedges and grasses



Common animals:
- Mule deer
- Elk
- Mountain lions
- Porcupines
- Grouse

Transition Life Zone

Ponderosa Pine Forest



Common plants:
- Ponderosa pine
- Gambel oak
- Currants
- Mutton grass
- Understory forbs

Common animals:
- Elk
- Abert & Kaibab squirrels
- Goshawks
- Stellar's jays

Upper Sonoran Life Zone

Pinyon-Juniper Woodland



Common plants:

- Pinyon pine
- Utah juniper
- Cliffrose
- Blue grama grass
- Banana yucca



Common animals:

- Coyotes
- Pinyon jays
- Mule deer
- Ravens
- Yucca moths

Lower Sonoran Life Zone

Desert Scrub



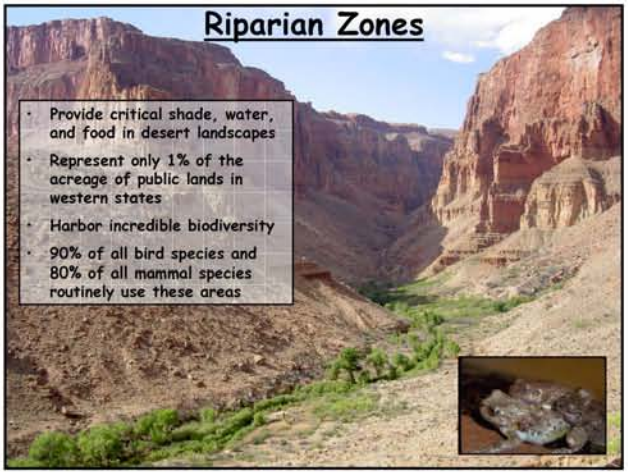
Common plants:

- Mormon tea
- Blackbrush
- Agave
- Saltbush
- Cacti

Common animals:

- Bighorn sheep
- Rattlesnakes
- Desert woodrats
- Canyon wrens
- Collared lizards

Riparian Zones



- Provide critical shade, water, and food in desert landscapes
- Represent only 1% of the acreage of public lands in western states
- Harbor incredible biodiversity
- 90% of all bird species and 80% of all mammal species routinely use these areas

Components of the Vegetation Program



Human Impacts Mitigation

Backcountry

- Monitoring and documentation of human impacts
- Review and analysis of previous restoration efforts
- Mitigation of damages at attraction sites, campsites, and on upper terraces in river corridor as part of Colorado River Management Plan Implementation



Disturbed Lands Restoration

Developed Areas



- Seed Collection/Storage
- Native Plant Salvage
- Out-Planting
- Nursery / Propagation
- Site Maintenance

Outreach, Education and Volunteers







Vegetation Mapping Project



- Began in spring 2007
- Will be a 5 year project
- Crews will "install" 1200+ vegetation plots
- New imagery will be acquired
- Final product is a new vegetation map for GRCA

Sensitive Species Management



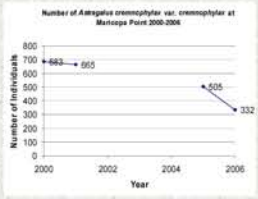
- The Maricopa Point population is decreasing in numbers, % flowering, and overall health
- There were 150 plants in 1980, recovered to 683 in 2000, has been 51% decline since then
- Fence was erected in 1990
- Park will be re-designing facilities and access in next few years
- 3 invasive species threaten the plants

Astragalus cremnophylax var. *cremnophylax* (Sentry milk-vetch)

Recovery plan released in 2006:

- ✓ Arboretum and GRCA nursery will be propagating ex-situ
- ✓ First step is to establish new population near Maricopa to develop restoration procedures
- ✓ Goal is to have 8 populations with 1000+ individuals

*North Rim population is a new species – *Astragalus septentriorema*



Roaring springs prickle poppy

Argemone arizonica
(Papaveraceae)



- Endemic to Grand Canyon
- Known from a few locations along the North Kaibab Trail
- Only a few hundred plants exist in the world
- We need help monitoring these populations!





Grand Canyon agave

Agave phillipsiana






- Known from only four locations in the Canyon, all in association with pre-Columbian archeological sites
- Populations in Verde Valley and Hassayampa River
- The closest relatives are in Mexico – this species was traded and cultivated
- Still have not re-located the population in Tapeats area

Grand Canyon flaveria

Flaveria mcdougallii
(Asteraceae)




- Endemic to Grand Canyon
- Known from a few locations in the park
- Grows at seeps and springs in side canyons and in Colorado River corridor
- We need help monitoring these populations!



Vocabulary Lesson

- Weed: Any plant considered to be "out of place".
- Exotic/Alien/Introduced/Non-native: Species that humans intentionally or unintentionally introduced into an area outside of a species natural range.
- Noxious Weed: Legal term used to describe plant species that are determined to be major pests and are subject, by law, to certain restrictions.
- Invasive Plant: A plant that displays rapid growth and spread, allowing it to establish over large areas.





How did they get here?

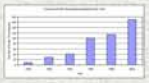
- **Imported intentionally or unintentionally by humans**
  - ornamentals / horticulture
  - agricultural uses
  - erosion protection / soil stabilization
  - stowaways in packing materials
  - lack of current information
- **Once established they can be transported via**
  - vehicles
  - construction equipment
  - animals
  - wind/water
  - humans





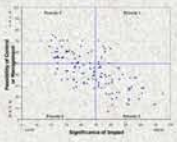




Invasive Plant Species Management

Park managers are directed to give high priority to control and management of exotic species that can be **easily managed** and have **substantial impacts** on the Park's resources.





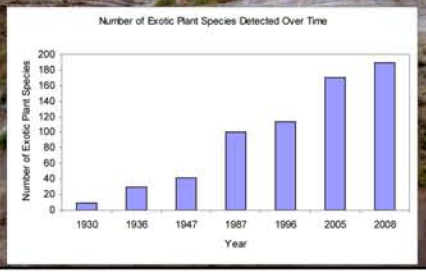




Program Goals:

- Prevent Invasion
- Increase Public Awareness
- Inventory and Monitor Non-natives
- Create Partnerships
- Integrate Planning and Evaluation
- Manage Invasive Non-natives

Exotic Plant Species Over Time



11/11/2008

What areas do we target?





Targets: High priority ecosystems, disturbance corridors, boundaries, relict areas, other areas with high potential for invasion such as river corridors

Species of Concern – Higher Elevations

Linaria dalmatica ~ Dalmatian toadflax

- Herbaceous perennial up to 1.8 m tall
- Creeping roots and showy yellow snapdragon-like flowers
- Reproduces by seed and vegetatively from lateral roots.
- One plant can produce 500,000 seeds
- Herbicide application is required for control unless you can continually pull



Onopardum acanthium ~ Scotch thistle





- Biennial spiny plant that grows 2 m wide and 3 m tall
- Large, coarsely-lobed leaves with velvety-grey appearance
- Dense infestations can create a barrier to livestock and recreationists
- Sites can be controlled mechanically

Acroptilon repens ~ Russian knapweed





- Shoots from rhizomes due to low seed production (up to 1,200 seeds per plant/year).
- Plants are aggressive and competitive, forming dense stands.
- Exhibit allelopathic effects which can easily colonize disturbed sites.
- Roots from a single plant can cover up to 12 sq. meters in 2 growing seasons.

Cardaria draba ~ Whitetop







- Reproduces by seed and horizontal growth of rootstocks.
- Root fragments can generate new plants.
- Roots can grow to a depth of 2 m or more.
- Under favorable growing conditions, a single plant can increase vegetatively up to 3 m in radius per year.
- This is a very aggressive plant.

Conium maculatum ~ Poison hemlock





- Grows up to 3m tall.
- Known for poisonous properties.
- Stems are rigid, branched, purple spotted and hollow.
- Leaves are finely divided, fern-like in appearance.
- Grows in moist areas.
- Found in only a few locations on the South Rim.

Salvia aethiopsis ~ Mediterranean Sage

- Hardy biennial with persistent, deep tap root.
- Escaped ornamental that entered park with the train.
- Each plant can produce over 500,000 seeds!
- Acts like tumbleweed in the fall.
- Manual removal is effective.





Tribulus terrestris ~ Puncture vine, goathead







- Sprawling, mat-forming annual to 2m long
- Widely distributed in the U.S.
- Found on the South Rim and in the Inner Canyon
- Reproduces by seeds contained in hard, spiny burs
- Can damage tires, injure wildlife and livestock and is often found in hay

Species of Concern in the Inner Canyon

- Russian olive
- Camelthorn
- Knapweeds
- Whitetop
- Puncturevine
- Ravenna grass
- Tree-of-heaven
- Tamarisk
- Himalaya blackberry
- Sow thistles
- Sahara mustard











REMEMBER: Park managers are directed to give high priority to control and management of exotic species that can be easily managed and have substantial impacts on the Park's resources.

Ravenna grass – *Saccharum ravennae*







- Ongoing control program since early 1990s
- Manual removal of more than 20,000 plants
- Volunteer efforts have been integral to success
- Created identification guide for boatmen
- Currently a manageable program, but unfunded
- Found huge new population in 2006!











Russian olive – *Elaeagnus angustifolia*

- Only scattered individuals in park
- Mapped and photographed all trees
- Removed all known trees within the park
- Currently a manageable program
- *Park staff will continue to monitor all sites*





Tree-of-Heaven – *Ailanthus altissima*

- Only one documented population
- Boatman notified park – education works!
- Early control initiated
- Cut stump method used
- Annual monitoring program ongoing



Camelthorn – *Alhagi maurorum*

- Widespread below Little Colorado River
- Surveys and transects to gather baseline data and monitor (1996)
- Public concern about spread and dominance in campsites
- Control is challenging – staff members are researching methods
- Will continue to manually remove camelthorn at two sites in 2007
- River guides have adopted these sites and help with control





Date Palm – *Phoenix dactylifera*

- Thrive in similar habitats and ecosystems
- Use copious amounts of water
- Several documented locations – new populations found over past few months
- Began to produce viable seeds in 2003 – potential for spread by animals / humans
- Removed all known trees beginning in 2004

Sahara mustard – *Brassica tournefortii*

- Native to North Africa and the Middle East – similar environments
- Thrives on wind-blown sand deposits and in disturbed areas
- Early flowering – monopolizes water and forms dense canopy
- Found at Lees Ferry in 2003
- Removed more than 26,000 plants at Lees Ferry in 2005 – drought helped in 2006-07





Himalaya Blackberry Control







Tamarisk Management and Tributary Restoration







WHY IS TAMARISK BAD?

- Creates inhospitable conditions for native plants
- One mature tree can produce 275,000,000 seeds
- Alters native desert riparian ecosystems
- Less susceptible to scouring / drowning than native species
- High seedling density impacts native species germination
- More drought tolerant than native species
- Impacts native wildlife











Project History

- Tamarisk surveys initiated in 1998
- Focus is on riparian areas in side canyons
- Environmental Assessment completed in 2002
- All project work funded by AZ Water Protection Fund















Control Methods





94% of GRCA is Proposed Wilderness



Manual removal

Basal bark application

Cut stump

Lance injection

Combo girdle / cut

Girdle





Phase I Summary:

- Crews removed more than 134,000 trees from 70 project areas
- Average of 12% of trees required follow-up treatment
- 376 photopoints and 22 vegetation transects installed
- Volunteers donated 8,000 volunteers hours ($140,000)
- Completed in partnership with GC Wildlands Council









Native vegetation is returning in project areas where tamarisk was once dominant.

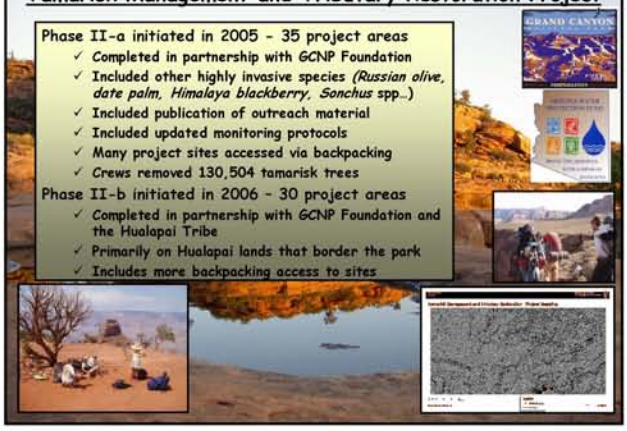
Tamarisk Management and Tributary Restoration Project

Phase II-a initiated in 2005 – 35 project areas

- ✓ Completed in partnership with GCNP Foundation
- ✓ Included other highly invasive species *(Russian olive, date palm, Himalaya blackberry, Sonchus* spp…)
- ✓ Included publication of outreach material
- ✓ Included updated monitoring protocols
- ✓ Many project sites accessed via backpacking
- ✓ Crews removed 130,504 tamarisk trees

Phase II-b initiated in 2006 – 30 project areas

- ✓ Completed in partnership with GCNP Foundation and the Hualapai Tribe
- ✓ Primarily on Hualapai lands that border the park
- ✓ Includes more backpacking access to sites



Project Monitoring

We install vegetation transects in 25% of project areas

- Point Intercept
- Vegetation Structure
- Additional Vegetation Cover & Ground Cover Data
- Soil Data
- Hydrological and Wildlife Data Collection

We install photopoints in ALL project areas







Plant species inventories are completed in each project area









Jane's globemallow
Sphaeralcea janeae



dark-throat shooting star
Dodecatheon pulchellum ssp. *pulchellum*



paleface
Hibiscus denudatus

Future Actions and Direction Of Overall Program



Appendix I. Plant Lists from Project Areas

Canyon Name	Scientific Name	Common Name
122 Mile Canyon L		
	Acacia greggii Gray	catclaw acacia
	Amelanchier utahensis Koehne	Utah serviceberry
	Aristida arizonica Vasey	Arizona threeawn
	Echinocereus engelmannii (Parry ex Engelm.) Lem.	Engelmann's hedgehog cactus
	Ephedra viridis Coville	mormon tea
	Galium stellatum Kellogg	starry bedstraw
	Isocoma acradenia (Greene) Greene	alkali goldenbush
	Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm.	roving sailor
	Opuntia phaeacantha Engelm.	tulip pricklypear
	Opuntia spp.	prickly pear
	Opuntia whipplei Engelm. & Bigelow	Whipple cholla
	Pleuraphis jamesii Torr.	James' galleta
	Porophyllum gracile Benth.	slender poreleaf
	Stephanomeria pauciflora (Torr.) A. Nels.	brownplume wirelettuce
	Tamarix ramosissima Ledeb.	saltcedar
140 Mile Canyon		
	Acacia greggii Gray	catclaw acacia
	Acourtia wrightii (Gray) Reveal & King	brownfoot
	Adiantum capillus-veneris L.	common maidenhair
	Agave utahensis var. utahensis	Utah agave
	Agrostis stolonifera L.	creeping bentgrass
	Aloysia wrightii Heller ex Abrams	Wright's beebrush
	Andropogon glomeratus (Walt.) B.S.P.	bushy bluestem
	Aristida purpurea Nutt.	purple threeawn
	Artemisia ludoviciana Nutt.	white sagebrush
	Astragalus praelongus Sheldon	stinking milkvetch
	Baccharis emoryi Gray	Emory's baccharis
	Baccharis salicifolia (Ruiz & Pavón) Pers.	seep willow
	Baccharis spp.	baccharis
	Bernardia incana Morton	hoary myrtlecroton
	Brickellia longifolia S. Wats.	longleaf brickellbush
	Bromus rubens L.	red brome
	Bromus spp.	brome grass
	Camissonia multijuga (S. Wats.) Raven	froststem suncup
	Camissonia walkeri (A. Nels.) Raven	Walker's suncup
	Celtis laevigata Willd. var. reticulata (Torr.) L. Benson	netleaf hackberry
	Cercis occidentalis Torr. ex Gray	redbud
	Cladium californicum (S. Wats.) O'Neill	California sawgrass
	Datura wrightii Regel	sacred thorn-apple
	Echinocereus coccineus Engelm. var. coccineus	scarlet hedgehog cactus
	Echinocereus engelmannii (Parry ex Engelm.) Lem.	Engelmann's hedgehog cactus
	Echinocereus triglochidiatus Engelm.	kingcup cactus
	Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake	button brittlebush
	Ephedra fasciculata A. Nels.	Arizona jointfir, mormon tea
	Epipactis gigantea Dougl. ex Hook.	stream orchid
	Erigeron lobatus A. Nels.	lobed fleabane
	Eriogonum spp.	buckwheat

Canyon Name	Scientific Name	Common Name
	Eucnide urens (Parry ex Gray) Parry	desert stingbush
	Eurybia glauca (Nutt.) Nesom	gray aster
	Ferocactus cylindraceus (Engelm.) Orcutt var. cylindraceus	California barrel cactus
	Fraxinus anomala Torr. ex S. Wats.	singleleaf ash
	Funastrum cynanchoides (Dcne.) Schlechter ssp. cynanchoides	fringed twinevine
	Galium stellatum Kellogg	starry bedstraw
	Gutierrezia sarothrae (Pursh) Britt. & Rusby	broom snakeweed
	Hedeoma nana (Torr.) Briq.	dwarf false pennyroyal
	Hesperodoria salicina (Blake) Nesom	willow glowweed
	Isocoma acradenia (Greene) Greene	alkali goldenbush
	Lycium pallidum Miers	pale desert-thorn
	Lycium torreyi Gray	squawthorn
	Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm.	roving sailor
	Mimulus guttatus DC.	seep monkeyflower
	Mirabilis multiflora (Torr.) Gray	Colorado four o'clock
	Nicotiana obtusifolia Mertens & Galeotti	desert tobacco
	Nicotiana obtusifolia Mertens & Galeotti var. obtusifolia	desert tobacco
	Nolina microcarpa S. Wats.	sacahuista, beargrass
	Opuntia phaeacantha Engelm.	tulip pricklypear
	Opuntia spp.	prickly pear
	Parietaria hespera Hinton	rillita pellitory
	Perityle congesta (M.E. Jones) Shinners	Grand Canyon rockdaisy
	Perityle emoryi	fetid marigold
	Pleuraphis jamesii Torr.	James' galleta
	Pluchea sericea (Nutt.) Coville	arrowweed
	Polypogon monspeliensis (L.) Desf.	annual rabbitsfoot grass
	Pseudognaphalium stramineum (Kunth) W.A. Weber	cottonbatting plant
	Rhus trilobata Nutt.	skunkbush sumac
	Salix exigua Nutt.	coyote willow
	Scirpus spp.	rush species
	Sonchus asper (L.) Hill	spiny sowthistle
	Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb.	gooseberryleaf globemallow
	Stanleya pinnata (Pursh) Britt.	desert princesplume
	Tamarix ramosissima Ledeb.	saltcedar
	Thymophylla pentachaeta (DC.) Small	fiveneedle pricklyleaf
	Typha latifolia L.	broadleaf cattail
	Typha spp.	cattail
148.5 Mile Spring		
	Adiantum capillus-veneris L.	common maidenhair
	Aquilegia L.	columbine
	Baccharis spp.	baccharis
	Cercis orbiculata Greene	California redbud
	Equisetum ×ferrissii Clute (pro sp.)	horsetail
	Imperata brevifolia Vasey	California satintail
	Nolina microcarpa S. Wats.	sacahuista, beargrass
151 Mile Spring		
	Acacia greggii Gray	catclaw acacia
	Adiantum capillus-veneris L.	common maidenhair
	Alhagi maurorum Medik.	camelthorn
	Andropogon glomeratus (Walt.) B.S.P.	bushy bluestem

Canyon Name	Scientific Name	Common Name
	Aristida purpurea Nutt.	purple threeawn
	Baccharis emoryi Gray	Emory's baccharis
	Baccharis salicifolia (Ruiz & Pavón) Pers.	seep willow
	Baccharis sergiloides Gray	squaw waterweed baccharis
	Bothriochloa barbinodis (Lag.) Herter	cane bluestem
	Brickellia longifolia S. Wats.	longleaf brickellbush
	Camissonia walkeri (A. Nels.) Raven	Walker's suncup
	Cladium californicum (S. Wats.) O'Neill	California sawgrass
	Cynodon dactylon (L.) Pers.	Bermudagrass
	Flaveria macdougalii Theroux, Pinkava & Keil	Macdougal's yellowtops
	Gutierrezia sarothrae (Pursh) Britt. & Rusby	broom snakeweed
	Lobelia cardinalis L.	cardinalflower
	Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	scratchgrass
	Nolina microcarpa S. Wats.	sacahuista, beargrass
	Oenothera elata Kunth	Hooker's evening-primrose
	Porophyllum gracile Benth.	slender poreleaf
	Schizachyrium scoparium (Michx.) Nash	little bluestem
	Stephanomeria pauciflora (Torr.) A. Nels.	brownplume wirelettuce
190 Mile Canyon		
	Acacia greggii Gray	catclaw acacia
	Ambrosia dumosa (Gray) Payne	burrobush
	Andropogon glomeratus (Walt.) B.S.P.	bushy bluestem
	Aristida purpurea Nutt.	purple threeawn
	Artemisia ludoviciana Nutt.	white sagebrush
	Astragalus spp.	astragalus
	Atriplex canescens (Pursh) Nutt.	fourwing saltbush
	Baccharis emoryi Gray	Emory's baccharis
	Baccharis sarothroides Gray	desertbroom
	Bebbia juncea (Benth.) Greene var. aspera Greene	sweetbush
	Brickellia longifolia S. Wats.	longleaf brickellbush
	Bromus rubens L.	red brome
	Camissonia walkeri (A. Nels.) Raven	Walker's suncup
	Cryptantha spp.	cryptantha
	Datura wrightii Regel	sacred thorn-apple
	Echinocereus engelmannii (Parry ex Engelm.) Lem.	Engelmann's hedgehog cactus
	Encelia farinosa Gray ex Torr.	goldenhills
	Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake	button brittlebush
	Ephedra spp.	Mormon tea
	Eriastrum diffusum (Gray) Mason	miniature woollystar
	Eriogonum fasciculatum Benth. var. polifolium (Benth.) Torr. & Gray	Eastern Mojave buckwheat
	Eucnide urens (Parry ex Gray) Parry	desert stingbush
	Ferocactus cylindraceus (Engelm.) Orcutt var. cylindraceus	California barrel cactus
	Fouquieria splendens Engelm.	ocotillo
	Galium stellatum Kellogg	starry bedstraw
	Gutierrezia spp.	snakeweed
	Isocoma acradenia (Greene) Greene	alkali goldenbush
	Juncus spp.	rush species
	Larrea tridentata (Sessé & Moc. ex DC.) Coville	creosote bush
	Lycium spp.	wolfberry

Canyon Name	Scientific Name	Common Name
	Machaeranthera pinnatifida (Hook.) Shinners	lacy tansyaster
	Nicotiana obtusifolia Mertens & Galeotti	desert tobacco
	Nolina spp	beargrass
	Oenothera caespitosa Nutt.	tufted evening-primrose
	Opuntia basilaris Engelm. & Bigelow	beavertail pricklypear
	Penstemon pachyphyllus Gray ex Rydb. var. congestus (M.E. Jones) N. Holmgren	thickleaf beardtongue
	Phacelia crenulata Torr. ex S. Wats.	cleftleaf wildheliotrope
	Pluchea sericea (Nutt.) Coville	arrowweed
	Polemonium spp	
	Polypogon monspeliensis (L.) Desf.	annual rabbitsfoot grass
	Porophyllum gracile Benth.	slender poreleaf
	Pseudognaphalium stramineum (Kunth) W.A. Weber	cottonbatting plant
	Salix gooddingii Ball	Goodding's willow
	Sisymbrium altissimum L.	tall tumblemustard
	Sonchus asper (L.) Hill	spiny sowthistle
	Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb.	gooseberryleaf globemallow
	Stanleya pinnata (Pursh) Britt.	desert princesplume
	Stylocline micropoides Gray	woollyhead neststraw
	Tamarix ramosissima Ledeb.	saltcedar
	Thymophylla pentachaeta (DC.) Small	fiveneedle pricklyleaf
	Typha spp.	cattail
	Vulpia octoflora (Walt.) Rydb.	
217 Mile Canyon		
	Acacia greggii Gray	catclaw acacia
	Aristida arizonica Vasey	Arizona threeawn
	Bebbia juncea (Benth.) Greene var. aspera Greene	sweetbush
	Bothriochloa barbinodis (Lag.) Herter	cane bluestem
	Brickellia longifolia S. Wats.	longleaf brickellbush
	Bromus rubens L.	red brome
	Camissonia walkeri (A. Nels.) Raven	Walker's suncup
	Crossoma spp	
	Cryptantha spp.	cryptantha
	Datura wrightii Regel	sacred thorn-apple
	Encelia farinosa Gray ex Torr.	goldenhills
	Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake	button brittlebush
	Ephedra spp.	Mormon tea
	Eriogonum fasciculatum Benth. var. polifolium (Benth.) Torr. & Gray	Eastern Mojave buckwheat
	Ferocactus cylindraceus (Engelm.) Orcutt var. cylindraceus	California barrel cactus
	Fouquieria splendens Engelm.	ocotillo
	Galium stellatum Kellogg	starry bedstraw
	Gutierrezia spp.	snakeweed
	Hedeoma nana (Torr.) Briq.	dwarf false pennyroyal
	Isocoma acradenia (Greene) Greene	alkali goldenbush
	Iva acerosa (Nutt.) R.C. Jackson	copperweed
	Machaeranthera pinnatifida (Hook.) Shinners	lacy tansyaster
	Mirabilis multiflora (Torr.) Gray	Colorado four o'clock
	Nicotiana obtusifolia Mertens & Galeotti	desert tobacco
	Oenothera caespitosa Nutt.	tufted evening-primrose
	Penstemon palmeri Gray	Palmer's penstemon

Canyon Name	Scientific Name	Common Name
	Phacelia crenulata Torr. ex S. Wats.	cleftleaf wildheliotrope
	Phoradendron californicum Nutt.	mesquite mistletoe
	Porophyllum gracile Benth.	slender poreleaf
	Silene antirrhina L.	sleepy silene
	Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb.	gooseberryleaf globemallow
	Sporobolus cryptandrus (Torr.) Gray	sand dropseed
	Stephanomeria parryi Gray	Parry's wirelettuce
	Stephanomeria pauciflora (Torr.) A. Nels.	brownplume wirelettuce
	Trixis californica Kellogg	American threefold
	Typha domingensis Pers.	southern cattail
	Typha spp.	cattail
	Viguiera parishii Greene	Parish's goldeneye
	Vulpia octoflora (Walt.) Rydb.	
221 Mile Spring		
	Acacia greggii Gray	catclaw acacia
	Encelia farinosa Gray ex Torr.	goldenhills
	Ferocactus cylindraceus (Engelm.) Orcutt var. cylindraceus	California barrel cactus
	Fouquieria splendens Engelm.	ocotillo
	Isocoma acradenia (Greene) Greene	alkali goldenbush
	Krameria erecta Willd. ex J.A. Schultes	littleleaf ratany
	Krameria grayi Rose & Painter	white ratany
	Larrea tridentata (Sessé & Moc. ex DC.) Coville	creosote bush
	Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	scratchgrass
	Opuntia basilaris Engelm. & Bigelow	beavertail pricklypear
	Phragmites australis (Cav.) Trin. ex Steud.	common reed
	Plantago ovata Forsk.	desert Indianwheat
	Pluchea sericea (Nutt.) Coville	arrowweed
	Prosopis glandulosa Torr.	honey mesquite
	Vulpia octoflora (Walt.) Rydb.	
221.5 Mile Creek		
	Acacia greggii Gray	catclaw acacia
	Bebbia juncea (Benth.) Greene var. aspera Greene	sweetbush
	Cladium californicum (S. Wats.) O'Neill	California sawgrass
	Cryptantha spp.	cryptantha
	Ephedra spp.	Mormon tea
	Ferocactus cylindraceus (Engelm.) Orcutt var. cylindraceus	California barrel cactus
	Fouquieria splendens Engelm.	ocotillo
	Isocoma acradenia (Greene) Greene	alkali goldenbush
	Juncus spp.	rush species
	Mammillaria grahamii Engelm. var. grahamii	Graham's nipple cactus
	Mirabilis multiflora (Torr.) Gray	Colorado four o'clock
	Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	scratchgrass
	Opuntia basilaris Engelm. & Bigelow	beavertail pricklypear
	Phragmites australis (Cav.) Trin. ex Steud.	common reed
	Pluchea sericea (Nutt.) Coville	arrowweed
	Prosopis glandulosa Torr.	honey mesquite
	Sporobolus airoides (Torr.) Torr.	alkali sacaton
	Tidestromia spp.	
222 Mile Canyon		
	Acacia greggii Gray	catclaw acacia

Canyon Name	Scientific Name	Common Name
	Aristida adscensionis L.	sixweeks threeawn
	Aristida arizonica Vasey	Arizona threeawn
	Baccharis salicifolia (Ruiz & Pavón) Pers.	seep willow
	Baccharis sarothroides Gray	desertbroom
	Bebbia juncea (Benth.) Greene var. aspera Greene	sweetbush
	Brickellia longifolia S. Wats.	longleaf brickellbush
	Bromus rubens L.	red brome
	Camissonia spp.	suncup
	Camissonia walkeri (A. Nels.) Raven	Walker's suncup
	Cryptantha spp.	cryptantha
	Dasyochloa pulchella (Kunth) Willd. ex Rydb.	low woollygrass
	Encelia farinosa Gray ex Torr.	goldenhills
	Ephedra spp.	Mormon tea
	Eriogonum fasciculatum Benth. var. polifolium (Benth.) Torr. & Gray	Eastern Mojave buckwheat
	Eriogonum inflatum Torr. & Frém.	desert trumpet
	Ferocactus cylindraceus (Engelm.) Orcutt var. cylindraceus	California barrel cactus
	Fouquieria splendens Engelm.	ocotillo
	Isocoma acradenia (Greene) Greene	alkali goldenbush
	Juncus spp.	rush species
	Larrea tridentata (Sessé & Moc. ex DC.) Coville	creosote bush
	Lycium spp.	wolfberry
	Machaeranthera pinnatifida (Hook.) Shinners	lacy tansyaster
	Mammillaria grahamii Engelm. var. grahamii	Graham's nipple cactus
	Mirabilis multiflora (Torr.) Gray	Colorado four o'clock
	Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	scratchgrass
	Nicotiana obtusifolia Mertens & Galeotti	desert tobacco
	Nicotiana obtusifolia Mertens & Galeotti var. obtusifolia	desert tobacco
	Opuntia basilaris Engelm. & Bigelow	beavertail pricklypear
	Opuntia bigelovii Engelm.	teddybear cholla
	Opuntia phaeacantha Engelm.	tulip pricklypear
	Perityle emoryi	fetid marigold
	Phacelia crenulata Torr. ex S. Wats.	cleftleaf wildheliotrope
	Physalis spp	groundcherry
	Plantago ovata Forsk.	desert Indianwheat
	Pleurocoronis pluriseta (Gray) King & H.E. Robins.	bush arrowleaf
	Pluchea sericea (Nutt.) Coville	arrowweed
	Polypogon monspeliensis (L.) Desf.	annual rabbitsfoot grass
	Porophyllum gracile Benth.	slender poreleaf
	Prosopis glandulosa Torr.	honey mesquite
	Senna covesii (Gray) Irwin & Barneby	Coves' cassia
	Silene antirrhina L.	sleepy silene
	Sonchus asper (L.) Hill	spiny sowthistle
	Stylocline micropoides Gray	woollyhead neststraw
	Tidestromia spp.	honeysweet
	Trixis californica Kellogg	American threefold
	Typha spp.	cattail
	Viguiera spp	goldeneye
	Vulpia octoflora (Walt.) Rydb.	sixweeks fescue
224 Mile Canyon		

Canyon Name	Scientific Name	Common Name
	Acacia greggii Gray	catclaw acacia
	Aristida adscensionis L.	sixweeks threeawn
	Aristida arizonica Vasey	Arizona threeawn
	Bebbia juncea (Benth.) Greene var. aspera Greene	sweetbush
	Bromus rubens L.	red brome
	Camissonia walkeri (A. Nels.) Raven	Walker's suncup
	Cryptantha spp.	cryptantha
	Dasyochloa pulchella (Kunth) Willd. ex Rydb.	low woollygrass
	Encelia farinosa Gray ex Torr.	goldenhills
	Eucnide urens (Parry ex Gray) Parry	desert stingbush
	Ferocactus cylindraceus (Engelm.) Orcutt var. cylindraceus	California barrel cactus
	Fouquieria splendens Engelm.	ocotillo
	Isocoma acradenia (Greene) Greene	alkali goldenbush
	Krameria erecta Willd. ex J.A. Schultes	littleleaf ratany
	Larrea tridentata (Sessé & Moc. ex DC.) Coville	creosote bush
	Lichen sp.	lichen species
	Mirabilis multiflora (Torr.) Gray	Colorado four o'clock
	Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	scratchgrass
	Nicotiana obtusifolia Mertens & Galeotti	desert tobacco
	Nicotiana obtusifolia Mertens & Galeotti var. obtusifolia	desert tobacco
	Opuntia bigelovii Engelm.	teddybear cholla
	Opuntia phaeacantha Engelm.	tulip pricklypear
	Opuntia whipplei Engelm. & Bigelow	Whipple cholla
	Perityle emoryi	fetid marigold
	Plantago ovata Forsk.	desert Indianwheat
	Polygala macradenia Gray	glandleaf milkwort
	Polypogon monspeliensis (L.) Desf.	annual rabbitsfoot grass
	Porophyllum gracile Benth.	slender poreleaf
	Prosopis glandulosa Torr.	honey mesquite
	Senna covesii (Gray) Irwin & Barneby	Coves' cassia
	Silene antirrhina L.	sleepy silene
	Sonchus asper (L.) Hill	spiny sowthistle
	Sporobolus cryptandrus (Torr.) Gray	sand dropseed
	Tidestromia lanuginosa (Nutt.) Standl.	woolly tidestromia
	Tidestromia spp.	honeysweet
	Typha spp.	cattail
	Viguiera spp	goldeneye
	Vulpia octoflora (Walt.) Rydb.	sixweeks fescue
Above Serpentine		
	Acacia greggii Gray	catclaw acacia
	Agave utahensis Engelm.	Utah agave
	Encelia farinosa Gray ex Torr.	goldenhills
	Yucca baccata Torr.	banana yucca
Agate Canyon		
	Acacia greggii Gray	catclaw acacia
	Agave utahensis Engelm.	Utah agave
	Aristida spp.	three awn
	Baccharis salicifolia (Ruiz & Pavón) Pers.	seep willow
	Baccharis sergiloides Gray	squaw waterweed baccharis
	Bernardia incana Morton	hoary myrtlecroton

Canyon Name	Scientific Name	Common Name
	Brickellia longifolia S. Wats.	longleaf brickellbush
	Bromus rubens L.	red brome
	Ceanothus greggii Gray	desert ceanothus
	Cercis occidentalis Torr. ex Gray	redbud
	Cercocarpus intricatus S. Wats.	littleleaf mountain mahogany
	Encelia farinosa Gray ex Torr.	goldenhills
	Ephedra spp.	Mormon tea
	Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird	rubber rabbitbrush
	Fallugia paradoxa (D. Don) Endl. ex Torr.	Apache plume
	Fraxinus anomala Torr. ex S. Wats.	singleleaf ash
	Garrya wrightii Torr.	Wright's silktassel
	Glossopetalon spinescens Gray var. aridum M.E. Jones	spiny greasebush
	Gutierrezia sarothrae (Pursh) Britt. & Rusby	broom snakeweed
	Hymenopappus filifolius Hook.	fineleaf hymenopappus
	Isocoma acradenia (Greene) Greene	alkali goldenbush
	Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm.	roving sailor
	Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	scratchgrass
	Nolina microcarpa S. Wats.	sacahuista, beargrass
	Opuntia spp.	prickly pear
	Perityle congesta (M.E. Jones) Shinners	Grand Canyon rockdaisy
	Petrophyton caespitosum (Nutt.) Rydb.	mat rockspirea
	Phlox austromontana Coville	mountain phlox
	Pinus edulis Engelm.	twoneedle pinyon, Colorado pinyon
	Psilostrophe sparsiflora (Gray) A. Nels.	greenstem paperflower
	Ptelea trifoliata L.	common hoptree
	Purshia mexicana (D. Don) Henrickson	Mexican cliffrose
	Rhus trilobata Nutt.	skunkbush sumac
	Stephanomeria exigua Nutt.	small wirelettuce
	Tamarix ramosissima Ledeb.	saltcedar
	Thamnosma montana Torr. & Frém.	turpentinebroom
	Thymophylla pentachaeta (DC.) Small	fiveneedle pricklyleaf
	Yucca elata (Engelm.) Engelm.	soaptree yucca
Cedar Spring		
	Acacia greggii Gray	catclaw acacia
	Agave utahensis Engelm.	Utah agave
	Aloysia wrightii Heller ex Abrams	Wright's beebrush
	Ephedra spp.	Mormon tea
	Imperata brevifolia Vasey	California satintail
	Isocoma acradenia (Greene) Greene	alkali goldenbush
	Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm.	roving sailor
	Mirabilis multiflora (Torr.) Gray	Colorado four o'clock
Flint Creek		
	Acacia greggii Gray	catclaw acacia
	Artemisia ludoviciana Nutt.	white sagebrush
	Baccharis emoryi Gray	Emory's baccharis
	Brickellia longifolia S. Wats.	longleaf brickellbush
	Datura wrightii Regel	sacred thorn-apple
	Fallugia paradoxa (D. Don) Endl. ex Torr.	Apache plume
	Fraxinus anomala Torr. ex S. Wats.	singleleaf ash
	Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	scratchgrass

Canyon Name	Scientific Name	Common Name
	Nolina microcarpa S. Wats.	sacahuista, beargrass
	Populus fremontii S. Wats.	Fremont cottonwood
	Quercus turbinella Greene	Sonoran scrub oak
	Robinia neomexicana Gray	New Mexico locust
	Salix exigua Nutt.	coyote willow
	Thamnosma montana Torr. & Frém.	turpentinebroom
	Typha spp.	cattail
Granite Park Canyon		
	Acacia greggii Gray	catclaw acacia
	Allionia incarnata L.	trailing windmills
	Ambrosia dumosa (Gray) Payne	burrobush
	Aristida purpurea Nutt.	purple threeawn
	Artemisia ludoviciana Nutt.	white sagebrush
	Astragalus nuttallianus DC.	smallflowered milkvetch
	Baccharis salicifolia (Ruiz & Pavón) Pers.	seep willow
	Baccharis sarothroides Gray	desertbroom
	Bebbia juncea (Benth.) Greene var. aspera Greene	sweetbush
	Brickellia longifolia S. Wats.	longleaf brickellbush
	Bromus rubens L.	red brome
	Camissonia walkeri (A. Nels.) Raven	Walker's suncup
	Centaurium arizonicum	Arizona centaury
	Centaurium calycosum (Buckl.) Fern.	Arizona centaury
	Cirsium neomexicanum Gray	New Mexico thistle
	Cryptantha spp.	cryptantha
		Cryptobiotic soil
	Cryptobiotic soil	cryptobiotic crust
	Dasyochloa pulchella (Kunth) Willd. ex Rydb.	low woollygrass
	Datura wrightii Regel	sacred thorn-apple
	Encelia farinosa Gray ex Torr.	goldenhills
	Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake	button brittlebush
	Erigeron divergens Torr. & Gray	spreading fleabane
	Erodium cicutarium (L.) L'Hér. ex Ait.	redstem stork's bill
	Eucnide urens (Parry ex Gray) Parry	desert stingbush
	Fouquieria splendens Engelm.	ocotillo
	Funastrum cynanchoides (Dcne.) Schlechter	fringed twinevine
	Gutierrezia sarothrae (Pursh) Britt. & Rusby	broom snakeweed
	Heliomeris multiflora Nutt.	showy goldeneye
	Isocoma acradenia (Greene) Greene	alkali goldenbush
	Juncus torreyi Coville	Torrey's rush
	Krameria erecta Willd. ex J.A. Schultes	littleleaf ratany
	Larrea tridentata (Sessé & Moc. ex DC.) Coville	creosote bush
	Lepidium lasiocarpum Nutt. var. lasiocarpum	shaggyfruit pepperweed
	Lepidium spp.	pepperweed
	Lycium spp.	wolfberry
	Mammillaria grahamii Engelm. var. grahamii	Graham's nipple cactus
	Melilotus officinalis (L.) Lam.	yellow sweetclover
	Mirabilis bigelovii Gray	wishbone-bush
	Nicotiana obtusifolia Mertens & Galeotti var. obtusifolia	desert tobacco
	Oenothera caespitosa Nutt.	tufted evening-primrose
	Oenothera caespitosa Nutt. ssp. marginata (Nutt. ex Hook. & Arn.) Munz	tufted evening-primrose

Canyon Name	Scientific Name	Common Name
	Opuntia engelmannii Salm-Dyck var. engelmannii	cactus apple
	Opuntia whipplei Engelm. & Bigelow	Whipple cholla
	Parietaria hespera Hinton	rillita pellitory
	Penstemon palmeri Gray	Palmer's penstemon
	Phacelia crenulata Torr. ex S. Wats.	cleftleaf wildheliotrope
	Phacelia rotundifolia Torr. ex S. Wats.	roundleaf phacelia
	Physalis spp	groundcherry
	Plantago patagonica Jacq.	woolly plantain
	Pluchea sericea (Nutt.) Coville	arrowweed
	Polypogon monspeliensis (L.) Desf.	annual rabbitsfoot grass
	Polypogon viridis (Gouan) Breistr.	beardless rabbitsfoot grass
	Populus fremontii S. Wats.	Fremont cottonwood
	Porophyllum gracile Benth.	slender poreleaf
	Prosopis glandulosa Torr.	honey mesquite
	Psilostrophe sparsiflora (Gray) A. Nels.	greenstem paperflower
	Salix exigua Nutt.	coyote willow
	Senna covesii (Gray) Irwin & Barneby	Coves' cassia
	Sonchus asper (L.) Hill	spiny sowthistle
	Sonchus oleraceus L.	common sowthistle
	Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb.	gooseberryleaf globemallow
	Sporobolus cryptandrus (Torr.) Gray	sand dropseed
	Stephanomeria pauciflora (Torr.) A. Nels.	brownplume wirelettuce
	Stylocline micropoides Gray	woollyhead neststraw
	Tamarix ramosissima Ledeb.	saltcedar
	Thymophylla pentachaeta (DC.) Small	fiveneedle pricklyleaf
	Thymophylla pentachaeta (DC.) Small var. belenidium (DC.) Strother	fiveneedle pricklyleaf
	Tiquilia canescens (DC.) A. Richards.	woody crinklemat
	Tiquilia latior (I.M. Johnston) A. Richards.	matted crinklemat
	Tridens muticus (Torr.) Nash	slim tridens
	Typha domingensis Pers.	southern cattail
	Viguiera parishii Greene	Parish's goldeneye
	Ziziphus obtusifolia (Hook. ex Torr. & Gray) Gray var. obtusifolia	lotebush
Granite Spring Canyon		
	Acacia greggii Gray	catclaw acacia
	Baccharis spp.	baccharis
	Bebbia juncea (Benth.) Greene var. aspera Greene	sweetbush
	Brickellia atractyloides Gray	spearleaf brickellbush
	Bromus rubens L.	red brome
	Canotia holacantha Torr.	crucifixion thorn
	Encelia farinosa Gray ex Torr.	goldenhills
	Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake	button brittlebush
	Fouquieria splendens Engelm.	ocotillo
	Isocoma acradenia (Greene) Greene	alkali goldenbush
	Mammillaria grahamii Engelm. var. grahamii	Graham's nipple cactus
	Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	scratchgrass
	Phragmites australis (Cav.) Trin. ex Steud.	common reed
	Pluchea sericea (Nutt.) Coville	arrowweed
	Populus fremontii S. Wats.	Fremont cottonwood
	Salazaria spp	paperbag bush

Canyon Name	Scientific Name	Common Name
	Scirpus spp.	rush
	Sonchus asper (L.) Hill	spiny sowthistle
	Tamarix ramosissima Ledeb.	saltcedar
	Trixis californica Kellogg	American threefold
Honga Spring		
	Acacia greggii Gray	catclaw acacia
	Adiantum capillus-veneris L.	common maidenhair
	Allionia incarnata L.	trailing windmills
	Andropogon glomeratus (Walt.) B.S.P.	bushy bluestem
	Apocynum cannabinum L.	Indianhemp
	Aquilegia chrysantha Gray	golden columbine
	Atriplex canescens (Pursh) Nutt.	fourwing saltbush
	Baccharis salicifolia (Ruiz & Pavón) Pers.	seep willow
	Baccharis sarothroides Gray	desertbroom
	Bothriochloa barbinodis (Lag.) Herter	cane bluestem
	Brickellia longifolia S. Wats.	longleaf brickellbush
	Bromus rubens L.	red brome
	Camissonia walkeri (A. Nels.) Raven	Walker's suncup
	Cladium californicum (S. Wats.) O'Neill	California sawgrass
	Cleome serrulata Pursh	Rocky Mountain beeplant
	Encelia farinosa Gray ex Torr.	goldenhills
	Erigeron lobatus A. Nels.	lobed fleabane
	Eucnide urens (Parry ex Gray) Parry	desert stingbush
	Flaveria macdougalii Theroux, Pinkava & Keil	Macdougal's yellowtops
	Funastrum cynanchoides (Dcne.) Schlechter	fringed twinevine
	Gutierrezia sarothrae (Pursh) Britt. & Rusby	broom snakeweed
	Imperata brevifolia Vasey	California satintail
	Isocoma acradenia (Greene) Greene	alkali goldenbush
	Lycium pallidum Miers	pale desert-thorn
	Machaeranthera pinnatifida (Hook.) Shinners	lacy tansyaster
	Mimulus cardinalis Dougl. ex Benth.	scarlet monkeyflower
	Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	scratchgrass
	Nicotiana obtusifolia Mertens & Galeotti	desert tobacco
	Nicotiana obtusifolia Mertens & Galeotti var. obtusifolia	desert tobacco
	Nolina microcarpa S. Wats.	sacahuista, beargrass
	Opuntia whipplei Engelm. & Bigelow	Whipple cholla
	Petrophyton caespitosum (Nutt.) Rydb.	mat rockspirea
	Physalis hederifolia Gray	ivyleaf groundcherry
	Prosopis glandulosa Torr.	honey mesquite
	Salix exigua Nutt.	coyote willow
	Stanleya pinnata (Pursh) Britt.	desert princesplume
	Stephanomeria exigua Nutt.	small wirelettuce
	Stephanomeria parryi Gray	Parry's wirelettuce
Horn Creek		
	Agave utahensis Engelm.	Utah agave
	Baccharis salicifolia (Ruiz & Pavón) Pers.	seep willow
	Bouteloua curtipendula (Michx.) Torr.	sideoats grama
	Brickellia longifolia S. Wats.	longleaf brickellbush
	Celtis laevigata Willd. var. reticulata (Torr.) L. Benson	netleaf hackberry
	Cercis orbiculata Greene	California redbud

Canyon Name	Scientific Name	Common Name
	Chrysothamnus spp.	rabbit brush
	Coleogyne ramosissima Torr.	blackbrush
	Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird	rubber rabbitbrush
	Fraxinus anomala Torr. ex S. Wats.	singleleaf ash
	Gutierrezia sarothrae (Pursh) Britt. & Rusby	broom snakeweed
	Porophyllum gracile Benth.	slender poreleaf
	Purshia mexicana (D. Don) Henrickson	Mexican cliffrose
	Rhus trilobata Nutt.	skunkbush sumac
	Salix exigua Nutt.	coyote willow
	Yucca baccata Torr.	banana yucca
Mohawk Canyon		
	Acacia greggii Gray	catclaw acacia
	Acourtia wrightii (Gray) Reveal & King	brownfoot
	Adiantum capillus-veneris L.	common maidenhair
	Agave utahensis Engelm.	Utah agave
	Agave utahensis var. utahensis	Utah agave
	Apocynum cannabinum L.	Indianhemp
	Aquilegia chrysantha Gray	golden columbine
	Aristida purpurea Nutt.	purple threeawn
	Artemisia ludoviciana Nutt.	white sagebrush
	Baccharis salicifolia (Ruiz & Pavón) Pers.	seep willow
	Baccharis sarothroides Gray	desertbroom
	Baccharis sergiloides Gray	squaw waterweed baccharis
	Bebbia juncea (Benth.) Greene var. aspera Greene	sweetbush
	Bothriochloa barbinodis (Lag.) Herter	cane bluestem
	Brickellia longifolia S. Wats.	longleaf brickellbush
	Bromus rubens L.	red brome
	Bromus tectorum L.	cheatgrass
	Camissonia walkeri (A. Nels.) Raven	Walker's suncup
	Canotia holacantha Torr.	crucifixion thorn
	Celtis laevigata Willd. var. reticulata (Torr.) L. Benson	netleaf hackberry
	Cercis occidentalis Torr. ex Gray	redbud
	Cercis orbiculata Greene	California redbud
	Chloracantha spinosa (Benth.) Nesom	spiny chloracantha
	Conyza canadensis (L.) Cronq.	Canadian horseweed
	Cryptantha maritima (Greene) Greene	Guadalupe cryptantha
	Cryptantha recurvata Coville	curvenut cryptantha
	Datura wrightii Regel	sacred thorn-apple
	Descurainia pinnata (Walt.) Britt.	western tansymustard
	Draba cuneifolia Nutt. ex Torr. & Gray	wedgeleaf draba
	Encelia farinosa Gray ex Torr.	goldenhills
	Ephedra fasciculata A. Nels.	Arizona jointfir, mormon tea
	Equisetum hyemale L.	scouringrush horsetail
	Eriastrum diffusum (Gray) Mason	miniature woollystar
	Erigeron divergens Torr. & Gray	spreading fleabane
	Eucnide urens (Parry ex Gray) Parry	desert stingbush
	Ferocactus cylindraceus (Engelm.) Orcutt var. cylindraceus	California barrel cactus
	Flaveria macdougalii Theroux, Pinkava & Keil	Macdougal's yellowtops
	Fouquieria splendens Engelm.	ocotillo
	Frangula betulifolia (Greene) V. Grub.	beechleaf frangula

Canyon Name	Scientific Name	Common Name
	Funastrum cynanchoides (Dcne.) Schlechter	fringed twinevine
	Galium stellatum Kellogg	starry bedstraw
	Gilia clokeyi Mason	Clokey's gilia
	Gutierrezia sarothrae (Pursh) Britt. & Rusby	broom snakeweed
	Hedeoma nana (Torr.) Briq.	dwarf false pennyroyal
	Hesperodoria salicina (Blake) Nesom	willow glowweed
	Imperata brevifolia Vasey	California satintail
	Isocoma acradenia (Greene) Greene	alkali goldenbush
	Juniperus osteosperma (Torr.) Little	Utah juniper
	Larrea tridentata (Sessé & Moc. ex DC.) Coville	creosote bush
	Lepidium lasiocarpum Nutt. var. lasiocarpum	shaggyfruit pepperweed
	Lepidium latifolium L.	broadleaved pepperweed
	Lepidium montanum Nutt.	mountain pepperweed
	Linanthus demissus (Gray) Greene	desertsnow
	Lobelia cardinalis L.	cardinalflower
	Lycium spp.	wolfberry
	Machaeranthera canescens (Pursh) Gray	hoary tansyaster
	Machaeranthera pinnatifida (Hook.) Shinners	lacy tansyaster
	Mammillaria grahamii Engelm. var. grahamii	Graham's nipple cactus
	Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm.	roving sailor
	Mimulus cardinalis Dougl. ex Benth.	scarlet monkeyflower
	Mortonia utahensis (Coville ex Gray) A. Nels.	Utah mortonia
	Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	scratchgrass
	Nolina microcarpa S. Wats.	sacahuista, beargrass
	Oenothera caespitosa Nutt.	tufted evening-primrose
	Opuntia phaeacantha Engelm.	tulip pricklypear
	Parietaria hespera Hinton	rillita pellitory
	Petrophyton caespitosum (Nutt.) Rydb.	mat rockspirea
	Phacelia crenulata Torr. ex S. Wats.	cleftleaf wildheliotrope
	Phacelia filiformis Brand	narrow phacelia
	Phacelia rotundifolia Torr. ex S. Wats.	roundleaf phacelia
	Pinus edulis Engelm.	twoneedle pinyon, Colorado pinyon
	Plantago patagonica Jacq.	woolly plantain
	Pleurocoronis pluriseta (Gray) King & H.E. Robins.	bush arrowleaf
	Pluchea sericea (Nutt.) Coville	arrowweed
	Poa bigelovii Vasey & Scribn.	Bigelow's bluegrass
	Polypogon monspeliensis (L.) Desf.	annual rabbitsfoot grass
	Polypogon viridis (Gouan) Breistr.	beardless rabbitsfoot grass
	Porophyllum gracile Benth.	slender poreleaf
	Pseudognaphalium spp	
	Ptelea trifoliata L.	common hoptree
	Quercus turbinella Greene	Sonoran scrub oak
	Rhus trilobata Nutt.	skunkbush sumac
	Rhus trilobata Nutt. var. simplicifolia (Greene) Barkl.	skunkbush sumac
	Salix exigua Nutt.	coyote willow
	Schismus spp.	schismus
	Silene antirrhina L.	sleepy silene
	Solanum douglasii Dunal	greenspot nightshade
	Solidago spp.	goldenrod species
	Sonchus asper (L.) Hill	spiny sowthistle

Canyon Name	Scientific Name	Common Name
	Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb.	gooseberryleaf globemallow
	Sphaeralcea spp.	globemallow
	Stanleya pinnata (Pursh) Britt.	desert princesplume
	Stephanomeria pauciflora (Torr.) A. Nels.	brownplume wirelettuce
	Tamarix ramosissima Ledeb.	saltcedar
	Thymophylla pentachaeta (DC.) Small	fiveneedle pricklyleaf
	Typha domingensis Pers.	southern cattail
	Typha latifolia L.	broadleaf cattail
	Viguiera parishii Greene	Parish's goldeneye
	Vulpia microstachys (Nutt.) Munro	small fescue
	Vulpia octoflora (Walt.) Rydb.	sixweeks fescue
	Ziziphus obtusifolia (Hook. ex Torr. & Gray) Gray var. obtusifolia	lotebush
National Canyon		
	Acacia greggii Gray	catclaw acacia
	Adiantum capillus-veneris L.	common maidenhair
	Aloysia wrightii Heller ex Abrams	Wright's beebrush
	Andropogon glomeratus (Walt.) B.S.P.	bushy bluestem
	Anulocaulis leiosolenus (Torr.) Standl.	ringstem
	Anulocaulis leiosolenus (Torr.) Standl. var. leiosolenus	southwestern ringstem
	Aristida purpurea Nutt.	purple threeawn
	Aristida spp.	three awn
	Artemisia ludoviciana Nutt.	white sagebrush
	Baccharis emoryi Gray	Emory's baccharis
	Baccharis salicifolia (Ruiz & Pavón) Pers.	seep willow
	Baccharis sarothroides Gray	desertbroom
	Baccharis sergiloides Gray	squaw waterweed baccharis
	Bebbia juncea (Benth.) Greene var. aspera Greene	sweetbush
	Brickellia californica (Torr. & Gray) Gray	California brickellbush
	Brickellia coulteri Gray	Coulter's brickellbush
	Brickellia longifolia S. Wats.	longleaf brickellbush
	Bromus rubens L.	red brome
	Camissonia multijuga (S. Wats.) Raven	froststem suncup
	Camissonia walkeri (A. Nels.) Raven	Walker's suncup
	Centaurium arizonicum	Arizona centaury
	Centaurium calycosum (Buckl.) Fern.	Arizona centaury
	Cheilanthes feei T. Moore	slender lipfern
	Datura wrightii Regel	sacred thorn-apple
	Encelia farinosa Gray ex Torr.	goldenhills
	Encelia resinifera C. Clark ssp. tenuifolia C. Clark	sticky brittlebush
	Ephedra spp.	Mormon tea
	Erigeron lobatus A. Nels.	lobed fleabane
	Erigeron spp.	fleabane
	Eriogonum inflatum Torr. & Frém.	desert trumpet
	Eucnide urens (Parry ex Gray) Parry	desert stingbush
	Flaveria macdougalii Theroux, Pinkava & Keil	Macdougal's yellowtops
	Fouquieria splendens Engelm.	ocotillo
	Frangula betulifolia (Greene) V. Grub.	beechleaf frangula
	Frangula betulifolia (Greene) V. Grub. ssp. obovata (Kearney & Peebles) Kartesz & Gandhi	frangula
	Fraxinus anomala Torr. ex S. Wats.	singleleaf ash

Canyon Name	Scientific Name	Common Name
	Funastrum cynanchoides (Dcne.) Schlechter	fringed twinevine
	Funastrum cynanchoides (Dcne.) Schlechter ssp. cynanchoides	fringed twinevine
	Galium proliferum Gray	limestone bedstraw
	Hedeoma nana (Torr.) Briq.	dwarf false pennyroyal
	Hesperodoria salicina (Blake) Nesom	willow glowweed
	Lactuca serriola L.	prickly lettuce
	Lycium spp.	wolfberry
	Machaeranthera pinnatifida (Hook.) Shinners	lacy tansyaster
	Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm.	roving sailor
	Mortonia utahensis (Coville ex Gray) A. Nels.	Utah mortonia
	Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	scratchgrass
	Nicotiana obtusifolia Mertens & Galeotti var. obtusifolia	desert tobacco
	Nolina microcarpa S. Wats.	sacahuista, beargrass
	Oenothera caespitosa Nutt.	tufted evening-primrose
	Opuntia chlorotica Engelm. & Bigelow	dollarjoint pricklypear
	Opuntia engelmannii Salm-Dyck var. engelmannii	cactus apple
	Parietaria hespera Hinton	rillita pellitory
	Perityle emoryi	fetid marigold
	Phacelia crenulata Torr. ex S. Wats.	cleftleaf wildheliotrope
	Phacelia filiformis Brand	narrow phacelia
	Pinus monophylla Torr. & Frém.	singleleaf pinyon
	Pleurocoronis pluriseta (Gray) King & H.E. Robins.	bush arrowleaf
	Polemonium spp	
	Polypogon monspeliensis (L.) Desf.	annual rabbitsfoot grass
	Polypogon viridis (Gouan) Breistr.	beardless rabbitsfoot grass
	Populus fremontii S. Wats.	Fremont cottonwood
	Porophyllum gracile Benth.	slender poreleaf
	Salix exigua Nutt.	coyote willow
	Salix gooddingii Ball	Goodding's willow
	Salvia davidsonii Greenm.	Davidson's sage
	Schismus arabicus Nees	Arabian schismus
	Solanum americanum P. Mill.	American black nightshade
	Solanum douglasii Dunal	greenspot nightshade
	Sonchus asper (L.) Hill	spiny sowthistle
	Stanleya pinnata (Pursh) Britt.	desert princesplume
	Stephanomeria parryi Gray	Parry's wirelettuce
	Stephanomeria pauciflora (Torr.) A. Nels.	brownplume wirelettuce
	Tamarix ramosissima Ledeb.	saltcedar
	Trixis californica Kellogg	American threefold
	Typha domingensis Pers.	southern cattail
	Typha latifolia L.	broadleaf cattail
	Ziziphus obtusifolia var. canescens (Gray) M.C. Johnston	lotebush
Prospect Canyon		
	Acacia greggii Gray	catclaw acacia
	Adiantum capillus-veneris L.	common maidenhair
	Baccharis salicifolia (Ruiz & Pavón) Pers.	seep willow
	Baccharis sarothroides Gray	desertbroom
	Brickellia longifolia S. Wats.	longleaf brickellbush
	Camissonia spp.	suncup
	Camissonia walkeri (A. Nels.) Raven	Walker's suncup

Canyon Name	Scientific Name	Common Name
	Eucnide urens (Parry ex Gray) Parry	desert stingbush
	Funastrum cynanchoides (Dcne.) Schlechter ssp. cynanchoides	fringed twinevine
	Isocoma acradenia (Greene) Greene	alkali goldenbush
	Lepidium lasiocarpum Nutt. var. lasiocarpum	shaggyfruit pepperweed
	Mimulus cardinalis Dougl. ex Benth.	scarlet monkeyflower
	Nicotiana obtusifolia Mertens & Galeotti	desert tobacco
	Penstemon palmeri Gray	Palmer's penstemon
	Salsola tragus L.	prickly Russian thistle
	Sporobolus contractus A.S. Hitchc.	spike dropseed
	Stephanomeria pauciflora (Torr.) A. Nels.	brownplume wirelettuce
	Tidestromia spp.	
Ruby Canyon		
	Acacia greggii Gray	catclaw acacia
	Agave L.	agave
	Baccharis emoryi Gray	Emory's baccharis
	Bebbia juncea (Benth.) Greene var. aspera Greene	sweetbush
	Brickellia longifolia S. Wats.	longleaf brickellbush
	Cercis orbiculata Greene	California redbud
	Encelia farinosa Gray ex Torr.	goldenhills
	Ephedra spp.	Mormon tea
	Fallugia paradoxa (D. Don) Endl. ex Torr.	Apache plume
	Fraxinus anomala Torr. ex S. Wats.	singleleaf ash
	Nolina microcarpa S. Wats.	sacahuista, beargrass
	Populus fremontii S. Wats.	Fremont cottonwood
	Porophyllum gracile Benth.	slender poreleaf
	Quercus turbinella Greene	Sonoran scrub oak
	Tamarix ramosissima Ledeb.	saltcedar
	Yucca baccata Torr.	banana yucca
	Yucca elata (Engelm.) Engelm.	soaptree yucca
	Yucca spp.	yucca
Salt Creek		
	Acacia greggii Gray	catclaw acacia
	Agave L.	agave
	Agave utahensis Engelm.	Utah agave
	Baccharis salicifolia (Ruiz & Pavón) Pers.	seep willow
	Gutierrezia sarothrae (Pursh) Britt. & Rusby	broom snakeweed
	Imperata brevifolia Vasey	California satintail
	Porophyllum gracile Benth.	slender poreleaf
	Yucca spp.	yucca
Sapphire Canyon		
	Acacia greggii Gray	catclaw acacia
	Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth	Indian ricegrass
	Adiantum capillus-veneris L.	common maidenhair
	Agave utahensis Engelm. var. kaibabensis (McKelvey) Breitung	Kaibab agave
	Amelanchier utahensis Koehne	Utah serviceberry
	Arctostaphylos Adans.	manzanita
	Aristida purpurea Nutt.	purple threeawn
	Artemisia ludoviciana Nutt.	white sagebrush
	Astragalus spp.	astragalus
	Baccharis emoryi Gray	Emory's baccharis

Canyon Name	Scientific Name	Common Name
	Baccharis salicifolia (Ruiz & Pavón) Pers.	seep willow
	Baccharis sergiloides Gray	squaw waterweed baccharis
	Berberis harrisoniana Kearney & Peebles	Harrison's barberry
	Berberis spp	barberry
	Bernardia incana Morton	hoary myrtlecroton
	Bothriochloa saccharoides (Sw.) Rydb.	silver bluestem
	Bouteloua curtipendula (Michx.) Torr.	sideoats grama
	Brickellia atractyloides Gray	spearleaf brickellbush
	Brickellia longifolia S. Wats.	longleaf brickellbush
	Bromus rubens L.	red brome
	Cercis occidentalis Torr. ex Gray	redbud
	Cercis orbiculata Greene	California redbud
	Cladium californicum (S. Wats.) O'Neill	California sawgrass
	Cleome lutea Hook.	yellow spiderflower
	Cryptantha spp.	cryptantha
	Delphinium parishii Gray	desert larkspur
	Encelia farinosa Gray ex Torr.	goldenhills
	Encelia frutescens (Gray) Gray	button brittlebush
	Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake	button brittlebush
	Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird	rubber rabbitbrush
	Erigeron lobatus A. Nels.	lobed fleabane
	Eriogonum inflatum Torr. & Frém.	desert trumpet
	Fallugia paradoxa (D. Don) Endl. ex Torr.	Apache plume
	Fraxinus anomala Torr. ex S. Wats.	singleleaf ash
	Funastrum cynanchoides (Dcne.) Schlechter	fringed twinevine
	Galium stellatum Kellogg	starry bedstraw
	Garrya flavescens S. Wats.	ashy silktassel
	Gutierrezia sarothrae (Pursh) Britt. & Rusby	broom snakeweed
	Hedeoma spp.	pennyroyal
	Isocoma acradenia (Greene) Greene	alkali goldenbush
	Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	scratchgrass
	Nicotiana obtusifolia Mertens & Galeotti	desert tobacco
	Nolina microcarpa S. Wats.	sacahuista, beargrass
	Oenothera caespitosa Nutt.	tufted evening-primrose
	Opuntia spp.	prickly pear
	Penstemon eatonii Gray	Eaton's penstemon
	Perityle congesta (M.E. Jones) Shinners	Grand Canyon rockdaisy
	Perityle emoryi	fetid marigold
	Phlox austromontana Coville	mountain phlox
	Pinus edulis Engelm.	twoneedle pinyon, Colorado pinyon
	Pleurocoronis pluriseta (Gray) King & H.E. Robins.	bush arrowleaf
	Pluchea sericea (Nutt.) Coville	arrowweed
	Poa spp.	bluegrass
	Populus fremontii S. Wats.	Fremont cottonwood
	Porophyllum gracile Benth.	slender poreleaf
	Psilostrophe sparsiflora (Gray) A. Nels.	greenstem paperflower
	Ptelea trifoliata L.	common hoptree
	Purshia mexicana (D. Don) Henrickson	Mexican cliffrose
	Rhus trilobata Nutt.	skunkbush sumac
	Salix exigua Nutt.	coyote willow

Canyon Name	Scientific Name	Common Name
	Salix gooddingii Ball	Goodding's willow
	Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb.	gooseberryleaf globemallow
	Stanleya pinnata (Pursh) Britt.	desert princesplume
	Tamarix ramosissima Ledeb.	saltcedar
	Thymophylla pentachaeta (DC.) Small	fiveneedle pricklyleaf
	Typha spp.	cattail
Slate Creek		
	Acacia greggii Gray	catclaw acacia
	Adiantum capillus-veneris L.	common maidenhair
	Agave utahensis Engelm.	Utah agave
	Agave utahensis Engelm. var. kaibabensis (McKelvey) Breitung	Kaibab agave
	Ambrosia artemisiifolia L.	annual ragweed
	Ambrosia dumosa (Gray) Payne	burrobush
	Amelanchier utahensis Koehne	Utah serviceberry
	Aristida spp.	three awn
	Artemisia ludoviciana Nutt.	white sagebrush
	Atriplex canescens (Pursh) Nutt.	fourwing saltbush
	Baccharis emoryi Gray	Emory's baccharis
	Baccharis salicifolia (Ruiz & Pavón) Pers.	seep willow
	Baccharis sergiloides Gray	squaw waterweed baccharis
	Bernardia incana Morton	hoary myrtlecroton
	Bothriochloa saccharoides (Sw.) Rydb.	silver bluestem
	Bouteloua curtipendula (Michx.) Torr.	sideoats grama
	Brickellia atractyloides Gray	spearleaf brickellbush
	Brickellia longifolia S. Wats.	longleaf brickellbush
	Bromus rubens L.	red brome
	Bromus tectorum L.	cheatgrass
	Cercis occidentalis Torr. ex Gray	redbud
	Cercis orbiculata Greene	California redbud
	Cercocarpus intricatus S. Wats.	littleleaf mountain mahogany
	Cryptantha spp.	cryptantha
	Encelia farinosa Gray ex Torr.	goldenhills
	Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake	button brittlebush
	Ephedra fasciculata A. Nels.	Arizona jointfir, mormon tea
	Ephedra spp.	Mormon tea
	Ephedra torreyana S. Wats.	Torrey's jointfir, Torrey mormon tea
	Ephedra viridis Coville	mormon tea
	Erigeron lobatus A. Nels.	lobed fleabane
	Eriogonum inflatum Torr. & Frém.	desert trumpet
	Fallugia paradoxa (D. Don) Endl. ex Torr.	Apache plume
	Flaveria macdougalii Theroux, Pinkava & Keil	Macdougal's yellowtops
	Fraxinus anomala Torr. ex S. Wats.	singleleaf ash
	Gutierrezia sarothrae (Pursh) Britt. & Rusby	broom snakeweed
	Isocoma acradenia (Greene) Greene	alkali goldenbush
	Juniperus osteosperma (Torr.) Little	Utah juniper
	Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	scratchgrass
	Nolina microcarpa S. Wats.	sacahuista, beargrass
	Oenothera caespitosa Nutt.	tufted evening-primrose
	Opuntia chlorotica Engelm. & Bigelow	dollarjoint pricklypear

Canyon Name	Scientific Name	Common Name
	Phlox austromontana Coville	mountain phlox
	Physalis hederifolia Gray	ivyleaf groundcherry
	Populus fremontii S. Wats.	Fremont cottonwood
	Porophyllum gracile Benth.	slender poreleaf
	Prosopis glandulosa Torr.	honey mesquite
	Ptelea trifoliata L.	common hoptree
	Purshia mexicana (D. Don) Henrickson	Mexican cliffrose
	Rhus trilobata Nutt.	skunkbush sumac
	Rhus trilobata Nutt. var. simplicifolia (Greene) Barkl.	skunkbush sumac
	Salix exigua Nutt.	narrowleaf willow coyote willow
	Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb.	gooseberryleaf globemallow
	Stephanomeria minor (Hook.) Nutt. var. minor	narrowleaf wirelettuce
	Tamarix ramosissima Ledeb.	saltcedar
	Typha latifolia L.	broadleaf cattail
	Vulpia octoflora (Walt.) Rydb.	sixweeks fescue
	Yucca elata (Engelm.) Engelm.	soaptree yucca
	Yucca spp.	yucca
Spring Canyon		
	Acacia greggii Gray	catclaw acacia
	Baccharis emoryi Gray	Emory's baccharis
	Baccharis sarothroides Gray	desertbroom
	Bromus rubens L.	red brome
	Datura wrightii Regel	sacred thorn-apple
	Pluchea sericea (Nutt.) Coville	arrowweed
	Tamarix ramosissima Ledeb.	saltcedar
	Typha spp.	cattail
Spring East of Cedar		
	Acacia greggii Gray	catclaw acacia
	Agave utahensis Engelm.	Utah agave
	Atriplex canescens (Pursh) Nutt.	fourwing saltbush
	Ephedra viridis Coville	mormon tea
	Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird	rubber rabbitbrush
	Gutierrezia sarothrae (Pursh) Britt. & Rusby	broom snakeweed
Three Springs Canyon		
	Acacia greggii Gray	catclaw acacia
	Agave L.	agave
	Andropogon glomeratus (Walt.) B.S.P.	bushy bluestem
	Apocynum cannabinum L.	Indianhemp
	Aristida purpurea Nutt.	purple threeawn
	Artemisia ludoviciana Nutt.	white sagebrush
	Astragalus nuttallianus DC.	smallflowered milkvetch
	Baccharis emoryi Gray	Emory's baccharis
	Baccharis salicifolia (Ruiz & Pavón) Pers.	seep willow
	Baccharis sarothroides Gray	desertbroom
	Baccharis sergiloides Gray	squaw waterweed baccharis
	Baccharis spp.	baccharis
	Bebbia juncea (Benth.) Greene var. aspera Greene	sweetbush
	Bothriochloa barbinodis (Lag.) Herter	cane bluestem

Canyon Name	Scientific Name	Common Name
	Brickellia coulteri Gray	Coulter's brickellbush
	Brickellia longifolia S. Wats.	longleaf brickellbush
	Bromus rubens L.	red brome
	Camissonia walkeri (A. Nels.) Raven	Walker's suncup
	Centaurium arizonicum	Arizona centaury
	Cercis orbiculata Greene	California redbud
	Cirsium arizonicum (Gray) Petrak	Arizona thistle
	Cirsium mohavense	Mojave thistle
	Conyza canadensis (L.) Cronq.	Canadian horseweed
	Cryptantha spp.	cryptantha
	Dasyochloa pulchella (Kunth) Willd. ex Rydb.	low woollygrass
	Datura wrightii Regel	sacred thorn-apple
	Eleocharis spp	spikerush
	Encelia farinosa Gray ex Torr.	goldenhills
	Ephedra fasciculata A. Nels.	Arizona jointfir, mormon tea
	Ephedra spp.	Mormon tea
	Erigeron lobatus A. Nels.	lobed fleabane
	Eriogonum fasciculatum Benth. var. polifolium (Benth.) Torr. & Gray	Eastern Mojave buckwheat
	Eucnide urens (Parry ex Gray) Parry	desert stingbush
	Ferocactus cylindraceus (Engelm.) Orcutt var. cylindraceus	California barrel cactus
	Fouquieria splendens Engelm.	ocotillo
	Gutierrezia sarothrae (Pursh) Britt. & Rusby	broom snakeweed
	Gutierrezia spp.	snakeweed
	Hedeoma nana (Torr.) Briq.	dwarf false pennyroyal
	Heterotheca villosa (Pursh) Shinners	hairy false goldenaster
	Isocoma acradenia (Greene) Greene	alkali goldenbush
	Juncus bufonius L.	toad rush
	Lactuca serriola L.	prickly lettuce
	Larrea tridentata (Sessé & Moc. ex DC.) Coville	creosote bush
	Lepidium lasiocarpum Nutt. var. lasiocarpum	shaggyfruit pepperweed
	Lycium spp.	wolfberry
	Machaeranthera pinnatifida (Hook.) Shinners	lacy tansyaster
	Mammillaria spp.	nipple cactus
	Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm.	roving sailor
	Mimulus cardinalis Dougl. ex Benth.	scarlet monkeyflower
	Nicotiana obtusifolia Mertens & Galeotti	desert tobacco
	Nicotiana obtusifolia Mertens & Galeotti var. obtusifolia	desert tobacco
	Oenothera caespitosa Nutt.	tufted evening-primrose
	Opuntia spp.	prickly pear
	Parietaria hespera Hinton	rillita pellitory
	Penstemon eatonii Gray	Eaton's penstemon
	Penstemon pachyphyllus Gray ex Rydb. var. congestus (M.E. Jones) N. Holmgren	thickleaf beardtongue
	Penstemon palmeri Gray	Palmer's penstemon
	Phacelia filiformis Brand	narrow phacelia
	Phacelia rotundifolia Torr. ex S. Wats.	roundleaf phacelia
	Phragmites australis (Cav.) Trin. ex Steud.	common reed
	Pluchea sericea (Nutt.) Coville	arrowweed
	Polemonium spp	
	Polypogon monspeliensis (L.) Desf.	annual rabbitsfoot grass

Canyon Name	Scientific Name	Common Name
	Populus fremontii S. Wats.	Fremont cottonwood
	Porophyllum gracile Benth.	slender poreleaf
	Prosopis glandulosa Torr.	honey mesquite
	Pseudognaphalium spp	
	Rhus trilobata Nutt.	skunkbush sumac
	Salix exigua Nutt.	coyote willow
	Salix gooddingii Ball	Goodding's willow
	Sonchus asper (L.) Hill	spiny sowthistle
	Sonchus oleraceus L.	common sowthistle
	Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb.	gooseberryleaf globemallow
	Sporobolus contractus A.S. Hitchc.	spike dropseed
	Sporobolus cryptandrus (Torr.) Gray	sand dropseed
	Stephanomeria pauciflora (Torr.) A. Nels.	brownplume wirelettuce
	Tamarix ramosissima Ledeb.	saltcedar
	Thymophylla pentachaeta (DC.) Small	fiveneedle pricklyleaf
	Thymophylla pentachaeta (DC.) Small var. belenidium (DC.) Strother	fiveneedle pricklyleaf
	Typha latifolia L.	broadleaf cattail
	Viguiera parishii Greene	Parish's goldeneye
	Yucca spp.	yucca
Topaz Canyon		
	Acacia greggii Gray	catclaw acacia
	Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth	Indian ricegrass
	Adiantum capillus-veneris L.	common maidenhair
	Agave utahensis var. utahensis	Utah agave
	Amelanchier utahensis Koehne	Utah serviceberry
	Aristida purpurea Nutt.	purple threeawn
	Aristida spp.	three awn
	Baccharis emoryi Gray	Emory's baccharis
	Baccharis sergiloides Gray	squaw waterweed baccharis
	Baccharis spp.	baccharis
	Bernardia incana Morton	hoary myrtlecroton
	Brickellia longifolia S. Wats.	longleaf brickellbush
	Bromus rubens L.	red brome
	Cercis occidentalis Torr. ex Gray	redbud
	Cercis orbiculata Greene	California redbud
	Cirsium arizonicum (Gray) Petrak	Arizona thistle
	Encelia farinosa Gray ex Torr.	goldenhills
	Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake	button brittlebush
	Ephedra fasciculata A. Nels.	Arizona jointfir, mormon tea
	Ephedra viridis Coville	mormon tea
	Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird	rubber rabbitbrush
	Frangula betulifolia (Greene) V. Grub.	beechleaf frangula
	Frangula betulifolia (Greene) V. Grub. ssp. betulifolia	beechleaf frangula
	Fraxinus anomala Torr. ex S. Wats.	singleleaf ash
	Galium aparine L.	stickywilly
	Gutierrezia sarothrae (Pursh) Britt. & Rusby	broom snakeweed
	Isocoma acradenia (Greene) Greene	alkali goldenbush
	Juniperus osteosperma (Torr.) Little	Utah juniper
	Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm.	roving sailor

Canyon Name	Scientific Name	Common Name
	Mentzelia spp.	blazingstar
	Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	scratchgrass
	Nolina microcarpa S. Wats.	sacahuista, beargrass
	Oenothera caespitosa Nutt.	tufted evening-primrose
	Opuntia chlorotica Engelm. & Bigelow	dollarjoint pricklypear
	Phacelia spp.	phacelia
	Plantago patagonica Jacq.	woolly plantain
	Populus fremontii S. Wats.	Fremont cottonwood
	Porophyllum gracile Benth.	slender poreleaf
	Ptelea trifoliata L.	common hoptree
	Purshia mexicana (D. Don) Henrickson	Mexican cliffrose
	Rhus trilobata Nutt.	skunkbush sumac
	Rhus trilobata Nutt. var. simplicifolia (Greene) Barkl.	skunkbush sumac
	Salvia dorrii (Kellogg) Abrams ssp. dorrii var. dorrii	purple sage
	Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb.	gooseberryleaf globemallow
	Stanleya pinnata (Pursh) Britt.	desert princesplume
	Stephanomeria pauciflora (Torr.) A. Nels.	brownplume wirelettuce
	Tamarix ramosissima Ledeb.	saltcedar
	Thamnosma montana Torr. & Frém.	turpentinebroom
	Thymophylla pentachaeta (DC.) Small	fiveneedle pricklyleaf
	Xylorhiza tortifolia (Torr. & Gray) Greene	Mojave woodyaster
	Yucca angustissima Engelm. ex Trel.	narrowleaf yucca, fine-leaf yucca
	Yucca baccata Torr.	banana yucca
	Yucca elata (Engelm.) Engelm.	soaptree yucca
Turquoise Canyon		
	Acacia greggii Gray	catclaw acacia
	Cercis orbiculata Greene	California redbud
	Salix gooddingii Ball	Goodding's willow
	Tamarix ramosissima Ledeb.	saltcedar
White Creek		
	Acacia greggii Gray	catclaw acacia
	Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth	Indian ricegrass
	Adiantum capillus-veneris L.	common maidenhair
	Aloysia wrightii Heller ex Abrams	Wright's beebrush
	Baccharis emoryi Gray	Emory's baccharis
	Baccharis salicifolia (Ruiz & Pavón) Pers.	seep willow
	Baccharis sarothroides Gray	desertbroom
	Baccharis spp.	baccharis
	Bouteloua curtipendula (Michx.) Torr.	sideoats grama
	Brickellia atractyloides Gray	spearleaf brickellbush
	Brickellia californica (Torr. & Gray) Gray	California brickellbush
	Brickellia longifolia S. Wats.	longleaf brickellbush
	Celtis laevigata Willd. var. reticulata (Torr.) L. Benson	netleaf hackberry
	Cercis occidentalis Torr. ex Gray	redbud
	Coleogyne ramosissima Torr.	blackbrush
	Datura wrightii Regel	sacred thorn-apple
	Echinocactus spp.	
	Encelia farinosa Gray ex Torr.	goldenhills
	Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake	button brittlebush
	Ephedra fasciculata A. Nels.	Arizona jointfir, mormon tea

Canyon Name	Scientific Name	Common Name
	Ephedra viridis Coville	mormon tea
	Equisetum spp.	Horsetail
	Fallugia paradoxa (D. Don) Endl. ex Torr.	Apache plume
	Fraxinus anomala Torr. ex S. Wats.	singleleaf ash
	Gutierrezia sarothrae (Pursh) Britt. & Rusby	broom snakeweed
	Isocoma acradenia (Greene) Greene	alkali goldenbush
	Juniperus spp.	juniper
	Mimulus cardinalis Dougl. ex Benth.	scarlet monkeyflower
	Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi	scratchgrass
	Nolina microcarpa S. Wats.	sacahuista, beargrass
	Oenothera elata Kunth ssp. hookeri (Torr. & Gray) W. Dietr. & W.L. Wagner	Hooker's evening-primrose
	Opuntia spp.	prickly pear
	Penstemon palmeri Gray	Palmer's penstemon
	Populus fremontii S. Wats.	Fremont cottonwood
	Porophyllum gracile Benth.	slender poreleaf
	Quercus gambelii Nutt.	Gambel oak
	Rhus trilobata Nutt.	skunkbush sumac
	Rhus trilobata Nutt. var. simplicifolia (Greene) Barkl.	skunkbush sumac
	Thamnosma montana Torr. & Frém.	turpentinebroom
	Thymophylla pentachaeta (DC.) Small	fiveneedle pricklyleaf
	Toxicodendron rydbergii (Small ex Rydb.) Greene	western poison ivy
	Typha domingensis Pers.	southern cattail
	Typha latifolia L.	broadleaf cattail
	Typha spp.	cattail
	Yucca baccata Torr.	banana yucca
	Yucca spp.	yucca

Appendix J. Plant Collections

Site No.	Location	Easting (NAD83)	Northing (NAD83)
140 Mile Canyon			
Trip May 2006			
22	Transect 1A	359439	4029220
23	Transect 1B	359411	4029160
24	Ca 100 m up from 23	359408	4029150
25		359450	4028748
Trip May 2007			
41	Mentzelia abyssa site	359451	4028779
148.5 Mile Spring (Springs below Matkatamiba Canyon)			
Trip May 2006			
27		348747	4022999
National Canyon			
Trip May 2006			
29	Transect T1A	330508	4013818
30	ca 300 m down from 29	330212	4013926
31	Transect T1B	330390	4013866
32	Mentzelia abyssa site	330144	4014031
33	beach near mouth	329736	4014027
34	above Transect 3A-B	331504	4013157
35	Transect T2A	331229	4013717
36	just above Transect 2B	331479	4013565
37	just above site 36	331525	4013480
38	Transect T3B	331511	4013234
39	Transect T3A	331492	4013237
Mohawk Canyon			
Trip May 2006			
40	Transect 1B	323109	4010627
41	up from site 40	323149	4010578
42	up from site 41, first seep on right	323029	4010425
43	left seep up from site 42	323094	4010425
44	Transect 1A	323128	4010702
45	Transect 2A, 2B	323022	4010294
46	dense seep above site 45	323015	4010296
47	Transect 3A	322924	4009740
	Transect 3B	323147	4011643
Trip May 2007			
46		323348	4011343
47		323042	4010547
48		323022	4010294
49		323204	4011633
50		323329	4011516
51		323019	4010432
52		323130	4011009
Prospect Canyon			
Trip May 2006			
48	mouth of canyon	312909	4007919
50		312863	4007801

51		312971	4007418
Granite Park Canyon			
Trip May 2006			
56		291190	3982987
57		291303	3982859
58	Transect T1A	291497	3982792
59		291646	3982599
60	Transect T2A-B	291597	3982582
61	right branch of Granite Park Cyn	291629	3981691
		291588	3981674
Trip May 2007			
61		291323	3982847
62		291306	3982848
63		291289	3982850
64		291237	3982803
65		291258	3982799
66		291495	3982766
67		291519	3982678
68		291597	3982425
Three Springs			
Trip May 2006			
62		291729	3973760
63	Transect T1A	291816	3973700
64		291906	3973681
65		292240	3973612
66		292577	3973649
67	Transect T2A	292628	3973659
68	Transect 3A	292780	3973626
Trip May 2007			
71		290268	3975470
217 Mile Canyon			
Trip May 2006			
69a		291895	3970831
69b		291900	3970751
69c		292995	3969741

Canyon / Species Information	Collection Number	Comments
140 Mile Canyon (May 2006)		
Site 22.		
Acacia greggii	20979	
Adiantum capillus-veneris	20976	
Andropogon glomeratus	20977	
Aristida purpurea var glauca	20978	varieties weakly differentiated
Astragalus praelongus var praelongus	20984	
Cladium californicum	20968	
Ephedra aspera	20973	includes E. fasciculata (Ickert-Bond 2006)
Epipactis gigantea	20982	
Erigeron lobatus	20986	
Funastrum cynanchoides ssp hartwegii	20972	
Hedeoma nana	20974	
Lycium torreyi	20975	
Mimulus guttatus	20985	
Opuntia cf phaeacantha	20969	pink-red-flowered form
Parietaria hespera var hespera	20971	
Pleuraphis jamesii	20981	
Pluchea sericea	20980	
Polypogon semiverticillata	20987	
Scirpus americanus	20970	
Site 23.		
Agave utahensis ssp utahensis	20993	Transect 1B
Echinocereus coccineus	20995	
Hesperodoria salicina	20994	Transect 1B; endemic to Grand Canyon
Maurandella antirrhiniflora	20997	
Nicotiana oblongifolia var oblongifolia	20989	
Perityle congesta	20991	
Phacelia perityloides var laxiflora	20990	
Pleuraphis jamesii	20992	
Porophyllum gracile	20998	
Sonchus asper	20988	
Sphaeralcea grossulariifolia	20996	probably, genus difficult to key to species
Site 24.		
Camissonia walkeri	21001	
Fraxinus anomala	21009	
Mentzelia cronquistii	21000	often mis-identified as M. multiflora
Nicotiana oblongifolia var oblongifolia	21008	
Phacelia crenulata	20999	part of large complex
Tridens muticus		
Site 25.		
Eucnide urens	21003	
Fraxinus velutina	21012	
Mentzelia abyssa	21002	brand new endemic species!
140 Mile Canyon (May 2007)		
Site 41.		
Echinocereus coccineus	21963	
Lepidium eastwoodiae	21965	ID by Andrew Salywon, close to L. montana, new to Grand Canyon
Mentzelia abyssa	21964	new species
148.5 Mile Spring (below Matkatamiba Canyon)		

Canyon / Species Information	Collection Number	Comments
Site 27.		
Salvia davidsonii	21013	complex group in need of study
National Canyon (May 2006)		
Site 29.		
Aristida purpurea var glauca	21019	
Brickellia coulteri	21023	
Camissonia walkeri	21029	
Cheilanthes feei	21018	
Erigeron lobatus	21024	
Funastrum cynanchoides ssp cynanchoides	21021	
Galium proliferum	21030	rare in Grand Canyon, undercollected
Hedeoma nana	21027	
Maurandella antirrhiniflora	21031	
Muhlenbergia asperrima	21020	
Nicotiana oblongifolia var palmeri	21032	
Parietaria hespera var hespera	21034	
Perityle emoryi	21025	
Phacelia crenulata	21026	
Pleurocoronis pluriseta	21022	
Salvia davidsonii	21028	flowers red
Solanum douglasii	21033	
Site 30.		
Brickellia coulteri	21035	
Galium stellatum	21037	
Hesperodoria salicina	21036	
Site 31.		
Aristida purpurea var glauca	21039	
Schismus arabicus	21038	
Site 32.		
Camissonia walkeri	21040	
Eucnides urens	21042	
Mentzelia abyssa	21041	new species
Site 33.		
Datura wrightii	21043	
Rumex obtusifolius	21044	second collection in Grand Canyon
Site 34.		
Erigeron lobatus	21045	
Site 35.		
Encelia resinifera var tenuifolia	21046	endemic to Canyon; rare but undercollected or misidentified
Site 36.		
Anulocaulis leisolenus var leisolenus	21048	
Echinocereus triglochidiatus	21052	
Fouquieria splendens	21049	Rarely collected in Canyon, not included in Vascular Plants of AZ
Mortonia scabrella var utahensis	21047	near endemic variety, otherwise known from sw Utah
Porophyllum gracile	21051	
Tridens muticus	21050	
Site 37.		
Layia glandulosa var glandulosa	21054	
Muhlenbergia microsperma	21053	
Phacelia filiformis	21058	endemic to Grand Canyon

Canyon / Species Information	Collection Number	Comments
Poa bigelovii	21057	
Polypogon monspeliensis	21056	
Polypogon semiverticillata	21055	
Site 38.		
Flaveria macdougalii	21060	endemic to Grand Canyon
Nolina cf. microcarpa	21059	perhaps a new taxon
Site 39.		
Centaurium arizonicum	21066	
Eriogonum inflatum	21068	
Frangula betulifolia ssp obovata	21070	
Oenothera caespitosa var marginata	21062	
Pinus monophylla	Tyler s.n.	further up canyon
Populus fremontii	21061	
Solanum americanum	21069	
Sphaeralcea sp.	21063	probably S. grossulariifolia
Stanleya pinnata var pinnata	21067	
Typha domingensis	21064	
Ziziphus obtusifolius var canescens	21065	
Mohawk Canyon (May 2006)		
Site 40.		
Bebbia juncea	21075	
Encelia farinosa	21072	
Hesperodoria salicina	21071	
Stephanomeria pauciflora	21074	
Viguiera parishii	21073	
Site 41.		
Adenophyllum porophylloides	21076	
Ephedra aspera	21080	
Fouquieria splendens	21081	
Hesperoyucca newberryi	21078	
Mortonia scabrella var utahensis	21077	
Site 42.		
Andropogon glomeratus	21088	
Flaveria macdougalii	21083	endemic to Grand Canyon
Frangula betulifolia ssp obovata	21082	
Gilia clokeyi	21085	new record for Grand Canyon if identified correctly
Imperata brevifolia	21081A	remnant populations in Canyon from otherwise wider distribution
Melilotus officinalis	21091	
Nolina cf microcarpa	21089, 21090	
Phacelia crenulata	21086	
Phacelia filiformis	21087	endemic to Grand Canyon
Pterostegia drymarioides	21084	
Site 43.		
Equisetum hymale	21093	
Mimulus cardinalis	21094	
Petrophyton caespitosum var caespitosum	21092	
Site 44.		
Cryptantha maritima	21097	
Cryptantha recurvata	21095	

Canyon / Species Information	Collection Number	Comments
Gilia clokeyi	21101	
Linanthus demissus	21096	
Phacelia rotundifolia	21099	
Setaria macrostachya	21102	
Silene antirrhina	21100	
Site 45.		
Erigeron divergens	21109	
Gilia clokeyi	21113	
Hedeoma nana	21112	
Lepidium montanum	21106	
Machaeranthera tortifolia var imberbis	21110	
Opuntia cf phaeacantha var laevis	21103	taxonomic questions, possibly new record for Grand Canyon
Opuntia cf. pinkavae x O. polyacantha	21104	
Phacelia crenulata	21111	
Phacelia filiformis	21107	endemic to Grand Canyon
Solanum douglasii	21105	
Vulpia octoflora	21108	
Site 46.		
Aquiilegia cf chrysantha x A. desertorum	21114	taxonomic questions
Aquilegia cf. chrysantha	21115	
Astragalus praelongus var praelongus	21117	
Carex curatorum	21116	"rare" species, appearing more common with documentation
Site 47.		
Larrea tridentata	21229	
Opuntia cf. phaeacantha	21118	
Mohawk Canyon (May 2007)		
Site 46.		
Acacia greggii	21978	
Camissonia walkeri	21977	
Cylindropuntia whipplei	21979	
Erigeron lobatus	21982	
Eucnide urens	21980	
Nolina cf microcarpa	21976	
Opuntia cf. phaeacantha	21981	
Site 47.		
Salix exigua	21983	
Site 48.		
Maurandella antirrhiniflora	21984	
Site 49.		
Echinocereus coccineus	21988	
Nolina cf microcarpa	21985	
Perityle congesta	21987	
Petrophyton caespitosum var caespitosum	21986	
Site 50.		
Lesquerella (Physaria) arizonica	21989	
Site 51.		
Erigeron lobatus	21992	
Nolina cf microcarpa	21991	
Pseudognaphalium canescens var canescens	21993	
Typha domingensis	21990	
Site 52.		

Canyon / Species Information	Collection Number	Comments
Hesperoyucca newberryi	21994	endemic to Grand Canyon; material for dna
Prospect Canyon (May 2006)		
Site 48.		
Centaurium exaltatum	21119	
Site 50.		
Encelia resinifera ssp tenuifolia	21121	rare, endemic to Grand Canyon
Cylindropuntia cf whipplei	21122	possibly introgressed with abyssii
Site 51.		
Camissonia walkeri	21123	
Cryptantha maritima	21126	
Cryptantha racemosa	21129	
Eucnide urens	21128	
Hedeoma nana	21125	
Penstemon palmeri var palmeri	21127	
Sisymbrium altissimum	21124	
Sphaeralcea grossulariifolia	21130	keying out sphaeralceas is problematic
Granite Park Canyon (May 2006)		
Site 56.		
Opuntia cf engelmannii	21153	red-pink flowered form
Salix gooddingii	21225	
Site 57.		
Mentzelia involucrata	21154	
Site 58.		
Aristida purpurea var glauca	21155	
Centaurium arizonicum	21165	
Cirsium neomexicanum	21159	
Funastrum cynanchoides ssp hartwegii	21157	
Krameria erecta	21166	under-collected plant
Melilotus officinalis	21164	
Mirabilis bigelovii	21167	
Oenothera caespitosa var marginata	21168	
Pluchea sericea	21160	
Senna covesii	21163	
Sonchus oleraceus	21161	
Stephanomeria pauciflora	21162	
Tridens muticus	21156	
Typha domingensis	21158	
Site 59.		
Heliomeris annua	21169	third collection in Grand Canyon
Site 60.		
Baileya multiradiata	21227	
Cryptantha racemosa	21170	
Eucnide urens	21172	
Juncus torreyi	21171	
Rafinesquia californica	21226	only second collection of this taxon in Grand Canyon
Sphaeralcea ambigua	21173	
Site 61.		
Cylindropuntia abyssii	21175	previously known only from Peach Springs
Granite Park Canyon (May 2007)		
Site 61.		

Canyon / Species Information	Collection Number	Comments
Cylindropuntia abyssii	22017	
Site 62.		
Cylindropuntia abyssii x C. acanthocarpa	22018	
Site 63.		
Cylindropuntia abyssii	22019	
Site 64.		
Cylindropuntia abyssii	22020	
Site 65.		
Cylindropuntia abyssii x C. acanthocarpa	22021	
Site 66.		
Cylindropuntia abyssii	22022	
Site 67.		
Ferocactus cylindraceus	22023	threadlike radials and small flowers, characteristic of region
Site 68.		
Astragalus nuttallianus	22029	
Bothrochloa barbinodis		
Galium	22026	
Lepidium lasiocarpum		
Lepidium montanum		
Lesquerella intermedia	22024	ID by Andrew Salywon, unusual specimen
Phacelia rotundifolia	22025	
Sporobolus contractus	22028	
Sporobolus cryptandrus	22027	
Three Springs Canyon (May 2006)		
Site 62.		
Cylindropuntia abyssii	21177	
Cylindropuntia acanthocarpa	21176	rarely collected in Grand Canyon
Ericameria paniculata	21174	
Krameria erecta	21232	rarely collected in Grand Canyon
Tiquilia canescens	21234	rarely collected in Grand Canyon
Site 63.		
Cirsium cf mohavense	21178	problematic taxon - new species? Introgressed with C. rydbergii?
Site 64.		
Heliomeris annua	21180	only second collection from Grand Canyon
Juncus nevadensis	21181	
Machaeranthera canescens	21179	
Mimulus cardinalis	21184	
Penstemon palmeri var palmeri	21186	
Phacelia glechomifolia	21182	
Pseudognaphalium canescens ssp canescens	21185	
Psilostrophe sparsiflora	21183	
Site 65.		
Hedeoma nana	21189	
Lycium torreyi	21187	
Piptatherum miliaceum	21188	New record for Grand Canyon; exotic; ID by Liz Makings, ASU
Thymophylla pentachaeta var belenidium	21190	
Site 66.		
Mentzelia involucrata	21192	
Viguiera parishii	21191	
Site 67.		

Canyon / Species Information	Collection Number	Comments
Alicellia subnuda	21201	new record for Grand Canyon
Crossosoma bigelovii	21202	
Galium proliferum	21203	
Penstmon eatoni var undosus	21200	
Phacelia glechomifolia	21204	
Site 68.		
Apocynum cannabinum	21210	
Erigeron lobatus	21211	
Lepidium montanum	21207	
Maurandella antirrhiniflora	21208	
Mimulus cardinalis	21206	
Piptatherum miliaceum	21205	second collection for Grand Canyon; id'd by Liz Makings, ASU
Senecio multilobatus	21209	
Three Springs Canyon (May 2007)		
Site 71.		
Centaurium exaltatum	22033	
217 Mile Canyon (May 2006)		
Site 69a-c.		
Castilleja linearifolia		Makarick and Watters, s.n.
Crossoma bigelovii		Makarick and Watters, s.n.
Eriogonum fasciculatum var polifolium		Makarick and Watters, s.n.
Ferocactus cylindraceus	21217	
Fouquieria splendens	21215	
Menodora scabra		Makarick and Watters, s.n.
Peucephyllum schottii	21218	
Phacelia crenulata		Makarick and Watters, s.n.
Trixis californica	21216	

Appendix K - Rare Plant Monitoring Data

Park Area/Canyon: 140 Mile Canyon River mile: 140 L

Location description: MENABY 1 Project (Phase): Phase IIb

Easting: 359450 Northing: 4028748 GPS Accuracy (m): 5 Elevation (m):

Site description: Need to collection site information and fill out plant monitoring during next visit. This is a new species that is likely to be rare.

Dominant species:

Associated species:

Species: Date: 5/10/2006

VEGETATION STRUCTURE WITHIN POPULATION

Cover Estimate		**Phenology**	
Tree Cover:	0%	Flowering:	%
Shrub Cover:	0%	Fruiting:	%
Forb Cover:	0%	Vegetative:	%
Graminoid Cover:	0%		
Moss Cover:	0%		
Lichen Cover:	0%		
Bare Ground Cover:	0%		
Soil Crust Cover:	0%		

POPULATION SIZE

Est Num of Individuals: Num of Sub Populations: Size of Area (sq meters):

ANIMAL USE EVIDENCE

Burrows Wildlife Trailing Nests Browsing Scat Vegetation Damage Sighting Bedding Site

Other:

NATURAL AND ANTHROPOGENIC DISTURBANCE

Campsite Evidence Microbiotic Soil Crust Damage Erosion Flooding Trails

Vegetation Damage (natural) Vegetation Damage (human) Archeological Feature Grazing

Rock Cairns Historic Structure Fire Other:

OTHER COMMENTS

Evidence of Reproductive Success:

Evidence of Symbiotic or Parasitic:

Evidence of Disease Predation or Injury:

Comments: Monitoring information needs to be collected during the next visit - this is a new species for the park and likely

Park Area/Canyon: 151 Mile Spring River mile: 151.2 R

Location description: FLAMAC 3 Project (Phase): Phase IIb

Easting: 345931 Northing: 4024040 GPS Accuracy (m): 29 Elevation (m): 622

Site description: Directly across from recent rock fall on river left, there is a small eddy at the base of a seep to pull in to. If you miss it, there is another eddy below, stay low on Muav to walk upriver.

Dominant species: Cladium californicum (S. Wats.) O'Neill

Associated species: Acacia greggii Gray, Schizachyrium scoparium (Michx.) Nash, Tamarix ramosissima Ledeb.

Species: *Flaveria macdougalii Theroux, Pinkava & Keil* Date: 9/4/2006

VEGETATION STRUCTURE WITHIN POPULATION

Cover Estimate		**Phenology**	
Tree Cover:	<1%	Flowering:	33 %
Shrub Cover:	1-5%	Fruiting:	%
Forb Cover:	<1%	Vegetative:	67 %
Graminoid Cover:	25-50%		
Moss Cover:	<1%		
Lichen Cover:	0%		
Bare Ground Cover:	<1%		
Soil Crust Cover:	0%		

POPULATION SIZE

Est Num of Individuals: 12 Num of Sub Populations: Size of Area (sq meters): 20

ANIMAL USE EVIDENCE

Burrows Wildlife Trailing Nests Browsing Scat Vegetation Damage Sighting Bedding Site

Other:

NATURAL AND ANTHROPOGENIC DISTURBANCE

Campsite Evidence Microbiotic Soil Crust Damage Erosion Flooding Trails

Vegetation Damage (natural) Vegetation Damage (human) Archeological Feature Grazing

Rock Cairns Historic Structure Fire Other:

OTHER COMMENTS

Evidence of Reproductive Success: No seedlings seen

Evidence of Symbiotic or Parasitic: Lots of pollinators including flies, Cisthene angelis (moth), tarantula hawks

Evidence of Disease Predation or Injury:

Comments:

Park Area/Canyon: Colorado River Corridor River mile: 151R

Location description: ANULEI 1 Project (Phase): Phase IIb

Easting: 341300 Northing: 4019185 GPS Accuracy (m): 32 Elevation (m): 612

Site description: On right about 400 m below Havasu, at first alcove at CRM 156.5. Pull in is right there in nice little nook.

Dominant species: Aristida purpurea Nutt., Bebbia juncea (Benth.) Greene var. aspera Greene, Ephedra spp.

Associated species: Baccharis sergiloides Gray, Bothriochloa barbinodis (Lag.) Herter, Encelia farinosa Gray ex Torr., Eucnide urens (Parry ex Gray) Parry, Ferocactus cylindraceus (Engelm.) Orcutt var. cylindraceus, Gutierrezia spp., Machaeranthera pinnatifida (Hook.) Shinners, Pleuraphis jamesii Torr.

Species: *Anulocaulis leiosolenus (Torr.) Standl.* Date: 9/4/2006

VEGETATION STRUCTURE WITHIN POPULATION

Cover Estimate		**Phenology**	
Tree Cover:	0%	Flowering:	0 %
Shrub Cover:	1-5%	Fruiting:	100 %
Forb Cover:	<1%	Vegetative:	0 %
Graminoid Cover:	1-5%		
Moss Cover:	0%		
Lichen Cover:	0%		
Bare Ground Cover:	25-50%		
Soil Crust Cover:	0%		

POPULATION SIZE

Est Num of Individuals: 8 Num of Sub Populations: Size of Area (sq meters): 100

ANIMAL USE EVIDENCE

Burrows Wildlife Trailing Nests Browsing Scat Vegetation Damage Sighting Bedding Site

Other:

NATURAL AND ANTHROPOGENIC DISTURBANCE

Campsite Evidence Microbiotic Soil Crust Damage Erosion Flooding Trails

Vegetation Damage (natural) Vegetation Damage (human) Archeological Feature Grazing

Rock Cairns Historic Structure Fire Other: None

OTHER COMMENTS

Evidence of Reproductive Success: none

Evidence of Symbiotic or Parasitic: none

Evidence of Disease Predation or Injury: none

Comments: There is another plant down river about 100 m. This population is on a steep slope with a vertical Muav face

Park Area/Canyon: Three Springs Canyon River mile: 215.6 L

Location description: CIRMOH 1 Project (Phase): Phase IIb

Easting: 292047 Northing: 3973727 GPS Accuracy (m): 10 Elevation (m): 440

Site description: Hike up trail from river and drop down into canyon. Site is just upstream of where trail drops down into canyon, and extends upcanyon and upslope.

Dominant species: Isocoma acradenia (Greene) Greene, Phragmites australis (Cav.) Trin. ex Steud., Tamarix ramosissima Ledeb., Typha spp.

Associated species: Acacia greggii Gray, Andropogon glomeratus (Walt.) B.S.P., Baccharis sarothroides Gray, Baccharis sergiloides Gray, Imperata brevifolia Vasey, Lactuca serriola L., Polypogon monspeliensis (L.) Desf.

Species: *Cirsium mohavense* Date: 5/17/2006

VEGETATION STRUCTURE WITHIN POPULATION

Cover Estimate		**Phenology**	
Tree Cover:	1-5%	Flowering:	50 %
Shrub Cover:	5-10%	Fruiting:	%
Forb Cover:	0%	Vegetative:	50 %
Graminoid Cover:	50-75%		
Moss Cover:	0%		
Lichen Cover:	0%		
Bare Ground Cover:	5-10%		
Soil Crust Cover:	0%		

POPULATION SIZE

Est Num of Individuals: 800 Num of Sub Populations: Size of Area (sq meters): 400

ANIMAL USE EVIDENCE

Burrows Wildlife Trailing Nests Browsing Scat Vegetation Damage Sighting Bedding Site

Other:

NATURAL AND ANTHROPOGENIC DISTURBANCE

Campsite Evidence Microbiotic Soil Crust Damage Erosion Flooding Trails

Vegetation Damage (natural) Vegetation Damage (human) Archeological Feature Grazing

Rock Cairns Historic Structure Fire Other:

OTHER COMMENTS

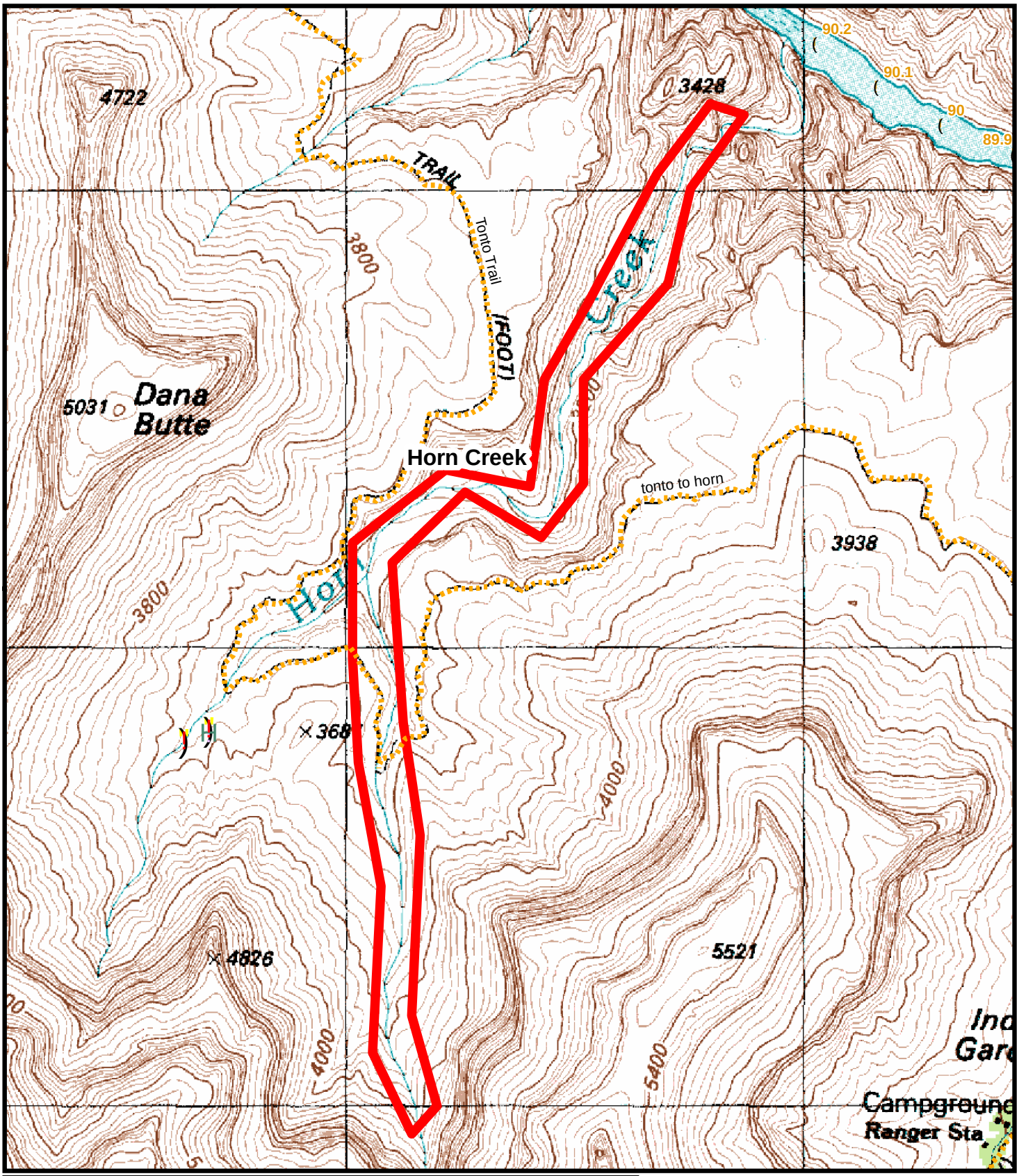
Evidence of Reproductive Success: Lots of bees and butterflies on flowers. Lots of down and standing stalks with mature seeds from last year, very healthy population.

Evidence of Symbiotic or Parasitic

Evidence of Disease Predation or Injury:

Comments: In addition to the population near water, there is an extension onto the higher dry shelves. Specimen collected -

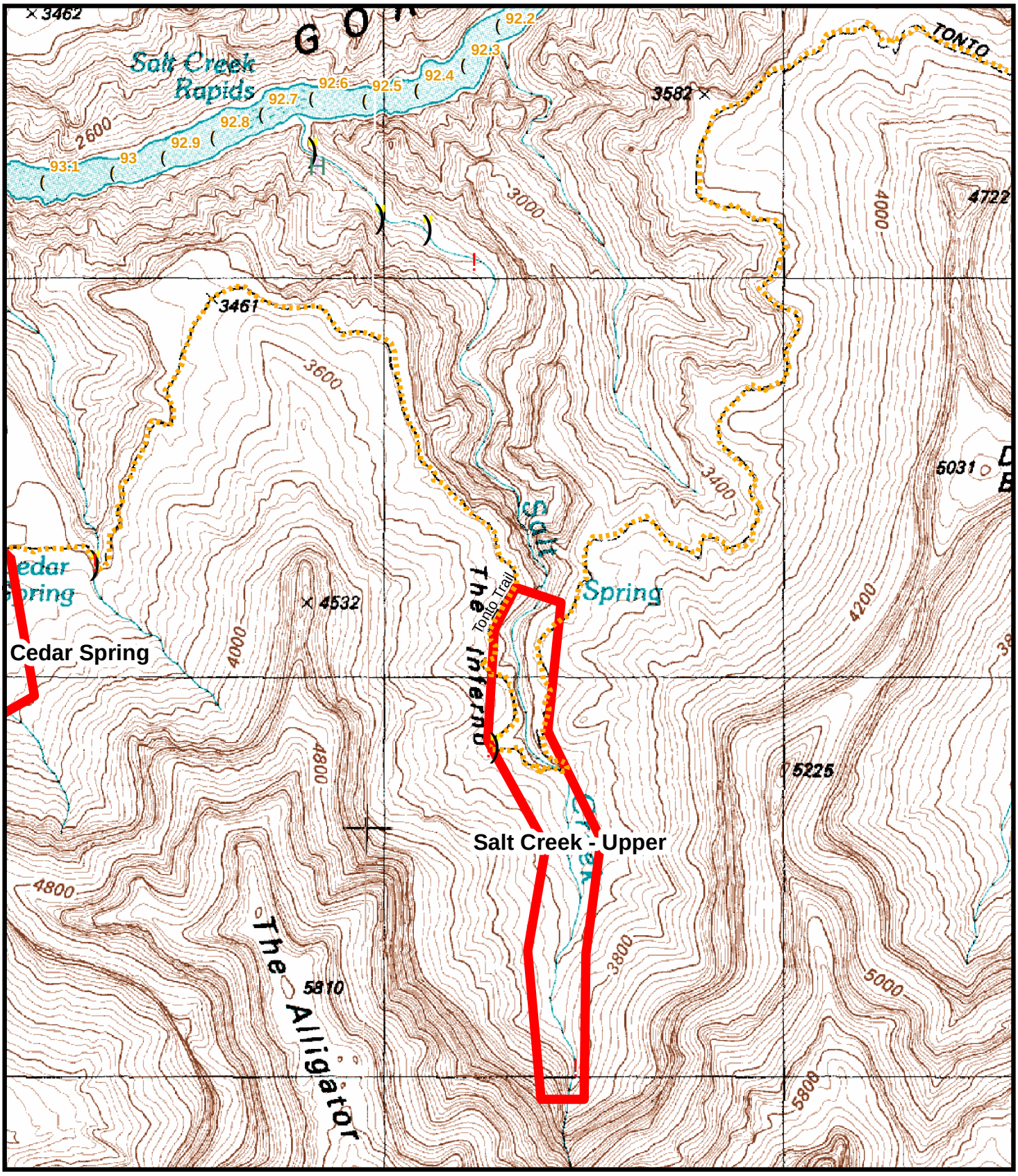
Project Area = Horn Creek



k PhaseIIB_Final_Transect
! PhaseIIB_Final_Tamarisk
H PhaseIIB_Final_HabitatAssessment
Õ PhaseIIB_Final_Hydrology
^ PhaseIIB_Final_OtherExotics
) PhaseIIB_Final_Photopoints
¡ PhaseIIB_Final_PlantCollection
AWPF_2006_2007_Project_Areas

0 0.15 0.3 0.6 Kilometers

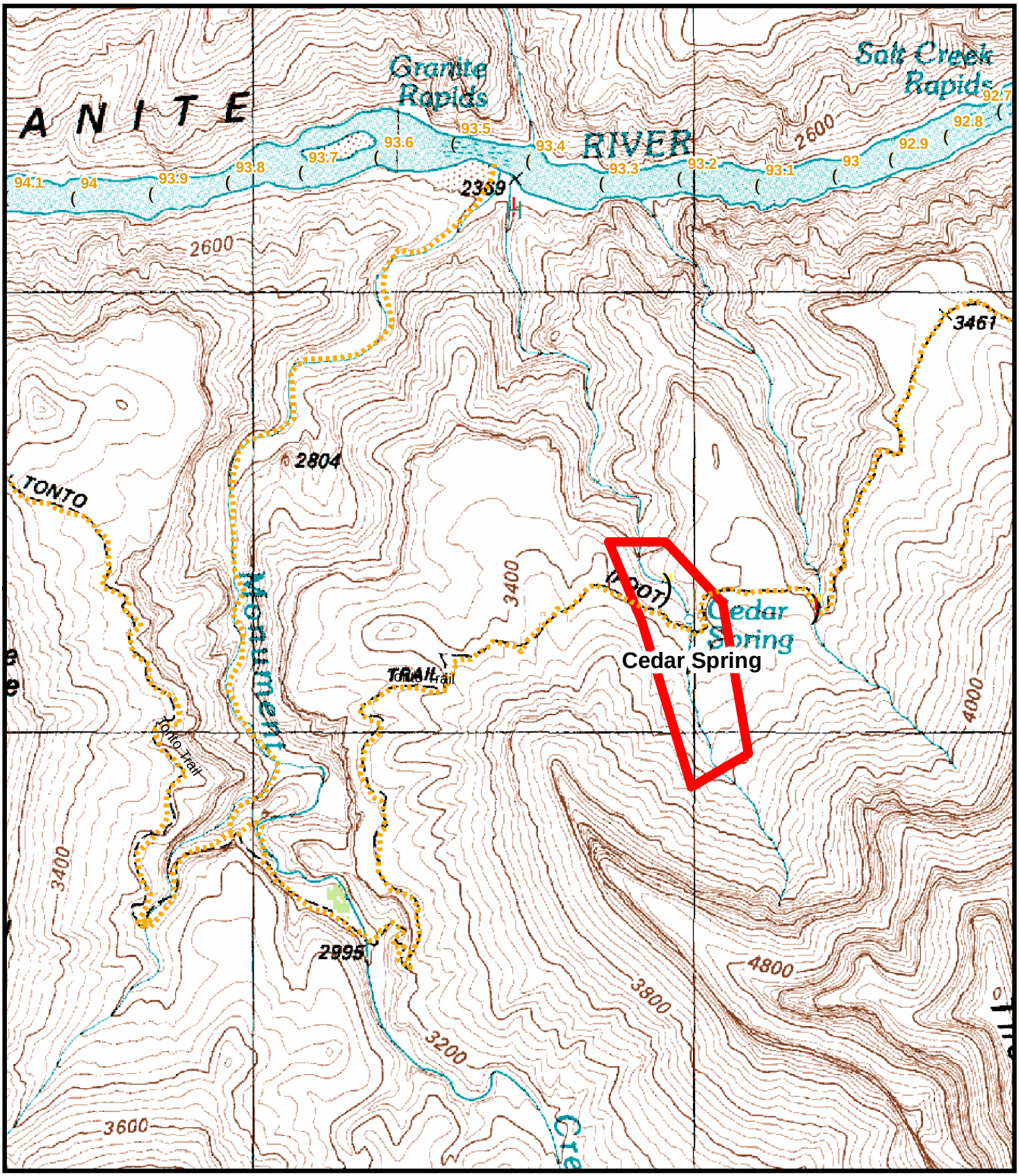
Project Area = Salt Creek-Upper



k PhaseIIB_Final_Transect	) PhaseIIB_Final_Photopoints
! PhaseIIB_Final_Tamarisk	! PhaseIIB_Final_PlantCollection
H PhaseIIB_Final_HabitatAssessment	AWPF_2006_2007_Project_Areas
Õ PhaseIIB_Final_Hydrology	
^ PhaseIIB_Final_OtherExotics	

0 0.125 0.25 0.5 Kilometers

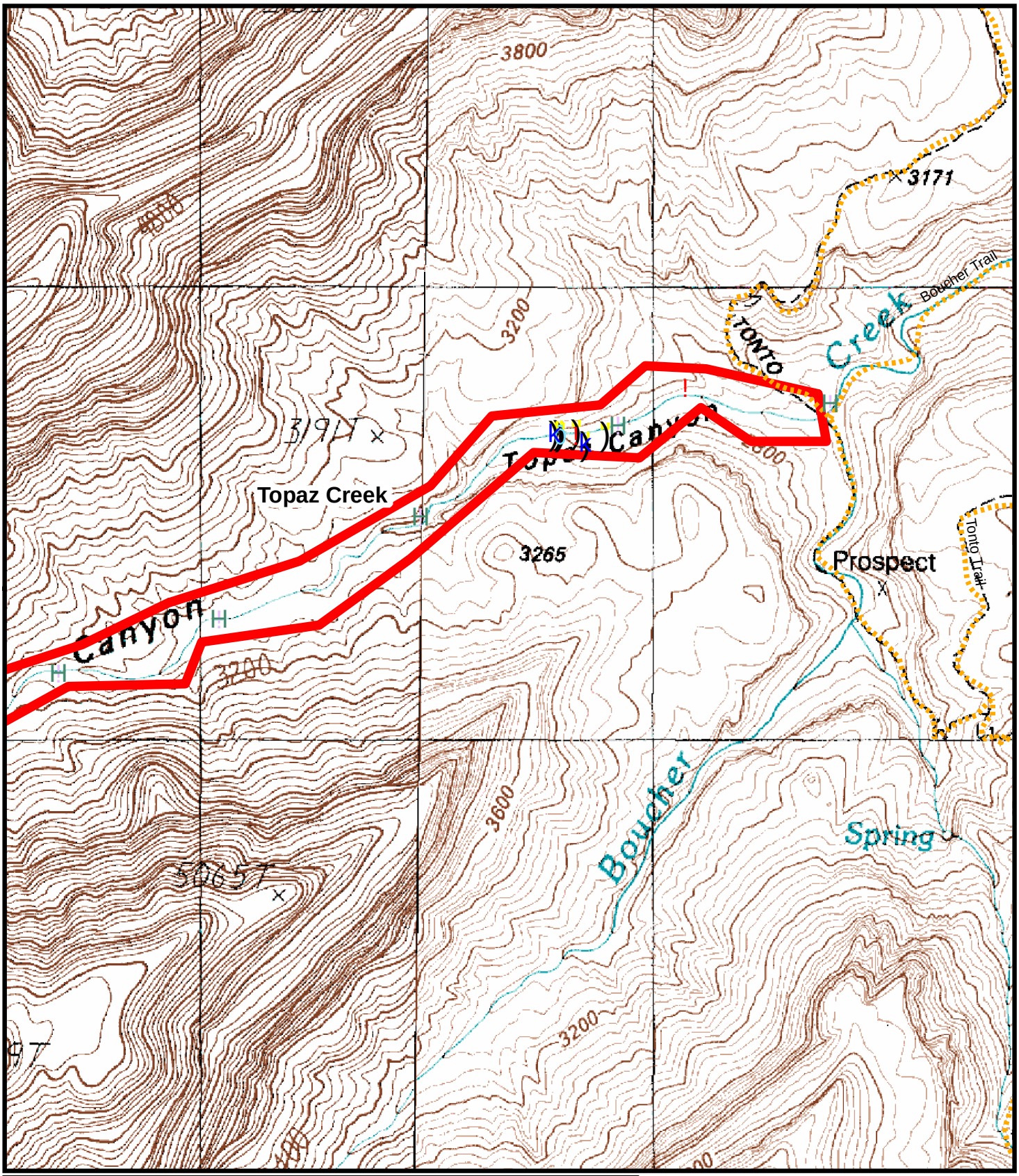
Project Area = Cedar Spring



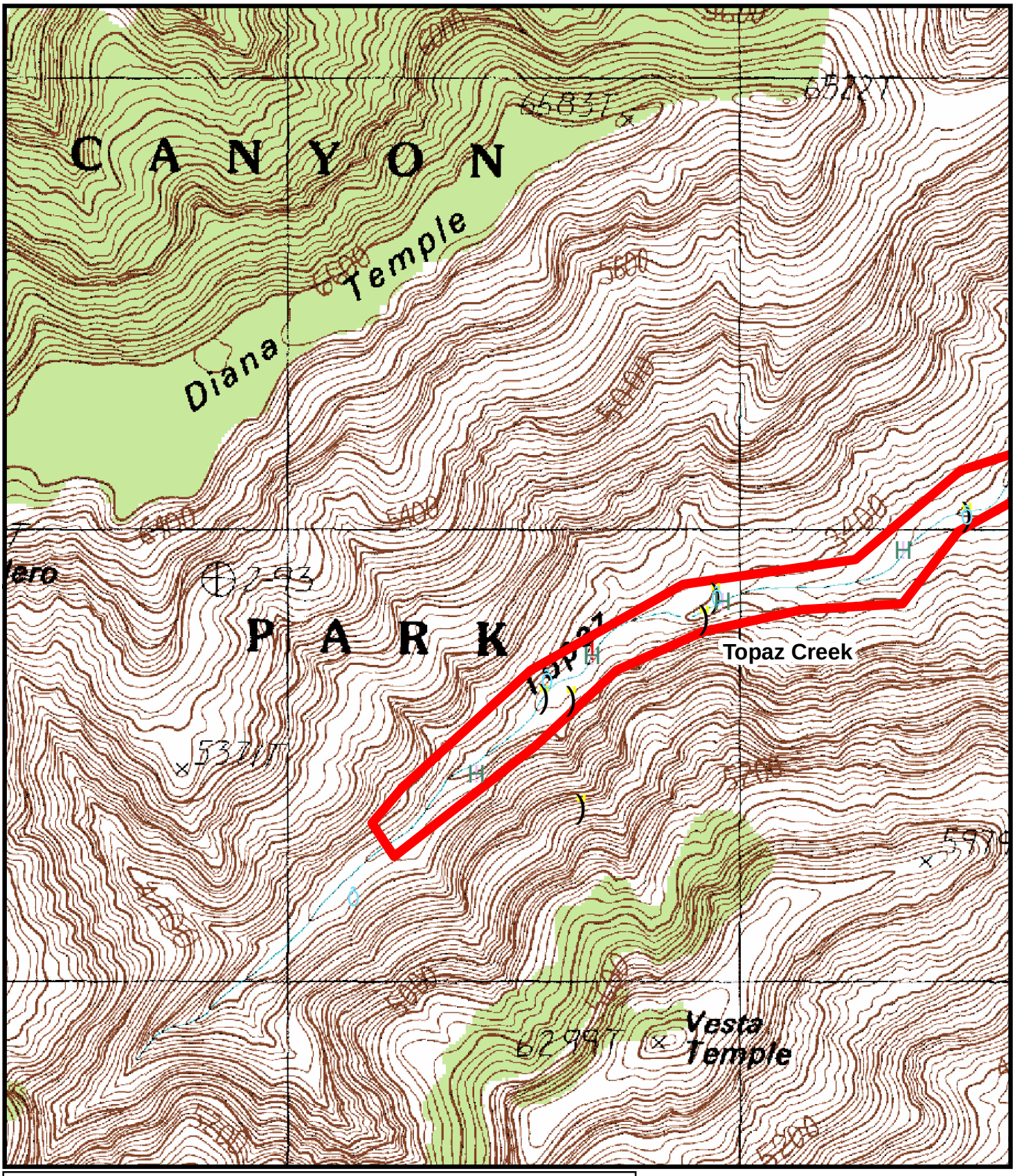
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- PhaseIIB_Final_Tamarisk
- PhaseIIB_Final_HabitatAssessment
- PhaseIIB_Final_Hydrology
- PhaseIIB_Final_OtherExotics
- PhaseIIB_Final_Photopoints
- PhaseIIB_Final_PlantCollection
- AWPF_2006_2007_Project_Areas

0 0.125 0.25 0.5 Kilometers

Project Area = Topaz Creek 1



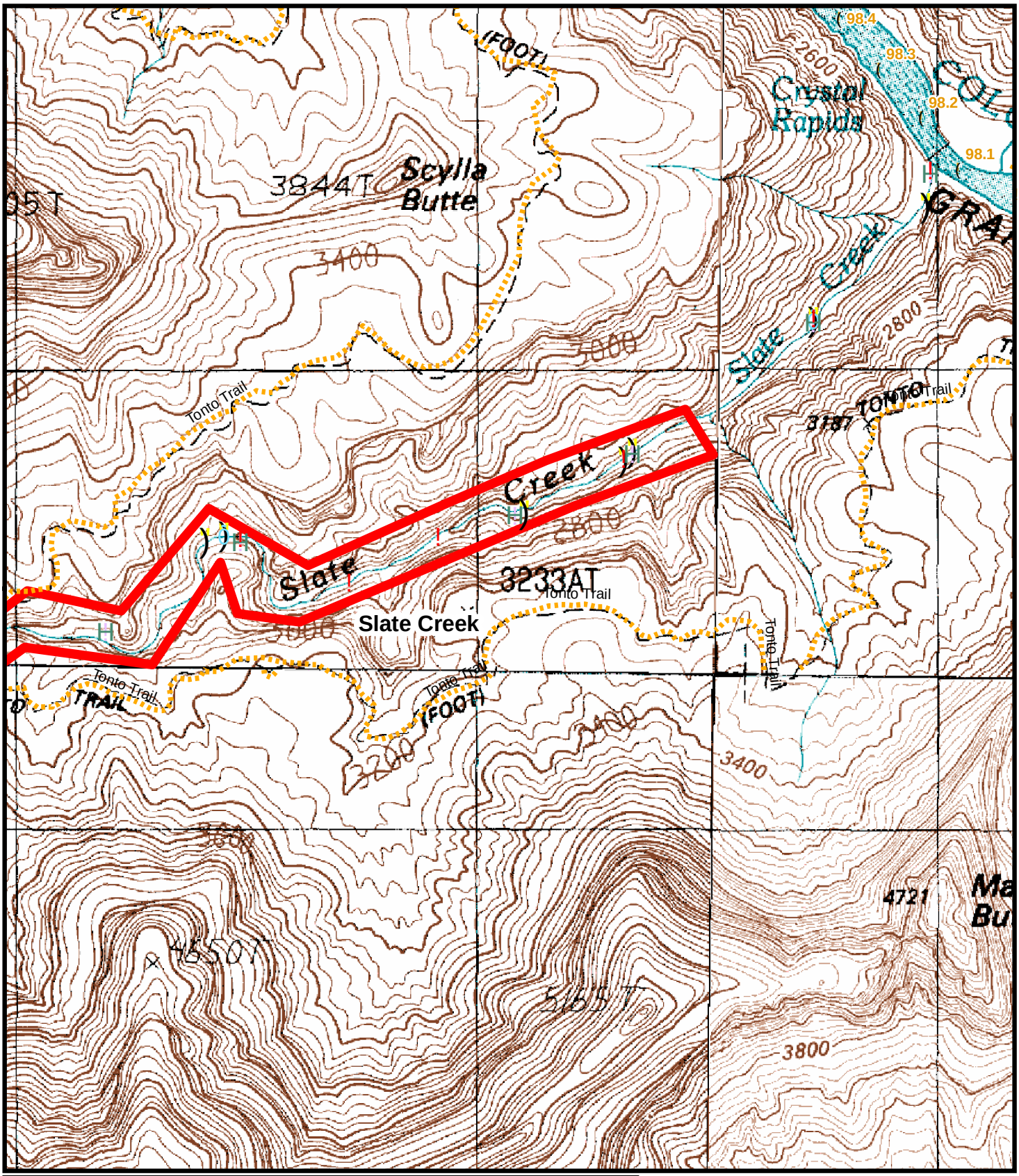
Project Area = Topaz Creek 2



k PhaseIIB_Final_Transect
! PhaseIIB_Final_Tamarisk
H PhaseIIB_Final_HabitatAssessment
Õ PhaseIIB_Final_Hydrology
^ PhaseIIB_Final_OtherExotics
) PhaseIIB_Final_Photopoints
! PhaseIIB_Final_PlantCollection
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0 0.125 0.25 0.5 Kilometers

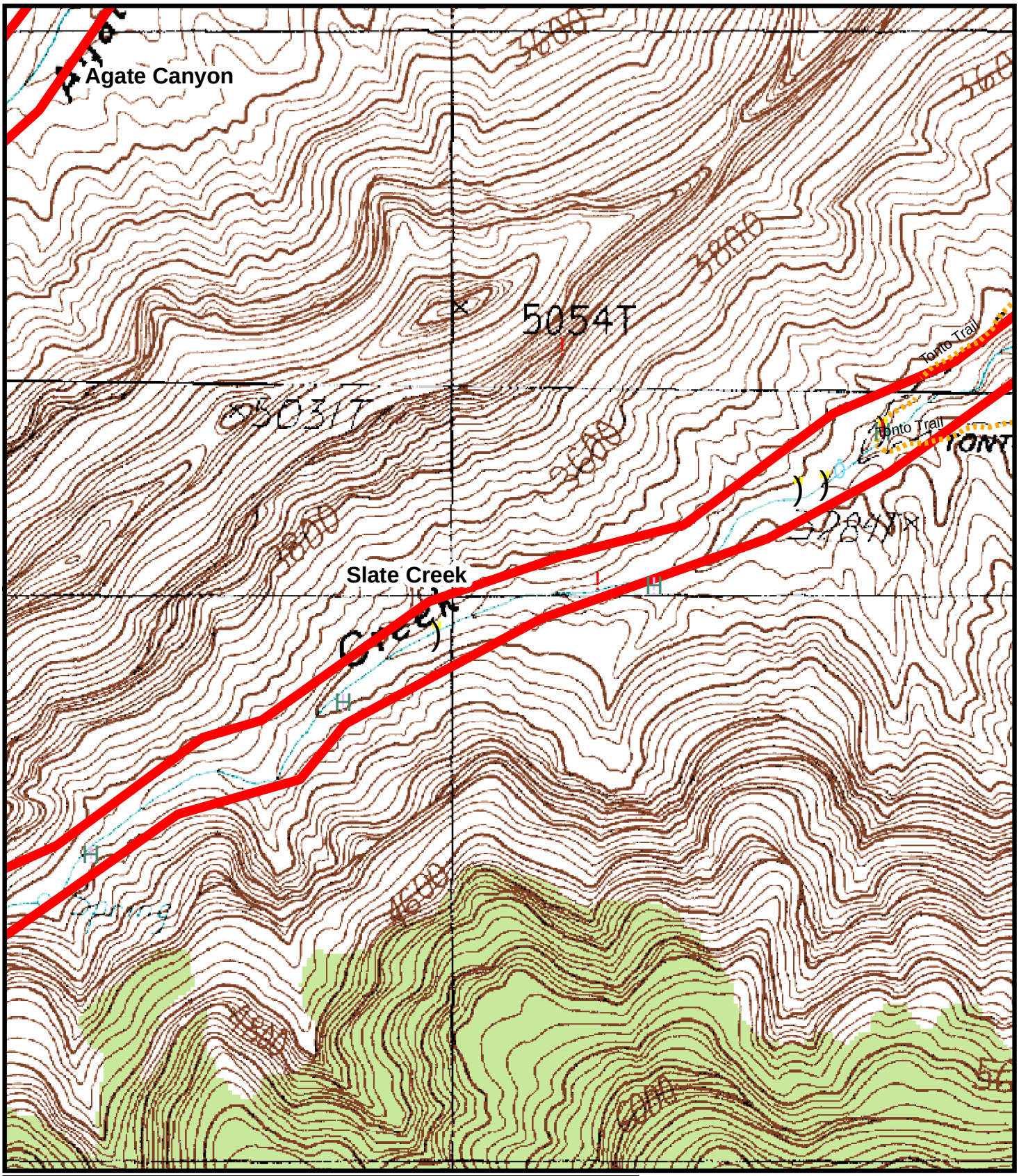
Project Area = Slate Creek 1



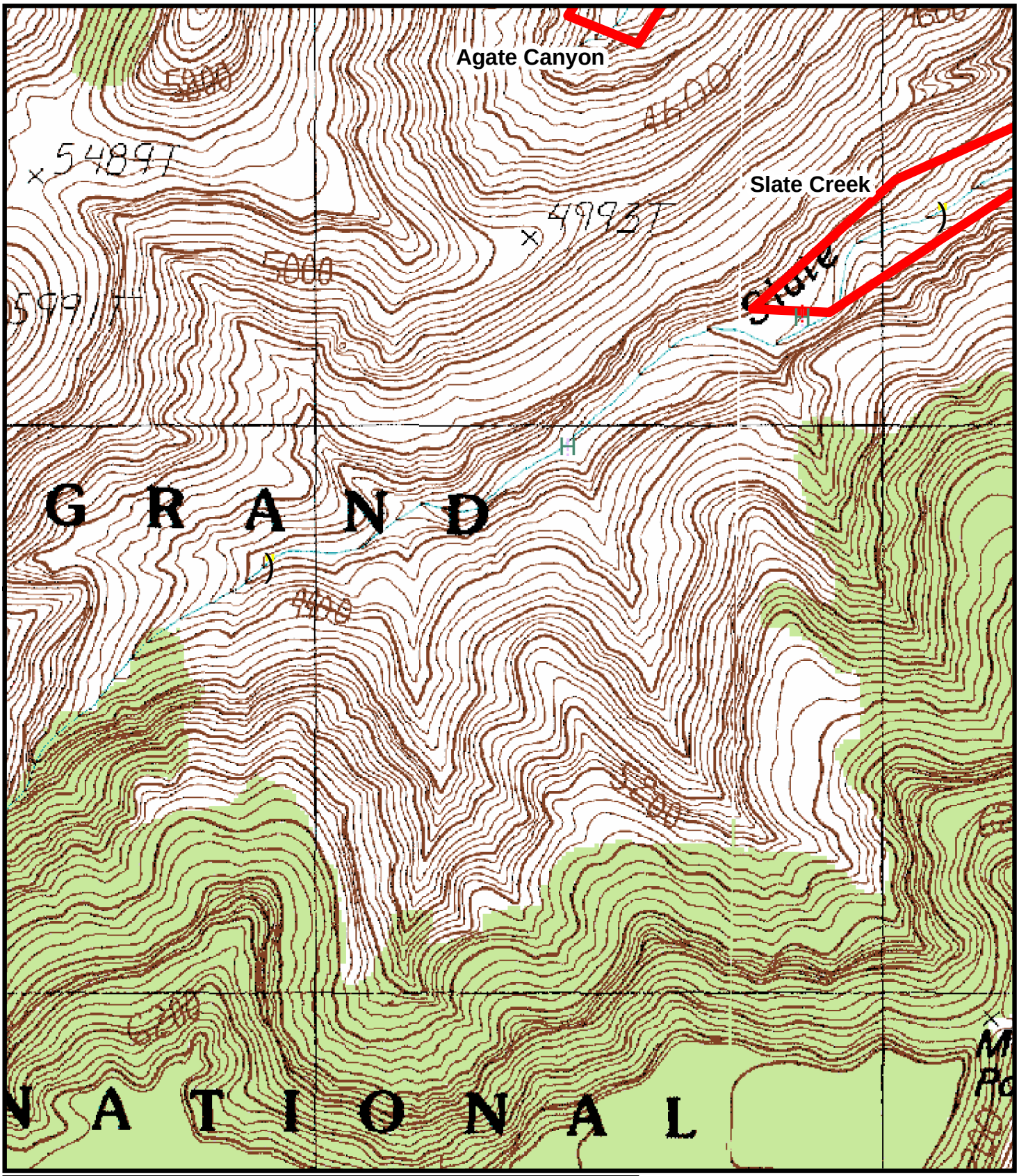
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PhaseIIB_Final_PlantCollection
AWPF_2006_2007_Project_Areas

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Project Area = Slate Creek 2



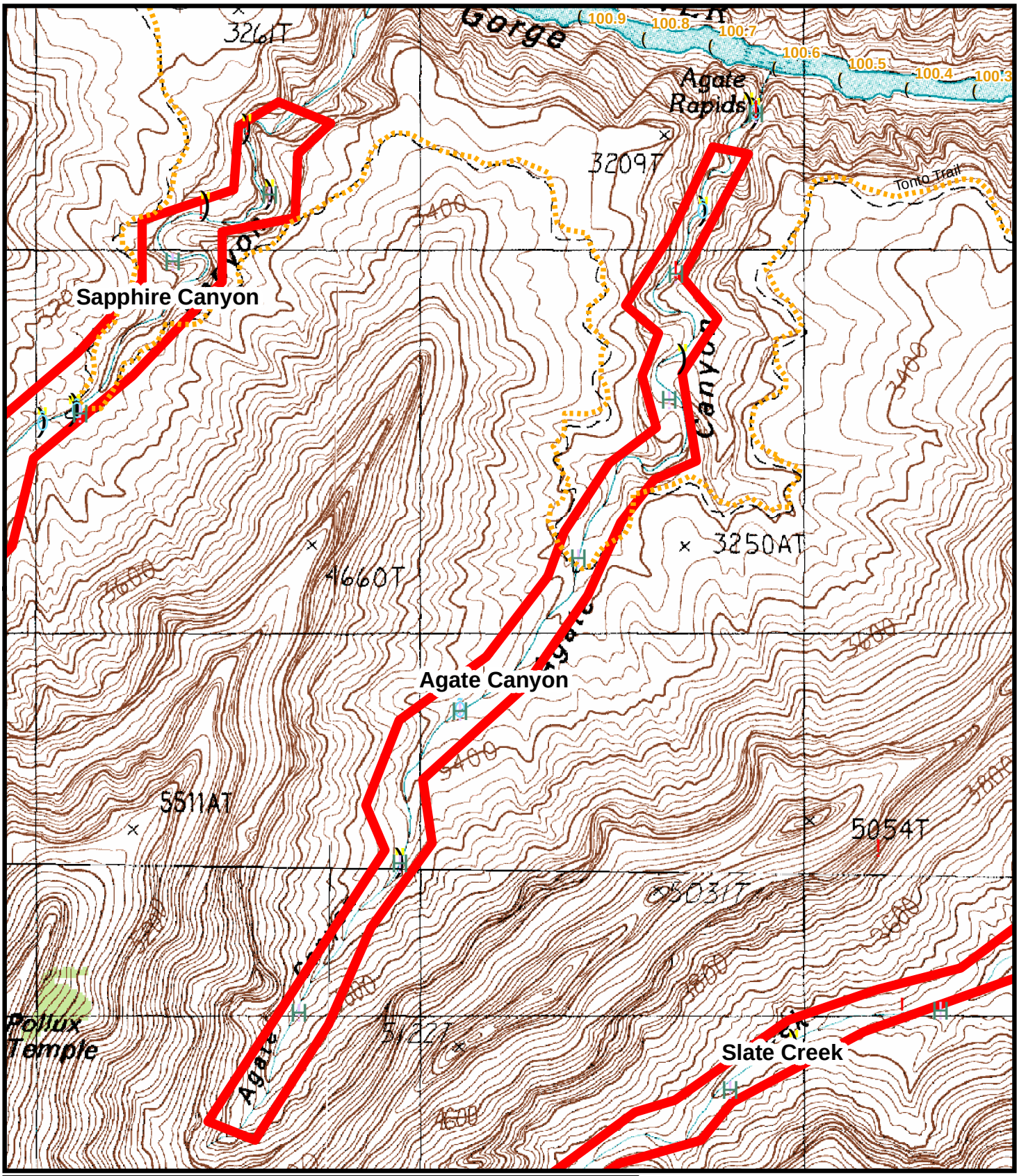
Project Area = Slate Creek 3



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PhaseIIB_Final_Tamarisk
PhaseIIB_Final_HabitatAssessment
PhaseIIB_Final_Hydrology
PhaseIIB_Final_OtherExotics
PhaseIIB_Final_Photopoints
PhaseIIB_Final_PlantCollection
AWPF_2006_2007_Project_Areas

0 0.1 0.2 0.4 Kilometers

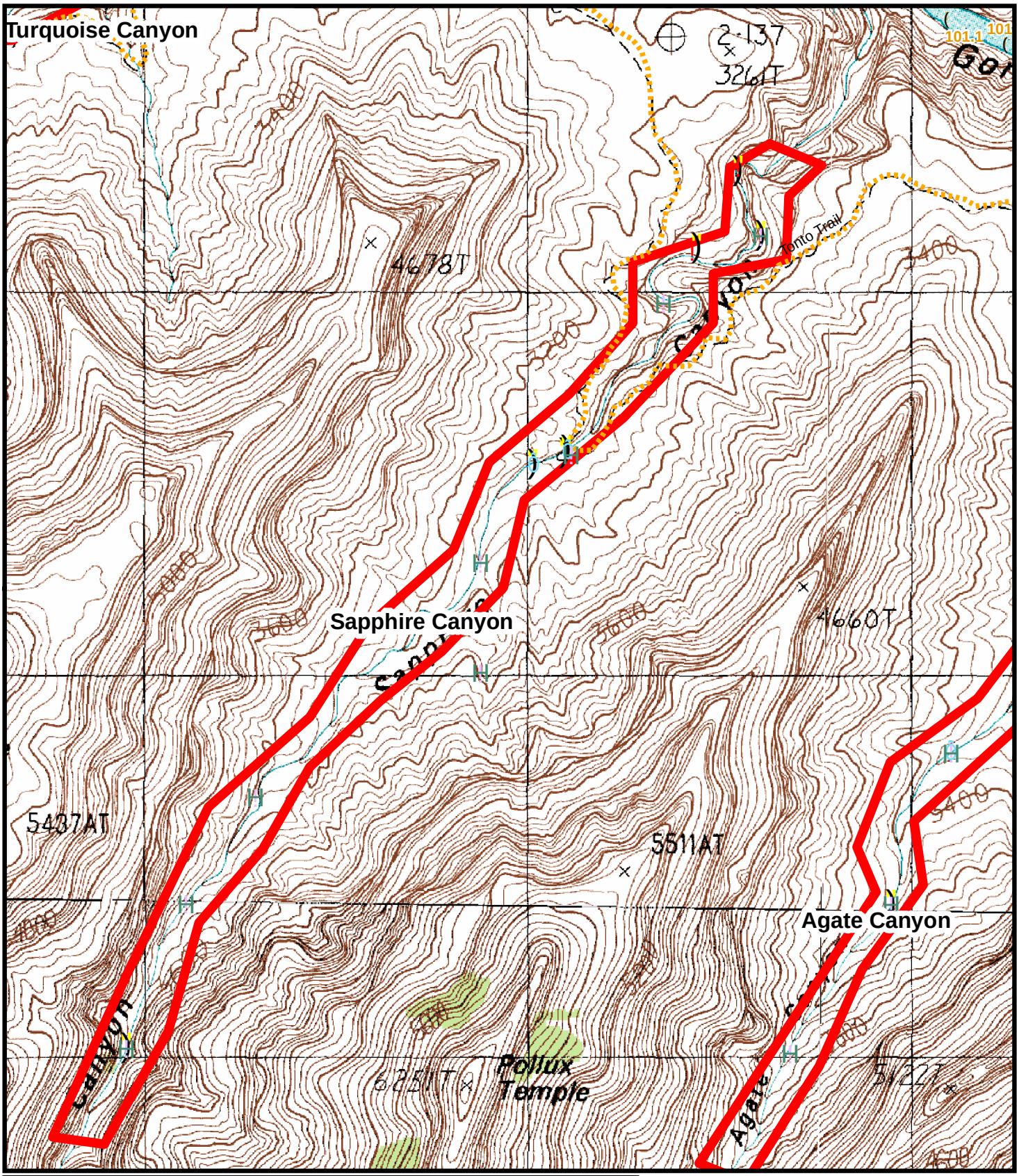
Project Area = Agate Canyon



k PhaseIIB_Final_Transect
! PhaseIIB_Final_Tamarisk
H PhaseIIB_Final_HabitatAssessment
Õ PhaseIIB_Final_Hydrology
^ PhaseIIB_Final_OtherExotics
) PhaseIIB_Final_Photopoints
! PhaseIIB_Final_PlantCollection
AWPF_2006_2007_Project_Areas

0 0.15 0.3 0.6 Kilometers

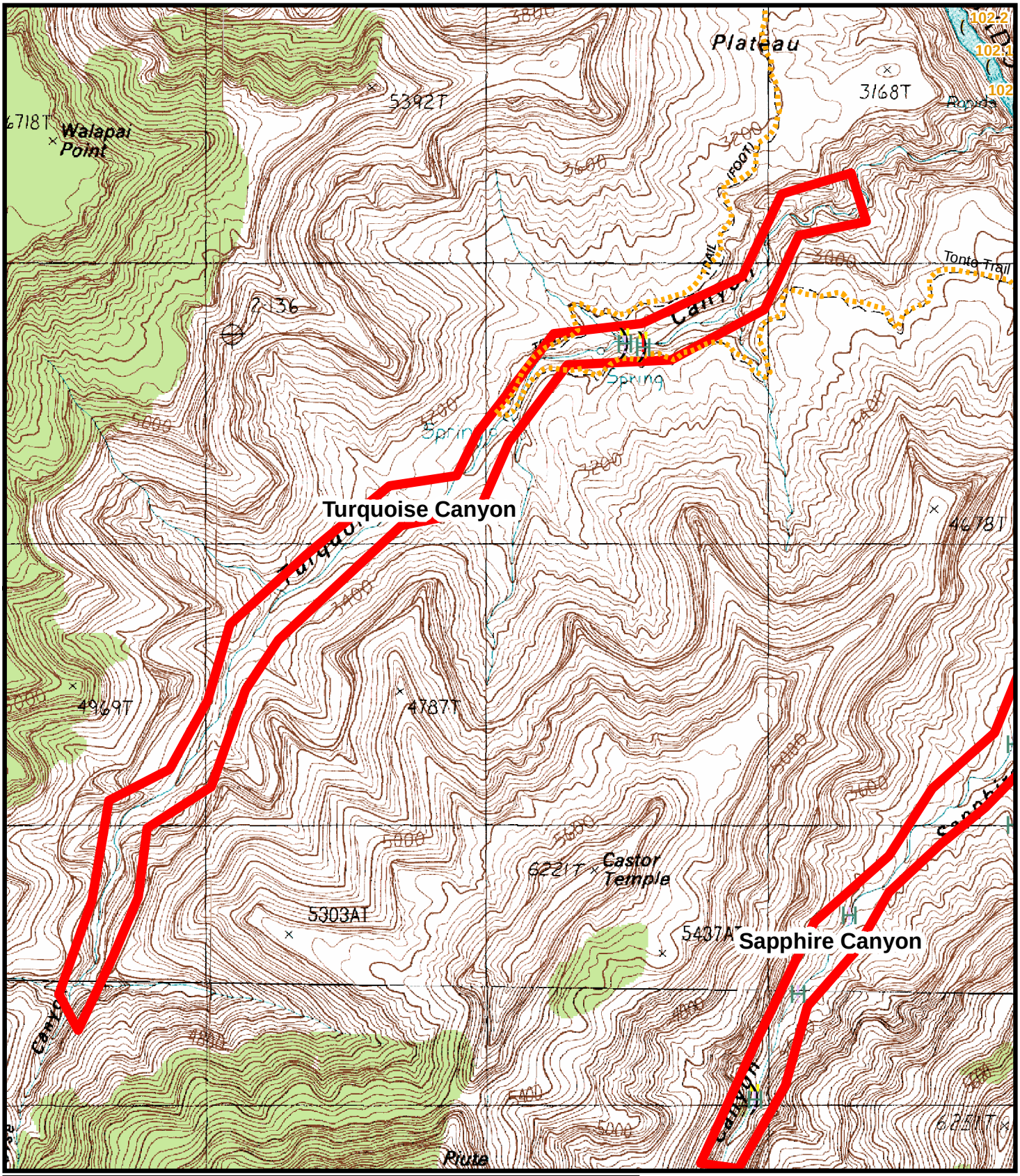
Project Area = Sapphire Canyon



PhaseIIB_Final_Transect
PhaseIIB_Final_Tamarisk
PhaseIIB_Final_HabitatAssessment
PhaseIIB_Final_Hydrology
PhaseIIB_Final_OtherExotics
PhaseIIB_Final_Photopoints
PhaseIIB_Final_PlantCollection
AWPF_2006_2007_Project_Areas

0 0.15 0.3 0.6 Kilometers

Project Area = Turquoise Canyon



k PhaseIIB_Final_Transect

! PhaseIIB_Final_Tamarisk

H PhaseIIB_Final_HabitatAssessment

Õ PhaseIIB_Final_Hydrology

^ PhaseIIB_Final_OtherExotics

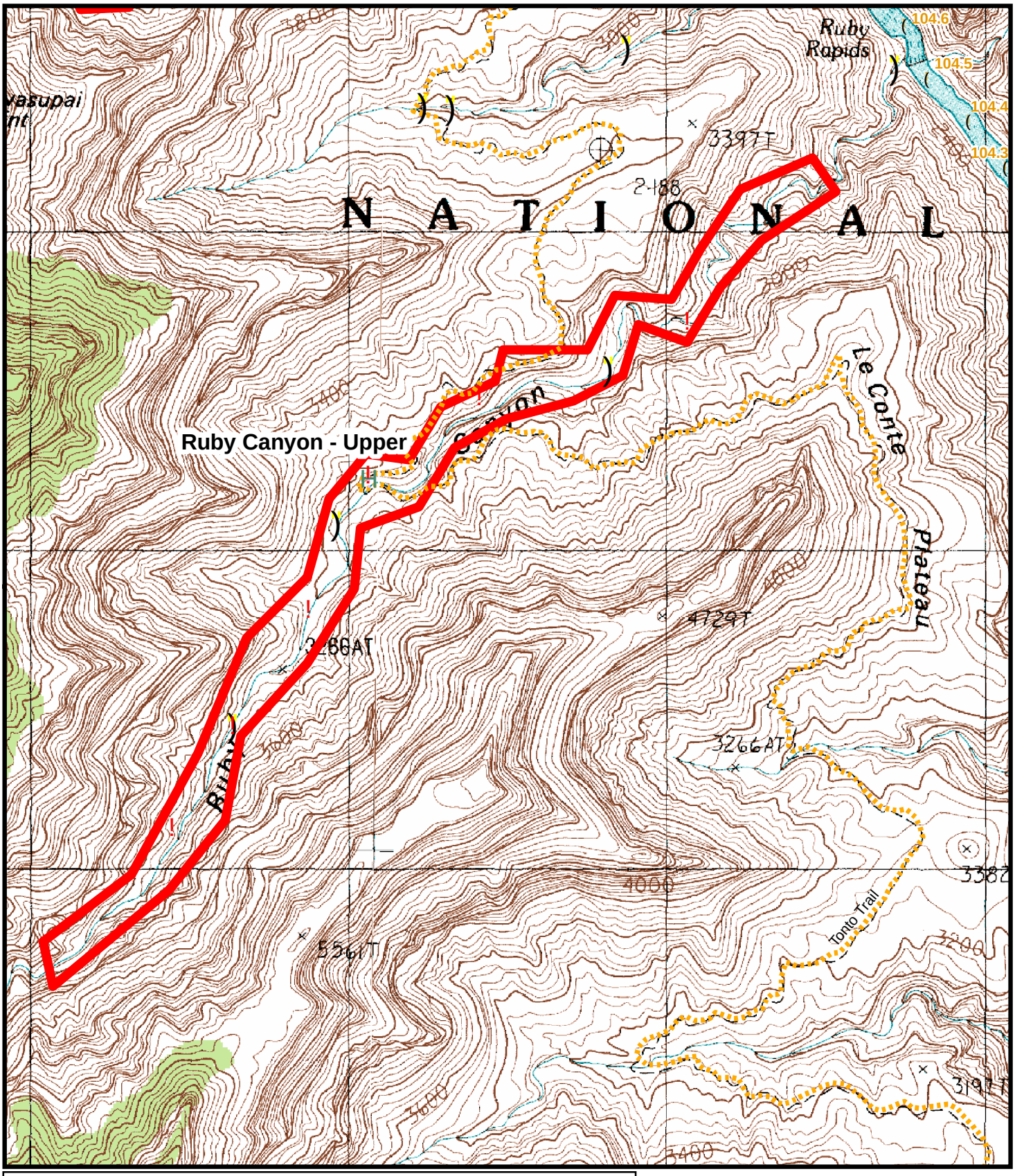
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PhaseIIB_Final_PlantCollection

AWPF_2006_2007_Project_Areas

0 0.25 0.5 1 Kilometers

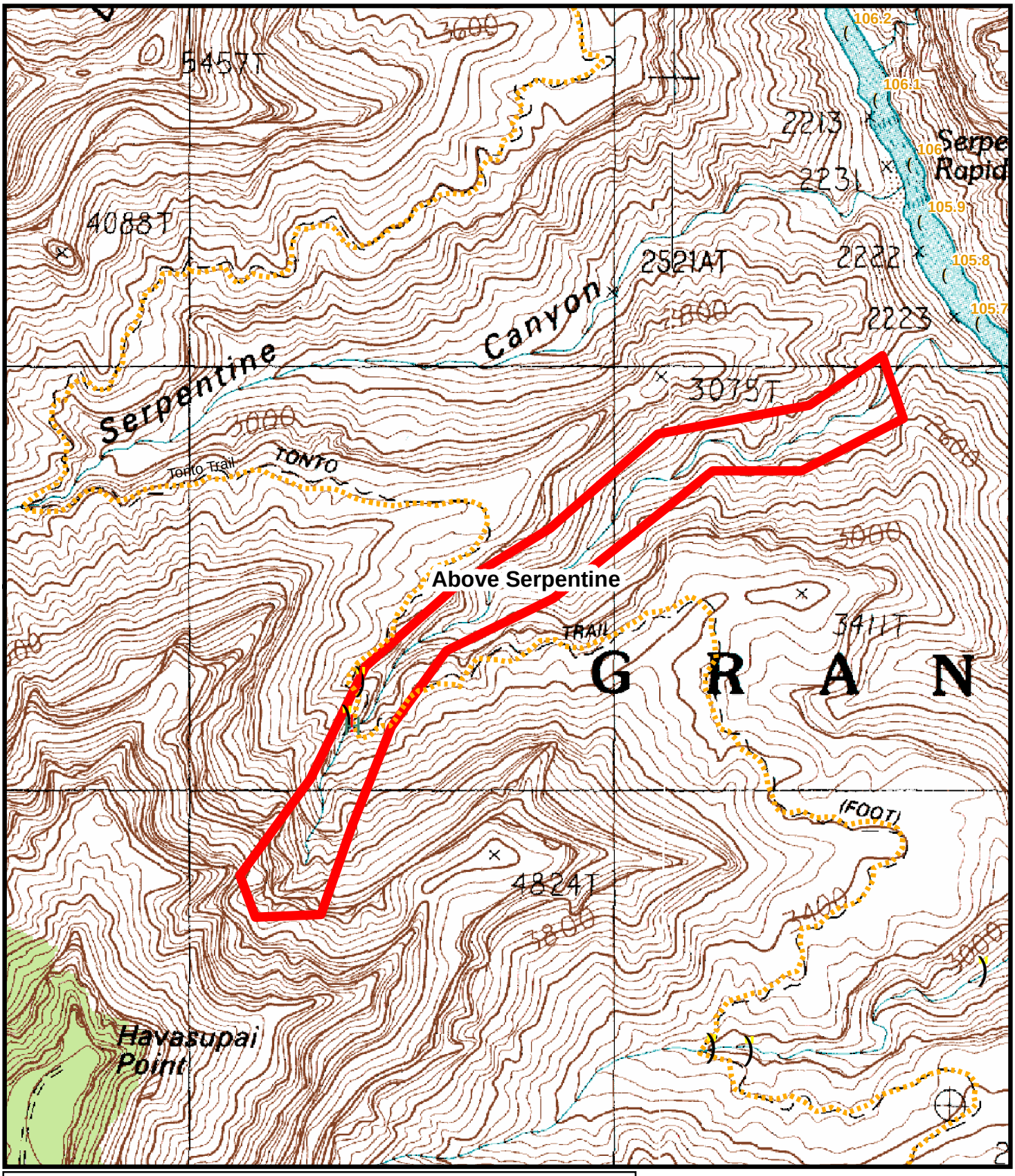
Project Area = Ruby Canyon-Upper



k PhaseIIB_Final_Transect
! PhaseIIB_Final_Tamarisk
H PhaseIIB_Final_HabitatAssessment
Õ PhaseIIB_Final_Hydrology
^ PhaseIIB_Final_OtherExotics
) PhaseIIB_Final_Photopoints
! PhaseIIB_Final_PlantCollection
AWPF_2006_2007_Project_Areas

0 0.15 0.3 0.6 Kilometers

Project Area = Above Serpentine



PhaseIIB_Final_Transect
PhaseIIB_Final_Tamarisk
PhaseIIB_Final_HabitatAssessment
PhaseIIB_Final_Hydrology
PhaseIIB_Final_OtherExotics
PhaseIIB_Final_Photopoints
PhaseIIB_Final_PlantCollection
AWPF_2006_2007_Project_Areas

0 0.15 0.3 0.6 Kilometers

Project Area = White Creek 1



k PhaseIIB_Final_Transect

! PhaseIIB_Final_Tamarisk

H PhaseIIB_Final_HabitatAssessment

Õ PhaseIIB_Final_Hydrology

^ PhaseIIB_Final_OtherExotics

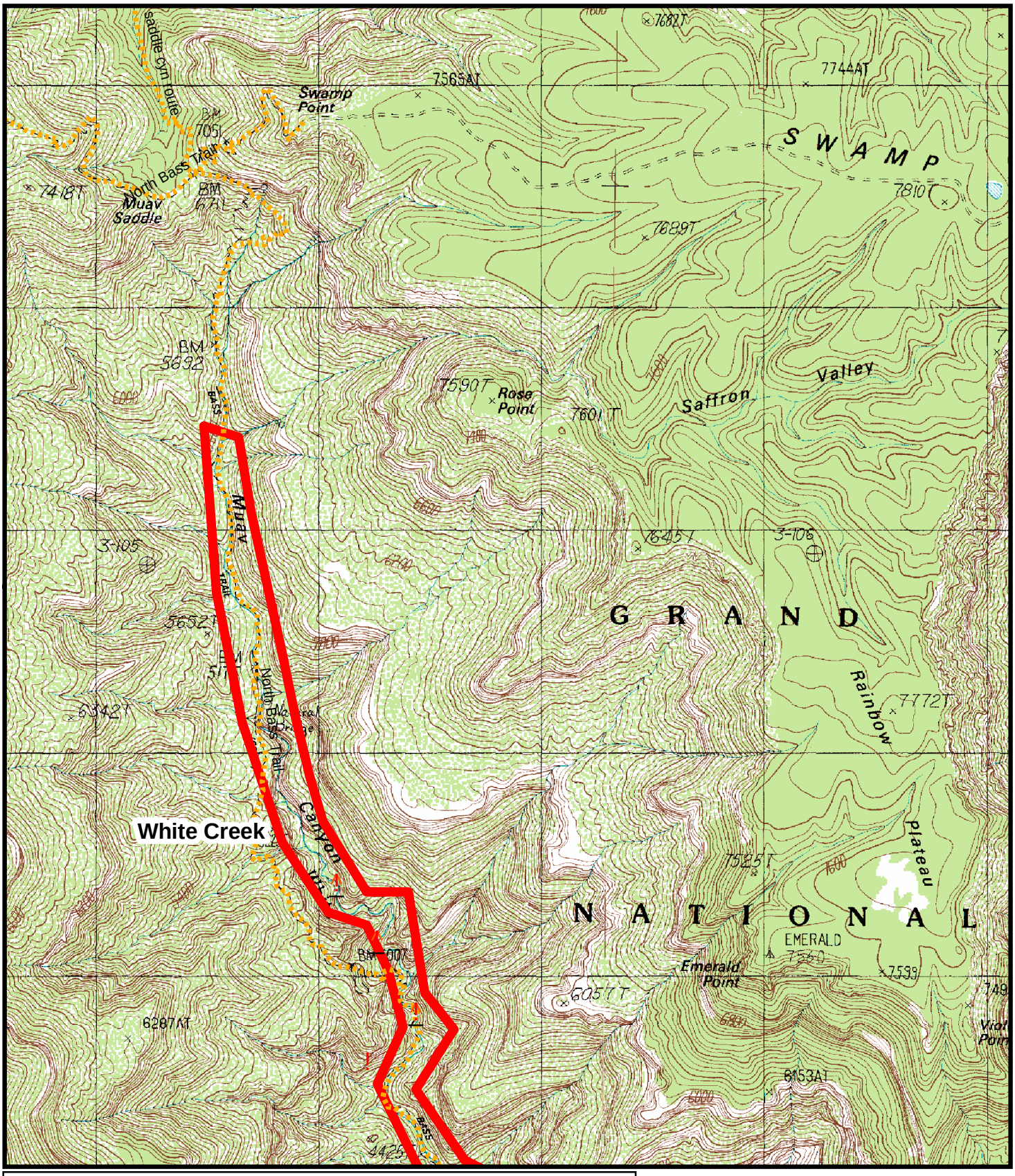
) PhaseIIB_Final_Photopoints

! PhaseIIB_Final_PlantCollection

AWPF_2006_2007_Project_Areas

0 0.25 0.5 1 Kilometers

Project Area = White Creek 2



k PhaseIIB_Final_Transect

! PhaseIIB_Final_Tamarisk

H PhaseIIB_Final_HabitatAssessment

Õ PhaseIIB_Final_Hydrology

^ PhaseIIB_Final_OtherExotics

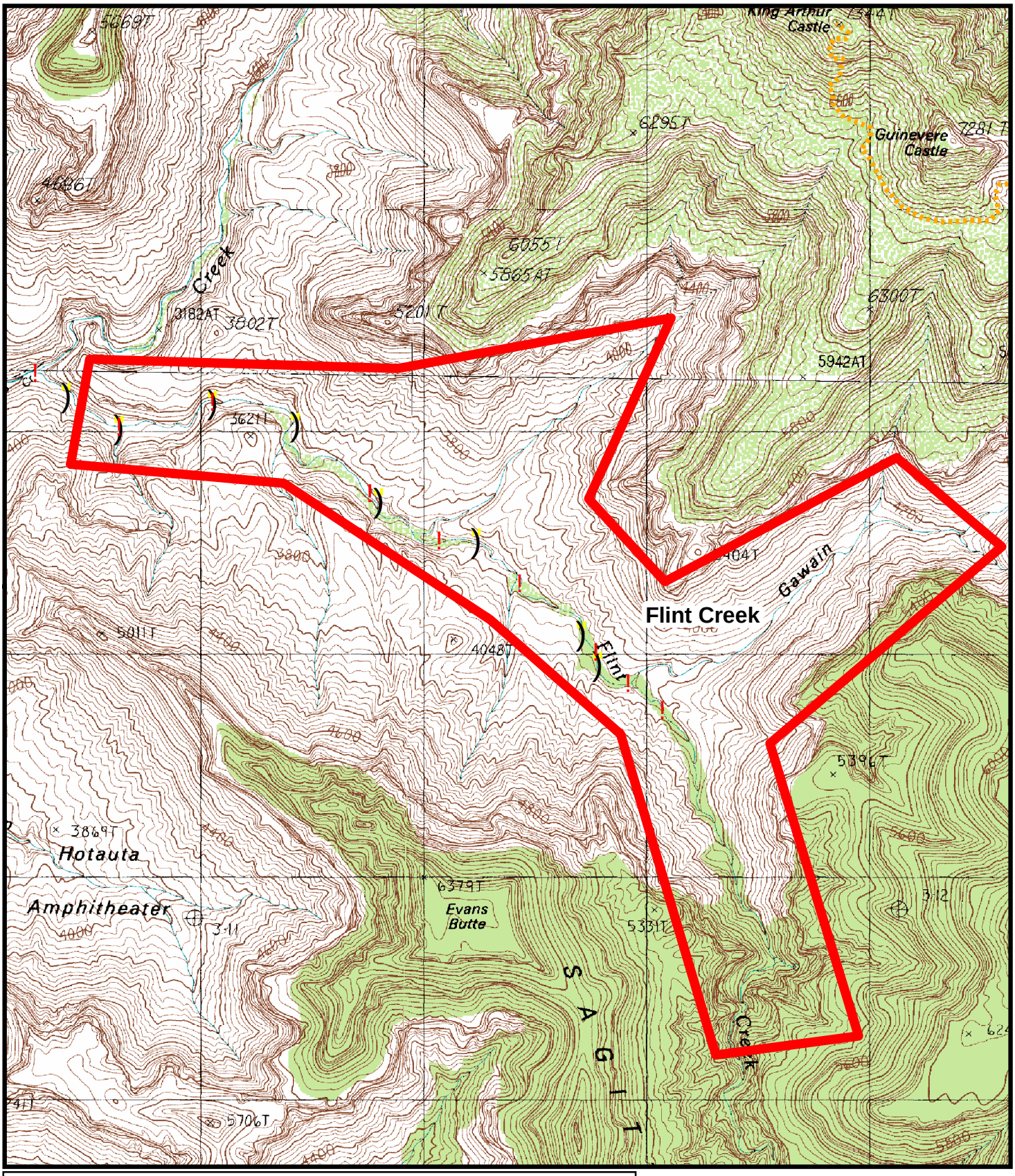
) PhaseIIB_Final_Photopoints

! PhaseIIB_Final_PlantCollection

AWPF_2006_2007_Project_Areas

0 0.25 0.5 1 Kilometers

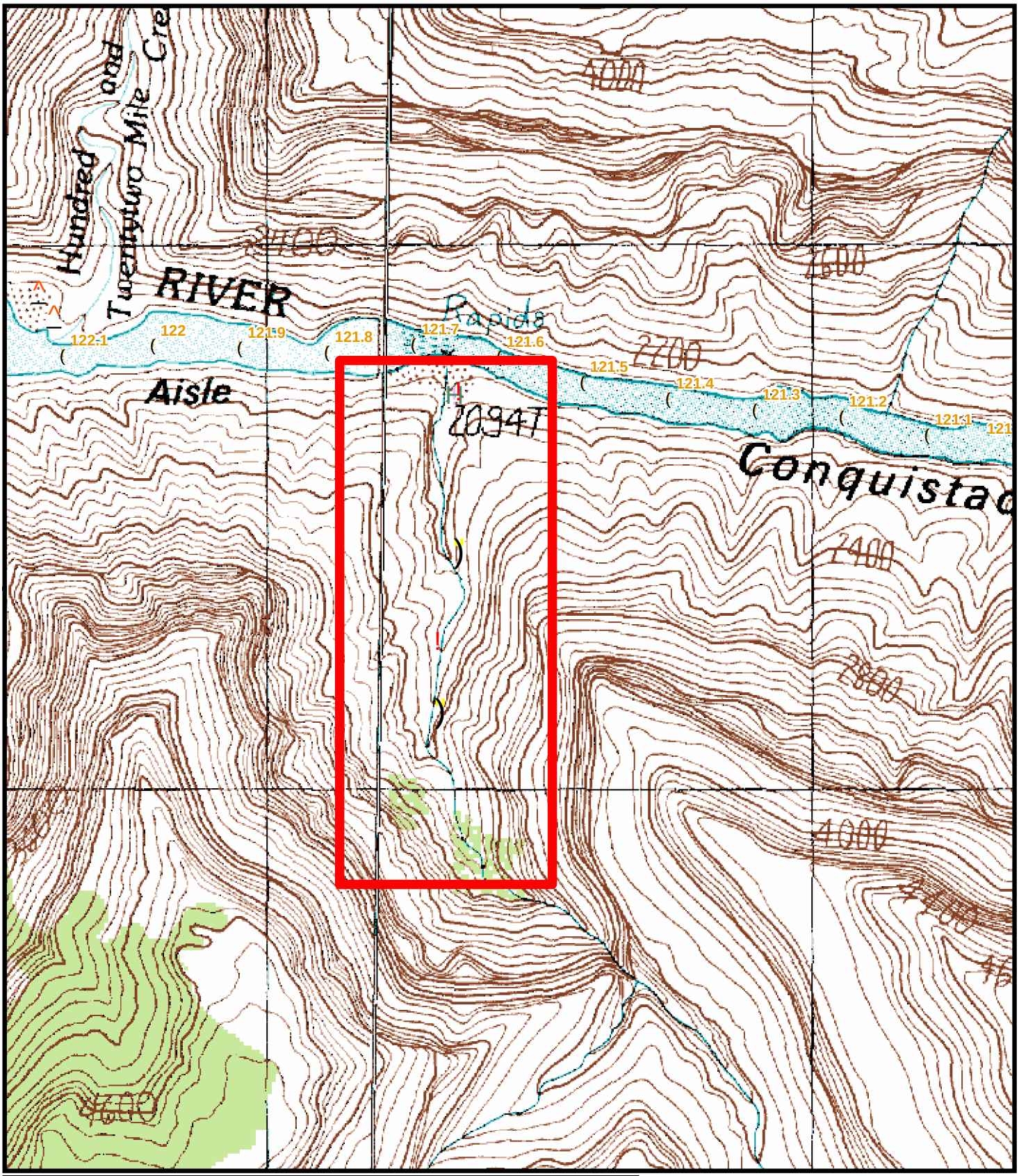
Project Area = Flint Creek



k PhaseIIB_Final_Transect	) PhaseIIB_Final_Photopoints
! PhaseIIB_Final_Tamarisk	! PhaseIIB_Final_PlantCollection
H PhaseIIB_Final_HabitatAssessment	AWPF_2006_2007_Project_Areas
Õ PhaseIIB_Final_Hydrology	
^ PhaseIIB_Final_OtherExotics	

0 0.25 0.5 1 Kilometers

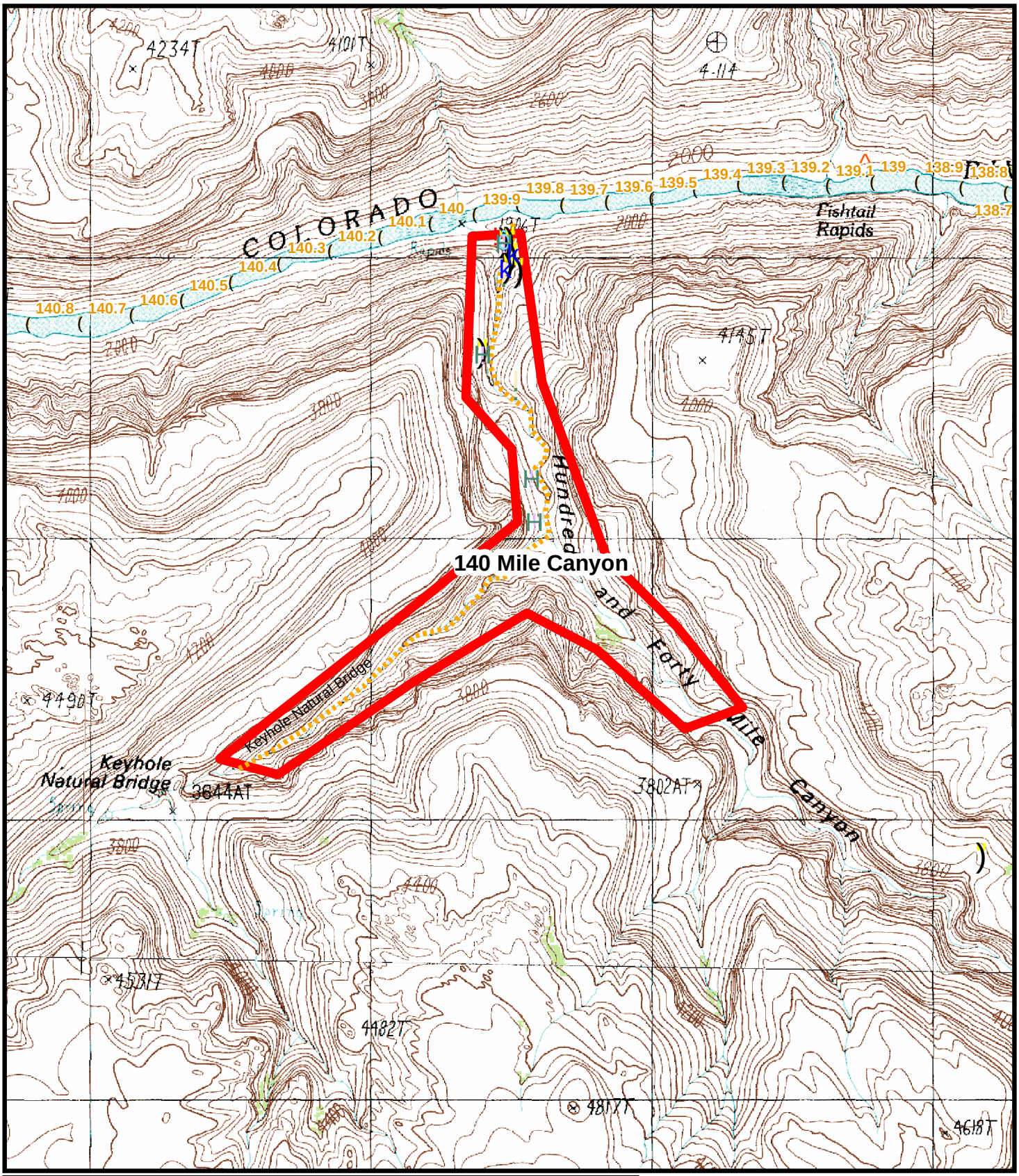
Project Area = 122 Mile Canyon



k PhaseIIB_Final_Transect
! PhaseIIB_Final_Tamarisk
H PhaseIIB_Final_HabitatAssessment
Õ PhaseIIB_Final_Hydrology
^ PhaseIIB_Final_OtherExotics
) PhaseIIB_Final_Photopoints
¡ PhaseIIB_Final_PlantCollection
AWPF_2006_2007_Project_Areas

0 0.125 0.25 0.5 Kilometers

Project Area = 140 Mile Canyon



k PhaseIIB_Final_Transect

! PhaseIIB_Final_Tamarisk

H PhaseIIB_Final_HabitatAssessment

Õ PhaseIIB_Final_Hydrology

^ PhaseIIB_Final_OtherExotics

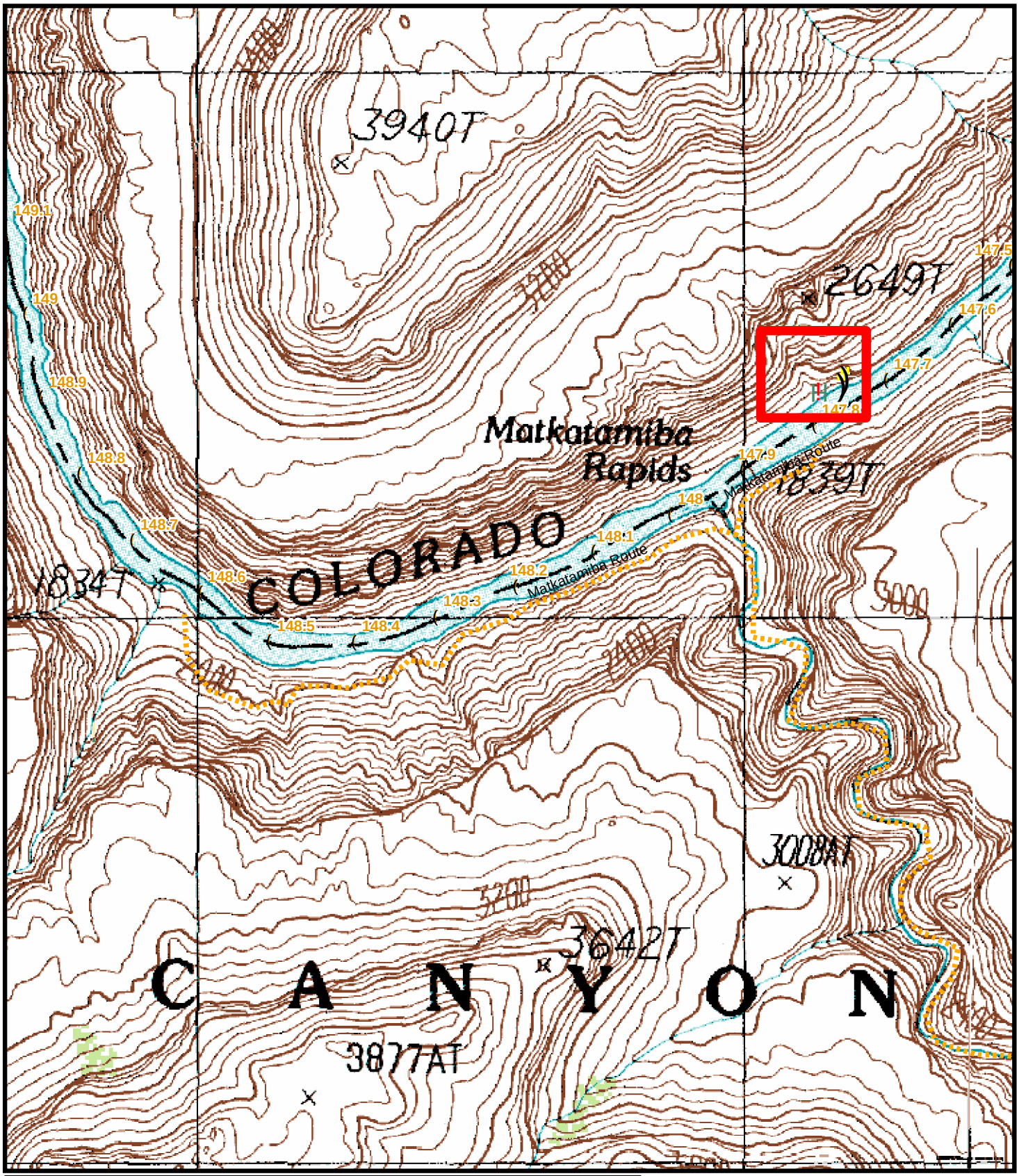
) PhaseIIB_Final_Photopoints

! PhaseIIB_Final_PlantCollection

AWPF_2006_2007_Project_Areas

0 0.2 0.4 0.8 Kilometers

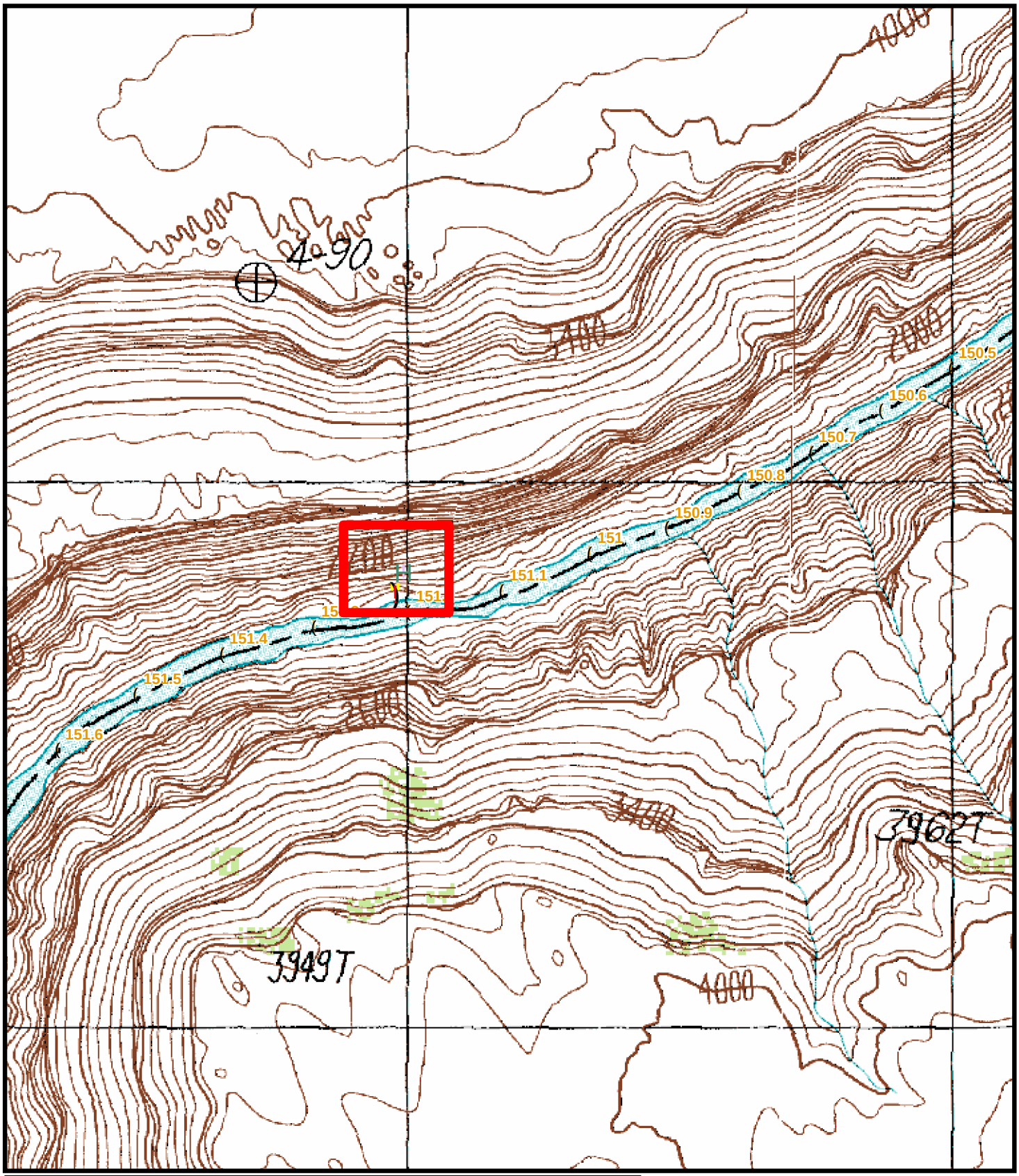
Project Area = 148.5 Mile Spring



k PhaseIIB_Final_Transect
! PhaseIIB_Final_Tamarisk
H PhaseIIB_Final_HabitatAssessment
Õ PhaseIIB_Final_Hydrology
^ PhaseIIB_Final_OtherExotics
) PhaseIIB_Final_Photopoints
! PhaseIIB_Final_PlantCollection
AWPF_2006_2007_Project_Areas

0 0.125 0.25 0.5 Kilometers

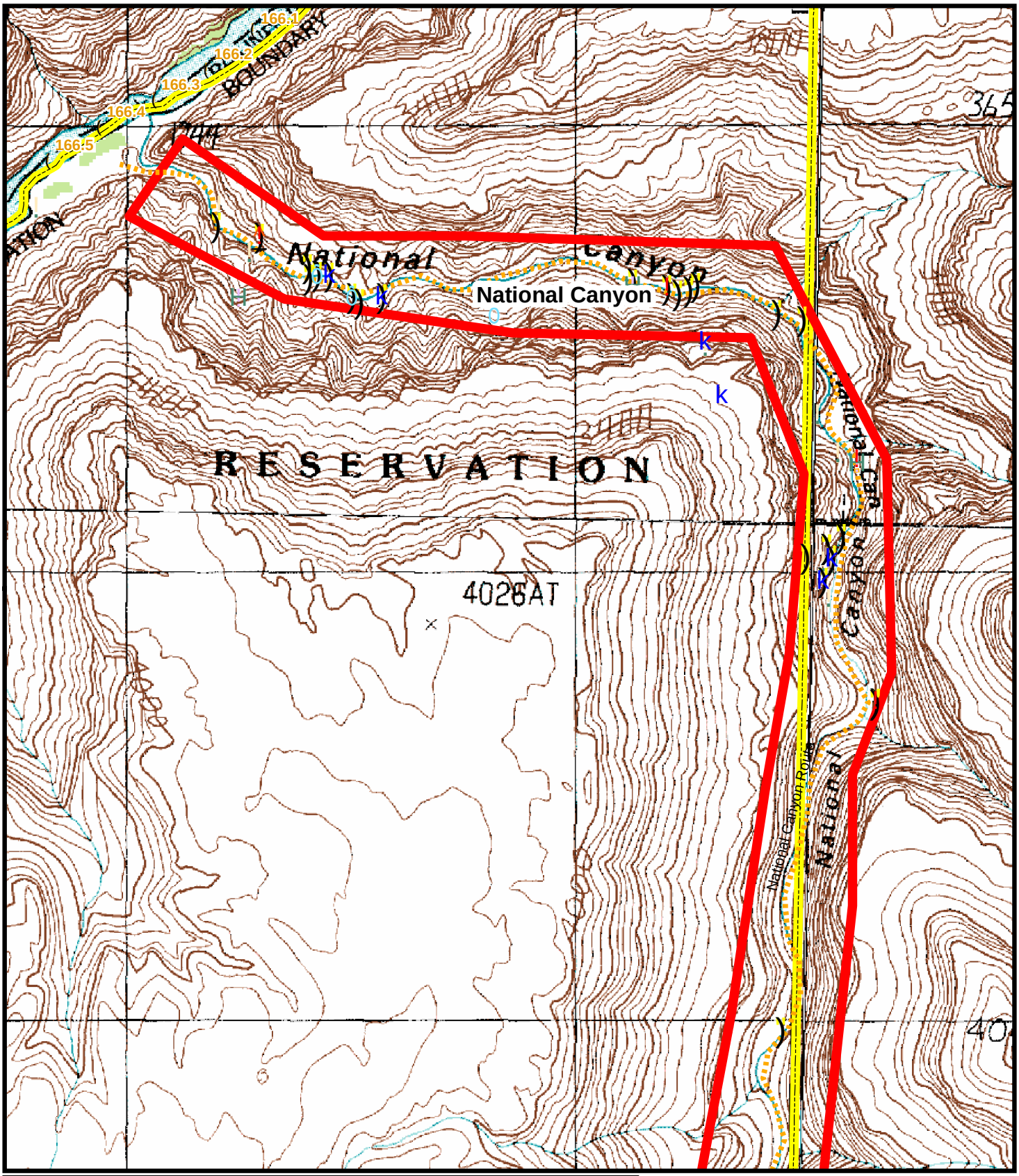
Project Area = 151 Mile Spring



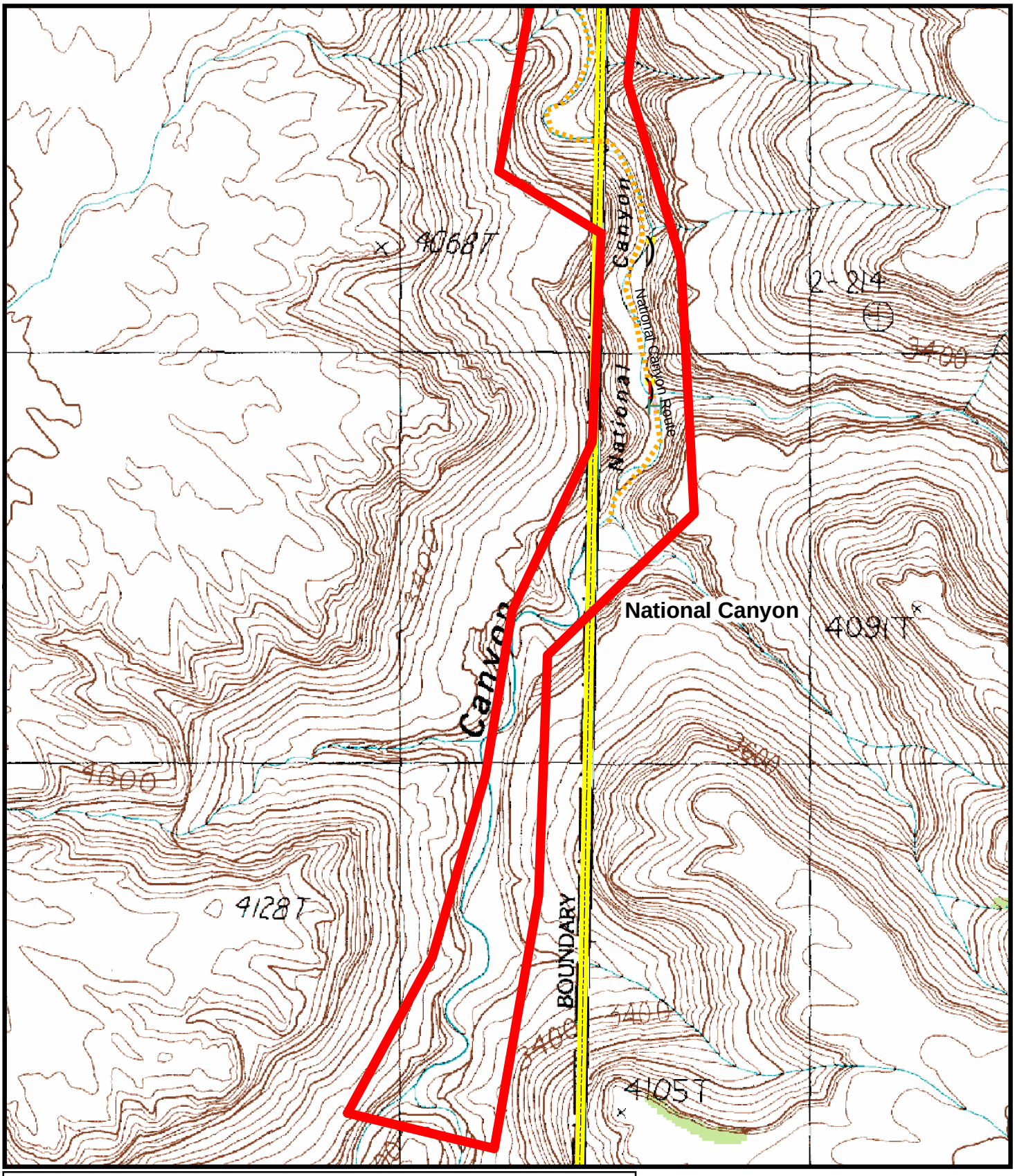
PhaseIIB_Final_Transect
PhaseIIB_Final_Tamarisk
PhaseIIB_Final_HabitatAssessment
PhaseIIB_Final_Hydrology
PhaseIIB_Final_OtherExotics
PhaseIIB_Final_Photopoints
PhaseIIB_Final_PlantCollection
AWPF_2006_2007_Project_Areas

0 0.125 0.25 0.5 Kilometers

Project Area = National Canyon 1



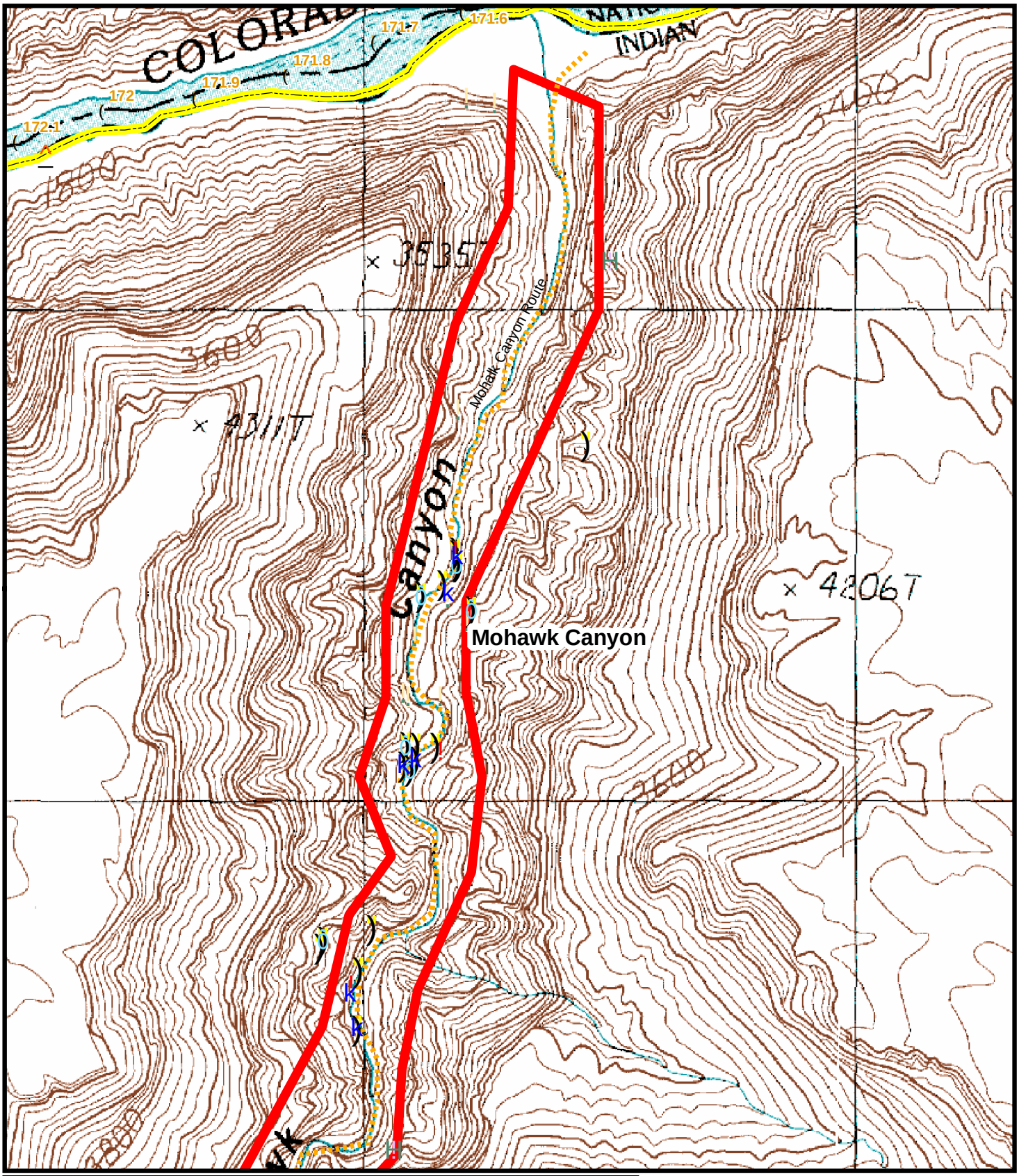
Project Area = National Canyon 2



PhaseIIB_Final_Transect
PhaseIIB_Final_Tamarisk
PhaseIIB_Final_HabitatAssessment
PhaseIIB_Final_Hydrology
PhaseIIB_Final_OtherExotics
PhaseIIB_Final_Photopoints
PhaseIIB_Final_PlantCollection
AWPF_2006_2007_Project_Areas

0 0.15 0.3 0.6 Kilometers

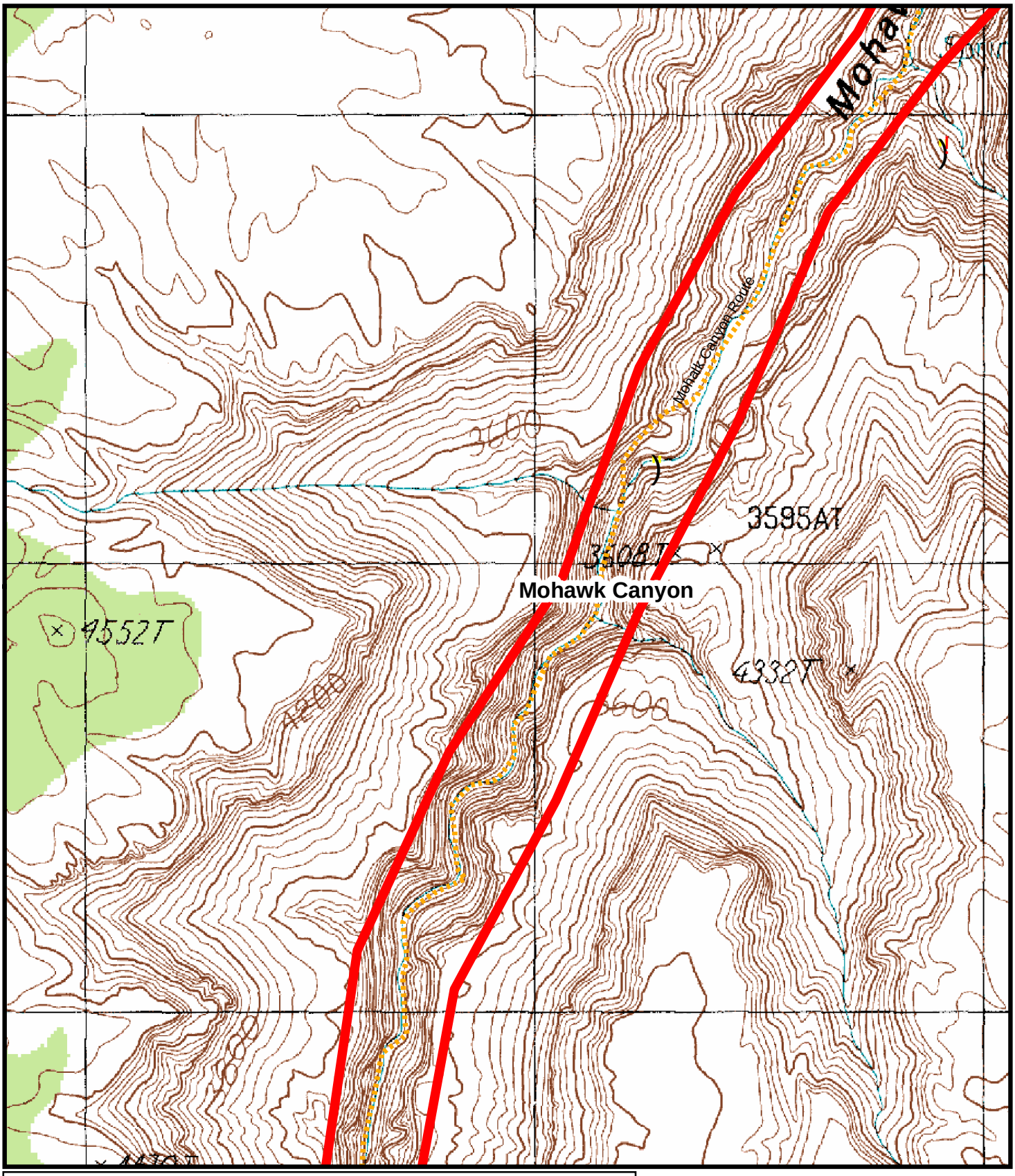
Project Area = Mohawk Canyon 1



k PhaseIIB_Final_Transect
! PhaseIIB_Final_Tamarisk
H PhaseIIB_Final_HabitatAssessment
Õ PhaseIIB_Final_Hydrology
^ PhaseIIB_Final_OtherExotics
) PhaseIIB_Final_Photopoints
! PhaseIIB_Final_PlantCollection
AWPF_2006_2007_Project_Areas

0 0.125 0.25 0.5 Kilometers

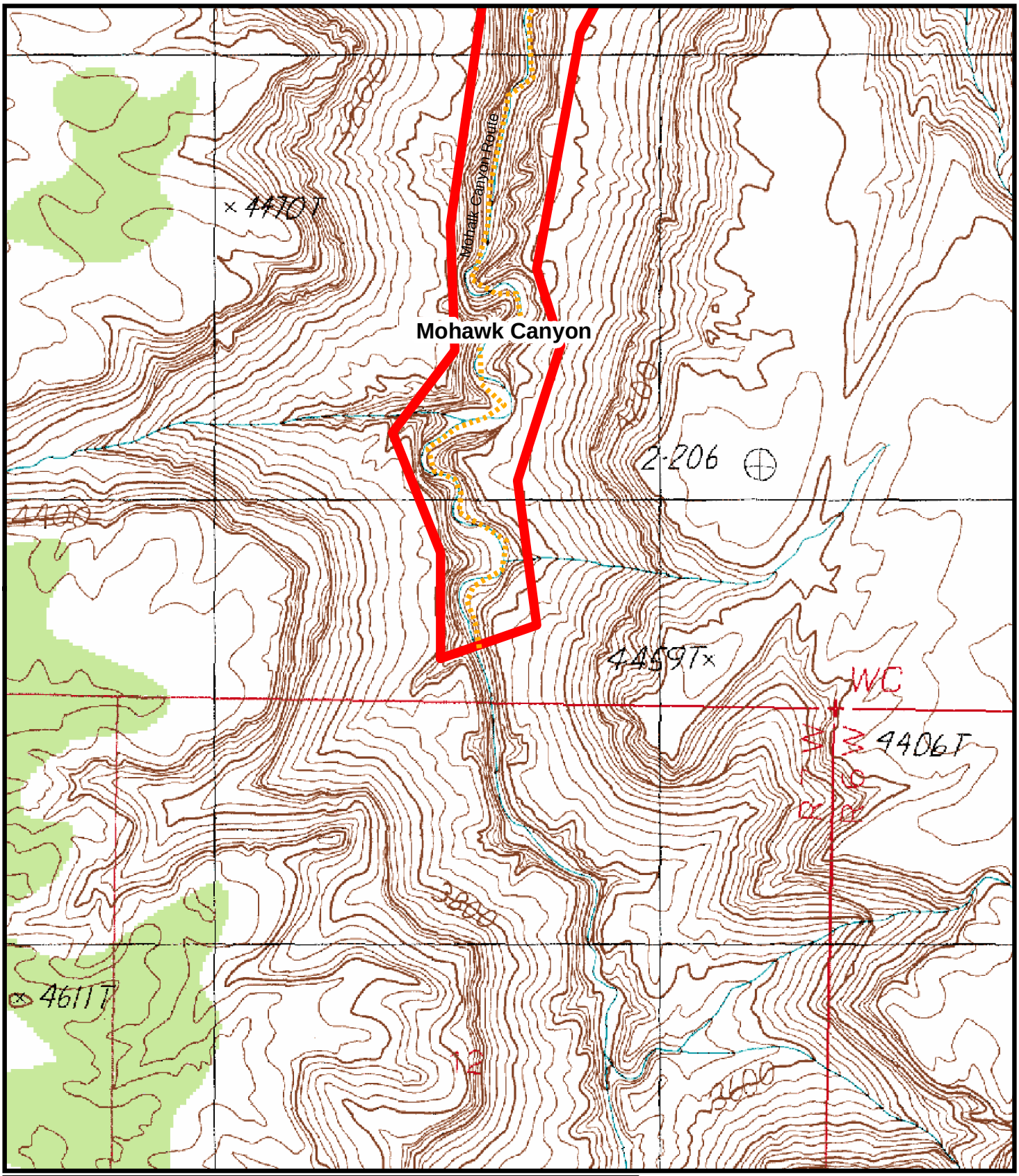
Project Area = Mohawk Canyon 2



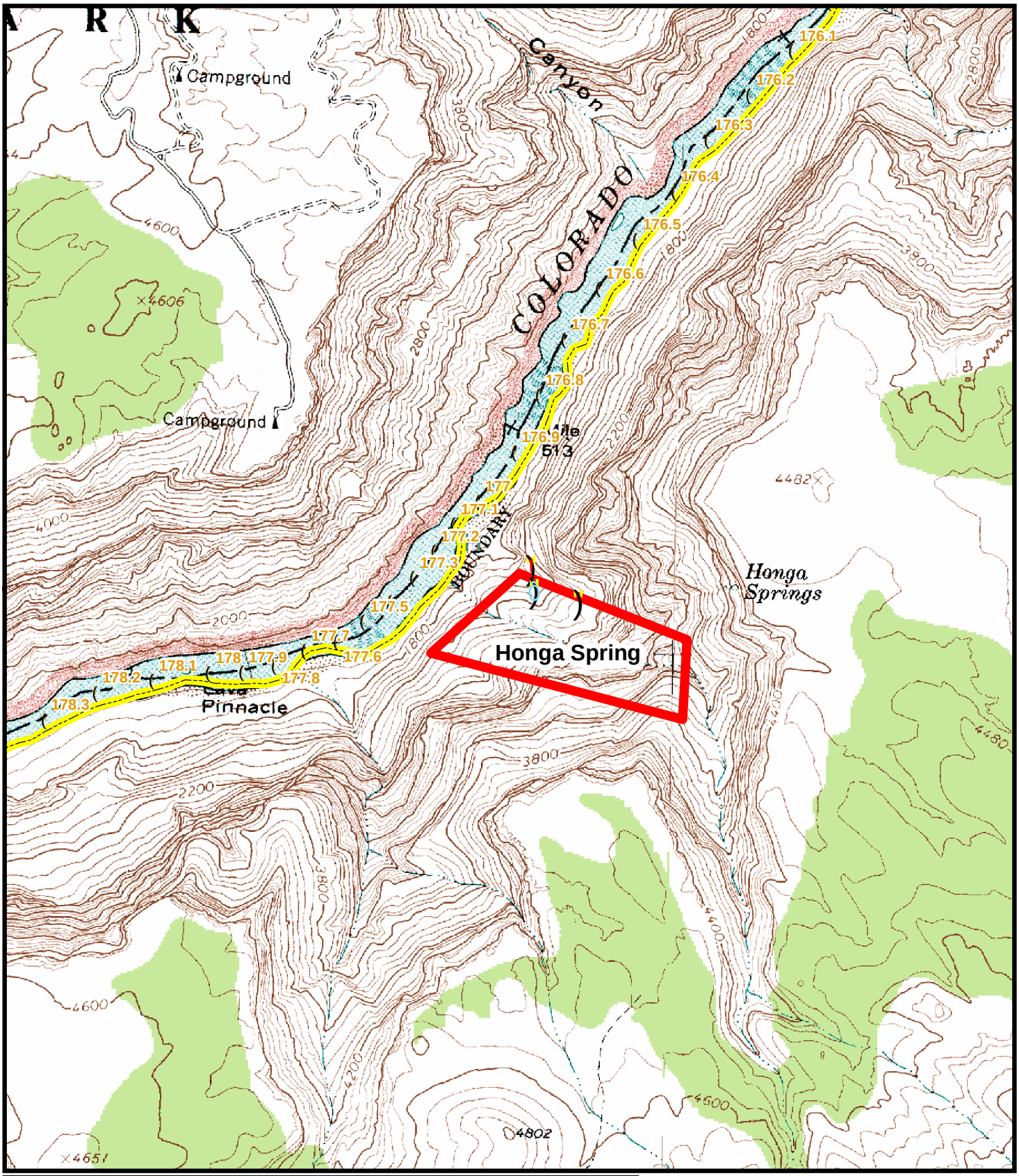
PhaseIIB_Final_Transect
PhaseIIB_Final_Tamarisk
PhaseIIB_Final_HabitatAssessment
PhaseIIB_Final_Hydrology
PhaseIIB_Final_OtherExotics
PhaseIIB_Final_Photopoints
PhaseIIB_Final_PlantCollection
AWPF_2006_2007_Project_Areas

0 0.15 0.3 0.6 Kilometers

Project Area = Mohawk Canyon 3



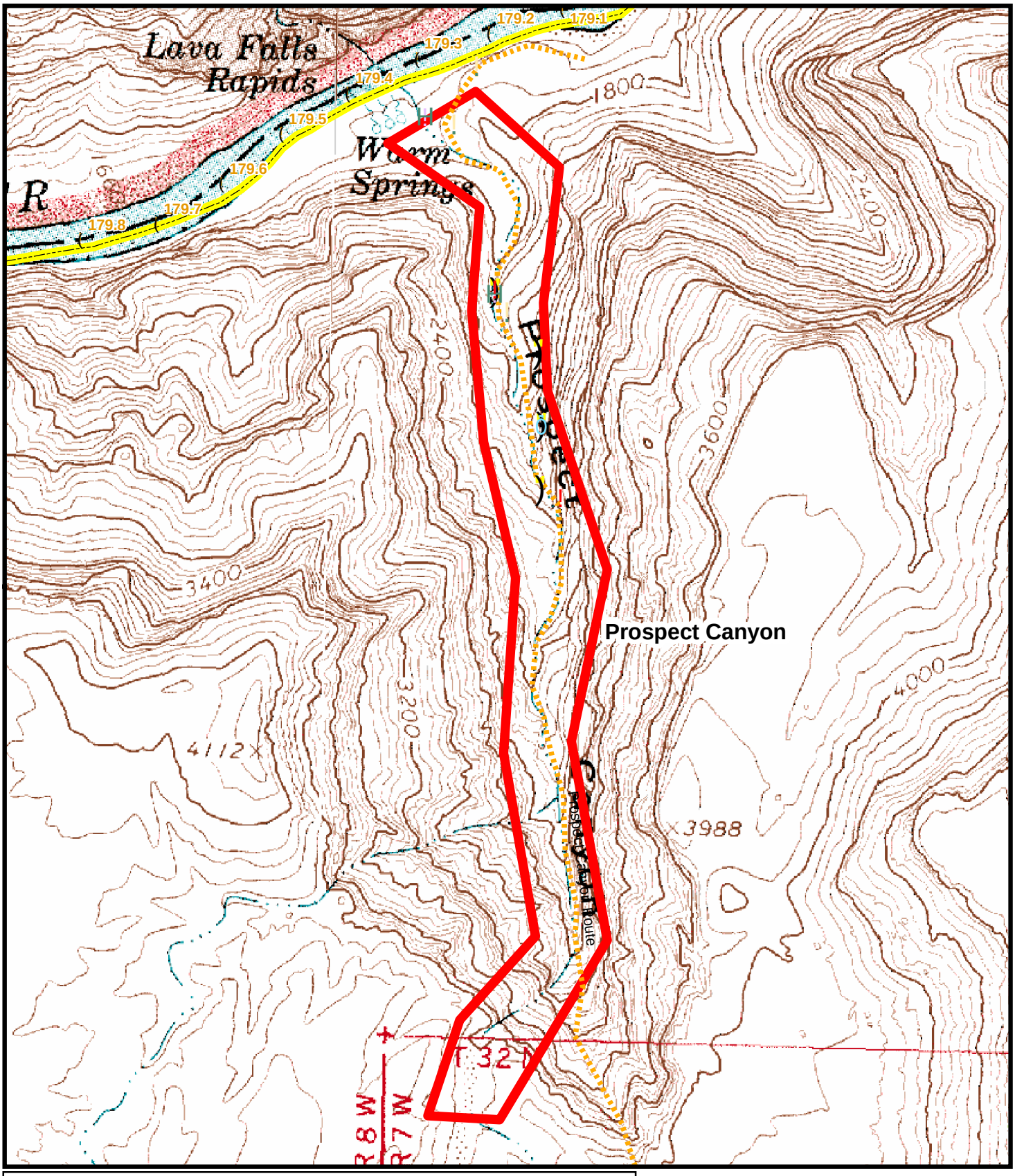
Project Area = Honga Spring



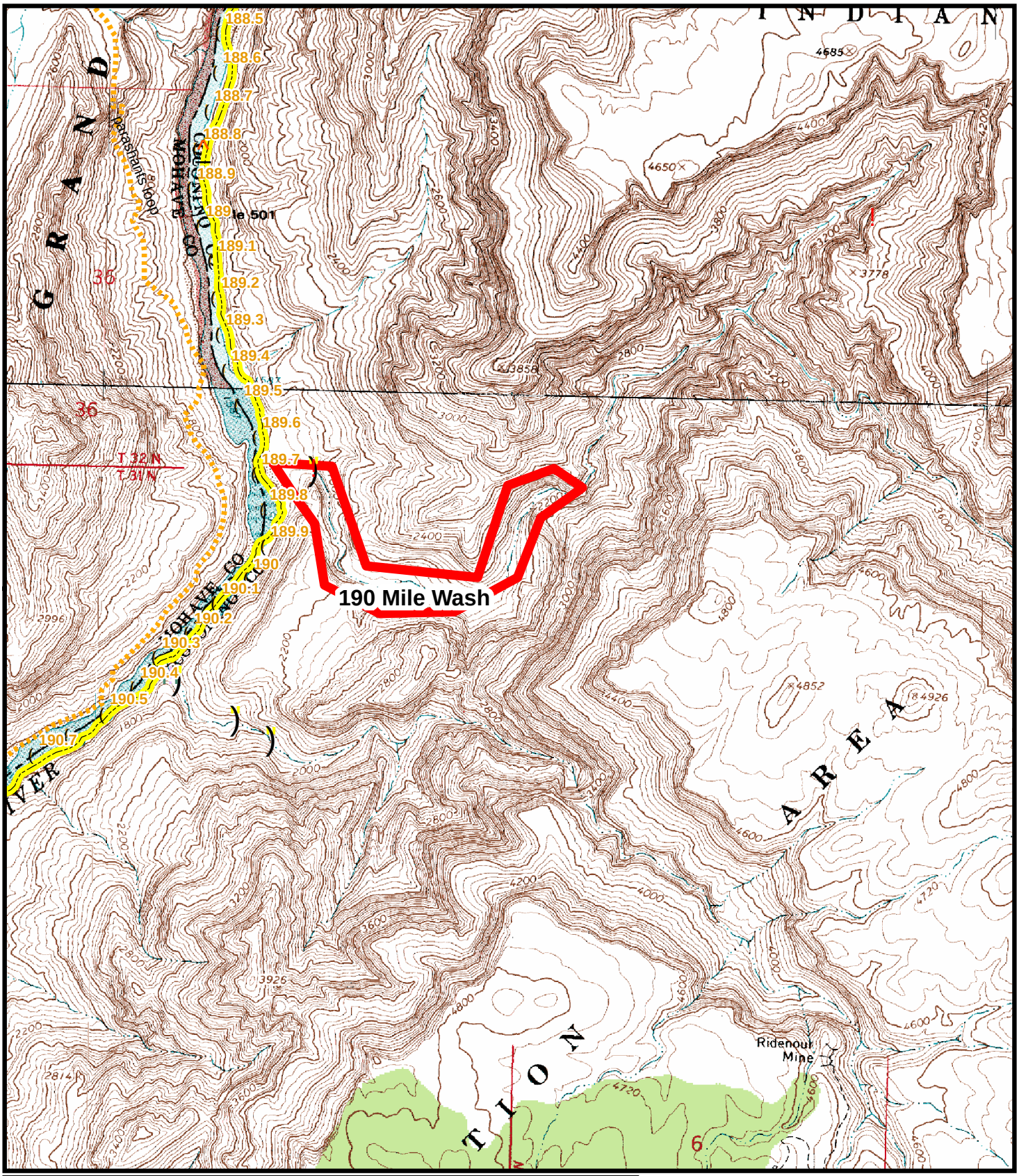
- PhaseIIB_Final_Transect
- PhaseIIB_Final_Tamarisk
- PhaseIIB_Final_HabitatAssessment
- PhaseIIB_Final_Hydrology
- PhaseIIB_Final_OtherExotics
- PhaseIIB_Final_Photopoints
- PhaseIIB_Final_PlantCollection
- AWPF_2006_2007_Project_Areas

0 0.15 0.3 0.6 Kilometers

Project Area = Prospect Canyon



Project Area = 190 Mile Wash



k PhaseIIB_Final_Transect

! PhaseIIB_Final_Tamarisk

H PhaseIIB_Final_HabitatAssessment

Õ PhaseIIB_Final_Hydrology

^ PhaseIIB_Final_OtherExotics

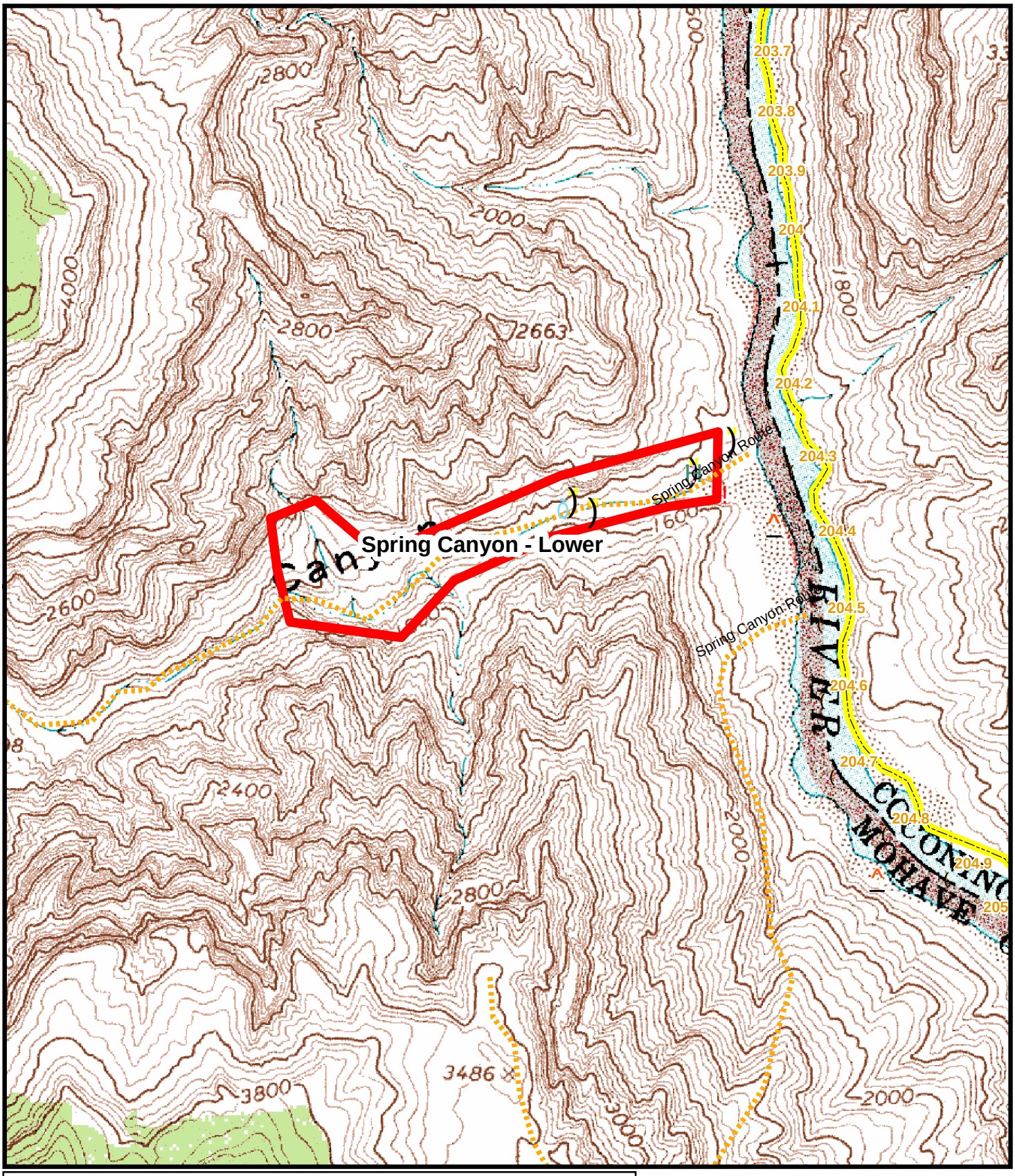
) PhaseIIB_Final_Photopoints

! PhaseIIB_Final_PlantCollection

AWPF_2006_2007_Project_Areas

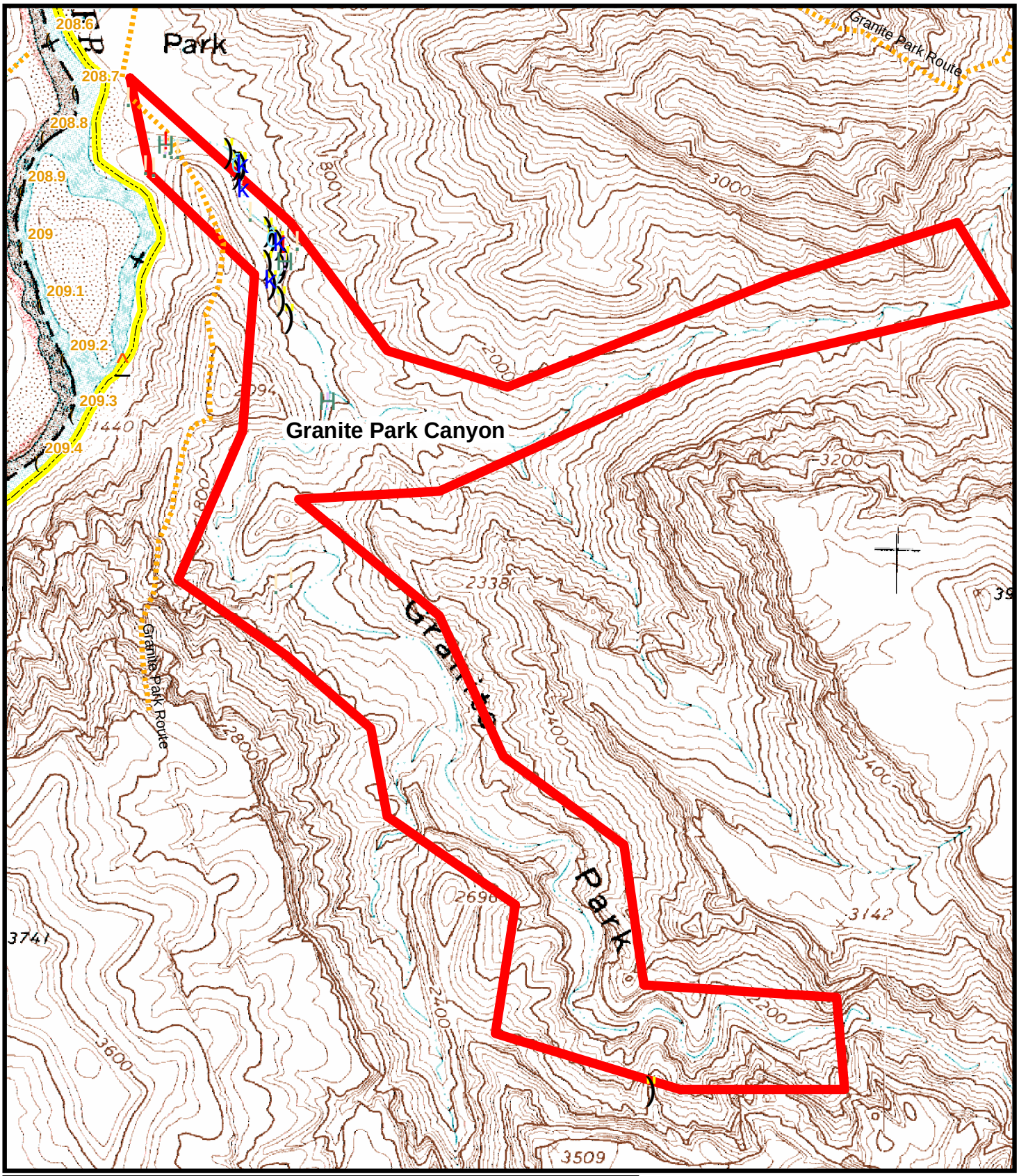
0 0.25 0.5 1 Kilometers

Project Area = Spring Canyon

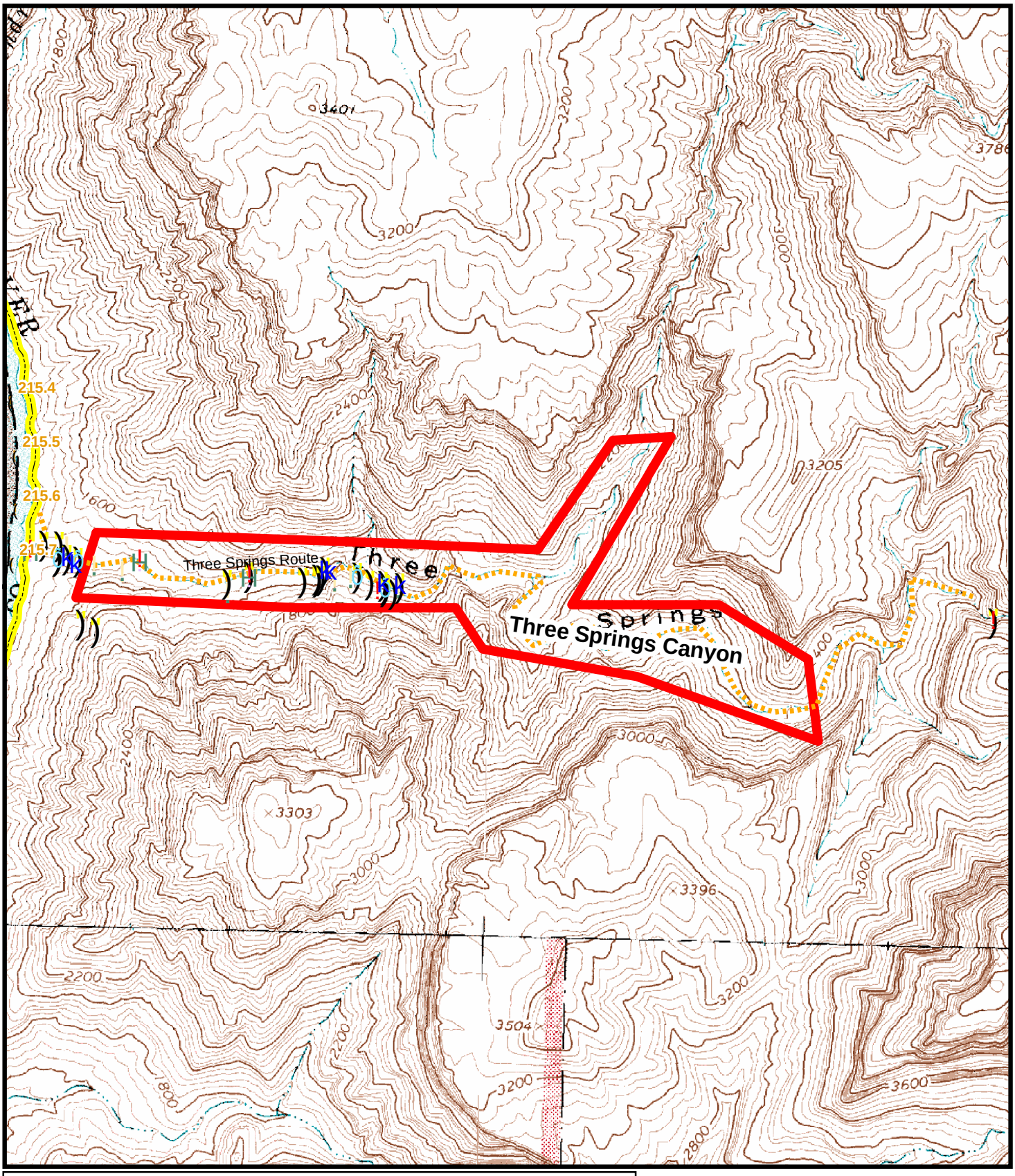


PhaseIIB_Final_Transect
PhaseIIB_Final_Tamarisk
PhaseIIB_Final_HabitatAssessment
PhaseIIB_Final_Hydrology
PhaseIIB_Final_OtherExotics
PhaseIIB_Final_Photopoints
PhaseIIB_Final_PlantCollection
AWPF_2006_2007_Project_Areas

Project Area = Granite Park Canyon



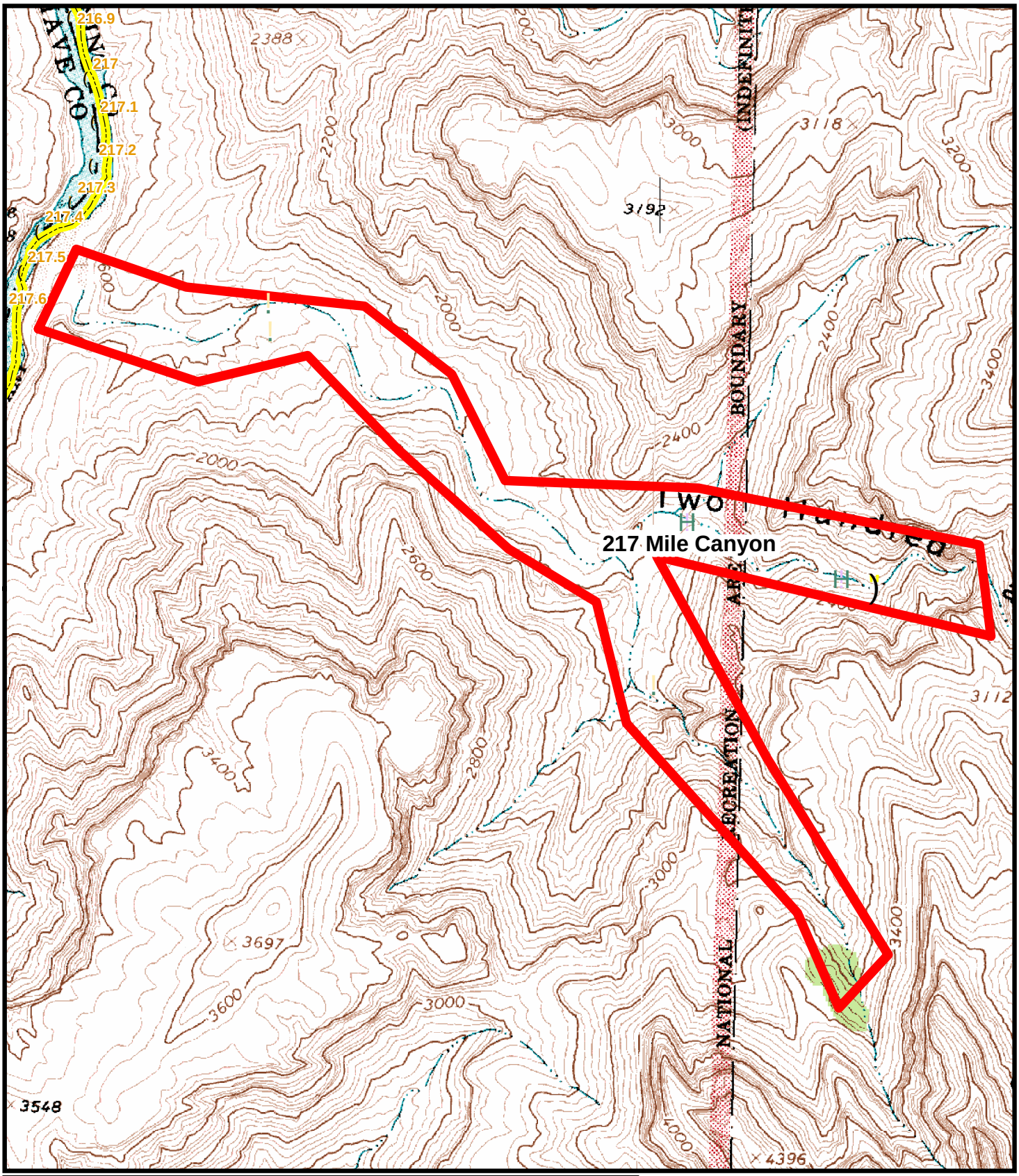
Project Area = Three Springs Canyon



k PhaseIIB_Final_Transect
! PhaseIIB_Final_Tamarisk
H PhaseIIB_Final_HabitatAssessment
Ô PhaseIIB_Final_Hydrology
^ PhaseIIB_Final_OtherExotics
) PhaseIIB_Final_Photopoints
! PhaseIIB_Final_PlantCollection
AWPF_2006_2007_Project_Areas

0 0.2 0.4 0.8 Kilometers

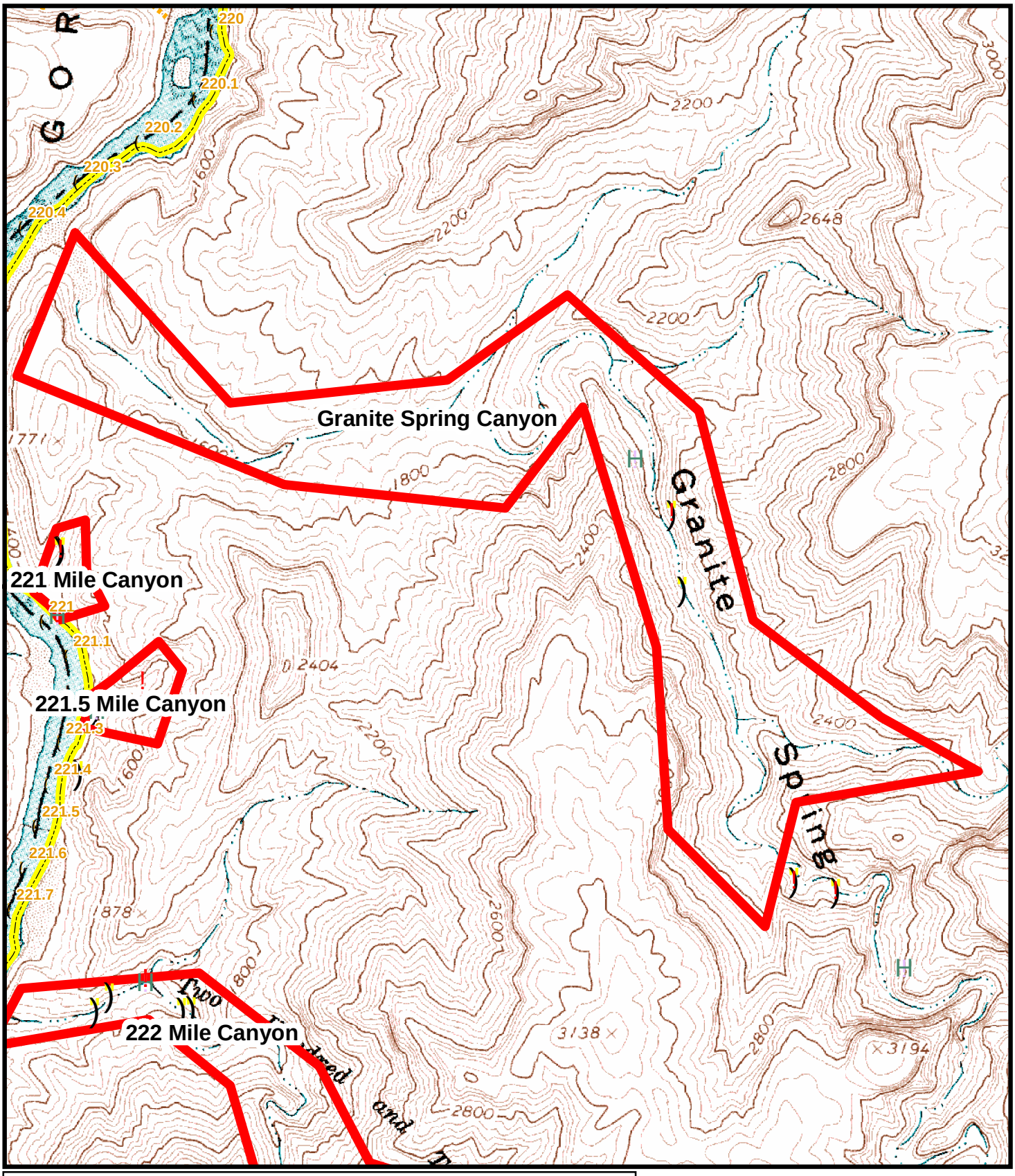
Project Area = 217 Mile Canyon



PhaseIIB_Final_Transect
PhaseIIB_Final_Tamarisk
PhaseIIB_Final_HabitatAssessment
PhaseIIB_Final_Hydrology
PhaseIIB_Final_OtherExotics
PhaseIIB_Final_Photopoints
PhaseIIB_Final_PlantCollection
AWPF_2006_2007_Project_Areas

0 0.15 0.3 0.6 Kilometers

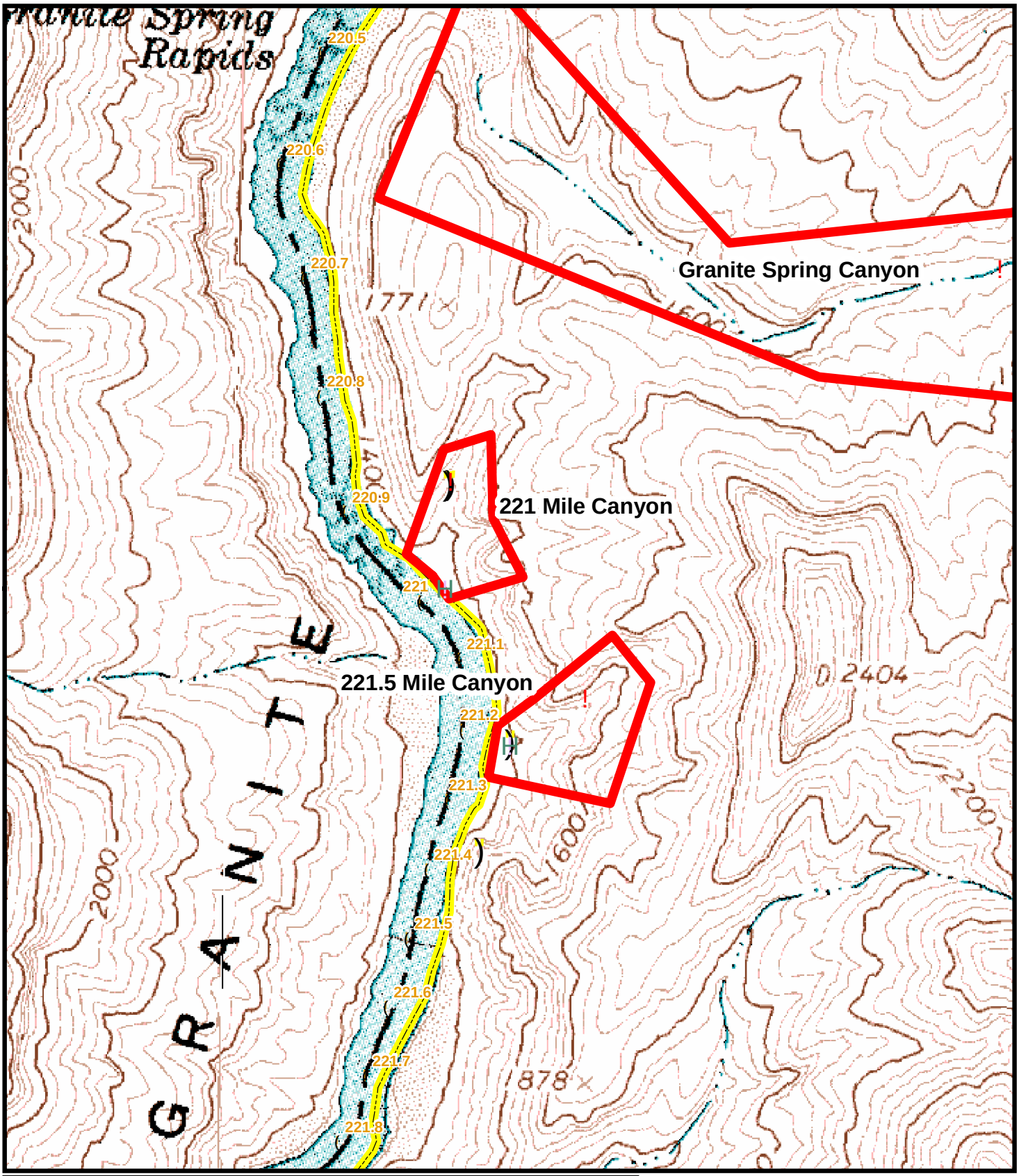
Project Area = Granite Spring Canyon



PhaseIIB_Final_Transect
PhaseIIB_Final_Tamarisk
PhaseIIB_Final_HabitatAssessment
PhaseIIB_Final_Hydrology
PhaseIIB_Final_OtherExotics
PhaseIIB_Final_Photopoints
PhaseIIB_Final_PlantCollection
AWPF_2006_2007_Project_Areas

0 0.2 0.4 0.8 Kilometers

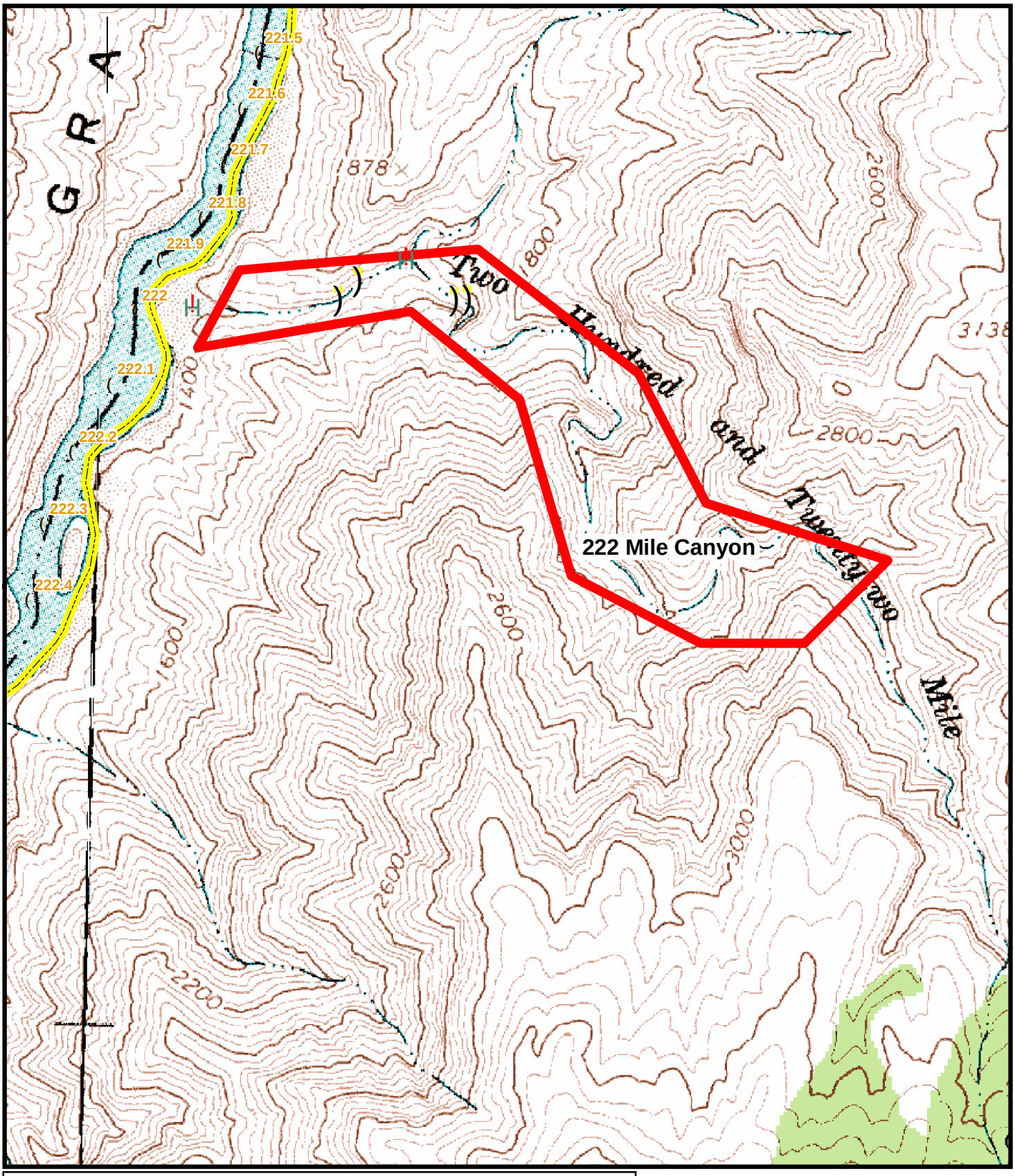
Project Area = 221 Mile Spring and 221.5 Mile Creek



PhaseIIB_Final_Transect
PhaseIIB_Final_Tamarisk
PhaseIIB_Final_HabitatAssessment
PhaseIIB_Final_Hydrology
PhaseIIB_Final_OtherExotics
PhaseIIB_Final_Photopoints
PhaseIIB_Final_PlantCollection
AWPF_2006_2007_Project_Areas

0 0.1 0.2 0.4 Kilometers

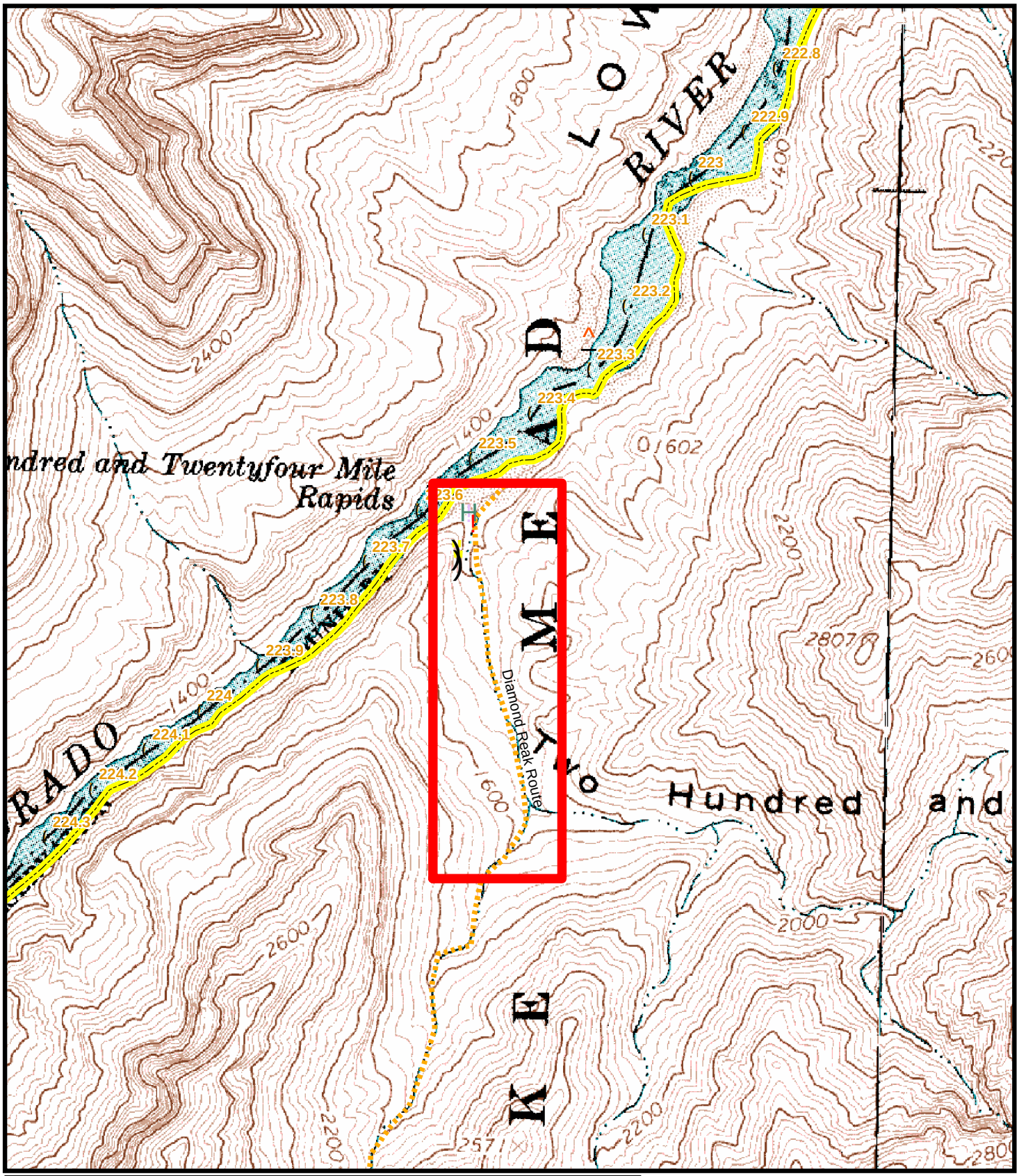
Project Area = 222 Mile Canyon



k PhaseIIB_Final_Transect
! PhaseIIB_Final_Tamarisk
H PhaseIIB_Final_HabitatAssessment
Õ PhaseIIB_Final_Hydrology
^ PhaseIIB_Final_OtherExotics
) PhaseIIB_Final_Photopoints
! PhaseIIB_Final_PlantCollection
AWPF_2006_2007_Project_Areas

0 0.15 0.3 0.6 Kilometers

Project Area = 224 Mile Canyon



k PhaseIIB_Final_Transect
! PhaseIIB_Final_Tamarisk
H PhaseIIB_Final_HabitatAssessment
Õ PhaseIIB_Final_Hydrology
^ PhaseIIB_Final_OtherExotics
) PhaseIIB_Final_Photopoints
! PhaseIIB_Final_PlantCollection
AWPF_2006_2007_Project_Areas

0 0.15 0.3 0.6 Kilometers