

APPENDIX A

Representative Project Photographs – Final 2007 Tamarisk Management Report Phase II-A *Management & Control of Tamarisk and Other Invasive Vegetation at Backcountry Seeps, Springs and Tributaries in Grand Canyon National Park*



Picture 1. The hard working tamarisk project crew leaders



Picture 2. The hard working crew on the February 2006 river trip



Picture 3. EPMT crew at Roaring Springs in Upper Bright Angel Creek



Picture 4. Getting there is half the battle! Volunteer crew on the way to a work site



Picture 5. A mighty cottonwood forest in need of protection from tamarisk



Picture 6. Backpacking crews making an early breakfast on the way to Nankoweap Creek

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Picture 7. Native seep willow growing intertwined with newly cut tamarisk stumps



Picture 8. Crew leader dutifully recording data



Picture 9. Crews experience extreme weather conditions on winter trips



Picture 10. Crew leader spraying herbicide on cut stumps

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Picture 11. Tools of the trade for data collection and photopoints



Picture 12. Using orienteering skills to find the best route to work sites



Picture 13. Large tree treated with the combo girdle/cut method



Picture 14. Crew leaders spraying herbicide on cut stumps



Picture 15. Volunteer crew members at work in 225 Mile Canyon



Picture 16. Native Phragmites grass growing around old cut stumps of tamarisk

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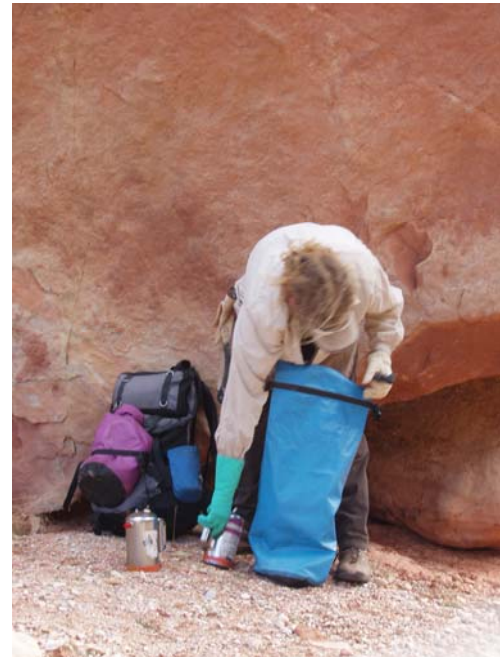
Picture 17. Tools and gear carefully laid out at the bunkhouse at the start of the day



Picture 18. Volunteers excavating tamarisk covered in flood debris



Picture 19. Crews accessing remote side drainages with the assistance of ropes



Picture 20. Crew leader preparing to transport herbicide in backpack

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Picture 21. ARR boatmen dwarfed by enormous tamarisk thicket at Crystal Creek



Picture 22. Slash pile before dispersal along terrace



Picture 23. Crew leaders refill herbicide sprayers



Picture 24. Crew leader calling Park dispatch for morning check-in



Picture 25. Volunteer encounters extensive tamarisk root system



Picture 26. Hiking herbicide stash from the river for backpacking trips

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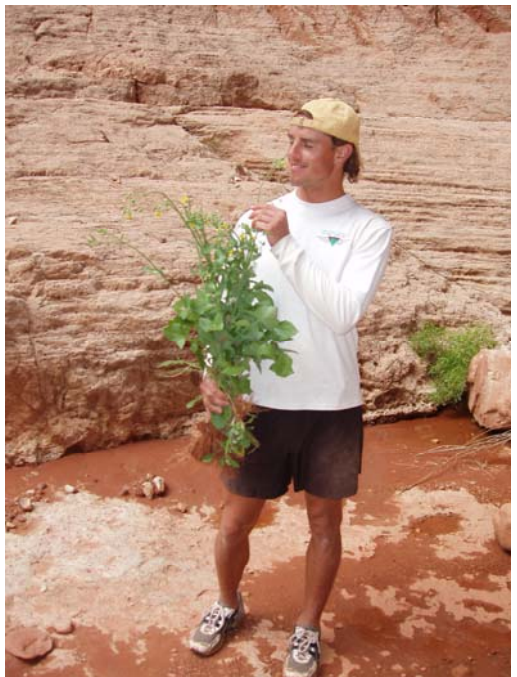
Picture 27. Transect through native vegetation



Picture 28. Botanists collecting plant specimens at Crystal Creek transect area



Picture 29. Collecting point intercept data, Upper Carbon transect



Picture 30. *Sonchus oleraceus* bouquet at 36.5 Mile project area.

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Picture 31. The hard working monitoring crew



Picture 32. Transportation to work sites



Picture 33. Hydrology team at work



Picture 34. Revisiting transects at South Canyon



Picture 35. Monitoring post tamarisk removal transects in Carbon Creek



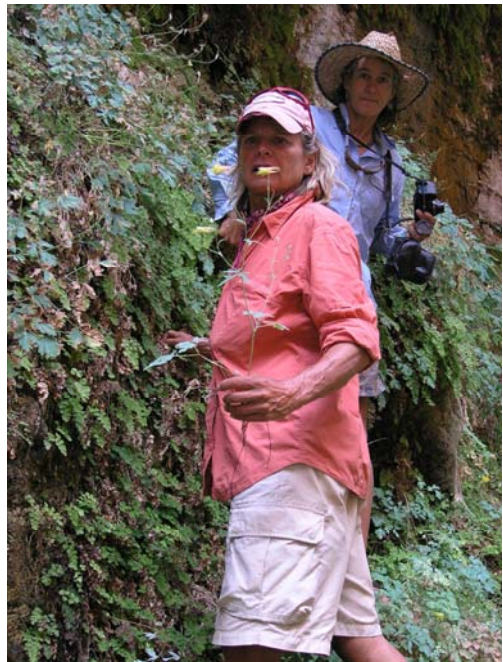
Picture 36. Native plant regrowth around tamarisk stumps at Nankoweap Creek

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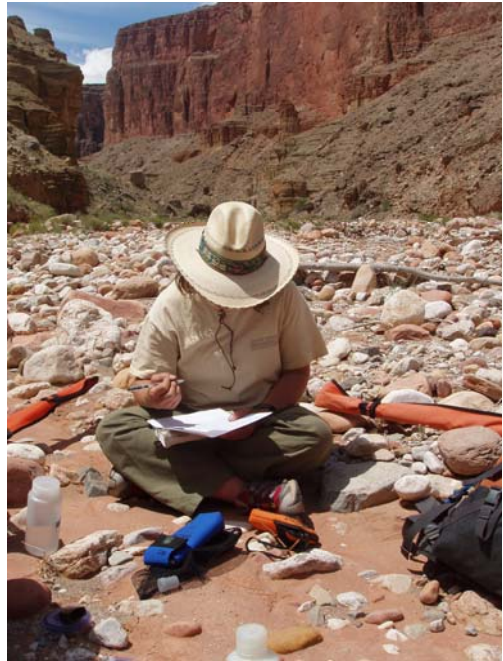
Picture 37. Crew leaders go over soil sampling protocols at Nankoweap Creek



Picture 38. Volunteer botanists collect golden columbine from a seep



Picture 39. Hydrology sampling at Crystal Creek



Picture 40. Lori Makarick, Project Director collecting data

Appendix B - Photopoint Summary Data

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|-----------|-----------------------|--|---|
| 36.5 mile 1 | 1 | 424244 | 4033941 | 5/7/2005 | Post | Standing at the top of lower portion of bowl on slick rock fall, below narrow slick rock fall that you can climb around on the right. Taken from canyon left at top of slick rock falls, right at bottom part of upper bowl. | Looking down into lower bowl; TAMRAM stumps and debris are visible. |
| 36.5 mile 1 | 2 | 424244 | 4033941 | 5/7/2005 | Post | Standing at the top of lower portion of bowl on slick rock fall, below narrow slick rock fall that you can climb around on the right. Taken from canyon left at top of slick rock falls, right at bottom part of upper bowl. | Looking up canyon into upper bowl; TAMRAM is gone. |
| 36.5 mile 1 | A | 424244 | 4033941 | 5/7/2005 | Pre | Standing at the top of lower portion of bowl on slick rock fall, below narrow slick rock fall that you can climb around on the right. Taken from canyon left at top of slick rock falls, right at bottom part of upper bowl. | Lori at PP. Standing at the top of the lower portion of the bowl; below a narrow slick rock fall that you can climb around on the right. |
| Papago 1 | 1 | 418244 | 3989278 | 2/17/2007 | Pre | About 200 m upstream of the mouth of Papago Creek, standing on a Shinamu ledge/dryfall on creek L | Looking downstream at Papago towards river. Only seedlings were pulled from this section, so we did not retake photo post-treatment photo at this time. |
| Papago 1 | A | 418244 | 3989278 | 2/17/2007 | Pre | About 200 m upstream of the mouth of Papago Creek, standing on a Shinamu ledge/dryfall on creek L | Lynn at photopoint |
| Papago Creek 4 | 1 | 418283 | 3988146 | 2/17/2007 | Pre | Standing on bedrock near base of dry fall (bowl) that marks the beginning of section 4. No GPS available, UTM's were taken from GIS layer, so field check for accuracy. | Looking downstream. Only seedlings were pulled in this section, so no post-treatment photos were taken at this time. |
| Papago Creek 4 | A | 418283 | 3988146 | 2/17/2007 | Pre | Standing on bedrock near base of dry fall (bowl) that marks the beginning of section 4. No GPS available, UTM's were taken from GIS layer, so field check for accuracy. | Sam at photopoint, taken from downstream. Note the bowl in background |
| PP 112 Mile 1 | 1 | 373749 | 4011271 | 5/14/2005 | Pre | Taken from middrainage about 60m from highwater line on pink 1.5x1x2m sandstone boulder. This boulder is at the base of 15x8m (tall) gneiss/schist veined bedrock. | Taken looking downstream at 3m tall ACAGRE up slope. Taken from creek right. Redwall, Supai and Tapeats in skyline. |
| PP 112 Mile 1 | 1 | 373749 | 4011271 | 11/1/2005 | Post | Taken from middrainage about 60m from highwater line on pink 1.5x1x2m sandstone boulder. This boulder is at the base of 15x8m (tall) gneiss/schist veined bedrock. | Post work. |
| PP 112 Mile 1 | 2 | 373749 | 4011271 | 5/14/2005 | Pre | Taken from middrainage about 60m from highwater line on pink 1.5x1x2m sandstone boulder. This boulder is at the base of 15x8m (tall) gneiss/schist veined bedrock. | Looking upstream at mature tamarisk 8m away, mid-drainage. View of where canyon cliffs out at 8m high waterfall with chalkstones. |
| PP 112 Mile 1 | 2 | 373749 | 4011271 | 11/1/2005 | Post | Taken from middrainage about 60m from highwater line on pink 1.5x1x2m sandstone boulder. This boulder is at the base of 15x8m (tall) gneiss/schist veined bedrock. | Post work. |
| PP 112 Mile 1 | A | 373749 | 4011271 | 5/14/2005 | Pre | Taken from middrainage about 60m from highwater line on pink 1.5x1x2m sandstone boulder. This boulder is at the base of 15x8m (tall) gneiss/schist veined bedrock. | Taken 6m downstream from photopoint at mouth of 2nd major waterfall. |
| PP 112 Mile 2 | 1 | 374078 | 4011212 | 5/14/2005 | Pre | No GPS. Taken from middrainage about 4m from the mouth of the second major waterfall. | Downstream view of mature tamarisk on creek right. There is water flowing over gneiss ledge. |
| PP 112 Mile 2 | 2 | 374078 | 4011212 | 5/14/2005 | Pre | No GPS. Taken from middrainage about 4m from the mouth of the second major waterfall. | Looking at black stained second major waterfall about 5m high. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|-----------|-----------------------|--|--|
| PP 112 Mile 2 | A | 374078 | 4011212 | 5/14/2005 | Pre | No GPS. Taken from middrainage about 4m from the mouth of the second major waterfall. | Maggie at photopoint. Photo taken from about 3m upstream. |
| PP 130 Mile 1 | 1 | 368274 | 4020698 | 5/14/2005 | Pre | Taken from on top 2 huge schist boulders that chock canyon forming a 5m waterfall. | Steve standing on Zoroaster boulder that chocks canyon below a huge falls. |
| PP 130 Mile 1 | 1 | 368274 | 4020698 | 11/3/2005 | Post | Taken from on top 2 huge schist boulders that chock canyon forming a 5m waterfall. | Post work. |
| PP 130 Mile 1 | 2 | 368274 | 4020698 | 5/14/2005 | Pre | Taken from on top 2 huge schist boulders that chock canyon forming a 5m waterfall. | Looking at huge waterfall in top left with a large 7x4x5m shade at bottom right. |
| PP 130 Mile 1 | 2 | 368274 | 4020698 | 11/3/2005 | Post | Taken from on top 2 huge schist boulders that chock canyon forming a 5m waterfall. | Post work. |
| PP 130 Mile 1 | A | 368274 | 4020698 | 5/14/2005 | Pre | Taken from on top 2 huge schist boulders that chock canyon forming a 5m waterfall. | Steve standing at photopoint on Zoroaster boulder that chocks canyon below the huge fall. Photo taken 6m below the 5m fall. |
| PP 225 Mile 1 | 1 | 285680 | 3961087 | 5/19/2005 | Pre | Taken from creek left on a granite rock about 1.5m high. This is at the beginning of granite narrows. | Looking up canyon from the mouth. Tamarisk granite protrusion on right. Shows creek and hydro sample #1. |
| PP 225 Mile 1 | 1 | 285680 | 3961087 | 5/20/2006 | Post | Taken from creek left on a granite rock about 1.5m high. This is at the beginning of granite narrows. | Looking up canyon from the mouth. Granite protrusion on right. Shows creek and hydro sample #1. |
| PP 225 Mile 1 | 2 | 285680 | 3961087 | 5/19/2005 | Pre | Taken from creek left on a granite rock about 1.5m high. This is at the beginning of granite narrows. | Looking downstream. TAMRAM, dry creek bed and a jagged skyline in view. |
| PP 225 Mile 1 | 2 | 285680 | 3961087 | 5/20/2006 | Post | Taken from creek left on a granite rock about 1.5m high. This is at the beginning of granite narrows. | Looking downstream. TAMRAM still not gone. |
| PP 225 Mile 1 | A | 285680 | 3961087 | 5/19/2005 | Pre | Taken from creek left on a granite rock about 1.5m high. This is at the beginning of granite narrows. | Looking at Nicole at the photopoint. Taken looking up canyon narrows. |
| PP 225 Mile 2 | 1 | 285505 | 3961530 | 5/19/2005 | Pre | Taken from in the drainage, standing slightly creek left (1/2m). To the north of sheer granite 7m tall slab. Water start. E: 285546 N: 3961453 acc. 9m | Looking upstream. View of red "mesa" on skyline. The drainage narrows upstream, there are granite walls and boulders for about 400m up the drainage from photopoint. |
| PP 225 Mile 2 | 1 | 285505 | 3961530 | 3/8/2006 | Post | Taken from in the drainage, standing slightly creek left (1/2m). To the north of sheer granite 7m tall slab. Water start. E: 285546 N: 3961453 acc. 9m | Post work. |
| PP 225 Mile 2 | 1 | 285505 | 3961530 | 5/20/2006 | Post | Taken from in the drainage, standing slightly creek left (1/2m). To the north of sheer granite 7m tall slab. Water start. E: 285546 N: 3961453 acc. 9m | Looking upstream. View of red mesa on skyline. The drainage narrows upstream, there are granite walls and boulders for about 400m up the drainage from photopoint. |
| PP 225 Mile 2 | 2 | 285505 | 3961530 | 5/19/2005 | Pre | Taken from in the drainage, standing slightly creek left (1/2m). To the north of sheer granite 7m tall slab. Water start. E: 285546 N: 3961453 acc. 9m | Looking downstream towards brown cliffs with the skyline visible. There are broken granite boulders visible. |
| PP 225 Mile 2 | 2 | 285505 | 3961530 | 3/8/2006 | Post | Taken from in the drainage, standing slightly creek left (1/2m). To the north of sheer granite 7m tall slab. Water start. E: 285546 N: 3961453 acc. 9m | Post work. |
| PP 225 Mile 2 | 2 | 285505 | 3961530 | 5/20/2006 | Post | Taken from in the drainage, standing slightly creek left (1/2m). To the north of sheer granite 7m tall slab. Water start. E: 285546 N: 3961453 acc. 9m | Looking downstream towards brown cliffs with the skyline visible. There are broken granite boulders visible. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|-----------|-----------------------|--|--|
| PP 225 Mile 2 | A | 285505 | 3961530 | 5/19/2005 | Pre | Taken from in the drainage, standing slightly creek left (1/2m). To the north of sheer granite 7m tall slab. Water start. E: 285546 N: 3961453 acc. 9m | Looking at photopoint with cliff on creek right. Taken from 10m downstream on creek left. |
| PP 225 Mile 3 | 1 | 285226 | 3961643 | 3/8/2006 | Post | Taken from a granite fin on creek left across from more granite. This is about 100m from the end of the section 3. Just downstream from a small Typha thicket. This is just above a wider flat area of the drainage. | Post work. |
| PP 225 Mile 3 | 1 | 285226 | 3961643 | 3/8/2006 | Pre | Taken from a granite fin on creek left across from more granite. This is about 100m from the end of the section 3. Just downstream from a small Typha thicket. This is just above a wider flat area of the drainage. | Looking downstream. |
| PP 225 Mile 3 | 1 | 285226 | 3961643 | 5/20/2006 | Post | Taken from a granite fin on creek left across from more granite. This is about 100m from the end of the section 3. Just downstream from a small Typha thicket. This is just above a wider flat area of the drainage. | Looking downstream. |
| PP 225 Mile 3 | 2 | 285226 | 3961643 | 5/20/2006 | Pre | Taken from a granite fin on creek left across from more granite. This is about 100m from the end of the section 3. Just downstream from a small Typha thicket. This is just above a wider flat area of the drainage. | Looking upstream, pre-treatment. |
| PP 225 Mile 3 | A | 285226 | 3961643 | 3/8/2006 | Pre | Taken from a granite fin on creek left across from more granite. This is about 100m from the end of the section 3. Just downstream from a small Typha thicket. This is just above a wider flat area of the drainage. | Chain pointing at photopoint. |
| PP 225 Mile 4-1 | 1 | 285183 | 3961966 | 5/19/2005 | Pre | Taken on top of a large, brown, Tapeats sandstone boulder (4x4x3m) on creek left. This is from a ??? Slope and upslope from a diagonally slanted 6x6x6m rock. | Looking upstream at a Tapeats (?) house-sized boulder garden. Vegetated. The Tapeats layer is in the foreground and the skyline has a redwall corner. There is a cascading talus slope at center left. |
| PP 225 Mile 4-1 | 2 | 285183 | 3961966 | 5/19/2005 | Pre | Taken on top of a large, brown, Tapeats sandstone boulder (4x4x3m) on creek left. This is from a ??? Slope and upslope from a diagonally slanted 6x6x6m rock. | Looking downstream. At the bottom right hand corner is a slab of Tapeats. There is a dry wash in the center and small outcrop on the skyline. The creek bends to creek right. |
| PP 225 Mile 4-1 | A | 285183 | 3961966 | 5/19/2005 | Pre | Taken on top of a large, brown, Tapeats sandstone boulder (4x4x3m) on creek left. This is from a ??? Slope and upslope from a diagonally slanted 6x6x6m rock. | Looking at Maggie on the photopoint with a large boulder on the right of the photo. |
| PP 225 Mile 4-2 | 1 | 285188 | 3961741 | 5/19/2005 | Pre | Taken from creek right on granite outcrop/ledge at the mouth of a side canyon also on creek right. | Looking upstream at dry, open about 10m wide creek bed and up at Supai/Redwall peak. |
| PP 225 Mile 4-2 | 2 | 285188 | 3961741 | 5/19/2005 | Pre | Taken from creek right on granite outcrop/ledge at the mouth of a side canyon also on creek right. | Looking downstream at cobbly/stony creek bed and a Tapeats wall. |
| PP 225 Mile 4-2 | 3 | 285188 | 3961741 | 5/19/2005 | Pre | Taken from creek right on granite outcrop/ledge at the mouth of a side canyon also on creek right. | Looking upstream at side canyon with Redwall/Muav in the distant skyline. |
| PP 225 Mile 4-2 | A | 285188 | 3961741 | 5/19/2005 | Pre | Taken from creek right on granite outcrop/ledge at the mouth of a side canyon also on creek right. | Looking upstream at Maggie on granite outcrop with Redwall in the distance. Taken from the center of the confluence and downstream of a granite outcropping. |
| PP 225 Mile 6 | 1 | 484959 | 3962175 | 5/19/2005 | Pre | GPS not recordable. Taken from the top of white granite poulover in mid-drainage creek bends creek right. There is no tamarisk in this area. Verify UTMS in field. | Looking upstream with white boulders in the foreground. Tapeats upslope in the background and TAMRAM on creek right by 8m granite wall. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|-----------|-----------------------|---|---|
| PP 225 Mile 6 | 2 | 484959 | 3962175 | 5/19/2005 | Pre | GPS not recordable. Taken from the top of white granite poulover in mid-drainage creek bends creek right. There is no tamarisk in this area. Verify UTMS in field. | Looking downstream over white granite boulders and down slope. |
| PP 225 Mile 6 | A | 484959 | 3962175 | 5/19/2005 | Pre | GPS not recordable. Taken from the top of white granite poulover in mid-drainage creek bends creek right. There is no tamarisk in this area. Verify UTMS in field. | Maggie at photopoint which is on a white granite boulder on the right and granite cliff on the left. Taken from 10m downstream and in the center of the drainage. |
| PP 70.8 Mile 1 | 1 | 422982 | 3993178 | 5/10/2005 | Pre | Downstream end of dripping seep emanating from Hakatai shale wall. | Looking upstream along seep toward linear TAMRAM patch. |
| PP 70.8 Mile 1 | 1 | 422982 | 3993178 | 3/7/2006 | Post | Downstream end of dripping seep emanating from Hakatai shale wall. | Post work. |
| PP 70.8 Mile 2 | 1 | 423078 | 3993050 | 5/10/2005 | Pre | Taken approx. 100m up drainage from TAMRAM on drainage left side where smaller drainage enters. The point is approx. 100m past TAMRAM. | Looking up drainage with cliff top against skyline. Vegetation, cliff and sky, as well as the drainage end are visible. |
| PP 70.8 Mile 2 | 2 | 423078 | 3993050 | 5/10/2005 | Pre | Taken approx. 100m up drainage from TAMRAM on drainage left side where smaller drainage enters. The point is approx. 100m past TAMRAM. | Looking down the drainage towards the river. |
| PP 70.8 Mile 2 | A | 423078 | 3993050 | 5/10/2005 | Pre | Taken approx. 100m up drainage from TAMRAM on drainage left side where smaller drainage enters. The point is approx. 100m past TAMRAM. | Nicole at photopoint (take fork on lookers right when walking up the drainage). The end of the drainage visible , as well as dry wash entering on drainage left. |
| PP 70.8 Mile 3 | 1 | 422966 | 3993324 | 5/10/2005 | Pre | Taken from a 3.5x1.5m basalt boulder in lookers left quadrant of wash as you walk up wash. | Looking up drainage. A flat topped butte in the background. |
| PP 70.8 Mile 3 | 2 | 422966 | 3993324 | 5/10/2005 | Pre | Taken from a 3.5x1.5m basalt boulder in lookers left quadrant of wash as you walk up wash. | Looking down wash at river with a big butte in the center. The wash bottom is visible. |
| PP 70.8 Mile 3 | A | 422966 | 3993324 | 5/10/2005 | Pre | Taken from a 3.5x1.5m basalt boulder in lookers left quadrant of wash as you walk up wash. | Carmen at photopoint. Looking up the drainage to photopoint and cliff face in the background against the skyline. |
| PP Badger 1-1 | 1 | 441351 | 4069827 | 5/4/2005 | Pre | Pock marked sandstone partially buried in the drainage near the mouth of canyon - above the high water line | View down the canyon showing seedlings and flowering tamarisk below the work area. |
| PP Badger 1-1 | 1 | 441351 | 4069827 | 5/3/2006 | Post | Pock marked sandstone partially buried in the drainage near the mouth of canyon - above the high water line | View down the canyon showing seedlings and flowering tamarisk below the work area. |
| PP Badger 1-1 | 2 | 441351 | 4069827 | 5/4/2005 | Pre | Pock marked sandstone partially buried in the drainage near the mouth of canyon - above the high water line | Looking up canyon. 4.2x 4.6x 1.5 meters |
| PP Badger 1-1 | 2 | 441351 | 4069827 | 5/3/2006 | Post | Pock marked sandstone partially buried in the drainage near the mouth of canyon - above the high water line | Looking up canyon. 4.2x4.6x1.5 meters. |
| PP Badger 1-1 | A | 441351 | 4069827 | 5/4/2005 | Pre | Pock marked sandstone partially buried in the drainage near the mouth of canyon - above the high water line | Steve at photopoint: mid-drainage about 6m down creek photopoint |
| PP Badger 1-1 | B | 441351 | 4069827 | 5/4/2005 | Pre | Pock marked sandstone partially buried in the drainage near the mouth of canyon - above the high water line | Steve on photopoint; mid-drainage about 6m down creek of photopoint |
| PP Badger 1-2 | 1 | 441043 | 4070176 | 5/4/2005 | Pre | Taken from tabletop boulder, standing about 2.25 meters above the drainage. This boulder is on the left looking downcanyon. Sandstone is at the base of the boulder and there is a conglomerate hill on the left. | Looking down canyon, includes canyon sky view. |
| PP Badger 1-2 | 1 | 441043 | 4070176 | 2/18/2006 | Post | Taken from tabletop boulder, standing about 2.25 meters above the drainage. This boulder is on the left looking downcanyon. Sandstone is at the base of the boulder and there is a conglomerate hill on the left. | Photo update. |

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| PP Badger 1-2 | 1 | 441043 | 4070176 | 5/3/2006 | Post | Taken from tabletop boulder, standing about 2.25 meters above the drainage. This boulder is on the left looking downcanyon. Sandstone is at the base of the boulder and there is a conglomerate hill on the left. | Looking down canyon, includes canyon sky view. |
| PP Badger 1-2 | 2 | 441043 | 4070176 | 5/4/2005 | Pre | Taken from tabletop boulder, standing about 2.25 meters above the drainage. This boulder is on the left looking downcanyon. Sandstone is at the base of the boulder and there is a conglomerate hill on the left. | Looking up canyon. Small mature tamarisk in the bottom left of photo. |
| PP Badger 1-2 | 2 | 441043 | 4070176 | 2/18/2006 | Post | Taken from tabletop boulder, standing about 2.25 meters above the drainage. This boulder is on the left looking downcanyon. Sandstone is at the base of the boulder and there is a conglomerate hill on the left. | Photo update. |
| PP Badger 1-2 | 2 | 441043 | 4070176 | 5/3/2006 | Post | Taken from tabletop boulder, standing about 2.25 meters above the drainage. This boulder is on the left looking downcanyon. Sandstone is at the base of the boulder and there is a conglomerate hill on the left. | Looking up canyon. |
| PP Badger 1-2 | A | 441043 | 4070176 | 5/4/2005 | Pre | Taken from tabletop boulder, standing about 2.25 meters above the drainage. This boulder is on the left looking downcanyon. Sandstone is at the base of the boulder and there is a conglomerate hill on the left. | Taken 6m down canyon from Nicole on photopoint. |
| PP Badger 1-2 | B | 441043 | 4070176 | 5/4/2005 | Pre | Taken from tabletop boulder, standing about 2.25 meters above the drainage. This boulder is on the left looking downcanyon. Sandstone is at the base of the boulder and there is a conglomerate hill on the left. | Taken from about 8m up canyon from the photopoint |
| PP Badger 2-1 | 1 | 440761 | 4070186 | 5/4/2005 | Pre | 2.5x2x3 meter, flat-topped sandstone boulder on canyon right | Looking down canyon. A large pacman boulder is on the left with a mature tamarisk nearby. |
| PP Badger 2-1 | 1 | 440761 | 4070186 | 2/18/2006 | Post | 2.5x2x3 meter, flat-topped sandstone boulder on canyon right | Photo update. |
| PP Badger 2-1 | 1 | 440761 | 4070186 | 5/3/2006 | Post | 2.5x2x3 meter, flat-topped sandstone boulder on canyon right | Looking down canyon. A large pacman boulder is on the left, no more tammy there! |
| PP Badger 2-1 | 2 | 440761 | 4070186 | 5/4/2005 | Pre | 2.5x2x3 meter, flat-topped sandstone boulder on canyon right | Looking up canyon. |
| PP Badger 2-1 | 2 | 440761 | 4070186 | 2/18/2006 | Post | 2.5x2x3 meter, flat-topped sandstone boulder on canyon right | Photo update. |
| PP Badger 2-1 | 2 | 440761 | 4070186 | 5/3/2006 | Post | 2.5x2x3 meter, flat-topped sandstone boulder on canyon right | Looking up canyon. |
| PP Badger 2-1 | A | 440761 | 4070186 | 5/4/2005 | Pre | 2.5x2x3 meter, flat-topped sandstone boulder on canyon right | Taken from 4m down canyon from photopoint from a boulder |
| PP Badger 2-1 | B | 440761 | 4070186 | 5/4/2005 | Pre | 2.5x2x3 meter, flat-topped sandstone boulder on canyon right | Taken 15m down canyon from the photopoint. |
| PP Badger 2-1 | C | 440761 | 4070186 | 5/4/2005 | Pre | 2.5x2x3 meter, flat-topped sandstone boulder on canyon right | Taken from 15m up canyon from photopoint, looking down canyon. |
| PP Badger 2-2 | 1 | 440518 | 4070225 | 5/4/2005 | Pre | Taken from just above a 2m step up. There is a boulder 4x3 meters on creek left. | Looking downstream. Waterfall tier in lower right corner and a cube rock on creek left. |
| PP Badger 2-2 | 1 | 440518 | 4070225 | 2/18/2006 | Post | Taken from just above a 2m step up. There is a boulder 4x3 meters on creek left. | Photo update. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|-----------|-----------------------|--|---|
| PP Badger 2-2 | 1 | 440518 | 4070225 | 5/5/2006 | Post | Taken from just above a 2m step up. There is a boulder 4x3 meters on creek left. | Looking downstream. Waterfall tier in lower right corner and cube rock on creek left. |
| PP Badger 2-2 | 2 | 440518 | 4070225 | 5/4/2005 | Pre | Taken from just above a 2m step up. There is a boulder 4x3 meters on creek left. | Looking upstream. A small mature tamarisk in the lower left corner and a 4m dry fall in center right. |
| PP Badger 2-2 | 2 | 440518 | 4070225 | 2/18/2006 | Post | Taken from just above a 2m step up. There is a boulder 4x3 meters on creek left. | Photo update. |
| PP Badger 2-2 | 2 | 440518 | 4070225 | 5/3/2006 | Post | Taken from just above a 2m step up. There is a boulder 4x3 meters on creek left. | Looking upstream. No more tammies in view! |
| PP Badger 2-2 | A | 440518 | 4070225 | 5/4/2005 | Pre | Taken from just above a 2m step up. There is a boulder 4x3 meters on creek left. | Taken just above 2 m step-up from a boulder 4x3m wide on creek left. |
| PP Badger 3 | 1 | 440303 | 4070353 | 5/4/2005 | Pre | Taken from large white boulder, a broken cube rock is behind on creek left. This is about 120 meters from a dry falls and at the end of the hike. | Looking downstream at a large mature tamarisk in the bottom left. Large rectangular boulder is on creek right. |
| PP Badger 3 | 1 | 440303 | 4070353 | 2/18/2006 | Post | Taken from large white boulder, a broken cube rock is behind on creek left. This is about 120 meters from a dry falls and at the end of the hike. | Photo update. |
| PP Badger 3 | 1 | 440303 | 4070353 | 5/3/2006 | Post | Taken from large white boulder, a broken cube rock is behind on creek left. This is about 120 meters from a dry falls and at the end of the hike. | Looking downstream with a large rectangular boulder on creek right. |
| PP Badger 3 | 2 | 440303 | 4070353 | 5/4/2005 | Pre | Taken from large white boulder, a broken cube rock is behind on creek left. This is about 120 meters from a dry falls and at the end of the hike. | Looking upstream. There is a broken cubed rock in the center of the photo. |
| PP Badger 3 | 2 | 440303 | 4070353 | 5/3/2006 | Post | Taken from large white boulder, a broken cube rock is behind on creek left. This is about 120 meters from a dry falls and at the end of the hike. | Looking upstream. There is a broken cubed rock in the center of the photo. |
| PP Badger 3 | A | 440303 | 4070353 | 5/4/2005 | Pre | Taken from large white boulder, a broken cube rock is behind on creek left. This is about 120 meters from a dry falls and at the end of the hike. | Chris at photopoint; taken looking up canyon from a large, white boulder with a broken cube rock behind. Taken from creek left. |
| PP Boucher 15 | 1 | 388051 | 3996150 | 1/8/2006 | Pre | Taken from a meter long boulder at a small pool in the Tapeats narrows. Just upstream of a straight stretch, about 30m, that is lined by grass on both sides of the creek. | Looking downstream at wall to TAMRAMs of right and a wall of sandstone on the left. |
| PP Boucher 15 | 1 | 388051 | 3996150 | 1/8/2006 | Post | Taken from a meter long boulder at a small pool in the Tapeats narrows. Just upstream of a straight stretch, about 30m, that is lined by grass on both sides of the creek. | Post work. |
| PP Boucher 15 | 2 | 388051 | 3996150 | 1/8/2006 | Pre | Taken from a meter long boulder at a small pool in the Tapeats narrows. Just upstream of a straight stretch, about 30m, that is lined by grass on both sides of the creek. | Looking across stream to dense thicket of TAMRAM. |
| PP Boucher 15 | 2 | 388051 | 3996150 | 1/8/2006 | Post | Taken from a meter long boulder at a small pool in the Tapeats narrows. Just upstream of a straight stretch, about 30m, that is lined by grass on both sides of the creek. | Post work. |
| PP Boucher 15 | 3 | 388051 | 3996150 | 1/8/2006 | Pre | Taken from a meter long boulder at a small pool in the Tapeats narrows. Just upstream of a straight stretch, about 30m, that is lined by grass on both sides of the creek. | Looking upstream to TAMRAM on both sides of creek. Tapeats wall is in the background. |
| PP Boucher 15 | 3 | 388051 | 3996150 | 1/8/2006 | Post | Taken from a meter long boulder at a small pool in the Tapeats narrows. Just upstream of a straight stretch, about 30m, that is lined by grass on both sides of the creek. | Post work. |

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|-----------------|------|-------------|--------------|----------|-----------------------|--|--|
| PP Boucher 15 | A | 388051 | 3996150 | 1/8/2006 | Pre | Taken from a meter long boulder at a small pool in the Tapeats narrows. Just upstream of a straight stretch, about 30m, that is lined by grass on both sides of the creek. | Pen pointing at photopoint. |
| PP Boucher 16-1 | 1 | 388378 | 3996438 | 1/6/2006 | Post | Photo taken from the large boulder that is close to both the creek and a social trail to access the creek. This is right at the creek right edge and 5m upstream of a large TAMRAM. | Post work. |
| PP Boucher 16-1 | 1 | 388378 | 3996438 | 1/6/2006 | Pre | Photo taken from the large boulder that is close to both the creek and a social trail to access the creek. This is right at the creek right edge and 5m upstream of a large TAMRAM. | Looking downstream at mature TAMRAM and a large butte in left background. |
| PP Boucher 16-1 | 2 | 388378 | 3996438 | 1/6/2006 | Pre | Photo taken from the large boulder that is close to both the creek and a social trail to access the creek. This is right at the creek right edge and 5m upstream of a large TAMRAM. | Looking upstream towards tapeats narrows of Boucher Creek. |
| PP Boucher 16-1 | 2 | 388378 | 3996438 | 1/6/2006 | Post | Photo taken from the large boulder that is close to both the creek and a social trail to access the creek. This is right at the creek right edge and 5m upstream of a large TAMRAM. | Post work. |
| PP Boucher 16-1 | A | 388378 | 3996438 | 1/6/2006 | Pre | Photo taken from the large boulder that is close to both the creek and a social trail to access the creek. This is right at the creek right edge and 5m upstream of a large TAMRAM. | Val on a large gray limestone (5x4x3m) boulder (photopoint). |
| PP Boucher 16-2 | 1 | 388279 | 3996343 | 1/5/2006 | Post | Taken from the highest, NW corner of the boulder. This is upstream of a small bend in the creek, about 150m from the camp and still below the Tapeats narrows. | Post work. |
| PP Boucher 16-2 | 1 | 388279 | 3996343 | 1/6/2006 | Pre | Taken from the highest, NW corner of the boulder. This is upstream of a small bend in the creek, about 150m from the camp and still below the Tapeats narrows. | Looking downstream at vegetation, TAMRAM protruding. |
| PP Boucher 16-2 | 2 | 388279 | 3996343 | 1/6/2006 | Pre | Taken from the highest, NW corner of the boulder. This is upstream of a small bend in the creek, about 150m from the camp and still below the Tapeats narrows. | Looking upstream towards Tapeats narrows with TAMRAM in the right half of the shot. |
| PP Boucher 16-2 | 2 | 388279 | 3996343 | 1/6/2006 | Post | Taken from the highest, NW corner of the boulder. This is upstream of a small bend in the creek, about 150m from the camp and still below the Tapeats narrows. | Post work. |
| PP Boucher 16-2 | A | 388279 | 3996343 | 1/6/2006 | Pre | Taken from the highest, NW corner of the boulder. This is upstream of a small bend in the creek, about 150m from the camp and still below the Tapeats narrows. | Tweezers pointing to the point where photo was taken on the large, flat, pinkish picnic rock. |
| PP Boucher 16-3 | 1 | 388208 | 3996248 | 1/7/2006 | Post | Taken from atop a 3x3x2m boulder on creek right. Just upstream the creek begins to get into the narrows with more pools and spill offs. It is still open here and about 250m above Boucher Camp. | Post work. |
| PP Boucher 16-3 | 1 | 388208 | 3996248 | 1/7/2006 | Pre | Taken from atop a 3x3x2m boulder on creek right. Just upstream the creek begins to get into the narrows with more pools and spill offs. It is still open here and about 250m above Boucher Camp. | Looking downstream at fairly dense vegetation. A cottonwood skeleton appears at photo right. |
| PP Boucher 16-3 | 2 | 388208 | 3996248 | 1/7/2006 | Pre | Taken from atop a 3x3x2m boulder on creek right. Just upstream the creek begins to get into the narrows with more pools and spill offs. It is still open here and about 250m above Boucher Camp. | Looking across the stream. There is a white boulder at bottom right and a mature TAMRAM on the opposite side of the creek. |
| PP Boucher 16-3 | 2 | 388208 | 3996248 | 1/7/2006 | Post | Taken from atop a 3x3x2m boulder on creek right. Just upstream the creek begins to get into the narrows with more pools and spill offs. It is still open here and about 250m above Boucher Camp. | Post work. |

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|-----------------|------|-------------|--------------|-----------|-----------------------|--|---|
| PP Boucher 16-3 | 3 | 388208 | 3996248 | 1/7/2005 | Pre | Taken from atop a 3x3x2m boulder on creek right. Just upstream the creek begins to get into the narrows with more pools and spill offs. It is still open here and about 250m above Boucher Camp. | Looking upstream. There is a roundish boulder in the foreground. Scattered TAMRAM. Beginning of tapeats section behind. |
| PP Boucher 16-3 | 3 | 388208 | 3996248 | 1/7/2006 | Post | Taken from atop a 3x3x2m boulder on creek right. Just upstream the creek begins to get into the narrows with more pools and spill offs. It is still open here and about 250m above Boucher Camp. | Post work. |
| PP Boucher 16-3 | A | 388208 | 3996248 | 1/7/2006 | Pre | Taken from atop a 3x3x2m boulder on creek right. Just upstream the creek begins to get into the narrows with more pools and spill offs. It is still open here and about 250m above Boucher Camp. | Pen pointing at photopoint. |
| PP Boucher 5 | 1 | 388382 | 3997022 | 3/4/2004 | Pre | Standing on a pink sandstone rock just right of creek, 210 m downstream from Topaz 9. | Looking across the creek to canyon left at a TAMRAM stand. |
| PP Boucher 5 | 1 | 388382 | 3997022 | 3/14/2004 | Post | Standing on a pink sandstone rock just right of creek, 210 m downstream from Topaz 9. | Post work. |
| PP Boucher 5 | 1 | 388382 | 3997022 | 6/2/2004 | Post | Standing on a pink sandstone rock just right of creek, 210 m downstream from Topaz 9. | Post work. |
| PP Boucher 5 | 1 | 388382 | 3997022 | 2/23/2005 | Post | Standing on a pink sandstone rock just right of creek, 210 m downstream from Topaz 9. | Post work. Looking across canyon. |
| PP Boucher 5 | 1 | 388382 | 3997022 | 4/29/2005 | Post | Standing on a pink sandstone rock just right of creek, 210 m downstream from Topaz 9. | Looking canyon left. This is a retake photo. |
| PP Boucher 5 | 2 | 388382 | 3997022 | 4/29/2005 | Post | Standing on a pink sandstone rock just right of creek, 210 m downstream from Topaz 9. | Looking down canyon. |
| PP Boucher 5 | 3 | 388382 | 3997022 | 4/29/2005 | Post | Standing on a pink sandstone rock just right of creek, 210 m downstream from Topaz 9. | Looking canyon right. |
| PP Boucher 5 | 4 | 388382 | 3997022 | 4/29/2005 | Post | Standing on a pink sandstone rock just right of creek, 210 m downstream from Topaz 9. | Looking up canyon. |
| PP Boucher 5 | A | 388382 | 3997022 | 3/14/2004 | Pre | Standing on a pink sandstone rock just right of creek, 210 m downstream from Topaz 9. | Leslie at pink rock photopoint. |
| PP Boucher 5 | A | 388382 | 3997022 | 4/29/2005 | Post | Standing on a pink sandstone rock just right of creek, 210 m downstream from Topaz 9. | Donna and pack at photopoint. |
| PP Boucher 6 | 1 | 388386 | 3996472 | 2/27/2006 | Post | Taken from a schist outcropping on the west side of the drainage. This is right at the campground area. | Post work. |
| PP Boucher 6 | 1 | 388386 | 3996472 | 2/27/2006 | Pre | Taken from a schist outcropping on the west side of the drainage. This is right at the campground area. | Looking downstream at a large schist wall to the north. |
| PP Boucher 6 | 2 | 388386 | 3996472 | 2/27/2006 | Post | Taken from a schist outcropping on the west side of the drainage. This is right at the campground area. | Post work. |
| PP Boucher 6 | 2 | 388386 | 3996472 | 2/27/2006 | Pre | Taken from a schist outcropping on the west side of the drainage. This is right at the campground area. | Looking east at TAMRAM across the stream on creek right. There is a Tapeats alcove in the background. |
| PP Boucher 6 | 3 | 388386 | 3996472 | 2/27/2006 | Post | Taken from a schist outcropping on the west side of the drainage. This is right at the campground area. | Post work. |
| PP Boucher 6 | 3 | 388386 | 3996472 | 2/27/2006 | Pre | Taken from a schist outcropping on the west side of the drainage. This is right at the campground area. | Looking upstream at redwall break in the background. |
| PP Boucher 6 | A | 388386 | 3996472 | 2/27/2006 | Pre | Taken from a schist outcropping on the west side of the drainage. This is right at the campground area. | Stick pointing at the photopoint. Can see the Redwall route of Boucher Trail coming in. |

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|-------------------|------|-------------|--------------|-----------|-----------------------|--|--|
| PP Boucher 9 | 1 | 385226 | 3993424 | 2/27/2006 | Post | Taken on a ledge on lookers left of cliff seep on the cliff wall. This may not be exactly associated with Section 9, so double check in the field and rename accordingly. | Post work. |
| PP Boucher 9 | 1 | 385226 | 3993424 | 2/27/2006 | Pre | Taken on a ledge on lookers left of cliff seep on the cliff wall. This may not be exactly associated with Section 9, so double check in the field and rename accordingly. | Looking up and across at the TAMRAM in the seep. |
| PP Boucher 9 | 2 | 385226 | 3993424 | 2/27/2006 | Pre | Taken on a ledge on lookers left of cliff seep on the cliff wall. This may not be exactly associated with Section 9, so double check in the field and rename accordingly. | No description or bearing. |
| PP Boucher 9 | A | 385226 | 3993424 | 2/27/2006 | Pre | Taken on a ledge on lookers left of cliff seep on the cliff wall. This may not be exactly associated with Section 9, so double check in the field and rename accordingly. | Pen points at photopoint. |
| PP Boucher East 1 | 1 | 388529 | 3996261 | 1/5/2006 | Pre | This photopoint is taken about 300 meters up the east fork of the Boucher side canyon that runs into the Boucher Creek right at the campground. Taken from creek right on a Tapeats ledge near a small amphitheater. | Looking upstream at a mature TAMRAM with Tapeats narrows in the background. |
| PP Boucher East 1 | 1 | 388529 | 3996261 | 1/5/2006 | Post | This photopoint is taken about 300 meters up the east fork of the Boucher side canyon that runs into the Boucher Creek right at the campground. Taken from creek right on a Tapeats ledge near a small amphitheater. | Post work. Looking upstream after large TAMRAM was felled. |
| PP Boucher East 1 | A | 388529 | 3996261 | 1/5/2006 | Pre | This photopoint is taken about 300 meters up the east fork of the Boucher side canyon that runs into the Boucher Creek right at the campground. Taken from creek right on a Tapeats ledge near a small amphitheater. | Steve on a Tapeats ledge. Behind him is Boucher Creek. |
| PP Boulder 1 | 1 | 406800 | 3990793 | 6/10/2005 | Pre | Taken from the Tonto Trail. | Upstream view of the west fork of Boulder Creek. |
| PP Boulder 2 | 1 | 406664 | 3990358 | 6/10/2005 | Pre | Taken from the top of a limestone boulder. | Downstream tamarisk takes up most of the left foreground. |
| PP Boulder 3 | 1 | 407139 | 3991023 | 6/10/2005 | Pre | Taken from a ledge at the top of a tapeats gorge. | Photo of the gorge below a pouroff. |
| PP Boulder 4 | 1 | 407428 | 3991187 | 6/10/2005 | Pre | Taken from bedrock next to creek. | Downstream view of tamarisk. |
| PP Boulder 5 | 1 | 408362 | 3990648 | 6/10/2005 | Pre | Taken from a tapeats ledge next to the Tonto Trail. | Wash with tamarisk in the left foreground. Angel's Gate in the top right background. |
| PP Boulder 9 | 1 | 407180 | 3991090 | 2/6/2006 | Post | Taken from a sandy spot at the creek's first bend towards the NW. This is after the pouroff, about 300m below the Tonto crossing Boulder Canyon. This photopoint is also about 40m below the waterfall at the bottom of the Tapeats and the top of the schist. | Post work. |
| PP Boulder 9 | 1 | 407180 | 3991090 | 2/6/2006 | Pre | Taken from a sandy spot at the creek's first bend towards the NW. This is after the pouroff, about 300m below the Tonto crossing Boulder Canyon. This photopoint is also about 40m below the waterfall at the bottom of the Tapeats and the top of the schist. | Looking upstream at 2 matures. |
| PP Boulder 9 | 2 | 407180 | 3991090 | 2/6/2006 | Pre | Taken from a sandy spot at the creek's first bend towards the NW. This is after the pouroff, about 300m below the Tonto crossing Boulder Canyon. This photopoint is also about 40m below the waterfall at the bottom of the Tapeats and the top of the schist. | Looking across stream at two big matures. |

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| PP Boulder 9 | 2 | 407180 | 3991090 | 2/6/2006 | Post | Taken from a sandy spot at the creek's first bend towards the NW. This is after the pouroff, about 300m below the Tonto crossing Boulder Canyon. This photopoint is also about 40m below the waterfall at the bottom of the Tapeats and the top of the schist. | Post work. |
| PP Boulder 9 | A | 407180 | 3991090 | 2/6/2006 | Pre | Taken from a sandy spot at the creek's first bend towards the NW. This is after the pouroff, about 300m below the Tonto crossing Boulder Canyon. This photopoint is also about 40m below the waterfall at the bottom of the Tapeats and the top of the schist. | Jaime standing on schist. The Great Unconformity in the background. |
| PP Boulder 9-1 | 1 | 407343 | 3991140 | 2/6/2006 | Post | Taken from the top of a 1x1x1m polished white limestone boulder lying in the middle of the Boulder Creek drainage. This area is about 200m below the Tapeats pouroff and about 100m above the start of the narrow schist bedrock, pretty section. | Post work. |
| PP Boulder 9-1 | 1 | 407343 | 3991140 | 2/6/2006 | Pre | Taken from the top of a 1x1x1m polished white limestone boulder lying in the middle of the Boulder Creek drainage. This area is about 200m below the Tapeats pouroff and about 100m above the start of the narrow schist bedrock, pretty section. | Looking downstream, beginning of schist narrow in background. |
| PP Boulder 9-1 | 2 | 407343 | 3991140 | 2/6/2006 | Post | Taken from the top of a 1x1x1m polished white limestone boulder lying in the middle of the Boulder Creek drainage. This area is about 200m below the Tapeats pouroff and about 100m above the start of the narrow schist bedrock, pretty section. | Post work. |
| PP Boulder 9-1 | 2 | 407343 | 3991140 | 2/6/2006 | Pre | Taken from the top of a 1x1x1m polished white limestone boulder lying in the middle of the Boulder Creek drainage. This area is about 200m below the Tapeats pouroff and about 100m above the start of the narrow schist bedrock, pretty section. | Looking up and across stream toward the east wall of Boulder with a mature TAMRAM in center. |
| PP Boulder 9-1 | 3 | 407343 | 3991140 | 2/6/2006 | Post | Taken from the top of a 1x1x1m polished white limestone boulder lying in the middle of the Boulder Creek drainage. This area is about 200m below the Tapeats pouroff and about 100m above the start of the narrow schist bedrock, pretty section. | Post work. |
| PP Boulder 9-1 | 3 | 407343 | 3991140 | 2/6/2006 | Pre | Taken from the top of a 1x1x1m polished white limestone boulder lying in the middle of the Boulder Creek drainage. This area is about 200m below the Tapeats pouroff and about 100m above the start of the narrow schist bedrock, pretty section. | Looking upstream at tall willows and also many TAMRAM interspersed. |
| PP Boulder 9-1 | A | 407343 | 3991140 | 2/6/2006 | Pre | Taken from the top of a 1x1x1m polished white limestone boulder lying in the middle of the Boulder Creek drainage. This area is about 200m below the Tapeats pouroff and about 100m above the start of the narrow schist bedrock, pretty section. | Pen pointing at photopoint. Taken from upstream of boulder by about 10m, in the drainage, but looking across to the Eastern wall of Boulder. |
| PP Bright Angel 1 | 1 | 401676 | 3995542 | 9/30/2005 | Pre | Taken near the Colorado River on a mound in drainage. The mound has a prominent clump of ACAGRE and sits between 2 forks of the Bright Angel Creek. The left fork is currently dry. | Standing with back to Colorado river and looking toward Phantom Ranch. Red rock mountains lined in green with 2 cottonwoods in the site. |

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|--------------------|------|-------------|--------------|-----------|-----------------------|---|---|
| PP Bright Angel 1 | 1 | 401676 | 3995542 | 4/1/2006 | Post | Taken near the Colorado River on a mound in drainage. The mound has a prominent clump of ACAGRE and sits between 2 forks of the Bright Angel Creek. The left fork is currently dry. | Photo update. |
| PP Bright Angel 1 | 2 | 401676 | 3995542 | 9/30/2005 | Pre | Taken near the Colorado River on a mound in drainage. The mound has a prominent clump of ACAGRE and sits between 2 forks of the Bright Angel Creek. The left fork is currently dry. | Standing with right shoulder to Colorado. Red rock mountains lined in green, large building-like rock formation at the highest point. |
| PP Bright Angel 1 | 2 | 401676 | 3995542 | 4/1/2006 | Post | Taken near the Colorado River on a mound in drainage. The mound has a prominent clump of ACAGRE and sits between 2 forks of the Bright Angel Creek. The left fork is currently dry. | Photo update. |
| PP Bright Angel 1 | 3 | 401676 | 3995542 | 9/30/2005 | Pre | Taken near the Colorado River on a mound in drainage. The mound has a prominent clump of ACAGRE and sits between 2 forks of the Bright Angel Creek. The left fork is currently dry. | Looking towards Colorado River with back to creek. Black bridge and an ACAGRE in view. |
| PP Bright Angel 1 | 3 | 401676 | 3995542 | 4/1/2006 | Post | Taken near the Colorado River on a mound in drainage. The mound has a prominent clump of ACAGRE and sits between 2 forks of the Bright Angel Creek. The left fork is currently dry. | Photo update. |
| PP Bright Angel 1 | 4 | 401676 | 3995542 | 9/30/2005 | Pre | Taken near the Colorado River on a mound in drainage. The mound has a prominent clump of ACAGRE and sits between 2 forks of the Bright Angel Creek. The left fork is currently dry. | Standing with left shoulder to Colorado river. Looking at tall, black, striated cliffs. An ACAGRE is a little to the left. |
| PP Bright Angel 1 | 4 | 401676 | 3995542 | 4/1/2006 | Post | Taken near the Colorado River on a mound in drainage. The mound has a prominent clump of ACAGRE and sits between 2 forks of the Bright Angel Creek. The left fork is currently dry. | Photo update. |
| PP Bright Angel 1 | A | 401676 | 3995542 | 9/30/2005 | Pre | Taken near the Colorado River on a mound in drainage. The mound has a prominent clump of ACAGRE and sits between 2 forks of the Bright Angel Creek. The left fork is currently dry. | Melissa standing on the red rock photopoint. |
| PP Bright Angel 10 | 1 | 402275 | 3997692 | 2/20/2004 | Pre | Taken from pipe cover on the trail about 150m above the GPS reading. GPS would not read at photopoint. Second description: After a small water pipe covering (the next one you see going up canyon) walk about 10 strides and look towards creek | Overlooking creek from left bend in creek/trail. |
| PP Bright Angel 10 | 1 | 402275 | 3997692 | 3/24/2005 | Pre | Taken from pipe cover on the trail about 150m above the GPS reading. GPS would not read at photopoint. Second description: After a small water pipe covering (the next one you see going up canyon) walk about 10 strides and look towards creek | Retake. |
| PP Bright Angel 10 | 1 | 402275 | 3997692 | 4/2/2006 | Post | Taken from pipe cover on the trail about 150m above the GPS reading. GPS would not read at photopoint. Second description: After a small water pipe covering (the next one you see going up canyon) walk about 10 strides and look towards creek | Photo update. |

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|----------------------|------|-------------|--------------|-----------|-----------------------|---|--|
| PP Bright Angel 10 | A | 402275 | 3997692 | 2/20/2004 | Pre | Taken from pipe cover on the trail about 150m above the GPS reading. GPS would not read at photopoint. Second description: After a small water pipe covering (the next one you see going up canyon) walk about 10 strides and look towards creek | Steve at photopoint. |
| PP Bright Angel 11-1 | 1 | 402750 | 3997919 | 2/20/2004 | Pre | Standing on the upstream corner of a 3m tall wall. | Looking upstream. |
| PP Bright Angel 11-1 | 1 | 402750 | 3997919 | 3/24/2005 | Pre | Standing on the upstream corner of a 3m tall wall. | Retake. |
| PP Bright Angel 11-1 | 1 | 402750 | 3997919 | 4/2/2006 | Post | Standing on the upstream corner of a 3m tall wall. | Photo update. |
| PP Bright Angel 11-1 | A | 402750 | 3997919 | 2/20/2004 | Pre | Standing on the upstream corner of a 3m tall wall. | Steve at photopoint. |
| PP Bright Angel 11-2 | 1 | 405060 | 4001551 | 12/9/2006 | Post | Approx. 100m downstream from Ribbon Falls bridge sign on creek left. 2x3m limestone boulder in between cluster of mature catclaw and 5m tall peach colored limestone boulder. | Post work. |
| PP Bright Angel 11-2 | 1 | 405060 | 4001551 | 12/9/2006 | Pre | Approx. 100m downstream from Ribbon Falls bridge sign on creek left. 2x3m limestone boulder in between cluster of mature catclaw and 5m tall peach colored limestone boulder. | Looking upstream. |
| PP Bright Angel 11-2 | 2 | 405060 | 4001551 | 12/9/2006 | Pre | Approx. 100m downstream from Ribbon Falls bridge sign on creek left. 2x3m limestone boulder in between cluster of mature catclaw and 5m tall peach colored limestone boulder. | Looking downstream. |
| PP Bright Angel 11-2 | A | 405060 | 4001551 | 12/9/2006 | Pre | Approx. 100m downstream from Ribbon Falls bridge sign on creek left. 2x3m limestone boulder in between cluster of mature catclaw and 5m tall peach colored limestone boulder. | Pen points to photopoint. Taken from down stream approx. 20m, in front of a peach colored limestone boulder. |
| PP Bright Angel 12 | 1 | 403060 | 3998276 | 2/20/2004 | Pre | Left of trail on a blade-like rock. | Looking downstream on creek left at large tamarisk. |
| PP Bright Angel 12 | 1 | 403060 | 3998276 | 4/2/2006 | Post | Left of trail on a blade-like rock. | Photo update. |
| PP Bright Angel 12 | A | 403060 | 3998276 | 2/20/2004 | Pre | Left of trail on a blade-like rock. | Steve at photopoint. |
| PP Bright Angel 12 | B | 403060 | 3998276 | 4/2/2006 | Pre | Left of trail on a blade-like rock. | Jill on photopoint rock. Taken from downstream about 10m, looking up canyon. |
| PP Bright Angel 13 | 1 | 403540 | 3999588 | 2/20/2004 | Pre | Taken from the left edge of the trail by the telephone pole and a small electrical box. | Looking over the creek from the left edge of trail across to schist. |
| PP Bright Angel 13 | 1 | 403540 | 3999588 | 4/2/2006 | Post | Taken from the left edge of the trail by the telephone pole and a small electrical box. | Photo update. |
| PP Bright Angel 13 | A | 403540 | 3999588 | 2/20/2004 | Pre | Taken from the left edge of the trail by the telephone pole and a small electrical box. | Steve at photopoint. |
| PP Bright Angel 14 | 1 | 403554 | 3999548 | 9/29/2005 | Pre | Taken from a 1x1m limestone boulder that is part of a clump of boulders. This is at the upstream end of a large Acacia patch elevated above the creek and on creek left. | Looking up creek towards creek right at tamarisk infestation with back to ACAGRE. |
| PP Bright Angel 14 | 1 | 403554 | 3999548 | 4/2/2006 | Post | Taken from a 1x1m limestone boulder that is part of a clump of boulders. This is at the upstream end of a large Acacia patch elevated above the creek and on creek left. | Photo update. |
| PP Bright Angel 14 | 2 | 403554 | 3999548 | 9/30/2005 | Pre | Taken from a 1x1m limestone boulder that is part of a clump of boulders. This is at the upstream end of a large Acacia patch elevated above the creek and on creek left. | Looking creek right at the creek edge. |
| PP Bright Angel 14 | 2 | 403554 | 3999548 | 4/2/2006 | Post | Taken from a 1x1m limestone boulder that is part of a clump of boulders. This is at the upstream end of a large Acacia patch elevated above the creek and on creek left. | Photo update. |
| PP Bright Angel 14 | 3 | 403554 | 3999548 | 9/29/2005 | Pre | Taken from a 1x1m limestone boulder that is part of a clump of boulders. This is at the upstream end of a large Acacia patch elevated above the creek and on creek left. | Looking right at a bend in the creek. Looking through the ACAGRE. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|----------------------|------|-------------|--------------|-----------|-----------------------|---|---|
| PP Bright Angel 14 | 3 | 403554 | 3999548 | 4/2/2006 | Post | Taken from a 1x1m limestone boulder that is part of a clump of boulders. This is at the upstream end of a large Acacia patch elevated above the creek and on creek left. | Photo update. |
| PP Bright Angel 14 | A | 403554 | 3999548 | 9/29/2005 | Pre | Taken from a 1x1m limestone boulder that is part of a clump of boulders. This is at the upstream end of a large Acacia patch elevated above the creek and on creek left. | Looking up creek at Maria standing on photopoint boulder. ACAGRE in background. |
| PP Bright Angel 14 | B | 403554 | 3999548 | 9/29/2005 | Pre | Taken from a 1x1m limestone boulder that is part of a clump of boulders. This is at the upstream end of a large Acacia patch elevated above the creek and on creek left. | Maria standing at photopoint. |
| PP Bright Angel 15 | 1 | 403629 | 3999749 | 9/29/2005 | Pre | Taken from large Zoroaster granite outcropping on creek right at the base of a shallow side canyon with a seep trickling. Standing on a outcropping near a metal stake in rock. | Looking down creek from creek left at tamarisk clump. Trail prominent, bend in trail directly in front of power line pole on trail. |
| PP Bright Angel 15 | 1 | 403629 | 3999749 | 4/2/2006 | Post | Taken from large Zoroaster granite outcropping on creek right at the base of a shallow side canyon with a seep trickling. Standing on a outcropping near a metal stake in rock. | Photo update. |
| PP Bright Angel 15 | 2 | 403629 | 3999749 | 9/29/2005 | Pre | Taken from large Zoroaster granite outcropping on creek right at the base of a shallow side canyon with a seep trickling. Standing on a outcropping near a metal stake in rock. | Directly perpendicular view of trail. Still standing on photopoint rock. |
| PP Bright Angel 15 | 2 | 403629 | 3999749 | 4/2/2006 | Post | Taken from large Zoroaster granite outcropping on creek right at the base of a shallow side canyon with a seep trickling. Standing on a outcropping near a metal stake in rock. | Photo update. |
| PP Bright Angel 15 | 3 | 403629 | 3999749 | 9/29/2005 | Pre | Taken from large Zoroaster granite outcropping on creek right at the base of a shallow side canyon with a seep trickling. Standing on a outcropping near a metal stake in rock. | Photographer has right shoulder towards trail, looking up creek at infestation. Skyline prominent and a view of the N. Rim Coconino is visible. |
| PP Bright Angel 15 | 3 | 403629 | 3999749 | 4/2/2006 | Post | Taken from large Zoroaster granite outcropping on creek right at the base of a shallow side canyon with a seep trickling. Standing on a outcropping near a metal stake in rock. | Photo update. |
| PP Bright Angel 15 | 4 | 403629 | 3999749 | 9/29/2005 | Pre | Taken from large Zoroaster granite outcropping on creek right at the base of a shallow side canyon with a seep trickling. Standing on a outcropping near a metal stake in rock. | Facing creek right (?) looking up a small incoming drainage with little vegetation. TAMRAM present. |
| PP Bright Angel 15 | 4 | 403629 | 3999749 | 4/2/2006 | Post | Taken from large Zoroaster granite outcropping on creek right at the base of a shallow side canyon with a seep trickling. Standing on a outcropping near a metal stake in rock. | Photo update. |
| PP Bright Angel 15 | A | 403629 | 3999749 | 9/29/2005 | Pre | Taken from large Zoroaster granite outcropping on creek right at the base of a shallow side canyon with a seep trickling. Standing on a outcropping near a metal stake in rock. | Person on photopoint taken from across the creek. |
| PP Bright Angel 16-1 | 1 | 403669 | 3999710 | 9/29/2005 | Pre | Taken from a horizontally striated white rock. | Unclear description, "facing photopoint actually standing on horizontally striated white rock". |
| PP Bright Angel 16-1 | 1 | 403669 | 3999710 | 4/2/2006 | Post | Taken from a horizontally striated white rock. | Photo update. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|----------------------|------|-------------|--------------|-----------|-----------------------|--|--|
| PP Bright Angel 16-1 | 2 | 403669 | 3999710 | 9/29/2005 | Pre | Taken from a horizontally striated white rock. | Standing with left shoulder to striations on rock. Standing so facing with creek on the immediate right and looking upstream. Creek is flowing towards photopoint. Trail is in view. |
| PP Bright Angel 16-1 | 2 | 403669 | 3999710 | 4/2/2006 | Post | Taken from a horizontally striated white rock. | Photo update. |
| PP Bright Angel 16-1 | 3 | 403669 | 3999710 | 9/29/2005 | Pre | Taken from a horizontally striated white rock. | Standing with back to rock striations and facing creek. The trail is directly across the creek. The photo is "fairly grassy green and gold the top has five layered blocks of rock" (?). |
| PP Bright Angel 16-1 | 3 | 403669 | 3999710 | 4/2/2006 | Post | Taken from a horizontally striated white rock. | Photo update. |
| PP Bright Angel 16-1 | 4 | 403669 | 3999710 | 9/29/2005 | Pre | Taken from a horizontally striated white rock. | Looking down creek with right shoulder to the striations and left shoulder to the creek. |
| PP Bright Angel 16-1 | 4 | 403669 | 3999710 | 4/2/2006 | Post | Taken from a horizontally striated white rock. | Photo update. |
| PP Bright Angel 16-1 | A | 403669 | 3999710 | 9/29/2005 | Pre | Taken from a horizontally striated white rock. | This is the photopoint from a distance of 5 yards, Back is to creek left. |
| PP Bright Angel 16-2 | 1 | 403694 | 3999694 | 4/2/2006 | Post | This photopoint is directly across the creek from BA 16-1 and was put in so that future photos could be taken without crossing the creek. Photo was taken from the center of the trail. This is right before a section of schist over hangs the trail. There is also a small outcropping of schist immediately next to the photopoint. | Looking down canyon. |
| PP Bright Angel 16-2 | 2 | 403694 | 3999694 | 4/2/2006 | Post | This photopoint is directly across the creek from BA 16-1 and was put in so that future photos could be taken without crossing the creek. Photo was taken from the center of the trail. This is right before a section of schist over hangs the trail. There is also a small outcropping of schist immediately next to the photopoint. | Looking slightly across and up canyon. |
| PP Bright Angel 16-2 | 3 | 403694 | 3999694 | 4/2/2006 | Post | This photopoint is directly across the creek from BA 16-1 and was put in so that future photos could be taken without crossing the creek. Photo was taken from the center of the trail. This is right before a section of schist over hangs the trail. There is also a small outcropping of schist immediately next to the photopoint. | Looking up canyon. |
| PP Bright Angel 16-2 | A | 403694 | 3999694 | 4/2/2006 | Pre | This photopoint is directly across the creek from BA 16-1 and was put in so that future photos could be taken without crossing the creek. Photo was taken from the center of the trail. This is right before a section of schist over hangs the trail. There is also a small outcropping of schist immediately next to the photopoint. | Kim at photopoint. Taken from about 15m down canyon on the trail. |
| PP Bright Angel 17 | 1 | 404038 | 3999924 | 3/24/2005 | Post | Located on a large white limestone boulder on creek left. This is about 40 ft up creek from a large ash tree. | Looking up creek at BA 18 post work area. |
| PP Bright Angel 17 | 1 | 404038 | 3999924 | 4/2/2006 | Post | Located on a large white limestone boulder on creek left. This is about 40 ft up creek from a large ash tree. | Photo update. |
| PP Bright Angel 17 | A | 404038 | 3999924 | 3/24/2005 | Pre | Located on a large white limestone boulder on creek left. This is about 40 ft up creek from a large ash tree. | Kari's backpack on the photopoint. |
| PP Bright Angel 18 | 1 | 405155 | 4001709 | 2/20/2004 | Pre | Taken 17 meters off spur trail to Ribbon Falls, before the N. Kaibab Trail. | Looking down canyon. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|--------------------|------|-------------|--------------|-----------|-----------------------|--|--|
| PP Bright Angel 18 | 1 | 405155 | 4001709 | 4/2/2006 | Pre | Taken 17 meters off spur trail to Ribbon Falls, before the N. Kaibab Trail. | Updated photo but no work done here yet. |
| PP Bright Angel 18 | 1 | 405155 | 4001709 | 2/6/2007 | Post | Taken 17 meters off spur trail to Ribbon Falls, before the N. Kaibab Trail. | Photo update. |
| PP Bright Angel 18 | A | 405155 | 4001709 | 2/20/2004 | Pre | Taken 17 meters off spur trail to Ribbon Falls, before the N. Kaibab Trail. | Steve at photopoint. |
| PP Bright Angel 19 | 1 | 406313 | 4003254 | 2/20/2004 | Pre | Taken near cottonwood on the N. Kaibab trail just below Cottonwood campground. | Looking downstream. |
| PP Bright Angel 19 | 1 | 406313 | 4003254 | 4/2/2006 | Post | Taken near cottonwood on the N. Kaibab trail just below Cottonwood campground. | Photo update. |
| PP Bright Angel 19 | A | 406313 | 4003254 | 2/20/2004 | Pre | Taken near cottonwood on the N. Kaibab trail just below Cottonwood campground. | Steve at photopoint. |
| PP Bright Angel 2 | 1 | 401527 | 3995562 | 2/20/2004 | Pre | Take from the lowest bridge leading to the silver bridge. | Looking upstream on creek left. |
| PP Bright Angel 2 | 1 | 401527 | 3995562 | 3/23/2005 | Pre | Take from the lowest bridge leading to the silver bridge. | Retake. |
| PP Bright Angel 2 | 1 | 401527 | 3995562 | 3/27/2005 | Post | Take from the lowest bridge leading to the silver bridge. | Post work. |
| PP Bright Angel 2 | 1 | 401527 | 3995562 | 4/1/2006 | Post | Take from the lowest bridge leading to the silver bridge. | Photo update. |
| PP Bright Angel 2 | 2 | 401527 | 3995562 | 3/23/2005 | Pre | Take from the lowest bridge leading to the silver bridge. | This is a view down creek. |
| PP Bright Angel 2 | 2 | 401527 | 3995562 | 4/1/2006 | Post | Take from the lowest bridge leading to the silver bridge. | Photo update. |
| PP Bright Angel 2 | A | 401527 | 3995562 | 2/20/2004 | Pre | Take from the lowest bridge leading to the silver bridge. | Steve at photopoint. |
| PP Bright Angel 20 | 1 | 404015 | 4000151 | 2/5/2007 | Pre | Standing on a small rise in the trail at water valve cover. This is roughly 100+m upstream from the beaver pond/marshy area. | Looking downstream at a fold in the Supergroup on the left. There is a large black boulder in the center of the hillside. |
| PP Bright Angel 20 | 2 | 404015 | 4000151 | 2/5/2007 | Pre | Standing on a small rise in the trail at water valve cover. This is roughly 100+m upstream from the beaver pond/marshy area. | Looking downstream and more the right of view 1. |
| PP Bright Angel 20 | 3 | 404015 | 4000151 | 2/5/2007 | Pre | Standing on a small rise in the trail at water valve cover. This is roughly 100+m upstream from the beaver pond/marshy area. | Looking across the creek at a large TAMRAM on the right bank. Hillers Butte in the background. |
| PP Bright Angel 20 | 4 | 404015 | 4000151 | 2/5/2007 | Pre | Standing on a small rise in the trail at water valve cover. This is roughly 100+m upstream from the beaver pond/marshy area. | Looking across and to the right of view 3. |
| PP Bright Angel 20 | 5 | 404015 | 4000151 | 2/5/2007 | Pre | Standing on a small rise in the trail at water valve cover. This is roughly 100+m upstream from the beaver pond/marshy area. | Looking upstream. |
| PP Bright Angel 20 | A | 404015 | 4000151 | 2/5/2007 | Pre | Standing on a small rise in the trail at water valve cover. This is roughly 100+m upstream from the beaver pond/marshy area. | Taken from down the trail. There is a water bottle of the water line cover (PP). Pen pointing at the PP. Clement Powell Butte in the background. |
| PP Bright Angel 21 | 1 | 404359 | 4000678 | 2/4/2007 | Pre | Taken from a white 1x1m boulder on creek right. This is at the start of the section. | Looking towards the S. Rim and 1 mature. Sun is right in the photo. |
| PP Bright Angel 21 | 1 | 404359 | 4000678 | 2/4/2007 | Post | Taken from a white 1x1m boulder on creek right. This is at the start of the section. | Post work. |
| PP Bright Angel 21 | 2 | 404359 | 4000678 | 2/4/2007 | Post | Taken from a white 1x1m boulder on creek right. This is at the start of the section. | Post work. |
| PP Bright Angel 21 | 2 | 404359 | 4000678 | 2/4/2007 | Pre | Taken from a white 1x1m boulder on creek right. This is at the start of the section. | Looking away from the creek at 1 mature. |
| PP Bright Angel 21 | 3 | 404359 | 4000678 | 2/4/2007 | Post | Taken from a white 1x1m boulder on creek right. This is at the start of the section. | Post work. |

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| PP Bright Angel 21 | 3 | 404359 | 4000678 | 2/4/2007 | Pre | Taken from a white 1x1m boulder on creek right. This is at the start of the section. | Looking upstream at numerous mature TAMRAMs. Cardenas lava wall behind. |
| PP Bright Angel 21 | A | 404359 | 4000678 | 2/4/2007 | Pre | Taken from a white 1x1m boulder on creek right. This is at the start of the section. | Taken 10m above the PP looking at pen pointing at white, round PP boulder. |
| PP Bright Angel 22 | 1 | 405663 | 4002441 | 2/2/2007 | Pre | PP is at a small boulder on the top of a creek left bank. This is about 250m above the bridge to Ribbon Falls. | Looking downstream at a mature TAMRAM aligned with the creek. |
| PP Bright Angel 22 | 1 | 405663 | 4002441 | 2/2/2007 | Post | PP is at a small boulder on the top of a creek left bank. This is about 250m above the bridge to Ribbon Falls. | Post work. |
| PP Bright Angel 22 | A | 405663 | 4002441 | 2/2/2007 | Pre | PP is at a small boulder on the top of a creek left bank. This is about 250m above the bridge to Ribbon Falls. | Looking up and across stream at PP rock. Rock has a 5' piece of driftwood on top of it and there is a quartzite wall in the background. |
| PP Bright Angel 23 | 1 | 406050 | 4003172 | 2/1/2007 | Post | Taken sitting on a small sandstone seat on top of a massive undercut sandstone boulder. This is on the right bank where a small wash dumps into the BA - about 200m below Cottonwood Campground. Access rock from the up side of the wash. | Post work. |
| PP Bright Angel 23 | 1 | 406050 | 4003172 | 2/1/2007 | Pre | Taken sitting on a small sandstone seat on top of a massive undercut sandstone boulder. This is on the right bank where a small wash dumps into the BA - about 200m below Cottonwood Campground. Access rock from the up side of the wash. | Looking downstream at gravel flats. There are small TAMRAMs in the flats and one large one on the right bank. |
| PP Bright Angel 23 | 2 | 406050 | 4003172 | 2/1/2007 | Pre | Taken sitting on a small sandstone seat on top of a massive undercut sandstone boulder. This is on the right bank where a small wash dumps into the BA - about 200m below Cottonwood Campground. Access rock from the up side of the wash. | Looking upstream. There are 4 mature complexes in the foreground. |
| PP Bright Angel 23 | 2 | 406050 | 4003172 | 2/1/2007 | Post | Taken sitting on a small sandstone seat on top of a massive undercut sandstone boulder. This is on the right bank where a small wash dumps into the BA - about 200m below Cottonwood Campground. Access rock from the up side of the wash. | Post work. |
| PP Bright Angel 23 | A | 406050 | 4003172 | 2/1/2007 | Pre | Taken sitting on a small sandstone seat on top of a massive undercut sandstone boulder. This is on the right bank where a small wash dumps into the BA - about 200m below Cottonwood Campground. Access rock from the up side of the wash. | Person at PP on top of the rock. Looking upstream to PP from gravels flats. |
| PP Bright Angel 24 | 1 | 404379 | 4000763 | 2/4/2007 | Pre | Taken about 500m above the spring at the top of the box. The channel is wide here with a split creek and a large boulder field. The PP rock is a 1x1m boulder on creek left. | Looking towards the BA creek and at a clump of small TAMRAMs. |
| PP Bright Angel 24 | 1 | 404379 | 4000763 | 2/4/2007 | Post | Taken about 500m above the spring at the top of the box. The channel is wide here with a split creek and a large boulder field. The PP rock is a 1x1m boulder on creek left. | Post work. |
| PP Bright Angel 24 | 2 | 404379 | 4000763 | 2/4/2007 | Post | Taken about 500m above the spring at the top of the box. The channel is wide here with a split creek and a large boulder field. The PP rock is a 1x1m boulder on creek left. | Post work. |
| PP Bright Angel 24 | 2 | 404379 | 4000763 | 2/4/2007 | Pre | Taken about 500m above the spring at the top of the box. The channel is wide here with a split creek and a large boulder field. The PP rock is a 1x1m boulder on creek left. | Looking perpendicular and away from the creek at a clump of small matures. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|--------------------|------|-------------|--------------|----------|-----------------------|---|---|
| PP Bright Angel 24 | A | 404379 | 4000763 | 2/4/2007 | Pre | Taken about 500m above the spring at the top of the box. The channel is wide here with a split creek and a large boulder field. The PP rock is a 1x1m boulder on creek left. | Taken downstream of PP by 10m. Looking up at PP boulder in a field of boulders. |
| PP Bright Angel 25 | 1 | 404585 | 4001054 | 2/3/2007 | Post | Standing on a point in the trail. This is high above the creek drainage that is coming across the creek from creek right. View 1 was taken from the north side of the point. View 2 & 3 were taken from the SW side of the point (vegetation in the way). | Post work. |
| PP Bright Angel 25 | 1 | 404585 | 4001054 | 2/3/2007 | Pre | Standing on a point in the trail. This is high above the creek drainage that is coming across the creek from creek right. View 1 was taken from the north side of the point. View 2 & 3 were taken from the SW side of the point (vegetation in the way). | Looking upstream. There are lots of small TAMRAM in the flats to looker's left of red/white striped sandstone boulder |
| PP Bright Angel 25 | 2 | 404585 | 4001054 | 2/3/2007 | Pre | Standing on a point in the trail. This is high above the creek drainage that is coming across the creek from creek right. View 1 was taken from the north side of the point. View 2 & 3 were taken from the SW side of the point (vegetation in the way). | Looking downstream. |
| PP Bright Angel 25 | 2 | 404585 | 4001054 | 2/3/2007 | Post | Standing on a point in the trail. This is high above the creek drainage that is coming across the creek from creek right. View 1 was taken from the north side of the point. View 2 & 3 were taken from the SW side of the point (vegetation in the way). | Post work. |
| PP Bright Angel 25 | 3 | 404585 | 4001054 | 2/3/2007 | Post | Standing on a point in the trail. This is high above the creek drainage that is coming across the creek from creek right. View 1 was taken from the north side of the point. View 2 & 3 were taken from the SW side of the point (vegetation in the way). | Post work. |
| PP Bright Angel 25 | 3 | 404585 | 4001054 | 2/3/2007 | Pre | Standing on a point in the trail. This is high above the creek drainage that is coming across the creek from creek right. View 1 was taken from the north side of the point. View 2 & 3 were taken from the SW side of the point (vegetation in the way). | Looking across the creek toward a side drainage. There is a massive boulder on creek right. |
| PP Bright Angel 25 | A | 404585 | 4001054 | 2/3/2007 | Pre | Standing on a point in the trail. This is high above the creek drainage that is coming across the creek from creek right. View 1 was taken from the north side of the point. View 2 & 3 were taken from the SW side of the point (vegetation in the way). | Taken from down the trail. The trail turns right into a shadow around the cliff. |
| PP Bright Angel 26 | 1 | 404913 | 4001503 | 2/3/2007 | Post | Sitting on a VW sized boulder on creek right in a wide open bowl area. This is 500+m below Ribbon Falls. | Post work. |
| PP Bright Angel 26 | 1 | 404913 | 4001503 | 2/3/2007 | Pre | Sitting on a VW sized boulder on creek right in a wide open bowl area. This is 500+m below Ribbon Falls. | Looking upstream at an ugly TAMRAM on the right bank. |
| PP Bright Angel 26 | 2 | 404913 | 4001503 | 2/3/2007 | Post | Sitting on a VW sized boulder on creek right in a wide open bowl area. This is 500+m below Ribbon Falls. | Post work. |
| PP Bright Angel 26 | 2 | 404913 | 4001503 | 2/3/2007 | Pre | Sitting on a VW sized boulder on creek right in a wide open bowl area. This is 500+m below Ribbon Falls. | Looking across the creek at a TAMRAM in SALEXI thicket. There is also a boulder on the left bank. |
| PP Bright Angel 26 | 3 | 404913 | 4001503 | 2/3/2007 | Pre | Sitting on a VW sized boulder on creek right in a wide open bowl area. This is 500+m below Ribbon Falls. | Looking downstream. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|---------------------|------|-------------|--------------|-----------|-----------------------|--|--|
| PP Bright Angel 26 | A | 404913 | 4001503 | 2/3/2007 | Pre | Sitting on a VW sized boulder on creek right in a wide open bowl area. This is 500+m below Ribbon Falls. | Taken from downstream on the creek right bank. Looking upstream. |
| PP Bright Angel 3-1 | 1 | 401387 | 3995749 | 3/23/2005 | Pre | Located on the main trail to Phantom Ranch about 1/2 way between Bridge 1 & 2 (campsites). Near stand of old cottonwoods. | Thicket on creek left looking down creek from trail. |
| PP Bright Angel 3-1 | 1 | 401387 | 3995749 | 4/1/2006 | Post | Located on the main trail to Phantom Ranch about 1/2 way between Bridge 1 & 2 (campsites). Near stand of old cottonwoods. | Photo update. |
| PP Bright Angel 3-1 | A | 401387 | 3995749 | 3/23/2005 | Pre | Located on the main trail to Phantom Ranch about 1/2 way between Bridge 1 & 2 (campsites). Near stand of old cottonwoods. | Kari's backpack at photopoint. |
| PP Bright Angel 3-2 | 1 | 401366 | 3995750 | 10/1/2000 | Pre | Taken from the East side of the creek, across from the second campsite up from the stone bathroom in the campground, standing on rock on the west side of the trail. | |
| PP Bright Angel 3-2 | 1 | 401366 | 3995750 | 4/1/2006 | Post | Taken from the East side of the creek, across from the second campsite up from the stone bathroom in the campground, standing on rock on the west side of the trail. | Photo update. |
| PP Bright Angel 3-2 | 2 | 401366 | 3995750 | 10/1/2000 | Pre | Taken from the East side of the creek, across from the second campsite up from the stone bathroom in the campground, standing on rock on the west side of the trail. | |
| PP Bright Angel 3-2 | 2 | 401366 | 3995750 | 4/1/2006 | Post | Taken from the East side of the creek, across from the second campsite up from the stone bathroom in the campground, standing on rock on the west side of the trail. | Photo update. |
| PP Bright Angel 3-2 | 3 | 401366 | 3995750 | 10/1/2000 | Pre | Taken from the East side of the creek, across from the second campsite up from the stone bathroom in the campground, standing on rock on the west side of the trail. | |
| PP Bright Angel 3-2 | 3 | 401366 | 3995750 | 4/1/2006 | Post | Taken from the East side of the creek, across from the second campsite up from the stone bathroom in the campground, standing on rock on the west side of the trail. | Photo update. |
| PP Bright Angel 4 | 1 | 401340 | 3995871 | 3/23/2005 | Pre | Located in the center of the bridge to the BA campsites. There is no photo of photopoint and no GPS was available. Did not retake these photopoints on 4/1/06 because it is a repeat of BA 2. This is at the lower bridge crossing the creek to the silver bridge. | Looking down creek. |
| PP Bright Angel 4 | 2 | 401340 | 3995871 | 3/23/2005 | Pre | Located in the center of the bridge to the BA campsites. There is no photo of photopoint and no GPS was available. Did not retake these photopoints on 4/1/06 because it is a repeat of BA 2. This is at the lower bridge crossing the creek to the silver bridge. | Looking up creek. |
| PP Bright Angel 5 | 1 | 401667 | 3996450 | 2/20/2004 | Pre | Taken above Phantom Ranch on the North Kaibab trail by the waterline. | Looking downstream. |
| PP Bright Angel 5 | 1 | 401667 | 3996450 | 3/24/2005 | Post | Taken above Phantom Ranch on the North Kaibab trail by the waterline. | Photo update. |
| PP Bright Angel 5 | 1 | 401667 | 3996450 | 4/2/2006 | Post | Taken above Phantom Ranch on the North Kaibab trail by the waterline. | Photo update. |
| PP Bright Angel 5 | A | 401667 | 3996450 | 2/20/2004 | Pre | Taken above Phantom Ranch on the North Kaibab trail by the waterline. | Kim at photopoint. |
| PP Bright Angel 6 | 1 | 401676 | 3996607 | 2/20/2004 | Pre | Taken from a large granite rock on creek left, immediately off the trail. | Looking upstream over tamarisk thicket on creek left. |

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| PP Bright Angel 6 | 1 | 401676 | 3996607 | 3/27/2005 | Post | Taken from a large granite rock on creek left, immediately off the trail. | Post work. |
| PP Bright Angel 6 | 1 | 401676 | 3996607 | 4/2/2006 | Post | Taken from a large granite rock on creek left, immediately off the trail. | Photo update. |
| PP Bright Angel 6 | A | 401676 | 3996607 | 4/2/2006 | Pre | Taken from a large granite rock on creek left, immediately off the trail. | Jill standing on photopoint rock. This is taken from downstream looking up canyon. |
| PP Bright Angel 7 | 1 | 401742 | 3996780 | 2/20/2004 | Pre | Standing on white rock left of the Clear Creek Trail sign, next to a red rock. | Overlooking creek. |
| PP Bright Angel 7 | 1 | 401742 | 3996780 | 3/24/2005 | Pre | Standing on white rock left of the Clear Creek Trail sign, next to a red rock. | Retake. |
| PP Bright Angel 7 | 1 | 401742 | 3996780 | 3/26/2005 | Post | Standing on white rock left of the Clear Creek Trail sign, next to a red rock. | Post work. |
| PP Bright Angel 7 | 1 | 401742 | 3996780 | 4/2/2006 | Post | Standing on white rock left of the Clear Creek Trail sign, next to a red rock. | Photo update. |
| PP Bright Angel 7 | A | 401742 | 3996780 | 2/20/2004 | Pre | Standing on white rock left of the Clear Creek Trail sign, next to a red rock. | Steve at photopoint. |
| PP Bright Angel 8 | 1 | 401935 | 3996861 | 2/20/2004 | Pre | Taken from the second rock wall supporting the trail just upstream of the GPS point. | Looking across creek at a large tamarisk. |
| PP Bright Angel 8 | 1 | 401935 | 3996861 | 3/24/2005 | Pre | Taken from the second rock wall supporting the trail just upstream of the GPS point. | Retake. |
| PP Bright Angel 8 | 1 | 401935 | 3996861 | 4/2/2006 | Post | Taken from the second rock wall supporting the trail just upstream of the GPS point. | Photo update. |
| PP Bright Angel 8 | 2 | 401935 | 3996861 | 3/26/2005 | Post | Taken from the second rock wall supporting the trail just upstream of the GPS point. | Post work. |
| PP Bright Angel 8 | 2 | 401935 | 3996861 | 3/26/2005 | Pre | Taken from the second rock wall supporting the trail just upstream of the GPS point. | Horizontal view, similar to view 1. |
| PP Bright Angel 8 | 2 | 401935 | 3996861 | 4/2/2006 | Post | Taken from the second rock wall supporting the trail just upstream of the GPS point. | Photo update. |
| PP Bright Angel 8 | A | 401935 | 3996861 | 2/20/2004 | Pre | Taken from the second rock wall supporting the trail just upstream of the GPS point. | Steve at photopoint. |
| PP Bright Angel 9 | 1 | 402142 | 3997532 | 2/20/2004 | Pre | Standing on pipe cover on trail within site if creek, by a large sandstone red rock overhanging the trail. | Looking upstream. |
| PP Bright Angel 9 | 1 | 402142 | 3997532 | 3/24/2005 | Pre | Standing on pipe cover on trail within site if creek, by a large sandstone red rock overhanging the trail. | Retake. |
| PP Bright Angel 9 | 1 | 402142 | 3997532 | 4/2/2006 | Post | Standing on pipe cover on trail within site if creek, by a large sandstone red rock overhanging the trail. | Photo update. |
| PP Bright Angel 9 | A | 402142 | 3997532 | 2/20/2004 | Pre | Standing on pipe cover on trail within site if creek, by a large sandstone red rock overhanging the trail. | Steve at photopoint. |
| PP Bright Angel T1A End | 1 | 403656 | 3999638 | 6/7/2005 | Pre | No GPS available. Transect end is on creek left embankment. | Looking up canyon, the transect is highly visible and there is a distinct skyline as well as a dry wash. There is a slick rock waterfall on creek right. |
| PP Bright Angel T1A End | 1 | 403656 | 3999638 | 4/15/2006 | Post | No GPS available. Transect end is on creek left embankment. | Looking up canyon, the transect is highly visible and there is a distinct skyline as well as a dry wash. There is a slick rock waterfall on creek right. |
| PP Bright Angel T1A End | 2 | 403656 | 3999638 | 6/7/2005 | Pre | No GPS available. Transect end is on creek left embankment. | Looking across creek at intricate wash, a slick rock dry canyon which definitely runs at times. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|---------------------------|------|-------------|--------------|-----------|-----------------------|---|---|
| PP Bright Angel T1A End | 2 | 403656 | 3999638 | 4/15/2006 | Post | No GPS available. Transect end is on creek left embankment. | Looking across the creek at intricate wash, a slick rock dry canyon which definitely runs at times. |
| PP Bright Angel T1A End | A | 403656 | 3999638 | 6/7/2005 | Pre | No GPS available. Transect end is on creek left embankment. | Looking at Kari on trail above and on creek left of the embankment. There is also a photopoint here. |
| PP Bright Angel T1A Start | 1 | 403723 | 3999435 | 6/7/2005 | Pre | Start is on the trail about 4m from a large TAMRAM. | Looking down creek at large TAMRAM where transect starts - skyline distinct. No bearing recorded. |
| PP Bright Angel T1A Start | 1 | 403723 | 3999435 | 4/15/2006 | Post | Start is on the trail about 4m from a large TAMRAM. | Looking down creek where the transect starts. Skyline distinct. |
| PP Bright Angel T1A Start | 2 | 403723 | 3999435 | 6/7/2005 | Pre | Start is on the trail about 4m from a large TAMRAM. | Looking down creek at transect tape and vegetation. |
| PP Bright Angel T1A Start | 2 | 403723 | 3999435 | 4/15/2006 | Post | Start is on the trail about 4m from a large TAMRAM. | Photopoint is pink Tapeats 2x2m. Looking down the creek at the transect tape. |
| PP Bright Angel T1A Start | 3 | 403723 | 3999435 | 4/15/2006 | Post | Start is on the trail about 4m from a large TAMRAM. | T1A start point. Directly SE towards the trail. |
| PP Bright Angel T1A Start | A | 403723 | 3999435 | 6/7/2005 | Pre | Start is on the trail about 4m from a large TAMRAM. | Looking at Kari sitting on granite boulder on right of trail. |
| PP Bright Angel T1A Start | B | 403723 | 3999435 | 4/15/2006 | Post | Start is on the trail about 4m from a large TAMRAM. | Looking at Kelly on granite boulder on trail to left looking downstream. |
| PP Bright Angel T2A End | 1 | 404302 | 4000280 | 6/7/2005 | Pre | At transect tape end. | Looking at transect tape going through large TAMRAM. From end of transect looking up the transect. |
| PP Bright Angel T2A End | 1 | 404302 | 4000280 | 4/16/2006 | Post | At transect tape end. | Photo update. |
| PP Bright Angel T2A End | A | 404302 | 4000280 | 6/7/2005 | Pre | At transect tape end. | Looking at Kari sitting at transect end. Tape is at her feet. Conglomerate mud embankment and large TAMRAM in view. |
| PP Bright Angel T2A End | A | 404302 | 4000280 | 4/16/2006 | Post | At transect tape end. | Photo update. |
| PP Bright Angel T2A Start | 1 | 404343 | 4000313 | 6/7/2005 | Pre | Taken at the 7m mark on transect. | Looking down canyon and down the transect. Looking at vegetation along transect, tape goes through and beyond tamarisk in view. |
| PP Bright Angel T2A Start | 1 | 404343 | 4000313 | 4/16/2006 | Post | Taken at the 7m mark on transect. | Photo update. |
| PP Bright Angel T2A Start | 2 | 404343 | 4000313 | 6/7/2005 | Pre | Taken at the 7m mark on transect. | No bearing recorded. Looking up canyon and up transect. Looking at transect tape as it goes through large tamarisk to origin of transect. |
| PP Bright Angel T2A Start | 2 | 404343 | 4000313 | 4/16/2006 | Post | Taken at the 7m mark on transect. | Photo update. |
| PP Bright Angel T2A Start | 1A | 404343 | 4000313 | 6/7/2005 | Pre | Taken at the 7m mark on transect. | Maria at the beginning of transect. Taken from about 4m up canyon from transect start. |
| PP Bright Angel T2A Start | 1A | 404343 | 4000313 | 4/16/2006 | Post | Taken at the 7m mark on transect. | Photo update. |
| PP Bright Angel T2A Start | A | 404343 | 4000313 | 6/7/2005 | Pre | Taken at the 7m mark on transect. | Maria at transect start, skyline in view and somewhat distinct. Taken 5m from transect start, closer to the creek looking towards creek left. |
| PP Bright Angel T2A Start | A | 404343 | 4000313 | 4/16/2006 | Post | Taken at the 7m mark on transect. | Photo update. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|---------------------------|------|-------------|--------------|-----------|-----------------------|---|---|
| PP Bright Angel T2A Start | B | 404343 | 4000313 | 6/7/2005 | Pre | Taken at the 7m mark on transect. | Maria at transect start, large Tapeats boulder across canyon in the background. Taken from about 5m mark down creek side of large tamarisk between an apache plume and an acacia. |
| PP Bright Angel T2A Start | B | 404343 | 4000313 | 4/16/2006 | Post | Taken at the 7m mark on transect. | Photo update. |
| PP Bright Angel T2B End | 1 | 404369 | 4000328 | 6/7/2005 | Pre | Taken at transect end near a limestone/sandstone boulder by the trail. | Looking at the taped running through to cottonwood tree by the trail up canyon. |
| PP Bright Angel T2B End | 1 | 404369 | 4000328 | 4/16/2006 | Post | Taken at transect end near a limestone/sandstone boulder by the trail. | Photo update. |
| PP Bright Angel T2B End | 2 | 404369 | 4000328 | 6/7/2005 | Pre | Taken at transect end near a limestone/sandstone boulder by the trail. | Looking at acacia and other associated species beyond the transect. |
| PP Bright Angel T2B End | 2 | 404369 | 4000328 | 4/16/2006 | Post | Taken at transect end near a limestone/sandstone boulder by the trail. | Photo update. |
| PP Bright Angel T2B End | A | 404369 | 4000328 | 6/7/2005 | Pre | Taken at transect end near a limestone/sandstone boulder by the trail. | Looking at Maria standing on transect end/photopoint. Limestone and sandstone boulder. Acacia and distinct canyon wall as backdrop. |
| PP Bright Angel T2B End | A | 404369 | 4000328 | 4/16/2006 | Post | Taken at transect end near a limestone/sandstone boulder by the trail. | Photo update. |
| PP Bright Angel T2B Start | 1 | 404413 | 4000348 | 6/7/2005 | Pre | Taken from a sandstone boulder creek right of trail. | Looking along transect tape at vegetation. |
| PP Bright Angel T2B Start | 1 | 404413 | 4000348 | 4/16/2006 | Post | Taken from a sandstone boulder creek right of trail. | Photo update. |
| PP Bright Angel T2B Start | 2 | 404413 | 4000348 | 6/7/2005 | Pre | Taken from a sandstone boulder creek right of trail. | Looking further down tape at vegetation including two large cottonwoods. |
| PP Bright Angel T2B Start | 2 | 404413 | 4000348 | 4/16/2006 | Post | Taken from a sandstone boulder creek right of trail. | Photo update. |
| PP Bright Angel T2B Start | 3 | 404413 | 4000348 | 6/7/2005 | Pre | Taken from a sandstone boulder creek right of trail. | Following trail up canyon from photopoint. |
| PP Bright Angel T2B Start | 3 | 404413 | 4000348 | 4/16/2006 | Post | Taken from a sandstone boulder creek right of trail. | Photo update. |
| PP Bright Angel T2B Start | A | 404413 | 4000348 | 6/7/2005 | Pre | Taken from a sandstone boulder creek right of trail. | Maria on white sandstone boulder just off trail. Transect tape begins near her feet. Trail in view as well as a somewhat distinct skyline. Photo is taken from trail looking up canyon about 7m from start of transect in between 2 large acacia shrubs, this is creek left of trail. |
| PP Bright Angel T2B Start | B | 404413 | 4000348 | 6/7/2005 | Pre | Taken from a sandstone boulder creek right of trail. | Same as previous photo just vertical. |
| PP Bright Angel T2B Start | B | 404413 | 4000348 | 4/16/2006 | Post | Taken from a sandstone boulder creek right of trail. | Photo update. |
| PP Carbon 10 | 1 | 424733 | 4002061 | 5/9/2005 | Pre | Taken creek left, 3m out of channel and 20m beyond point of mesquite island. Carbon 10 is only 200m long. | Looking downstream, hillside in the background. |
| PP Carbon 10 | 1 | 424733 | 4002061 | 5/9/2005 | Pre | Taken creek left, 3m out of channel and 20m beyond point of mesquite island. Carbon 10 is only 200m long. | Looking downstream, hillside in the background. |
| PP Carbon 10 | 2 | 424733 | 4002061 | 5/9/2005 | Pre | Taken creek left, 3m out of channel and 20m beyond point of mesquite island. Carbon 10 is only 200m long. | Looking upstream into mesquite thicket. |
| PP Carbon 10 | 2 | 424733 | 4002061 | 5/9/2005 | Pre | Taken creek left, 3m out of channel and 20m beyond point of mesquite island. Carbon 10 is only 200m long. | Looking upstream into mesquite thicket. |
| PP Carbon 10 | A | 424733 | 4002061 | 5/9/2005 | Pre | Taken creek left, 3m out of channel and 20m beyond point of mesquite island. Carbon 10 is only 200m long. | Carbon east. |
| PP Carbon 10 | A | 424733 | 4002061 | 5/9/2005 | Pre | Taken creek left, 3m out of channel and 20m beyond point of mesquite island. Carbon 10 is only 200m long. | Looking downstream with RV Ward at photopoint at the mouth of Carbon East. Taken from the mouth of Carbon East. |

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| PP Carbon 10 | B | 424733 | 4002061 | 5/9/2005 | Pre | Taken creek left, 3m out of channel and 20m beyond point of mesquite island. Carbon 10 is only 200m long. | View from south of RV on photopoint. |
| PP Carbon 10 | B | 424733 | 4002061 | 5/9/2005 | Pre | Taken creek left, 3m out of channel and 20m beyond point of mesquite island. Carbon 10 is only 200m long. | View from south of RV on photopoint. |
| PP Carbon 10-1 | 1 | 424661 | 4002125 | 10/27/2005 | Pre | This is replacing Carbon 10 because it could not be relocated. Taken from a large sandstone conglomerate on creek left. This is about 30m upcreek from a mesquite island and about 30m downstream of confluence of forks into the main drainage. | Looking upstream at drainage confluence. |
| PP Carbon 10-1 | 1 | 424661 | 4002125 | 10/27/2005 | Post | This is replacing Carbon 10 because it could not be relocated. Taken from a large sandstone conglomerate on creek left. This is about 30m upcreek from a mesquite island and about 30m downstream of confluence of forks into the main drainage. | Post work. Looking upstream at drainage confluence. |
| PP Carbon 10-1 | 1 | 424661 | 4002125 | 5/6/2006 | Post | This is replacing Carbon 10 because it could not be relocated. Taken from a large sandstone conglomerate on creek left. This is about 30m upcreek from a mesquite island and about 30m downstream of confluence of forks into the main drainage. | Looking upstream at drainage confluence. |
| PP Carbon 10-1 | 2 | 424661 | 4002125 | 10/27/2005 | Pre | This is replacing Carbon 10 because it could not be relocated. Taken from a large sandstone conglomerate on creek left. This is about 30m upcreek from a mesquite island and about 30m downstream of confluence of forks into the main drainage. | Looking downstream at mesquite island. |
| PP Carbon 10-1 | 2 | 424661 | 4002125 | 10/27/2005 | Post | This is replacing Carbon 10 because it could not be relocated. Taken from a large sandstone conglomerate on creek left. This is about 30m upcreek from a mesquite island and about 30m downstream of confluence of forks into the main drainage. | Post work. Looking downstream at mesquite island. |
| PP Carbon 10-1 | 2 | 424661 | 4002125 | 5/6/2006 | Post | This is replacing Carbon 10 because it could not be relocated. Taken from a large sandstone conglomerate on creek left. This is about 30m upcreek from a mesquite island and about 30m downstream of confluence of forks into the main drainage. | Looking downstream at mesquite island. |
| PP Carbon 10-1 | A | 424661 | 4002125 | 10/27/2005 | Pre | This is replacing Carbon 10 because it could not be relocated. Taken from a large sandstone conglomerate on creek left. This is about 30m upcreek from a mesquite island and about 30m downstream of confluence of forks into the main drainage. | Kari on photopoint. Taken from downstream looking upstream. Formation in skyline. |
| PP Carbon 10-1 | A | 424661 | 4002125 | 10/27/2005 | Pre | This is replacing Carbon 10 because it could not be relocated. Taken from a large sandstone conglomerate on creek left. This is about 30m upcreek from a mesquite island and about 30m downstream of confluence of forks into the main drainage. | Kari on photopoint. Taken from downstream looking upstream. |
| PP Carbon 10-2 | 1 | 424709 | 4002222 | 10/27/2005 | Pre | Taken from a 6x3m Tapeats sandstone boulder in the wash. Just upstream of fork where the Chuar formation is readily visible. | Looking downstream of the beginning of the west fork. |

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| PP Carbon 10-2 | 1 | 424709 | 4002222 | 10/27/2005 | Pre | Taken from a 6x3m Tapeats sandstone boulder in the wash. Just upstream of fork where the Chuar formation is readily visible. | Looking downstream of west fork beginning. |
| PP Carbon 10-2 | 1 | 424709 | 4002222 | 5/6/2006 | Post | Taken from a 6x3m Tapeats sandstone boulder in the wash. Just upstream of fork where the Chuar formation is readily visible. | Looking downstream of beginning of West Fork. |
| PP Carbon 10-2 | 2 | 424709 | 4002222 | 10/27/2005 | Pre | Taken from a 6x3m Tapeats sandstone boulder in the wash. Just upstream of fork where the Chuar formation is readily visible. | View upstream, mid-drainage. |
| PP Carbon 10-2 | 2 | 424709 | 4002222 | 10/27/2005 | Pre | Taken from a 6x3m Tapeats sandstone boulder in the wash. Just upstream of fork where the Chuar formation is readily visible. | View upstream, mid-drainage. |
| PP Carbon 10-2 | 2 | 424709 | 4002222 | 5/6/2006 | Post | Taken from a 6x3m Tapeats sandstone boulder in the wash. Just upstream of fork where the Chuar formation is readily visible. | View upstream, mid-drainage. |
| PP Carbon 10-2 | 3 | 424709 | 4002222 | 10/27/2005 | Pre | Taken from a 6x3m Tapeats sandstone boulder in the wash. Just upstream of fork where the Chuar formation is readily visible. | View upstream, looking at NW portion of drainage. |
| PP Carbon 10-2 | 3 | 424709 | 4002222 | 10/27/2005 | Pre | Taken from a 6x3m Tapeats sandstone boulder in the wash. Just upstream of fork where the Chuar formation is readily visible. | View upstream, looking at NW portion of drainage. |
| PP Carbon 10-2 | 3 | 424709 | 4002222 | 5/6/2006 | Post | Taken from a 6x3m Tapeats sandstone boulder in the wash. Just upstream of fork where the Chuar formation is readily visible. | View upstream, looking at NW portion of drainage. |
| PP Carbon 10-2 | A | 424709 | 4002222 | 10/27/2005 | Pre | Taken from a 6x3m Tapeats sandstone boulder in the wash. Just upstream of fork where the Chuar formation is readily visible. | Kate at photopoint. |
| PP Carbon 10-2 | A | 424709 | 4002222 | 10/27/2005 | Pre | Taken from a 6x3m Tapeats sandstone boulder in the wash. Just upstream of fork where the Chuar formation is readily visible. | Kate at photopoint. |
| PP Carbon 8 | 1 | 424971 | 4001481 | 5/9/2005 | Pre | Taken from 300m west of the narrows, obvious uplift of gold colored formation (photo taken from the base of the formation). | Looking upstream at a medium boulder in the creek. |
| PP Carbon 8 | 1 | 424971 | 4001481 | 5/9/2005 | Pre | Taken from 300m west of the narrows, obvious uplift of gold colored formation (photo taken from the base of the formation). | Looking upstream at a medium boulder in the creek. |
| PP Carbon 8 | 1 | 424971 | 4001481 | 10/26/2005 | Post | Taken from 300m west of the narrows, obvious uplift of gold colored formation (photo taken from the base of the formation). | Post work. Bearing is different than the pre photo. |
| PP Carbon 8 | 1 | 424971 | 4001481 | 10/26/2005 | Post | Taken from 300m west of the narrows, obvious uplift of gold colored formation (photo taken from the base of the formation). | Post work. |
| PP Carbon 8 | 1 | 424971 | 4001481 | 5/6/2006 | Post | Taken from 300m west of the narrows, obvious uplift of gold colored formation (photo taken from the base of the formation). | Looking upstream at a medium sized boulder in the creek. |
| PP Carbon 8 | 2 | 424971 | 4001481 | 10/26/2005 | Post | Taken from 300m west of the narrows, obvious uplift of gold colored formation (photo taken from the base of the formation). | Post work. |

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| PP Carbon 8 | 2 | 424971 | 4001481 | 10/26/2005 | Post | Taken from 300m west of the narrows, obvious uplift of gold colored formation (photo taken from the base of the formation). | Post work. |
| PP Carbon 8 | A | 424971 | 4001481 | 5/9/2005 | Pre | Taken from 300m west of the narrows, obvious uplift of gold colored formation (photo taken from the base of the formation). | Looking upstream; Dan Hall at photopoint. |
| PP Carbon 8 | A | 424971 | 4001481 | 5/9/2005 | Pre | Taken from 300m west of the narrows, obvious uplift of gold colored formation (photo taken from the base of the formation). | Looking upstream; Dan Hall at photopoint. |
| PP Carbon 8 | B | 424971 | 4001481 | 5/9/2005 | Pre | Taken from 300m west of the narrows, obvious uplift of gold colored formation (photo taken from the base of the formation). | Looking downstream; Dan Hall at photopoint. |
| PP Carbon 8 | B | 424971 | 4001481 | 5/9/2005 | Pre | Taken from 300m west of the narrows, obvious uplift of gold colored formation (photo taken from the base of the formation). | Looking downstream, at Dan Hall on photopoint |
| PP Carbon 9-1 | 1 | 424797 | 4001477 | 5/9/2005 | Pre | No description. | Looking downstream at a 2x3m red boulder on creek right, 30m below point. |
| PP Carbon 9-1 | 1 | 424797 | 4001477 | 5/9/2005 | Pre | No description. | Looking downstream at a 2x3m red boulder on creek right, 30m below the photopoint. |
| PP Carbon 9-1 | 1 | 424797 | 4001477 | 10/26/2005 | Post | No description. | Photo update. |
| PP Carbon 9-1 | 1 | 424797 | 4001477 | 10/26/2005 | Post | No description. | Post work. |
| PP Carbon 9-1 | 1 | 424797 | 4001477 | 5/6/2006 | Post | No description. | Looking downstream at a 2x3m red boulder on creek right, 30m below the photopoint. |
| PP Carbon 9-1 | 2 | 424797 | 4001477 | 5/9/2005 | Pre | No description. | Looking upstream at a 3x1m red boulder about 50m out. |
| PP Carbon 9-1 | 2 | 424797 | 4001477 | 5/9/2005 | Pre | No description. | Looking upstream at a 3x1m red boulder about 50m out. |
| PP Carbon 9-1 | 2 | 424797 | 4001477 | 10/26/2005 | Post | No description. | Photo update. |
| PP Carbon 9-1 | 2 | 424797 | 4001477 | 10/26/2005 | Post | No description. | Post work. |
| PP Carbon 9-1 | 2 | 424797 | 4001477 | 5/6/2006 | Post | No description. | Looking upstream at a 3x1m boulder about 50m out. |
| PP Carbon 9-1 | A | 424797 | 4001477 | 5/9/2005 | Pre | No description. | Looking upstream at Dan Hall at photopoint. |
| PP Carbon 9-1 | A | 424797 | 4001477 | 5/9/2005 | Pre | No description. | Looking upstream at Dan Hall at photopoint. |
| PP Carbon 9-2 | 1 | 424648 | 4001893 | 10/26/2005 | Post | Taken from creek right. There is a large rock outcrop about 2m high and it is very colorful with shades of purple, green, yellow and brown. | Post work. |
| PP Carbon 9-2 | 1 | 424648 | 4001893 | 10/26/2005 | Pre | Taken from creek right. There is a large rock outcrop about 2m high and it is very colorful with shades of purple, green, yellow and brown. | Looking downstream. |
| PP Carbon 9-2 | 1 | 424648 | 4001893 | 10/26/2005 | Pre | Taken from creek right. There is a large rock outcrop about 2m high and it is very colorful with shades of purple, green, yellow and brown. | Looking downstream. |
| PP Carbon 9-2 | 1 | 424648 | 4001893 | 10/26/2005 | Post | Taken from creek right. There is a large rock outcrop about 2m high and it is very colorful with shades of purple, green, yellow and brown. | Post work. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
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| PP Carbon 9-2 | 1 | 424648 | 4001893 | 5/6/2006 | Post | Taken from creek right. There is a large rock outcrop about 2m high and it is very colorful with shades of purple, green, yellow and brown. | Looking downstream. |
| PP Carbon 9-2 | 2 | 424648 | 4001893 | 10/26/2005 | Post | Taken from creek right. There is a large rock outcrop about 2m high and it is very colorful with shades of purple, green, yellow and brown. | Post work. |
| PP Carbon 9-2 | 2 | 424648 | 4001893 | 10/26/2005 | Pre | Taken from creek right. There is a large rock outcrop about 2m high and it is very colorful with shades of purple, green, yellow and brown. | Looking upstream. |
| PP Carbon 9-2 | 2 | 424648 | 4001893 | 10/26/2005 | Post | Taken from creek right. There is a large rock outcrop about 2m high and it is very colorful with shades of purple, green, yellow and brown. | Post work. Some still standing because they were girdled. |
| PP Carbon 9-2 | 2 | 424648 | 4001893 | 10/26/2005 | Pre | Taken from creek right. There is a large rock outcrop about 2m high and it is very colorful with shades of purple, green, yellow and brown. | Looking upstream. |
| PP Carbon 9-2 | 2 | 424648 | 4001893 | 5/6/2006 | Post | Taken from creek right. There is a large rock outcrop about 2m high and it is very colorful with shades of purple, green, yellow and brown. | Looking upstream. |
| PP Carbon 9-2 | A | 424648 | 4001893 | 10/26/2005 | Pre | Taken from creek right. There is a large rock outcrop about 2m high and it is very colorful with shades of purple, green, yellow and brown. | Melissa on photopoint. Taken from downstream, looking upstream. |
| PP Carbon 9-2 | A | 424648 | 4001893 | 10/26/2005 | Pre | Taken from creek right. There is a large rock outcrop about 2m high and it is very colorful with shades of purple, green, yellow and brown. | Melissa on the photopoint. Taken from downstream, looking upstream. |
| PP Carbon Hydro 1 | 1 | 424986 | 4001485 | 5/9/2005 | Pre | Seep/spring. | Looking upstream from sample point. Showing a flowing stretch in an untreated reach. |
| PP Carbon Hydro 1 | 1 | 424986 | 4001485 | 5/6/2006 | Post | Seep/spring. | Looking upstream from sample point. |
| PP Carbon Hydro 1 | 2 | 424986 | 4001485 | 5/9/2005 | Pre | Seep/spring. | Looking downstream from the sample point. Showing flowing stream in the treated reach. |
| PP Carbon Hydro 1 | 2 | 424986 | 4001485 | 5/6/2006 | Post | Seep/spring. | Looking downstream from the sample point. |
| PP Carbon Hydro 1 | 3 | 424986 | 4001485 | 5/9/2005 | Pre | Seep/spring. | Looking downstream at seep/spring source of this intermittent reach. GPS reading here is 425007/4001245 acc. 5m. |
| PP Carbon Hydro 1 | 3 | 424986 | 4001485 | 5/6/2006 | Post | Seep/spring. | Looking downstream at seep/spring source. GPS reading here is 424943/4001447 acc. 11 |
| PP Carbon Hydro 2 | 1 | 424652 | 4001881 | 5/9/2005 | Pre | Taken at a sandstone capped blue and maroon rock between 2 vegetation transects. | Looking upstream along stream and TAMRAM monitoring transect. |
| PP Carbon Hydro 2 | 1 | 424652 | 4001881 | 5/6/2006 | Post | Taken at a sandstone capped blue and maroon rock between 2 vegetation transects. | Looking upstream along stream and TAMRAM monitoring transect. |
| PP Carbon Hydro 2 | 2 | 424652 | 4001881 | 5/9/2005 | Pre | Taken at a sandstone capped blue and maroon rock between 2 vegetation transects. | Looking downstream along the stream toward the control transect. |
| PP Carbon Hydro 2 | 2 | 424652 | 4001881 | 5/6/2006 | Post | Taken at a sandstone capped blue and maroon rock between 2 vegetation transects. | Looking downstream along the stream toward the control transect. |

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| PP Carbon Hydro 3 | 1 | 424728 | 4001970 | 5/9/2005 | Pre | Sample taken 10m downstream of confluence. In May 2006 there was no water present at Carbon Hydro 3 and thus no data was collected, just photo retakes. | Looking upstream to confluence and water sample. |
| PP Carbon Hydro 3 | 1 | 424728 | 4001970 | 5/6/2006 | Post | Sample taken 10m downstream of confluence. In May 2006 there was no water present at Carbon Hydro 3 and thus no data was collected, just photo retakes. | Looking upstream to confluence and water sample. |
| PP Carbon Hydro 3 | 2 | 424728 | 4001970 | 5/9/2005 | Pre | Sample taken 10m downstream of confluence. In May 2006 there was no water present at Carbon Hydro 3 and thus no data was collected, just photo retakes. | Taken from the confluence, looking up the east fork. |
| PP Carbon Hydro 3 | 2 | 424728 | 4001970 | 5/6/2006 | Post | Sample taken 10m downstream of confluence. In May 2006 there was no water present at Carbon Hydro 3 and thus no data was collected, just photo retakes. | Taken from the confluence, looking up the east fork. |
| PP Carbon Hydro 3 | 3 | 424728 | 4001970 | 5/9/2005 | Pre | Sample taken 10m downstream of confluence. In May 2006 there was no water present at Carbon Hydro 3 and thus no data was collected, just photo retakes. | Taken from the confluence looking up the dry west fork. |
| PP Carbon Hydro 3 | 3 | 424728 | 4001970 | 5/6/2006 | Post | Sample taken 10m downstream of confluence. In May 2006 there was no water present at Carbon Hydro 3 and thus no data was collected, just photo retakes. | Taken from the confluence looking up the dry West Fork. |
| PP Carbon Hydro 3 | 4 | 424728 | 4001970 | 5/9/2005 | Pre | Sample taken 10m downstream of confluence. In May 2006 there was no water present at Carbon Hydro 3 and thus no data was collected, just photo retakes. | Taken from the confluence of the "middle" and east fork. This is 25m upstream of the seep. Looking downstream at TAMRAM and spring/seep. GPS reading here is 424743/4001999 acc. 3m. |
| PP Carbon Hydro 3 | 4 | 424728 | 4001970 | 5/6/2006 | Post | Sample taken 10m downstream of confluence. In May 2006 there was no water present at Carbon Hydro 3 and thus no data was collected, just photo retakes. | Taken from the confluence of the "middle" and east fork. This is 25m upstream of the seep. Looking downstream at spring/seep. GPS reading here is: E: 424660 N: 4002220 acc. 5m |
| PP Carbon Hydro 3 | 5 | 424728 | 4001970 | 5/9/2005 | Pre | Sample taken 10m downstream of confluence. In May 2006 there was no water present at Carbon Hydro 3 and thus no data was collected, just photo retakes. | Looking at the spring/seep source (marked by yellow box) in the east fork. GPS reading here is 424760/40023720acc. 5m. |
| PP Carbon Hydro 3 | 5 | 424728 | 4001970 | 5/6/2006 | Post | Sample taken 10m downstream of confluence. In May 2006 there was no water present at Carbon Hydro 3 and thus no data was collected, just photo retakes. | Looking at the seep/spring source. GPS reading here is E: 424706 N: 4002582 acc. 9m |
| PP Carbon Hydro 3 | 6 | 424728 | 4001970 | 5/9/2005 | Pre | Sample taken 10m downstream of confluence. In May 2006 there was no water present at Carbon Hydro 3 and thus no data was collected, just photo retakes. | Spring/seep source in the east fork. |
| PP Carbon Hydro 3 | 6 | 424728 | 4001970 | 5/6/2006 | Post | Sample taken 10m downstream of confluence. In May 2006 there was no water present at Carbon Hydro 3 and thus no data was collected, just photo retakes. | Seep/spring source in the east fork. |
| PP Carbon T1 End | 1 | 425657 | 4001296 | 5/6/2006 | Post | End of Carbon 1 transect. | Looking down canyon. This was Carbon 2. |
| PP Carbon T1 End | 2 | 425657 | 4001296 | 5/6/2006 | Post | End of Carbon 1 transect. | Looking up canyon. |
| PP Carbon T1 End | A | 425657 | 4001296 | 5/6/2006 | Pre | End of Carbon 1 transect. | Close up of the endpoint. |
| PP Carbon T1 Start | 1 | 425709 | 4001412 | 5/6/2006 | Post | Start of Carbon 1 transect. | Looking up canyon. |
| PP Carbon T1 Start | 2 | 425709 | 4001412 | 5/6/2006 | Post | Start of Carbon 1 transect. | Looking down canyon. |
| PP Carbon T1 Start | A | 425709 | 4001412 | 5/6/2006 | Pre | Start of Carbon 1 transect. | Looking up canyon showing the start point. |
| PP Carbon T1 Start | B | 425709 | 4001412 | 5/6/2006 | Pre | Start of Carbon 1 transect. | Close up of start point. |
| PP Carbon T2 End | 1 | 425314 | 4001397 | 5/6/2006 | Post | End of Carbon Transect 2. | Looking up canyon towards the start of the transect. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
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| PP Carbon T2 End | 2 | 425314 | 4001397 | 5/6/2006 | Post | End of Carbon Transect 2. | Looking down canyon towards a sharp bend. |
| PP Carbon T2 End | A | 425314 | 4001397 | 5/6/2006 | Pre | End of Carbon Transect 2. | Lori standing at the transect end. Taken from mid creek about 4m from the end point. |
| PP Carbon T2 End | B | 425314 | 4001397 | 5/6/2006 | Pre | End of Carbon Transect 2. | Shows the rock that has the transect end. Taken from about 1m from the end of the transect, looking down. |
| PP Carbon T2 Start | 1 | 425362 | 4001189 | 5/6/2006 | Post | Start of Carbon transect 2. | Looking down canyon toward the narrows and the end of the transect. |
| PP Carbon T2 Start | 2 | 425362 | 4001189 | 5/6/2006 | Post | Start of Carbon transect 2. | Looking up canyon. |
| PP Carbon T2 Start | A | 425362 | 4001189 | 5/6/2006 | Pre | Start of Carbon transect 2. | Lori at start point of Carbon Transect 2, the new brain rock. Taken from mid creek about 3m from the new brain rock. |
| PP Carbon T3 End | 2 | 425141 | 4001264 | 5/6/2006 | Post | End point of Carbon transect 3. This is about 3m from the water's edge. | Looking up canyon, showing mesquite. |
| PP Carbon T3 End | A | 425141 | 4001264 | 5/6/2006 | Pre | End point of Carbon transect 3. This is about 3m from the water's edge. | Looking down canyon to the endpoint (clip board). Rocks are on the SE side of the creek. Taken from up canyon of the transect end point. |
| PP Carbon T3 End | | 425141 | 4001264 | | Post | End point of Carbon transect 3. This is about 3m from the water's edge. | Looking down the transect toward the start point. Notice the dense phragmites. |
| PP Carbon T3 Start | 1 | 425189 | 4001282 | 5/6/2006 | Post | Start of Carbon transect 3. This is the NW bank of the creek. | Looking up canyon toward the end of the transect. |
| PP Carbon T3 Start | 2 | 425189 | 4001282 | 5/6/2006 | Post | Start of Carbon transect 3. This is the NW bank of the creek. | Looking down canyon. |
| PP Carbon T3 Start | A | 425189 | 4001282 | 5/6/2006 | Pre | Start of Carbon transect 3. This is the NW bank of the creek. | Clipboard is at the transect start point. |
| PP Carbon T4A End | 1 | 424704 | 4001692 | 5/9/2005 | Pre | Endpoint at downstream end of Prosopis clump on a slope below a bulging overhang of the cliff above. | Looking toward the start of the transect with dense TAMRAM on creek right with butte on the top left. |
| PP Carbon T4A End | 1 | 424704 | 4001692 | 5/6/2006 | Post | Endpoint at downstream end of Prosopis clump on a slope below a bulging overhang of the cliff above. | Post treatment. |
| PP Carbon T4A End | 2 | 424704 | 4001692 | 5/9/2005 | Pre | Endpoint at downstream end of Prosopis clump on a slope below a bulging overhang of the cliff above. | Taken from endpoint looking down canyon with a large mature TAMRAM on creek left. |
| PP Carbon T4A End | 2 | 424704 | 4001692 | 5/6/2006 | Post | Endpoint at downstream end of Prosopis clump on a slope below a bulging overhang of the cliff above. | Post treatment. |
| PP Carbon T4A End | 3 | 424704 | 4001692 | 5/9/2005 | Pre | Endpoint at downstream end of Prosopis clump on a slope below a bulging overhang of the cliff above. | Taken from the endpoint looking across canyon. Mature TAMRAM on creek left with running water in foreground. |
| PP Carbon T4A End | 3 | 424704 | 4001692 | 5/6/2006 | Post | Endpoint at downstream end of Prosopis clump on a slope below a bulging overhang of the cliff above. | Post treatment. |
| PP Carbon T4A End | A | 424704 | 4001692 | 5/9/2005 | Pre | Endpoint at downstream end of Prosopis clump on a slope below a bulging overhang of the cliff above. | Looking across creek left, west, to Lisa at the endpoint. Endpoint below a distinct GC supergroup with conglomerate on top. |
| PP Carbon T4A End | B | 424704 | 4001692 | 5/9/2005 | Pre | Endpoint at downstream end of Prosopis clump on a slope below a bulging overhang of the cliff above. | Looking at endpoint with Linda holding 50m mark amid a 4x4m ACAGRE. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
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| PP Carbon T4A Start | 1 | 424733 | 4001731 | 5/9/2005 | Pre | Starts at a 1.5x2m reddish sandstone boulder. | Taken from T4 start point, looking down canyon and down the transect. Mesquite and TAMRAM in view. |
| PP Carbon T4A Start | 1 | 424733 | 4001731 | 5/6/2006 | Post | Starts at a 1.5x2m reddish sandstone boulder. | Post treatment. |
| PP Carbon T4A Start | 2 | 424733 | 4001731 | 5/9/2005 | Pre | Starts at a 1.5x2m reddish sandstone boulder. | Taken from start point looking up canyon and across creek bend. Showing scattered saplings with mesquite. Also looking at highest point of Temple Butte in the background. |
| PP Carbon T4A Start | 2 | 424733 | 4001731 | 5/6/2006 | Post | Starts at a 1.5x2m reddish sandstone boulder. | Post treatment. |
| PP Carbon T4A Start | A | 424733 | 4001731 | 5/9/2005 | Pre | Starts at a 1.5x2m reddish sandstone boulder. | Looking up canyon 8 degrees, Lisa on 1.5x2m sandstone reddish colored boulder. |
| PP Carbon T4A Start | B | 424733 | 4001731 | 5/9/2005 | Pre | Starts at a 1.5x2m reddish sandstone boulder. | Taken from approx. 2m away, showing a closer view of Lisa at the start point. |
| PP Carbon T4A Start | C | 424733 | 4001731 | 5/9/2005 | Pre | Starts at a 1.5x2m reddish sandstone boulder. | Extreme close up of start point. |
| PP Carbon T4B 5 meter | 1 | 424722 | 4001640 | 5/9/2005 | Pre | Taken from the 5m mark on the transect. | Looking at large healthy PROGLA with lava formation in the background. |
| PP Carbon T4B 5 meter | 1 | 424722 | 4001640 | 5/6/2006 | Post | Taken from the 5m mark on the transect. | Post treatment. |
| PP Carbon T4B 5 meter | 2 | 424722 | 4001640 | 5/9/2005 | Pre | Taken from the 5m mark on the transect. | Shows PROGLA at the start of transect with the top of the Temple Butte in the background. |
| PP Carbon T4B 5 meter | 2 | 424722 | 4001640 | 5/6/2006 | Post | Taken from the 5m mark on the transect. | Post treatment. |
| PP Carbon T4B End | 1 | 424731 | 4001596 | 5/9/2005 | Pre | Transect ends at 4x3m large flat sandstone boulder on creek left. | Taken from the endpoint. Looking down creek at large dead ACAGRE with a rocky slope. |
| PP Carbon T4B End | 1 | 424731 | 4001596 | 5/6/2006 | Post | Transect ends at 4x3m large flat sandstone boulder on creek left. | Post treatment. |
| PP Carbon T4B End | 2 | 424731 | 4001596 | 5/9/2005 | Pre | Transect ends at 4x3m large flat sandstone boulder on creek left. | Looking up canyon and up the transect from the end point. The highest point of Temple Butte in the background. |
| PP Carbon T4B End | 2 | 424731 | 4001596 | 5/6/2006 | Post | Transect ends at 4x3m large flat sandstone boulder on creek left. | Post treatment. |
| PP Carbon T4B End | A | 424731 | 4001596 | 5/9/2005 | Pre | Transect ends at 4x3m large flat sandstone boulder on creek left. | Lisa at the endpoint. Note the sloping layer and conglomerate in the top left, also a large ACAGRE. |
| PP Carbon T4B Start | 1 | 424724 | 4001642 | 5/9/2005 | Pre | Start point is on the branch of a large mesquite close to the edge of the drainage. | Taken from the start of transect within PROGLA tree. Looking down the transect tape and down creek. Shows PROGLA branches. |
| PP Carbon T4B Start | 1 | 424724 | 4001642 | 5/6/2006 | Post | Start point is on the branch of a large mesquite close to the edge of the drainage. | Post treatment. |
| PP Carbon T4B Start | 2 | 424724 | 4001642 | 5/9/2005 | Pre | Start point is on the branch of a large mesquite close to the edge of the drainage. | Taken from the transect start. Looking up canyon across the creek with PROGLA in the foreground and highest point of Temple Butte in the background. |
| PP Carbon T4B Start | 2 | 424724 | 4001642 | 5/6/2006 | Post | Start point is on the branch of a large mesquite close to the edge of the drainage. | Post treatment. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
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| PP Carbon T4B Start | A | 424724 | 4001642 | 5/9/2005 | Pre | Start point is on the branch of a large mesquite close to the edge of the drainage. | Looking at the transect start with Lori in a big PROGLA. There is also a large sandstone boulder (5x1.5m) in the upper right corner. |
| PP Carbon T4B Start | B | 424724 | 4001642 | 5/9/2005 | Pre | Start point is on the branch of a large mesquite close to the edge of the drainage. | Shows close-up of transect start 0.75m away. Taken from within PROGLA clump. |
| PP Carbon T5A End | 1 | 424792 | 4002036 | 5/9/2005 | Pre | No description of endpoint on info sheets. | Taken from the end of the transect. Looking downstream and across drainage with a distinct skyline. |
| PP Carbon T5A End | 1 | 424792 | 4002036 | 5/6/2006 | Post | No description of endpoint on info sheets. | Post treatment. |
| PP Carbon T5A End | 2 | 424792 | 4002036 | 5/9/2005 | Pre | No description of endpoint on info sheets. | Taken from the end of the transect. Looking upstream through dense TAMRAM. |
| PP Carbon T5A End | 2 | 424792 | 4002036 | 5/6/2006 | Post | No description of endpoint on info sheets. | Post treatment. |
| PP Carbon T5A End | A | 424792 | 4002036 | 5/9/2005 | Pre | No description of endpoint on info sheets. | Looking at the end of transect from drainage, Looking creek left and up slope at cliff band. |
| PP Carbon T5A End | B | 424792 | 4002036 | 5/9/2005 | Pre | No description of endpoint on info sheets. | Standing in stream bed looking upstream/creek left. Looking at ridge top forming hoodoo in upper left corner of the photo. |
| PP Carbon T5A Start | 1 | 424783 | 4002075 | 5/9/2005 | Pre | No description recorded on the info sheet. | Taken from the start of the transect. Looking downstream with sandstone boulder in the foreground. TAMRAM and cliff band in the background. |
| PP Carbon T5A Start | 1 | 424783 | 4002075 | 5/6/2006 | Post | No description recorded on the info sheet. | Post treatment. |
| PP Carbon T5A Start | 2 | 424783 | 4002075 | 5/9/2005 | Pre | No description recorded on the info sheet. | Taken from the start of the transect. Looking upstream. Prominent skyline on stream right. |
| PP Carbon T5A Start | 2 | 424783 | 4002075 | 5/6/2006 | Post | No description recorded on the info sheet. | Post treatment. |
| PP Carbon T5A Start | A | 424783 | 4002075 | 5/9/2005 | Pre | No description recorded on the info sheet. | Taken from upstream, on creek left and looking down from a boulder at the transect start. Shows the beginning of the transect tape with tape crossing a large boulder at 6m mark. |
| PP Carbon T5A Start | B | 424783 | 4002075 | 5/9/2005 | Pre | No description recorded on the info sheet. | Taken from downstream and looking at the transect start (girl with the white shirt and hat). Distinct skyline feature in the background. |
| PP Carbon T5B End | 1 | 424791 | 4002077 | 5/9/2005 | Pre | No description recorded on the info sheet. | Taken from the transect end. Looking upstream at prosopis stand. Skyline in view. |
| PP Carbon T5B End | 1 | 424791 | 4002077 | 5/6/2006 | Post | No description recorded on the info sheet. | Post treatment. |
| PP Carbon T5B End | 2 | 424791 | 4002077 | 5/9/2005 | Pre | No description recorded on the info sheet. | Taken from the transect end. Looking downstream through TAMRAM and prosopis at the skyline. |
| PP Carbon T5B End | 2 | 424791 | 4002077 | 5/6/2006 | Post | No description recorded on the info sheet. | Post treatment. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
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| PP Carbon T5B End | A | 424791 | 4002077 | 5/9/2005 | Pre | No description recorded on the info sheet. | Standing 3m downstream from transect end. There is a 1x1m dark brown boulder seen from the drainage looking creek left. Photo looking at streambed and skyline. |
| PP Carbon T5B End | B | 424791 | 4002077 | 5/9/2005 | Pre | No description recorded on the info sheet. | Looking at the end of the transect. |
| PP Carbon T5B Start | 1 | 424809 | 4002120 | 5/9/2005 | Pre | The start is on a 4x2m white rock. | Taken from the transect start. Looking downstream down the drainage with a distinct skyline. |
| PP Carbon T5B Start | 1 | 424809 | 4002120 | 5/6/2006 | Post | The start is on a 4x2m white rock. | Post treatment. |
| PP Carbon T5B Start | 2 | 424809 | 4002120 | 5/9/2005 | Pre | The start is on a 4x2m white rock. | Taken from the photopoint. Looking up the drainage with the skyline in view. |
| PP Carbon T5B Start | 2 | 424809 | 4002120 | 5/6/2006 | Post | The start is on a 4x2m white rock. | Post treatment. |
| PP Carbon T5B Start | A | 424809 | 4002120 | 5/9/2005 | Pre | The start is on a 4x2m white rock. | Looking at Amy at the transect start. There is a boulder on creek right. Taken from the streambed looking at the large boulders. |
| PP Carbon T5B Start | B | 424809 | 4002120 | 5/9/2005 | Pre | The start is on a 4x2m white rock. | Taken from downstream, looking upstream at boulder and transect start. There is also a distinct skyline. |
| PP Cardenas Hillside Spring 1 | 1 | 423158 | 3993678 | 5/10/2005 | Pre | Photopoint is on the hillside towards the top of the riparian vegetation. Standing in the Dox sandstone in between some ACAGRE and the main spring area on the front side of the hill. | Looking at TAMRAM and PROGLA in the foreground and Tabernacle is in the background on the horizon. Looking downriver. |
| PP Cardenas Hillside Spring 1 | 1 | 423223 | 3993478 | 5/10/2005 | Pre | PP is on the hillside looking towards the top of the riparian vegetation. Standing in the Dox sandstone in between ACAGRE and the main spring on the front side of the hill. | Looking at TAMRAM and PROGLA in the foreground and Tabernacle is in the background on the horizon. Looking downriver. |
| PP Cardenas Hillside Spring 1 | 1 | 423158 | 3993678 | 3/6/2006 | Post | Photopoint is on the hillside towards the top of the riparian vegetation. Standing in the Dox sandstone in between some ACAGRE and the main spring area on the front side of the hill. | Post work. |
| PP Cardenas Hillside Spring 1 | 2 | 423158 | 3993678 | 5/10/2005 | Pre | Photopoint is on the hillside towards the top of the riparian vegetation. Standing in the Dox sandstone in between some ACAGRE and the main spring area on the front side of the hill. | Looking upstream. Visible in the photo: river, Cárdenas lavas and 2 nipple buttes against the skyline. |
| PP Cardenas Hillside Spring 1 | 2 | 423223 | 3993478 | 5/10/2005 | Pre | PP is on the hillside looking towards the top of the riparian vegetation. Standing in the Dox sandstone in between ACAGRE and the main spring on the front side of the hill. | Looking upstream. Visible in the photo: river, Cardenas lavas and 2 nipple buttes against the skyline. |
| PP Cardenas Hillside Spring 1 | 2 | 423158 | 3993678 | 3/6/2006 | Post | Photopoint is on the hillside towards the top of the riparian vegetation. Standing in the Dox sandstone in between some ACAGRE and the main spring area on the front side of the hill. | Post work. |
| PP Cardenas Hillside Spring 1 | A | 423223 | 3993478 | 5/10/2005 | Pre | PP is on the hillside looking towards the top of the riparian vegetation. Standing in the Dox sandstone in between ACAGRE and the main spring on the front side of the hill. | Looking uphill at Nicole standing on the PP with Comanche Point against the skyline. |
| PP Cardenas Hillside Spring 1 | A | 423158 | 3993678 | 5/10/2005 | Pre | Photopoint is on the hillside towards the top of the riparian vegetation. Standing in the Dox sandstone in between some ACAGRE and the main spring area on the front side of the hill. | Looking uphill at Nicole standing on the photopoint with Comanche Point against the skyline. |

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| PP Cardenas Hillside Spring 2 | 1 | 423158 | 3993502 | 5/10/2005 | Pre | Taken from a basalt boulder on the down river side of the wash and on down river side of the spring, just below the bottom of the spring. | Looking uphill at the spring. Wash visible in the lower portion of the picture. Comanche Point against the skyline. A rock slope is visible behind the veg clump. |
| PP Cardenas Hillside Spring 2 | 1 | 423094 | 3993701 | 5/10/2005 | Pre | Taken from a basalt boulder on the down river side of the wash and on down river side of spring, just below the bottom of the spring. | Looking uphill at the spring. Wash visible in the lower portion of the picture. Comanche Point against the skyline. A rock slope is visible behind the veg clump. |
| PP Cardenas Hillside Spring 2 | 1 | 423094 | 3993701 | 3/6/2006 | Post | Taken from a basalt boulder on the down river side of the wash and on down river side of spring, just below the bottom of the spring. | Post work. |
| PP Cardenas Hillside Spring 2 | 2 | 423094 | 3993701 | 5/10/2005 | Pre | Taken from a basalt boulder on the down river side of the wash and on down river side of spring, just below the bottom of the spring. | Looking up the side drainage toward basalt covered hillside. Veg covered slope visible in photo left. |
| PP Cardenas Hillside Spring 2 | 2 | 423158 | 3993502 | 5/10/2005 | Pre | Taken from a basalt boulder on the down river side of the wash and on down river side of the spring, just below the bottom of the spring. | Looking up the side drainage toward basalt covered hillside. Veg covered slope visible in photo left. |
| PP Cardenas Hillside Spring 2 | 2 | 423094 | 3993701 | 3/6/2006 | Post | Taken from a basalt boulder on the down river side of the wash and on down river side of spring, just below the bottom of the spring. | Post work. |
| PP Cardenas Hillside Spring 2 | A | 423158 | 3993502 | 5/10/2005 | Pre | Taken from a basalt boulder on the down river side of the wash and on down river side of the spring, just below the bottom of the spring. | Carmen at the PP. Hillside spring and Comanche Point are visible in the background. |
| PP Cardenas Hillside Spring 2 | A | 423094 | 3993701 | 5/10/2005 | Pre | Taken from a basalt boulder on the down river side of the wash and on down river side of spring, just below the bottom of the spring. | Carmen at the photopoint. Hillside spring and Comanche Point are visible in the background. |
| PP Cardenas Hillside Spring 3 | 1 | 423262 | 3993519 | 5/10/2005 | Pre | Taken from an outcropping of intensely weathered and pitted travertine or limestone on the downstream side of the drainage. This is at the base of the hillside spring. | Looking up the drainage toward TAMRAM and a very old ACAGRE. |
| PP Cardenas Hillside Spring 3 | 1 | 423198 | 3993717 | 5/10/2005 | Pre | Taken from an outcropping of intensely weathered and pitted travertine or limestone on the downstream side of the drainage. This is at the base of the hillside spring. | Looking up the drainage toward TAMRAM and a very old ACAGRE. |
| PP Cardenas Hillside Spring 3 | 1 | 423198 | 3993717 | 3/6/2006 | Post | Taken from an outcropping of intensely weathered and pitted travertine or limestone on the downstream side of the drainage. This is at the base of the hillside spring. | post work. |
| PP Cardenas Hillside Spring 3 | A | 423198 | 3993717 | 5/10/2005 | Pre | Taken from an outcropping of intensely weathered and pitted travertine or limestone on the downstream side of the drainage. This is at the base of the hillside spring. | Chris Murphy at photopoint. Looking down slope toward the river. |
| PP Cardenas Hillside Spring 3 | A | 423262 | 3993519 | 5/10/2005 | Pre | Taken from an outcropping of intensely weathered and pitted travertine or limestone on the downstream side of the drainage. This is at the base of the hillside spring. | Chris Murphy at PP. Looking down slope toward the river. |
| PP Clear 2 | 1 | 406919 | 3994418 | 2/20/2007 | Post | No satellites. Site is located approx. 80m above the first falls and before the straight away. Taken sitting on a slopy ledge on creek left at right bend in the creek. UTMS taken from GIS layer, field check. | Postwork. |
| PP Clear 2 | 1 | 406919 | 3994418 | 2/20/2007 | Pre | No satellites. Site is located approx. 80m above the first falls and before the straight away. Taken sitting on a slopy ledge on creek left at right bend in the creek. UTMS taken from GIS layer, field check. | Looking upstream - creek bends to looker's right before hitting a straight away. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
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| PP Clear 2 | 2 | 406919 | 3994418 | 2/20/2007 | Pre | No satellites. Site is located approx. 80m above the first falls and before the straight away. Taken sitting on a slopy ledge on creek left at right bend in the creek. UTMS taken from GIS layer, field check. | Looking downstream. |
| PP Clear 2 | 2 | 406919 | 3994418 | 2/20/2007 | Post | No satellites. Site is located approx. 80m above the first falls and before the straight away. Taken sitting on a slopy ledge on creek left at right bend in the creek. UTMS taken from GIS layer, field check. | Post work. |
| PP Clear 2 | A | 406919 | 3994418 | 2/20/2007 | Pre | No satellites. Site is located approx. 80m above the first falls and before the straight away. Taken sitting on a slopy ledge on creek left at right bend in the creek. UTMS taken from GIS layer, field check. | looking at Loren at photopoint. Taken from downstream looking up. |
| PP Clear 10 | 1 | 409041 | 3997182 | 11/29/2005 | Pre | Located about 30m upstream of Clear Creek Trail junction with the creek (the campground) atop a 15 foot tall base embankment at the Shinumo quartzite narrows. | Looking at quartzite wall with stream turning at the wall. There is TAMRAM to the left side of photo. |
| PP Clear 10 | 1 | 409041 | 3997182 | 12/3/2005 | Post | Located about 30m upstream of Clear Creek Trail junction with the creek (the campground) atop a 15 foot tall base embankment at the Shinumo quartzite narrows. | Post work. |
| PP Clear 10 | 2 | 409041 | 3997182 | 11/29/2005 | Pre | Located about 30m upstream of Clear Creek Trail junction with the creek (the campground) atop a 15 foot tall base embankment at the Shinumo quartzite narrows. | Looking across and upstream to a loose stream bank, TAMRAM in foreground with cottonwoods behind. |
| PP Clear 10 | 2 | 409041 | 3997182 | 12/3/2005 | Post | Located about 30m upstream of Clear Creek Trail junction with the creek (the campground) atop a 15 foot tall base embankment at the Shinumo quartzite narrows. | Post work. |
| PP Clear 10 | A | 409041 | 3997182 | 11/29/2005 | Pre | Located about 30m upstream of Clear Creek Trail junction with the creek (the campground) atop a 15 foot tall base embankment at the Shinumo quartzite narrows. | Nate at photopoint. |
| PP Clear 11 | 1 | 409236 | 3998068 | 11/30/2005 | Pre | Located on a red boulder in front of scrub oak in creek right, just below the dry confluence. | Looking down and across creek at left bank. End of Tapeats wall in the background. |
| PP Clear 11 | 1 | 409236 | 3998068 | 11/30/2005 | Post | Located on a red boulder in front of scrub oak in creek right, just below the dry confluence. | Post work. |
| PP Clear 11 | A | 409236 | 3998068 | 11/30/2005 | Pre | Located on a red boulder in front of scrub oak in creek right, just below the dry confluence. | Pen points at photopoint. |
| PP Clear 12 | 1 | 409518 | 3998304 | 11/30/2005 | Post | Located at the top of red sandstone boulder shaped like a great surfing wave. Located on creek left on slope above creek and below tapeats cliff that has an overhang shaped like lips or a moustache. | Post work. |
| PP Clear 12 | 1 | 409518 | 3998304 | 11/30/2005 | Pre | Located at the top of red sandstone boulder shaped like a great surfing wave. Located on creek left on slope above creek and below tapeats cliff that has an overhang shaped like lips or a moustache. | Looking upstream at cottonwood and toward west fork. |
| PP Clear 12 | 2 | 409518 | 3998304 | 11/30/2005 | Pre | Located at the top of red sandstone boulder shaped like a great surfing wave. Located on creek left on slope above creek and below tapeats cliff that has an overhang shaped like lips or a moustache. | Looking downstream and across creek. |
| PP Clear 12 | 2 | 409518 | 3998304 | 11/30/2005 | Post | Located at the top of red sandstone boulder shaped like a great surfing wave. Located on creek left on slope above creek and below tapeats cliff that has an overhang shaped like lips or a moustache. | Post work. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
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| PP Clear 12 | A | 409518 | 3998304 | 11/30/2005 | Pre | Located at the top of red sandstone boulder shaped like a great surfing wave. Located on creek left on slope above creek and below tapeats cliff that has an overhang shaped like lips or a moustache. | Pen points at photopoint. |
| PP Clear 14 | 1 | 409595 | 3998693 | 11/30/2005 | Pre | Located at small rock on creek left, 20m below Tapeats fin that juts towards the left side of the creek. On top of gravel wall 15 feet above creek. | Looking upstream and across creek. |
| PP Clear 14 | 1 | 409595 | 3998693 | 12/1/2005 | Post | Located at small rock on creek left, 20m below Tapeats fin that juts towards the left side of the creek. On top of gravel wall 15 feet above creek. | Post work. |
| PP Clear 14 | A | 409595 | 3998693 | 11/30/2005 | Pre | Located at small rock on creek left, 20m below Tapeats fin that juts towards the left side of the creek. On top of gravel wall 15 feet above creek. | Pen points to photopoint. |
| PP Clear 15 | 1 | 409639 | 3998838 | 12/1/2005 | Pre | Located on boulders on creek right between creek and head of deep seep drainage. | Looking upstream. No bearing recorded. |
| PP Clear 17 | 1 | 410435 | 4000484 | 12/1/2005 | Pre | Located on point between two creeks. On a Tapeats ledge 10 feet above confluence. Standing on a white spot in rock. These UTM's are taken from the map. | Looking upstream at west fork's creek right Tapeats wall. |
| PP Clear 17 | A | 410435 | 4000484 | 12/1/2005 | Pre | Located on point between two creeks. On a Tapeats ledge 10 feet above confluence. Standing on a white spot in rock. These UTM's are taken from the map. | Person at photopoint. |
| PP Clear 5 | 1 | 408171 | 3995846 | 11/12/2006 | Pre | A creek right, orange boulder (2x1x1m) on a long straight away with a large cut bank wall on creek right. This UTM was taken off of the map. | Looking downstream at small creek left TAMRAM. |
| PP Clear 5 | 1 | 408171 | 3995846 | 11/12/2006 | Post | A creek right, orange boulder (2x1x1m) on a long straight away with a large cut bank wall on creek right. This UTM was taken off of the map. | Post work. |
| PP Clear 5 | A | 408171 | 3995846 | 11/12/2006 | Pre | A creek right, orange boulder (2x1x1m) on a long straight away with a large cut bank wall on creek right. This UTM was taken off of the map. | Pen points at photopoint. Taken from the creek bottom looking at the photopoint boulder. There is a schist wall in the background. |
| PP Clear 15 | 1 | 409639 | 3998838 | 12/1/2005 | Post | Located on boulders on creek right between creek and head of deep seep drainage. | Post work. |
| PP Clear 15 | A | 409639 | 3998838 | 12/1/2005 | Pre | Located on boulders on creek right between creek and head of deep seep drainage. | Pen points to photopoint. |
| PP Clear 16 | 1 | 409856 | 3999512 | 12/1/2005 | Pre | Taken from Tapeats ledge on creek left. Standing where two small parallel vertical cracks run up the side of the ledge. One crack extends across the top of the ledge...that's the spot. | Looking downstream at Tapeats narrows. |
| PP Clear 16 | 1 | 409856 | 3999512 | 12/1/2005 | Post | Taken from Tapeats ledge on creek left. Standing where two small parallel vertical cracks run up the side of the ledge. One crack extends across the top of the ledge...that's the spot. | Post work. |
| PP Clear 16 | A | 409856 | 3999512 | 12/1/2005 | Pre | Taken from Tapeats ledge on creek left. Standing where two small parallel vertical cracks run up the side of the ledge. One crack extends across the top of the ledge...that's the spot. | Person at photopoint. |

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|-----------------|------|-------------|--------------|------------|-----------------------|---|---|
| PP Clear 17 | 1 | 410435 | 4000484 | 12/1/2005 | Post | Located on point between two creeks. On a Tapeats ledge 10 feet above confluence. Standing on a white spot in rock. These UTM's are taken from the map. | Post work. |
| PP Clear 19 | 1 | 411380 | 3999913 | 11/10/2006 | Pre | No GPS signal. Taken atop a 1x1x1m boulder on creek left, 80 meters below the major spring/source of the Ariel Pt fork of Clear Creek (which is on the creek left hillside). | Looking downstream at 1 mature gold tammy with tall cottonwood to the left. |
| PP Clear 19 | 1 | 411380 | 3999913 | 11/10/2006 | Post | No GPS signal. Taken atop a 1x1x1m boulder on creek left, 80 meters below the major spring/source of the Ariel Pt fork of Clear Creek (which is on the creek left hillside). | Post work. |
| PP Clear 19 | A | 411380 | 3999913 | 11/10/2006 | Pre | No GPS signal. Taken atop a 1x1x1m boulder on creek left, 80 meters below the major spring/source of the Ariel Pt fork of Clear Creek (which is on the creek left hillside). | Pen points at photopoint. Taken from the creek bottom looking across and up at the PP boulder. |
| PP Clear 6 | 1 | 408461 | 3995986 | 11/12/2006 | Post | This is 1 km below the confluence of Clear Creek and it's east arm at a straight stretch of the creek. There are many tall cottonwoods. PP boulder is 1x1x1 m on creek right. | Post work. |
| PP Clear 6 | 1 | 408461 | 3995986 | 11/12/2006 | Pre | This is 1 km below the confluence of Clear Creek and it's east arm at a straight stretch of the creek. There are many tall cottonwoods. PP boulder is 1x1x1 m on creek right. | Looking upstream at a TAMRAM adjacent to schist wall with POPFRE in the background. |
| PP Clear 6 | 2 | 408461 | 3995986 | 11/12/2006 | Post | This is 1 km below the confluence of Clear Creek and it's east arm at a straight stretch of the creek. There are many tall cottonwoods. PP boulder is 1x1x1 m on creek right. | Post work. |
| PP Clear 6 | 2 | 408461 | 3995986 | 11/12/2006 | Pre | This is 1 km below the confluence of Clear Creek and it's east arm at a straight stretch of the creek. There are many tall cottonwoods. PP boulder is 1x1x1 m on creek right. | Looking downstream with smaller TAMRAM in creek right at a distance. |
| PP Clear 6 | A | 408461 | 3995986 | 11/12/2006 | Pre | This is 1 km below the confluence of Clear Creek and it's east arm at a straight stretch of the creek. There are many tall cottonwoods. PP boulder is 1x1x1 m on creek right. | Looking across at PP, taken from schist bedrock on creek left. |
| PP Clear 8 | 1 | 411271 | 3996529 | 12/2/2005 | Post | Located atop a 1x1m smooth limestone boulder at the confluence delta about 1km south of campground. These UTM's are taken off the map. | Post work. |
| PP Clear 8 | 1 | 411271 | 3996529 | 12/2/2005 | Pre | Located atop a 1x1m smooth limestone boulder at the confluence delta about 1km south of campground. These UTM's are taken off the map. | Looking downstream with TAMRAM to the left and a schist wall behind and to the right of TAMRAM. |
| PP Clear 8 | 2 | 411271 | 3996529 | 12/2/2005 | Pre | Located atop a 1x1m smooth limestone boulder at the confluence delta about 1km south of campground. These UTM's are taken off the map. | Looking upstream in Clear Creek proper. Small cascade in the foreground and N. Rim in the background. |
| PP Clear 8 | 3 | 411271 | 3996529 | 12/2/2005 | Pre | Located atop a 1x1m smooth limestone boulder at the confluence delta about 1km south of campground. These UTM's are taken off the map. | Looking up the major East arm of Clear Creek (small but perennial stream). |
| PP Clear 8 | A | 411271 | 3996529 | 12/2/2005 | Pre | Located atop a 1x1m smooth limestone boulder at the confluence delta about 1km south of campground. These UTM's are taken off the map. | Nate with hand raised at photopoint. |
| PP Clear 9 | 1 | 409095 | 3996722 | 12/2/2005 | Post | Located atop a purple and white Shinumo quartzite boulder (4x5x4m), about 400m upstream of the first major drainage (from the east) below the campsite. | Post work. |
| PP Clear 9 | 1 | 409095 | 3996722 | 12/2/2005 | Pre | Located atop a purple and white Shinumo quartzite boulder (4x5x4m), about 400m upstream of the first major drainage (from the east) below the campsite. | Looking across the drainage to TAMRAM and coyote willow mix. Hakatai shale in the back top. |

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|-----------------|------|-------------|--------------|-----------|-----------------------|--|---|
| PP Clear 9 | 2 | 409095 | 3996722 | 12/2/2005 | Post | Located atop a purple and white Shinumo quartzite boulder (4x5x4m), about 400m upstream of the first major drainage (from the east) below the campsite. | Post work. |
| PP Clear 9 | 2 | 409095 | 3996722 | 12/2/2005 | Pre | Located atop a purple and white Shinumo quartzite boulder (4x5x4m), about 400m upstream of the first major drainage (from the east) below the campsite. | Looking downstream past cottonwoods to Shinumo wall on creek right. |
| PP Clear 9 | A | 409095 | 3996722 | 12/2/2005 | Pre | Located atop a purple and white Shinumo quartzite boulder (4x5x4m), about 400m upstream of the first major drainage (from the east) below the campsite. | Nate at photopoint. |
| PP Copper 1 | 1 | 376537 | 4011556 | 5/14/2005 | Pre | No GPS recorded. Taken on top of Vishnu schist high point on creek left, this is right in view of the mouth of the creek. | Looking downstream at small parking eddy with 2 boats right at the canyon mouth. |
| PP Copper 1 | 2 | 376537 | 4011556 | 5/14/2005 | Pre | No GPS recorded. Taken on top of Vishnu schist high point on creek left, this is right in view of the mouth of the creek. | Looking upstream at Vishnu schist canyon narrows. There is a mature ACAGRE hanging over the drainage. |
| PP Copper 1 | A | 376537 | 4011556 | 5/14/2005 | Pre | No GPS recorded. Taken on top of Vishnu schist high point on creek left, this is right in view of the mouth of the creek. | Lisa standing at the photopoint on top of Vishnu schist high point on creek left. Colorado river in the background. Taken from creek left about 10m upstream of photopoint. |
| PP Copper 1 | B | 376537 | 4011556 | 5/14/2005 | Pre | No GPS recorded. Taken on top of Vishnu schist high point on creek left, this is right in view of the mouth of the creek. | Lisa at photopoint on top of rock. Narrow schist slot canyon in the background. Taken from about 7m downstream, almost directly 10m above the river. |
| PP Copper 2 | 1 | 376583 | 4011549 | 3/14/2007 | Post | Pink and grey granite (medium sized - small Geo car) boulder in the middle of the creek about 30m upstream from a small pouroff. The boulder is in line with a small tributary on creek right. | Post work. |
| PP Copper 2 | 1 | 376583 | 4011549 | 3/14/2007 | Pre | Pink and grey granite (medium sized - small Geo car) boulder in the middle of the creek about 30m upstream from a small pouroff. The boulder is in line with a small tributary on creek right. | Looking downstream of mature TAMRAM. |
| PP Copper 2 | A | 376583 | 4011549 | 3/14/2007 | Pre | Pink and grey granite (medium sized - small Geo car) boulder in the middle of the creek about 30m upstream from a small pouroff. The boulder is in line with a small tributary on creek right. | Pen points at PP. Taken about 10m downstream on creek left, just before a small pouroff. |
| PP Copper 3 | 1 | 376506 | 4011409 | 3/14/2007 | Pre | Taken from the lip of a schist pool (about 1m deep) and about 10m upstream from a pouroff. | Looking upstream. |
| PP Copper 3 | A | 376506 | 4011409 | 3/14/2007 | Pre | Taken from the lip of a schist pool (about 1m deep) and about 10m upstream from a pouroff. | Pen points to PP. Looking directly downstream at granite lip. |
| PP Copper 6 | 1 | 376054 | 4009825 | 3/13/2007 | Pre | Standing on a boulder creek right, 30m below pour offs in Muav/Bright Angel shale. | Looking upstream toward dry pouroff. |
| PP Copper 6 | A | 376054 | 4009825 | 3/13/2007 | Pre | Standing on a boulder creek right, 30m below pour offs in Muav/Bright Angel shale. | Looking upstream to person at PP. |
| PP Copper 7 | 1 | 375966 | 4009423 | 3/13/2007 | Pre | Standing on limestone boulder on creek left in between 2 30' pour offs. | Looking upstream at a large grey boulder on creek left. |
| PP Copper 7 | 1 | 375966 | 4009423 | 3/13/2007 | Post | Standing on limestone boulder on creek left in between 2 30' pour offs. | Post work. |
| PP Copper 7 | 2 | 375966 | 4009423 | 3/13/2007 | Pre | Standing on limestone boulder on creek left in between 2 30' pour offs. | Looking into creek at TAMRAM below a grey and white speckled boulder. |

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|-----------------|------|-------------|--------------|------------|-----------------------|--|--|
| PP Copper 7 | 2 | 375966 | 4009423 | 3/13/2007 | Post | Standing on limestone boulder on creek left in between 2 30' pour offs. | Post work. |
| PP Copper 7 | 3 | 375966 | 4009423 | 3/13/2007 | Pre | Standing on limestone boulder on creek left in between 2 30' pour offs. | Looking downstream at lip of lower pouroff (left of frame) several TAMRAM in drainage. |
| PP Copper 7 | 3 | 375966 | 4009423 | 3/13/2007 | Post | Standing on limestone boulder on creek left in between 2 30' pour offs. | Post work. |
| PP Copper 7 | A | 375966 | 4009423 | 3/13/2007 | Pre | Standing on limestone boulder on creek left in between 2 30' pour offs. | Pen points to PP. Taken from the drainage looking directly up the bank at PP on shelf on creek left. |
| PP Copper 8 | 1 | 375929 | 4009061 | 3/13/2007 | Post | Standing beside a 3' boulder in the middle of the creek bed just below Muav pouroff where a side drainage comes in on creek right. | Post work. |
| PP Copper 8 | 1 | 375929 | 4009061 | 3/13/2007 | Pre | Standing beside a 3' boulder in the middle of the creek bed just below Muav pouroff where a side drainage comes in on creek right. | Looking directly upstream at Muav pouroff. |
| PP Copper 8 | A | 375929 | 4009061 | 3/13/2007 | Pre | Standing beside a 3' boulder in the middle of the creek bed just below Muav pouroff where a side drainage comes in on creek right. | Finger points at PP. Taken from downstream. |
| PP Cottonwood 1 | 1 | 410868 | 3988039 | 6/9/2005 | Pre | Standing on the first ledge of Tapeats, upstream of a cottonwood on creek right. | Glenn's pack and a downstream view of uppermost tammies. |
| PP Cottonwood 1 | 1 | 410868 | 3988039 | 10/12/2005 | Post | Standing on the first ledge of Tapeats, upstream of a cottonwood on creek right. | View downstream; post treatment. |
| PP Cottonwood 1 | A | 410868 | 3988039 | 10/12/2005 | Pre | Standing on the first ledge of Tapeats, upstream of a cottonwood on creek right. | Loren standing at photopoint. |
| PP Cottonwood 2 | 1 | 410744 | 3988705 | 6/9/2005 | Pre | Taken from horseshoe intrusions of pink granite into Vishnu schist in the middle of the channel. Up a slope on creek left is a yellow pentagon shaped flat boulder face. | Tamarisk in the right foreground and Vishnu Temple in the right background. |
| PP Cottonwood 2 | 1 | 410744 | 3988705 | 10/12/2005 | Post | Taken from horseshoe intrusions of pink granite into Vishnu schist in the middle of the channel. Up a slope on creek left is a yellow pentagon shaped flat boulder face. | Looking downstream; post treatment |
| PP Cottonwood 2 | A | 410744 | 3988705 | 10/12/2005 | Pre | Taken from horseshoe intrusions of pink granite into Vishnu schist in the middle of the channel. Up a slope on creek left is a yellow pentagon shaped flat boulder face. | Melissa at photopoint. |
| PP Cottonwood 3 | A | 410997 | 3989060 | 10/13/2005 | Pre | Photopoint at the base of 40' fall. Access to the base is up and over on creek left. Photo taken from downstream. | Loren at photopoint no TAMRAM in view. |
| PP Cottonwood 4 | 1 | 411028 | 3989221 | 10/13/2005 | Post | Large sandstone boulder, mid-channel but before the channel narrows back down in the granite. | Post treatment. |
| PP Cottonwood 4 | 1 | 411028 | 3989221 | 10/13/2005 | Pre | Large sandstone boulder, mid-channel but before the channel narrows back down in the granite. | Pretreatment photo; looking downstream at stand of TAMRAM. |
| PP Cottonwood 5 | 1 | 411056 | 3989364 | 11/16/2005 | Pre | Located at a large sandstone boulder on the left side of the creek. This is at the schist/granite formation that creates a large bend in the creek. | Looking down creek in the drainage at the first part of the section. Eleanor is working on TAMRAM. |
| PP Cottonwood 5 | 2 | 411056 | 3989364 | 11/16/2005 | Pre | Located at a large sandstone boulder on the left side of the creek. This is at the schist/granite formation that creates a large bend in the creek. | Same as view 1 but vertical. |
| PP Cottonwood 5 | A | 411056 | 3989364 | 11/16/2005 | Pre | Located at a large sandstone boulder on the left side of the creek. This is at the schist/granite formation that creates a large bend in the creek. | Kari at photopoint. Taken from down canyon, looking up canyon. |

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|-----------------|------|-------------|--------------|-----------|-----------------------|---|--|
| PP Crystal 1-1 | 1 | 388088 | 3999721 | 5/12/2005 | Pre | Taken at canyon mouth on the 1st Vishnu schist outcrop from a small sandstone boulder on creek right. | Looking upstream at Vishnu schist uplift topped by Tapeats. There is a notch in the Tapeats on the left. |
| PP Crystal 1-1 | 1 | 388088 | 3999721 | 3/1/2006 | Post | Taken at canyon mouth on the 1st Vishnu schist outcrop from a small sandstone boulder on creek right. | Post work. |
| PP Crystal 1-1 | 2 | 388088 | 3999721 | 5/12/2005 | Pre | Taken at canyon mouth on the 1st Vishnu schist outcrop from a small sandstone boulder on creek right. | Looking downstream at a triangular peak on river left. |
| PP Crystal 1-1 | 2 | 388088 | 3999721 | 3/1/2006 | Post | Taken at canyon mouth on the 1st Vishnu schist outcrop from a small sandstone boulder on creek right. | Post work. |
| PP Crystal 1-1 | A | 388088 | 3999721 | 5/12/2005 | Pre | Taken at canyon mouth on the 1st Vishnu schist outcrop from a small sandstone boulder on creek right. | Looking upstream at Maggie at photopoint on a small sandstone boulder on creek right. |
| PP Crystal 1-2 | 1 | 388291 | 3999787 | 3/1/2006 | Pre | Standing on a schist outcrop, 8m above and away (creek left) from the stream. This is about 200-300m from the mouth of Crystal Creek. | Looking upstream. There is a wall of TAMRAM that lines both sides of the creek. There is Baccharis and Pluchea mixed in. |
| PP Crystal 1-2 | 2 | 388291 | 3999787 | 3/1/2006 | Pre | Standing on a schist outcrop, 8m above and away (creek left) from the stream. This is about 200-300m from the mouth of Crystal Creek. | Looking across the stream at many mature TAMRAMs. |
| PP Crystal 1-2 | 2 | 388291 | 3999787 | 3/2/2006 | Post | Standing on a schist outcrop, 8m above and away (creek left) from the stream. This is about 200-300m from the mouth of Crystal Creek. | Post work. |
| PP Crystal 1-2 | 3 | 388291 | 3999787 | 3/1/2006 | Pre | Standing on a schist outcrop, 8m above and away (creek left) from the stream. This is about 200-300m from the mouth of Crystal Creek. | Looking downstream. There are two extremely large TAMRAMs in the foreground and many others are hidden. |
| PP Crystal 1-2 | 3 | 388291 | 3999787 | 3/2/2006 | Post | Standing on a schist outcrop, 8m above and away (creek left) from the stream. This is about 200-300m from the mouth of Crystal Creek. | Post work. |
| PP Crystal 1-2 | A | 388291 | 3999787 | 3/1/2006 | Pre | Standing on a schist outcrop, 8m above and away (creek left) from the stream. This is about 200-300m from the mouth of Crystal Creek. | Pen pointing at photopoint. Taken from the stream and looking at the east wall of the canyon. |
| PP Crystal 2-1 | 1 | 388518 | 3999987 | 5/12/2005 | Pre | Taken from a large slab of schist (12m x 6m) with Zoroaster veins 500m up from Crystal 1 on creek right. | Looking upstream at V of canyon. The N. Rim is in the background. |
| PP Crystal 2-1 | 2 | 388518 | 3999987 | 5/12/2005 | Pre | Taken from a large slab of schist (12m x 6m) with Zoroaster veins 500m up from Crystal 1 on creek right. | Looking downstream at a small nipple (in top middle of the photo) above Tapeats. |
| PP Crystal 2-1 | A | 388518 | 3999987 | 5/12/2005 | Pre | Taken from a large slab of schist (12m x 6m) with Zoroaster veins 500m up from Crystal 1 on creek right. | Looking at Maggie on photopoint with some Granite in it. |
| PP Crystal 2-2 | 1 | 388632 | 4000218 | 2/22/2007 | Pre | Taken from barn sized boulder on creek right about 50m from a small waterfall (1st of 2 waterfalls). | Look upstream of TAMRAM. |
| PP Crystal 2-2 | 1 | 388632 | 4000218 | 2/22/2007 | Post | Taken from barn sized boulder on creek right about 50m from a small waterfall (1st of 2 waterfalls). | Post work. |
| PP Crystal 2-2 | 2 | 388632 | 4000218 | 2/22/2007 | Post | Taken from barn sized boulder on creek right about 50m from a small waterfall (1st of 2 waterfalls). | Post work. |
| PP Crystal 2-2 | 2 | 388632 | 4000218 | 2/22/2007 | Pre | Taken from barn sized boulder on creek right about 50m from a small waterfall (1st of 2 waterfalls). | Looking downstream at TAMRAM. |
| PP Crystal 2-2 | A | 388632 | 4000218 | 2/22/2007 | Pre | Taken from barn sized boulder on creek right about 50m from a small waterfall (1st of 2 waterfalls). | Taken from downstream of PP about 25 meters on creek right. Pen pointing at PP. |

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|-----------------|------|-------------|--------------|-----------|-----------------------|---|---|
| PP Crystal 3-1 | 1 | 388744 | 4000370 | 5/12/2005 | Pre | Taken from a large boulder (4x3m) on top of Zoroaster granite outcrop. Boulder is on creek left and sits about 10m above the creek. | Looking downstream at a creek bend with Tapeats and Redwall in the distance. |
| PP Crystal 3-1 | 2 | 388744 | 4000370 | 5/12/2005 | Pre | Taken from a large boulder (4x3m) on top of Zoroaster granite outcrop. Boulder is on creek left and sits about 10m above the creek. | Looking upstream. The bottom center of the photo is Zoroaster granite and schist. |
| PP Crystal 3-1 | A | 388744 | 4000370 | 5/12/2005 | Pre | Taken from a large boulder (4x3m) on top of Zoroaster granite outcrop. Boulder is on creek left and sits about 10m above the creek. | Looking at Maggie on the photopoint. |
| PP Crystal 3-2 | 1 | 388840 | 4000455 | 2/22/2007 | Post | Taken from a 2x1m Tapeats boulder on creek left. This is about 100 meters before a dodge to the left in the canyon. | Post work. |
| PP Crystal 3-2 | 1 | 388840 | 4000455 | 2/22/2007 | Pre | Taken from a 2x1m Tapeats boulder on creek left. This is about 100 meters before a dodge to the left in the canyon. | Looking upstream to TAMRAM on creek left. |
| PP Crystal 3-2 | 2 | 388840 | 4000455 | 2/22/2007 | Post | Taken from a 2x1m Tapeats boulder on creek left. This is about 100 meters before a dodge to the left in the canyon. | Post work. |
| PP Crystal 3-2 | 2 | 388840 | 4000455 | 2/22/2007 | Pre | Taken from a 2x1m Tapeats boulder on creek left. This is about 100 meters before a dodge to the left in the canyon. | Looking downstream to creek right. |
| PP Crystal 3-2 | A | 388840 | 4000455 | 2/22/2007 | Pre | Taken from a 2x1m Tapeats boulder on creek left. This is about 100 meters before a dodge to the left in the canyon. | Pen is pointing at PP. Taken from downstream about 20m on creek left. |
| PP Crystal 4 | 1 | 389005 | 4000460 | 5/12/2005 | Pre | Taken from a large Vishnu schist outcrop (20x3.5m) on creek right. Topped by a large red Zoroaster granite boulder (5x4m). | Looking downstream from creek right. Top left there is a finger shaped spire of Tapeats; right center there is talus Vishnu schist rockslide; in the middle there is a Y shaped Zoroaster vein. |
| PP Crystal 4 | 2 | 389005 | 4000460 | 5/12/2005 | Pre | Taken from a large Vishnu schist outcrop (20x3.5m) on creek right. Topped by a large red Zoroaster granite boulder (5x4m). | Looking upstream at granite slope, behind eph. spp. (?). In mid photo there is a black stained Zoroaster granite. |
| PP Crystal 5 | 1 | 389205 | 4000784 | 5/13/2005 | Pre | Taken from a Zoroaster, triangle shaped boulder (4x1.5x2m) in the middle of the stream bed, on the river right of stream flow. | Looking downstream at S shaped bend in creek; granite wall on creek right and top left view on far ridge is Tapeats. |
| PP Crystal 5 | 2 | 389205 | 4000784 | 5/13/2005 | Pre | Taken from a Zoroaster, triangle shaped boulder (4x1.5x2m) in the middle of the stream bed, on the river right of stream flow. | Looking upstream; 6m tall cottonwood on creek left about 30m away from the photopoint; schist boulder on upper slope of creek left balanced on the slope above the cottonwood. |
| PP Crystal 5 | A | 389205 | 4000784 | 5/13/2005 | Pre | Taken from a Zoroaster, triangle shaped boulder (4x1.5x2m) in the middle of the stream bed, on the river right of stream flow. | Looking upstream at Maggie on the photopoint. Photo taken from downstream on creek right about 10m away. |
| PP Crystal 6 | 1 | 389452 | 4001068 | 5/13/2005 | Pre | Taken from a schist boulder (3x3x2m) on creek right at the middle of large bend that goes to the southeast. | Looking downstream; mid right of photo is white water stained schist (vertical) pourover; far cliffs are south rim with supai nipple and redwall below. |
| PP Crystal 6 | 2 | 389452 | 4001068 | 5/13/2005 | Pre | Taken from a schist boulder (3x3x2m) on creek right at the middle of large bend that goes to the southeast. | Looking upstream at loose schist/granite slope; far ridge is tapeats; looking at S-curve that goes to the southeast. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
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| PP Crystal 6 | A | 389452 | 4001068 | 5/13/2005 | Pre | Taken from a schist boulder (3x3x2m) on creek right at the middle of large bend that goes to the southeast. | Looking at Maggie on photopoint boulder with talus slope behind; top of photo shows Tapeats cliff and shiny granite cliff below. Photo taken standing creek left about 10m upstream looking NNW up at boulder with talus slope behind. |
| PP Crystal 7 | 1 | 389719 | 4000900 | 5/13/2005 | Pre | Taken from creek right on a shiny schist boulder/bedrock (3.5x3.5x3.5m). There is a Tapeats boulder about 1m away. | Looking at schist slope with Tapeats top layer; closer is the Zoroaster granite vertical vein sandwiched between schist talus. |
| PP Crystal 7 | 2 | 389719 | 4000900 | 5/13/2005 | Pre | Taken from creek right on a shiny schist boulder/bedrock (3.5x3.5x3.5m). There is a Tapeats boulder about 1m away. | Looking upstream; across creek bend at narrow talus slope in the top right corner of the photo; looking down at a cobbly creek bed. |
| PP Crystal 7 | A | 389719 | 4000900 | 5/13/2005 | Pre | Taken from creek right on a shiny schist boulder/bedrock (3.5x3.5x3.5m). There is a Tapeats boulder about 1m away. | Looking up at Carmen standing on the photopoint boulder/bedrock. Taken from downstream boulder about 20m away. |
| PP Crystal Hydro T1A | 1 | 388698 | 4000228 | 5/12/2005 | Pre | View 1: Taken from the top of seep area in a boulder pile. View 2: Taken standing below seep area with bedrock on river right, about 4m downstream from sample pool. | Looking down creek at seep with bedrock on river right. |
| PP Crystal Hydro T1A | 1 | 388698 | 4000228 | 5/11/2007 | Post | View 1: Taken from the top of seep area in a boulder pile. View 2: Taken standing below seep area with bedrock on river right, about 4m downstream from sample pool. | Looking down creek at seep with bedrock on river right. |
| PP Crystal Hydro T1A | 2 | 388698 | 4000228 | 5/12/2005 | Pre | View 1: Taken from the top of seep area in a boulder pile. View 2: Taken standing below seep area with bedrock on river right, about 4m downstream from sample pool. | Looking upstream at seep area with big schist and sandstone boulders in the middle of the creek bed. |
| PP Crystal Hydro T1A | 2 | 388698 | 4000228 | 5/11/2007 | Post | View 1: Taken from the top of seep area in a boulder pile. View 2: Taken standing below seep area with bedrock on river right, about 4m downstream from sample pool. | Looking upstream at seep area with big schist and sandstone boulders in the middle of the creek bed. |
| PP Crystal Hydro T2A | 1 | 388447 | 3999832 | 5/13/2005 | Pre | See downstream photopoint description for T2A = Taken from creek left about 600m from the mouth of the creek; about 130m above where the creek makes a sharp turn around a rocky delta; look for somewhat distinct schist wall on creek left. | Looking at terrace cross section and bank from the creek channel. |
| PP Crystal Hydro T2A | 1 | 388447 | 3999832 | 5/11/2007 | Post | See downstream photopoint description for T2A = Taken from creek left about 600m from the mouth of the creek; about 130m above where the creek makes a sharp turn around a rocky delta; look for somewhat distinct schist wall on creek left. | Looking at terrace cross section and bank from the creek channel |
| PP Crystal T1A End | 1 | 388727 | 4000325 | 5/12/2005 | Pre | No description of transect location. | Looking upstream from the endpoint with a tiny part of the skyline and the canyon wall in the background. |
| PP Crystal T1A End | 2 | 388727 | 4000325 | 5/12/2005 | Pre | No description of transect location. | Looking downstream at canyon wall on creek left. |
| PP Crystal T1A End | A | 388727 | 4000325 | 5/12/2005 | Pre | No description of transect location. | Looking at Lisa standing at the endpoint; boulders on creek left, opposite side of transect and skyline. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|----------------------|------|-------------|--------------|-----------|-----------------------|---|--|
| PP Crystal T1A End | B | 388727 | 4000325 | 5/12/2005 | Pre | No description of transect location. | Looking at Lisa standing at endpoint with boulders on slope that are perpendicular to Lisa. |
| PP Crystal T1A Start | 1 | 388729 | 4000352 | 5/12/2005 | Pre | This GPS is taken from the 25m mark due to poor GPS coverage. Transect is in a narrow canyon; no other description. | Looking downstream with the skyline in the back. Taken from about 1.5m downstream of start point; TAMRAM in view. |
| PP Crystal T1A Start | 2 | 388729 | 4000352 | 5/12/2005 | Pre | This GPS is taken from the 25m mark due to poor GPS coverage. Transect is in a narrow canyon; no other description. | Looking upstream to narrow canyon section; there is a cliff wall where the stream makes a bend. Taken from about 1.5m downstream of start point. |
| PP Crystal T1A Start | A | 388729 | 4000352 | 5/12/2005 | Pre | This GPS is taken from the 25m mark due to poor GPS coverage. Transect is in a narrow canyon; no other description. | Looking at start point with Lisa waving; a tiny bit of skyline shows and the canyon wall is behind. Taken from about 30m downstream. |
| PP Crystal T1A Start | B | 388729 | 4000352 | 5/12/2005 | Pre | This GPS is taken from the 25m mark due to poor GPS coverage. Transect is in a narrow canyon; no other description. | View of start with a pen next to the darkened corner in the canyon wall, for scale. Photo taken in stream directly perpendicular to start point. |
| PP Crystal T1A Start | C | 388729 | 4000352 | 5/12/2005 | Pre | This GPS is taken from the 25m mark due to poor GPS coverage. Transect is in a narrow canyon; no other description. | Looking at a close up of the starting point with a pen for scale. Taken from 1m upstream on creek right. |
| PP Crystal T1B End | 1 | 388634 | 4000126 | 5/12/2005 | Pre | There is no description of the endpoint. | Looking up creek up the transect; there is a shadow cast from the canyon wall on creek right. Taken from endpoint. |
| PP Crystal T1B End | 2 | 388634 | 4000126 | 5/12/2005 | Pre | There is no description of the endpoint. | Looking downstream, shadow is cast from canyon wall; distinct meander of creek and skyline. Taken from endpoint. |
| PP Crystal T1B End | A | 388634 | 4000126 | 5/12/2005 | Pre | There is no description of the endpoint. | Lisa pointing at rocky wall - distinct wall lines and skyline. |
| PP Crystal T1B Start | 1 | 388644 | 4000140 | 5/12/2005 | Pre | Start point is right where canyon narrows. | Looking downstream at a stand of arrow weed with a very distinct skyline. Taken from the start point. |
| PP Crystal T1B Start | 2 | 388644 | 4000140 | 5/12/2005 | Pre | Start point is right where canyon narrows. | Looking upstream at canyon wall, which is across the stream on creek left. Distinct skyline. Taken from start point. |
| PP Crystal T1B Start | A | 388644 | 4000140 | 5/12/2005 | Pre | Start point is right where canyon narrows. | Looking at Lisa standing on the start point from approximately 10m away and downstream. Notice skyline. |
| PP Crystal T1B Start | B | 388644 | 4000140 | 5/12/2005 | Pre | Start point is right where canyon narrows. | Looking at Lisa at start point with skyline. Taken from about 5m down creek. |
| PP Crystal T2A End | 1 | 0 | 0 | 5/13/2005 | Pre | No GPS recorded. No description of the endpoint. | Looking from the transect tape end upstream into the veg thicket. Taken from endpoint looking upstream along the transect tape. |
| PP Crystal T2A End | A | 0 | 0 | 5/13/2005 | Pre | No GPS recorded. No description of the endpoint. | Looking at endpoint with prominent features behind, slope with chute and skyline. Taken from the bank on creek right, opposite of the transect end (on creek about 1m from the creek). |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|----------------------|------|-------------|--------------|-----------|-----------------------|--|--|
| PP Crystal T2A End | B | 0 | 0 | 5/13/2005 | Pre | No GPS recorded. No description of the endpoint. | Looking at Kate at the endpoint with a white boulder in the foreground. |
| PP Crystal T2A Start | 1 | 0 | 0 | 5/13/2005 | Pre | No GPS recorded. Start point is on a pink boulder with a reference big boulder on creek right. | Looking at the transect line form downstream. Taken from start point looking downstream along transect line. |
| PP Crystal T2A Start | 2 | 0 | 0 | 5/13/2005 | Pre | No GPS recorded. Start point is on a pink boulder with a reference big boulder on creek right. | Looking upstream at Tapeats skyline. Taken from start point looking upstream. |
| PP Crystal T2A Start | A | 0 | 0 | 5/13/2005 | Pre | No GPS recorded. Start point is on a pink boulder with a reference big boulder on creek right. | Looking at start point on pink boulder with reference big boulder on creek right. Taken from upstream of start point about 3m and looking downstream. |
| PP Crystal T2A Start | B | 0 | 0 | 5/13/2005 | Pre | No GPS recorded. Start point is on a pink boulder with a reference big boulder on creek right. | Looking at Tapeats chimney stack in background and start point in foreground. Taken from streambed looking at creek left cliff. |
| PP Crystal T2A Start | C | 0 | 0 | 5/13/2005 | Pre | No GPS recorded. Start point is on a pink boulder with a reference big boulder on creek right. | Looking at start point and second reference boulder (Tapeats slab) upstream of photopoint on creek right. Taken from downstream of start point on a big boulder on creek right. |
| PP Crystal T2A Start | D | 0 | 0 | 5/13/2005 | Pre | No GPS recorded. Start point is on a pink boulder with a reference big boulder on creek right. | Looking at Kate at photopoint with downstream skyline features. Taken from upstream of start point looking at start point. |
| PP Crystal T2B End | 1 | 388489 | 3999915 | 5/13/2005 | Pre | The end of the transect is about 4-5m from the edge of the creek; across creek from Zoroaster granite intrusion through schist on creek left; in a cobble stone and boulder with some cryptobiotic crusts. | Looking up canyon and up transect, note some TAMRAM. |
| PP Crystal T2B End | 2 | 388489 | 3999915 | 5/13/2005 | Pre | The end of the transect is about 4-5m from the edge of the creek; across creek from Zoroaster granite intrusion through schist on creek left; in a cobble stone and boulder with some cryptobiotic crusts. | Looking across the creek toward a schist wall with Zoroaster granite intrusion - a few TAMRAM. |
| PP Crystal T2B End | 3 | 388489 | 3999915 | 5/13/2005 | Pre | The end of the transect is about 4-5m from the edge of the creek; across creek from Zoroaster granite intrusion through schist on creek left; in a cobble stone and boulder with some cryptobiotic crusts. | Looking down canyon, note large TAMRAM in the foreground and delta across the canyon. |
| PP Crystal T2B End | 4 | 388489 | 3999915 | 5/13/2005 | Pre | The end of the transect is about 4-5m from the edge of the creek; across creek from Zoroaster granite intrusion through schist on creek left; in a cobble stone and boulder with some cryptobiotic crusts. | Looking down canyon with the same view of cobble delta, but not obstructed by TAMRAM. Taken about 1m towards creek. |
| PP Crystal T2B End | A | 388489 | 3999915 | 5/13/2005 | Pre | The end of the transect is about 4-5m from the edge of the creek; across creek from Zoroaster granite intrusion through schist on creek left; in a cobble stone and boulder with some cryptobiotic crusts. | Looking at Jason at the end of the transect and creek left vegetation - note the distinct tapeats column in the background. Taken from the middle of the creek. |
| PP Crystal T2B End | B | 388489 | 3999915 | 5/13/2005 | Pre | The end of the transect is about 4-5m from the edge of the creek; across creek from Zoroaster granite intrusion through schist on creek left; in a cobble stone and boulder with some cryptobiotic crusts. | Looking at Jason at the end of the transect - note the Tapeats wall; across the river well developed layers looking towards the South Rim. Taken from near the 46m mark on the transect. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|----------------------|------|-------------|--------------|-----------|-----------------------|--|---|
| PP Crystal T2B Start | 1 | 388515 | 3999952 | 5/13/2005 | Pre | Transect start on creek left about 600m from the mouth of the creek, about 130m above where creek makes a sharp turn around a rocky delta. Look for a somewhat distinct schist wall on creek left. | Looking down transect, on creek left. Shows dense BACEMO with a few scattered TAMRAM. |
| PP Crystal T2B Start | 2 | 388515 | 3999952 | 5/13/2005 | Pre | Transect start on creek left about 600m from the mouth of the creek, about 130m above where creek makes a sharp turn around a rocky delta. Look for a somewhat distinct schist wall on creek left. | Looking across the creek - note the cut bank with sapling TAMRAM and some BACEMO. |
| PP Crystal T2B Start | 3 | 388515 | 3999952 | 5/13/2005 | Pre | Transect start on creek left about 600m from the mouth of the creek, about 130m above where creek makes a sharp turn around a rocky delta. Look for a somewhat distinct schist wall on creek left. | Looking across the creek, same as view 2. |
| PP Crystal T2B Start | 4 | 388515 | 3999952 | 5/13/2005 | Pre | Transect start on creek left about 600m from the mouth of the creek, about 130m above where creek makes a sharp turn around a rocky delta. Look for a somewhat distinct schist wall on creek left. | Looking up canyon - note the schist wall and the large, flat, slanted schist boulder on creek right. |
| PP Crystal T2B Start | A | 388515 | 3999952 | 5/13/2005 | Pre | Transect start on creek left about 600m from the mouth of the creek, about 130m above where creek makes a sharp turn around a rocky delta. Look for a somewhat distinct schist wall on creek left. | Looking at Jason standing at transect start point which is on creek left at the base of schist just below agave. Taken from down creek. |
| PP Crystal T2B Start | B | 388515 | 3999952 | 5/13/2005 | Pre | Transect start on creek left about 600m from the mouth of the creek, about 130m above where creek makes a sharp turn around a rocky delta. Look for a somewhat distinct schist wall on creek left. | Looking at the transect start point tucked into the schist. Taken from very close to the transect start in the BACEMO. |
| PP Grapevine 1 | 1 | 441815 | 3896141 | 9/28/2006 | Post | End of Grapevine about 40ft from the river on top of the last poulover. Crew states that they are not sure if the Northing UTM is correct. | Post work, view upstream. |
| PP Grapevine 1 | 1 | 441815 | 3896141 | 9/28/2006 | Pre | End of Grapevine about 40ft from the river on top of the last poulover. Crew states that they are not sure if the Northing UTM is correct. | View upstream. |
| PP Grapevine 1 | A | 441815 | 3896141 | 9/28/2006 | Pre | End of Grapevine about 40ft from the river on top of the last poulover. Crew states that they are not sure if the Northing UTM is correct. | Pen pointing at photopoint. |
| PP Grapevine 2 | 1 | 409623 | 3990667 | 9/29/2006 | Pre | Taken from a large red and cream striped sandstone boulder on creek left, 3x2x3m. This is about 200m upstream from the 3rd poulover from the river. | View downstream. |
| PP Grapevine 2 | 1 | 409623 | 3990667 | 2/3/2007 | Post | Taken from a large red and cream striped sandstone boulder on creek left, 3x2x3m. This is about 200m upstream from the 3rd poulover from the river. | Post work. |
| PP Grapevine 2 | 2 | 409623 | 3990667 | 9/29/2006 | Pre | Taken from a large red and cream striped sandstone boulder on creek left, 3x2x3m. This is about 200m upstream from the 3rd poulover from the river. | View downstream. |
| PP Grapevine 2 | 2 | 409623 | 3990667 | 2/3/2007 | Post | Taken from a large red and cream striped sandstone boulder on creek left, 3x2x3m. This is about 200m upstream from the 3rd poulover from the river. | Post work. |
| PP Grapevine 2 | A | 409623 | 3990667 | 9/29/2006 | Pre | Taken from a large red and cream striped sandstone boulder on creek left, 3x2x3m. This is about 200m upstream from the 3rd poulover from the river. | Melissa at photopoint. Taken from 8m upstream of the photopoint in mid-creek bed. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|----------|-----------------------|---|---|
| PP Grapevine 3 | 1 | 409289 | 3989805 | 2/9/2006 | Post | Standing at wall or creek right, a long continuous straight away of schist. This is the longest view in Grapevine (about 150m). It's color is a maroon-red. | Post work. |
| PP Grapevine 3 | 1 | 409289 | 3989805 | 2/9/2006 | Pre | Standing at wall or creek right, a long continuous straight away of schist. This is the longest view in Grapevine (about 150m). It's color is a maroon-red. | Looking upstream with TAMRAMs resting high on creek left bank. There is a winding creek in the foreground. |
| PP Grapevine 3 | A | 409289 | 3989805 | 2/9/2006 | Pre | Standing at wall or creek right, a long continuous straight away of schist. This is the longest view in Grapevine (about 150m). It's color is a maroon-red. | Looking at photopoint? Taken upstream about 10m, looking down at the rest of a very large straight stretch of canyon. |
| PP Grapevine 4 | 1 | 408953 | 3989691 | 2/9/2006 | Post | Two giant cottonwoods grow in the middle of the schist narrows about 20m apart. They are noteworthy, and the first big cottonwoods this far up creek (don't mix then up with the large Gooding's Willows upstream 1km). | Post work. |
| PP Grapevine 4 | 1 | 408953 | 3989691 | 2/9/2006 | Pre | Two giant cottonwoods grow in the middle of the schist narrows about 20m apart. They are noteworthy, and the first big cottonwoods this far up creek (don't mix then up with the large Gooding's Willows upstream 1km). | Looking upstream past numerous small, connected TAMRAMs lining the bank at a very large cottonwood. |
| PP Grapevine 4 | 2 | 408953 | 3989691 | 2/9/2006 | Post | Two giant cottonwoods grow in the middle of the schist narrows about 20m apart. They are noteworthy, and the first big cottonwoods this far up creek (don't mix then up with the large Gooding's Willows upstream 1km). | Post work. |
| PP Grapevine 4 | 2 | 408953 | 3989691 | 2/9/2006 | Pre | Two giant cottonwoods grow in the middle of the schist narrows about 20m apart. They are noteworthy, and the first big cottonwoods this far up creek (don't mix then up with the large Gooding's Willows upstream 1km). | Looking downstream and to the left at a couple large TAMRAMs growing on a bank at a left bend in the creek. Slanted schist wall to the right. |
| PP Grapevine 4 | 3 | 408953 | 3989691 | 2/9/2006 | Post | Two giant cottonwoods grow in the middle of the schist narrows about 20m apart. They are noteworthy, and the first big cottonwoods this far up creek (don't mix then up with the large Gooding's Willows upstream 1km). | Post work. |
| PP Grapevine 4 | 3 | 408953 | 3989691 | 2/9/2006 | Pre | Two giant cottonwoods grow in the middle of the schist narrows about 20m apart. They are noteworthy, and the first big cottonwoods this far up creek (don't mix then up with the large Gooding's Willows upstream 1km). | Looking downstream past cottonwood to the TAMRAMs lining the bank on creek right. Photo taken from a crouched position. |
| PP Grapevine 4 | A | 408953 | 3989691 | 2/9/2006 | Pre | Two giant cottonwoods grow in the middle of the schist narrows about 20m apart. They are noteworthy, and the first big cottonwoods this far up creek (don't mix then up with the large Gooding's Willows upstream 1km). | Pen pointing at photopoint. Taken from the drainage bottom with back against the schist wall on creek left. |
| PP Grapevine 5 | 1 | 408705 | 3989494 | 2/8/2006 | Pre | Standing atop a 2x2x2m whitish boulder in the center of a wide drainage. This point is the first significantly wider section in Grapevine after the pretty winding narrows that occur for a few hundred meters below the Tapeats. | Looking upstream to the left (creek right) at some TAMRAM that line the banks and the narrows in the background. |
| PP Grapevine 5 | 1 | 408705 | 3989494 | 2/9/2006 | Post | Standing atop a 2x2x2m whitish boulder in the center of a wide drainage. This point is the first significantly wider section in Grapevine after the pretty winding narrows that occur for a few hundred meters below the Tapeats. | Post work. |
| PP Grapevine 5 | 2 | 408705 | 3989494 | 2/8/2006 | Pre | Standing atop a 2x2x2m whitish boulder in the center of a wide drainage. This point is the first significantly wider section in Grapevine after the pretty winding narrows that occur for a few hundred meters below the Tapeats. | Looking upstream and to the right (creek left) at a mature TAMRAM on the creek left bank. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|----------|-----------------------|---|--|
| PP Grapevine 5 | 2 | 408705 | 3989494 | 2/9/2006 | Post | Standing atop a 2x2x2m whitish boulder in the center of a wide drainage. This point is the first significantly wider section in Grapevine after the pretty winding narrows that occur for a few hundred meters below the Tapeats. | Post work. |
| PP Grapevine 5 | 3 | 408705 | 3989494 | 2/8/2006 | Pre | Standing atop a 2x2x2m whitish boulder in the center of a wide drainage. This point is the first significantly wider section in Grapevine after the pretty winding narrows that occur for a few hundred meters below the Tapeats. | Looking downstream at big TAMRAM on the left bank. |
| PP Grapevine 5 | 3 | 408705 | 3989494 | 2/9/2006 | Post | Standing atop a 2x2x2m whitish boulder in the center of a wide drainage. This point is the first significantly wider section in Grapevine after the pretty winding narrows that occur for a few hundred meters below the Tapeats. | Post work. |
| PP Grapevine 5 | A | 408705 | 3989494 | 2/8/2006 | Pre | Standing atop a 2x2x2m whitish boulder in the center of a wide drainage. This point is the first significantly wider section in Grapevine after the pretty winding narrows that occur for a few hundred meters below the Tapeats. | Pen pointing at photopoint. Taken from downstream of the boulder about 10m. This photo looks up to the schist narrows. |
| PP Grapevine 6 | 1 | 408451 | 3989219 | 2/8/2006 | Post | Taken from a 1x1x2m purple boulder lying on creek right near schist narrows. This is 300m downstream of the Great Unconformity where the water begins to flow again. Couldn't locate the pre photo for view 2. | Post work. |
| PP Grapevine 6 | 1 | 408451 | 3989219 | 2/8/2006 | Pre | Taken from a 1x1x2m purple boulder lying on creek right near schist narrows. This is 300m downstream of the Great Unconformity where the water begins to flow again. Couldn't locate the pre photo for view 2. | Looking upstream at 2 large mature TAMRAM. There is a crumbly wall in the background. |
| PP Grapevine 6 | 2 | 408451 | 3989219 | 2/8/2006 | Post | Taken from a 1x1x2m purple boulder lying on creek right near schist narrows. This is 300m downstream of the Great Unconformity where the water begins to flow again. Couldn't locate the pre photo for view 2. | Post work. I think this is view 2, the pre photo could not be located (KF). |
| PP Grapevine 6 | A | 408451 | 3989219 | 2/8/2006 | Pre | Taken from a 1x1x2m purple boulder lying on creek right near schist narrows. This is 300m downstream of the Great Unconformity where the water begins to flow again. Couldn't locate the pre photo for view 2. | Pen pointing at photopoint. Taken from upstream about 10m standing on schist bedrock. There is a pink schist wall in the background. |
| PP Grapevine 7 | 1 | 408147 | 3989194 | 2/8/2006 | Pre | Taken standing atop a yellow streaked purple boulder in tapeats section. This is downstream to the spring that drips in the creekbed on creek left. The boulder is of tapeats sandstone and is 4x3x2m with right angles. | Looking across the stream (dry at this point) to mature clump of knocked down TAMRAMs. Tapeats sheer wall is in the background. |
| PP Grapevine 7 | 1 | 408147 | 3989194 | 2/8/2006 | Post | Taken standing atop a yellow streaked purple boulder in tapeats section. This is downstream to the spring that drips in the creekbed on creek left. The boulder is of tapeats sandstone and is 4x3x2m with right angles. | Post work. |
| PP Grapevine 7 | A | 408147 | 3989194 | 2/8/2006 | Pre | Taken standing atop a yellow streaked purple boulder in tapeats section. This is downstream to the spring that drips in the creekbed on creek left. The boulder is of tapeats sandstone and is 4x3x2m with right angles. | Pen pointing at photopoint. Taken from the left mature TAMRAM. This is about 13m across the stream from the boulder. |
| PP Grapevine 8 | 1 | 407822 | 3988672 | 2/8/2006 | Post | Taken from creek right about 30-40m upstream of where the Tonto trail crosses the west arm of Grapevine. Photopoint is on a 1x1x1m round, white boulder on ledge. | Post work. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------------|------|-------------|--------------|-----------|-----------------------|--|---|
| PP Grapevine 8 | 1 | 407822 | 3988672 | 2/8/2006 | Pre | Taken from creek right about 30-40m upstream of where the Tonto trail crosses the west arm of Grapevine. Photopoint is on a 1x1x1m round, white boulder on ledge. | Looking upstream at clump of TAMRAM in dry or at least a mostly dry creek bed. There is a juniper on creek right. |
| PP Grapevine 8 | 2 | 407822 | 3988672 | 2/8/2006 | Post | Taken from creek right about 30-40m upstream of where the Tonto trail crosses the west arm of Grapevine. Photopoint is on a 1x1x1m round, white boulder on ledge. | Post work. |
| PP Grapevine 8 | 2 | 407822 | 3988672 | 2/8/2006 | Pre | Taken from creek right about 30-40m upstream of where the Tonto trail crosses the west arm of Grapevine. Photopoint is on a 1x1x1m round, white boulder on ledge. | Looking across the stream at 1 mature TAMRAM with a boulder to it's right. |
| PP Grapevine 8 | A | 407822 | 3988672 | 2/8/2006 | Pre | Taken from creek right about 30-40m upstream of where the Tonto trail crosses the west arm of Grapevine. Photopoint is on a 1x1x1m round, white boulder on ledge. | John at photopoint. Taken from the same flat, good camping ledge about 10m down downstream of boulder. |
| PP Grapevine 9 | 1 | 407929 | 3988437 | 2/8/2006 | Post | Taken on a flat 1x1x0.3m boulder. The boulder is very close to the mature juniper at camp where the Tonto trail crossed the east arm of Grapevine (creek right is where the juniper grows, right at tent sites). | Post work. |
| PP Grapevine 9 | 1 | 407929 | 3988437 | 2/8/2006 | Pre | Taken on a flat 1x1x0.3m boulder. The boulder is very close to the mature juniper at camp where the Tonto trail crossed the east arm of Grapevine (creek right is where the juniper grows, right at tent sites). | Looking upstream at the one mature TAMRAM growing in the creek bed near the Grapevine campground. |
| PP Grapevine 9 | A | 407929 | 3988437 | 2/8/2006 | Pre | Taken on a flat 1x1x0.3m boulder. The boulder is very close to the mature juniper at camp where the Tonto trail crossed the east arm of Grapevine (creek right is where the juniper grows, right at tent sites). | Pen points to photopoint. Taken from the bottom of the drainage channel 5m west of the photopoint boulder. |
| PP Grapevine Spring 1 | 1 | 408695 | 3989133 | 9/30/2006 | Pre | Ledge on Tonto Trail where it crossed the Grapevine Spring TAMRAM, 5m below the ledge. | View downstream. |
| PP Grapevine Spring 1 | 2 | 408695 | 3989133 | 9/30/2006 | Pre | Ledge on Tonto Trail where it crossed the Grapevine Spring TAMRAM, 5m below the ledge. | View upstream. |
| PP Grapevine Spring 1 | A | 408695 | 3989133 | 9/30/2006 | Pre | Ledge on Tonto Trail where it crossed the Grapevine Spring TAMRAM, 5m below the ledge. | Pen points at ledge. Taken from 15m upstream of TAMRAM about 5m upstream from the Tonto Trail on the ledge. |
| PP Hance 10 | 1 | 413332 | 3987989 | 4/2/2006 | Post | No promises on the GPS readings for this one. Photopoint in on a Tapeats ledge on creek right at the first sharp right bend in the creek (working downstream) | View ? Not sure. But one should be able to find this based on the description. |
| PP Hance 10 | 1 | 413332 | 3987989 | 3/5/2007 | Post | No promises on the GPS readings for this one. Photopoint in on a Tapeats ledge on creek right at the first sharp right bend in the creek (working downstream) | Photo update. |
| PP Hance 10 | 2 | 413332 | 3987989 | 3/5/2007 | Post | No promises on the GPS readings for this one. Photopoint in on a Tapeats ledge on creek right at the first sharp right bend in the creek (working downstream) | Looking upstream. |
| PP Hance 10 | A | 413332 | 3987989 | 4/2/2006 | Post | No promises on the GPS readings for this one. Photopoint in on a Tapeats ledge on creek right at the first sharp right bend in the creek (working downstream) | View of photopoint. View upstream to PP.. |
| PP Hance 11 | 1 | 413576 | 3986211 | 9/8/2005 | Pre | First terrace upstream of Tapeats ledge on creek left. | Downstream view of uppermost tamarisk in Hance Canyon |
| PP Hance 11 | 1 | 413576 | 3986211 | 4/2/2006 | Post | First terrace upstream of Tapeats ledge on creek left. | Post work. |
| PP Hance 11 | 1 | 413576 | 3986211 | 3/5/2007 | Post | First terrace upstream of Tapeats ledge on creek left. | Photo update. |
| PP Hance 11 | A | 413576 | 3986211 | 4/2/2006 | Pre | First terrace upstream of Tapeats ledge on creek left. | Pen points at photopoint. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|-----------|-----------------------|--|--|
| PP Hance 11 | B | 413576 | 3986211 | 4/2/2006 | Pre | First terrace upstream of Tapeats ledge on creek left. | Pen points at photopoint. Taken from downstream on creek left of rock that is in the photo. |
| PP Hance 3 | 1 | 413862 | 3988880 | 3/9/2007 | Pre | Taken from a sloping granite/schist ledge on creek left about 20 ft upstream of a noticeable opening in the canyon. | Looking upstream. |
| PP Hance 3 | 1 | 413862 | 3988880 | 3/9/2007 | Post | Taken from a sloping granite/schist ledge on creek left about 20 ft upstream of a noticeable opening in the canyon. | Post work. |
| PP Hance 3 | 2 | 413862 | 3988880 | 3/9/2007 | Pre | Taken from a sloping granite/schist ledge on creek left about 20 ft upstream of a noticeable opening in the canyon. | Looking across the stream. |
| PP Hance 3 | 2 | 413862 | 3988880 | 3/9/2007 | Post | Taken from a sloping granite/schist ledge on creek left about 20 ft upstream of a noticeable opening in the canyon. | Post work. |
| PP Hance 3 | 3 | 413862 | 3988880 | 3/9/2007 | Post | Taken from a sloping granite/schist ledge on creek left about 20 ft upstream of a noticeable opening in the canyon. | Post work. |
| PP Hance 3 | 3 | 413862 | 3988880 | 3/9/2007 | Pre | Taken from a sloping granite/schist ledge on creek left about 20 ft upstream of a noticeable opening in the canyon. | Looking downstream. |
| PP Hance 3 | A | 413862 | 3988880 | 3/9/2007 | Pre | Taken from a sloping granite/schist ledge on creek left about 20 ft upstream of a noticeable opening in the canyon. | Pen is pointing at PP. |
| PP Hance 4 | 1 | 413357 | 3988491 | 9/9/2006 | Pre | No Satellite reception. About 3.5 km downstream of Tonto junction (Hance Camp) in schist narrows below the first major pouroff (about 300m) that must be detoured. Taken from a orange boulder (1x1x1m) in the center of the creek. UTM taken from GIS, verify in field. | Looking upstream at thicket of mature TAMRAMS on creek left. Schist wall on creek right. |
| PP Hance 4 | 1 | 413357 | 3988491 | 9/10/2006 | Post | No Satellite reception. About 3.5 km downstream of Tonto junction (Hance Camp) in schist narrows below the first major pouroff (about 300m) that must be detoured. Taken from a orange boulder (1x1x1m) in the center of the creek. UTM taken from GIS, verify in field. | Post work. Looking upstream at thicket of mature TAMRAMS on creek left. There is a schist wall on creek right. |
| PP Hance 4 | 1 | 413357 | 3988491 | 3/6/2007 | Post | No Satellite reception. About 3.5 km downstream of Tonto junction (Hance Camp) in schist narrows below the first major pouroff (about 300m) that must be detoured. Taken from a orange boulder (1x1x1m) in the center of the creek. UTM taken from GIS, verify in field. | Photo update. |
| PP Hance 4 | 2 | 413357 | 3988491 | 9/9/2006 | Pre | No Satellite reception. About 3.5 km downstream of Tonto junction (Hance Camp) in schist narrows below the first major pouroff (about 300m) that must be detoured. Taken from a orange boulder (1x1x1m) in the center of the creek. UTM taken from GIS, verify in field. | View downstream at one large mature. |
| PP Hance 4 | 2 | 413357 | 3988491 | 9/10/2006 | Post | No Satellite reception. About 3.5 km downstream of Tonto junction (Hance Camp) in schist narrows below the first major pouroff (about 300m) that must be detoured. Taken from a orange boulder (1x1x1m) in the center of the creek. UTM taken from GIS, verify in field. | Post work. |
| PP Hance 4 | 2 | 413357 | 3988491 | 3/6/2007 | Post | No Satellite reception. About 3.5 km downstream of Tonto junction (Hance Camp) in schist narrows below the first major pouroff (about 300m) that must be detoured. Taken from a orange boulder (1x1x1m) in the center of the creek. UTM taken from GIS, verify in field. | Photo update. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|----------|-----------------------|--|--|
| PP Hance 4 | A | 413357 | 3988491 | 9/9/2006 | Pre | No Satellite reception. About 3.5 km downstream of Tonto junction (Hance Camp) in schist narrows below the first major pouroff (about 300m) that must be detoured. Taken from a orange boulder (1x1x1m) in the center of the creek. UTM taken from GIS, verify in field. | Person at photopoint. This is taken 10m downstream of orange photopoint boulder. |
| PP Hance 5-1 | 1 | 413338 | 3988274 | 4/3/2006 | Post | Big white boulder, mid-stream. About 80m downstream from a pool that can be navigated around on the right. The canyon opens back up, just above the photopoint you can see a very large cave in the Tapeats when looking upstream. | View upstream. Post-removal |
| PP Hance 5-1 | 1 | 413338 | 3988274 | 4/3/2006 | Pre | Big white boulder, mid-stream. About 80m downstream from a pool that can be navigated around on the right. The canyon opens back up, just above the photopoint you can see a very large cave in the Tapeats when looking upstream. | View upstream. |
| PP Hance 5-1 | 1 | 413338 | 3988274 | 3/6/2007 | Post | Big white boulder, mid-stream. About 80m downstream from a pool that can be navigated around on the right. The canyon opens back up, just above the photopoint you can see a very large cave in the Tapeats when looking upstream. | Photo update. |
| PP Hance 5-1 | 2 | 413338 | 3988274 | 4/3/2006 | Post | Big white boulder, mid-stream. About 80m downstream from a pool that can be navigated around on the right. The canyon opens back up, just above the photopoint you can see a very large cave in the Tapeats when looking upstream. | View downstream. Post removal |
| PP Hance 5-1 | 2 | 413338 | 3988274 | 4/3/2006 | Pre | Big white boulder, mid-stream. About 80m downstream from a pool that can be navigated around on the right. The canyon opens back up, just above the photopoint you can see a very large cave in the Tapeats when looking upstream. | View downstream. |
| PP Hance 5-1 | 2 | 413338 | 3988274 | 3/6/2007 | Post | Big white boulder, mid-stream. About 80m downstream from a pool that can be navigated around on the right. The canyon opens back up, just above the photopoint you can see a very large cave in the Tapeats when looking upstream. | Photo update. |
| PP Hance 5-1 | 3 | 413338 | 3988274 | 4/3/2006 | Pre | Big white boulder, mid-stream. About 80m downstream from a pool that can be navigated around on the right. The canyon opens back up, just above the photopoint you can see a very large cave in the Tapeats when looking upstream. | View directly creek left. |
| PP Hance 5-1 | 3 | 413338 | 3988274 | 4/3/2006 | Post | Big white boulder, mid-stream. About 80m downstream from a pool that can be navigated around on the right. The canyon opens back up, just above the photopoint you can see a very large cave in the Tapeats when looking upstream. | View creek left, post removal. |
| PP Hance 5-1 | 3 | 413338 | 3988274 | 3/6/2007 | Post | Big white boulder, mid-stream. About 80m downstream from a pool that can be navigated around on the right. The canyon opens back up, just above the photopoint you can see a very large cave in the Tapeats when looking upstream. | Photo update. |
| PP Hance 5-1 | A | 413338 | 3988274 | 4/3/2006 | Pre | Big white boulder, mid-stream. About 80m downstream from a pool that can be navigated around on the right. The canyon opens back up, just above the photopoint you can see a very large cave in the Tapeats when looking upstream. | View looking downstream at the photopoint. Pen is pointing to the rock. |
| PP Hance 5-2 | 1 | 413454 | 3988490 | 9/9/2006 | Pre | Taken from a 2x2x4m light colored boulder in the center of the creek. Boulder is at the top of a approx. 4m high waterfall. | View downstream. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|-----------|-----------------------|---|---|
| PP Hance 5-2 | 1 | 413454 | 3988490 | 9/10/2006 | Post | Taken from a 2x2x4m light colored boulder in the center of the creek. Boulder is at the top of a approx. 4m high waterfall. | View downstream. Post work. |
| PP Hance 5-2 | 1 | 413454 | 3988490 | 3/8/2007 | Post | Taken from a 2x2x4m light colored boulder in the center of the creek. Boulder is at the top of a approx. 4m high waterfall. | Photo update. |
| PP Hance 5-2 | 2 | 413454 | 3988490 | 9/9/2006 | Pre | Taken from a 2x2x4m light colored boulder in the center of the creek. Boulder is at the top of a approx. 4m high waterfall. | View upstream. |
| PP Hance 5-2 | 2 | 413454 | 3988490 | 9/10/2006 | Post | Taken from a 2x2x4m light colored boulder in the center of the creek. Boulder is at the top of a approx. 4m high waterfall. | Post work. |
| PP Hance 5-2 | 2 | 413454 | 3988490 | 3/8/2007 | Post | Taken from a 2x2x4m light colored boulder in the center of the creek. Boulder is at the top of a approx. 4m high waterfall. | Photo update. |
| PP Hance 5-2 | 3 | 413454 | 3988490 | 9/9/2006 | Pre | Taken from a 2x2x4m light colored boulder in the center of the creek. Boulder is at the top of a approx. 4m high waterfall. | View slightly to creek right and upstream. |
| PP Hance 5-2 | 3 | 413454 | 3988490 | 9/11/2006 | Post | Taken from a 2x2x4m light colored boulder in the center of the creek. Boulder is at the top of a approx. 4m high waterfall. | Post work. |
| PP Hance 5-2 | 3 | 413454 | 3988490 | 3/8/2007 | Post | Taken from a 2x2x4m light colored boulder in the center of the creek. Boulder is at the top of a approx. 4m high waterfall. | Photo update. |
| PP Hance 5-2 | A | 413454 | 3988490 | 9/9/2006 | Pre | Taken from a 2x2x4m light colored boulder in the center of the creek. Boulder is at the top of a approx. 4m high waterfall. | View of yellow box on photopoint. Taken from about 5m upstream of the photopoint boulder. |
| PP Hance 6 | 1 | 413463 | 3988167 | 4/3/2006 | Post | Photopoint is a granite mound on creek left about 100m down from the tricky spot to navigate around without getting your feet wet. Several deep pools nearby and just before a left hand turn downstream. | View upstream, post tammy whacking. |
| PP Hance 6 | 1 | 413463 | 3988167 | 4/3/2006 | Pre | Photopoint is a granite mound on creek left about 100m down from the tricky spot to navigate around without getting your feet wet. Several deep pools nearby and just before a left hand turn downstream. | View upstream, with Elson. |
| PP Hance 6 | 1 | 413463 | 3988167 | 3/6/2007 | Post | Photopoint is a granite mound on creek left about 100m down from the tricky spot to navigate around without getting your feet wet. Several deep pools nearby and just before a left hand turn downstream. | Photo update. |
| PP Hance 6 | 2 | 413463 | 3988167 | 4/3/2006 | Pre | Photopoint is a granite mound on creek left about 100m down from the tricky spot to navigate around without getting your feet wet. Several deep pools nearby and just before a left hand turn downstream. | View downstream. |
| PP Hance 6 | 2 | 413463 | 3988167 | 4/3/2006 | Post | Photopoint is a granite mound on creek left about 100m down from the tricky spot to navigate around without getting your feet wet. Several deep pools nearby and just before a left hand turn downstream. | View downstream, post. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|----------|-----------------------|---|---|
| PP Hance 6 | 2 | 413463 | 3988167 | 3/6/2007 | Post | Photopoint is a granite mound on creek left about 100m down from the tricky spot to navigate around without getting your feet wet. Several deep pools nearby and just before a left hand turn downstream. | Photo update. |
| PP Hance 6 | A | 413463 | 3988167 | 4/3/2006 | Pre | Photopoint is a granite mound on creek left about 100m down from the tricky spot to navigate around without getting your feet wet. Several deep pools nearby and just before a left hand turn downstream. | Looking downstream with the pen pointing to the photopoint rock. |
| PP Hance 7 | 1 | 413335 | 3988012 | 4/3/2006 | Post | Long flowing mound of granite just after a lovely little section of POPFRE AND SALEXI and a juniper just downstream of a POPFRE. | View upstream, post treatment. |
| PP Hance 7 | 1 | 413335 | 3988012 | 4/3/2006 | Pre | Long flowing mound of granite just after a lovely little section of POPFRE AND SALEXI and a juniper just downstream of a POPFRE. | View upstream. |
| PP Hance 7 | 1 | 413335 | 3988012 | 3/5/2007 | Post | Long flowing mound of granite just after a lovely little section of POPFRE AND SALEXI and a juniper just downstream of a POPFRE. | Photo update. |
| PP Hance 7 | 2 | 413335 | 3988012 | 3/5/2007 | Post | Long flowing mound of granite just after a lovely little section of POPFRE AND SALEXI and a juniper just downstream of a POPFRE. | Looking downstream. |
| PP Hance 7 | A | 413335 | 3988012 | 4/3/2006 | Pre | Long flowing mound of granite just after a lovely little section of POPFRE AND SALEXI and a juniper just downstream of a POPFRE. | View looking downstream at the photopoint. The pen is pointing to the spot. |
| PP Hance 8 | 1 | 413107 | 3987441 | 4/3/2006 | Post | Photopoint is a gray rock under a POPFRE that is bent at a 90 degree angle on creek left. | View upstream. Post removal |
| PP Hance 8 | 1 | 413107 | 3987441 | 4/3/2006 | Pre | Photopoint is a gray rock under a POPFRE that is bent at a 90 degree angle on creek left. | View upstream. |
| PP Hance 8 | 1 | 413107 | 3987441 | 3/5/2007 | Post | Photopoint is a gray rock under a POPFRE that is bent at a 90 degree angle on creek left. | Photo update. |
| PP Hance 8 | 2 | 413107 | 3987441 | 4/3/2006 | Post | Photopoint is a gray rock under a POPFRE that is bent at a 90 degree angle on creek left. | View across the stream to creek right, after removal. |
| PP Hance 8 | 2 | 413107 | 3987441 | 4/3/2006 | Pre | Photopoint is a gray rock under a POPFRE that is bent at a 90 degree angle on creek left. | View across the stream to creek right. |
| PP Hance 8 | 2 | 413107 | 3987441 | 3/5/2007 | Post | Photopoint is a gray rock under a POPFRE that is bent at a 90 degree angle on creek left. | Photo update. |
| PP Hance 8 | 3 | 413107 | 3987441 | 4/3/2006 | Pre | Photopoint is a gray rock under a POPFRE that is bent at a 90 degree angle on creek left. | View downstream to creek right. |
| PP Hance 8 | 3 | 413107 | 3987441 | 4/3/2006 | Post | Photopoint is a gray rock under a POPFRE that is bent at a 90 degree angle on creek left. | View downstream post removal. |
| PP Hance 8 | 3 | 413107 | 3987441 | 3/5/2007 | Post | Photopoint is a gray rock under a POPFRE that is bent at a 90 degree angle on creek left. | Photo update. |
| PP Hance 8 | A | 413107 | 3987441 | 4/3/2006 | Pre | Photopoint is a gray rock under a POPFRE that is bent at a 90 degree angle on creek left. | Pen pointing at the photopoint rock. View is downstream. |
| PP Hance 9 | 1 | 413406 | 3988356 | 6/8/2005 | Pre | Scramble about 15' up the bedrock on creek left. | Downstream view in the shade of tamarisk, SAEX, BACSAR |
| PP Hance 9 | 1 | 413406 | 3988356 | 3/8/2007 | Post | Scramble about 15' up the bedrock on creek left. | The pre photo may not be correct. The 2 post photos should be used from now on. |
| PP Hance 9 | 2 | 413406 | 3988356 | 3/8/2007 | Post | Scramble about 15' up the bedrock on creek left. | Photo update. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|---------------------|------|-------------|--------------|------------|-----------------------|---|---|
| PP Kwagunt 11 | 1 | 421111 | 4010522 | 10/23/2005 | Post | Taken from creek right on the edge of the wash on a large white boulder. | Post work. |
| PP Kwagunt 11 | 1 | 421111 | 4010522 | 10/23/2005 | Pre | Taken from creek right on the edge of the wash on a large white boulder. | Looking downstream. |
| PP Kwagunt 11 | 2 | 421111 | 4010522 | 10/23/2005 | Post | Taken from creek right on the edge of the wash on a large white boulder. | Post work. |
| PP Kwagunt 11 | 2 | 421111 | 4010522 | 10/23/2005 | Pre | Taken from creek right on the edge of the wash on a large white boulder. | Looking upstream with a large spire straight ahead. |
| PP Kwagunt S Fork 1 | 1 | 418975 | 4009112 | 10/23/2005 | Post | This GPS and site info is from the exotic data sheets because there was no information on the photopoint sheet (so it may not be right). Site located up the south fork of Kwagunt which drains the valley between Banta and Jeffords point. There is a small wet seep in otherwise dry drainage channel. This was the last stand found upstream. | Post work. |
| PP Kwagunt S Fork 1 | 1 | 418975 | 4009112 | 10/23/2005 | Pre | This GPS and site info is from the exotic data sheets because there was no information on the photopoint sheet (so it may not be right). Site located up the south fork of Kwagunt which drains the valley between Banta and Jeffords point. There is a small wet seep in otherwise dry drainage channel. This was the last stand found upstream. | Pretreatment. No data on photopoint sheet. |
| PP Kwagunt S Fork 1 | A | 418975 | 4009112 | 10/23/2005 | Pre | This GPS and site info is from the exotic data sheets because there was no information on the photopoint sheet (so it may not be right). Site located up the south fork of Kwagunt which drains the valley between Banta and Jeffords point. There is a small wet seep in otherwise dry drainage channel. This was the last stand found upstream. | Stuff at photopoint. |
| PP Lava East 1 | 1 | 421067 | 4003029 | 2/23/2006 | Pre | Taken from a 3x2m Tapeats boulder wedged in creek left bank about 10m above the creek. | Looking across the drainage at large tamarisk. |
| PP Lava East 1 | 1 | 421067 | 4003029 | 2/23/2006 | Post | Taken from a 3x2m Tapeats boulder wedged in creek left bank about 10m above the creek. | Post work. |
| PP Lava East 1 | 2 | 421067 | 4003029 | 2/23/2006 | Post | Taken from a 3x2m Tapeats boulder wedged in creek left bank about 10m above the creek. | Post work. |
| PP Lava East 1 | 2 | 421067 | 4003029 | 2/23/2006 | Pre | Taken from a 3x2m Tapeats boulder wedged in creek left bank about 10m above the creek. | Looking upstream at small patch of TAMRAM. |
| PP Lava East 1 | 3 | 421067 | 4003029 | 2/23/2006 | Post | Taken from a 3x2m Tapeats boulder wedged in creek left bank about 10m above the creek. | Post work. |
| PP Lava East 1 | 3 | 421067 | 4003029 | 2/23/2006 | Pre | Taken from a 3x2m Tapeats boulder wedged in creek left bank about 10m above the creek. | Looking downstream with no TAMRAM and a large cottonwood on creek left. |
| PP Lava East 1 | A | 421067 | 4003029 | 2/23/2006 | Pre | Taken from a 3x2m Tapeats boulder wedged in creek left bank about 10m above the creek. | Kate on photopoint rock. Taken from upstream about 15m. |
| PP Lava East 2 | 1 | 420995 | 4003060 | 2/23/2006 | Post | Taken from a large tapeats boulder (3x5x2m) in the middle of the creek. | Post work. |
| PP Lava East 2 | 1 | 420995 | 4003060 | 2/23/2006 | Pre | Taken from a large tapeats boulder (3x5x2m) in the middle of the creek. | Looking downstream. |
| PP Lava East 2 | 2 | 420995 | 4003060 | 2/23/2006 | Post | Taken from a large tapeats boulder (3x5x2m) in the middle of the creek. | Post work. |
| PP Lava East 2 | 2 | 420995 | 4003060 | 2/23/2006 | Pre | Taken from a large tapeats boulder (3x5x2m) in the middle of the creek. | Looking upstream. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------------|------|-------------|--------------|-----------|-----------------------|--|--|
| PP Lava East 2 | A | 420995 | 4003060 | 2/23/2006 | Pre | Taken from a large tapeats boulder (3x5x2m) in the middle of the creek. | Photo taken from 20m downstream looking upstream at photopoint rock. |
| PP Lava East 4 | 1 | 420542 | 4004187 | 11/4/2006 | Pre | Taken from a large, white boulder on creek left. This is approx. 20-30m upstream from an extra large black and white boulder on creek left. This is towards the end of the section. | Post work. |
| PP Lava East 4 | 1 | 420542 | 4004187 | 11/4/2006 | Pre | Taken from a large, white boulder on creek left. This is approx. 20-30m upstream from an extra large black and white boulder on creek left. This is towards the end of the section. | Looking upstream. |
| PP Lava East 4 | 2 | 420542 | 4004187 | 11/4/2006 | Post | Taken from a large, white boulder on creek left. This is approx. 20-30m upstream from an extra large black and white boulder on creek left. This is towards the end of the section. | Post work. |
| PP Lava East 4 | 2 | 420542 | 4004187 | 11/4/2006 | Pre | Taken from a large, white boulder on creek left. This is approx. 20-30m upstream from an extra large black and white boulder on creek left. This is towards the end of the section. | Looking downstream. |
| PP Lava East 4 | A | 420542 | 4004187 | 11/4/2006 | Pre | Taken from a large, white boulder on creek left. This is approx. 20-30m upstream from an extra large black and white boulder on creek left. This is towards the end of the section. | Josh on photopoint. Taken from approx. 20m upstream. |
| PP Little Nankoweap 1 | 1 | 421140 | 4018291 | 5/8/2005 | Pre | Taken in the upper reaches of Muav narrows below a 10m fall. This is about 100m from the last steep pour off. Standing below first pouroff, before sketchy bouldering up to the end. No GPS recorded here. | Looking downstream at narrow S curves of Muav. |
| PP Little Nankoweap 1 | 2 | 421140 | 4018291 | 5/8/2005 | Pre | Taken in the upper reaches of Muav narrows below a 10m fall. This is about 100m from the last steep pour off. Standing below first pouroff, before sketchy bouldering up to the end. No GPS recorded here. | Looking upstream at the first pour off. |
| PP Little Nankoweap 1 | A | 421140 | 4018291 | 5/8/2005 | Pre | Taken in the upper reaches of Muav narrows below a 10m fall. This is about 100m from the last steep pour off. Standing below first pouroff, before sketchy bouldering up to the end. No GPS recorded here. | Steve at PP. He's standing in the middle of the drainage in a gravelly bottom just before the first pour off. Photo taken from creek right on a limestone ledge, 3m from the gravelly creek bed. |
| PP Little Nankoweap 2 | 1 | 421317 | 4018310 | 5/8/2005 | Pre | Taken on a mid-creek, large boulder (1.5x1.5x1.5m) at junction with bedrock canyon. | Looking downstream of Little Nankoweap with a view of a big pillar upslope on creek right. |
| PP Little Nankoweap 2 | 2 | 421317 | 4018310 | 5/8/2005 | Pre | Taken on a mid-creek, large boulder (1.5x1.5x1.5m) at junction with bedrock canyon. | Looking up canyon a bedrock canyon due north with ACAGRE in the center. |
| PP Little Nankoweap 2 | 3 | 421317 | 4018310 | 5/8/2005 | Pre | Taken on a mid-creek, large boulder (1.5x1.5x1.5m) at junction with bedrock canyon. | Looking upstream of Little Nankoweap with limestone talus rock slide just right of center. |
| PP Little Nankoweap 2 | A | 421317 | 4018310 | 5/8/2005 | Pre | Taken on a mid-creek, large boulder (1.5x1.5x1.5m) at junction with bedrock canyon. | Looking upstream of Little Nankoweap with a limestone rock slide in the background. Photo taken from drainage bottom, just NE of boulder. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------------|------|-------------|--------------|------------|-----------------------|--|--|
| PP Little Nankoweap 2 | B | 421317 | 4018310 | 5/8/2005 | Pre | Taken on a mid-creek, large boulder (1.5x1.5x1.5m) at junction with bedrock canyon. | Looking downstream of Little Nanko with Redwall limestone pillar in the background. Photo taken from the drainage bottom, just NW of the boulder. |
| PP Little Nankoweap 3 | 1 | 421745 | 4018316 | 5/8/2005 | Pre | Taken on top of large pink/white butt-slide, limestone boulder. | Looking upstream at a pillar on creek right and a 2m tall black and white vertical striped boulder on creek right. |
| PP Little Nankoweap 3 | 2 | 421745 | 4018316 | 5/8/2005 | Pre | Taken on top of large pink/white butt-slide, limestone boulder. | Looking downstream at numerous gigantic boulders. On top of the boulders has a medicine ball sized boulder balanced on top. |
| PP Little Nankoweap 3 | A | 421745 | 4018316 | 5/8/2005 | Pre | Taken on top of large pink/white butt-slide, limestone boulder. | Looking downstream at 6m tall pink/white limestone butt-slide rock. Photo taken from in the drainage west of the boulder looking downstream. |
| PP Little Nankoweap 4 | 1 | 422080 | 4018241 | 5/8/2005 | Pre | Taken on top of marbled boulder (3x6m) with diagonal stripes of gray, white and pink. Boulder on creek left. | Looking downstream at Bright Angel shale overhang on creek left and Muav above creek drainage. |
| PP Little Nankoweap 4 | 2 | 422080 | 4018241 | 5/8/2005 | Pre | Taken on top of marbled boulder (3x6m) with diagonal stripes of gray, white and pink. Boulder on creek left. | Looking upstream from the top of the Bright Angel shale into Muav limestone. Two 5m boulders are blocked by acacia. |
| PP Little Nankoweap 4 | A | 422080 | 4018241 | 5/8/2005 | Pre | Taken on top of marbled boulder (3x6m) with diagonal stripes of gray, white and pink. Boulder on creek left. | Looking downstream at shale/limestone wall. Photo taken in creek bed upstream from a large marbled boulder (8.5x1.5m) behind a row of boulders. |
| PP Little Nankoweap 4 | B | 422080 | 4018241 | 5/8/2005 | Pre | Taken on top of marbled boulder (3x6m) with diagonal stripes of gray, white and pink. Boulder on creek left. | Looking across creek at big slumpy boulder. The boulder is upslope from the creek on creek right. |
| PP Little Nankoweap 5 | 1 | 422831 | 4018325 | 5/8/2005 | Pre | Taken on orange boulder (1x1x1m) creek left, right at the mouth of Little Nanko canyon. View A was not taken due to lack of time. Views 1 & 2 were taken from the mouth of little Nanko where an imaginary line between the two cliffs on either side of the drainage. | Looking downstream at 8m wide gravelly creek bed. |
| PP Little Nankoweap 5 | 2 | 422831 | 4018325 | 5/8/2005 | Pre | Taken on orange boulder (1x1x1m) creek left, right at the mouth of Little Nanko canyon. View A was not taken due to lack of time. Views 1 & 2 were taken from the mouth of little Nanko where an imaginary line between the two cliffs on either side of the drainage. | Looking upstream at long stretch of flat, cobbly creek bed. The creek bed extends onto the Bright Angel shale that has a large seep midway up the cliff. |
| PP Manzanita 1 | 1 | 407960 | 4004938 | 10/29/2006 | Pre | Taken atop a creek right 3x3x3 cubic meter red-orange boulder. This is 50m below the first side drainage up Manzanita Creek. | looking upstream at a bushy TAMRAM on the left with a tall cottonwood to its right and behind. |
| PP Manzanita 1 | 1 | 407960 | 4004938 | 10/29/2006 | Post | Taken atop a creek right 3x3x3 cubic meter red-orange boulder. This is 50m below the first side drainage up Manzanita Creek. | Post work. |
| PP Manzanita 1 | 2 | 407960 | 4004938 | 10/29/2006 | Post | Taken atop a creek right 3x3x3 cubic meter red-orange boulder. This is 50m below the first side drainage up Manzanita Creek. | Post work. |
| PP Manzanita 1 | 2 | 407960 | 4004938 | 10/29/2006 | Pre | Taken atop a creek right 3x3x3 cubic meter red-orange boulder. This is 50m below the first side drainage up Manzanita Creek. | Looking away from the stream at numerous pesky full colored TAMRAMS. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|------------|-----------------------|--|---|
| PP Manzanita 1 | A | 407960 | 4004938 | 10/29/2006 | Pre | Taken atop a creek right 3x3x3 cubic meter red-orange boulder. This is 50m below the first side drainage up Manzanita Creek. | Taken 15m downstream, looking up from the creek bottom at photopoint. There is a tall cottonwood and a drainage on the right. |
| PP Manzanita 2 | 1 | 408121 | 4004971 | 10/29/2006 | Pre | Taken 50m above the first confluence up Manzanita Creek, atop a slopish Muav slab on creek left. | Looking upstream at some big and very bushy TAMRAM. |
| PP Manzanita 2 | 1 | 408121 | 4004971 | 10/29/2006 | Post | Taken 50m above the first confluence up Manzanita Creek, atop a slopish Muav slab on creek left. | Post work. |
| PP Manzanita 2 | 2 | 408121 | 4004971 | 10/29/2006 | Post | Taken 50m above the first confluence up Manzanita Creek, atop a slopish Muav slab on creek left. | Post work. |
| PP Manzanita 2 | 2 | 408121 | 4004971 | 10/29/2006 | Pre | Taken 50m above the first confluence up Manzanita Creek, atop a slopish Muav slab on creek left. | Looking downstream at golden box elders with a TAMRAM below it. |
| PP Manzanita 2 | A | 408121 | 4004971 | 10/29/2006 | Pre | Taken 50m above the first confluence up Manzanita Creek, atop a slopish Muav slab on creek left. | Taken from creek bottom, 10m upstream of photopoint. |
| PP Nankoweap 11 | 1 | 420157 | 4015374 | 11/14/2005 | Pre | Taken from atop an orange (1x1m) boulder just upstream of drainage. The orange boulder is just atop the cutbank and at the delta of the first drainage. This is above the trail/stream junction that enters from the creek right. | Looking downstream with basalt outcropping (from a side drainage) on creek right. Gold cottonwoods and tammies in view. |
| PP Nankoweap 11 | 1 | 420157 | 4015374 | 11/15/2005 | Post | Taken from atop an orange (1x1m) boulder just upstream of drainage. The orange boulder is just atop the cutbank and at the delta of the first drainage. This is above the trail/stream junction that enters from the creek right. | Post work. |
| PP Nankoweap 11 | 2 | 420157 | 4015374 | 11/14/2005 | Pre | Taken from atop an orange (1x1m) boulder just upstream of drainage. The orange boulder is just atop the cutbank and at the delta of the first drainage. This is above the trail/stream junction that enters from the creek right. | Looking across creek towards burned flat area. Cottonwood in foreground, it hides a large TAMRAM. |
| PP Nankoweap 11 | 2 | 420157 | 4015374 | 11/15/2005 | Post | Taken from atop an orange (1x1m) boulder just upstream of drainage. The orange boulder is just atop the cutbank and at the delta of the first drainage. This is above the trail/stream junction that enters from the creek right. | Post work. |
| PP Nankoweap 11 | 3 | 420157 | 4015374 | 11/14/2005 | Pre | Taken from atop an orange (1x1m) boulder just upstream of drainage. The orange boulder is just atop the cutbank and at the delta of the first drainage. This is above the trail/stream junction that enters from the creek right. | Looking across creek at large mature TAMRAM near bend in the creek. Burnt and bent cottonwood on right of photo. |
| PP Nankoweap 11 | 3 | 420157 | 4015374 | 11/15/2005 | Post | Taken from atop an orange (1x1m) boulder just upstream of drainage. The orange boulder is just atop the cutbank and at the delta of the first drainage. This is above the trail/stream junction that enters from the creek right. | Post work. |
| PP Nankoweap 11 | A | 420157 | 4015374 | 11/14/2005 | Pre | Taken from atop an orange (1x1m) boulder just upstream of drainage. The orange boulder is just atop the cutbank and at the delta of the first drainage. This is above the trail/stream junction that enters from the creek right. | Looking at Steve at photopoint with cottonwoods in the background. Taken from below photopoint at the waters edge. |
| PP Nankoweap 12 | 1 | 419658 | 4015230 | 11/14/2005 | Pre | Photopoint is at a large prominent cube boulder (6x6x6m). This boulder is sharp limestone with a solitary blackbrush growing on top. Takes an easy climb move to summit. Boulder is about 200m upstream from a big drainage that enters Nankoweap canyon from creek right. | Looking downstream at TAMRAMs on creek right with supergroup formation in the background. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|------------|-----------------------|--|---|
| PP Nankoweap 12 | 1 | 419658 | 4015230 | 11/15/2005 | Post | Photopoint is at a large prominent cube boulder (6x6x6m). This boulder is sharp limestone with a solitary blackbrush growing on top. Takes an easy climb move to summit. Boulder is about 200m upstream from a big drainage that enters Nankoweap canyon from creek right. | Post work. |
| PP Nankoweap 12 | 2 | 419658 | 4015230 | 11/14/2005 | Pre | Photopoint is at a large prominent cube boulder (6x6x6m). This boulder is sharp limestone with a solitary blackbrush growing on top. Takes an easy climb move to summit. Boulder is about 200m upstream from a big drainage that enters Nankoweap canyon from creek right. | Looking upstream at TAMRAM thicket. A 300' tall round, dark-red, sandstone capped hill in the center background of photo. |
| PP Nankoweap 12 | 2 | 419658 | 4015230 | 11/15/2005 | Post | Photopoint is at a large prominent cube boulder (6x6x6m). This boulder is sharp limestone with a solitary blackbrush growing on top. Takes an easy climb move to summit. Boulder is about 200m upstream from a big drainage that enters Nankoweap canyon from creek right. | Post work. |
| PP Nankoweap 12 | A | 419658 | 4015230 | 11/14/2005 | Pre | Photopoint is at a large prominent cube boulder (6x6x6m). This boulder is sharp limestone with a solitary blackbrush growing on top. Takes an easy climb move to summit. Boulder is about 200m upstream from a big drainage that enters Nankoweap canyon from creek right. | Looking at photopoint. Taken from downstream 35m away from the photopoint on creek left of boulder. |
| PP Nankoweap 13 | 1 | 419282 | 4015098 | 11/15/2005 | Pre | Photopoint is on a white (1x0.5m) boulder that is adjacent to a mature cottonwood at the stream confluence. This point is at the only confluence of 2 perennial streams about 1/2 mile above where the trail junctions with Nankoweap creek. | Looking up the main (south) fork. Looking over a BRILON at the stream and cottonwood grove. |
| PP Nankoweap 13 | 1 | 419282 | 4015098 | 4/3/2006 | Post | Photopoint is on a white (1x0.5m) boulder that is adjacent to a mature cottonwood at the stream confluence. This point is at the only confluence of 2 perennial streams about 1/2 mile above where the trail junctions with Nankoweap creek. | Post work. |
| PP Nankoweap 13 | 2 | 419282 | 4015098 | 11/15/2005 | Pre | Photopoint is on a white (1x0.5m) boulder that is adjacent to a mature cottonwood at the stream confluence. This point is at the only confluence of 2 perennial streams about 1/2 mile above where the trail junctions with Nankoweap creek. | Looking downstream at confluence and beyond. |
| PP Nankoweap 13 | 2 | 419282 | 4015098 | 4/3/2006 | Post | Photopoint is on a white (1x0.5m) boulder that is adjacent to a mature cottonwood at the stream confluence. This point is at the only confluence of 2 perennial streams about 1/2 mile above where the trail junctions with Nankoweap creek. | Post work. |
| PP Nankoweap 13 | A | 419282 | 4015098 | 11/15/2005 | Pre | Photopoint is on a white (1x0.5m) boulder that is adjacent to a mature cottonwood at the stream confluence. This point is at the only confluence of 2 perennial streams about 1/2 mile above where the trail junctions with Nankoweap creek. | Backpack with hat are at the photopoint. Taken from just downstream of the confluence of the streams. |
| PP Nankoweap 14 | 1 | 418872 | 4014889 | 11/6/2005 | Post | Located at 6x3m sandstone boulder that is slouching into creek left. This is about 100m into Nanko 14. | Post work. |
| PP Nankoweap 14 | 1 | 418872 | 4014889 | 11/16/2005 | Pre | Located at 6x3m sandstone boulder that is slouching into creek left. This is about 100m into Nanko 14. | Looking downstream at TAMRAMs on creek right. |

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|-------------------|------|-------------|--------------|------------|-----------------------|---|--|
| PP Nankoweap 14 | 2 | 418872 | 4014889 | 11/16/2005 | Post | Located at 6x3m sandstone boulder that is slouching into creek left. This is about 100m into Nanko 14. | Post work. |
| PP Nankoweap 14 | 2 | 418872 | 4014889 | 11/16/2005 | Pre | Located at 6x3m sandstone boulder that is slouching into creek left. This is about 100m into Nanko 14. | Looking across the creek at the creek right bank. |
| PP Nankoweap 14 | 3 | 418872 | 4014889 | 11/16/2005 | Post | Located at 6x3m sandstone boulder that is slouching into creek left. This is about 100m into Nanko 14. | Post work. |
| PP Nankoweap 14 | 3 | 418872 | 4014889 | 11/16/2005 | Pre | Located at 6x3m sandstone boulder that is slouching into creek left. This is about 100m into Nanko 14. | Looking upstream at TAMRAMs on creek right bank. |
| PP Nankoweap 14 | A | 418872 | 4014889 | 11/16/2005 | Pre | Located at 6x3m sandstone boulder that is slouching into creek left. This is about 100m into Nanko 14. | Note the large cottonwood behind Kate on the photopoint rock. Taken from downstream about 10m. |
| PP Nankoweap 15-1 | 1 | 418537 | 4014572 | 11/18/2005 | Post | Located at a cream-colored, 2x3m, limestone boulder on creek right bank. This is about 20m from the creek. | Post work. |
| PP Nankoweap 15-1 | 1 | 418537 | 4014572 | 11/18/2005 | Pre | Located at a cream-colored, 2x3m, limestone boulder on creek right bank. This is about 20m from the creek. | Looking upstream at creek right bench of TAMRAM and N. Rim buttes in the background. |
| PP Nankoweap 15-1 | A | 418537 | 4014572 | 11/18/2005 | Pre | Located at a cream-colored, 2x3m, limestone boulder on creek right bank. This is about 20m from the creek. | Kate on photopoint rock with chuar hill on creek right in the background. |
| PP Nankoweap 15-2 | 1 | 418373 | 4014488 | 11/18/2005 | Pre | Taken from 6x4m pink sandstone boulder on creek left. This is at the confluence with dry side channel and next to a big plunge pool. | Looking upstream at debris fan filled with TAMRAM, toward the center of the drainage. |
| PP Nankoweap 15-2 | 1 | 418373 | 4014488 | 11/18/2005 | Post | Taken from 6x4m pink sandstone boulder on creek left. This is at the confluence with dry side channel and next to a big plunge pool. | Post work. |
| PP Nankoweap 15-2 | 2 | 418373 | 4014488 | 11/18/2005 | Post | Taken from 6x4m pink sandstone boulder on creek left. This is at the confluence with dry side channel and next to a big plunge pool. | Post work. |
| PP Nankoweap 15-2 | 2 | 418373 | 4014488 | 11/18/2005 | Pre | Taken from 6x4m pink sandstone boulder on creek left. This is at the confluence with dry side channel and next to a big plunge pool. | Looking upstream with the dry drainage channel in the middle of the photo. |
| PP Nankoweap 15-2 | 3 | 418373 | 4014488 | 11/18/2005 | Post | Taken from 6x4m pink sandstone boulder on creek left. This is at the confluence with dry side channel and next to a big plunge pool. | Post work. |
| PP Nankoweap 15-2 | 3 | 418373 | 4014488 | 11/18/2005 | Pre | Taken from 6x4m pink sandstone boulder on creek left. This is at the confluence with dry side channel and next to a big plunge pool. | Looking directly at creek left bank. |
| PP Nankoweap 15-2 | A | 418373 | 4014488 | 11/18/2005 | Pre | Taken from 6x4m pink sandstone boulder on creek left. This is at the confluence with dry side channel and next to a big plunge pool. | Linda at the photopoint rock. Taken from downstream of rock. |
| PP Nankoweap 16-1 | 1 | 418146 | 4014438 | 3/31/2006 | Pre | Taken from a sedimentary boulder on creek left beside sedimentary cliffs. | Looking down river and across at large cottonwoods and a TAMRAM bosc. |
| PP Nankoweap 16-1 | 1 | 418146 | 4014438 | 4/1/2006 | Post | Taken from a sedimentary boulder on creek left beside sedimentary cliffs. | Post work. |
| PP Nankoweap 16-1 | A | 418146 | 4014438 | 3/31/2006 | Pre | Taken from a sedimentary boulder on creek left beside sedimentary cliffs. | Yellow box is at the photopoint. |
| PP Nankoweap 16-2 | 1 | 418042 | 4014382 | 3/31/2006 | Pre | Taken from a large boulder on river left. This is between a large set of cottonwoods that are directly across the river towards the end of the section. | Looking downstream at Nankoweap Mesa with sedimentary cliffs on river left and a line of cottonwoods on river right. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-------------------|------|-------------|--------------|-----------|-----------------------|---|---|
| PP Nankoweap 16-2 | 1 | 418042 | 4014382 | 4/1/2006 | Post | Taken from a large boulder on river left. This is between a large set of cottonwoods that are directly across the river towards the end of the section. | Post work. |
| PP Nankoweap 16-2 | 2 | 418042 | 4014382 | 3/31/2006 | Pre | Taken from a large boulder on river left. This is between a large set of cottonwoods that are directly across the river towards the end of the section. | Looking up river where canyon constricts from river left. |
| PP Nankoweap 16-2 | 2 | 418042 | 4014382 | 4/1/2006 | Post | Taken from a large boulder on river left. This is between a large set of cottonwoods that are directly across the river towards the end of the section. | Post work. |
| PP Nankoweap 16-2 | 3 | 418042 | 4014382 | 3/31/2006 | Pre | Taken from a large boulder on river left. This is between a large set of cottonwoods that are directly across the river towards the end of the section. | Looking directly across the creek at cottonwoods and a large tower in the background. |
| PP Nankoweap 16-2 | 3 | 418042 | 4014382 | 4/1/2006 | Post | Taken from a large boulder on river left. This is between a large set of cottonwoods that are directly across the river towards the end of the section. | Post work. |
| PP Nankoweap 16-2 | A | 418042 | 4014382 | 3/31/2006 | Pre | Taken from a large boulder on river left. This is between a large set of cottonwoods that are directly across the river towards the end of the section. | Loren at photopoint. |
| PP Nankoweap 17 | 1 | 417706 | 4014136 | 3/31/2006 | Pre | Taken from a round 4ft. Sedimentary boulder on creek left. This is above creek at the base of racer stripe walls. | Looking down creek at the racer stripe cliffs. |
| PP Nankoweap 17 | 1 | 417706 | 4014136 | 3/31/2006 | Post | Taken from a round 4ft. Sedimentary boulder on creek left. This is above creek at the base of racer stripe walls. | Post work. |
| PP Nankoweap 17 | 2 | 417706 | 4014136 | 3/31/2006 | Pre | Taken from a round 4ft. Sedimentary boulder on creek left. This is above creek at the base of racer stripe walls. | Looking NW at racer stripe cliffs. |
| PP Nankoweap 17 | 2 | 417706 | 4014136 | 3/31/2006 | Post | Taken from a round 4ft. Sedimentary boulder on creek left. This is above creek at the base of racer stripe walls. | Post work. |
| PP Nankoweap 17 | A | 417706 | 4014136 | 3/31/2006 | Pre | Taken from a round 4ft. Sedimentary boulder on creek left. This is above creek at the base of racer stripe walls. | Loren at photopoint. |
| PP Nankoweap 18 | 1 | 417356 | 4013869 | 3/31/2006 | Pre | Taken from a large sandstone rock on creek left on Supergroup hill. Right above the confluence about 50m. | Looking downstream from the sandstone rock. This is looking towards the confluence. |
| PP Nankoweap 18 | 1 | 417356 | 4013869 | 4/1/2006 | Post | Taken from a large sandstone rock on creek left on Supergroup hill. Right above the confluence about 50m. | Post work. |
| PP Nankoweap 18 | 2 | 417356 | 4013869 | 3/31/2006 | Pre | Taken from a large sandstone rock on creek left on Supergroup hill. Right above the confluence about 50m. | Looking upstream on creek left with supergroup on photo right. |
| PP Nankoweap 18 | 2 | 417356 | 4013869 | 4/1/2006 | Post | Taken from a large sandstone rock on creek left on Supergroup hill. Right above the confluence about 50m. | Post work. |
| PP Nankoweap 18 | A | 417356 | 4013869 | 3/31/2006 | Pre | Taken from a large sandstone rock on creek left on Supergroup hill. Right above the confluence about 50m. | Pen is pointing at photopoint. |
| PP Nankoweap 19 | 1 | 417182 | 4013756 | 3/31/2006 | Pre | Taken from a large limestone boulder on creek right. This is upstream from the Supergroup on creek left. | Looking upstream. |
| PP Nankoweap 19 | 1 | 417182 | 4013756 | 4/1/2006 | Post | Taken from a large limestone boulder on creek right. This is upstream from the Supergroup on creek left. | Post work. |
| PP Nankoweap 19 | A | 417182 | 4013756 | 3/31/2006 | Pre | Taken from a large limestone boulder on creek right. This is upstream from the Supergroup on creek left. | Person at photopoint. |
| PP Nankoweap 20 | 1 | 416586 | 4013752 | 3/31/2006 | Pre | This is taken on creek right with 2 cottonwoods right behind the rock. | Looking across and upstream. |
| PP Nankoweap 20 | 1 | 416586 | 4013752 | 4/1/2006 | Post | This is taken on creek right with 2 cottonwoods right behind the rock. | Post work. |

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|------------------------|------|-------------|--------------|-----------|-----------------------|---|--|
| PP Nankoweap 20 | A | 416586 | 4013752 | 3/31/2006 | Pre | This is taken on creek right with 2 cottonwoods right behind the rock. | Pen is pointing at photopoint. |
| PP Nankoweap 22 | 1 | 416053 | 4013963 | 4/1/2006 | Pre | Below the spring in the main fork of Nanko there is a lovely spring on creek right with a rose bush and tons of columbines. Taken standing on a 1x1x1m boulder on the right side of the creek. A small stream protrudes from the thick vegetation here and joins Nanko creek. | Looking across stream at mature TAMRAM. |
| PP Nankoweap 22 | 1 | 416053 | 4013963 | 4/1/2006 | Post | Below the spring in the main fork of Nanko there is a lovely spring on creek right with a rose bush and tons of columbines. Taken standing on a 1x1x1m boulder on the right side of the creek. A small stream protrudes from the thick vegetation here and joins Nanko creek. | Post work. |
| PP Nankoweap 22 | A | 416053 | 4013963 | 4/1/2006 | Pre | Below the spring in the main fork of Nanko there is a lovely spring on creek right with a rose bush and tons of columbines. Taken standing on a 1x1x1m boulder on the right side of the creek. A small stream protrudes from the thick vegetation here and joins Nanko creek. | Kelly at photopoint. Taken looking downstream at rock and hillside spring in the background. |
| PP Nankoweap 25 | 1 | 415049 | 4013904 | 4/1/2006 | Post | This is 400m below the Mystic Nankoweap Spring on a boulder at creek left. | Post work. |
| PP Nankoweap 25 | 1 | 415049 | 4013904 | 4/1/2006 | Pre | This is 400m below the Mystic Nankoweap Spring on a boulder at creek left. | Looking away from stream at mature TAMRAM. |
| PP Nankoweap 25 | 2 | 415049 | 4013904 | 4/1/2006 | Post | This is 400m below the Mystic Nankoweap Spring on a boulder at creek left. | Post work. |
| PP Nankoweap 25 | 2 | 415049 | 4013904 | 4/1/2006 | Pre | This is 400m below the Mystic Nankoweap Spring on a boulder at creek left. | Looking downstream at numerous mature TAMRAM. |
| PP Nankoweap 25 | A | 415049 | 4013904 | 4/1/2006 | Pre | This is 400m below the Mystic Nankoweap Spring on a boulder at creek left. | Looking upstream at Kelly on photopoint. |
| PP Nankoweap T1A End | 1 | 422468 | 4017805 | 10/1/2004 | Pre | Check UTM's. | ??? |
| PP Nankoweap T1A End | A | 422468 | 4017805 | 10/1/2004 | Pre | Check UTM's. | End of transect? |
| PP Nankoweap T1A End | B | 422468 | 4017805 | 10/1/2004 | Pre | Check UTM's. | End of transect?? |
| PP Nankoweap T1A Start | 1 | 422468 | 4017805 | 10/1/2004 | Pre | From 9m mark on the transect tape. | Looking towards transect end? |
| PP Nankoweap T1A Start | 2 | 422468 | 4017805 | 10/1/2004 | Pre | From 9m mark on the transect tape. | Photopoint boulder? |
| PP Nankoweap T1A Start | A | 422468 | 4017805 | 10/1/2004 | Pre | From 9m mark on the transect tape. | Start of transect from 9m mark? |
| PP Nankoweap T1A Start | B | 422468 | 4017805 | 10/1/2004 | Pre | From 9m mark on the transect tape. | Start of transect? With photopoint boulder? |
| PP Nankoweap T1A Start | C | 422468 | 4017805 | 10/1/2004 | Pre | From 9m mark on the transect tape. | Start? Not sure? |
| PP Nankoweap T1B End | 1 | 422441 | 4017839 | 10/2/2004 | Pre | Check UTM's. | Looking at end? |
| PP Nankoweap T1B End | A | 422441 | 4017839 | 10/2/2004 | Pre | Check UTM's. | Looking at endpoint? |
| PP Nankoweap T1B Start | 1 | 422490 | 4018123 | 10/2/2004 | Pre | No UTM's. Got from GIS layer-verify in field | Looking from start? |
| PP Nankoweap T1B Start | 2 | 422490 | 4018123 | 10/2/2004 | Pre | No UTM's. Got from GIS layer-verify in field | Looking from start? |
| PP Nankoweap T1B Start | 3 | 422490 | 4018123 | 10/2/2004 | Pre | No UTM's. Got from GIS layer-verify in field | View from start? |
| PP Nankoweap T1B Start | A | 422490 | 4018123 | 10/2/2004 | Pre | No UTM's. Got from GIS layer-verify in field | Transect start. |
| PP Nankoweap T2A End | 1 | 421175 | 4017251 | 5/7/2007 | Post | Transect end point is 1m below the base of a 1.5m wide BACSER on a Muav ledge, about 1m upcreek from where the spring is seeping from a ledge. | Looking down the transect tape toward the start |
| PP Nankoweap T2A End | 2 | 421175 | 4017251 | 5/7/2007 | Post | Transect end point is 1m below the base of a 1.5m wide BACSER on a Muav ledge, about 1m upcreek from where the spring is seeping from a ledge. | Looking across creek to creek left. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|------------------------|------|-------------|--------------|-----------|-----------------------|---|---|
| PP Nankoweap T2A End | 3 | 421175 | 4017251 | 5/7/2007 | Post | Transect end point is 1m below the base of a 1.5m wide BACSER on a Muav ledge, about 1m upcreek from where the spring is seeping from a ledge. | Looking downstream |
| PP Nankoweap T2A End | 4 | 421175 | 4017251 | 5/7/2007 | Post | Transect end point is 1m below the base of a 1.5m wide BACSER on a Muav ledge, about 1m upcreek from where the spring is seeping from a ledge. | Looking upslope creek right |
| PP Nankoweap T2A End | 5 | 421175 | 4017251 | 10/2/2004 | Pre | Transect end point is 1m below the base of a 1.5m wide BACSER on a Muav ledge, about 1m upcreek from where the spring is seeping from a ledge. | Looking from start towards end. |
| PP Nankoweap T2A End | 6 | 421175 | 4017251 | 10/2/2004 | Pre | Transect end point is 1m below the base of a 1.5m wide BACSER on a Muav ledge, about 1m upcreek from where the spring is seeping from a ledge. | Zoomed in view looking from start towards the end. |
| PP Nankoweap T2A End | A | 421175 | 4017251 | 5/7/2007 | Post | Transect end point is 1m below the base of a 1.5m wide BACSER on a Muav ledge, about 1m upcreek from where the spring is seeping from a ledge. | Kate at transect end. Taken at 45m mark on tape. |
| PP Nankoweap T2A End | B | 421175 | 4017251 | 10/2/2004 | Pre | Transect end point is 1m below the base of a 1.5m wide BACSER on a Muav ledge, about 1m upcreek from where the spring is seeping from a ledge. | View of transect end on Muav ledge taken from about 20m upcreek on creek left side of drainage. |
| PP Nankoweap T2A End | B | 421175 | 4017251 | 5/7/2007 | Post | Transect end point is 1m below the base of a 1.5m wide BACSER on a Muav ledge, about 1m upcreek from where the spring is seeping from a ledge. | Kate at transect end on Muav ledge taken from about 20m upcreek on creek left side of drainage |
| PP Nankoweap T2A End | C | 421175 | 4017251 | 5/7/2007 | Post | Transect end point is 1m below the base of a 1.5m wide BACSER on a Muav ledge, about 1m upcreek from where the spring is seeping from a ledge. | Kate at transect end taken from about 10m downstream of end. |
| PP Nankoweap T2A End | D | 421175 | 4017251 | 5/7/2007 | Post | Transect end point is 1m below the base of a 1.5m wide BACSER on a Muav ledge, about 1m upcreek from where the spring is seeping from a ledge. | Close-up view of transect end taken from about 10m downstream of end. |
| PP Nankoweap T2A Start | 1 | 421153 | 4017203 | 5/7/2007 | Post | Transect start point is at the SE base of a 8m tall and 35cm DBH cottonwood tree, that is 2m to the E side of the creek right, active stream channel. | Looking down transect tape toward end. |
| PP Nankoweap T2A Start | 2 | 421153 | 4017203 | 5/7/2007 | Post | Transect start point is at the SE base of a 8m tall and 35cm DBH cottonwood tree, that is 2m to the E side of the creek right, active stream channel. | Looking toward creek right at Melissa at start of T2B |
| PP Nankoweap T2A Start | 3 | 421153 | 4017203 | 5/7/2007 | Post | Transect start point is at the SE base of a 8m tall and 35cm DBH cottonwood tree, that is 2m to the E side of the creek right, active stream channel. | Looking upstream |
| PP Nankoweap T2A Start | 4 | 421153 | 4017203 | 5/7/2007 | Post | Transect start point is at the SE base of a 8m tall and 35cm DBH cottonwood tree, that is 2m to the E side of the creek right, active stream channel. | Looking at creek left cutbank. |
| PP Nankoweap T2A Start | 5 | 421153 | 4017203 | 5/7/2007 | Post | Transect start point is at the SE base of a 8m tall and 35cm DBH cottonwood tree, that is 2m to the E side of the creek right, active stream channel. | Looking from start towards end. |
| PP Nankoweap T2A Start | 6 | 421153 | 4017203 | 5/7/2007 | Post | Transect start point is at the SE base of a 8m tall and 35cm DBH cottonwood tree, that is 2m to the E side of the creek right, active stream channel. | Zoomed in view looking from start towards end. |
| PP Nankoweap T2A Start | A | 421153 | 4017203 | 10/2/2004 | Pre | Transect start point is at the SE base of a 8m tall and 35cm DBH cottonwood tree, that is 2m to the E side of the creek right, active stream channel. | View of start? |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|------------------------|------|-------------|--------------|-----------|-----------------------|---|--|
| PP Nankoweap T2A Start | A | 421153 | 4017203 | 5/7/2007 | Post | Transect start point is at the SE base of a 8m tall and 35cm DBH cottonwood tree, that is 2m to the E side of the creek right, active stream channel. | Kate at transect start at the base of a POPFRE from the 5m mark on transect tape. |
| PP Nankoweap T2A Start | B | 421153 | 4017203 | 5/7/2007 | Post | Transect start point is at the SE base of a 8m tall and 35cm DBH cottonwood tree, that is 2m to the E side of the creek right, active stream channel. | Kate at transect start taken from 5m mark, upstream, showing cutbank in background in reference to POPFRE |
| PP Nankoweap T2A Start | C | 421153 | 4017203 | 5/7/2007 | Post | Transect start point is at the SE base of a 8m tall and 35cm DBH cottonwood tree, that is 2m to the E side of the creek right, active stream channel. | Kate at transect start taken from about 10m across creek on creek left with Kate at T2A start and Melissa at T2B start in background |
| PP Nankoweap T2A Start | D | 421153 | 4017203 | 5/7/2007 | Post | Transect start point is at the SE base of a 8m tall and 35cm DBH cottonwood tree, that is 2m to the E side of the creek right, active stream channel. | Close up of transect start taken from 1m to the creek right side of drainage. |
| PP Nankoweap T2B End | 1 | 421245 | 4016973 | 10/2/2004 | Pre | Check UTM's. | View from end? |
| PP Nankoweap T2B End | A | 421245 | 4016973 | 10/2/2004 | Pre | Check UTM's. | View of end? |
| PP Nankoweap T2B Start | A | 421177 | 4017196 | 10/2/2004 | Pre | | View of start? |
| PP Nankoweap T3A End | 1 | 420983 | 4016652 | 10/3/2004 | Pre | End point of Nankoweap T3A. | Looking up canyon to start of T3A. |
| PP Nankoweap T3A End | 1 | 420983 | 4016652 | 5/7/2007 | Post | End point of Nanko T3A. | Looking up canyon to start of transect tape |
| PP Nankoweap T3A End | 2 | 420983 | 4016652 | 10/3/2004 | Pre | End point of Nankoweap T3A. | Looking down canyon from transect end point. |
| PP Nankoweap T3A End | 2 | 420983 | 4016652 | 5/7/2007 | Post | End point of Nanko T3A. | Looking down canyon with creek to right of center in photo |
| PP Nankoweap T3A End | 3 | 420983 | 4016652 | 5/7/2007 | Post | End point of Nanko T3A. | Looking across creek, focused on a 3x3m limestone boulder. |
| PP Nankoweap T3A End | A | 420983 | 4016652 | 5/7/2007 | Post | End point of Nanko T3A. | From 45m mark on transect. Looking down canyon to Lori at end of nanko T3A |
| PP Nankoweap T3A End | B | 420983 | 4016652 | 5/7/2007 | Post | End point of Nanko T3A. | From 5m downcanyon of endpoint. Looking up canyon to Lori standing on end point boulder. |
| PP Nankoweap T3A End | C | 420983 | 4016652 | 5/7/2007 | Post | End point of Nanko T3A. | Close up of 50m mark of tape end point boulder |
| PP Nankoweap T3A Start | 1 | 420954 | 4016615 | 5/7/2007 | Post | Large limestone boulder to west of transect, on bench approx 2.5 m tall and 4 m wide. | Looking down canyon toward end of transect tape. |
| PP Nankoweap T3A Start | 2 | 420954 | 4016615 | 5/7/2007 | Post | Large limestone boulder to west of transect, on bench approx 2.5 m tall and 4 m wide. | Looking across to creek left, toward slope |
| PP Nankoweap T3A Start | 3 | 420954 | 4016615 | 5/7/2007 | Post | Large limestone boulder to west of transect, on bench approx 2.5 m tall and 4 m wide. | Looking up canyon with creek to left in photo |
| PP Nankoweap T3A Start | 4 | 420954 | 4016615 | 5/7/2007 | Post | Large limestone boulder to west of transect, on bench approx 2.5 m tall and 4 m wide. | Looking up canyon showing drainage channel and creek in photo |
| PP Nankoweap T3A Start | A | 420954 | 4016615 | 10/3/2004 | Pre | Large limestone boulder to west of transect, on bench approx 2.5 m tall and 4 m wide. | Suzanne at start of transect T3A |
| PP Nankoweap T3A Start | B | 420954 | 4016615 | 5/7/2007 | Post | Large limestone boulder to west of transect, on bench approx 2.5 m tall and 4 m wide. | From 5m mark on transect tape, looking up canyon to Lori standing on start point rock. |
| PP Nankoweap T3A Start | C | 420954 | 4016615 | 5/7/2007 | Post | Large limestone boulder to west of transect, on bench approx 2.5 m tall and 4 m wide. | Close up view of start point of transect in V-wedge on boulder |
| PP Nankoweap T3B Start | 1 | 420994 | 4016678 | 10/3/2004 | Pre | From large boulder at start point of Nanko T3B. | Down canyon toward end of transect. |
| PP Nankoweap T3B Start | A | 420994 | 4016678 | 10/3/2004 | Pre | From large boulder at start point of Nanko T3B. | Lori at Start point of Nanko T3B |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|------------------------|------|-------------|--------------|-----------|-----------------------|---|--|
| PP Nankoweap T3B Start | B | 420994 | 4016678 | 10/3/2004 | Pre | From large boulder at start point of Nanko T3B. | Close-up of exact start point of Nanko T 3B. |
| PP Phantom 1 | 1 | 402123 | 3997678 | 12/7/2006 | Pre | This is the first tricky to negotiate boulder up Phantom, just over 100m up from BA Creek confluence with Phantom. | Looking downstream at mature TAMRAM on creek left. |
| PP Phantom 1 | 1 | 402123 | 3997678 | 12/7/2006 | Post | This is the first tricky to negotiate boulder up Phantom, just over 100m up from BA Creek confluence with Phantom. | Post work. |
| PP Phantom 1 | A | 402123 | 3997678 | 12/7/2006 | Pre | This is the first tricky to negotiate boulder up Phantom, just over 100m up from BA Creek confluence with Phantom. | Pen points at photopoint. Taken from 10m upstream of PP boulder. |
| PP Phantom 10 | 1 | 398547 | 4001158 | 1/20/2007 | Post | Taken 30m above the grove of cottonwoods that are in a bendy stretch of the creek about 700m above the Phantom / Haunted confluence. | Post work. |
| PP Phantom 10 | 1 | 398547 | 4001158 | 1/20/2007 | Pre | Taken 30m above the grove of cottonwoods that are in a bendy stretch of the creek about 700m above the Phantom / Haunted confluence. | Looking across stream at mature TAMRAM with no leaves. |
| PP Phantom 10 | A | 398547 | 4001158 | 1/20/2007 | Pre | Taken 30m above the grove of cottonwoods that are in a bendy stretch of the creek about 700m above the Phantom / Haunted confluence. | Pen points to PP. Looking at a secondary dry wash and at a gray boulder 1x1m right of the creek. |
| PP Phantom 11 | 1 | 398230 | 4001350 | 1/20/2007 | Post | Start 20m below the start of where Phantom Creek flows. Taken from a 1x2m gray boulder on creek left amidst horsetail. | Post work. |
| PP Phantom 11 | 1 | 398230 | 4001350 | 1/20/2007 | Pre | Start 20m below the start of where Phantom Creek flows. Taken from a 1x2m gray boulder on creek left amidst horsetail. | Looking upstream at 2 mature TAMRAMs. Base of Isis Temple in the background. |
| PP Phantom 11 | A | 398230 | 4001350 | 1/20/2007 | Pre | Start 20m below the start of where Phantom Creek flows. Taken from a 1x2m gray boulder on creek left amidst horsetail. | Pen points at PP on gray boulder. |
| PP Phantom 12 | 1 | 397734 | 4001878 | 1/21/2007 | Post | Taken 200m below the first major fork in Phantom that is above the source of Phantom Creek. Taken from creek left in the Muav and from a Muav boulder 1x2x1m. | Post work. |
| PP Phantom 12 | 1 | 397734 | 4001878 | 1/21/2007 | Pre | Taken 200m below the first major fork in Phantom that is above the source of Phantom Creek. Taken from creek left in the Muav and from a Muav boulder 1x2x1m. | Looking downstream at a small thicket of TAMRAM. |
| PP Phantom 12 | A | 397734 | 4001878 | 1/21/2007 | Pre | Taken 200m below the first major fork in Phantom that is above the source of Phantom Creek. Taken from creek left in the Muav and from a Muav boulder 1x2x1m. | Pen points to PP. Taken 10m downstream and looking up towards the first fork. |
| PP Phantom 13 | 1 | 397700 | 4002151 | 1/21/2007 | Post | Taken from a 1x2m Muav limestone boulder on creek left about 2m from the Muav wall. There is a large mature pinyon pine leaning away from the wall about 30-40m downstream and on creek left. | Post work. |
| PP Phantom 13 | 1 | 397700 | 4002151 | 1/21/2007 | Pre | Taken from a 1x2m Muav limestone boulder on creek left about 2m from the Muav wall. There is a large mature pinyon pine leaning away from the wall about 30-40m downstream and on creek left. | Looking downstream at TAMRAM with a crooked pinyon pine in the background. |
| PP Phantom 13 | A | 397700 | 4002151 | 1/21/2007 | Pre | Taken from a 1x2m Muav limestone boulder on creek left about 2m from the Muav wall. There is a large mature pinyon pine leaning away from the wall about 30-40m downstream and on creek left. | Pen points to PP. Taken from about 5m downstream. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|-----------|-----------------------|--|--|
| PP Phantom 14 | 1 | 398992 | 4003482 | 1/21/2007 | Pre | This is at the end of Phantom Canyon. PP is located about 100m below the end of the drainage on a 3x2m gray boulder on creek left. Got UTM's from GIS layer-field verify, if no GPS available, mark point on map. | Looking upstream. |
| PP Phantom 14 | 1 | 398992 | 4003482 | 1/21/2007 | Post | This is at the end of Phantom Canyon. PP is located about 100m below the end of the drainage on a 3x2m gray boulder on creek left. Got UTM's from GIS layer-field verify, if no GPS available, mark point on map. | Post work. |
| PP Phantom 14 | A | 398992 | 4003482 | 1/21/2007 | Pre | This is at the end of Phantom Canyon. PP is located about 100m below the end of the drainage on a 3x2m gray boulder on creek left. Got UTM's from GIS layer-field verify, if no GPS available, mark point on map. | Pen points to PP. Taken from downstream about 3m. |
| PP Phantom 2 | 1 | 401532 | 3997657 | 12/7/2006 | Post | UTMs taken from the map. Photo taken from a long slopey, 50m stretch of slabby granite on creek left. This is about 500m from the confluence of Phantom with Bright Angel Creek. | Post work. |
| PP Phantom 2 | 1 | 401532 | 3997657 | 12/7/2006 | Pre | UTMs taken from the map. Photo taken from a long slopey, 50m stretch of slabby granite on creek left. This is about 500m from the confluence of Phantom with Bright Angel Creek. | Looking across the stream at TAMRAM. |
| PP Phantom 2 | A | 401532 | 3997657 | 12/7/2006 | Pre | UTMs taken from the map. Photo taken from a long slopey, 50m stretch of slabby granite on creek left. This is about 500m from the confluence of Phantom with Bright Angel Creek. | Pen points at photopoint. Taken from 5m upstream of a huge granite slab. |
| PP Phantom 3 | 1 | 401352 | 3997748 | 12/7/2006 | Post | UTMs taken from the map. After a rough 1.5 km up Phantom Creek you reach a pool that you'd have to swim in to get past. 50m down canyon is a barn-sized Tapeats boulder at a bend in the creek. PP us at the base of the boulder on the downstream side. | Post work. |
| PP Phantom 3 | 1 | 401352 | 3997748 | 12/7/2006 | Pre | UTMs taken from the map. After a rough 1.5 km up Phantom Creek you reach a pool that you'd have to swim in to get past. 50m down canyon is a barn-sized Tapeats boulder at a bend in the creek. PP us at the base of the boulder on the downstream side. | Looking downstream at mature TAMRAM with leaves. |
| PP Phantom 3 | 2 | 401352 | 3997748 | 12/7/2006 | Post | UTMs taken from the map. After a rough 1.5 km up Phantom Creek you reach a pool that you'd have to swim in to get past. 50m down canyon is a barn-sized Tapeats boulder at a bend in the creek. PP us at the base of the boulder on the downstream side. | Post work. |
| PP Phantom 3 | 2 | 401352 | 3997748 | 12/7/2006 | Pre | UTMs taken from the map. After a rough 1.5 km up Phantom Creek you reach a pool that you'd have to swim in to get past. 50m down canyon is a barn-sized Tapeats boulder at a bend in the creek. PP us at the base of the boulder on the downstream side. | Looking across at a mature with yellow leaves. |
| PP Phantom 3 | A | 401352 | 3997748 | 12/7/2006 | Pre | UTMs taken from the map. After a rough 1.5 km up Phantom Creek you reach a pool that you'd have to swim in to get past. 50m down canyon is a barn-sized Tapeats boulder at a bend in the creek. PP us at the base of the boulder on the downstream side. | Taken from downstream of Tapeats boulder by 15m. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|-----------|-----------------------|--|--|
| PP Phantom 5 | 1 | 399507 | 3998724 | 1/19/2007 | Pre | Three mature cottonwoods in a row about 5m upstream on creek left. | Looking downstream at TAMRAM. |
| PP Phantom 5 | 1 | 399507 | 3998724 | 1/19/2007 | Post | Three mature cottonwoods in a row about 5m upstream on creek left. | Post work. |
| PP Phantom 5 | A | 399507 | 3998724 | 1/19/2007 | Pre | Three mature cottonwoods in a row about 5m upstream on creek left. | Pen points to PP. Taken upstream about 5m and on creek left. |
| PP Phantom 6 | 1 | 399426 | 3999751 | 1/19/2007 | Pre | Taken from a 1x1m sandstone boulder on creek left about 150m downstream of the overhang camp. | Looking at TAMRAM. |
| PP Phantom 6 | 1 | 399426 | 3999751 | 1/19/2007 | Post | Taken from a 1x1m sandstone boulder on creek left about 150m downstream of the overhang camp. | Post work. |
| PP Phantom 6 | A | 399426 | 3999751 | 1/19/2007 | Pre | Taken from a 1x1m sandstone boulder on creek left about 150m downstream of the overhang camp. | Steve at PP. Taken from about 5m upstream on creek left. |
| PP Phantom 8 | 1 | 399196 | 4000452 | 1/19/2007 | Pre | Taken from a box sized salmon colored sandstone boulder on creek left. Boulder is in the water and directly across from a mature scrub oak on creek right. | Looking downstream at TAMRAM. |
| PP Phantom 8 | 1 | 399196 | 4000452 | 1/19/2007 | Post | Taken from a box sized salmon colored sandstone boulder on creek left. Boulder is in the water and directly across from a mature scrub oak on creek right. | Post work. |
| PP Phantom 8 | A | 399196 | 4000452 | 1/19/2007 | Pre | Taken from a box sized salmon colored sandstone boulder on creek left. Boulder is in the water and directly across from a mature scrub oak on creek right. | Kelly at PP. Taken from creek left about 3m to the left of the boulder. |
| PP Phantom 9 | 1 | 399100 | 4000603 | 1/20/2007 | Post | Taken a top a downed cottonwood at the confluence of Phantom and Haunted Creeks. This is about 40 m west of the actual joining of waters. | Post work. |
| PP Phantom 9 | 1 | 399100 | 4000603 | 1/20/2007 | Pre | Taken a top a downed cottonwood at the confluence of Phantom and Haunted Creeks. This is about 40 m west of the actual joining of waters. | Looking at TAMRAM sapling - in the right center portion of picture. |
| PP Phantom 9 | A | 399100 | 4000603 | 1/20/2007 | Pre | Taken a top a downed cottonwood at the confluence of Phantom and Haunted Creeks. This is about 40 m west of the actual joining of waters. | Pen points to PP. Looking upstream to the dead and snow-topped cottonwood. |
| PP Pipe 1 | 1 | 400024 | 3995200 | 3/23/2005 | Pre | Taken from second step on stairway leading to the rest house near the river. | Looking up the creek from the rest house. |
| PP Pipe 1 | 1 | 400024 | 3995200 | 3/20/2006 | Post | Taken from second step on stairway leading to the rest house near the river. | Post work. Looking upstream, a small cottonwood in photo left. |
| PP Pipe 1 | A | 400024 | 3995200 | 3/23/2005 | Pre | Taken from second step on stairway leading to the rest house near the river. | Photo of person at photopoint. GPS is 400023 and 3995199 (7m). |
| PP Pipe 2 | 1 | 399938 | 3994907 | 3/23/2005 | Pre | Taken from west of trail on granite slab/outcrop with a pink vein. | Looking up creek to 3 descending ridges in view. |
| PP Pipe 2 | 1 | 399938 | 3994907 | 3/20/2006 | Post | Taken from west of trail on granite slab/outcrop with a pink vein. | Post work. Looking upstream. |
| PP Pipe 2 | A | 399938 | 3994907 | 3/23/2005 | Pre | Taken from west of trail on granite slab/outcrop with a pink vein. | Looking at person standing at photopoint in a slick rock drainage. Photo taken from creek. |
| PP Pipe 2 | B | 399938 | 3994907 | 3/23/2005 | Pre | Taken from west of trail on granite slab/outcrop with a pink vein. | Looking at person standing at photopoint. Taken from down creek of photopoint. |
| PP Pipe 3 | 1 | 399960 | 3994236 | 3/23/2005 | Pre | Taken from a flat ledge on the side of the trail. | Looking up creek from the trail to spring/small waterfall. |
| PP Pipe 3 | 1 | 399960 | 3994236 | 3/20/2006 | Post | Taken from a flat ledge on the side of the trail. | Post work. Looking upstream. |
| PP Pipe 3 | A | 399960 | 3994236 | 3/23/2005 | Pre | Taken from a flat ledge on the side of the trail. | Person at photopoint. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|-----------|-----------------------|---|--|
| PP Pipe 4 | 1 | 400040 | 3994059 | 3/23/2005 | Pre | Taken sitting on boulder on creek left, below the corkscrews. | Looking down creek. |
| PP Pipe 4 | 1 | 400040 | 3994059 | 3/20/2006 | Post | Taken sitting on boulder on creek left, below the corkscrews. | Post work. Looking downstream. |
| PP Pipe 4 | 2 | 400040 | 3994059 | 3/23/2005 | Pre | Taken sitting on boulder on creek left, below the corkscrews. | Looking up creek. |
| PP Pipe 4 | 2 | 400040 | 3994059 | 3/20/2006 | Post | Taken sitting on boulder on creek left, below the corkscrews. | Post work. Looking upstream. |
| PP Pipe 4 | 3 | 400040 | 3994059 | 3/23/2005 | Pre | Taken sitting on boulder on creek left, below the corkscrews. | Looking up creek to the right. |
| PP Pipe 4 | 3 | 400040 | 3994059 | 3/20/2006 | Post | Taken sitting on boulder on creek left, below the corkscrews. | Post work. Looking across and upstream. |
| PP Pipe 4 | A | 400040 | 3994059 | 3/23/2005 | Pre | Taken sitting on boulder on creek left, below the corkscrews. | Looking down creek toward photopoint. |
| PP Pipe 5 | 1 | 400033 | 3994055 | 3/23/2005 | Pre | Taken from creek left, looking up creek. This is next to a large boulder in photopoint 4. | Looking up creek. |
| PP Pipe 5 | 1 | 400033 | 3994055 | 3/24/2005 | Post | Taken from creek left, looking up creek. This is next to a large boulder in photopoint 4. | Looking up creek to bend and large rock face (and large cottonwood). |
| PP Pipe 5 | A | 400033 | 3994055 | 3/24/2005 | Pre | Taken from creek left, looking up creek. This is next to a large boulder in photopoint 4. | Looking at photopoint across the creek to boulder and corkscrews of trail. |
| PP Pipe 6 | 1 | 400073 | 3993867 | 3/24/2005 | Post | Taken from creek left at second bend (from bottom of corkscrews) on a large, sand colored boulder. This boulder is the furthest from the creek and a small waterfall. | This compass bearing is different then the Pipe 6 view 1 pretreatment. |
| PP Pipe 6 | 1 | 400073 | 3993867 | 3/24/2005 | Pre | Taken from creek left at second bend (from bottom of corkscrews) on a large, sand colored boulder. This boulder is the furthest from the creek and a small waterfall. | Looking up creek. This compass bearing is different then the post treatment so it should be verified. |
| PP Pipe 6 | 1 | 400073 | 3993867 | 3/20/2006 | Post | Taken from creek left at second bend (from bottom of corkscrews) on a large, sand colored boulder. This boulder is the furthest from the creek and a small waterfall. | Post work. Looking upstream. |
| PP Pipe 6 | 2 | 400073 | 3993867 | 3/24/2005 | Pre | Taken from creek left at second bend (from bottom of corkscrews) on a large, sand colored boulder. This boulder is the furthest from the creek and a small waterfall. | This one has a different GPS but is very close to View 1 so it is under the same photopoint name (Pipe 6). The GPS here is 400068 easting and 3993862 westing, acc 7m. This photo is looking up creek. |
| PP Pipe 6 | 2 | 400073 | 3993867 | 3/20/2006 | Post | Taken from creek left at second bend (from bottom of corkscrews) on a large, sand colored boulder. This boulder is the furthest from the creek and a small waterfall. | Post work. Looking downstream. |
| PP Pipe 6 | A | 400073 | 3993867 | 3/24/2005 | Pre | Taken from creek left at second bend (from bottom of corkscrews) on a large, sand colored boulder. This boulder is the furthest from the creek and a small waterfall. | Looking up creek at person at photopoint. Taken from the top of a talus slope facing the waterfall. |
| PP Pipe 7 | 1 | 400217 | 3993884 | 3/24/2005 | Post | No GPS reading. Taken sitting on a pink granite boulder on creek right at a bend. This is upcreek from a 5' drop off/small waterfall. Got GPS reading from map so need to check in field and if still no reading, mark on map so we can update. | |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|-----------|-----------------------|---|--|
| PP Pipe 7 | 1 | 400217 | 3993884 | 3/24/2005 | Pre | No GPS reading. Taken sitting on a pink granite boulder on creek right at a bend. This is upcreek from a 5' drop off/small waterfall. Got GPS reading from map so need to check in field and if still no reading, mark on map so we can update. | Looking up creek. |
| PP Pipe 7 | 1 | 400217 | 3993884 | 3/20/2006 | Post | No GPS reading. Taken sitting on a pink granite boulder on creek right at a bend. This is upcreek from a 5' drop off/small waterfall. Got GPS reading from map so need to check in field and if still no reading, mark on map so we can update. | Post work. Looking upstream. |
| PP Pipe 7 | 2 | 400217 | 3993884 | 3/24/2005 | Pre | No GPS reading. Taken sitting on a pink granite boulder on creek right at a bend. This is upcreek from a 5' drop off/small waterfall. Got GPS reading from map so need to check in field and if still no reading, mark on map so we can update. | Looking downstream. |
| PP Pipe 7 | 2 | 400217 | 3993884 | 3/20/2006 | Post | No GPS reading. Taken sitting on a pink granite boulder on creek right at a bend. This is upcreek from a 5' drop off/small waterfall. Got GPS reading from map so need to check in field and if still no reading, mark on map so we can update. | Post work. Looking downstream. |
| PP Pipe 7 | A | 400217 | 3993884 | 3/24/2005 | Pre | No GPS reading. Taken sitting on a pink granite boulder on creek right at a bend. This is upcreek from a 5' drop off/small waterfall. Got GPS reading from map so need to check in field and if still no reading, mark on map so we can update. | Looking at photopoint and a crack in the rock face. Taken from down slope from a large black/rose boulder. |
| PP Red Canyon 1 | 1 | 416438 | 3987368 | 3/10/2006 | Post | Taken on a sandstone ledge 250m below where the trail enters the drainage. | Post work. |
| PP Red Canyon 1 | 1 | 416438 | 3987368 | 3/10/2006 | Pre | Taken on a sandstone ledge 250m below where the trail enters the drainage. | Looking upstream at 3 TAMRAMs. |
| PP Red Canyon 1 | 1 | 416438 | 3987368 | 2/20/2007 | Post | Taken on a sandstone ledge 250m below where the trail enters the drainage. | Photo update. |
| PP Red Canyon 1 | A | 416438 | 3987368 | 3/10/2006 | Pre | Taken on a sandstone ledge 250m below where the trail enters the drainage. | Sprayer and yellow box are on the photopoint. |
| PP Red Canyon 2 | 1 | 416260 | 3987191 | 3/9/2006 | Pre | This is about 35m from the first cottonwood as you come upstream. If you are looking upstream this is >100m from where the Hance Trail drops into the drainage. | Looking upstream. |
| PP Red Canyon 2 | 1 | 416260 | 3987191 | 3/31/2006 | Post | This is about 35m from the first cottonwood as you come upstream. If you are looking upstream this is >100m from where the Hance Trail drops into the drainage. | Post work. |
| PP Red Canyon 2 | 1 | 416260 | 3987191 | 2/21/2007 | Post | This is about 35m from the first cottonwood as you come upstream. If you are looking upstream this is >100m from where the Hance Trail drops into the drainage. | Photo update. |
| PP Red Canyon 2 | A | 416260 | 3987191 | 3/9/2006 | Pre | This is about 35m from the first cottonwood as you come upstream. If you are looking upstream this is >100m from where the Hance Trail drops into the drainage. | Will sitting at photopoint. This is under Coronado Point. |
| PP Red Canyon 3 | 1 | 416002 | 3986855 | 3/30/2006 | Pre | Taken from a big, roundish, and white boulder. Just on top on a 10 ft. cascading, ledgey waterfall. | View downstream. |
| PP Red Canyon 3 | 1 | 416002 | 3986855 | 3/31/2006 | Post | Taken from a big, roundish, and white boulder. Just on top on a 10 ft. cascading, ledgey waterfall. | Post work. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-------------------|------|-------------|--------------|-----------|-----------------------|--|---|
| PP Red Canyon 3 | 1 | 416002 | 3986855 | 2/21/2007 | Post | Taken from a big, roundish, and white boulder. Just on top on a 10 ft. cascading, ledgey waterfall. | Photo update. |
| PP Red Canyon 3 | 2 | 416002 | 3986855 | 3/30/2006 | Pre | Taken from a big, roundish, and white boulder. Just on top on a 10 ft. cascading, ledgey waterfall. | View downstream and to creek right. |
| PP Red Canyon 3 | 2 | 416002 | 3986855 | 3/31/2006 | Post | Taken from a big, roundish, and white boulder. Just on top on a 10 ft. cascading, ledgey waterfall. | Post work. |
| PP Red Canyon 3 | 2 | 416002 | 3986855 | 2/21/2007 | Post | Taken from a big, roundish, and white boulder. Just on top on a 10 ft. cascading, ledgey waterfall. | Photo update. |
| PP Red Canyon 3 | 3 | 416002 | 3986855 | 3/30/2006 | Pre | Taken from a big, roundish, and white boulder. Just on top on a 10 ft. cascading, ledgey waterfall. | View across from photopoint. |
| PP Red Canyon 3 | 3 | 416002 | 3986855 | 3/31/2006 | Post | Taken from a big, roundish, and white boulder. Just on top on a 10 ft. cascading, ledgey waterfall. | Post work. |
| PP Red Canyon 3 | 3 | 416002 | 3986855 | 2/21/2007 | Post | Taken from a big, roundish, and white boulder. Just on top on a 10 ft. cascading, ledgey waterfall. | Photo update. |
| PP Red Canyon 3 | 4 | 416002 | 3986855 | 3/30/2006 | Pre | Taken from a big, roundish, and white boulder. Just on top on a 10 ft. cascading, ledgey waterfall. | View upstream and to creek right. |
| PP Red Canyon 3 | 4 | 416002 | 3986855 | 3/31/2006 | Post | Taken from a big, roundish, and white boulder. Just on top on a 10 ft. cascading, ledgey waterfall. | Post work. |
| PP Red Canyon 3 | 4 | 416002 | 3986855 | 2/21/2007 | Post | Taken from a big, roundish, and white boulder. Just on top on a 10 ft. cascading, ledgey waterfall. | Photo update. |
| PP Red Canyon 3 | 5 | 416002 | 3986855 | 3/30/2006 | Pre | Taken from a big, roundish, and white boulder. Just on top on a 10 ft. cascading, ledgey waterfall. | View upstream and to creek right. |
| PP Red Canyon 3 | 5 | 416002 | 3986855 | 3/31/2006 | Post | Taken from a big, roundish, and white boulder. Just on top on a 10 ft. cascading, ledgey waterfall. | Post work. |
| PP Red Canyon 3 | 5 | 416002 | 3986855 | 2/21/2007 | Post | Taken from a big, roundish, and white boulder. Just on top on a 10 ft. cascading, ledgey waterfall. | Photo update. |
| PP Red Canyon 3 | A | 416002 | 3986855 | 3/30/2006 | Pre | Taken from a big, roundish, and white boulder. Just on top on a 10 ft. cascading, ledgey waterfall. | View of photopoint boulder with Gooding's willow in the background. Looking upstream. |
| PP Red Canyon 4 | 1 | 415651 | 3986019 | 3/31/2006 | Pre | Taken standing on a 1x1x2m white limestone boulder on creek left. | Upstream view. |
| PP Red Canyon 4 | 1 | 415651 | 3986019 | 3/31/2006 | Post | Taken standing on a 1x1x2m white limestone boulder on creek left. | Post work. |
| PP Red Canyon 4 | 2 | 415651 | 3986019 | 3/31/2006 | Pre | Taken standing on a 1x1x2m white limestone boulder on creek left. | Downstream and creek left. Shale shelves with TAMRAM. |
| PP Red Canyon 4 | 2 | 415651 | 3986019 | 3/31/2006 | Post | Taken standing on a 1x1x2m white limestone boulder on creek left. | Post work. |
| PP Red Canyon 4 | A | 415651 | 3986019 | 3/31/2006 | Pre | Taken standing on a 1x1x2m white limestone boulder on creek left. | Kate at photopoint. Taken from 7m upstream on creek left. |
| PP Red Canyon 5 | 1 | 415689 | 3985859 | 3/31/2006 | Pre | Standing on a bright angel shale pouroff, 150m from the beginning of the section. | Looking downstream. |
| PP Red Canyon 5 | 1 | 415689 | 3985859 | 3/31/2006 | Post | Standing on a bright angel shale pouroff, 150m from the beginning of the section. | Post work. |
| PP Red Canyon 5 | 2 | 415689 | 3985859 | 3/31/2006 | Pre | Standing on a bright angel shale pouroff, 150m from the beginning of the section. | Upstream view. |
| PP Red Canyon 5 | A | 415689 | 3985859 | 3/31/2006 | Pre | Standing on a bright angel shale pouroff, 150m from the beginning of the section. | Kate at photopoint. Taken from downstream. |
| PP Ribbon Falls 1 | 1 | 405059 | 4002067 | 10/2/2005 | Pre | Located at a 4x3x3m Shinumo boulder on creek left. This is about 75m downstream from Ribbon Falls. No GPS available. | Looking upstream at Ribbon Falls. There is a TAMRAM in the foreground on the right. |

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| PP Ribbon Falls 1 | 1 | 405059 | 4002067 | 10/2/2005 | Post | Located at a 4x3x3m Shinumo boulder on creek left. This is about 75m downstream from Ribbon Falls. No GPS available. | Post work. |
| PP Ribbon Falls 1 | 1 | 405059 | 4002067 | 4/2/2006 | Post | Located at a 4x3x3m Shinumo boulder on creek left. This is about 75m downstream from Ribbon Falls. No GPS available. | Photo update. |
| PP Ribbon Falls 1 | 2 | 405059 | 4002067 | 10/2/2005 | Pre | Located at a 4x3x3m Shinumo boulder on creek left. This is about 75m downstream from Ribbon Falls. No GPS available. | Looking downstream of the narrow opening to Ribbon Falls Canyon. There is a bit of Shinumo rock in the foreground. |
| PP Ribbon Falls 1 | 2 | 405059 | 4002067 | 10/2/2005 | Post | Located at a 4x3x3m Shinumo boulder on creek left. This is about 75m downstream from Ribbon Falls. No GPS available. | Post work. |
| PP Ribbon Falls 1 | 2 | 405059 | 4002067 | 4/2/2006 | Post | Located at a 4x3x3m Shinumo boulder on creek left. This is about 75m downstream from Ribbon Falls. No GPS available. | Photo update. |
| PP Ribbon Falls 1 | A | 405059 | 4002067 | 10/2/2005 | Pre | Located at a 4x3x3m Shinumo boulder on creek left. This is about 75m downstream from Ribbon Falls. No GPS available. | Kate at photopoint. |
| PP Roaring Springs 1 | 1 | 405818 | 4004430 | 10/11/2006 | Post | Large grey and white boulder that is approx. 5m long on creek right. There is a makeshift trail at the confluence of Roaring Springs and Bright Angel. A water pipe is 5m above the photopoint and there is a large juniper directly below the photopoint. | View looking upstream. |
| PP Roaring Springs 1 | 2 | 405818 | 4004430 | 10/11/2006 | Post | Large grey and white boulder that is approx. 5m long on creek right. There is a makeshift trail at the confluence of Roaring Springs and Bright Angel. A water pipe is 5m above the photopoint and there is a large juniper directly below the photopoint. | View looking downstream. |
| PP Roaring Springs 1 | A | 405818 | 4004430 | 10/11/2006 | Pre | Large grey and white boulder that is approx. 5m long on creek right. There is a makeshift trail at the confluence of Roaring Springs and Bright Angel. A water pipe is 5m above the photopoint and there is a large juniper directly below the photopoint. | Megan at photopoint. Taken 5m upstream on creek right. |
| PP Roosevelt 1 | 1 | 417343 | 4013734 | 4/1/2006 | Pre | Taken on creek right from a small sediment bench with 3 limestone boulders across from the triangular limestone rock on creek left. This is about 150m up from the confluence. | Looking across stream at TAMRAM and triangular limestone boulder. Redwall and Mt. Hayden through junipers in the background. |
| PP Roosevelt 1 | 1 | 417343 | 4013734 | 4/1/2006 | Post | Taken on creek right from a small sediment bench with 3 limestone boulders across from the triangular limestone rock on creek left. This is about 150m up from the confluence. | Post work. |
| PP Roosevelt 1 | A | 417343 | 4013734 | 4/1/2006 | Pre | Taken on creek right from a small sediment bench with 3 limestone boulders across from the triangular limestone rock on creek left. This is about 150m up from the confluence. | Person at photopoint. |
| PP Roosevelt 2-1 | 1 | 417143 | 4013331 | 4/2/2006 | Pre | Taken from large red sandstone boulder on creek left. It's very hard to miss if you are looking. The first 3 views were taken from a sitting position. The 4th view is from a standing position. | Looking directly downstream at large juniper before creek bends to the right. |
| PP Roosevelt 2-1 | 2 | 417143 | 4013331 | 4/2/2006 | Pre | Taken from large red sandstone boulder on creek left. It's very hard to miss if you are looking. The first 3 views were taken from a sitting position. The 4th view is from a standing position. | Looking upstream and at creek right thicket. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|------------------|------|-------------|--------------|----------|-----------------------|--|---|
| PP Roosevelt 2-1 | 2 | 417143 | 4013331 | 4/2/2006 | Post | Taken from large red sandstone boulder on creek left. It's very hard to miss if you are looking. The first 3 views were taken from a sitting position. The 4th view is from a standing position. | Post work. |
| PP Roosevelt 2-1 | 3 | 417143 | 4013331 | 4/2/2006 | Post | Taken from large red sandstone boulder on creek left. It's very hard to miss if you are looking. The first 3 views were taken from a sitting position. The 4th view is from a standing position. | Post work. |
| PP Roosevelt 2-1 | 3 | 417143 | 4013331 | 4/2/2006 | Pre | Taken from large red sandstone boulder on creek left. It's very hard to miss if you are looking. The first 3 views were taken from a sitting position. The 4th view is from a standing position. | Looking upstream at creek left. Redwall pyramids in the background. |
| PP Roosevelt 2-1 | 4 | 417143 | 4013331 | 4/2/2006 | Pre | Taken from large red sandstone boulder on creek left. It's very hard to miss if you are looking. The first 3 views were taken from a sitting position. The 4th view is from a standing position. | Looking away from the creek at hillside behind rock on creek left. |
| PP Roosevelt 2-1 | 4 | 417143 | 4013331 | 4/2/2006 | Post | Taken from large red sandstone boulder on creek left. It's very hard to miss if you are looking. The first 3 views were taken from a sitting position. The 4th view is from a standing position. | Post work. |
| PP Roosevelt 2-1 | A | 417143 | 4013331 | 4/2/2006 | Pre | Taken from large red sandstone boulder on creek left. It's very hard to miss if you are looking. The first 3 views were taken from a sitting position. The 4th view is from a standing position. | Pen is pointing at photopoint. |
| PP Roosevelt 2-2 | 1 | 417146 | 4013308 | 4/2/2006 | Pre | Located approx. 20m upstream from 2-1. This is on creek right, below the left bend at the base of a small cottonwood on a red boulder. | Looking across and upstream at TAMRAM thicket. There is a cottonwood and a spire in the background. |
| PP Roosevelt 2-2 | 1 | 417146 | 4013308 | 4/2/2006 | Post | Located approx. 20m upstream from 2-1. This is on creek right, below the left bend at the base of a small cottonwood on a red boulder. | Post work. |
| PP Roosevelt 2-2 | A | 417146 | 4013308 | 4/2/2006 | Pre | Located approx. 20m upstream from 2-1. This is on creek right, below the left bend at the base of a small cottonwood on a red boulder. | Steve at photopoint. |
| PP Roosevelt 3 | 1 | 416923 | 4012974 | 4/2/2006 | Pre | Taken from a small nondescript rock on creek left. There is a secondary drainage channel to the left. Photopoint located about 85m up from the spring. | Looking down and left at 3 mature TAMRAM thicket. |
| PP Roosevelt 3 | 1 | 416923 | 4012974 | 4/2/2006 | Post | Taken from a small nondescript rock on creek left. There is a secondary drainage channel to the left. Photopoint located about 85m up from the spring. | Post work. |
| PP Roosevelt 3 | 2 | 416923 | 4012974 | 4/2/2006 | Post | Taken from a small nondescript rock on creek left. There is a secondary drainage channel to the left. Photopoint located about 85m up from the spring. | Post work. |
| PP Roosevelt 3 | 2 | 416923 | 4012974 | 4/2/2006 | Pre | Taken from a small nondescript rock on creek left. There is a secondary drainage channel to the left. Photopoint located about 85m up from the spring. | Looking across creek at cottonwood. One TAMRAM behind. |
| PP Roosevelt 3 | 3 | 416923 | 4012974 | 4/2/2006 | Post | Taken from a small nondescript rock on creek left. There is a secondary drainage channel to the left. Photopoint located about 85m up from the spring. | Post work. |

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|-----------------|------|-------------|--------------|------------|-----------------------|--|---|
| PP Roosevelt 3 | 3 | 416923 | 4012974 | 4/2/2006 | Pre | Taken from a small nondescript rock on creek left. There is a secondary drainage channel to the left. Photopoint located about 85m up from the spring. | Looking across and slightly upstream at TAMRAM to looker's left of a nice pear-shaped juniper. |
| PP Roosevelt 3 | A | 416923 | 4012974 | 4/2/2006 | Pre | Taken from a small nondescript rock on creek left. There is a secondary drainage channel to the left. Photopoint located about 85m up from the spring. | Steve at photopoint. |
| PP Saddle 1 | 1 | 420098 | 4025115 | 5/7/2005 | Pre | Taken about 175m from the river on canyon left. Standing on top of 2x2m boulder which is on top of a 4x4 m boulder. There is Redwall limestone and CELLAE and ACAGRE at base on downcanyon side. | Looking up canyon; showing lower part of Saddle drainage. |
| PP Saddle 1 | 2 | 420098 | 4025115 | 5/7/2005 | Pre | Taken about 175m from the river on canyon left. Standing on top of 2x2m boulder which is on top of a 4x4 m boulder. There is Redwall limestone and CELLAE and ACAGRE at base on downcanyon side. | Looking down canyon toward the area that we will not work in. |
| PP Saddle 1 | A | 420098 | 4025115 | 5/7/2005 | Pre | Taken about 175m from the river on canyon left. Standing on top of 2x2m boulder which is on top of a 4x4 m boulder. There is Redwall limestone and CELLAE and ACAGRE at base on downcanyon side. | Frank at photopoints. Taken from the middle of the drainage looking down canyon to Frank on creek left. |
| PP Saddle 1 | B | 420098 | 4025115 | 5/7/2005 | Pre | Taken about 175m from the river on canyon left. Standing on top of 2x2m boulder which is on top of a 4x4 m boulder. There is Redwall limestone and CELLAE and ACAGRE at base on downcanyon side. | Frank at photopoint, showing up canyon view. Taken from creek right looking across canyon. |
| PP Saddle 1-2 | 1 | 419650 | 4024973 | 5/4/2003 | Post | No GPS reading. Garage-sized limestone chockstone boulder about 150m downstream of where trail drops into the drainage. Field check UTM's as they are from GIS layer-mark on map. | Looking down the drainage with the NE redwall face on the other side of the river in view. |
| PP Saddle 1-2 | 1 | 419650 | 4024973 | 10/20/2005 | Pre | No GPS reading. Garage-sized limestone chockstone boulder about 150m downstream of where trail drops into the drainage. Field check UTM's as they are from GIS layer-mark on map. | Looking down drainage with NE redwall face on the other side of the river in view. |
| PP Saddle 1-2 | 1 | 419650 | 4024973 | 10/20/2005 | Post | No GPS reading. Garage-sized limestone chockstone boulder about 150m downstream of where trail drops into the drainage. Field check UTM's as they are from GIS layer-mark on map. | Post work. |
| PP Saddle 1-2 | 2 | 419650 | 4024973 | 10/20/2005 | Pre | No GPS reading. Garage-sized limestone chockstone boulder about 150m downstream of where trail drops into the drainage. Field check UTM's as they are from GIS layer-mark on map. | Looking upstream at saddle drainage with big debris wall in the background. |
| PP Saddle 1-2 | 2 | 419650 | 4024973 | 10/20/2005 | Post | No GPS reading. Garage-sized limestone chockstone boulder about 150m downstream of where trail drops into the drainage. Field check UTM's as they are from GIS layer-mark on map. | Post work. |
| PP Saddle 1-2 | 2 | 419650 | 4024973 | 5/4/2006 | Post | No GPS reading. Garage-sized limestone chockstone boulder about 150m downstream of where trail drops into the drainage. Field check UTM's as they are from GIS layer-mark on map. | Looking upstream at Saddle drainage with a big debris wall in the background. q |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|------------|-----------------------|---|---|
| PP Saddle 1-2 | A | 419650 | 4024973 | 10/20/2005 | Pre | No GPS reading. Garage-sized limestone chockstone boulder about 150m downstream of where trail drops into the drainage. Field check UTM's as they are from GIS layer-mark on map. | Kate standing at limestone photopoint boulder. |
| PP Saddle 2 | 1 | 419773 | 4024961 | 5/7/2005 | Pre | Taken from about 50m down canyon from where trail drops in. Standing on top of 4x6m gray limestone boulder on creek left. | Looking down canyon in area with a huge house size boulder. CELLAE in foreground and can see TAMRAM in lower section. |
| PP Saddle 2 | 1 | 419773 | 4024961 | 10/20/2005 | Post | Taken from about 50m down canyon from where trail drops in. Standing on top of 4x6m gray limestone boulder on creek left. | Photo update. |
| PP Saddle 2 | 1 | 419773 | 4024961 | 5/4/2006 | Post | Taken from about 50m down canyon from where trail drops in. Standing on top of 4x6m gray limestone boulder on creek left. | Looking down canyon in an area with a huge house sized boulder. CELLAE in foreground but no more TAMRAM. |
| PP Saddle 2 | 2 | 419773 | 4024961 | 5/7/2005 | Pre | Taken from about 50m down canyon from where trail drops in. Standing on top of 4x6m gray limestone boulder on creek left. | Looking up canyon showing tall, somewhat dense CELLAE and BRILON. ALENEG is also seen in the foreground. |
| PP Saddle 2 | 2 | 419773 | 4024961 | 10/20/2005 | Post | Taken from about 50m down canyon from where trail drops in. Standing on top of 4x6m gray limestone boulder on creek left. | Photo update. |
| PP Saddle 2 | 2 | 419773 | 4024961 | 5/4/2006 | Post | Taken from about 50m down canyon from where trail drops in. Standing on top of 4x6m gray limestone boulder on creek left. | Looking up canyon showing a tall, somewhat dense CELLAE and BRILON. ALENEG is also seen in the foreground. |
| PP Saddle 2 | A | 419773 | 4024961 | 5/7/2005 | Pre | Taken from about 50m down canyon from where trail drops in. Standing on top of 4x6m gray limestone boulder on creek left. | Looking down canyon at Lori on photopoint rock, not the skyline. Taken from 8m up canyon of photopoint rock. |
| PP Saddle 3 | 1 | 419319 | 4024642 | 5/7/2005 | Pre | On a 2x3m Redwall limestone boulder on creek right; canyon is just beginning to narrow down; Redwall is blocky with steep vertical walls. | Looking down canyon. |
| PP Saddle 3 | 1 | 419319 | 4024642 | 5/4/2006 | Post | On a 2x3m Redwall limestone boulder on creek right; canyon is just beginning to narrow down; Redwall is blocky with steep vertical walls. | Looking down canyon. |
| PP Saddle 3 | 2 | 419319 | 4024642 | 5/7/2005 | Pre | On a 2x3m Redwall limestone boulder on creek right; canyon is just beginning to narrow down; Redwall is blocky with steep vertical walls. | Looking up canyon. |
| PP Saddle 3 | 2 | 419319 | 4024642 | 5/4/2006 | Post | On a 2x3m Redwall limestone boulder on creek right; canyon is just beginning to narrow down; Redwall is blocky with steep vertical walls. | Looking up canyon. |
| PP Saddle 3 | A | 419319 | 4024642 | 5/7/2005 | Pre | On a 2x3m Redwall limestone boulder on creek right; canyon is just beginning to narrow down; Redwall is blocky with steep vertical walls. | Looking up canyon at the photopoint. Taken from mid-creek. |
| PP Saddle 3 | A | 419319 | 4024642 | 5/4/2006 | Post | On a 2x3m Redwall limestone boulder on creek right; canyon is just beginning to narrow down; Redwall is blocky with steep vertical walls. | Looking up canyon at the photopoint. Retake for fun! |
| PP Saddle 3 | B | 419319 | 4024642 | 5/7/2005 | Pre | On a 2x3m Redwall limestone boulder on creek right; canyon is just beginning to narrow down; Redwall is blocky with steep vertical walls. | Looking at Kari sitting below the photopoint rock. Taken from mid-creek. |
| PP Saddle 3 | B | 419319 | 4024642 | 5/4/2006 | Post | On a 2x3m Redwall limestone boulder on creek right; canyon is just beginning to narrow down; Redwall is blocky with steep vertical walls. | Looking at Kari sitting below the photopoint. Retake for fun! Look at Miss Malen one year later... |

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| PP Saddle 4 | 1 | 418913 | 4024449 | 5/7/2005 | Pre | Taken from creek right on limestone ledge on 2x2x2m boulder. GPS is taken from map so it may be way off, look for land features. | Looking upstream to creek opening, then narrowing and curving. |
| PP Saddle 4 | 2 | 418913 | 4024449 | 5/7/2005 | Pre | Taken from creek right on limestone ledge on 2x2x2m boulder. GPS is taken from map so it may be way off, look for land features. | Looking 120 degrees downstream at limestone ledge, 1/2x20m long with Chris waving from boulder atop ledge. Looking downstream with redbud in center and massive redwall (?). |
| PP Saddle 4 | A | 418913 | 4024449 | 5/7/2005 | Pre | Taken from creek right on limestone ledge on 2x2x2m boulder. GPS is taken from map so it may be way off, look for land features. | Taken from middle/creek on gravel bed in open area. |
| PP Saddle 5 | 1 | 418785 | 4024449 | 5/7/2005 | Pre | Taken from upper canyon about 30 meters below ledge/waterfall on muav ledge 1/2m above creek. GPS reading from map so it may be way off, look for land features. | Looking upstream towards a lovely cascading pouroff. |
| PP Saddle 5 | 2 | 418785 | 4024449 | 5/7/2005 | Pre | Taken from upper canyon about 30 meters below ledge/waterfall on muav ledge 1/2m above creek. GPS reading from map so it may be way off, look for land features. | Looking downstream through limestone narrows and creek bend. |
| PP Saddle 5 | A | 418785 | 4024449 | 5/7/2005 | Pre | Taken from upper canyon about 30 meters below ledge/waterfall on muav ledge 1/2m above creek. GPS reading from map so it may be way off, look for land features. | Looking upstream. Taken from bend in creek about 10m downstream from photopoint. |
| PP South 1 | 1 | 417415 | 4036887 | 5/6/2005 | Pre | Taken 40m upstream of Gambel Oak grove on large, cream colored sandstone boulder (4m tall x 5.5m wide). Boulder is about 200m downstream of trail junction which is marked by cairns. In the Hermit shale about a mile up canyon. | Looking up canyon at a large boulder in top right of picture. |
| PP South 1 | 2 | 417415 | 4036887 | 5/6/2005 | Pre | Taken 40m upstream of Gambel Oak grove on large, cream colored sandstone boulder (4m tall x 5.5m wide). Boulder is about 200m downstream of trail junction which is marked by cairns. In the Hermit shale about a mile up canyon. | Looking downstream. Hermit shale slope in the left top corner adjacent to a large Gambel Oak grove. There are about 10 mature tamarisk in the foreground. |
| PP South 1 | A | 417415 | 4036887 | 5/6/2005 | Pre | Taken 40m upstream of Gambel Oak grove on large, cream colored sandstone boulder (4m tall x 5.5m wide). Boulder is about 200m downstream of trail junction which is marked by cairns. In the Hermit shale about a mile up canyon. | Steve at photopoint; taken about 15m up canyon from photopoint. |
| PP South 1 | B | 417415 | 4036887 | 5/6/2005 | Pre | Taken 40m upstream of Gambel Oak grove on large, cream colored sandstone boulder (4m tall x 5.5m wide). Boulder is about 200m downstream of trail junction which is marked by cairns. In the Hermit shale about a mile up canyon. | Steve at photopoint; taken about 20m down canyon from a boulder |
| PP South 10-1 | 1 | 419991 | 4038697 | 3/20/2006 | Pre | Taken from a large sandstone boulder on creek left; flat topped and about 20m up the drainage from the spire in the skyline. Also note this boulder denotes the end of section 9 and the beginning of section 10. | Looking down canyon at TAMRAM in the drainage. Notice Supai layer and sandstone. |
| PP South 10-1 | 1 | 419991 | 4038697 | 3/20/2006 | Post | Taken from a large sandstone boulder on creek left; flat topped and about 20m up the drainage from the spire in the skyline. Also note this boulder denotes the end of section 9 and the beginning of section 10. | Post work. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|-----------|-----------------------|---|--|
| PP South 10-1 | A | 419991 | 4038697 | 3/20/2006 | Pre | Taken from a large sandstone boulder on creek left; flat topped and about 20m up the drainage from the spire in the skyline. Also note this boulder denotes the end of section 9 and the beginning of section 10. | Kameron on photopoint boulder. Taken from about 12m up canyon. |
| PP South 10-2 | 1 | 421152 | 4039659 | 5/6/2005 | Pre | Taken from a large sandstone boulder downcreek from the mouth of a side drainage. | Looking up canyon at large tamarisks. |
| PP South 10-2 | 2 | 421152 | 4039659 | 5/6/2005 | Pre | Taken from a large sandstone boulder downcreek from the mouth of a side drainage. | Looking down canyon over a 50 ft. pour off. |
| PP South 10-2 | A | 421152 | 4039659 | 5/6/2005 | Pre | Taken from a large sandstone boulder downcreek from the mouth of a side drainage. | Steve at photopoint showing the mouth of the side drainage, which is the prominent feature in the background. Taken from creek right about 25m from the photopoint looking up and left of the creek. |
| PP South 11 | 1 | 422091 | 4039753 | 5/6/2005 | Pre | Taken from 3m tall pyramidal Supai boulder on creek left 4m out of drainage. This is located where the traverse above South canyon drainage reaches the actual drainage. | Looking downstream. Shows a very large kidney-shaped boulder and there is Redwall limestone in the background. |
| PP South 11 | 2 | 422091 | 4039753 | 5/6/2005 | Pre | Taken from 3m tall pyramidal Supai boulder on creek left 4m out of drainage. This is located where the traverse above South canyon drainage reaches the actual drainage. | Looking upstream. Showing the top of Redwall and the bottom of the Supai. |
| PP South 11 | A | 422091 | 4039753 | 5/6/2005 | Pre | Taken from 3m tall pyramidal Supai boulder on creek left 4m out of drainage. This is located where the traverse above South canyon drainage reaches the actual drainage. | No info. |
| PP South 12 | 1 | 420961 | 4039623 | 3/20/2006 | Pre | Taken from an enormous sandstone boulder on creek left. This is about 20m upcreek from the junction with major side drainage canyon (Bedrock). | Looking at TAMRAM in drainage with slick rock bottom and volunteers working. |
| PP South 12 | 1 | 420961 | 4039623 | 3/20/2006 | Post | Taken from an enormous sandstone boulder on creek left. This is about 20m upcreek from the junction with major side drainage canyon (Bedrock). | Post work. |
| PP South 12 | 2 | 420961 | 4039623 | 3/20/2006 | Pre | Taken from an enormous sandstone boulder on creek left. This is about 20m upcreek from the junction with major side drainage canyon (Bedrock). | This is an attempt to include the skyline above the area where the TAMRAM is thick. |
| PP South 12 | 2 | 420961 | 4039623 | 3/20/2006 | Post | Taken from an enormous sandstone boulder on creek left. This is about 20m upcreek from the junction with major side drainage canyon (Bedrock). | Post work. |
| PP South 12 | 3 | 420961 | 4039623 | 3/20/2006 | Post | Taken from an enormous sandstone boulder on creek left. This is about 20m upcreek from the junction with major side drainage canyon (Bedrock). | Post work. |
| PP South 12 | 3 | 420961 | 4039623 | 3/20/2006 | Pre | Taken from an enormous sandstone boulder on creek left. This is about 20m upcreek from the junction with major side drainage canyon (Bedrock). | Photo is between views 1 and 2. |
| PP South 12 | 4 | 420961 | 4039623 | 3/20/2006 | Pre | Taken from an enormous sandstone boulder on creek left. This is about 20m upcreek from the junction with major side drainage canyon (Bedrock). | Horizontal view. |
| PP South 12 | 4 | 420961 | 4039623 | 3/20/2006 | Post | Taken from an enormous sandstone boulder on creek left. This is about 20m upcreek from the junction with major side drainage canyon (Bedrock). | Post work. |
| PP South 12 | A | 420961 | 4039623 | 3/20/2006 | Pre | Taken from an enormous sandstone boulder on creek left. This is about 20m upcreek from the junction with major side drainage canyon (Bedrock). | Kari on photopoint. Taken from slightly up canyon and across drainage. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|-----------|-----------------------|--|---|
| PP South 12 | B | 420961 | 4039623 | 3/20/2006 | Pre | Taken from an enormous sandstone boulder on creek left. This is about 20m upcreek from the junction with major side drainage canyon (Bedrock). | Kari at photopoint. |
| PP South 3 | 1 | 417687 | 4037209 | 3/17/2006 | Post | Taken from a random spot in the creek drainage, on creek left. The notable feature is the overhanging rock in the picture on left. This is right upstream from the TAMRAM. The photopoint is approx. 10m downstream from the said boulder. | Post work. |
| PP South 3 | 1 | 417687 | 4037209 | 3/17/2006 | Pre | Taken from a random spot in the creek drainage, on creek left. The notable feature is the overhanging rock in the picture on left. This is right upstream from the TAMRAM. The photopoint is approx. 10m downstream from the said boulder. | Looking upstream at lone TAMRAM in front of overhanging boulder on creek left. |
| PP South 3 | A | 417687 | 4037209 | 3/17/2006 | Pre | Taken from a random spot in the creek drainage, on creek left. The notable feature is the overhanging rock in the picture on left. This is right upstream from the TAMRAM. The photopoint is approx. 10m downstream from the said boulder. | Loren at photopoint. |
| PP South 4-1 | 1 | 418272 | 4037494 | 3/17/2006 | Post | Taken from a white sandstone boulder in the center of the drainage. This boulder lies at the end of section 4 and the beginning of section 5. The skyline view is helpful on canyon left upstream from the point. | Post work. |
| PP South 4-1 | 1 | 418272 | 4037494 | 3/17/2006 | Pre | Taken from a white sandstone boulder in the center of the drainage. This boulder lies at the end of section 4 and the beginning of section 5. The skyline view is helpful on canyon left upstream from the point. | Looking up canyon at left bank and a TAMRAM thicket. |
| PP South 4-1 | 2 | 418272 | 4037494 | 3/17/2006 | Post | Taken from a white sandstone boulder in the center of the drainage. This boulder lies at the end of section 4 and the beginning of section 5. The skyline view is helpful on canyon left upstream from the point. | Post work. |
| PP South 4-1 | 2 | 418272 | 4037494 | 3/17/2006 | Pre | Taken from a white sandstone boulder in the center of the drainage. This boulder lies at the end of section 4 and the beginning of section 5. The skyline view is helpful on canyon left upstream from the point. | Looking at more TAMRAM along bank, Hermit slope in view on canyon left. |
| PP South 4-1 | A | 418272 | 4037494 | 3/17/2006 | Pre | Taken from a white sandstone boulder in the center of the drainage. This boulder lies at the end of section 4 and the beginning of section 5. The skyline view is helpful on canyon left upstream from the point. | Looking upstream at photopoint rock and skyline. |
| PP South 4-1 | B | 418272 | 4037494 | 3/17/2006 | Pre | Taken from a white sandstone boulder in the center of the drainage. This boulder lies at the end of section 4 and the beginning of section 5. The skyline view is helpful on canyon left upstream from the point. | Another view of the photopoint rock. Taken from about 10m down creek. |
| PP South 4-2 | 1 | 418173 | 4037403 | 5/6/2005 | Pre | Medium sized, sandstone boulder at S-curve in drainage on creek right below a large desert varnished boulder (3.5x7x3 meters) in the middle of hermit layer. | looking at clump of mature tamarisk in the center of the photo and looking at the center of the drainage. |
| PP South 4-2 | 1 | 418173 | 4037403 | 3/17/2006 | Post | Medium sized, sandstone boulder at S-curve in drainage on creek right below a large desert varnished boulder (3.5x7x3 meters) in the middle of hermit layer. | Post work. |

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|-----------------|------|-------------|--------------|-----------|-----------------------|---|--|
| PP South 4-2 | 2 | 418173 | 4037403 | 5/6/2005 | Pre | Medium sized, sandstone boulder at S-curve in drainage on creek right below a large desert varnished boulder (3.5x7x3 meters) in the middle of hermit layer. | Looking at Coconino boulder on a Hermit spire about 200m up canyon and at the mouth of a small side drainage. |
| PP South 4-2 | 2 | 418173 | 4037403 | 3/17/2006 | Post | Medium sized, sandstone boulder at S-curve in drainage on creek right below a large desert varnished boulder (3.5x7x3 meters) in the middle of hermit layer. | Post work. |
| PP South 4-2 | A | 418173 | 4037403 | 5/6/2005 | Pre | Medium sized, sandstone boulder at S-curve in drainage on creek right below a large desert varnished boulder (3.5x7x3 meters) in the middle of hermit layer. | Steve at photopoint; showing large desert varnished boulder; taken from the drainage |
| PP South 4-2 | B | 418173 | 4037403 | 5/6/2005 | Pre | Medium sized, sandstone boulder at S-curve in drainage on creek right below a large desert varnished boulder (3.5x7x3 meters) in the middle of hermit layer. | Taken about 10 m down creek from photopoint. |
| PP South 5 | 1 | 418360 | 4037581 | 5/6/2005 | Pre | Taken from a white sandstone boulder with some huecos right of the drainage near base of side canyon about 100-150m downcreek. There is an S-curve in hermit shale section of drainage. There is a 200m high Hermit wall on creek left. | Looking downstream in the hermit shale. Hermit wall behind about 5 mature tamarisk trees. |
| PP South 5 | 1 | 418360 | 4037581 | 3/18/2006 | Post | Taken from a white sandstone boulder with some huecos right of the drainage near base of side canyon about 100-150m downcreek. There is an S-curve in hermit shale section of drainage. There is a 200m high Hermit wall on creek left. | Post work. |
| PP South 5 | 2 | 418360 | 4037581 | 5/6/2005 | Pre | Taken from a white sandstone boulder with some huecos right of the drainage near base of side canyon about 100-150m downcreek. There is an S-curve in hermit shale section of drainage. There is a 200m high Hermit wall on creek left. | Looking upstream. Hermit slope in background and mature tamarisk in foreground. |
| PP South 5 | 2 | 418360 | 4037581 | 3/18/2006 | Post | Taken from a white sandstone boulder with some huecos right of the drainage near base of side canyon about 100-150m downcreek. There is an S-curve in hermit shale section of drainage. There is a 200m high Hermit wall on creek left. | Post work. |
| PP South 5 | A | 418360 | 4037581 | 5/6/2005 | Pre | Taken from a white sandstone boulder with some huecos right of the drainage near base of side canyon about 100-150m downcreek. There is an S-curve in hermit shale section of drainage. There is a 200m high Hermit wall on creek left. | Steve on photopoint; Hermit wall visible as well as a large flat boulder about 40m across slanting down into the drainage. Should be easy to find. Taken down creek and right of the photopoint. |
| PP South 6 | 1 | 418824 | 4037763 | 5/6/2005 | Pre | Taken from sandstone boulder (3x4.3x3m) located at the top of a small poulover in the Esplanade. Canyon begins to open up here and the poulover is the best identifier. | Downstream view of drainage. Tamarisk upstream of here but not below. Bedrock in top of esplanade. |
| PP South 6 | 1 | 418824 | 4037763 | 3/18/2006 | Post | Taken from sandstone boulder (3x4.3x3m) located at the top of a small poulover in the Esplanade. Canyon begins to open up here and the poulover is the best identifier. | Post work. |
| PP South 6 | 2 | 418824 | 4037763 | 5/6/2005 | Pre | Taken from sandstone boulder (3x4.3x3m) located at the top of a small poulover in the Esplanade. Canyon begins to open up here and the poulover is the best identifier. | Upstream view. |
| PP South 6 | 2 | 418824 | 4037763 | 3/18/2006 | Post | Taken from sandstone boulder (3x4.3x3m) located at the top of a small poulover in the Esplanade. Canyon begins to open up here and the poulover is the best identifier. | Post work. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|-----------|-----------------------|--|--|
| PP South 6 | A | 418824 | 4037763 | 5/6/2005 | Pre | Taken from sandstone boulder (3x4.3x3m) located at the top of a small pourover in the Esplanade. Canyon begins to open up here and the pourover is the best identifier. | looking upstream at Supai boulder that lies above a 2m pouroff. Taken from 15m below boulder in drainage center. |
| PP South 6 | B | 418824 | 4037763 | 5/6/2005 | Pre | Taken from sandstone boulder (3x4.3x3m) located at the top of a small pourover in the Esplanade. Canyon begins to open up here and the pourover is the best identifier. | Looking downstream at Supai boulder (4m tall). Taken from the center of drainage about 8m above pouroff (2m tall). |
| PP South 8 | 1 | 419471 | 4038125 | 5/6/2005 | Pre | Taken at junction of Esplanade and second layer of Supai from the creek right of the drainage. This is at the "up and over" pourover spot, but the second up and over as you hike up canyon. Taken about 7m above drainage. | Looking upstream at 10m dry fall near cairn that marks the trail around the dry fall. |
| PP South 8 | 1 | 419471 | 4038125 | 3/20/2006 | Post | Taken at junction of Esplanade and second layer of Supai from the creek right of the drainage. This is at the "up and over" pourover spot, but the second up and over as you hike up canyon. Taken about 7m above drainage. | Post work. |
| PP South 8 | 2 | 419471 | 4038125 | 5/6/2005 | Pre | Taken at junction of Esplanade and second layer of Supai from the creek right of the drainage. This is at the "up and over" pourover spot, but the second up and over as you hike up canyon. Taken about 7m above drainage. | Looking downstream through a narrow section of Supai towards a clump of mature tamarisk. |
| PP South 8 | 2 | 419471 | 4038125 | 3/20/2006 | Post | Taken at junction of Esplanade and second layer of Supai from the creek right of the drainage. This is at the "up and over" pourover spot, but the second up and over as you hike up canyon. Taken about 7m above drainage. | Post work. |
| PP South 8 | A | 419471 | 4038125 | 5/6/2005 | Pre | Taken at junction of Esplanade and second layer of Supai from the creek right of the drainage. This is at the "up and over" pourover spot, but the second up and over as you hike up canyon. Taken about 7m above drainage. | Steve at photopoint from about 2m closer to the drainage. Skyline is the key element in the photo looking right out of the drainage. |
| PP South 8 | B | 419471 | 4038125 | 5/6/2005 | Pre | Taken at junction of Esplanade and second layer of Supai from the creek right of the drainage. This is at the "up and over" pourover spot, but the second up and over as you hike up canyon. Taken about 7m above drainage. | Steve at photopoint. Looking up canyon from about 10m down canyon; cairn and pourover in view. |
| PP South 9 | 1 | 419747 | 4038336 | 5/6/2005 | Pre | Taken from above the first pourover area where the bedrock becomes white. Taken at the first large sandstone and slightly desert varnished boulder (10x6x4m) on creek left closest to creek bed. It is about a mile from transect 1. | Looking upstream at tamarisk area where transect 2 was taken. |
| PP South 9 | 1 | 419747 | 4038336 | 3/20/2006 | Post | Taken from above the first pourover area where the bedrock becomes white. Taken at the first large sandstone and slightly desert varnished boulder (10x6x4m) on creek left closest to creek bed. It is about a mile from transect 1. | Post work. |
| PP South 9 | 2 | 419747 | 4038336 | 5/6/2005 | Pre | Taken from above the first pourover area where the bedrock becomes white. Taken at the first large sandstone and slightly desert varnished boulder (10x6x4m) on creek left closest to creek bed. It is about a mile from transect 1. | Looking down on bleached white supai bedrock section. |
| PP South 9 | 2 | 419747 | 4038336 | 3/20/2006 | Post | Taken from above the first pourover area where the bedrock becomes white. Taken at the first large sandstone and slightly desert varnished boulder (10x6x4m) on creek left closest to creek bed. It is about a mile from transect 1. | Post work. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|------------------|------|-------------|--------------|-----------|-----------------------|--|---|
| PP South 9 | A | 419747 | 4038336 | 5/6/2005 | Pre | Taken from above the first poulover area where the bedrock becomes white. Taken at the first large sandstone and slightly desert varnished boulder (10x6x4m) on creek left closest to creek bed. It is about a mile from transect 1. | Steve on photopoint. Taken from about 30m to the right, across the drainage from the photopoint boulder. |
| PP South Hydro 1 | 1 | 420288 | 4038742 | 5/6/2005 | Pre | Overview of seep (in cloud); seep at base of white sandstone poulover. | Looking upstream towards the seep wall. |
| PP South Hydro 1 | 1 | 420288 | 4038742 | 4/22/2006 | Post | Overview of seep (in cloud); seep at base of white sandstone poulover. | Looking upstream towards the seep wall. |
| PP South Hydro 1 | 2 | 420288 | 4038742 | 5/6/2005 | Pre | Overview of seep (in cloud); seep at base of white sandstone poulover. | Filling a beaker at the highest volume seep. |
| PP South Hydro 1 | 2 | 420288 | 4038742 | 4/22/2006 | Post | Overview of seep (in cloud); seep at base of white sandstone poulover. | Not sure if this is the same view due to the lack of water. |
| PP South Hydro 2 | 1 | 420037 | 4038732 | 5/6/2005 | Pre | South Hydro 2 | Looking upstream at identifying card. Taken 7m downstream of last plunge pool off shelf, looking up across a wet shelf. |
| PP South Hydro 2 | 1 | 420037 | 4038732 | 4/22/2006 | Post | South Hydro 2 | Looking up stream. Taken 7m downstream of last plunge pool off shelf, looking up across a wet shelf. Photopoint for hydro 3, view 1 is up on mid-left corner of the photo, on the upper most visible shelf. |
| PP South Hydro 2 | 2 | 420037 | 4038732 | 5/6/2005 | Pre | South Hydro 2 | Looking downstream from 3m above the source (at base of a small poulover). Taken from the upstream end of intermittent reach, at the lip of a rock ledge poulover. |
| PP South Hydro 2 | 3 | 420037 | 4038732 | 4/22/2006 | Post | South Hydro 2 | Perceived source for hydro point 2 view 1 taken from 25m upstream. On shelf creek right looking creek left. Spring source hydro. 25m upstream from view 1. |
| PP South Hydro 2 | 4 | 420037 | 4038732 | 4/23/2006 | Post | South Hydro 2 | Standing downstream of pot hole in Supai bedrock. Looking upstream at the pot hole and supai poulovers. |
| PP South Hydro 2 | A | 420037 | 4038732 | 4/23/2006 | Post | South Hydro 2 | Standing on creek right 2m from the pothole. View of a sexy man. |
| PP South Hydro 3 | 1 | 420061 | 4038487 | 5/6/2005 | Pre | Downstream end of intermittent reach #2 where alluvium meets rocky floored pool. | Looking upstream. |
| PP South Hydro 3 | 2 | 420061 | 4038487 | 5/6/2005 | Pre | Downstream end of intermittent reach #2 where alluvium meets rocky floored pool. | Upstream end of reach. Algae filled pools at source. |
| PP South Hydro 3 | 2 | 420061 | 4038487 | 4/23/2006 | Post | Downstream end of intermittent reach #2 where alluvium meets rocky floored pool. | About 30m upstream of South Hydro 2, view 2, looking downstream. Photopoint for View is the large, red, flatter rock on mid-right of the photo. |
| PP South Hydro 4 | 1 | 419805 | 4038119 | 5/6/2005 | Pre | Upstream end of intermittent reach, near the end of transect #2. | Looking downstream across a rock shelf. |
| PP South Hydro 4 | 1 | 419805 | 4038119 | 4/23/2006 | Post | Upstream end of intermittent reach, near the end of transect #2. | View is looking upstream at photopoint for South Hydro 4, View 1, pretty much right in the center of the photo. |
| PP South Hydro 5 | 1 | 419820 | 4038140 | 5/6/2005 | Pre | Downstream end of intermittent reach, white rock shelf. | Looking upstream across a rock shelf. |
| PP South T1A End | 1 | 421130 | 4039471 | 5/6/2005 | Pre | Transect ends on the top of log on a debris pile on creek left. | Looking upstream. Clump of mature TAMRAM to the left of the tape. |

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|--------------------|------|-------------|--------------|-----------|-----------------------|--|--|
| PP South T1A End | 1 | 421130 | 4039471 | 4/22/2006 | Post | Transect ends on the top of log on a debris pile on creek left. | Looking upstream. |
| PP South T1A End | 2 | 421130 | 4039471 | 5/6/2005 | Pre | Transect ends on the top of log on a debris pile on creek left. | Looking into creek bed. 1 mature TAMRAM in the photo. |
| PP South T1A End | 2 | 421130 | 4039471 | 4/22/2006 | Post | Transect ends on the top of log on a debris pile on creek left. | Looking into the creek bed. |
| PP South T1A End | A | 421130 | 4039471 | 5/6/2005 | Pre | Transect ends on the top of log on a debris pile on creek left. | Looking at creek bed with a large white boulder on creek left in the bottom right corner of the photo. |
| PP South T1A Start | 1 | 421084 | 4039457 | 5/6/2005 | Pre | Look for a large boulder in center of the creekbed where first side canyon comes in on creek left. Starts on a smaller boulder upstream from the larger boulder. | Looking down canyon at through mature tamarisk. |
| PP South T1A Start | 1 | 421084 | 4039457 | 4/22/2006 | Post | Look for a large boulder in center of the creekbed where first side canyon comes in on creek left. Starts on a smaller boulder upstream from the larger boulder. | Looking down canyon. |
| PP South T1A Start | 2 | 421084 | 4039457 | 5/6/2005 | Pre | Look for a large boulder in center of the creekbed where first side canyon comes in on creek left. Starts on a smaller boulder upstream from the larger boulder. | The large boulder downstream of transect start is visible. |
| PP South T1A Start | 2 | 421084 | 4039457 | 4/22/2006 | Post | Look for a large boulder in center of the creekbed where first side canyon comes in on creek left. Starts on a smaller boulder upstream from the larger boulder. | The large boulder downstream of the transect start is visible. |
| PP South T1A Start | 3 | 421084 | 4039457 | 5/6/2005 | Pre | Look for a large boulder in center of the creekbed where first side canyon comes in on creek left. Starts on a smaller boulder upstream from the larger boulder. | Looking upstream from the start of transect 1. |
| PP South T1A Start | 3 | 421084 | 4039457 | 4/22/2006 | Post | Look for a large boulder in center of the creekbed where first side canyon comes in on creek left. Starts on a smaller boulder upstream from the larger boulder. | Looking upstream from the start of T1A |
| PP South T1A Start | 4 | 421084 | 4039457 | 5/6/2005 | Pre | Look for a large boulder in center of the creekbed where first side canyon comes in on creek left. Starts on a smaller boulder upstream from the larger boulder. | Looking up side canyon that comes in from creek left. |
| PP South T1A Start | 4 | 421084 | 4039457 | 4/22/2006 | Post | Look for a large boulder in center of the creekbed where first side canyon comes in on creek left. Starts on a smaller boulder upstream from the larger boulder. | Looking up side canyon that comes in from creek left. |
| PP South T1A Start | A | 421084 | 4039457 | 5/6/2005 | Pre | Look for a large boulder in center of the creekbed where first side canyon comes in on creek left. Starts on a smaller boulder upstream from the larger boulder. | Looking upstream at the beginning of transect 1. |
| PP South T1A Start | B | 421084 | 4039457 | 5/6/2005 | Pre | Look for a large boulder in center of the creekbed where first side canyon comes in on creek left. Starts on a smaller boulder upstream from the larger boulder. | This is a view of the start of transect 1 from the right side of the streambed. |
| PP South T1A Start | C | 421084 | 4039457 | 5/6/2005 | Pre | Look for a large boulder in center of the creekbed where first side canyon comes in on creek left. Starts on a smaller boulder upstream from the larger boulder. | Close up of the South T1A B. Beginning of transect #1. |
| PP South T1A Start | D | 421084 | 4039457 | 5/6/2005 | Pre | Look for a large boulder in center of the creekbed where first side canyon comes in on creek left. Starts on a smaller boulder upstream from the larger boulder. | Looking straight down on transect start. |
| PP South T1A Start | E | 421084 | 4039457 | 5/6/2005 | Pre | Look for a large boulder in center of the creekbed where first side canyon comes in on creek left. Starts on a smaller boulder upstream from the larger boulder. | Lori at beginning of transect. Taken from down canyon of start. |

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|--------------------|------|-------------|--------------|-----------|-----------------------|--|--|
| PP South T1A Start | | 421084 | 4039457 | | Pre | Look for a large boulder in center of the creekbed where first side canyon comes in on creek left. Starts on a smaller boulder upstream from the larger boulder. | |
| PP South T1B End | 1 | 421053 | 4039450 | 5/6/2005 | Pre | End of transect 1B is in a Opuntia basilaris clump. | Looking toward 2 huge boulders and the beginning of the transect, up canyon. |
| PP South T1B End | 1 | 421053 | 4039450 | 4/22/2006 | Post | End of transect 1B is in a Opuntia basilaris clump. | Looking toward 2 huge boulders and the beginning of the transect, up canyon. |
| PP South T1B End | 2 | 421053 | 4039450 | 5/6/2005 | Pre | End of transect 1B is in a Opuntia basilaris clump. | Looking down canyon showing a fork in the canyon on creek left. |
| PP South T1B End | 2 | 421053 | 4039450 | 4/22/2006 | Post | End of transect 1B is in a Opuntia basilaris clump. | Looking down canyon showing a fork in the canyon on creek left. |
| PP South T1B End | 3 | 421053 | 4039450 | 5/6/2005 | Pre | End of transect 1B is in a Opuntia basilaris clump. | Looking down canyon. Showing start of transect 1A near a large TAMRAM. |
| PP South T1B End | 3 | 421053 | 4039450 | 4/22/2006 | Post | End of transect 1B is in a Opuntia basilaris clump. | Looking down canyon. Showing transect start. |
| PP South T1B End | A | 421053 | 4039450 | 5/6/2005 | Pre | End of transect 1B is in a Opuntia basilaris clump. | Amy at the end of transect, showing a distinct boulder in the background. Taken from near drainage. |
| PP South T1B End | B | 421053 | 4039450 | 5/6/2005 | Pre | End of transect 1B is in a Opuntia basilaris clump. | Looking at Amy at the end of the transect. Showing skyline with canyon fork in the background. |
| PP South T1B End | C | 421053 | 4039450 | 4/22/2006 | Post | End of transect 1B is in a Opuntia basilaris clump. | South T1B end. Looking down on end point from uphill side. Into 5m cactus cluster at tape location. |
| PP South T1B Start | 1 | 421031 | 4039417 | 5/6/2005 | Pre | Transect starts on a triangular boulder with a sapling TAMRAM behind. This is less than 100m upstream of T1A. | Looking at transect facing downstream. There is a large boulder on creek left and measuring tape is visible. |
| PP South T1B Start | 1 | 421031 | 4039417 | 4/22/2006 | Post | Transect starts on a triangular boulder with a sapling TAMRAM behind. This is less than 100m upstream of T1A. | Looking at the transect facing downstream. There is a large boulder on creek left and the measuring tape is visible. |
| PP South T1B Start | 2 | 421031 | 4039417 | 5/6/2005 | Pre | Transect starts on a triangular boulder with a sapling TAMRAM behind. This is less than 100m upstream of T1A. | looking upstream through thick TAMRAM clump from the start of transect 1B. |
| PP South T1B Start | 2 | 421031 | 4039417 | 4/22/2006 | Post | Transect starts on a triangular boulder with a sapling TAMRAM behind. This is less than 100m upstream of T1A. | Looking upstream from the start of T1B |
| PP South T1B Start | A | 421031 | 4039417 | 5/6/2005 | Pre | Transect starts on a triangular boulder with a sapling TAMRAM behind. This is less than 100m upstream of T1A. | Looking at start of transect from downstream. The start is just upstream of large boulder. |
| PP South T1B Start | B | 421031 | 4039417 | 5/6/2005 | Pre | Transect starts on a triangular boulder with a sapling TAMRAM behind. This is less than 100m upstream of T1A. | Looking downstream from just upstream of the transect start. |
| PP South T1B Start | C | 421031 | 4039417 | 5/6/2005 | Pre | Transect starts on a triangular boulder with a sapling TAMRAM behind. This is less than 100m upstream of T1A. | Looking at transect start. Measuring tape is hard to see. It starts on boulder and is held down by smaller rocks. |
| PP South T1B Start | D | 421031 | 4039417 | 5/6/2005 | Pre | Transect starts on a triangular boulder with a sapling TAMRAM behind. This is less than 100m upstream of T1A. | This is an up close view of transect start, taken from just downstream. |
| PP South T2A End | 1 | 419748 | 4038327 | 5/6/2005 | Pre | No GPS data on info sheet. No description of endpoint. | Looking upstream from the end of the transect. View of upstream at white boulder seen through a TAMRAM. |
| PP South T2A End | 1 | 419748 | 4038327 | 4/23/2006 | Post | No GPS data on info sheet. No description of endpoint. | Looking upstream from the end of the transect. View upstream at white boulder. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|--------------------|------|-------------|--------------|-----------|-----------------------|---|---|
| PP South T2A End | 2 | 419748 | 4038327 | 5/6/2005 | Pre | No GPS data on info sheet. No description of endpoint. | Taken from endpoint looking to creek left through TAMRAM and dense vegetation. Canyon wall in view. |
| PP South T2A End | 2 | 419748 | 4038327 | 4/23/2006 | Post | No GPS data on info sheet. No description of endpoint. | Taken from the endpoint looking to creek left. Canyon wall in view. |
| PP South T2A End | A | 419748 | 4038327 | 5/6/2005 | Pre | No GPS data on info sheet. No description of endpoint. | Looking downstream from a boulder in the middle of the streambed. |
| PP South T2A End | B | 419748 | 4038327 | 5/6/2005 | Pre | No GPS data on info sheet. No description of endpoint. | Standing just upstream of transect end looking at the end. |
| PP South T2A End | C | 419748 | 4038327 | 5/6/2005 | Pre | No GPS data on info sheet. No description of endpoint. | Standing just upstream looking at transect end. |
| PP South T2A Start | 1 | 419769 | 4038117 | 5/6/2005 | Pre | No description of transect T2A start location. | Looking downstream through mature TAMRAMs. |
| PP South T2A Start | 1 | 419769 | 4038117 | 4/23/2006 | Post | No description of transect T2A start location. | Looking downstream. |
| PP South T2A Start | 2 | 419769 | 4038117 | 5/6/2005 | Pre | No description of transect T2A start location. | Looking upstream from the transect start. |
| PP South T2A Start | 2 | 419769 | 4038117 | 4/23/2006 | Post | No description of transect T2A start location. | Looking upstream from the transect start. |
| PP South T2A Start | A | 419769 | 4038117 | 5/6/2005 | Pre | No description of transect T2A start location. | Looking at transect start. Taken from standing in the creek bed looking towards creek left. |
| PP South T2A Start | B | 419769 | 4038117 | 5/6/2005 | Pre | No description of transect T2A start location. | Looking upstream at photopoint. |
| PP South T2A Start | C | 419769 | 4038117 | 5/6/2005 | Pre | No description of transect T2A start location. | Looking straight down on transect start. |
| PP South T2B End | 1 | 419766 | 4038109 | 5/6/2005 | Pre | No description of transect end on the info sheet. | Looking upstream from transect end. |
| PP South T2B End | 1 | 419766 | 4038109 | 4/23/2006 | Post | No description of transect end on the info sheet. | Looking upstream from the transect end. |
| PP South T2B End | 2 | 419766 | 4038109 | 5/6/2005 | Pre | No description of transect end on the info sheet. | Looking downstream from transect end towards stream right. |
| PP South T2B End | 2 | 419766 | 4038109 | 4/23/2006 | Post | No description of transect end on the info sheet. | Looking downstream from transect end towards stream right. |
| PP South T2B End | A | 419766 | 4038109 | 5/6/2005 | Pre | No description of transect end on the info sheet. | Looking upstream at photopoint from a large boulder on stream right and 5m downstream. |
| PP South T2B End | B | 419766 | 4038109 | 5/6/2005 | Pre | No description of transect end on the info sheet. | Looking downstream at transect end. Taken from stream right 7m upstream from point. |
| PP South T2B End | C | 419766 | 4038109 | 5/6/2005 | Pre | No description of transect end on the info sheet. | Looking down on transect end. |
| PP South T2B Start | 1 | 419726 | 4038100 | 5/6/2005 | Pre | UTMs taken from 8m mark on transect, north of boulder. Taken from a boulder 0.5x1x1.2m, no other description. | Taken from the start of the transect, looking down transect with a boulder in the way. |
| PP South T2B Start | 1 | 419726 | 4038100 | 4/23/2006 | Post | UTMs taken from 8m mark on transect, north of boulder. Taken from a boulder 0.5x1x1.2m, no other description. | Taken from the start of the transect, looking down the transect with a boulder in the way. |
| PP South T2B Start | 2 | 419726 | 4038100 | 5/6/2005 | Pre | UTMs taken from 8m mark on transect, north of boulder. Taken from a boulder 0.5x1x1.2m, no other description. | Taken from the 7.5m mark looking down the transect. |
| PP South T2B Start | 2 | 419726 | 4038100 | 4/23/2006 | Post | UTMs taken from 8m mark on transect, north of boulder. Taken from a boulder 0.5x1x1.2m, no other description. | Taken from the 7.5m mark looking down the transect. |
| PP South T2B Start | A | 419726 | 4038100 | 5/6/2005 | Pre | UTMs taken from 8m mark on transect, north of boulder. Taken from a boulder 0.5x1x1.2m, no other description. | Carmen at start of transect. Taken from 1m north of 8m mark on transect line; north side of 5x8m Supai boulder. |
| PP South T2B Start | B | 419726 | 4038100 | 5/6/2005 | Pre | UTMs taken from 8m mark on transect, north of boulder. Taken from a boulder 0.5x1x1.2m, no other description. | Looking at start of transect on top of a boulder about 0.5x1x1.2m. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|-----------|-----------------------|--|--|
| PP Trail 1 | 1 | 289763 | 3968388 | 5/18/2005 | Pre | Taken standing 4m up on the south wall of Trail Canyon at its mouth of creek right. | Looking downstream from the mouth; Colorado River in the background and large tamarisk in picture left. |
| PP Trail 1 | 1 | 289763 | 3968388 | 11/7/2005 | Post | Taken standing 4m up on the south wall of Trail Canyon at its mouth of creek right. | Post work. |
| PP Trail 1 | 1 | 289763 | 3968388 | 5/19/2006 | Post | Taken standing 4m up on the south wall of Trail Canyon at its mouth of creek right. | Looking downstream from the mouth, the Colorado river in the background and large tamarisk on the left. |
| PP Trail 1 | 2 | 289763 | 3968388 | 5/18/2005 | Pre | Taken standing 4m up on the south wall of Trail Canyon at its mouth of creek right. | Looking upstream through a gravelly drainage with a windy creek; there are steep schist walls. |
| PP Trail 1 | 2 | 289763 | 3968388 | 11/7/2005 | Post | Taken standing 4m up on the south wall of Trail Canyon at its mouth of creek right. | Post work. |
| PP Trail 1 | 2 | 289763 | 3968388 | 5/19/2006 | Post | Taken standing 4m up on the south wall of Trail Canyon at its mouth of creek right. | Looking upstream through a gravelly drainage with a windy creek, there are steep schist walls. |
| PP Trail 1 | A | 289763 | 3968388 | 5/18/2005 | Pre | Taken standing 4m up on the south wall of Trail Canyon at its mouth of creek right. | Looking at Jason on 4m high granite outcrop that is right at the creek mouth. Photo taken from 10m upstream of photopoint rock; standing in the drainage about 100m from the Colorado River. |
| PP Trail 1 | B | 289763 | 3968388 | 5/18/2005 | Pre | Taken standing 4m up on the south wall of Trail Canyon at its mouth of creek right. | Looking at Jason standing about 4 m high on a granite outcropping on creek right at the mouth of Trail Canyon. Photo taken standing in drainage about 10m downstream of photopoint rock. |
| PP Trail 2 | 1 | 289467 | 3968452 | 5/18/2005 | Pre | Taken from granite rock on creek right, 520m from the mouth of the canyon in a 150m straight stretch of the creek. | Looking downstream at a semi-dense tamarisk thicket growing in sandy pockets of granite bedrock. |
| PP Trail 2 | 1 | 289467 | 3968452 | 11/7/2005 | Post | Taken from granite rock on creek right, 520m from the mouth of the canyon in a 150m straight stretch of the creek. | Post work. |
| PP Trail 2 | 1 | 289467 | 3968452 | 5/19/2006 | Post | Taken from granite rock on creek right, 520m from the mouth of the canyon in a 150m straight stretch of the creek. | Looking downstream. |
| PP Trail 2 | 2 | 289467 | 3968452 | 5/18/2005 | Pre | Taken from granite rock on creek right, 520m from the mouth of the canyon in a 150m straight stretch of the creek. | Looking upstream at bend to the right in the canyon; several sapling tamarisk in foreground and lots of granite bedrock. |
| PP Trail 2 | 2 | 289467 | 3968452 | 11/7/2005 | Post | Taken from granite rock on creek right, 520m from the mouth of the canyon in a 150m straight stretch of the creek. | Post work. |
| PP Trail 2 | 2 | 289467 | 3968452 | 5/19/2006 | Post | Taken from granite rock on creek right, 520m from the mouth of the canyon in a 150m straight stretch of the creek. | Looking upstream at bend to the right in the canyon. Lots of granite bedrock. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|-----------|-----------------------|--|---|
| PP Trail 2 | A | 289467 | 3968452 | 5/18/2005 | Pre | Taken from granite rock on creek right, 520m from the mouth of the canyon in a 150m straight stretch of the creek. | Looking upstream at Jason on granite bedrock, 2m above creek on creek right, Photo taken 8m downstream of photopoint on granite rock; taken from creek right about 520m from the mouth of Trail Canyon. |
| PP Trail 2 | B | 289467 | 3968452 | 5/18/2005 | Pre | Taken from granite rock on creek right, 520m from the mouth of the canyon in a 150m straight stretch of the creek. | Looking downstream at Jason on granite boulder about 520m from the river; lots of tamarisk in the background. Photo taken 10m upstream of photopoint on creek left (1m from the creek and 1m above creek) on granite bedrock. |
| PP Trail 3 | 1 | 289207 | 3968941 | 5/18/2005 | Pre | Taken from limestone boulder (5x3x4m) 1200m from the mouth of canyon, near a bend to west in creek. Many mature acacias in the area. | Looking upstream; schist/tapeats unconformity in the background. |
| PP Trail 3 | 1 | 289207 | 3968941 | 3/6/2006 | Post | Taken from limestone boulder (5x3x4m) 1200m from the mouth of canyon, near a bend to west in creek. Many mature acacias in the area. | Post work. |
| PP Trail 3 | 1 | 289207 | 3968941 | 5/19/2006 | Post | Taken from limestone boulder (5x3x4m) 1200m from the mouth of canyon, near a bend to west in creek. Many mature acacias in the area. | Looking upstream, schist/tapeats unconformity in the background. |
| PP Trail 3 | 2 | 289207 | 3968941 | 5/18/2005 | Pre | Taken from limestone boulder (5x3x4m) 1200m from the mouth of canyon, near a bend to west in creek. Many mature acacias in the area. | Looking downstream at thick riparian vegetation with tapeats cliff in background. |
| PP Trail 3 | 2 | 289207 | 3968941 | 3/6/2006 | Post | Taken from limestone boulder (5x3x4m) 1200m from the mouth of canyon, near a bend to west in creek. Many mature acacias in the area. | Post work. |
| PP Trail 3 | 2 | 289207 | 3968941 | 5/18/2006 | Post | Taken from limestone boulder (5x3x4m) 1200m from the mouth of canyon, near a bend to west in creek. Many mature acacias in the area. | Looking downstream at thick riparian vegetation with tapeats cliff in background. |
| PP Trail 3 | 3 | 289207 | 3968941 | 3/6/2006 | Pre | Taken from limestone boulder (5x3x4m) 1200m from the mouth of canyon, near a bend to west in creek. Many mature acacias in the area. | Looking across the drainage at TAMALP (?) This plant was in among the TAMRAM. |
| PP Trail 3 | 3 | 289207 | 3968941 | 5/19/2006 | Post | Taken from limestone boulder (5x3x4m) 1200m from the mouth of canyon, near a bend to west in creek. Many mature acacias in the area. | Looking across the drainage. |
| PP Trail 3 | A | 289207 | 3968941 | 5/18/2005 | Pre | Taken from limestone boulder (5x3x4m) 1200m from the mouth of canyon, near a bend to west in creek. Many mature acacias in the area. | Steve on a large triangular gray boulder (3x5x4m) on creek right. Photo taken from BRORUB patch; 9m west of creek at the same level as the top of the boulder. Taken 1200m from the mouth. |
| PP Trail 3 | B | 289207 | 3968941 | 5/18/2005 | Pre | Taken from limestone boulder (5x3x4m) 1200m from the mouth of canyon, near a bend to west in creek. Many mature acacias in the area. | Steve on a large triangular gray boulder (3x5x4m); schist wall in the background. Taken from dry creek bed (old flow area) 8m downstream of photopoint rock; 1200m from the mouth of the canyon. |
| PP Trail 4 | 1 | 289011 | 3969227 | 5/18/2005 | Pre | Taken from narrow spot in creek. 1.77 km up from the mouth of the canyon. 500m past where the creek stops flowing strongly. | Looking upstream at Tapeats "narrows" and Acacia on sides of drainage; Bright Angel shale in the background. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|-----------|-----------------------|---|--|
| PP Trail 4 | 1 | 289011 | 3969227 | 5/19/2006 | Post | Taken from narrow spot in creek. 1.77 km up from the mouth of the canyon. 500m past where the creek stops flowing strongly. | Looking upstream at tapeats narrows and acacia on sides of drainage. Bright Angel shale in the background. |
| PP Trail 4 | 2 | 289011 | 3969227 | 5/18/2005 | Pre | Taken from narrow spot in creek. 1.77 km up from the mouth of the canyon. 500m past where the creek stops flowing strongly. | Looking downstream at dry creek bed. Large acacias on either side of drainage. Tapeats cliff (20m) and Bright Angel Shale slope in the background. |
| PP Trail 4 | 2 | 289011 | 3969227 | 5/19/2006 | Post | Taken from narrow spot in creek. 1.77 km up from the mouth of the canyon. 500m past where the creek stops flowing strongly. | Looking downstream at dry creek bed. Large acacias on either side of the drainage. Tapeats cliff (20m) and BA shale slope in the background. |
| PP Trail 4 | A | 289011 | 3969227 | 5/18/2005 | Pre | Taken from narrow spot in creek. 1.77 km up from the mouth of the canyon. 500m past where the creek stops flowing strongly. | Looking downstream at Jason in the Tapeats narrows; 10m high sandstone walls on either side. Photo taken upstream of photopoint about 12 m, in the middle of the dry, gravelly creek bed at small narrow section in tapeats. |
| PP Trail 4 | B | 289011 | 3969227 | 5/18/2005 | Pre | Taken from narrow spot in creek. 1.77 km up from the mouth of the canyon. 500m past where the creek stops flowing strongly. | Looking upstream at Jason in narrowest spot in the Tapeats section of the canyon (5m wide). Taken downstream of photopoint 15m in the cobbly dry creek bed. |
| PP Trail 5 | 1 | 288887 | 3969276 | 5/18/2005 | Pre | Taken on top of Tapeats shelf/patio, 3m east of the largest pouroff in the area. This is 2.2km from the mouth, the BA shales is at waist level. | Looking upstream from falls and on top of tapeats. Bright Angel shale on the right. |
| PP Trail 5 | 1 | 288887 | 3969276 | 5/19/2006 | Post | Taken on top of Tapeats shelf/patio, 3m east of the largest pouroff in the area. This is 2.2km from the mouth, the BA shales is at waist level. | Looking upstream from falls and on top of tapeats. BA shale on the right. |
| PP Trail 5 | 2 | 288887 | 3969276 | 5/18/2005 | Pre | Taken on top of Tapeats shelf/patio, 3m east of the largest pouroff in the area. This is 2.2km from the mouth, the BA shales is at waist level. | Looking downstream through tapeats layer; multiple cascading falls and large muav boulder on creek left. |
| PP Trail 5 | 2 | 288887 | 3969276 | 5/19/2006 | Post | Taken on top of Tapeats shelf/patio, 3m east of the largest pouroff in the area. This is 2.2km from the mouth, the BA shales is at waist level. | Looking downstream through tapeats layer; multiple cascading falls and large muav boulder on creek left. |
| PP Trail 5 | A | 288887 | 3969276 | 5/18/2005 | Pre | Taken on top of Tapeats shelf/patio, 3m east of the largest pouroff in the area. This is 2.2km from the mouth, the BA shales is at waist level. | Steve at photopoint about 4m upstream. |
| PP Trail 5 | B | 288887 | 3969276 | 5/18/2005 | Pre | Taken on top of Tapeats shelf/patio, 3m east of the largest pouroff in the area. This is 2.2km from the mouth, the BA shales is at waist level. | Steve at photopoint looking downstream. Taken from about 5m across stream. |
| PP Trail 6 | 1 | 288253 | 3970213 | 5/18/2005 | Pre | Taken atop 1.5m high boulder lying in the drainage bottom near the lowermost ledge of Bright Angel that is a natural bench about 15m long. | Looking downstream at S. Rim and whitewashed cobble creek bed. |
| PP Trail 6 | 1 | 288253 | 3970213 | 5/19/2006 | Post | Taken atop 1.5m high boulder lying in the drainage bottom near the lowermost ledge of Bright Angel that is a natural bench about 15m long. | Looking downstream at S. Rim and whitewashed cobble creek bed. |
| PP Trail 6 | 2 | 288253 | 3970213 | 5/18/2005 | Pre | Taken atop 1.5m high boulder lying in the drainage bottom near the lowermost ledge of Bright Angel that is a natural bench about 15m long. | Looking upstream at broken muav/temple butte cliffs and a major fork in Trail Canyon. |

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|-----------------|------|-------------|--------------|-----------|-----------------------|---|---|
| PP Trail 6 | 2 | 288253 | 3970213 | 5/19/2006 | Post | Taken atop 1.5m high boulder lying in the drainage bottom near the lowermost ledge of Bright Angel that is a natural bench about 15m long. | Looking upstream at broken Muav/temple butte cliffs and a major fork in Trail Canyon. |
| PP Trail 6 | A | 288253 | 3970213 | 5/18/2005 | Pre | Taken atop 1.5m high boulder lying in the drainage bottom near the lowermost ledge of Bright Angel that is a natural bench about 15m long. | Looking downstream at Jason and the gravelly, dry creek bed; looking at open view of the canyon towards the S. Rim. Photo taken in drainage bottom 10m upstream of a white boulder (2x3x2m) that lies in the drainage bottom. |
| PP Trail 6 | B | 288253 | 3970213 | 5/18/2005 | Pre | Taken atop 1.5m high boulder lying in the drainage bottom near the lowermost ledge of Bright Angel that is a natural bench about 15m long. | Looking upstream at Jason on boulder with the first major fork in the Bright Angel shale in the background about 300m away. Photo taken 20m downstream of photo boulder, which lies about 3m north of a Bright Angel shale outcrop ledge. |
| PP Trail 7 | 1 | 287891 | 3970978 | 5/18/2005 | Pre | Taken from muav limestone boulder with multiple quartz intrusions. Boulder is 5x5x4m on creek left of the main channel. This is about 4.4km from the river. | Looking downstream at a 15m tall loose embankment in the center of the photo; Bright Angel shale jutting out at odd angle. |
| PP Trail 7 | 1 | 287891 | 3970978 | 5/19/2006 | Post | Taken from muav limestone boulder with multiple quartz intrusions. Boulder is 5x5x4m on creek left of the main channel. This is about 4.4km from the river. | Looking downstream at a 15m tall loose embankment in the center of the photo. BA shale jutting out at an odd angle. |
| PP Trail 7 | 2 | 287891 | 3970978 | 5/18/2005 | Pre | Taken from muav limestone boulder with multiple quartz intrusions. Boulder is 5x5x4m on creek left of the main channel. This is about 4.4km from the river. | Looking upstream at broken cliffs of muav; acacias in stream bed. |
| PP Trail 7 | 2 | 287891 | 3970978 | 5/19/2006 | Post | Taken from muav limestone boulder with multiple quartz intrusions. Boulder is 5x5x4m on creek left of the main channel. This is about 4.4km from the river. | Looking upstream at broken cliffs of muav, acacias in the stream bed. |
| PP Trail 7 | A | 287891 | 3970978 | 5/18/2005 | Pre | Taken from muav limestone boulder with multiple quartz intrusions. Boulder is 5x5x4m on creek left of the main channel. This is about 4.4km from the river. | Steve on photopoint. Taken from upstream and a cobbled embankment in background. |
| PP Trail 7 | B | 287891 | 3970978 | 5/18/2005 | Pre | Taken from muav limestone boulder with multiple quartz intrusions. Boulder is 5x5x4m on creek left of the main channel. This is about 4.4km from the river. | Steve on photopoint. Taken from downstream looking at a gap in the redwall. |
| PP Trail 8 | 1 | 287661 | 3971784 | 5/18/2005 | Pre | Taken atop an almost round, gray boulder on creek left at a bend. This is 5.5km from the canyon mouth, up the right fork that starts at 5km. | Looking upstream at a typical desert landscape with a dry creek bed and boulders. |
| PP Trail 8 | 1 | 287661 | 3971784 | 5/19/2006 | Post | Taken atop an almost round, gray boulder on creek left at a bend. This is 5.5km from the canyon mouth, up the right fork that starts at 5km. | Looking upstream at a typical desert landscape with a dry creek bed and boulders. |
| PP Trail 8 | 2 | 287661 | 3971784 | 5/18/2005 | Pre | Taken atop an almost round, gray boulder on creek left at a bend. This is 5.5km from the canyon mouth, up the right fork that starts at 5km. | Looking downstream at buttressed skyline. There is a big boulder in creek bottom in the foreground of the picture. |
| PP Trail 8 | 2 | 287661 | 3971784 | 5/19/2006 | Post | Taken atop an almost round, gray boulder on creek left at a bend. This is 5.5km from the canyon mouth, up the right fork that starts at 5km. | Looking downstream at buttressed skyline. There is a big boulder in the creek bottom in the foreground of the picture. |
| PP Trail 8 | A | 287661 | 3971784 | 5/18/2005 | Pre | Taken atop an almost round, gray boulder on creek left at a bend. This is 5.5km from the canyon mouth, up the right fork that starts at 5km. | Tyler standing on photopoint boulder. |

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|------------------|------|-------------|--------------|-----------|-----------------------|---|--|
| PP Trail 8 | B | 287661 | 3971784 | 5/18/2005 | Pre | Taken atop an almost round, gray boulder on creek left at a bend. This is 5.5km from the canyon mouth, up the right fork that starts at 5km. | Tyler standing on gray photopoint boulder. |
| PP Trail 9 | 1 | 287549 | 3972303 | 5/18/2005 | Pre | Taken from standing on an orange table rock (3x3x3m), 30m away from Muav pouroff and about 6km away from the mouth of Trail Canyon. No GPS reading was available here. | Looking down canyon at a boulder stream creek bed. The S. Rim is in the distance. |
| PP Trail 9 | 1 | 287549 | 3972303 | 5/19/2006 | Post | Taken from standing on an orange table rock (3x3x3m), 30m away from Muav pouroff and about 6km away from the mouth of Trail Canyon. No GPS reading was available here. | Looking down canyon at a boulder strewn creek bed. The S. Rim in the distance. |
| PP Trail 9 | 2 | 287549 | 3972303 | 5/18/2005 | Pre | Taken from standing on an orange table rock (3x3x3m), 30m away from Muav pouroff and about 6km away from the mouth of Trail Canyon. No GPS reading was available here. | Looking up canyon at a lovely dry muav cliff with acacia in the bottom right of the frame. |
| PP Trail 9 | 2 | 287549 | 3972303 | 5/19/2006 | Post | Taken from standing on an orange table rock (3x3x3m), 30m away from Muav pouroff and about 6km away from the mouth of Trail Canyon. No GPS reading was available here. | Looking up canyon at a lovely dry muav cliff with acacia in the bottom right of the frame. |
| PP Trail 9 | A | 287549 | 3972303 | 5/18/2005 | Pre | Taken from standing on an orange table rock (3x3x3m), 30m away from Muav pouroff and about 6km away from the mouth of Trail Canyon. No GPS reading was available here. | Looking at Steve sitting at photopoint rock. The rock is an orange table-like rock with muav dry fall behind it. Taken from 9m downstream on a large 3x3x3m boulder. |
| PP Trail 9 | B | 287549 | 3972303 | 5/18/2005 | Pre | Taken from standing on an orange table rock (3x3x3m), 30m away from Muav pouroff and about 6km away from the mouth of Trail Canyon. No GPS reading was available here. | Steve-Dave on boulder looking down Trail Canyon. Taken from 20m upstream near the base of Muav pouroff at the end of the right fork. |
| PP Trail Hydro 1 | 1 | 289191 | 3968785 | 5/19/2006 | Pre | Trail Canyon Hydro 1 | 5m upstream of beginning of hydro 1. Downstream view of hydro 1. |
| PP Trail Hydro 1 | 1 | 289191 | 3968785 | 5/21/2007 | Post | Trail Canyon Hydro 1 | 5m upstream of beginning of hydro 1. Downstream view of hydro 1. |
| PP Trail Hydro 1 | 2 | 289191 | 3968785 | 5/19/2006 | Pre | Trail Canyon Hydro 1 | 5m downstream of end of hydro 1. Upstream view of hydro 1. |
| PP Trail Hydro 2 | 1 | 288820 | 3969481 | 5/21/2007 | Post | Trail Canyon hydro 2 | No water flowing at Trail Hydro 2. Only one small pool about 10m downstream of hydro point. View shows the pool with Sam taking the temp. readings. |
| PP Trail Hydro 2 | 2. | 288820 | 3969481 | 5/19/2006 | Pre | Trail Canyon hydro 2 | 7m upstream of pour off where measurement was taken. Frank standing at the edge of the pour off downstream. |
| PP Trail Hydro 2 | 2 | 288820 | 3969481 | 5/21/2007 | Post | Trail Canyon hydro 2 | 7m upstream of pour off where measurement was taken in 2006 |
| PP Trail Hydro 2 | 3. | 288820 | 3969481 | 5/19/2006 | Pre | Trail Canyon hydro 2 | 7m downstream of pouroff where measurement was taken. View upstream. |
| PP Trail Hydro 2 | 3 | 288820 | 3969481 | 5/21/2007 | Post | Trail Canyon hydro 2 | 7m downstream of pouroff where measurement in 2006 was taken. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|--------------------|------|-------------|--------------|-----------|-----------------------|--|--|
| PP Trail T1A End | 1 | 289334 | 3968567 | 5/18/2005 | Pre | No description recorded on info sheet. | Taken from the transect end point and looking up the tape. Dense TAMRAM and tapeats up canyon. Supai/Redwall skyline in the distance. |
| PP Trail T1A End | 1 | 289334 | 3968567 | 5/19/2006 | Post | No description recorded on info sheet. | Post treatment. Same view, but far fewer TAMRAM. Notice PLUSER and BACSAL are the dominant vegetation. |
| PP Trail T1A End | 2 | 289334 | 3968567 | 5/18/2005 | Pre | No description recorded on info sheet. | Taken from the end point. Looking across the creek. Showing PLUSER in the foreground and ACAGRE and ENCFAR in the background. |
| PP Trail T1A End | 2 | 289334 | 3968567 | 5/19/2006 | Post | No description recorded on info sheet. | Post treatment. |
| PP Trail T1A End | 3 | 289334 | 3968567 | 5/18/2005 | Pre | No description recorded on info sheet. | Taken from the end point. Looking downstream at a distinct granitic cliff on creek left. Creek bends to the right. TAMRAM and PLUSER on creek right. Tapeats ridge topped with ocotillo in the distance. |
| PP Trail T1A End | A | 289334 | 3968567 | 5/18/2005 | Pre | No description recorded on info sheet. | Looking at Amy at endpoint and a small portion of top of a granite ridgeline. Taken from 5m downstream from the endpoint. |
| PP Trail T1A End | B | 289334 | 3968567 | 5/18/2005 | Pre | No description recorded on info sheet. | Looking upstream and across the canyon at the endpoint on a granitic band with immediate skyline visible. Taken from the opposite side of the creek and 5m downstream. |
| PP Trail T1A Start | 1 | 289295 | 3968587 | 5/18/2005 | Pre | No description on info sheet. | Taken from the start point. Looking down canyon. Showing TAMRAM, ACAGRE and BACSPP with a Tapeats ridge in background. |
| PP Trail T1A Start | 1 | 289295 | 3968587 | 5/19/2006 | Post | No description on info sheet. | Same view but fewer TAMRAM. |
| PP Trail T1A Start | 2 | 289295 | 3968587 | 5/18/2005 | Pre | No description on info sheet. | Taken from start point. Looking across the creek towards the opposite bank. Shows scattered TAMRAM among BACSAL. |
| PP Trail T1A Start | 2 | 289295 | 3968587 | 5/19/2006 | Post | No description on info sheet. | Photo update. |
| PP Trail T1A Start | 3 | 289295 | 3968587 | 5/18/2005 | Pre | No description on info sheet. | Taken from the start point. Looking across creek showing a distinct white granite slope below a Tapeats ridge. Good for relocating this spot. |
| PP Trail T1A Start | 3 | 289295 | 3968587 | 5/19/2006 | Post | No description on info sheet. | Photo update. |
| PP Trail T1A Start | 4 | 289295 | 3968587 | 5/18/2005 | Pre | No description on info sheet. | Taken from start point. Looking up canyon and shows a conglomerate waterfall with ACAGRE below the granite slope in the background. Note the open cobbly stream bed with TAMRAM. |
| PP Trail T1A Start | 4 | 289295 | 3968587 | 5/19/2006 | Post | No description on info sheet. | Same view, but less water over the conglomerate poulover and fewer TAMRAM in the stream bed. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|--------------------|------|-------------|--------------|-----------|-----------------------|--|---|
| PP Trail T1A Start | A | 289295 | 3968587 | 5/18/2005 | Pre | No description on info sheet. | Looking up canyon from 7m downstream of start point. Amy is at start point with conglomerate pourover in the bottom left. Distinct redwall ridgeline in the far background. |
| PP Trail T1A Start | B | 289295 | 3968587 | 5/18/2005 | Pre | No description on info sheet. | Looking upstream at start point (from streambed 5m below). Showing distinct Tapeats outcroppings above the start point with distant Supai/Redwall butte in the background. |
| PP Trail T1A Start | C | 289295 | 3968587 | 5/18/2005 | Pre | No description on info sheet. | Taken from the same point as view B. Shows stream and cut bank and a somewhat distinct granite boulder below Amy. |
| PP Trail T1B End | 1 | 289225 | 3968610 | 5/18/2005 | Pre | No description of endpoint on info sheet. | Looking up canyon along transect line. |
| PP Trail T1B End | 1 | 289225 | 3968610 | 5/19/2006 | Post | No description of endpoint on info sheet. | Post treatment. |
| PP Trail T1B End | 2 | 289225 | 3968610 | 5/18/2005 | Pre | No description of endpoint on info sheet. | Looking up canyon along transect line, showing far bench and vertical redwall in the background. |
| PP Trail T1B End | 2 | 289225 | 3968610 | 5/19/2006 | Post | No description of endpoint on info sheet. | Taken squatting at the end of the transect. Post treatment. |
| PP Trail T1B End | 3 | 289225 | 3968610 | 5/18/2005 | Pre | No description of endpoint on info sheet. | Looking across the creek (NW) toward Baccharis. Taken from the end of the transect. |
| PP Trail T1B End | 3 | 289225 | 3968610 | 5/19/2006 | Post | No description of endpoint on info sheet. | Post treatment. |
| PP Trail T1B End | 4 | 289225 | 3968610 | 5/18/2005 | Pre | No description of endpoint on info sheet. | Looking down the canyon to veg on creek left with a ledge across the creek with barrel cactus. |
| PP Trail T1B End | 4 | 289225 | 3968610 | 5/19/2006 | Post | No description of endpoint on info sheet. | Post treatment. |
| PP Trail T1B End | A | 289225 | 3968610 | 5/18/2005 | Pre | No description of endpoint on info sheet. | Lisa at the end of the transect. Taken from 3m down canyon from the end of the transect. |
| PP Trail T1B End | B | 289225 | 3968610 | 5/18/2005 | Pre | No description of endpoint on info sheet. | Looking at the end point of the tape on the down canyon side of BEBJUN. Taken from just down canyon from the end of the transect. |
| PP Trail T1B Start | 1 | 289222 | 3968621 | 5/18/2005 | Pre | Transect start is on a 5x3x2.5m granite boulder on creek left about 20m below flat topped bench with ocotillo, where the canyon turns. | Looking straight down the transect line taken from the start of the transect. |
| PP Trail T1B Start | 1 | 289222 | 3968621 | 5/19/2006 | Post | Transect start is on a 5x3x2.5m granite boulder on creek left about 20m below flat topped bench with ocotillo, where the canyon turns. | Post treatment. |
| PP Trail T1B Start | 2 | 289222 | 3968621 | 5/18/2005 | Pre | Transect start is on a 5x3x2.5m granite boulder on creek left about 20m below flat topped bench with ocotillo, where the canyon turns. | Looking across the creek showing Baccharis and edge of a granite outcropping. Taken from the transect start. No bearing was recorded. |
| PP Trail T1B Start | 2 | 289222 | 3968621 | 5/19/2006 | Post | Transect start is on a 5x3x2.5m granite boulder on creek left about 20m below flat topped bench with ocotillo, where the canyon turns. | Post treatment. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|--------------------|------|-------------|--------------|-----------|-----------------------|--|--|
| PP Trail T1B Start | 3 | 289222 | 3968621 | 5/18/2005 | Pre | Transect start is on a 5x3x2.5m granite boulder on creek left about 20m below flat topped bench with ocotillo, where the canyon turns. | Looking up canyon and across the creek with SALGOO in the center of the photo. There is also cattail and Baccharis. Taken from the transect start. No bearing was recorded. |
| PP Trail T1B Start | 3 | 289222 | 3968621 | 5/19/2006 | Post | Transect start is on a 5x3x2.5m granite boulder on creek left about 20m below flat topped bench with ocotillo, where the canyon turns. | Post treatment. |
| PP Trail T1B Start | 4 | 289222 | 3968621 | 5/18/2005 | Pre | Transect start is on a 5x3x2.5m granite boulder on creek left about 20m below flat topped bench with ocotillo, where the canyon turns. | Looking up canyon with one SALGOO in the center. Taken from the start point. No bearing recorded. |
| PP Trail T1B Start | 4 | 289222 | 3968621 | 5/19/2006 | Post | Transect start is on a 5x3x2.5m granite boulder on creek left about 20m below flat topped bench with ocotillo, where the canyon turns. | Post treatment. |
| PP Trail T1B Start | A | 289222 | 3968621 | 5/18/2005 | Pre | Transect start is on a 5x3x2.5m granite boulder on creek left about 20m below flat topped bench with ocotillo, where the canyon turns. | Amy on start point. Taken down creek of start point from the opposite side of the creek, about 15m away. |
| PP Trail T1B Start | B | 289222 | 3968621 | 5/18/2005 | Pre | Transect start is on a 5x3x2.5m granite boulder on creek left about 20m below flat topped bench with ocotillo, where the canyon turns. | Amy on the 5x3m granite boulder (start point). Jagged tapeats in the background. |
| PP Trail T1B Start | C | 289222 | 3968621 | 5/18/2005 | Pre | Transect start is on a 5x3x2.5m granite boulder on creek left about 20m below flat topped bench with ocotillo, where the canyon turns. | Looking down at the start point of the transect tape. Showing the edge of the boulder and Amy pointing at the start point. Taken from next to the transect boulder. |
| PP Trail T1B Start | D | 289222 | 3968621 | 5/18/2005 | Pre | Transect start is on a 5x3x2.5m granite boulder on creek left about 20m below flat topped bench with ocotillo, where the canyon turns. | Looking downward at actual start point of tape, which is in a small V on top of the rock and about 1m from the east side of the boulder. |
| PP Trail T2A End | 1 | 289487 | 3968490 | 5/18/2005 | Pre | Crew moved a new rock to the end point. IT is a reddish granite rock. End point is 4 m from the water. | Looking at a clump of TAMRAM saplings within 10m of tape. Taken looking up the transect from the endpoint. |
| PP Trail T2A End | 1 | 289487 | 3968490 | 5/19/2006 | Post | Crew moved a new rock to the end point. IT is a reddish granite rock. End point is 4 m from the water. | Post treatment. |
| PP Trail T2A End | 2 | 289487 | 3968490 | 5/18/2005 | Pre | Crew moved a new rock to the end point. IT is a reddish granite rock. End point is 4 m from the water. | Looking down canyon at granitic creek narrows with Tapeats nub on creek right. |
| PP Trail T2A End | 2 | 289487 | 3968490 | 5/19/2006 | Post | Crew moved a new rock to the end point. IT is a reddish granite rock. End point is 4 m from the water. | Post treatment. |
| PP Trail T2A End | A | 289487 | 3968490 | 5/19/2006 | Pre | Crew moved a new rock to the end point. IT is a reddish granite rock. End point is 4 m from the water. | Looking up the canyon at the end of the transect (white clipboard). Notice granite slope as creek turns on creek left, tapeats ridge beyond and a muav(?) ridge in the distance. Taken from creek right 1m from the edge of creek and on a granitic outcropping. |
| PP Trail T2A End | B | 289487 | 3968490 | 5/19/2006 | Pre | Crew moved a new rock to the end point. IT is a reddish granite rock. End point is 4 m from the water. | This is a view from directly across the creek looking at the endpoint. The white clipboard marks the endpoint. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|--------------------|------|-------------|--------------|-----------|-----------------------|--|---|
| PP Trail T2A End | C | 289487 | 3968490 | 5/19/2006 | Pre | Crew moved a new rock to the end point. IT is a reddish granite rock. End point is 4 m from the water. | Rock at endpoint is reddish and granite. Endpoint is about 4m from the water. |
| PP Trail T2A Start | 1 | 289454 | 3968453 | 5/18/2005 | Pre | No exact description of the start point but there is a small pool with granitic slabs nearby. The creek curves to creek left 25m past the start point. Start point on flat granite slab about 6m from the stream on stream left. | Looking downstream along the transect tape. |
| PP Trail T2A Start | 1 | 289454 | 3968453 | 5/19/2006 | Post | No exact description of the start point but there is a small pool with granitic slabs nearby. The creek curves to creek left 25m past the start point. Start point on flat granite slab about 6m from the stream on stream left. | Post treatment. |
| PP Trail T2A Start | 2 | 289454 | 3968453 | 5/18/2005 | Pre | No exact description of the start point but there is a small pool with granitic slabs nearby. The creek curves to creek left 25m past the start point. Start point on flat granite slab about 6m from the stream on stream left. | Looking up canyon showing creek and granite walls from the start point. |
| PP Trail T2A Start | 2 | 289454 | 3968453 | 5/19/2006 | Post | No exact description of the start point but there is a small pool with granitic slabs nearby. The creek curves to creek left 25m past the start point. Start point on flat granite slab about 6m from the stream on stream left. | Post treatment. |
| PP Trail T2A Start | 3 | 289454 | 3968453 | 5/18/2005 | Pre | No exact description of the start point but there is a small pool with granitic slabs nearby. The creek curves to creek left 25m past the start point. Start point on flat granite slab about 6m from the stream on stream left. | Looking up slop on creek left at Tapeats knob. Notice barrel cactus on hill for relocation. |
| PP Trail T2A Start | 3 | 289454 | 3968453 | 5/19/2006 | Post | No exact description of the start point but there is a small pool with granitic slabs nearby. The creek curves to creek left 25m past the start point. Start point on flat granite slab about 6m from the stream on stream left. | Post treatment. |
| PP Trail T2A Start | A | 289454 | 3968453 | 5/18/2005 | Pre | No exact description of the start point but there is a small pool with granitic slabs nearby. The creek curves to creek left 25m past the start point. Start point on flat granite slab about 6m from the stream on stream left. | Notice the small pool with granitic slabs in the foreground. The creek curves to creek left 25m past the start point. Taken from the streambed looking up canyon towards the start of the transect. |
| PP Trail T2A Start | B | 289454 | 3968453 | 5/18/2005 | Pre | No exact description of the start point but there is a small pool with granitic slabs nearby. The creek curves to creek left 25m past the start point. Start point on flat granite slab about 6m from the stream on stream left. | Looking at start point and can see the Tapeats ridge on creek right in the background. |
| PP Trail T2A Start | C | 289454 | 3968453 | 5/18/2005 | Pre | No exact description of the start point but there is a small pool with granitic slabs nearby. The creek curves to creek left 25m past the start point. Start point on flat granite slab about 6m from the stream on stream left. | Amy at the start point from the 4m transect mark (looking upstream). |
| PP Trail T2A Start | D | 289454 | 3968453 | 5/18/2005 | Pre | No exact description of the start point but there is a small pool with granitic slabs nearby. The creek curves to creek left 25m past the start point. Start point on flat granite slab about 6m from the stream on stream left. | Looking at the boulder features at the start point from the 1m mark on the tape. |
| PP Transept 1-1 | 1 | 406415 | 4003684 | 9/30/2005 | Pre | Taken directly below in a fork in the creek on the edge of a tilted rock. | Looking up creek at a wrap around view of the left side of creek and Tapeats rock formation. |
| PP Transept 1-1 | 1 | 406415 | 4003684 | 9/30/2005 | Post | Taken directly below in a fork in the creek on the edge of a tilted rock. | Post work. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|-----------|-----------------------|--|---|
| PP Transept 1-1 | 1 | 406415 | 4003684 | 4/3/2006 | Post | Taken directly below in a fork in the creek on the edge of a tilted rock. | Photo update. |
| PP Transept 1-1 | 2 | 406415 | 4003684 | 9/30/2005 | Pre | Taken directly below in a fork in the creek on the edge of a tilted rock. | Looking across creek. Facing the north part of the creek wall. |
| PP Transept 1-1 | 2 | 406415 | 4003684 | 9/30/2005 | Post | Taken directly below in a fork in the creek on the edge of a tilted rock. | Post work. |
| PP Transept 1-1 | 2 | 406415 | 4003684 | 4/3/2006 | Post | Taken directly below in a fork in the creek on the edge of a tilted rock. | Photo update. |
| PP Transept 1-1 | 3 | 406415 | 4003684 | 9/30/2005 | Pre | Taken directly below in a fork in the creek on the edge of a tilted rock. | In the distance the east wall is in view by the creek wall. |
| PP Transept 1-1 | 3 | 406415 | 4003684 | 9/30/2005 | Post | Taken directly below in a fork in the creek on the edge of a tilted rock. | Post work. |
| PP Transept 1-1 | 3 | 406415 | 4003684 | 4/3/2006 | Post | Taken directly below in a fork in the creek on the edge of a tilted rock. | Photo update. |
| PP Transept 1-1 | A | 406415 | 4003684 | 9/30/2005 | Pre | Taken directly below in a fork in the creek on the edge of a tilted rock. | Tony at photopoint. Looking up towards SW wall in canyon on a reddish burgundy boulder. |
| PP Transept 1-2 | 1 | 406268 | 4003737 | 9/30/2005 | Post | Taken from creek right grayish/white boulder at the foot of a southwest wall and at the foot of a tapeats wall. | Post work. |
| PP Transept 1-2 | 1 | 406268 | 4003737 | 9/30/2005 | Pre | Taken from creek right grayish/white boulder at the foot of a southwest wall and at the foot of a tapeats wall. | Looking down creek. There is a little cave visible in the SE part of the mountain. |
| PP Transept 1-2 | 1 | 406268 | 4003737 | 4/3/2006 | Post | Taken from creek right grayish/white boulder at the foot of a southwest wall and at the foot of a tapeats wall. | Photo update. |
| PP Transept 1-2 | 2 | 406268 | 4003737 | 9/30/2005 | Post | Taken from creek right grayish/white boulder at the foot of a southwest wall and at the foot of a tapeats wall. | Post work. |
| PP Transept 1-2 | 2 | 406268 | 4003737 | 9/30/2005 | Pre | Taken from creek right grayish/white boulder at the foot of a southwest wall and at the foot of a tapeats wall. | Looking up creek, wrap around visible along the side of the canyon walls. |
| PP Transept 1-2 | 2 | 406268 | 4003737 | 4/3/2006 | Post | Taken from creek right grayish/white boulder at the foot of a southwest wall and at the foot of a tapeats wall. | Photo update. |
| PP Transept 1-2 | 3 | 406268 | 4003737 | 9/30/2005 | Post | Taken from creek right grayish/white boulder at the foot of a southwest wall and at the foot of a tapeats wall. | Post work. |
| PP Transept 1-2 | 3 | 406268 | 4003737 | 9/30/2005 | Pre | Taken from creek right grayish/white boulder at the foot of a southwest wall and at the foot of a tapeats wall. | Looking across the creek. Patch of rocks and one whole side of the creek wall in the front. |
| PP Transept 1-2 | 3 | 406268 | 4003737 | 4/3/2006 | Post | Taken from creek right grayish/white boulder at the foot of a southwest wall and at the foot of a tapeats wall. | Photo update. |
| PP Transept 1-2 | A | 406268 | 4003737 | 9/30/2005 | Pre | Taken from creek right grayish/white boulder at the foot of a southwest wall and at the foot of a tapeats wall. | Tony at photopoint. There is a rock with agave plant in the background. |
| PP Transept 2 | 1 | 406173 | 4004025 | 10/1/2005 | Post | Taken from on a ledge in the Dox about 6m up on creek right. Did not retake this photopoint on 4/3/06 because we felt like it was too sketchy for up to safely do. | Post work. |
| PP Transept 2 | 1 | 406173 | 4004025 | 10/1/2005 | Pre | Taken from on a ledge in the Dox about 6m up on creek right. Did not retake this photopoint on 4/3/06 because we felt like it was too sketchy for up to safely do. | Looking downstream to creek right with southwest wall in view. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|-----------|-----------------------|--|--|
| PP Transept 2 | 2 | 406173 | 4004025 | 10/1/2005 | Pre | Taken from on a ledge in the Dox about 6m up on creek right. Did not retake this photopoint on 4/3/06 because we felt like it was too sketchy for up to safely do. | Looking across the creek from creek right to left. There is a juniper on the left side of the photo. |
| PP Transept 2 | 2 | 406173 | 4004025 | 10/1/2005 | Post | Taken from on a ledge in the Dox about 6m up on creek right. Did not retake this photopoint on 4/3/06 because we felt like it was too sketchy for up to safely do. | Post work. |
| PP Transept 2 | 3 | 406173 | 4004025 | 10/1/2005 | Post | Taken from on a ledge in the Dox about 6m up on creek right. Did not retake this photopoint on 4/3/06 because we felt like it was too sketchy for up to safely do. | Post work. |
| PP Transept 2 | 3 | 406173 | 4004025 | 10/1/2005 | Pre | Taken from on a ledge in the Dox about 6m up on creek right. Did not retake this photopoint on 4/3/06 because we felt like it was too sketchy for up to safely do. | Looking upstream to creek right with a box elder in the center of the photo. |
| PP Transept 2 | A | 406173 | 4004025 | 10/1/2005 | Pre | Taken from on a ledge in the Dox about 6m up on creek right. Did not retake this photopoint on 4/3/06 because we felt like it was too sketchy for up to safely do. | Person at photopoint with shrub live oak growing out of ledge. |
| PP Transept 3-1 | 1 | 406081 | 4004256 | 10/1/2005 | Post | Taken from a Tapeats boulder on creek left. | Post work. |
| PP Transept 3-1 | 1 | 406081 | 4004256 | 10/1/2005 | Pre | Taken from a Tapeats boulder on creek left. | Looking upstream of the creek with a large cottonwood growing horizontal on creek left. |
| PP Transept 3-1 | 1 | 406081 | 4004256 | 4/3/2006 | Post | Taken from a Tapeats boulder on creek left. | Photo update. |
| PP Transept 3-1 | 2 | 406081 | 4004256 | 10/1/2005 | Pre | Taken from a Tapeats boulder on creek left. | Looking at creek right at a big slope with lots of trees. |
| PP Transept 3-1 | 2 | 406081 | 4004256 | 10/1/2005 | Post | Taken from a Tapeats boulder on creek left. | Post work. |
| PP Transept 3-1 | 2 | 406081 | 4004256 | 4/3/2006 | Post | Taken from a Tapeats boulder on creek left. | Photo update. |
| PP Transept 3-1 | 3 | 406081 | 4004256 | 10/1/2005 | Post | Taken from a Tapeats boulder on creek left. | Post work. |
| PP Transept 3-1 | 3 | 406081 | 4004256 | 10/1/2005 | Pre | Taken from a Tapeats boulder on creek left. | Looking downstream towards the bright angel creek. |
| PP Transept 3-1 | 3 | 406081 | 4004256 | 4/3/2006 | Post | Taken from a Tapeats boulder on creek left. | Photo update. |
| PP Transept 3-1 | A | 406081 | 4004256 | 10/1/2005 | Pre | Taken from a Tapeats boulder on creek left. | Chris doing handstand on photopoint rock. Taken looking upstream. |
| PP Transept 3-2 | 1 | 405731 | 4004483 | 10/3/2005 | Pre | Taken in boulder field in middle of Transept creek, sitting on a 1x0.5m sandstone boulder. | Looking downstream with a cottonwood in the middle of the creek. Toroweap spires in the distance. |
| PP Transept 3-2 | 1 | 405731 | 4004483 | 4/3/2006 | Post | Taken in boulder field in middle of Transept creek, sitting on a 1x0.5m sandstone boulder. | Photo update. |
| PP Transept 3-2 | 2 | 405731 | 4004483 | 10/3/2005 | Pre | Taken in boulder field in middle of Transept creek, sitting on a 1x0.5m sandstone boulder. | Looking North towards creek left and a side canyon coming into Transept canyon. |
| PP Transept 3-2 | 2 | 405731 | 4004483 | 4/3/2006 | Post | Taken in boulder field in middle of Transept creek, sitting on a 1x0.5m sandstone boulder. | Photo update. |
| PP Transept 3-2 | 3 | 405731 | 4004483 | 10/3/2005 | Pre | Taken in boulder field in middle of Transept creek, sitting on a 1x0.5m sandstone boulder. | Looking upstream towards a clear view of the N. Rim. |
| PP Transept 3-2 | 3 | 405731 | 4004483 | 4/3/2006 | Post | Taken in boulder field in middle of Transept creek, sitting on a 1x0.5m sandstone boulder. | Photo update. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|------------|-----------------------|---|--|
| PP Transept 3-2 | 4 | 405731 | 4004483 | 10/3/2005 | Pre | Taken in boulder field in middle of Transept creek, sitting on a 1x0.5m sandstone boulder. | Looking upstream at Tapeats narrows and a juniper tree. |
| PP Transept 3-2 | 4 | 405731 | 4004483 | 4/3/2006 | Post | Taken in boulder field in middle of Transept creek, sitting on a 1x0.5m sandstone boulder. | Photo update. |
| PP Transept 3-2 | A | 405731 | 4004483 | 10/3/2005 | Pre | Taken in boulder field in middle of Transept creek, sitting on a 1x0.5m sandstone boulder. | Amy sitting on rock boulder field with side canyon in view. |
| PP Transept 3-3 | 1 | 405716 | 4004484 | 12/11/2005 | Post | Located at a large white, triangular boulder on creek right. The boulder is about 15m away from the creek and about midway through the Tapeats. | Post work. |
| PP Transept 3-3 | 1 | 405716 | 4004484 | 12/11/2005 | Pre | Located at a large white, triangular boulder on creek right. The boulder is about 15m away from the creek and about midway through the Tapeats. | Looking upstream to the right of a healthy juniper and a small tapeats overhang on creek left. |
| PP Transept 3-3 | 1 | 405716 | 4004484 | 4/3/2006 | Post | Located at a large white, triangular boulder on creek right. The boulder is about 15m away from the creek and about midway through the Tapeats. | Photo update. |
| PP Transept 3-3 | A | 405716 | 4004484 | 12/11/2005 | Pre | Located at a large white, triangular boulder on creek right. The boulder is about 15m away from the creek and about midway through the Tapeats. | Pen points at photopoint. |
| PP Transept 4 | 1 | 405397 | 4004709 | 12/11/2005 | Pre | Located on a large orange and white boulder on creek right. This is above a small pool with a 1m pourover. This is also just upstream of the tapeats narrows. These photos were not retaken on 4/3/06. For some reason the photos taken in were duplicates of Transept 3-2. These should be retaken the next time work is done in Transept. | Looking upstream. |
| PP Transept 4 | 1 | 405397 | 4004709 | 11/3/2006 | Post | Located on a large orange and white boulder on creek right. This is above a small pool with a 1m pourover. This is also just upstream of the tapeats narrows. These photos were not retaken on 4/3/06. For some reason the photos taken in were duplicates of Transept 3-2. These should be retaken the next time work is done in Transept. | Photo update. |
| PP Transept 4 | 2 | 405397 | 4004709 | 12/11/2005 | Pre | Located on a large orange and white boulder on creek right. This is above a small pool with a 1m pourover. This is also just upstream of the tapeats narrows. These photos were not retaken on 4/3/06. For some reason the photos taken in were duplicates of Transept 3-2. These should be retaken the next time work is done in Transept. | Looking across the stream at creek left. |
| PP Transept 4 | 2 | 405397 | 4004709 | 11/3/2006 | Post | Located on a large orange and white boulder on creek right. This is above a small pool with a 1m pourover. This is also just upstream of the tapeats narrows. These photos were not retaken on 4/3/06. For some reason the photos taken in were duplicates of Transept 3-2. These should be retaken the next time work is done in Transept. | Photo update. |
| PP Transept 4 | 3 | 405397 | 4004709 | 12/11/2005 | Pre | Located on a large orange and white boulder on creek right. This is above a small pool with a 1m pourover. This is also just upstream of the tapeats narrows. These photos were not retaken on 4/3/06. For some reason the photos taken in were duplicates of Transept 3-2. These should be retaken the next time work is done in Transept. | Looking downstream. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|------------|-----------------------|---|---|
| PP Transept 4 | 3 | 405397 | 4004709 | 11/3/2006 | Post | Located on a large orange and white boulder on creek right. This is above a small pool with a 1m pourover. This is also just upstream of the tapeats narrows. These photos were not retaken on 4/3/06. For some reason the photos taken in were duplicates of Transept 3-2. These should be retaken the next time work is done in Transept. | Photo update. |
| PP Transept 4 | A | 405397 | 4004709 | 12/11/2005 | Pre | Located on a large orange and white boulder on creek right. This is above a small pool with a 1m pourover. This is also just upstream of the tapeats narrows. These photos were not retaken on 4/3/06. For some reason the photos taken in were duplicates of Transept 3-2. These should be retaken the next time work is done in Transept. | Pen points at photopoint. |
| PP Transept 5-1 | 1 | 405149 | 4005028 | 11/1/2006 | Pre | About 150m upstream from where the water disappears, there is a prominent BA shale wall on creek left. The PP is on a ledge at the upstream end of the wall. | Looking upstream. |
| PP Transept 5-1 | 1 | 405149 | 4005028 | 11/1/2006 | Post | About 150m upstream from where the water disappears, there is a prominent BA shale wall on creek left. The PP is on a ledge at the upstream end of the wall. | Post work. |
| PP Transept 5-1 | 2 | 405149 | 4005028 | 11/1/2006 | Pre | About 150m upstream from where the water disappears, there is a prominent BA shale wall on creek left. The PP is on a ledge at the upstream end of the wall. | Looking downstream. |
| PP Transept 5-1 | 2 | 405149 | 4005028 | 11/1/2006 | Post | About 150m upstream from where the water disappears, there is a prominent BA shale wall on creek left. The PP is on a ledge at the upstream end of the wall. | Post work. |
| PP Transept 5-1 | A | 405149 | 4005028 | 11/1/2006 | Pre | About 150m upstream from where the water disappears, there is a prominent BA shale wall on creek left. The PP is on a ledge at the upstream end of the wall. | Melissa on PP rock. Taken from about 5m downstream. |
| PP Transept 5-2 | 1 | 404850 | 4005287 | 11/3/2006 | Post | PP rock is a grey limestone 4x2x3m boulder on creek right. The boulder top has a ramping slope towards the creek. This is about mid-way through the section and about 120 m into the water section. | Looking upstream. |
| PP Transept 5-2 | 1 | 404850 | 4005287 | 11/3/2006 | Pre | PP rock is a grey limestone 4x2x3m boulder on creek right. The boulder top has a ramping slope towards the creek. This is about mid-way through the section and about 120 m into the water section. | Looking upstream. |
| PP Transept 5-2 | 2 | 404850 | 4005287 | 11/3/2006 | Post | PP rock is a grey limestone 4x2x3m boulder on creek right. The boulder top has a ramping slope towards the creek. This is about mid-way through the section and about 120 m into the water section. | Looking across the stream. |
| PP Transept 5-2 | 2 | 404850 | 4005287 | 11/3/2006 | Pre | PP rock is a grey limestone 4x2x3m boulder on creek right. The boulder top has a ramping slope towards the creek. This is about mid-way through the section and about 120 m into the water section. | Looking across the creek. |
| PP Transept 5-2 | 3 | 404850 | 4005287 | 11/3/2006 | Post | PP rock is a grey limestone 4x2x3m boulder on creek right. The boulder top has a ramping slope towards the creek. This is about mid-way through the section and about 120 m into the water section. | Post work. |

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| PP Transept 5-2 | 3 | 404850 | 4005287 | 11/3/2006 | Pre | PP rock is a grey limestone 4x2x3m boulder on creek right. The boulder top has a ramping slope towards the creek. This is about mid-way through the section and about 120 m into the water section. | Looking downstream. |
| PP Transept 5-2 | A | 404850 | 4005287 | 11/3/2006 | Pre | PP rock is a grey limestone 4x2x3m boulder on creek right. The boulder top has a ramping slope towards the creek. This is about mid-way through the section and about 120 m into the water section. | Pen pointing at PP rock. Taken from about 2m downstream of the rock on a bank on creek right. |
| PP Transept 6 | 1 | 404638 | 4005523 | 11/2/2006 | Post | About 15m below lower spring that is feeding the creek. 3x5m pool just below with large boulders circling it. This is about 30m above a huge POPFRE. Pre photos were not on camera. | View upstream. Post work. |
| PP Transept 6 | 2 | 404638 | 4005523 | 11/2/2006 | Post | About 15m below lower spring that is feeding the creek. 3x5m pool just below with large boulders circling it. This is about 30m above a huge POPFRE. Pre photos were not on camera. | Looking downstream. Post work. |
| PP Transept 8 | 1 | 403476 | 4006822 | 11/2/2006 | Post | PP rock is about 180m downstream of where the canyon forks. The PP rock is limestone and on creek right. It is in the middle of section 8. | Post work. |
| PP Transept 8 | 1 | 403476 | 4006822 | 11/2/2006 | Pre | PP rock is about 180m downstream of where the canyon forks. The PP rock is limestone and on creek right. It is in the middle of section 8. | Looking upstream. |
| PP Transept 8 | 2 | 403476 | 4006822 | 11/2/2006 | Pre | PP rock is about 180m downstream of where the canyon forks. The PP rock is limestone and on creek right. It is in the middle of section 8. | Looking downstream. |
| PP Transept 8 | 2 | 403476 | 4006822 | 11/2/2006 | Post | PP rock is about 180m downstream of where the canyon forks. The PP rock is limestone and on creek right. It is in the middle of section 8. | Post work. |
| PP Transept 8 | A | 403476 | 4006822 | 11/2/2006 | Pre | PP rock is about 180m downstream of where the canyon forks. The PP rock is limestone and on creek right. It is in the middle of section 8. | Pen is pointing at photopoint. Taken from about 5m downstream. |
| PP Transept 9 | 1 | 403398 | 4006961 | 11/1/2006 | Pre | PP rock is the biggest rock in the field center. This is where two forks at the upper end of the canyon in the Redwall come together. The main water source is from the west fork. A boulder field is up the east fork. | View downstream. |
| PP Transept 9 | 1 | 403398 | 4006961 | 11/2/2006 | Post | PP rock is the biggest rock in the field center. This is where two forks at the upper end of the canyon in the Redwall come together. The main water source is from the west fork. A boulder field is up the east fork. | Post work. |
| PP Transept 9 | 2 | 403398 | 4006961 | 11/1/2006 | Pre | PP rock is the biggest rock in the field center. This is where two forks at the upper end of the canyon in the Redwall come together. The main water source is from the west fork. A boulder field is up the east fork. | Looking towards the W fork |
| PP Transept 9 | 2 | 403398 | 4006961 | 11/2/2006 | Post | PP rock is the biggest rock in the field center. This is where two forks at the upper end of the canyon in the Redwall come together. The main water source is from the west fork. A boulder field is up the east fork. | Post work. |

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|-----------------|------|-------------|--------------|------------|-----------------------|---|--|
| PP Transept 9 | 3 | 403398 | 4006961 | 11/1/2006 | Pre | PP rock is the biggest rock in the field center. This is where two forks at the upper end of the canyon in the Redwall come together. The main water source is from the west fork. A boulder field is up the east fork. | Looking upstream. |
| PP Transept 9 | 3 | 403398 | 4006961 | 11/2/2006 | Post | PP rock is the biggest rock in the field center. This is where two forks at the upper end of the canyon in the Redwall come together. The main water source is from the west fork. A boulder field is up the east fork. | Post work. |
| PP Transept 9 | A | 403398 | 4006961 | 11/1/2006 | Pre | PP rock is the biggest rock in the field center. This is where two forks at the upper end of the canyon in the Redwall come together. The main water source is from the west fork. A boulder field is up the east fork. | Melissa at photopoint. Taken from about 8m below and slightly up the W fork. |
| PP Unkar 10 | 1 | 418714 | 3994649 | 10/29/2005 | Post | Taken from a 2x2m boulder on creek right across from a UPS truck sized Tapeats boulder. | Post work, looking upstream. |
| PP Unkar 10 | 1 | 418714 | 3994649 | 10/29/2005 | Pre | Taken from a 2x2m boulder on creek right across from a UPS truck sized Tapeats boulder. | Looking upstream at TAMRAM clump on creek right, interspersed with cottonwood. |
| PP Unkar 10 | 2 | 418714 | 3994649 | 10/29/2005 | Post | Taken from a 2x2m boulder on creek right across from a UPS truck sized Tapeats boulder. | Post work, looking downstream. |
| PP Unkar 10 | 2 | 418714 | 3994649 | 10/29/2005 | Pre | Taken from a 2x2m boulder on creek right across from a UPS truck sized Tapeats boulder. | Looking downstream with mature cottonwood on creek right with a shale wall in the distant background. |
| PP Unkar 10 | A | 418714 | 3994649 | 10/29/2005 | Pre | Taken from a 2x2m boulder on creek right across from a UPS truck sized Tapeats boulder. | View of Kate on photopoint. Photo looking downstream from creek right. |
| PP Unkar 11 | 1 | 418413 | 3994923 | 10/29/2005 | Post | Taken from a large, whitish boulder in the middle of wash surrounded by cottonwoods. | Post work. |
| PP Unkar 11 | 1 | 418413 | 3994923 | 10/29/2005 | Pre | Taken from a large, whitish boulder in the middle of wash surrounded by cottonwoods. | Looking downstream through catclaw acacia with TAMRAM behind the acacia. |
| PP Unkar 11 | 2 | 418413 | 3994923 | 10/29/2005 | Post | Taken from a large, whitish boulder in the middle of wash surrounded by cottonwoods. | Post work. |
| PP Unkar 11 | 2 | 418413 | 3994923 | 10/29/2005 | Pre | Taken from a large, whitish boulder in the middle of wash surrounded by cottonwoods. | Looking upstream with large cottonwood in middle ground, partially obscuring TAMRAM in the background. |
| PP Unkar 11 | A | 418413 | 3994923 | 10/29/2005 | Pre | Taken from a large, whitish boulder in the middle of wash surrounded by cottonwoods. | View of first aid kit on top of photopoint. Taken looking downstream. |
| PP Unkar 19 | 1 | 416376 | 3997771 | 11/7/2006 | Pre | Taken from a sandstone boulder on creek left about 10-15m downstream of a juniper cluster. | Looking upstream. |
| PP Unkar 19 | 2 | 416376 | 3997771 | 11/7/2006 | Post | Taken from a sandstone boulder on creek left about 10-15m downstream of a juniper cluster. | Post work. |
| PP Unkar 19 | 2 | 416376 | 3997771 | 11/7/2006 | Pre | Taken from a sandstone boulder on creek left about 10-15m downstream of a juniper cluster. | Looking downstream at TAMRAM. |
| PP Unkar 20 | 1 | 416169 | 3997816 | 11/7/2006 | Pre | Taken from a medium gray and white sandstone boulder. This is on creek right about 30m downstream from a waterfall and about 10m from a cottonwood on creek left. | Looking upstream. |
| PP Unkar 20 | 2 | 416169 | 3997816 | 11/7/2006 | Pre | Taken from a medium gray and white sandstone boulder. This is on creek right about 30m downstream from a waterfall and about 10m from a cottonwood on creek left. | Looking downstream. |
| PP Unkar 20 | 2 | 416169 | 3997816 | 11/7/2006 | Post | Taken from a medium gray and white sandstone boulder. This is on creek right about 30m downstream from a waterfall and about 10m from a cottonwood on creek left. | Post work. |

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| PP Unkar 20 | A | 416169 | 3997816 | 11/7/2006 | Pre | Taken from a medium gray and white sandstone boulder. This is on creek right about 30m downstream from a waterfall and about 10m from a cottonwood on creek left. | Tech box at photopoint. |
| PP Unkar 21 | 1 | 415675 | 3997999 | 11/6/2006 | Pre | Taken approx. 50m into section 21 standing on creek left in front of a juniper and some Gooding's willows. | Looking upstream. |
| PP Unkar 21 | 1 | 415675 | 3997999 | 11/6/2006 | Post | Taken approx. 50m into section 21 standing on creek left in front of a juniper and some Gooding's willows. | Post work. |
| PP Unkar 21 | 2 | 415675 | 3997999 | 11/6/2006 | Pre | Taken approx. 50m into section 21 standing on creek left in front of a juniper and some Gooding's willows. | Looking downstream at TAMRAM. |
| PP Unkar 21 | 2 | 415675 | 3997999 | 11/6/2006 | Post | Taken approx. 50m into section 21 standing on creek left in front of a juniper and some Gooding's willows. | Post work. |
| PP Unkar 21 | A | 415675 | 3997999 | 11/6/2006 | Pre | Taken approx. 50m into section 21 standing on creek left in front of a juniper and some Gooding's willows. | Kate standing on creek left at photopoint. Redwall in the background. |
| PP Unkar 9-2 | 1 | 419074 | 3994781 | 10/29/2005 | Post | Taken about 150m upstream of fork (creek right). There is an arching chunky wall of sandstone about 90m long and 70m tall. | Post work, looking downstream. |
| PP Unkar 9-2 | 1 | 419074 | 3994781 | 10/29/2005 | Pre | Taken about 150m upstream of fork (creek right). There is an arching chunky wall of sandstone about 90m long and 70m tall. | Looking downstream. |
| PP Unkar 9-2 | 2 | 419074 | 3994781 | 10/29/2005 | Pre | Taken about 150m upstream of fork (creek right). There is an arching chunky wall of sandstone about 90m long and 70m tall. | Looking upstream. |
| PP Unkar 9-2 | 2 | 419074 | 3994781 | 10/29/2005 | Post | Taken about 150m upstream of fork (creek right). There is an arching chunky wall of sandstone about 90m long and 70m tall. | Post work, looking upstream. |
| PP Unkar 9-2 | A | 419074 | 3994781 | 10/29/2005 | Pre | Taken about 150m upstream of fork (creek right). There is an arching chunky wall of sandstone about 90m long and 70m tall. | Nate at photopoint site. Photo taken from downstream of photopoint looking upstream. |
| PP Unkar T1A End | 1 | 419474 | 3994637 | 10/8/2004 | Pre | Above transect T1A on red slope | Check bearing. View of end of transect |
| PP Unkar T1A End | A | 419474 | 3994637 | 10/8/2004 | Pre | Above transect T1A on red slope | Loren at transect bottom. |
| PP Unkar T1A Start | 1 | 419435 | 3994664 | 10/8/2004 | Pre | Start point of Unkar T1A | Looking from transect start down transect |
| PP Unkar T1A Start | A | 419435 | 3994664 | 10/8/2004 | Pre | Start point of Unkar T1A | Transect top with rod. |
| PP Unkar T1B End | A | 419397 | 3994823 | 10/8/2004 | Pre | Transect end is located in the creek bottom about .75m away from the base of the Dox wall that turns to the north as you walk up the creek. Just above the transect end, CLACAL is growing in a seep. End is downslope of T1A end. | End of transect? |
| PP Unkar T1B Start | 1 | 419351 | 3994844 | 10/8/2004 | Pre | Transect start is located at the creek right side of the drainage on a slope with SALEXI and PHRAUS. Start is .5m downcreek of a 5cm diameter SALEXI. A 1mx.5m limestone boulder is upslope of transect at the 4m mark. Transect end is located in the creek bottom about .75m away from the base of the Dox wall that turns to the north as you walk up the creek. Just above the transect end, CLACAL is growing in a seep. | Transect 1B top. |

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|--------------------|------|-------------|--------------|-----------|-----------------------|---|---|
| PP Unkar T1B Start | A | 419351 | 3994844 | 10/8/2004 | Pre | Transect start is located at the creek right side of the drainage on a slope with SALEXI and PHRAUS. Start is .5m downcreek of a 5cm diameter SALEXI. A 1mx.5m limestone boulder is upslope of transect at the 4m mark. Transect end is located in the creek bottom about .75m away from the base of the Dox wall that turns to the north as you walk up the creek. Just above the transect end, CLACAL is growing in a seep. | View of transect start? |
| PP Unkar T2A End | 1 | 419075 | 3994568 | 10/8/2004 | Pre | Check UTMs not sure if correct. No other description. | Looking at end of transect. |
| PP Unkar T2A End | 2 | 419075 | 3994568 | 10/8/2004 | Pre | Check UTMs not sure if correct. No other description. | Looking at transect end? |
| PP Unkar T2A End | 3 | 419075 | 3994568 | 10/8/2004 | Pre | Check UTMs not sure if correct. No other description. | Looking at the start from the endpoint. |
| PP Unkar T2A End | A | 419075 | 3994568 | 10/8/2004 | Pre | Check UTMs not sure if correct. No other description. | Looking at end? |
| PP Unkar T2A start | 1 | 419039 | 3994608 | 10/8/2004 | Pre | Transect T2A Bottom? | Looking downstream from the start to end. |
| PP Unkar T2A start | 2 | 419039 | 3994608 | 10/8/2004 | Pre | Transect T2A Bottom? | No bearing or description. |
| PP Unkar T2A start | 3 | 419039 | 3994608 | 10/8/2004 | Pre | Transect T2A Bottom? | Not sure of bearing or description. |
| PP Unkar T2B End | 1 | 419175 | 3994568 | 10/8/2004 | Pre | Not sure if this is the correct UTM for this transect. | No description. |
| PP Unkar T2B End | 3 | 419175 | 3994568 | 10/8/2004 | Pre | Not sure if this is the correct UTM for this transect. | Looking at end? |
| PP Unkar T2B End | 4 | 419175 | 3994568 | 10/8/2004 | Pre | Not sure if this is the correct UTM for this transect. | Looking at end? |
| PP Unkar T2B Start | 1 | 418996 | 3994812 | 10/8/2004 | Pre | Transect start is nestled beneath a mature acacia at the upstream und of a Hakatai ledge on creek left side of the drainage | Looking from start? |
| PP Unkar T2B Start | 2 | 418996 | 3994812 | 10/8/2004 | Pre | Transect start is nestled beneath a mature acacia at the upstream und of a Hakatai ledge on creek left side of the drainage | Not sure what this is a picture of start of end? |
| PP Unkar T2B Start | A | 418996 | 3994812 | 10/8/2004 | Pre | Transect start is nestled beneath a mature acacia at the upstream und of a Hakatai ledge on creek left side of the drainage | View of start? |
| PP Upper BA 1 | 1 | 406299 | 4003288 | 9/29/2005 | Post | Taken standing of debris pile of old dead cottonwood on ground on creek left at the edge of the bank. There is a big cottonwood behind. Just downstream of ranger station. | Post work. |
| PP Upper BA 1 | 1 | 406299 | 4003288 | 9/29/2005 | Pre | Taken standing of debris pile of old dead cottonwood on ground on creek left at the edge of the bank. There is a big cottonwood behind. Just downstream of ranger station. | Upstream view. Cottonwood in foreground and emerging boulder on creek right. |
| PP Upper BA 1 | 1 | 406299 | 4003288 | 4/3/2006 | Post | Taken standing of debris pile of old dead cottonwood on ground on creek left at the edge of the bank. There is a big cottonwood behind. Just downstream of ranger station. | Photo update. |
| PP Upper BA 1 | 2 | 406299 | 4003288 | 9/29/2005 | Post | Taken standing of debris pile of old dead cottonwood on ground on creek left at the edge of the bank. There is a big cottonwood behind. Just downstream of ranger station. | Post work. |
| PP Upper BA 1 | 2 | 406299 | 4003288 | 9/29/2005 | Pre | Taken standing of debris pile of old dead cottonwood on ground on creek left at the edge of the bank. There is a big cottonwood behind. Just downstream of ranger station. | Looking from creek left to creek right. Western slope in view and vegetation below. |
| PP Upper BA 1 | 2 | 406299 | 4003288 | 4/3/2006 | Post | Taken standing of debris pile of old dead cottonwood on ground on creek left at the edge of the bank. There is a big cottonwood behind. Just downstream of ranger station. | Photo update. |
| PP Upper BA 1 | 3 | 406299 | 4003288 | 9/29/2005 | Post | Taken standing of debris pile of old dead cottonwood on ground on creek left at the edge of the bank. There is a big cottonwood behind. Just downstream of ranger station. | Post work. |

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|------------------|------|-------------|--------------|------------|-----------------------|--|--|
| PP Upper BA 1 | 3 | 406299 | 4003288 | 9/29/2005 | Pre | Taken standing of debris pile of old dead cottonwood on ground on creek left at the edge of the bank. There is a big cottonwood behind. Just downstream of ranger station. | Looking downstream. TAMRAM on creek left. Creek bend with trail visible in the distance. |
| PP Upper BA 1 | 3 | 406299 | 4003288 | 4/3/2006 | Post | Taken standing of debris pile of old dead cottonwood on ground on creek left at the edge of the bank. There is a big cottonwood behind. Just downstream of ranger station. | Photo update. |
| PP Upper BA 1 | A | 406299 | 4003288 | 9/25/2005 | Pre | Taken standing of debris pile of old dead cottonwood on ground on creek left at the edge of the bank. There is a big cottonwood behind. Just downstream of ranger station. | Person at photopoint. |
| PP Upper BA 1 | A | 406299 | 4003288 | 9/29/2005 | Pre | Taken standing of debris pile of old dead cottonwood on ground on creek left at the edge of the bank. There is a big cottonwood behind. Just downstream of ranger station. | Person at photopoint. |
| PP Upper BA 10 | 1 | 407450 | 4006225 | 10/27/2006 | Pre | This is above Roaring Springs and BA confluence and about 100-150m below where the old BA drops into BA Creek. Taken atop a small boulder on creek left. | Looking downstream at a golden TAMRAM with a juniper just to the left of it. |
| PP Upper BA 10 | 1 | 407450 | 4006225 | 10/27/2006 | Post | This is above Roaring Springs and BA confluence and about 100-150m below where the old BA drops into BA Creek. Taken atop a small boulder on creek left. | Post work. |
| PP Upper BA 10 | A | 407450 | 4006225 | 10/27/2006 | Pre | This is above Roaring Springs and BA confluence and about 100-150m below where the old BA drops into BA Creek. Taken atop a small boulder on creek left. | Looking upstream at photopoint rock. |
| PP Upper BA 12-1 | 1 | 408011 | 4007320 | 10/13/2006 | Pre | Taken from a large red/white sandstone boulder on creek right. This is 20m from the confluence. There are is a large boxelder both up and downstream and this is about 8m from the Bright Angel Creek. | Looking upstream and mostly up a side canyon. |
| PP Upper BA 12-1 | 1 | 408011 | 4007320 | 10/13/2006 | Post | Taken from a large red/white sandstone boulder on creek right. This is 20m from the confluence. There are is a large boxelder both up and downstream and this is about 8m from the Bright Angel Creek. | Postwork. Looking upstream and up a side canyon. |
| PP Upper BA 12-1 | 2 | 408011 | 4007320 | 10/3/2006 | Post | Taken from a large red/white sandstone boulder on creek right. This is 20m from the confluence. There are is a large boxelder both up and downstream and this is about 8m from the Bright Angel Creek. | Postwork. Looking downstream. |
| PP Upper BA 12-1 | 2 | 408011 | 4007320 | 10/13/2006 | Pre | Taken from a large red/white sandstone boulder on creek right. This is 20m from the confluence. There are is a large boxelder both up and downstream and this is about 8m from the Bright Angel Creek. | Looking downstream. |
| PP Upper BA 12-1 | A | 408011 | 4007320 | 10/13/2006 | Pre | Taken from a large red/white sandstone boulder on creek right. This is 20m from the confluence. There are is a large boxelder both up and downstream and this is about 8m from the Bright Angel Creek. | Looking at Kelly on photopoint rock. Taken from about 3m from the PP rock, between the rock and the creek. |
| PP Upper BA 12-2 | 1 | 408369 | 4007910 | 10/13/2006 | Post | Small sandstone boulder that is low to the ground and found on a rocky bench creek right. This is in a clearing about 80m long, notice the skyline. There is a spruce like tree 5m upstream from the PP. Also surrounded by boxelder, willow and serviceberry. | Postwork. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|----------------------|------|-------------|--------------|------------|-----------------------|--|--|
| PP Upper BA 12-2 | 1 | 408369 | 4007910 | 10/13/2006 | Pre | Small sandstone boulder that is low to the ground and found on a rocky bench creek right. This is in a clearing about 80m long, notice the skyline. There is a spruce like tree 5m upstream from the PP. Also surrounded by boxelder, willow and serviceberry. | Looking upstream. |
| PP Upper BA 12-2 | 2 | 408369 | 4007910 | 10/13/2006 | Pre | Small sandstone boulder that is low to the ground and found on a rocky bench creek right. This is in a clearing about 80m long, notice the skyline. There is a spruce like tree 5m upstream from the PP. Also surrounded by boxelder, willow and serviceberry. | Looking downstream. |
| PP Upper BA 12-2 | 2 | 408369 | 4007910 | 10/13/2006 | Post | Small sandstone boulder that is low to the ground and found on a rocky bench creek right. This is in a clearing about 80m long, notice the skyline. There is a spruce like tree 5m upstream from the PP. Also surrounded by boxelder, willow and serviceberry. | Postwork. |
| PP Upper BA 12-2 | A | 408369 | 4007910 | 10/13/2006 | Pre | Small sandstone boulder that is low to the ground and found on a rocky bench creek right. This is in a clearing about 80m long, notice the skyline. There is a spruce like tree 5m upstream from the PP. Also surrounded by boxelder, willow and serviceberry. | Tyler at photopoint. Taken from 5m upstream. |
| PP Upper BA 1st fork | 1 | 408013 | 4007340 | 10/12/2006 | Pre | Taken from a large grayish/white flat boulder 5-10m downstream from the confluence on creek right. | Looking upstream. |
| PP Upper BA 1st fork | 1 | 408013 | 4007340 | 10/23/2006 | Post | Taken from a large grayish/white flat boulder 5-10m downstream from the confluence on creek right. | Post work. |
| PP Upper BA 1st fork | 2 | 408013 | 4007340 | 10/12/2006 | Post | Taken from a large grayish/white flat boulder 5-10m downstream from the confluence on creek right. | Post work. |
| PP Upper BA 1st fork | 2 | 408013 | 4007340 | 10/12/2006 | Pre | Taken from a large grayish/white flat boulder 5-10m downstream from the confluence on creek right. | Looking downstream. |
| PP Upper BA 1st fork | A | 408013 | 4007340 | 10/12/2006 | Pre | Taken from a large grayish/white flat boulder 5-10m downstream from the confluence on creek right. | Allie at photopoint at the confluence of BA and the side drainage. |
| PP Upper BA 2 | 1 | 406379 | 4003387 | 9/29/2005 | Pre | Taken from Tapeats boulder on creek left, opposite Cottonwood toilets. | Looking upstream at creek. |
| PP Upper BA 2 | 1 | 406379 | 4003387 | 9/29/2005 | Post | Taken from Tapeats boulder on creek left, opposite Cottonwood toilets. | Post work. |
| PP Upper BA 2 | 1 | 406379 | 4003387 | 4/3/2006 | Post | Taken from Tapeats boulder on creek left, opposite Cottonwood toilets. | Photo update. |
| PP Upper BA 2 | 2 | 406379 | 4003387 | 9/29/2005 | Pre | Taken from Tapeats boulder on creek left, opposite Cottonwood toilets. | Looking across to creek right at exposed boulder on the side of the slope. |
| PP Upper BA 2 | 2 | 406379 | 4003387 | 9/29/2005 | Post | Taken from Tapeats boulder on creek left, opposite Cottonwood toilets. | Post work. |
| PP Upper BA 2 | 2 | 406379 | 4003387 | 4/3/2006 | Post | Taken from Tapeats boulder on creek left, opposite Cottonwood toilets. | Photo update. |
| PP Upper BA 2 | 3 | 406379 | 4003387 | 9/29/2005 | Pre | Taken from Tapeats boulder on creek left, opposite Cottonwood toilets. | Looking downstream view of cottonwood on creek left with path in the distance. |
| PP Upper BA 2 | 3 | 406379 | 4003387 | 9/29/2005 | Post | Taken from Tapeats boulder on creek left, opposite Cottonwood toilets. | Post work. |
| PP Upper BA 2 | 3 | 406379 | 4003387 | 4/3/2006 | Post | Taken from Tapeats boulder on creek left, opposite Cottonwood toilets. | Photo update. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|-----------|-----------------------|---|--|
| PP Upper BA 2 | A | 406379 | 4003387 | 9/29/2005 | Pre | Taken from Tapeats boulder on creek left, opposite Cottonwood toilets. | Alicia at photopoint. |
| PP Upper BA 3-1 | 1 | 406582 | 4003634 | 9/29/2005 | Pre | Taken from a 2x3m white slanted boulder on creek left. | Looking up creek at Redwall. There is a rock face west. |
| PP Upper BA 3-1 | 1 | 406582 | 4003634 | 4/3/2006 | Post | Taken from a 2x3m white slanted boulder on creek left. | Photo update. |
| PP Upper BA 3-1 | 2 | 406582 | 4003634 | 9/29/2005 | Pre | Taken from a 2x3m white slanted boulder on creek left. | Looking across creek, from creek left to right. There is a good view of the side canyon coming in from the west. |
| PP Upper BA 3-1 | 3 | 406582 | 4003634 | 9/29/2005 | Pre | Taken from a 2x3m white slanted boulder on creek left. | Looking downstream at south rim in the distance. No TAMRAM in sight. |
| PP Upper BA 3-1 | 3 | 406582 | 4003634 | 4/3/2006 | Post | Taken from a 2x3m white slanted boulder on creek left. | Photo update. |
| PP Upper BA 3-1 | A | 406582 | 4003634 | 9/29/2005 | Pre | Taken from a 2x3m white slanted boulder on creek left. | Kate standing on photopoint boulder. Photo taken looking upstream. |
| PP Upper BA 3-2 | 1 | 406643 | 4003849 | 9/30/2005 | Pre | 1200m above cottonwood campground in bright angel creek left. This is just below the trail on a 2x3m Tapeats boulder. | Looking upstream of the Bright Angel trail with tapeats wall to the north and young box elder trees in the center. |
| PP Upper BA 3-2 | 1 | 406643 | 4003849 | 4/3/2006 | Post | 1200m above cottonwood campground in bright angel creek left. This is just below the trail on a 2x3m Tapeats boulder. | Photo update. |
| PP Upper BA 3-2 | 2 | 406643 | 4003849 | 9/30/2005 | Post | 1200m above cottonwood campground in bright angel creek left. This is just below the trail on a 2x3m Tapeats boulder. | Post work. |
| PP Upper BA 3-2 | 2 | 406643 | 4003849 | 4/3/2006 | Pre | 1200m above cottonwood campground in bright angel creek left. This is just below the trail on a 2x3m Tapeats boulder. | Looking across from creek left to right with old bushy box elder in the center and a dead tree. |
| PP Upper BA 3-2 | 2 | 406643 | 4003849 | 4/3/2006 | Post | 1200m above cottonwood campground in bright angel creek left. This is just below the trail on a 2x3m Tapeats boulder. | Photo update. |
| PP Upper BA 3-2 | 3 | 406643 | 4003849 | 9/30/2005 | Post | 1200m above cottonwood campground in bright angel creek left. This is just below the trail on a 2x3m Tapeats boulder. | Post treatment. |
| PP Upper BA 3-2 | 3 | 406643 | 4003849 | 9/30/2005 | Pre | 1200m above cottonwood campground in bright angel creek left. This is just below the trail on a 2x3m Tapeats boulder. | Looking downstream with a clear view of the south rim in the distance. Red shale slope on creek right. |
| PP Upper BA 3-2 | 3 | 406643 | 4003849 | 4/3/2006 | Post | 1200m above cottonwood campground in bright angel creek left. This is just below the trail on a 2x3m Tapeats boulder. | Photo update. |
| PP Upper BA 3-2 | A | 406643 | 4003849 | 9/30/2005 | Pre | 1200m above cottonwood campground in bright angel creek left. This is just below the trail on a 2x3m Tapeats boulder. | Mike at photopoint. Retaining wall of trail in the background. |
| PP Upper BA 4-1 | 1 | 406769 | 4004182 | 1/5/2006 | Pre | Taken at the upper end of a large boulder field on creek right. | Looking downstream. |
| PP Upper BA 4-1 | 2 | 406769 | 4004182 | 1/5/2006 | Pre | Taken at the upper end of a large boulder field on creek right. | Looking upstream. |
| PP Upper BA 4-1 | A | 406769 | 4004182 | 1/5/2006 | Pre | Taken at the upper end of a large boulder field on creek right. | John at photopoint taken from upstream. |
| PP Upper BA 4-2 | 1 | 406872 | 4004231 | 1/6/2006 | Pre | Taken on a boulder creek left about 100 meters from the main creek. | Looking upstream (description unclear)? |
| PP Upper BA 4-2 | 2 | 406872 | 4004231 | 1/6/2006 | Pre | Taken on a boulder creek left about 100 meters from the main creek. | Looking downstream towards boulder field in wash. |
| PP Upper BA 4-2 | A | 406872 | 4004231 | 1/6/2006 | Pre | Taken on a boulder creek left about 100 meters from the main creek. | Person at photopoint. Looking upstream bend in creek in view on creek right as the canyon bends to the west. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
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| PP Upper BA 6 | 1 | 407017 | 4004995 | 10/11/2006 | Pre | Taken from a large pink and wavy boulder that is split down the middle on creek left. This is approx. 50m from the bend on the creek heading left. | Looking upstream. |
| PP Upper BA 6 | 2 | 407017 | 4004995 | 10/11/2006 | Pre | Taken from a large pink and wavy boulder that is split down the middle on creek left. This is approx. 50m from the bend on the creek heading left. | Looking downstream with the Bright Angel Trail on creek left. |
| PP Upper BA 6 | A | 407017 | 4004995 | 10/11/2006 | Pre | Taken from a large pink and wavy boulder that is split down the middle on creek left. This is approx. 50m from the bend on the creek heading left. | Megan at photopoint. Taken from upstream on creek left. |
| PP Upper BA 7 | 1 | 407204 | 4005290 | 10/11/2006 | Pre | Taken from a large grey and white boulder on creek left with a sharp edge at the top of a vertical on the North side. This is approx. 200m North of Manzanita Creek. | Looking upstream. |
| PP Upper BA 7 | 2 | 407204 | 4005290 | 10/11/2006 | Pre | Taken from a large grey and white boulder on creek left with a sharp edge at the top of a vertical on the North side. This is approx. 200m North of Manzanita Creek. | Looking downstream. |
| PP Upper BA 7 | A | 407204 | 4005290 | 10/11/2006 | Pre | Taken from a large grey and white boulder on creek left with a sharp edge at the top of a vertical on the North side. This is approx. 200m North of Manzanita Creek. | Richard at photopoint. Taken from creek left 15m downstream. |
| PP Upper BA 8 | 1 | 407742 | 4006849 | 10/26/2006 | Pre | Standing under a large scrub oak on creek left. This is just upstream from where the creek bounces off a BA Shale wall. | Looking across and downstream at a large limestone boulder in the foreground on creek right. |
| PP Upper BA 8 | 1 | 407742 | 4006849 | 10/26/2006 | Post | Standing under a large scrub oak on creek left. This is just upstream from where the creek bounces off a BA Shale wall. | Post work. |
| PP Upper BA 8 | A | 407742 | 4006849 | 10/26/2006 | Pre | Standing under a large scrub oak on creek left. This is just upstream from where the creek bounces off a BA Shale wall. | Loren standing at photopoint underneath an oak. Taken looking upstream at photopoint. |
| PP Upper BA 9 | 1 | 407630 | 4006510 | 10/27/2006 | Pre | Taken from a large square boulder (4x5m) on creek left, at a nice chute/pool . This is about 100m upstream of the first old BA trail creek crossing that goes from the east-west side of the creek. | Looking at one mature TAMRAM. |
| PP Upper BA 9 | 1 | 407630 | 4006510 | 10/27/2006 | Post | Taken from a large square boulder (4x5m) on creek left, at a nice chute/pool . This is about 100m upstream of the first old BA trail creek crossing that goes from the east-west side of the creek. | Post work. |
| PP Upper BA 9 | A | 407630 | 4006510 | 10/27/2006 | Pre | Taken from a large square boulder (4x5m) on creek left, at a nice chute/pool . This is about 100m upstream of the first old BA trail creek crossing that goes from the east-west side of the creek. | Taken atop a big boulder on creek right. This is 5m above the nice swimming hole. |
| PP Upper Boucher 2 | 1 | 386577 | 3994724 | 2/27/2006 | Pre | Located on a small muav sitting shelf. This is on creek left above a nice muav steppe. | Looking down and across the creek at Redwall and the North Rim is in the background. |
| PP Upper Boucher 2 | 1 | 386577 | 3994724 | 2/27/2006 | Post | Located on a small muav sitting shelf. This is on creek left above a nice muav steppe. | Post work. |
| PP Upper Boucher 2 | A | 386577 | 3994724 | 2/27/2006 | Pre | Located on a small muav sitting shelf. This is on creek left above a nice muav steppe. | |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-------------------|------|-------------|--------------|-----------|-----------------------|--|---|
| PP Upper Lava 1-1 | 1 | 419268 | 4002625 | 2/24/2006 | Pre | Taken from a large white, grey and pink boulder on creek left about 1m high. This is 15m downstream of a 12m high almost vertical boulder on creek left. The photopoint rock has a crease in the middle that makes a fine seat facing out towards the creek. | Looking upstream at the TAMRAM. |
| PP Upper Lava 1-1 | 1 | 419268 | 4002625 | 2/24/2006 | Post | Taken from a large white, grey and pink boulder on creek left about 1m high. This is 15m downstream of a 12m high almost vertical boulder on creek left. The photopoint rock has a crease in the middle that makes a fine seat facing out towards the creek. | Post work. |
| PP Upper Lava 1-1 | A | 419268 | 4002625 | 2/24/2006 | Pre | Taken from a large white, grey and pink boulder on creek left about 1m high. This is 15m downstream of a 12m high almost vertical boulder on creek left. The photopoint rock has a crease in the middle that makes a fine seat facing out towards the creek. | Pen pointing to photopoint rock. Taken from downstream. |
| PP Upper Lava 1-2 | 1 | 419259 | 4002619 | 2/24/2006 | Post | Taken from a 3m high boulder in the right center of the creek. The boulder is sloped at a 45 degree angle facing downstream. There is a 9x9 ft standing pool of water on creek right just below the boulder. | Post work. |
| PP Upper Lava 1-2 | 1 | 419259 | 4002619 | 2/24/2006 | Pre | Taken from a 3m high boulder in the right center of the creek. The boulder is sloped at a 45 degree angle facing downstream. There is a 9x9 ft standing pool of water on creek right just below the boulder. | Looking upstream towards the N. Rim. |
| PP Upper Lava 1-2 | 2 | 419259 | 4002619 | 2/24/2006 | Post | Taken from a 3m high boulder in the right center of the creek. The boulder is sloped at a 45 degree angle facing downstream. There is a 9x9 ft standing pool of water on creek right just below the boulder. | Post work. |
| PP Upper Lava 1-2 | 2 | 419259 | 4002619 | 2/24/2006 | Pre | Taken from a 3m high boulder in the right center of the creek. The boulder is sloped at a 45 degree angle facing downstream. There is a 9x9 ft standing pool of water on creek right just below the boulder. | Looking downstream. |
| PP Upper Lava 1-2 | 3 | 419259 | 4002619 | 2/24/2006 | Post | Taken from a 3m high boulder in the right center of the creek. The boulder is sloped at a 45 degree angle facing downstream. There is a 9x9 ft standing pool of water on creek right just below the boulder. | Post work. |
| PP Upper Lava 1-2 | 3 | 419259 | 4002619 | 2/24/2006 | Pre | Taken from a 3m high boulder in the right center of the creek. The boulder is sloped at a 45 degree angle facing downstream. There is a 9x9 ft standing pool of water on creek right just below the boulder. | View slightly upstream on creek left. |
| PP Upper Lava 1-2 | 4 | 419259 | 4002619 | 2/24/2006 | Post | Taken from a 3m high boulder in the right center of the creek. The boulder is sloped at a 45 degree angle facing downstream. There is a 9x9 ft standing pool of water on creek right just below the boulder. | Post work. |
| PP Upper Lava 1-2 | 4 | 419259 | 4002619 | 2/24/2006 | Pre | Taken from a 3m high boulder in the right center of the creek. The boulder is sloped at a 45 degree angle facing downstream. There is a 9x9 ft standing pool of water on creek right just below the boulder. | View slightly downstream on creek left. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-------------------|------|-------------|--------------|-----------|-----------------------|--|---|
| PP Upper Lava 1-2 | A | 419259 | 4002619 | 2/24/2006 | Pre | Taken from a 3m high boulder in the right center of the creek. The boulder is sloped at a 45 degree angle facing downstream. There is a 9x9 ft standing pool of water on creek right just below the boulder. | Melissa on photopoint. Taken from downstream. |
| PP Upper Lava 6 | 1 | 418124 | 4004000 | 11/5/2006 | Post | Taken right at the beginning of this section where you begin to see the Bright Angel shale. There is a 2x2m Redwall limestone boulder on creek right. | Post work. |
| PP Upper Lava 6 | 1 | 418124 | 4004000 | 11/5/2006 | Pre | Taken right at the beginning of this section where you begin to see the Bright Angel shale. There is a 2x2m Redwall limestone boulder on creek right. | Looking upstream in the drainage. |
| PP Upper Lava 6 | 2 | 418124 | 4004000 | 11/5/2006 | Pre | Taken right at the beginning of this section where you begin to see the Bright Angel shale. There is a 2x2m Redwall limestone boulder on creek right. | Looking downstream. |
| PP Upper Lava 6 | 2 | 418124 | 4004000 | 11/5/2006 | Post | Taken right at the beginning of this section where you begin to see the Bright Angel shale. There is a 2x2m Redwall limestone boulder on creek right. | Post work. |
| PP Upper Lava 6 | A | 418124 | 4004000 | 11/5/2006 | Pre | Taken right at the beginning of this section where you begin to see the Bright Angel shale. There is a 2x2m Redwall limestone boulder on creek right. | Kate at photopoint. Taken from 10m upstream. |
| PP Upper Pipe 1 | 1 | 400783 | 3992380 | 9/15/2005 | Pre | Taken from about 8m downstream from where the surface water starts on creek left. Go up the slope roughly 6m from the water under a medium sized pinyon pine. Just below this pine, about 2m, is a large downed, dead tree. On the downstream side of the pine there is a young cottonwood on the upstream side there is a small/medium sized snowberry and right under that there is a juniper growing out of the bank. When you look directly across the creek there is a large, many branched, half dead cottonwood about 40m tall. Directly behind that cottonwood about 4m is a very large, gray, square boulder (3.5m tall). | Looking upstream, creek left. |
| PP Upper Pipe 1 | 2 | 400783 | 3992380 | 9/15/2005 | Pre | Taken from about 8m downstream from where the surface water starts on creek left. Go up the slope roughly 6m from the water under a medium sized pinyon pine. Just below this pine, about 2m, is a large downed, dead tree. On the downstream side of the pine there is a young cottonwood on the upstream side there is a small/medium sized snowberry and right under that there is a juniper growing out of the bank. When you look directly across the creek there is a large, many branched, half dead cottonwood about 40m tall. Directly behind that cottonwood about 4m is a very large, gray, square boulder (3.5m tall). | Looking directly down at large TAMRAM that's 3m down on creek left. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|-----------|-----------------------|--|---|
| PP Upper Pipe 1 | 2 | 400783 | 3992380 | 9/15/2005 | Post | Taken from about 8m downstream from where the surface water starts on creek left. Go up the slope roughly 6m from the water under a medium sized pinyon pine. Just below this pine, about 2m, is a large downed, dead tree. On the downstream side of the pine there is a young cottonwood on the upstream side there is a small/medium sized snowberry and right under that there is a juniper growing out of the bank. When you look directly across the creek there is a large, many branched, half dead cottonwood about 40m tall. Directly behind that cottonwood about 4m is a very large, gray, square boulder (3.5m tall). | |
| PP Upper Pipe 1 | 3 | 400783 | 3992380 | 9/15/2005 | Pre | Taken from about 8m downstream from where the surface water starts on creek left. Go up the slope roughly 6m from the water under a medium sized pinyon pine. Just below this pine, about 2m, is a large downed, dead tree. On the downstream side of the pine there is a young cottonwood on the upstream side there is a small/medium sized snowberry and right under that there is a juniper growing out of the bank. When you look directly across the creek there is a large, many branched, half dead cottonwood about 40m tall. Directly behind that cottonwood about 4m is a very large, gray, square boulder (3.5m tall). | Looking directly across the creek to creek right. |
| PP Upper Pipe 1 | 4 | 400783 | 3992380 | 9/15/2005 | Pre | Taken from about 8m downstream from where the surface water starts on creek left. Go up the slope roughly 6m from the water under a medium sized pinyon pine. Just below this pine, about 2m, is a large downed, dead tree. On the downstream side of the pine there is a young cottonwood on the upstream side there is a small/medium sized snowberry and right under that there is a juniper growing out of the bank. When you look directly across the creek there is a large, many branched, half dead cottonwood about 40m tall. Directly behind that cottonwood about 4m is a very large, gray, square boulder (3.5m tall). | Looking across the creek, slightly downstream to creek right. |
| PP Upper Pipe 1 | 4 | 400783 | 3992380 | 9/15/2005 | Post | Taken from about 8m downstream from where the surface water starts on creek left. Go up the slope roughly 6m from the water under a medium sized pinyon pine. Just below this pine, about 2m, is a large downed, dead tree. On the downstream side of the pine there is a young cottonwood on the upstream side there is a small/medium sized snowberry and right under that there is a juniper growing out of the bank. When you look directly across the creek there is a large, many branched, half dead cottonwood about 40m tall. Directly behind that cottonwood about 4m is a very large, gray, square boulder (3.5m tall). | |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|-----------|-----------------------|--|--|
| PP Upper Pipe 1 | 5 | 400783 | 3992380 | 9/15/2005 | Post | Taken from about 8m downstream from where the surface water starts on creek left. Go up the slope roughly 6m from the water under a medium sized pinyon pine. Just below this pine, about 2m, is a large downed, dead tree. On the downstream side of the pine there is a young cottonwood on the upstream side there is a small/medium sized snowberry and right under that there is a juniper growing out of the bank. When you look directly across the creek there is a large, many branched, half dead cottonwood about 40m tall. Directly behind that cottonwood about 4m is a very large, gray, square boulder (3.5m tall). | |
| PP Upper Pipe 1 | 5 | 400783 | 3992380 | 9/15/2005 | Pre | Taken from about 8m downstream from where the surface water starts on creek left. Go up the slope roughly 6m from the water under a medium sized pinyon pine. Just below this pine, about 2m, is a large downed, dead tree. On the downstream side of the pine there is a young cottonwood on the upstream side there is a small/medium sized snowberry and right under that there is a juniper growing out of the bank. When you look directly across the creek there is a large, many branched, half dead cottonwood about 40m tall. Directly behind that cottonwood about 4m is a very large, gray, square boulder (3.5m tall). | Looking across the creek and slightly downstream to creek right. |
| PP Upper Pipe 1 | 6 | 400783 | 3992380 | 9/15/2005 | Pre | Taken from about 8m downstream from where the surface water starts on creek left. Go up the slope roughly 6m from the water under a medium sized pinyon pine. Just below this pine, about 2m, is a large downed, dead tree. On the downstream side of the pine there is a young cottonwood on the upstream side there is a small/medium sized snowberry and right under that there is a juniper growing out of the bank. When you look directly across the creek there is a large, many branched, half dead cottonwood about 40m tall. Directly behind that cottonwood about 4m is a very large, gray, square boulder (3.5m tall). | Looking downstream. |
| PP Upper Pipe 1 | 7 | 400783 | 3992380 | 9/15/2005 | Pre | Taken from about 8m downstream from where the surface water starts on creek left. Go up the slope roughly 6m from the water under a medium sized pinyon pine. Just below this pine, about 2m, is a large downed, dead tree. On the downstream side of the pine there is a young cottonwood on the upstream side there is a small/medium sized snowberry and right under that there is a juniper growing out of the bank. When you look directly across the creek there is a large, many branched, half dead cottonwood about 40m tall. Directly behind that cottonwood about 4m is a very large, gray, square boulder (3.5m tall). | Looking downstream but with a higher perspective than view 6. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
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| PP Upper Pipe 1 | 8 | 400783 | 3992380 | 9/15/2005 | Pre | Taken from about 8m downstream from where the surface water starts on creek left. Go up the slope roughly 6m from the water under a medium sized pinyon pine. Just below this pine, about 2m, is a large downed, dead tree. On the downstream side of the pine there is a young cottonwood on the upstream side there is a small/medium sized snowberry and right under that there is a juniper growing out of the bank. When you look directly across the creek there is a large, many branched, half dead cottonwood about 40m tall. Directly behind that cottonwood about 4m is a very large, gray, square boulder (3.5m tall). | Taken holding the camera high, looking directly down at the creek. |
| PP Upper Pipe 2 | 1 | 400764 | 3992431 | 9/15/2005 | Post | Moving downstream these photos are taken from under the cottonwood in the downstream photos of UP1. The cottonwood is about 25m tall branching 3 times at the bottom of the tree. There are 2 large (1x1m) gray boulders flanking the tree on the upstream side. | |
| PP Upper Pipe 2 | 1 | 400764 | 3992431 | 9/15/2005 | Pre | Moving downstream these photos are taken from under the cottonwood in the downstream photos of UP1. The cottonwood is about 25m tall branching 3 times at the bottom of the tree. There are 2 large (1x1m) gray boulders flanking the tree on the upstream side. | Looking upstream. |
| PP Upper Pipe 2 | 2 | 400764 | 3992431 | 9/15/2005 | Post | Moving downstream these photos are taken from under the cottonwood in the downstream photos of UP1. The cottonwood is about 25m tall branching 3 times at the bottom of the tree. There are 2 large (1x1m) gray boulders flanking the tree on the upstream side. | |
| PP Upper Pipe 2 | 2 | 400764 | 3992431 | 9/15/2005 | Pre | Moving downstream these photos are taken from under the cottonwood in the downstream photos of UP1. The cottonwood is about 25m tall branching 3 times at the bottom of the tree. There are 2 large (1x1m) gray boulders flanking the tree on the upstream side. | Looking slightly upstream creek right. |
| PP Upper Pipe 2 | 3 | 400764 | 3992431 | 9/15/2005 | Post | Moving downstream these photos are taken from under the cottonwood in the downstream photos of UP1. The cottonwood is about 25m tall branching 3 times at the bottom of the tree. There are 2 large (1x1m) gray boulders flanking the tree on the upstream side. | |
| PP Upper Pipe 2 | 3 | 400764 | 3992431 | 9/15/2005 | Pre | Moving downstream these photos are taken from under the cottonwood in the downstream photos of UP1. The cottonwood is about 25m tall branching 3 times at the bottom of the tree. There are 2 large (1x1m) gray boulders flanking the tree on the upstream side. | Looking across from the creek. |
| PP Upper Pipe 2 | 4 | 400764 | 3992431 | 9/15/2005 | Post | Moving downstream these photos are taken from under the cottonwood in the downstream photos of UP1. The cottonwood is about 25m tall branching 3 times at the bottom of the tree. There are 2 large (1x1m) gray boulders flanking the tree on the upstream side. | |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
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| PP Upper Pipe 2 | 4 | 400764 | 3992431 | 9/15/2005 | Pre | Moving downstream these photos are taken from under the cottonwood in the downstream photos of UP1. The cottonwood is about 25m tall branching 3 times at the bottom of the tree. There are 2 large (1x1m) gray boulders flanking the tree on the upstream side. | Looking across the creek. |
| PP Upper Pipe 2 | 5 | 400764 | 3992431 | 9/15/2005 | Pre | Moving downstream these photos are taken from under the cottonwood in the downstream photos of UP1. The cottonwood is about 25m tall branching 3 times at the bottom of the tree. There are 2 large (1x1m) gray boulders flanking the tree on the upstream side. | Looking downstream creek right. |
| PP Upper Pipe 2 | 5 | 400764 | 3992431 | 9/15/2005 | Post | Moving downstream these photos are taken from under the cottonwood in the downstream photos of UP1. The cottonwood is about 25m tall branching 3 times at the bottom of the tree. There are 2 large (1x1m) gray boulders flanking the tree on the upstream side. | |
| PP Upper Pipe 2 | 6 | 400764 | 3992431 | 9/15/2005 | Pre | Moving downstream these photos are taken from under the cottonwood in the downstream photos of UP1. The cottonwood is about 25m tall branching 3 times at the bottom of the tree. There are 2 large (1x1m) gray boulders flanking the tree on the upstream side. | Looking directly downstream. |
| PP Upper Pipe 2 | 6 | 400764 | 3992431 | 9/15/2005 | Post | Moving downstream these photos are taken from under the cottonwood in the downstream photos of UP1. The cottonwood is about 25m tall branching 3 times at the bottom of the tree. There are 2 large (1x1m) gray boulders flanking the tree on the upstream side. | |
| PP Upper Pipe 2 | 7 | 400764 | 3992431 | 9/15/2005 | Pre | Moving downstream these photos are taken from under the cottonwood in the downstream photos of UP1. The cottonwood is about 25m tall branching 3 times at the bottom of the tree. There are 2 large (1x1m) gray boulders flanking the tree on the upstream side. | Looking downstream creek left. |
| PP Upper Pipe 2 | 7 | 400764 | 3992431 | 9/15/2005 | Post | Moving downstream these photos are taken from under the cottonwood in the downstream photos of UP1. The cottonwood is about 25m tall branching 3 times at the bottom of the tree. There are 2 large (1x1m) gray boulders flanking the tree on the upstream side. | |
| PP Upper Pipe 2 | A | 400764 | 3992431 | 9/15/2005 | Pre | Moving downstream these photos are taken from under the cottonwood in the downstream photos of UP1. The cottonwood is about 25m tall branching 3 times at the bottom of the tree. There are 2 large (1x1m) gray boulders flanking the tree on the upstream side. | Photopoint. |
| PP Upper Pipe 3 | 1 | 400732 | 3992474 | 9/15/2005 | Pre | Taken from under a cottonwood on creek right. The cottonwood is growing at the end of the shale/sandstone terrace that begins about 30m upstream. The tree has a distinct bend to the left and a root protruding about 1m up from the ground on the right looking downstream. All the growth on the tree is on the right side with a few dead branches out to the left. Just behind and to the right, about 12m, there is a large (6m tall) sandstone boulder. No TAMRAM. | Looking upstream. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|-----------|-----------------------|---|----------------------------|
| PP Upper Pipe 3 | 2 | 400732 | 3992474 | 9/15/2005 | Pre | Taken from under a cottonwood on creek right. The cottonwood is growing at the end of the shale/sandstone terrace that begins about 30m upstream. The tree has a distinct bend to the left and a root protruding about 1m up from the ground on the right looking downstream. All the growth on the tree is on the right side with a few dead branches out to the left. Just behind and to the right, about 12m, there is a large (6m tall) sandstone boulder. No TAMRAM. | Looking across the stream. |
| PP Upper Pipe 3 | 3 | 400732 | 3992474 | 9/15/2005 | Pre | Taken from under a cottonwood on creek right. The cottonwood is growing at the end of the shale/sandstone terrace that begins about 30m upstream. The tree has a distinct bend to the left and a root protruding about 1m up from the ground on the right looking downstream. All the growth on the tree is on the right side with a few dead branches out to the left. Just behind and to the right, about 12m, there is a large (6m tall) sandstone boulder. No TAMRAM. | Looking downstream. |
| PP Upper Pipe 3 | A | 400732 | 3992474 | 9/15/2005 | Pre | Taken from under a cottonwood on creek right. The cottonwood is growing at the end of the shale/sandstone terrace that begins about 30m upstream. The tree has a distinct bend to the left and a root protruding about 1m up from the ground on the right looking downstream. All the growth on the tree is on the right side with a few dead branches out to the left. Just behind and to the right, about 12m, there is a large (6m tall) sandstone boulder. No TAMRAM. | Photopoint. |
| PP Upper Pipe 4 | 1 | 400717 | 3992503 | 9/15/2005 | Pre | Taken from a large (2m high) limestone boulder on creek left. There are 2 small cottonwoods, one on the upstream side and one on the downstream side. There is a medium sized juniper upstream and about 4m from the boulder. When you sit on the boulder and look east you see the Redwall limestone layer and it appears to abruptly end (on the downstream end). | Looking upstream. |
| PP Upper Pipe 4 | 1 | 400717 | 3992503 | 9/15/2005 | Post | Taken from a large (2m high) limestone boulder on creek left. There are 2 small cottonwoods, one on the upstream side and one on the downstream side. There is a medium sized juniper upstream and about 4m from the boulder. When you sit on the boulder and look east you see the Redwall limestone layer and it appears to abruptly end (on the downstream end). | |
| PP Upper Pipe 4 | 2 | 400717 | 3992503 | 9/15/2005 | Post | Taken from a large (2m high) limestone boulder on creek left. There are 2 small cottonwoods, one on the upstream side and one on the downstream side. There is a medium sized juniper upstream and about 4m from the boulder. When you sit on the boulder and look east you see the Redwall limestone layer and it appears to abruptly end (on the downstream end). | |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|-----------|-----------------------|--|---|
| PP Upper Pipe 4 | 2 | 400717 | 3992503 | 9/15/2005 | Pre | Taken from a large (2m high) limestone boulder on creek left. There are 2 small cottonwoods, one on the upstream side and one on the downstream side. There is a medium sized juniper upstream and about 4m from the boulder. When you sit on the boulder and look east you see the Redwall limestone layer and it appears to abruptly end (on the downstream end). | Looking across the stream to creek right. |
| PP Upper Pipe 4 | 3 | 400717 | 3992503 | 9/15/2005 | Pre | Taken from a large (2m high) limestone boulder on creek left. There are 2 small cottonwoods, one on the upstream side and one on the downstream side. There is a medium sized juniper upstream and about 4m from the boulder. When you sit on the boulder and look east you see the Redwall limestone layer and it appears to abruptly end (on the downstream end). | Looking downstream. |
| PP Upper Pipe 4 | 3 | 400717 | 3992503 | 9/15/2005 | Post | Taken from a large (2m high) limestone boulder on creek left. There are 2 small cottonwoods, one on the upstream side and one on the downstream side. There is a medium sized juniper upstream and about 4m from the boulder. When you sit on the boulder and look east you see the Redwall limestone layer and it appears to abruptly end (on the downstream end). | |
| PP Upper Pipe 4 | A | 400717 | 3992503 | 9/15/2005 | Pre | Taken from a large (2m high) limestone boulder on creek left. There are 2 small cottonwoods, one on the upstream side and one on the downstream side. There is a medium sized juniper upstream and about 4m from the boulder. When you sit on the boulder and look east you see the Redwall limestone layer and it appears to abruptly end (on the downstream end). | Melissa at photopoint. |
| PP Upper Pipe 5 | 1 | 400713 | 3992535 | 9/15/2005 | Pre | There is a series of 3 medium sized, limestone boulders (3x1m) along creek. Moving perpendicular from the creek, a small sandstone rock (0.5m high) is near. The limestone rock the photopoint is taken from is 6m wide and 1m high. The rock is relatively flat on top. Directly across the creek is a 2m high limestone boulder about 2m from the creek. Just downstream from the rock is a small cottonwood; 3m high and dead on top. | Looking upstream to creek right. No bearing was recorded. |
| PP Upper Pipe 5 | 1 | 400713 | 3992535 | 9/15/2005 | Post | There is a series of 3 medium sized, limestone boulders (3x1m) along creek. Moving perpendicular from the creek, a small sandstone rock (0.5m high) is near. The limestone rock the photopoint is taken from is 6m wide and 1m high. The rock is relatively flat on top. Directly across the creek is a 2m high limestone boulder about 2m from the creek. Just downstream from the rock is a small cottonwood; 3m high and dead on top. | No bearing was recorded. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|-----------|-----------------------|--|---|
| PP Upper Pipe 5 | 2 | 400713 | 3992535 | 9/15/2005 | Post | There is a series of 3 medium sized, limestone boulders (3x1m) along creek. Moving perpendicular from the creek, a small sandstone rock (0.5m high) is near. The limestone rock the photopoint is taken from is 6m wide and 1m high. The rock is relatively flat on top. Directly across the creek is a 2m high limestone boulder about 2m from the creek. Just downstream from the rock is a small cottonwood; 3m high and dead on top. | No bearing was recorded. |
| PP Upper Pipe 5 | 2 | 400713 | 3992535 | 9/15/2005 | Pre | There is a series of 3 medium sized, limestone boulders (3x1m) along creek. Moving perpendicular from the creek, a small sandstone rock (0.5m high) is near. The limestone rock the photopoint is taken from is 6m wide and 1m high. The rock is relatively flat on top. Directly across the creek is a 2m high limestone boulder about 2m from the creek. Just downstream from the rock is a small cottonwood; 3m high and dead on top. | Looking upstream creek left. No bearing was recorded. |
| PP Upper Pipe 5 | 3 | 400713 | 3992535 | 9/15/2005 | Pre | There is a series of 3 medium sized, limestone boulders (3x1m) along creek. Moving perpendicular from the creek, a small sandstone rock (0.5m high) is near. The limestone rock the photopoint is taken from is 6m wide and 1m high. The rock is relatively flat on top. Directly across the creek is a 2m high limestone boulder about 2m from the creek. Just downstream from the rock is a small cottonwood; 3m high and dead on top. | Looking directly across the creek. No bearing was recorded. |
| PP Upper Pipe 5 | 3 | 400713 | 3992535 | 9/15/2005 | Post | There is a series of 3 medium sized, limestone boulders (3x1m) along creek. Moving perpendicular from the creek, a small sandstone rock (0.5m high) is near. The limestone rock the photopoint is taken from is 6m wide and 1m high. The rock is relatively flat on top. Directly across the creek is a 2m high limestone boulder about 2m from the creek. Just downstream from the rock is a small cottonwood; 3m high and dead on top. | No bearing was recorded. |
| PP Upper Pipe 5 | 4 | 400713 | 3992535 | 9/15/2005 | Post | There is a series of 3 medium sized, limestone boulders (3x1m) along creek. Moving perpendicular from the creek, a small sandstone rock (0.5m high) is near. The limestone rock the photopoint is taken from is 6m wide and 1m high. The rock is relatively flat on top. Directly across the creek is a 2m high limestone boulder about 2m from the creek. Just downstream from the rock is a small cottonwood; 3m high and dead on top. | No bearing was recorded. |
| PP Upper Pipe 5 | 4 | 400713 | 3992535 | 9/15/2005 | Pre | There is a series of 3 medium sized, limestone boulders (3x1m) along creek. Moving perpendicular from the creek, a small sandstone rock (0.5m high) is near. The limestone rock the photopoint is taken from is 6m wide and 1m high. The rock is relatively flat on top. Directly across the creek is a 2m high limestone boulder about 2m from the creek. Just downstream from the rock is a small cottonwood; 3m high and dead on top. | Looking directly downstream. No bearing was recorded. |

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|-----------------|------|-------------|--------------|-----------|-----------------------|--|--|
| PP Upper Pipe 5 | 5 | 400713 | 3992535 | 9/15/2005 | Pre | There is a series of 3 medium sized, limestone boulders (3x1m) along creek. Moving perpendicular from the creek, a small sandstone rock (0.5m high) is near. The limestone rock the photopoint is taken from is 6m wide and 1m high. The rock is relatively flat on top. Directly across the creek is a 2m high limestone boulder about 2m from the creek. Just downstream from the rock is a small cottonwood; 3m high and dead on top. | Looking directly behind the photopoint. No bearing was recorded. |
| PP Upper Pipe 5 | 5 | 400713 | 3992535 | 9/15/2005 | Post | There is a series of 3 medium sized, limestone boulders (3x1m) along creek. Moving perpendicular from the creek, a small sandstone rock (0.5m high) is near. The limestone rock the photopoint is taken from is 6m wide and 1m high. The rock is relatively flat on top. Directly across the creek is a 2m high limestone boulder about 2m from the creek. Just downstream from the rock is a small cottonwood; 3m high and dead on top. | No bearing was recorded. |
| PP Upper Pipe 5 | 6 | 400713 | 3992535 | 9/15/2005 | Pre | There is a series of 3 medium sized, limestone boulders (3x1m) along creek. Moving perpendicular from the creek, a small sandstone rock (0.5m high) is near. The limestone rock the photopoint is taken from is 6m wide and 1m high. The rock is relatively flat on top. Directly across the creek is a 2m high limestone boulder about 2m from the creek. Just downstream from the rock is a small cottonwood; 3m high and dead on top. | Looking downstream to creek left. No bearing was recorded. |
| PP Upper Pipe 5 | 6 | 400713 | 3992535 | 9/15/2005 | Post | There is a series of 3 medium sized, limestone boulders (3x1m) along creek. Moving perpendicular from the creek, a small sandstone rock (0.5m high) is near. The limestone rock the photopoint is taken from is 6m wide and 1m high. The rock is relatively flat on top. Directly across the creek is a 2m high limestone boulder about 2m from the creek. Just downstream from the rock is a small cottonwood; 3m high and dead on top. | No bearing was recorded. |
| PP Upper Pipe 5 | A | 400713 | 3992535 | 9/15/2005 | Pre | There is a series of 3 medium sized, limestone boulders (3x1m) along creek. Moving perpendicular from the creek, a small sandstone rock (0.5m high) is near. The limestone rock the photopoint is taken from is 6m wide and 1m high. The rock is relatively flat on top. Directly across the creek is a 2m high limestone boulder about 2m from the creek. Just downstream from the rock is a small cottonwood; 3m high and dead on top. | Photopoint. |
| PP Upper Pipe 6 | 1 | 400702 | 3992585 | 9/15/2005 | Pre | The Tonto trail crosses Pipe creek and right as you step across there is a large limestone rock on the right of the trail. This rock is about 2m long with a sloping flat face. Behind and slightly upstream (about 0.5m away) there is a small cottonwood about 3m tall. | Looking upstream towards creek left. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
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| PP Upper Pipe 6 | 2 | 400702 | 3992585 | 9/15/2005 | Pre | The Tonto trail crosses Pipe creek and right as you step across there is a large limestone rock on the right of the trail. This rock is about 2m long with a sloping flat face. Behind and slightly upstream (about 0.5m away) there is a small cottonwood about 3m tall. | Looking directly across the creek. |
| PP Upper Pipe 6 | 2 | 400702 | 3992585 | 9/15/2005 | Post | The Tonto trail crosses Pipe creek and right as you step across there is a large limestone rock on the right of the trail. This rock is about 2m long with a sloping flat face. Behind and slightly upstream (about 0.5m away) there is a small cottonwood about 3m tall. | |
| PP Upper Pipe 6 | 3 | 400702 | 3992585 | 9/15/2005 | Pre | The Tonto trail crosses Pipe creek and right as you step across there is a large limestone rock on the right of the trail. This rock is about 2m long with a sloping flat face. Behind and slightly upstream (about 0.5m away) there is a small cottonwood about 3m tall. | Looking downstream to creek left. |
| PP Upper Pipe 6 | 4 | 400702 | 3992585 | 9/15/2005 | Pre | The Tonto trail crosses Pipe creek and right as you step across there is a large limestone rock on the right of the trail. This rock is about 2m long with a sloping flat face. Behind and slightly upstream (about 0.5m away) there is a small cottonwood about 3m tall. | Looking downstream to creek left. |
| PP Upper Pipe 6 | A | 400702 | 3992585 | 9/15/2005 | Pre | The Tonto trail crosses Pipe creek and right as you step across there is a large limestone rock on the right of the trail. This rock is about 2m long with a sloping flat face. Behind and slightly upstream (about 0.5m away) there is a small cottonwood about 3m tall. | Photopoint. |
| PP Upper Pipe W Fork 1-1 | 1 | 399659 | 3992578 | 9/16/2005 | Pre | Taken from the top of the drainage where it cliffs out. There is a large (3x3m) boulder about 8m from the base of the cliff. It is the biggest boulder lodged in the center of the drainage. | Looking directly upstream at cliff. |
| PP Upper Pipe W Fork 1-1 | 2 | 399659 | 3992578 | 9/16/2005 | Pre | Taken from the top of the drainage where it cliffs out. There is a large (3x3m) boulder about 8m from the base of the cliff. It is the biggest boulder lodged in the center of the drainage. | Looking downstream. |
| PP Upper Pipe W Fork 1-1 | A | 399659 | 3992578 | 9/16/2005 | Pre | Taken from the top of the drainage where it cliffs out. There is a large (3x3m) boulder about 8m from the base of the cliff. It is the biggest boulder lodged in the center of the drainage. | View of photopoint. |
| PP Upper Pipe W Fork 1-2 | 1 | 399987 | 3993026 | 9/16/2005 | Pre | Start where the Tonto trail crosses the drainage; at that point walk downstream about 90m. On creek left there is a huge (5mx5m) sandstone boulder that slopes upstream. Looking straight across the drainage there is a sandstone outcropping the shape of half dome. It's about 20m from the creek bottom. | Looking upstream. No bearing was recorded. |
| PP Upper Pipe W Fork 1-2 | 2 | 399987 | 3993026 | 9/16/2005 | Post | Start where the Tonto trail crosses the drainage; at that point walk downstream about 90m. On creek left there is a huge (5mx5m) sandstone boulder that slopes upstream. Looking straight across the drainage there is a sandstone outcropping the shape of half dome. It's about 20m from the creek bottom. | Looking directly across after the tammie was removed. No bearing was recorded. |

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|--------------------------|------|-------------|--------------|-----------|-----------------------|--|---|
| PP Upper Pipe W Fork 1-2 | 2 | 399987 | 3993026 | 9/16/2005 | Pre | Start where the Tonto trail crosses the drainage; at that point walk downstream about 90m. On creek left there is a huge (5mx5m) sandstone boulder that slopes upstream. Looking straight across the drainage there is a sandstone outcropping the shape of half dome. It's about 20m from the creek bottom. | Looking directly across at the lone tammie. No bearing recorded. |
| PP Upper Pipe W Fork 1-2 | A | 399987 | 3993026 | 9/16/2005 | Pre | Start where the Tonto trail crosses the drainage; at that point walk downstream about 90m. On creek left there is a huge (5mx5m) sandstone boulder that slopes upstream. Looking straight across the drainage there is a sandstone outcropping the shape of half dome. It's about 20m from the creek bottom. | Photopoint. |
| PP Wall 1 | 1 | 405959 | 4002646 | 2/2/2007 | Pre | Standing on creek left on the bank next to a big scrub oak on a cottonwood carcass. This is where the creek makes an S bend and above a cottonwood clinging to a cliff on creek left. | Looking downstream at creek left cliff with an amazing cottonwood clinging to the side of the cliff. TAMRAM in the foreground with Val. |
| PP Wall 1 | 1 | 405959 | 4002646 | 2/2/2007 | Post | Standing on creek left on the bank next to a big scrub oak on a cottonwood carcass. This is where the creek makes an S bend and above a cottonwood clinging to a cliff on creek left. | Post work. |
| PP Wall 1 | A | 405959 | 4002646 | 2/2/2007 | Pre | Standing on creek left on the bank next to a big scrub oak on a cottonwood carcass. This is where the creek makes an S bend and above a cottonwood clinging to a cliff on creek left. | Stick points at PP. Taken from upstream. |
| PP Wall 2 | 1 | 406180 | 4002531 | 2/3/2007 | Pre | No UTMs available. Got UTMS from GIS-field verify. Sitting on a large limestone boulder against a terrace bank on creek right. This is about 50m from the creek. To get on top there is a climb up the upstream side. | Looking upstream. No TAMRAM. |
| PP Wall 2 | 2 | 406180 | 4002531 | 2/3/2007 | Post | No UTMs available. Got UTMS from GIS-field verify. Sitting on a large limestone boulder against a terrace bank on creek right. This is about 50m from the creek. To get on top there is a climb up the upstream side. | Post work. |
| PP Wall 2 | 2 | 406180 | 4002531 | 2/3/2007 | Pre | No UTMs available. Got UTMS from GIS-field verify. Sitting on a large limestone boulder against a terrace bank on creek right. This is about 50m from the creek. To get on top there is a climb up the upstream side. | Looking downstream at creek right terrace. Black boulder in bottom right hand corner. There is also a large oak in the background. |
| PP Wall 2 | 3 | 406180 | 4002531 | 2/3/2007 | Post | No UTMs available. Got UTMS from GIS-field verify. Sitting on a large limestone boulder against a terrace bank on creek right. This is about 50m from the creek. To get on top there is a climb up the upstream side. | Post work. |
| PP Wall 2 | 3 | 406180 | 4002531 | 2/3/2007 | Pre | No UTMs available. Got UTMS from GIS-field verify. Sitting on a large limestone boulder against a terrace bank on creek right. This is about 50m from the creek. To get on top there is a climb up the upstream side. | Looking just left of view 2. An ACENEG is on the left of the picture. |
| PP Wall 2 | A | 406180 | 4002531 | 2/3/2007 | Pre | No UTMs available. Got UTMS from GIS-field verify. Sitting on a large limestone boulder against a terrace bank on creek right. This is about 50m from the creek. To get on top there is a climb up the upstream side. | Loren at PP. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|------------|-----------------------|---|---|
| PP Wall 3 | 1 | 407334 | 4002610 | 11/5/2006 | Pre | This is about 65m from where section 4 starts (there are many channels). Taken on a mound of rocks in the center of 2 drainages, one wet and one dry. Note: Buddha Temple in the background of view A. | Looking to creek left. |
| PP Wall 3 | 1 | 407334 | 4002610 | 11/5/2006 | Post | This is about 65m from where section 4 starts (there are many channels). Taken on a mound of rocks in the center of 2 drainages, one wet and one dry. Note: Buddha Temple in the background of view A. | Post work. |
| PP Wall 3 | 2 | 407334 | 4002610 | 11/5/2006 | Pre | This is about 65m from where section 4 starts (there are many channels). Taken on a mound of rocks in the center of 2 drainages, one wet and one dry. Note: Buddha Temple in the background of view A. | Looking to creek right. |
| PP Wall 3 | 2 | 407334 | 4002610 | 11/5/2006 | Post | This is about 65m from where section 4 starts (there are many channels). Taken on a mound of rocks in the center of 2 drainages, one wet and one dry. Note: Buddha Temple in the background of view A. | Post work. |
| PP Wall 3 | A | 407334 | 4002610 | 11/5/2006 | Pre | This is about 65m from where section 4 starts (there are many channels). Taken on a mound of rocks in the center of 2 drainages, one wet and one dry. Note: Buddha Temple in the background of view A. | Pen is pointing at PP rock. It is on creek right in the middle of a rock mound. Note Buddha Temple. |
| PP Woosley 1 | 1 | 418554 | 4015075 | 11/16/2005 | Pre | Located at a Tapeats sandstone boulder (4x4m), 50m above the drainage on creek left at a bend in the creek. This is SW of Marion Pt. | Wide view, looking upstream into the drainage. |
| PP Woosley 1 | 1 | 418554 | 4015075 | 4/1/2006 | Post | Located at a Tapeats sandstone boulder (4x4m), 50m above the drainage on creek left at a bend in the creek. This is SW of Marion Pt. | Post work. |
| PP Woosley 1 | 2 | 418554 | 4015075 | 11/16/2005 | Pre | Located at a Tapeats sandstone boulder (4x4m), 50m above the drainage on creek left at a bend in the creek. This is SW of Marion Pt. | Wide view, looking downstream onto drainage from the top of SW slope. |
| PP Woosley 1 | 3 | 418554 | 4015075 | 11/16/2005 | Pre | Located at a Tapeats sandstone boulder (4x4m), 50m above the drainage on creek left at a bend in the creek. This is SW of Marion Pt. | Tight or zoomed view of upstream. |
| PP Woosley 1 | 3 | 418554 | 4015075 | 4/1/2006 | Post | Located at a Tapeats sandstone boulder (4x4m), 50m above the drainage on creek left at a bend in the creek. This is SW of Marion Pt. | Post work. |
| PP Woosley 1 | 4 | 418554 | 4015075 | 11/16/2005 | Pre | Located at a Tapeats sandstone boulder (4x4m), 50m above the drainage on creek left at a bend in the creek. This is SW of Marion Pt. | Tight or zoomed view of downstream. |
| PP Woosley 1 | 4 | 418554 | 4015075 | 4/1/2006 | Post | Located at a Tapeats sandstone boulder (4x4m), 50m above the drainage on creek left at a bend in the creek. This is SW of Marion Pt. | Post work. |
| PP Woosley 1 | A | 418554 | 4015075 | 11/16/2005 | Pre | Located at a Tapeats sandstone boulder (4x4m), 50m above the drainage on creek left at a bend in the creek. This is SW of Marion Pt. | Kate's bag on the photopoint rock. Taken from down slope of the limestone boulder. |
| PP Woosley 2 | 1 | 418129 | 4015233 | 4/3/2006 | Post | Taken sitting atop a blue Supergroup ledge about 400m above the start of Nanko-Woosley 1. There is a huge "V" cottonwood 20m downstream. This stretch of creek is narrow, straight and runs right along the blue-colored wall on its right. | Post work. |

| Photopoint Name | View | UTM Easting | UTM Northing | Date | Pre or Post Treatment | Description of Photopoint | View from Photopoint |
|-----------------|------|-------------|--------------|----------|-----------------------|---|--|
| PP Woosley 2 | 1 | 418129 | 4015233 | 4/3/2006 | Pre | Taken sitting atop a blue Supergroup ledge about 400m above the start of Nanko-Woosley 1. There is a huge "V" cottonwood 20m downstream. This stretch of creek is narrow, straight and runs right along the blue-colored wall on its right. | Looking downstream at mature TAMRAM. |
| PP Woosley 2 | A | 418129 | 4015233 | 4/3/2006 | Pre | Taken sitting atop a blue Supergroup ledge about 400m above the start of Nanko-Woosley 1. There is a huge "V" cottonwood 20m downstream. This stretch of creek is narrow, straight and runs right along the blue-colored wall on its right. | Pen is pointing at blue ledge with cottonwood in the background. |
| PP Woosley 3-1 | 1 | 418052 | 4015256 | 4/3/2006 | Pre | This photopoint is 20m above the start of Nanko-Woosley 2-1, on a 1x1x1m boulder on creek right at "S" curve in creek. | Looking upstream at mature TAMRAM. |
| PP Woosley 3-1 | 1 | 418052 | 4015256 | 4/3/2006 | Post | This photopoint is 20m above the start of Nanko-Woosley 2-1, on a 1x1x1m boulder on creek right at "S" curve in creek. | Post work. |
| PP Woosley 3-1 | 2 | 418052 | 4015256 | 4/3/2006 | Pre | This photopoint is 20m above the start of Nanko-Woosley 2-1, on a 1x1x1m boulder on creek right at "S" curve in creek. | Looking downstream at mature TAMRAM. |
| PP Woosley 3-1 | 2 | 418052 | 4015256 | 4/3/2006 | Post | This photopoint is 20m above the start of Nanko-Woosley 2-1, on a 1x1x1m boulder on creek right at "S" curve in creek. | Post work. |
| PP Woosley 3-1 | A | 418052 | 4015256 | 4/3/2006 | Pre | This photopoint is 20m above the start of Nanko-Woosley 2-1, on a 1x1x1m boulder on creek right at "S" curve in creek. | Pen is pointing at photopoint boulder. Supergroup hillside in the background. Taken from 15m upstream. |
| PP Woosley 3-2 | 1 | 417975 | 4015223 | 4/3/2006 | Post | Taken from a boulder on creek right, 40m below the source of the Woosley Fork creek. There is a small Cladium patch just across the stream about 4m away. | Post work. |
| PP Woosley 3-2 | 1 | 417975 | 4015223 | 4/3/2006 | Pre | Taken from a boulder on creek right, 40m below the source of the Woosley Fork creek. There is a small Cladium patch just across the stream about 4m away. | Looking upstream at a monster TAMRAM. |
| PP Woosley 3-2 | 2 | 417975 | 4015223 | 4/3/2006 | Post | Taken from a boulder on creek right, 40m below the source of the Woosley Fork creek. There is a small Cladium patch just across the stream about 4m away. | Post work. |
| PP Woosley 3-2 | 2 | 417975 | 4015223 | 4/3/2006 | Pre | Taken from a boulder on creek right, 40m below the source of the Woosley Fork creek. There is a small Cladium patch just across the stream about 4m away. | Looking downstream at matures. |
| PP Woosley 3-2 | A | 417975 | 4015223 | 4/3/2006 | Pre | Taken from a boulder on creek right, 40m below the source of the Woosley Fork creek. There is a small Cladium patch just across the stream about 4m away. | Pen is pointing at photopoint rock. There are cottonwoods at the spring in the background. |

PP 112 Mile 1

Photopoints printed on:
Monday, October 15, 2007

RM: 112 RS: L

Easting: 373749 Northing: 4011271 Height: 5'03

Project: Phase IIa

Photopoint Description: Taken from middrainage about 60m from highwater line on pink 1.5x1x2m sandstone boulder. This boulder is at the base of 15x8m (tall) gneiss/schist veined bedrock.

View # 1

Bearing: 270

5/14/2005 10:15 AM Pre Treatment

Taken looking downstream at 3m tall ACAGRE up slope. Taken from creek right. Redwall, Supai and Tapeats in skyline.



11/1/2005 3:00 PM Post Treatment

Post work.



View # 2

Bearing: 81

5/14/2005 10:21 AM Pre Treatment

Looking upstream at mature tamarisk 8m away, mid-drainage. View of where canyon cliffs out at 8m high waterfall with chalkstones.



11/1/2005 3:00 PM Post Treatment

Post work.



PP 112 Mile 1

Photopoints printed on:
Monday, October 15, 2007

RM: 112 RS: L

Easting: 373749 Northing: 4011271 Height: 5'03

Project: Phase IIa

Photopoint Description: Taken from middrainage about 60m from highwater line on pink 1.5x1x2m sandstone boulder. This boulder is at the base of 15x8m (tall) gneiss/schist veined bedrock.

View # A Bearing:

5/14/2005 10:22 AM Pre Treatment

Taken 6m downstream from photopoint at mouth of 2nd major waterfall.



PP 130 Mile 1

Photopoints printed on:
Monday, October 15, 2007

RM: 130 RS: R

Easting: 368274 Northing: 4020698 Height: 5'04

Project: Phase IIa

Photopoint Description: Taken from on top 2 huge schist boulders that chock canyon forming a 5m waterfall.

View # 1 Bearing: 318

5/14/2005 4:22 PM Pre Treatment

Steve standing on Zoroaster boulder that chocks canyon below a huge falls.



11/3/2005 3:00 PM Post Treatment

Post work.



View # 2 Bearing: 138

5/14/2005 4:28 PM Pre Treatment

Looking at huge waterfall in top left with a large 7x4x5m shade at bottom right.



11/3/2005 3:00 PM Post Treatment

Post work.



PP 130 Mile 1

Photopoints printed on:
Monday, October 15, 2007

RM: 130 RS: R

Easting: 368274 Northing: 4020698 Height:

Project: Phase IIa

Photopoint Description: Taken from on top 2 huge schist boulders that chock canyon forming a 5m waterfall.

View # A

Bearing:

5/14/2005 4:28 PM Pre Treatment

Steve standing at photopoint on Zoroaster boulder that chocks canyon below the huge fall. Photo taken 6m below the 5m fall.



PP 225 Mile 2

Photopoints printed on:
Monday, October 15, 2007

RM: 225 RS: R

Easting: 285505 Northing: 3961530 Height: 5'02

Project: Phase IIa

Photopoint Description: Taken from in the drainage, standing slightly creek left (1/2m). To the north of sheer granite 7m tall slab.
Water start. E: 285546 N: 3961453 acc. 9m

View # 1

Bearing: 303

5/19/2005 1:22 PM Pre Treatment

Looking upstream. View of red "mesa" on skyline. The drainage narrows upstream, there are granite walls and boulders for about 400m up the drainage from photopoint.



5/20/2006 12:00 PM Post Treatment

Looking upstream. View of red mesa on skyline. The drainage narrows upstream, there are granite walls and boulders for about 400m up the drainage from photopoint.



3/8/2006

Post Treatment

Post work.



PP 225 Mile 2

Photopoints printed on:
Monday, October 15, 2007

RM: 225 RS: R

Easting: 285505 Northing: 3961530 Height: 5'02

Project: Phase IIa

Photopoint Description: Taken from in the drainage, standing slightly creek left (1/2m). To the north of sheer granite 7m tall slab.
Water start. E: 285546 N: 3961453 acc. 9m

View # 2

Bearing: 129

5/20/2006 12:01 PM Post Treatment

5/19/2005 1:22 PM Pre Treatment

Looking downstream towards brown cliffs with the skyline visible. There are broken granite boulders visible.

Looking downstream towards brown cliffs with the skyline visible. There are broken granite boulders visible.



3/8/2006

Post Treatment

Post work.



View # A

Bearing:

5/19/2005 1:22 PM Pre Treatment

Looking at photopoint with cliff on creek right.
Taken from 10m downstream on creek left.

36.5 mile 1

Photopoints printed on:
Friday, October 19, 2007

RM: 36.6 RS: R

Easting: 424244 Northing: 4033941 Height:

Project: Phase IIa

Photopoint Description: Standing at the top of lower portion of bowl on slick rock fall, below narrow slick rock fall that you can climb around on the right. Taken from canyon left at top of slick rock falls, right at bottom part of upper bowl.

View # 1 Bearing: 153

5/7/2005 10:22 AM Post Treatment

Looking down into lower bowl; TAMRAM stumps and debris are visible.



View # A Bearing:

5/7/2005 10:22 AM Pre Treatment

Lori at PP. Standing at the top of the lower portion of the bowl; below a narrow slick rock fall that you can climb around on the right.



View # 2 Bearing: 300

5/7/2005 10:27 AM Post Treatment

Looking up canyon into upper bowl; TAMRAM is gone.



PP 70.8 Mile 2

Photopoints printed on:
Friday, October 19, 2007

RM: 70.8 RS: L

Easting: 423078 Northing: 3993050 Height: 5'05

Project: Phase IIa

Photopoint Description: Taken approx. 100m up drainage from TAMRAM on drainage left side where smaller drainage enters. The point is approx. 100m past TAMRAM.

View # 1

Bearing: 128

5/10/2005 1:25 PM Pre Treatment

Looking up drainage with cliff top against skyline. Vegetation, cliff and sky, as well as the drainage end are visible.



View # A

Bearing:

5/10/2005 1:25 PM Pre Treatment

Nicole at photopoint (take fork on lookers right when walking up the drainage). The end of the drainage visible, as well as dry wash entering on drainage left.



View # 2

Bearing: 323

5/10/2005 1:34 PM Pre Treatment

Looking down the drainage towards the river.



PP Badger 1-1

Photopoints printed on:
Friday, October 19, 2007

RM: 8 RS: R

Easting: 441351 Northing: 4069827 Height: 5'10

Project: Phase IIa

Photopoint Description: Pock marked sandstone partially buried in the drainage near the mouth of canyon - above the high water line

View # 1

Bearing: 39

5/4/2005 3:25 PM Pre Treatment

View down the canyon showing seedlings and flowering tamarisk below the work area.



5/3/2006 11:00 AM Post Treatment

View down the canyon showing seedlings and flowering tamarisk below the work area.



View # 2

Bearing: 286

5/4/2005 3:43 PM Pre Treatment

Looking up canyon.
4.2x 4.6x 1.5 meters



5/3/2006 11:02 AM Post Treatment

Looking up canyon. 4.2x4.6x1.5 meters.



PP Badger 1-1

Photopoints printed on:
Friday, October 19, 2007

RM: 8 RS: R

Easting: 441351 Northing: 4069827 Height: 5'10

Project: Phase IIa

Photopoint Description: Pock marked sandstone partially buried in the drainage near the mouth of canyon - above the high water line

View # A Bearing:

5/4/2005 3:25 PM Pre Treatment

Steve at photopoint: mid-drainage about 6m down creek photopoint



View # B Bearing:

5/4/2005 3:25 PM Pre Treatment

Steve on photopoint; mid-drainage about 6m down creek of photopoint



PP Boucher 16-1

Photopoints printed on:
Monday, October 15, 2007

RM: 96.7 RS: L

Easting: 388378 Northing: 3996438 Height: 5'06

Project: Phase IIa

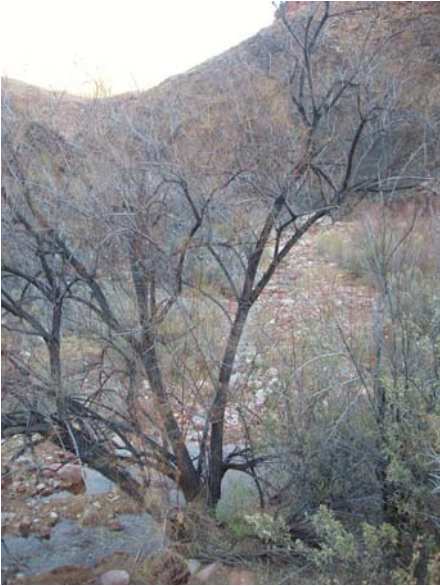
Photopoint Description: Photo taken from the large boulder that is close to both the creek and a social trail to access the creek. This is right at the creek right edge and 5m upstream of a large TAMRAM.

View # 1

Bearing: 340

1/6/2006 9:30 AM Pre Treatment

Looking downstream at mature TAMRAM and a large butte in left background.



1/6/2006 10:15 AM Post Treatment

Post work.



View # 2

Bearing: 190

1/6/2006 10:15 AM Post Treatment

Post work.



1/6/2006 9:30 AM Pre Treatment

Looking upstream towards tapers narrows of Boucher Creek.



PP Boucher 16-1

Photopoints printed on:
Monday, October 15, 2007

RM: 96.7 RS: L

Easting: 388378 Northing: 3996438 Height: 5'06

Project: Phase IIa

Photopoint Description: Photo taken from the large boulder that is close to both the creek and a social trail to access the creek. This is right at the creek right edge and 5m upstream of a large TAMRAM.

View # A

Bearing: 310

1/6/2006 9:30 AM Pre Treatment

Val on a large gray limestone (5x4x3m) boulder (photopoint).



PP Boulder 9

Photopoints printed on:
Friday, October 19, 2007

RM: 82.8 RS: L

Easting: 407180 Northing: 3991090 Height: 5'06

Project: Phase IIa

Photopoint Description: Taken from a sandy spot at the creek's first bend towards the NW. This is after the pouroff, about 300m below the Tonto crossing Boulder Canyon. This photopoint is also about 40m below the waterfall at the bottom of the Tapeats and the top of the schist.

View # 1

Bearing: 135

2/6/2006 11:00 AM Post Treatment

Post work.



View # 2

Bearing: 260

2/6/2006 11:00 AM Post Treatment

Post work.



2/6/2006 8:30 AM Pre Treatment

Looking upstream at 2 matures.



2/6/2006 8:30 AM Pre Treatment

Looking across stream at two big matures.



PP Boulder 9

Photopoints printed on:
Friday, October 19, 2007

RM: 82.8 RS: L

Easting: 407180 Northing: 3991090 Height: 5'06

Project: Phase IIa

Photopoint Description: Taken from a sandy spot at the creek's first bend towards the NW. This is after the pouroff, about 300m below the Tonto crossing Boulder Canyon. This photopoint is also about 40m below the waterfall at the bottom of the Tapeats and the top of the schist.

View # A Bearing: 315

2/6/2006 8:30 AM Pre Treatment

Jaime standing on schist. The Great Unconformity in the background.



PP Bright Angel 26

Photopoints printed on:
Friday, October 19, 2007

RM: 88 RS: R

Easting: 404913 Northing: 4001503 Height: 3'00

Project: Phase IIa

Photopoint Description: Sitting on a VW sized boulder on creek right in a wide open bowl area. This is 500+m below Ribbon Falls.

View # 1

Bearing: 60

2/3/2007 12:10 PM Post Treatment

Post work.



View # 2

Bearing: 140

2/3/2007 10:30 AM Pre Treatment

Looking across the creek at a TAMRAM in SALEXI thicket. There is also a boulder on the left bank.



2/3/2007 10:30 AM Pre Treatment

Looking upstream at an ugly TAMRAM on the right bank.



2/3/2007 12:10 PM Post Treatment

Post work.



PP Bright Angel 26

Photopoints printed on:
Friday, October 19, 2007

RM: 88 RS: R

Easting: 404913 Northing: 4001503 Height: 3'00

Project: Phase IIa

Photopoint Description: Sitting on a VW sized boulder on creek right in a wide open bowl area. This is 500+m below Ribbon Falls.

View # 3 Bearing: 210

2/3/2007 10:30 AM Pre Treatment

Looking downstream.



View # A Bearing: 30

2/3/2007 10:40 AM Pre Treatment

Taken from downstream on the creek right bank. Looking upstream.



PP Bright Angel T1A End

Photopoints printed on:
Friday, October 19, 2007

RM: 88 RS: R

Easting: 403656 Northing: 3999638 Height:

Project: Phase IIa

Photopoint Description: No GPS available. Transect end is on creek left embankment.

View # 1

Bearing: 14

6/7/2005 5:28 PM Pre Treatment

Looking up canyon, the transect is highly visible and there is a distinct skyline as well as a dry wash. There is a slick rock waterfall on creek right.



4/15/2006 11:30 AM Post Treatment

Looking up canyon, the transect is highly visible and there is a distinct skyline as well as a dry wash. There is a slick rock waterfall on creek right.



View # 2

Bearing: 294

6/7/2005 5:28 PM Pre Treatment

Looking across creek at intricate wash, a slick rock dry canyon which definitely runs at times.



4/15/2006 11:30 AM Post Treatment

Looking across the creek at intricate wash, a slick rock dry canyon which definitely runs at times.



PP Bright Angel T1A End

Photopoints printed on:
Friday, October 19, 2007

RM: 88 RS: R

Easting: 403656 Northing: 3999638 Height:

Photopoint Description: No GPS available. Transect end is on creek left embankment.

Project: Phase IIa

View # A Bearing:

6/7/2005 5:28 PM Pre Treatment

Looking at Kari on trail above and on creek left of the embankment. There is also a photopoint here.



PP Bright Angel T1A Start

Photopoints printed on:
Friday, October 19, 2007

RM: 88 RS: R

Easting: 403723 Northing: 3999435 Height:

Project: Phase IIa

Photopoint Description: Start is on the trail about 4m from a large TAMRAM.

View # 1

Bearing:

6/7/2005 5:28 PM Pre Treatment

Looking down creek at large TAMRAM where transect starts - skyline distinct. No bearing recorded.



View # 2

Bearing: 210

6/7/2005 5:28 PM Pre Treatment

Looking down creek at transect tape and vegetation.



4/15/2006 10:37 AM Post Treatment

Looking down creek where the transect starts. Skyline distinct.



4/15/2006 11:10 AM Post Treatment

Photopoint is pink Tapeats 2x2m. Looking down the creek at the transect tape.



PP Bright Angel T1A Start

Photopoints printed on:
Friday, October 19, 2007

RM: 88 RS: R

Easting: 403723 Northing: 3999435 Height: 5'4 "

Project: Phase Ila

Photopoint Description: Start is on the trail about 4m from a large TAMRAM.

View # 3 Bearing: 130

4/15/2006 11:29 AM Post Treatment

T1A start point. Directly SE towards the trail.



View # B Bearing: 200

4/15/2006 11:20 AM Post Treatment

Looking at Kelly on granite boulder on trail to left looking downstream.



View # A Bearing: 200

6/7/2005 5:28 PM Pre Treatment

Looking at Kari sitting on granite boulder on right of trail.



PP Carbon 8

Photopoints printed on:
Friday, October 19, 2007

RM: 64.7 RS: R

Easting: 424971 Northing: 4001481 Height: 6'00

Project: Phase IIa

Photopoint Description: Taken from 300m west of the narrows, obvious uplift of gold colored formation (photo taken from the base of the formation).

View # 1

Bearing: 220

5/9/2005

Pre Treatment

Looking upstream at a medium boulder in the creek.



5/9/2005

9:00 AM

Pre Treatment

Looking upstream at a medium boulder in the creek.



10/26/2005 11:15 AM Post Treatment

Post work.



10/26/2005

Post Treatment

Post work. Bearing is different than the pre photo.



PP Carbon 8

Photopoints printed on:
Friday, October 19, 2007

RM: 64.7 RS: R

Easting: 424971 Northing: 4001481 Height:

Project: Phase IIa

Photopoint Description: Taken from 300m west of the narrows, obvious uplift of gold colored formation (photo taken from the base of the formation).

5/6/2006 8:43 AM Post Treatment

Looking upstream at a medium sized boulder in the creek.



View # 2

Bearing: 62

10/26/2005

Post Treatment

Post work.



10/26/2005 11:15 AM Post Treatment

Post work.



PP Carbon 8

Photopoints printed on:
Friday, October 19, 2007

RM: 64.7 RS: R

Easting: 424971 Northing: 4001481 Height: 6'00

Project: Phase IIa

Photopoint Description: Taken from 300m west of the narrows, obvious uplift of gold colored formation (photo taken from the base of the formation).

View # A

Bearing:

5/9/2005 9:01 AM Pre Treatment

Looking upstream; Dan Hall at photopoint.



5/9/2005

Pre Treatment

Looking upstream; Dan Hall at photopoint.



View # B

Bearing:

5/9/2005 9:05 AM Pre Treatment

Looking downstream, at Dan Hall on photopoint



5/9/2005

Pre Treatment

Looking downstream; Dan Hall at photopoint.

PP Carbon Hydro 2

Photopoints printed on:
Friday, October 19, 2007

RM: 64.7 RS: R

Easting: 424652 Northing: 4001881 Height: 5'00

Project: Phase IIa

Photopoint Description: Taken at a sandstone capped blue and maroon rock between 2 vegetation transects.

View # 1

Bearing: 5

5/9/2005

Pre Treatment

Looking upstream along stream and TAMRAM monitoring transect.



5/6/2006

Post Treatment

Looking upstream along stream and TAMRAM monitoring transect.



View # 2

Bearing: 148

5/9/2005

Pre Treatment

Looking downstream along the stream toward the control transect.



5/6/2006

Post Treatment

Looking downstream along the stream toward the control transect.



PP Carbon T4A End

Photopoints printed on:
Friday, October 19, 2007

RM: 64.7 RS: R

Easting: 424704 Northing: 4001692 Height: 5'02

Project: Phase IIa

Photopoint Description: Endpoint at downstream end of Prosopis clump on a slope below a bulging overhang of the cliff above.

View # 1

Bearing: 25

5/9/2005

Pre Treatment

Looking toward the start of the transect with dense TAMRAM on creek right with butte on the top left.



5/6/2006

Post Treatment

Post treatment.



View # 2

Bearing: 148

5/9/2005

Pre Treatment

Taken from endpoint looking down canyon with a large mature TAMRAM on creek left.



5/6/2006

Post Treatment

Post treatment.



PP Carbon T4A End

Photopoints printed on:
Friday, October 19, 2007

RM: 64.7 RS: R

Easting: 424704 Northing: 4001692 Height: 5'02

Project: Phase IIa

Photopoint Description: Endpoint at downstream end of Prosopis clump on a slope below a bulging overhang of the cliff above.

View # 3

Bearing: 85

5/9/2005

Pre Treatment

Taken from the endpoint looking across canyon. Mature TAMRAM on creek left with running water in foreground.



View # A

Bearing:

5/9/2005

Pre Treatment

Looking across creek left, west, to Lisa at the endpoint. Endpoint below a distinct GC supergroup with conglomerate on top.



5/6/2006

Post Treatment

Post treatment.



View # B

Bearing:

5/9/2005

Pre Treatment

Looking at endpoint with Linda holding 50m mark amid a 4x4m ACAGRE.



PP Carbon T4A Start

Photopoints printed on:
Friday, October 19, 2007

RM: 64.7 RS: R

Easting: 424733 Northing: 4001731 Height:

Project: Phase IIa

Photopoint Description: Starts at a 1.5x2m reddish sandstone boulder.

View # 1

Bearing: 212

5/9/2005

Pre Treatment

Taken from T4 start point, looking down canyon and down the transect. Mesquite and TAMRAM in view.



5/6/2006

Post Treatment

Post treatment.



View # 2

Bearing: 14

5/9/2005

Pre Treatment

Taken from start point looking up canyon and across creek bend. Showing scattered saplings with mesquite. Also looking at highest point of Temple Butte in the background.



5/6/2006

Post Treatment

Post treatment.



PP Carbon T4A Start

Photopoints printed on:
Friday, October 19, 2007

RM: 64.7 RS: R

Easting: 424733 Northing: 4001731 Height:

Project: Phase IIa

Photopoint Description: Starts at a 1.5x2m reddish sandstone boulder.

View # A

Bearing:

5/9/2005

Pre Treatment

Looking up canyon 8 degrees, Lisa on 1.5x2m sandstone reddish colored boulder.



View # C

Bearing:

5/9/2005

Pre Treatment

Extreme close up of start point.



View # B

Bearing:

5/9/2005

Pre Treatment

Taken from approx. 2m away, showing a closer view of Lisa at the start point.



PP Cardenas Hillside Spring 2

Photopoints printed on:
Friday, October 19, 2007

RM: RS:

Easting: 423158 Northing: 3993502 Height: 5'03

Project: Phase IIa

Photopoint Description: Taken from a basalt boulder on the down river side of the wash and on down river side of the spring, just below the bottom of the spring.

View # 1 Bearing: 88

5/10/2005 12:24 PM Pre Treatment

Looking uphill at the spring. Wash visible in the lower portion of the picture. Comanche Point against the skyline. A rock slope is visible behind the veg clump.



View # 2 Bearing: 150

5/10/2005 12:24 PM Pre Treatment

Looking up the side drainage toward basalt covered hillside. Veg covered slope visible in photo left.



View # A Bearing:

5/10/2005 12:28 PM Pre Treatment

Carmen at the PP. Hillside spring and Comanche Point are visible in the background.



PP Clear 17

Photopoints printed on:
Friday, October 19, 2007

RM: 84.1 RS: R

Easting: 410435 Northing: 4000484 Height: 6'00

Project: Phase IIa

Photopoint Description: Located on point between two creeks. On a Tapeats ledge 10 feet above confluence. Standing on a white spot in rock. These UTM's are taken from the map.

View # 1

Bearing: 290

12/1/2005 1:00 PM Post Treatment

Post work.



View # A

Bearing: 80

12/1/2005 1:00 PM Pre Treatment

Person at photopoint.



12/1/2005 1:00 PM Pre Treatment

Looking upstream at west fork's creek right Tapeats wall.



PP Copper 2

Photopoints printed on:
Monday, October 15, 2007

RM: 111 RS: L

Easting: 376583 Northing: 4011549 Height: 5'06

Project: Phase IIa

Photopoint Description: Pink and grey granite (medium sized - small Geo car) boulder in the middle of the creek about 30m upstream from a small pouroff. The boulder is in line with a small tributary on creek right.

View # 1

Bearing: 44

3/14/2007 11:02 AM Pre Treatment

Looking downstream of mature TAMRAM.



3/14/2007 11:10 AM Post Treatment

Post work.



View # A

Bearing: 197

3/14/2007 11:00 AM Pre Treatment

Pen points at PP. Taken about 10m downstream on creek left, just before a small pouroff.



PP Cottonwood 5

Photopoints printed on:
Friday, October 19, 2007

RM: 80.6 RS: L

Easting: 411056 Northing: 3989364 Height: 3'00

Project: Phase IIa

Photopoint Description: Located at a large sandstone boulder on the left side of the creek. This is at the schist/granite formation that creates a large bend in the creek.

View # 1 Bearing: 3

11/16/2005 11:00 AM Pre Treatment

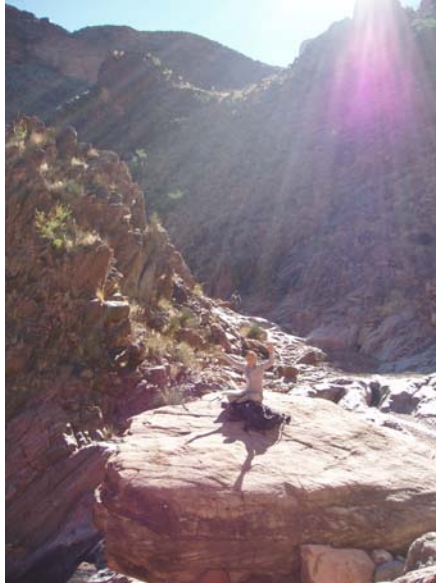
Looking down creek in the drainage at the first part of the section. Eleanor is working on TAMRAM.



View # A Bearing:

11/16/2005 11:02 AM Pre Treatment

Kari at photopoint. Taken from down canyon, looking up canyon.



View # 2 Bearing: 3

11/16/2005 11:00 AM Pre Treatment

Same as view 1 but vertical.



PP Crystal 2-2

Photopoints printed on:
Monday, October 15, 2007

RM: 99 RS: R

Easting: 388632 Northing: 4000218 Height: 5'08

Project: Phase IIa

Photopoint Description: Taken from barn sized boulder on creek right about 50m from a small waterfall (1st of 2 waterfalls).

View # 1

Bearing: 44

2/22/2007 11:17 AM Post Treatment

Post work.



View # 2

Bearing: 238

2/22/2007 9:24 AM Pre Treatment

Looking downstream at TAMRAM.



2/22/2007 9:23 AM Pre Treatment

Look upstream of TAMRAM.



2/22/2007 11:19 AM Post Treatment

Post work.



PP Crystal 2-2

Photopoints printed on:
Monday, October 15, 2007

RM: 99 RS: R

Easting: 388632 Northing: 4000218 Height: 5'08

Project: Phase IIa

Photopoint Description: Taken from barn sized boulder on creek right about 50m from a small waterfall (1st of 2 waterfalls).

View # A Bearing: 39

2/22/2007 9:20 AM Pre Treatment

Taken from downstream of PP about 25 meters on creek right. Pen pointing at PP.



PP Crystal T1A End

Photopoints printed on:
Monday, October 15, 2007

RM: 99 RS: R

Easting: 388727 Northing: 4000325 Height: 5'08

Project: Phase IIa

Photopoint Description: No description of transect location.

View # 1 Bearing: 360

5/12/2005 3:32 PM Pre Treatment

Looking upstream from the endpoint with a tiny part of the skyline and the canyon wall in the background.



View # A Bearing:

5/12/2005 3:28 PM Pre Treatment

Looking at Lisa standing at the endpoint; boulders on creek left, opposite side of transect and skyline.



View # 2 Bearing: 190

5/12/2005 3:35 PM Pre Treatment

Looking downstream at canyon wall on creek left.



View # B Bearing:

5/12/2005 3:30 PM Pre Treatment

Looking at Lisa standing at endpoint with boulders on slope that are perpendicular to Lisa.



PP Crystal Hydro T1A

Photopoints printed on:
Monday, October 15, 2007

RM: 99 RS: R

Easting: 388698 Northing: 4000228 Height: 5'03

Project: Phase Ila

Photopoint Description: View 1: Taken from the top of seep area in a boulder pile. View 2: Taken standing below seep area with bedrock on river right, about 4m downstream from sample pool.

View # 1

Bearing: 176

5/12/2005 6:21 PM Pre Treatment

Looking down creek at seep with bedrock on river right.



5/11/2007 2:31 PM Post Treatment

Looking down creek at seep with bedrock on river right.



View # 2

Bearing: 359

5/12/2005 4:24 PM Pre Treatment

Looking upstream at seep area with big schist and sandstone boulders in the middle of the creek bed.



5/11/2007 2:31 PM Post Treatment

Looking upstream at seep area with big schist and sandstone boulders in the middle of the creek bed.



PP Crystal T1A Start

Photopoints printed on:
Monday, October 15, 2007

RM: 99 RS: R

Easting: 388729 Northing: 4000352 Height: 5'08

Project: Phase IIa

Photopoint Description: This GPS is taken from the 25m mark due to poor GPS coverage. Transect is in a narrow canyon; no other description.

View # 1 Bearing: 184

5/12/2005 3:20 PM Pre Treatment

Looking downstream with the skyline in the back. Taken from about 1.5m downstream of start point; TAMRAM in view.



View # 2 Bearing: 30

5/12/2005 3:24 PM Pre Treatment

Looking upstream to narrow canyon section; there is a cliff wall where the stream makes a bend. Taken from about 1.5m downstream of start point.



PP Crystal T1A Start

Photopoints printed on:
Monday, October 15, 2007

RM: 99 RS: R

Easting: 388729 Northing: 4000352 Height: 5'08

Project: Phase IIa

Photopoint Description: This GPS is taken from the 25m mark due to poor GPS coverage. Transect is in a narrow canyon; no other description.

View # A

Bearing:

5/12/2005 5:11 PM Pre Treatment

Looking at start point with Lisa waving; a tiny bit of skyline shows and the canyon wall is behind. Taken from about 30m downstream.



View # C

Bearing:

5/12/2005 3:15 PM Pre Treatment

Looking at a close up of the starting point with a pen for scale. Taken from 1m upstream on creek right.



View # B

Bearing:

5/12/2005 5:13 PM Pre Treatment

View of start with a pen next to the darkened corner in the canyon wall, for scale. Photo taken in stream directly perpendicular to start point.



PP Grapevine 4

Photopoints printed on:
Friday, October 19, 2007

RM: 81.5 RS: L

Easting: 408953 Northing: 3989691 Height: 5'06

Project: Phase IIa

Photopoint Description: Two giant cottonwoods grow in the middle of the schist narrows about 20m apart. They are noteworthy, and the first big cottonwoods this far up creek (don't mix them up with the large Gooding's Willows upstream 1km).

View # 1

Bearing: 320

2/9/2006 3:00 PM Post Treatment

Post work.



2/9/2006 9:00 AM Pre Treatment

Looking upstream past numerous small, connected TAMRAMs lining the bank at a very large cottonwood.



View # 2

Bearing: 90

2/9/2006 3:00 PM Post Treatment

Post work.



2/9/2006 9:00 AM Pre Treatment

Looking downstream and to the left at a couple large TAMRAMs growing on a bank at a left bend in the creek. Slanted schist wall to the right.



PP Grapevine 4

Photopoints printed on:
Friday, October 19, 2007

RM: 81.5 RS: L

Easting: 408953 Northing: 3989691 Height: 5'06

Project: Phase IIa

Photopoint Description: Two giant cottonwoods grow in the middle of the schist narrows about 20m apart. They are noteworthy, and the first big cottonwoods this far up creek (don't mix them up with the large Gooding's Willows upstream 1km).

View # 3

Bearing: 135

2/9/2006 9:00 AM Pre Treatment

Looking downstream past cottonwood to the TAMRAMs lining the bank on creek right. Photo taken from a crouched position.



2/9/2006 3:00 PM Post Treatment

Post work.



View # A

Bearing: 180

2/9/2006 9:00 AM Pre Treatment

Pen pointing at photopoint. Taken from the drainage bottom with back against the schist wall on creek left.



PP Hance 7

Photopoints printed on:
Friday, October 19, 2007

RM: 76.6 RS: L

Easting: 413335 Northing: 3988012 Height: 5'0 "

Project: Phase IIa

Photopoint Description: Long flowing mound of granite just after a lovely little section of POPFRE AND SALEXI and a juniper just downstream of a POPFRE.

View # 1

Bearing: 240

4/3/2006 11:58 AM Post Treatment

View upstream, post treatment.



3/5/2007

Post Treatment

Photo update.



4/3/2006 11:51 AM Pre Treatment

View upstream.



View # 2

Bearing:

3/5/2007 4:25 PM Post Treatment

Looking downstream.



PP Hance 7

Photopoints printed on:
Friday, October 19, 2007

RM: 76.6 RS: L

Easting: 413335 Northing: 3988012 Height: 5'0 "

Project: Phase IIa

Photopoint Description: Long flowing mound of granite just after a lovely little section of POPFRE AND SALEXI and a juniper just downstream of a POPFRE.

View # A Bearing: 60

4/3/2006 11:50 AM Pre Treatment

View looking downstream at the photopoint.
The pen is pointing to the spot.



PP Kwagunt 9

Photopoints printed on:
Friday, October 19, 2007

RM: 56.2 RS: R

Easting: 422610 Northing: 4012174 Height: 5'04

Project: Phase I

Photopoint Description: Taken on a Redwall boulder about 5m upstream from another large Redwall boulder.

View # 1

Bearing: 348

10/14/2002 1:00 PM Pre Treatment

Looking across the drainage and left at the fault line.



View # 2

Bearing:

10/14/2002 1:00 PM Pre Treatment

No bearing recorded. Looking upstream at Fred with the BA in the background.



5/28/2004

Post Treatment

Photo update.



5/28/2004

Post Treatment

Photo update.



PP Kwagunt 9

Photopoints printed on:
Friday, October 19, 2007

RM: 56.2 RS: R

Easting: 422610 Northing: 4012174 Height: 5'04

Project: Phase I

Photopoint Description: Taken on a Redwall boulder about 5m upstream from another large Redwall boulder.

View # A Bearing:

10/14/2002 1:00 PM Pre Treatment

Pack at photopoint, notice the large gray boulder downstream of the pack. Taken from drainage right near the edge of the water.



5/28/2004 Pre Treatment

Clip board at photopoint.



PP Little Nankoweap 2

Photopoints printed on:
Friday, October 19, 2007

RM: 52 RS: R

Easting: 421317 Northing: 4018310 Height: 5'10

Project: Phase IIa

Photopoint Description: Taken on a mid-creek, large boulder (1.5x1.5x1.5m) at junction with bedrock canyon.

View # 1 Bearing: 96

5/8/2005 12:00 PM Pre Treatment

Looking downstream of Little Nankoweap with a view of a big pillar upslope on creek right.



View # 3 Bearing: 230

5/8/2005 12:00 PM Pre Treatment

Looking upstream of Little Nankoweap with limestone talus rock slide just right of center.



View # 2 Bearing: 0

5/8/2005 12:00 PM Pre Treatment

Looking up canyon a bedrock canyon due north with ACAGRE in the center.



View # A Bearing:

5/8/2005 12:00 PM Pre Treatment

Looking upstream of Little Nankoweap with a limestone rock slide in the background. Photo taken from drainage bottom, just NE of boulder.



PP Little Nankoweap 2

Photopoints printed on:
Friday, October 19, 2007

RM: 52 RS: R

Easting: 421317 Northing: 4018310 Height: 5'10

Project: Phase IIa

Photopoint Description: Taken on a mid-creek, large boulder (1.5x1.5x1.5m) at junction with bedrock canyon.

View # B

Bearing:

5/8/2005 12:00 PM Pre Treatment

Looking downstream of Little Nanko with Redwall limestone pillar in the background. Photo taken from the drainage bottom, just NW of the boulder.



PP Roosevelt 3

Photopoints printed on:
Monday, October 15, 2007

RM: 52.1 RS: R

Easting: 416923 Northing: 4012974 Height: 6'00

Project: Phase IIa

Photopoint Description: Taken from a small nondescript rock on creek left. There is a secondary drainage channel to the left. Photopoint located about 85m up from the spring.

View # 1

Bearing: 20

4/2/2006

Post Treatment

Post work.



View # 2

Bearing: 158

4/2/2006

2:30 AM

Pre Treatment

Looking across creek at cottonwood. One TAMRAM behind.



4/2/2006

2:30 AM

Pre Treatment

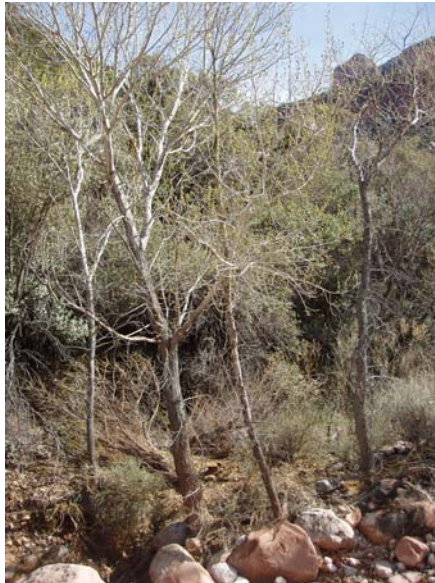
Looking down and left at 3 mature TAMRAM thicket.



4/2/2006

Post Treatment

Post work.



PP Roosevelt 3

Photopoints printed on:
Monday, October 15, 2007

RM: 52.1 RS: R

Easting: 416923 Northing: 4012974 Height: 6'00

Project: Phase IIa

Photopoint Description: Taken from a small nondescript rock on creek left. There is a secondary drainage channel to the left. Photopoint located about 85m up from the spring.

View # 3

Bearing: 190

4/2/2006

Post Treatment

Post work.



View # A

Bearing: 254

4/2/2006

2:30 AM

Pre Treatment

Steve at photopoint.



4/2/2006

2:30 AM

Pre Treatment

Looking across and slightly upstream at TAMRAM to looker's left of a nice pear-shaped juniper.



PP Nankoweap 15-2

Photopoints printed on:
Monday, October 15, 2007

RM: 52.1 RS: R

Easting: 418373 Northing: 4014488 Height: 5'02

Project: Phase IIa

Photopoint Description: Taken from 6x4m pink sandstone boulder on creek left. This is at the confluence with dry side channel and next to a big plunge pool.

View # 1

Bearing: 222

11/18/2005 4:10 PM Post Treatment

Post work.



View # 2

Bearing: 250

11/18/2005 4:11 PM Post Treatment

Post work.



11/18/2005 2:20 PM Pre Treatment

Looking upstream at debris fan filled with TAMRAM, toward the center of the drainage.



11/18/2005 2:21 PM Pre Treatment

Looking upstream with the dry drainage channel in the middle of the photo.



PP Nankoweap 15-2

Photopoints printed on:
Monday, October 15, 2007

RM: 52.1 RS: R

Easting: 418373 Northing: 4014488 Height: 5'02

Project: Phase IIa

Photopoint Description: Taken from 6x4m pink sandstone boulder on creek left. This is at the confluence with dry side channel and next to a big plunge pool.

View # 3

Bearing: 299

11/18/2005 4:12 PM Post Treatment

Post work.



View # A

Bearing: 210

11/18/2005 2:15 PM Pre Treatment

Linda at the photopoint rock. Taken from downstream of rock.



11/18/2005 2:22 PM Pre Treatment

Looking directly at creek left bank.



PP Nankoweap T2B End

Photopoints printed on:
Monday, October 15, 2007

RM: 52.1 RS: R

Easting: 421245 Northing: 4016973 Height: 5'00

Photopoint Check UTM's.
Description:

Project: Phase IIa

View # 1

Bearing:

10/2/2004 3:10 PM Pre Treatment

View from end?



View # A

Bearing:

10/2/2004 3:10 PM Pre Treatment

View of end?



PP Nankoweap T2B Start

Photopoints printed on:
Monday, October 15, 2007

RM: 52.1 RS: R

Easting: 421177 Northing: 4017196 Height: 5'00

Project: Phase IIa

Photopoint
Description:

View # A

Bearing:

10/2/2004 3:10 PM Pre Treatment

View of start?



Papago 1

Photopoints printed on:
Monday, October 22, 2007

RM: 76 RS: L

Easting: 418244 Northing: 3989278 Height: 5'00

Project: Phase IIa

Photopoint Description: About 200 m upstream of the mouth of Papago Creek, standing on a Shinamu ledge/dryfall on creek L

View # 1 Bearing: 37

2/17/2007 9:18 AM Pre Treatment

Looking downstream at Papago towards river.
Only seedlings were pulled from this section, so we did not retake photo post-treatment photo at this time.



View # A Bearing: 300

2/17/2007 9:10 AM Pre Treatment

Lynn at photopoint



PP Pipe 2

Photopoints printed on:
Monday, October 15, 2007

RM: 89 RS: L

Easting: 399938 Northing: 3994907 Height: 5'05

Project: Phase IIa

Photopoint Description: Taken from west of trail on granite slab/outcrop with a pink vein.

View # 1 Bearing: 164

3/23/2005 11:10 AM Pre Treatment

Looking up creek to 3 descending ridges in view.



View # A Bearing: 164

3/23/2005 11:20 AM Pre Treatment

Looking at person standing at photopoint in a slick rock drainage. Photo taken from creek.



3/20/2006 12:10 PM Post Treatment

Post work. Looking upstream.



View # B Bearing:

3/23/2005 11:20 AM Pre Treatment

Looking at person standing at photopoint.
Taken from down creek of photopoint.



PP Red Canyon 1

Photopoints printed on:
Friday, October 19, 2007

RM: 76.6 RS: L

Easting: 416438 Northing: 3987368 Height: 5'00

Project: Phase IIa

Photopoint Description: Taken on a sandstone ledge 250m below where the trail enters the drainage.

View # 1

Bearing: 236

3/10/2006 10:50 AM Pre Treatment

Looking upstream at 3 TAMRAMs.



2/20/2007 9:45 AM Post Treatment

Photo update.



3/10/2006 11:05 AM Post Treatment

Post work.



View # A

Bearing: 52

3/10/2006 10:45 AM Pre Treatment

Sprayer and yellow box are on the photopoint.



PP Saddle 2

Photopoints printed on:
Friday, October 19, 2007

RM: 47 RS: L

Easting: 419773 Northing: 4024961 Height: 5'10

Project: Phase IIa

Photopoint Description: Taken from about 50m down canyon from where trail drops in. Standing on top of 4x6m gray limestone boulder on creek left.

View # 1

Bearing: 32

5/7/2005 4:26 PM Pre Treatment

Looking down canyon in area with a huge house size boulder. CELLAE in foreground and can see TAMRAM in lower section.



5/4/2006 5:10 PM Post Treatment

Looking down canyon in an area with a huge house sized boulder. CELLAE in foreground but no more TAMRAM.



10/20/2005

Post Treatment

Photo update.



PP Saddle 2

Photopoints printed on:
Friday, October 19, 2007

RM: 47 RS: L

Easting: 419773 Northing: 4024961 Height: 5'10

Project: Phase IIa

Photopoint Description: Taken from about 50m down canyon from where trail drops in. Standing on top of 4x6m gray limestone boulder on creek left.

View # 2

Bearing: 218

5/7/2005 4:33 PM Pre Treatment

Looking up canyon showing tall, somewhat dense CELLAE and BRILON. ALENEG is also seen in the foreground.



5/4/2006 5:10 PM Post Treatment

Looking up canyon showing a tall, somewhat dense CELLAE and BRILON. ALENEG is also seen in the foreground.



10/20/2005

Post Treatment

Photo update.



View # A

Bearing:

5/7/2005 4:25 PM Pre Treatment

Looking down canyon at Lori on photopoint rock, not the skyline. Taken from 8m up canyon of photopoint rock.



PP South 1

Photopoints printed on:
Friday, October 19, 2007

RM: 31.9 RS: R

Easting: 417415 Northing: 4036887 Height: 5'10

Project: Phase IIa

Photopoint Description: Taken 40m upstream of Gambel Oak grove on large, cream colored sandstone boulder (4m tall x 5.5m wide). Boulder is about 200m downstream of trail junction which is marked by cairns. In the Hermit shale about a mile up canyon.

View # 1 Bearing: 235

5/6/2005 1:32 PM Pre Treatment

Looking up canyon at a large boulder in top right of picture.



View # A Bearing:

5/6/2005 1:30 PM Pre Treatment

Steve at photopoint; taken about 15m up canyon from photopoint.



View # 2 Bearing: 45

5/6/2005 1:30 PM Pre Treatment

Looking downstream. Hermit shale slope in the left top corner adjacent to a large Gambel Oak grove. There are about 10 mature tamarisk in the foreground.



View # B Bearing:

5/6/2005 1:30 PM Pre Treatment

Steve at photopoint; taken about 20m down canyon from a boulder



PP South 6

Photopoints printed on:
Friday, October 19, 2007

RM: 31.9 RS: R

Easting: 418824 Northing: 4037763 Height: 5'10

Project: Phase IIa

Photopoint Description: Taken from sandstone boulder (3x4.3x3m) located at the top of a small pourover in the Esplanade. Canyon begins to open up here and the pourover is the best identifier.

View # 1

Bearing: 68

5/6/2005 3:15 PM Pre Treatment

Downstream view of drainage. Tamarisk upstream of here but not below. Bedrock in top of esplanade.



3/18/2006

Post Treatment

Post work.



View # 2

Bearing: 240

5/6/2005 3:15 PM Pre Treatment

Upstream view.



3/18/2006

Post Treatment

Post work.



PP South 6

Photopoints printed on:
Friday, October 19, 2007

RM: 31.9 RS: R

Easting: 418824 Northing: 4037763 Height: 5'10

Project: Phase IIa

Photopoint Description: Taken from sandstone boulder (3x4.3x3m) located at the top of a small pourover in the Esplanade. Canyon begins to open up here and the pourover is the best identifier.

View # A Bearing:

5/6/2005 3:15 PM Pre Treatment

looking upstream at Supai boulder that lies above a 2m pouroff. Taken from 15m below boulder in drainage center.



View # B Bearing:

5/6/2005 3:15 PM Pre Treatment

Looking downstream at Supai boulder (4m tall). Taken from the center of drainage about 8m above pouroff (2m tall).



PP South Hydro 1

Photopoints printed on:
Friday, October 19, 2007

RM: 31.9 RS: R

Easting: 420288 Northing: 4038742 Height: 5'06

Project: Phase IIa

Photopoint Description: Overview of seep (in cloud); seep at base of white sandstone pourover.

View # 1

Bearing: 355

5/6/2005 11:30 AM Pre Treatment

Looking upstream towards the seep wall.



View # 2

Bearing:

5/6/2005 11:30 AM Pre Treatment

Filling a beaker at the highest volume seep.



4/22/2006 12:00 PM Post Treatment

Looking upstream towards the seep wall.



4/22/2006 12:00 PM Post Treatment

Not sure if this is the same view due to the lack of water.



PP South T1A End

Photopoints printed on:
Friday, October 19, 2007

RM: 31.9 RS: R

Easting: 421130 Northing: 4039471 Height: 5'08

Project: Phase Ila

Photopoint Description: Transect ends on the top of log on a debris pile on creek left.

View # 1 Bearing: 248

5/6/2005 10:53 AM Pre Treatment

Looking upstream. Clump of mature TAMRAM to the left of the tape.



4/22/2006 11:15 AM Post Treatment

Looking upstream.



View # 2 Bearing: 128

5/6/2005 10:53 AM Pre Treatment

Looking into creek bed. 1 mature TAMRAM in the photo.



4/22/2006 11:15 AM Post Treatment

Looking into the creek bed.



PP South T1A End

Photopoints printed on:
Friday, October 19, 2007

RM: 31.9 RS: R

Easting: 421130 Northing: 4039471 Height: 5'08

Photopoint Description: Transect ends on the top of log on a debris pile on creek left.

Project: Phase IIa

View # A Bearing: 248

5/6/2005 10:53 AM Pre Treatment

Looking at creek bed with a large white boulder on creek left in the bottom right corner of the photo.



PP South T1A Start

Photopoints printed on:
Friday, October 19, 2007

RM: 31.9 RS: R

Easting: 421084 Northing: 4039457 Height:

Project: Phase IIa

Photopoint Description: Look for a large boulder in center of the creekbed where first side canyon comes in on creek left. Starts on a smaller boulder upstream from the larger boulder.

View

Bearing:

Pre Treatment



View # 1

Bearing: 79

5/6/2005 10:47 AM Pre Treatment

Looking down canyon at through mature tamarisk.



4/22/2006 11:00 AM Post Treatment

Looking down canyon.



PP South T1A Start

Photopoints printed on:
Friday, October 19, 2007

RM: 31.9 RS: R

Easting: 421084 Northing: 4039457 Height: 7'9 "

Project: Phase IIa

Photopoint Description: Look for a large boulder in center of the creekbed where first side canyon comes in on creek left. Starts on a smaller boulder upstream from the larger boulder.

View # 2

Bearing:

5/6/2005 10:47 AM Pre Treatment

The large boulder downstream of transect start is visible.



View # 3

Bearing: 261

5/6/2005 10:47 AM Pre Treatment

Looking upstream from the start of transect 1.



4/22/2006 11:00 AM Post Treatment

The large boulder downstream of the transect start is visible.



4/22/2006 11:00 AM Post Treatment

Looking upstream from the start of T1A



PP South T1A Start

Photopoints printed on:
Friday, October 19, 2007

RM: 31.9 RS: R

Easting: 421084 Northing: 4039457 Height:

Project: Phase IIa

Photopoint Description: Look for a large boulder in center of the creekbed where first side canyon comes in on creek left. Starts on a smaller boulder upstream from the larger boulder.

View # 4 Bearing: 0

5/6/2005 10:47 AM Pre Treatment

Looking up side canyon that comes in from creek left.



4/22/2006 11:00 AM Post Treatment

Looking up side canyon that comes in from creek left.



View # A Bearing:

5/6/2005 9:55 AM Pre Treatment

Looking upstream at the beginning of transect 1.



View # B Bearing:

5/6/2005 9:55 AM Pre Treatment

This is a view of the start of transect 1 from the right side of the streambed.



PP South T1A Start

Photopoints printed on:
Friday, October 19, 2007

RM: 31.9 RS: R

Easting: 421084 Northing: 4039457 Height: 0'02

Project: Phase IIa

Photopoint Description: Look for a large boulder in center of the creekbed where first side canyon comes in on creek left. Starts on a smaller boulder upstream from the larger boulder.

View # C

Bearing:

5/6/2005 9:55 AM Pre Treatment

Close up of the South T1A B. Beginning of transect #1.



View # E

Bearing:

5/6/2005 9:55 AM Pre Treatment

Lori at beginning of transect. Taken from down canyon of start.



View # D

Bearing:

5/6/2005 9:55 AM Pre Treatment

Looking straight down on transect start.



PP Trail 7

Photopoints printed on:
Monday, October 15, 2007

RM: 219 RS: R

Easting: 287891 Northing: 3970978 Height: 5'06

Project: Phase IIa

Photopoint Description: Taken from muav limestone boulder with multiple quartz intrusions. Boulder is 5x5x4m on creek left of the main channel. This is about 4.4km from the river.

View # 1 Bearing: 168

5/18/2005 3:15 AM Pre Treatment

Looking downstream at a 15m tall loose embankment in the center of the photo; Bright Angel shale jutting out at odd angle.



View # 2 Bearing: 330

5/18/2005 3:15 AM Pre Treatment

Looking upstream at broken cliffs of muav; acacias in stream bed.



5/19/2006 11:11 AM Post Treatment

Looking downstream at a 15m tall loose embankment in the center of the photo. BA shale jutting out at an odd angle.



5/19/2006 11:11 AM Post Treatment

Looking upstream at broken cliffs of muav, acacias in the stream bed.



PP Trail 7

Photopoints printed on:
Monday, October 15, 2007

RM: 219 RS: R

Easting: 287891 Northing: 3970978 Height: 5'06

Project: Phase IIa

Photopoint Description: Taken from muav limestone boulder with multiple quartz intrusions. Boulder is 5x5x4m on creek left of the main channel. This is about 4.4km from the river.

View # A Bearing:

5/18/2005 3:15 AM Pre Treatment

Steve on photopoint. Taken from upstream and a cobbled embankment in background.



View # B Bearing:

5/18/2005 3:15 AM Pre Treatment

Steve on photopoint. Taken from downstream looking at a gap in the redwall.



PP Trail Hydro 1

Photopoints printed on:
Monday, October 15, 2007

RM: 219 RS: R

Easting: 289191 Northing: 3968785 Height: 6'0 "

Project: Phase Ila

Photopoint Trail Canyon Hydro 1
Description:

View # 1 Bearing: 90

5/19/2006 10:15 AM Pre Treatment

5m upstream of beginning of hydro 1.
Downstream view of hydro 1.



View # 2 Bearing: 284

5/19/2006 10:15 AM Pre Treatment

5m downstream of end of hydro 1. Upstream
view of hydro 1.



5/21/2007 1:30 PM Post Treatment

5m upstream of beginning of hydro 1.
Downstream view of hydro 1.



PP Trail T1A End

Photopoints printed on:
Monday, October 15, 2007

RM: 219 RS: R

Easting: 289334 Northing: 3968567 Height:

Project: Phase IIa

Photopoint Description: No description recorded on info sheet.

View # 1 Bearing: 282

5/18/2005 10:15 AM Pre Treatment

Taken from the transect end point and looking up the tape. Dense TAMRAM and tapeats up canyon. Supai/Redwall skyline in the distance.



5/19/2006 1:31 PM Post Treatment

Post treatment. Same view, but far fewer TAMRAM. Notice PLUSER and BACSAL are the dominant vegetation.



View # 2 Bearing: 206

5/18/2005 10:15 AM Pre Treatment

Taken from the end point. Looking across the creek. Showing PLUSER in the foreground and ACAGRE and ENCFAR in the background.



5/19/2006 1:34 PM Post Treatment

Post treatment.



PP Trail T1A End

Photopoints printed on:
Monday, October 15, 2007

RM: 219 RS: R

Easting: 289334 Northing: 3968567 Height:

Project: Phase IIa

Photopoint Description: No description recorded on info sheet.

View # 3 Bearing: 166

5/18/2005 10:15 AM Pre Treatment

Taken from the end point. Looking downstream at a distinct granitic cliff on creek left. Creek bends to the right. TAMRAM and PLUSER on creek right. Tapeats ridge topped with ocotillo in the distance.



View # A Bearing: 336

5/18/2005 10:10 AM Pre Treatment

Looking at Amy at endpoint and a small portion of top of a granite ridgeline. Taken from 5m downstream from the endpoint.



PP Trail T1A End

RM: 219 RS: R

Easting: 289334 Northing: 3968567 Height:

Photopoint No description recorded on info sheet.
Description:

Photopoints printed on:
Monday, October 15, 2007

Project: Phase IIa

View # B Bearing: 315

5/18/2005 10:15 AM Pre Treatment

Looking upstream and across the canyon at the endpoint on a granitic band with immediate skyline visible. Taken from the opposite side of the creek and 5m downstream.



PP Trail T1A Start

Photopoints printed on:
Monday, October 15, 2007

RM: 219 RS: R

Easting: 289295 Northing: 3968587 Height:

Project: Phase IIa

Photopoint No description on info sheet.
Description:

View # 1 Bearing: 102

5/18/2005 10:00 AM Pre Treatment

Taken from the start point. Looking down canyon. Showing TAMRAM, ACAGRE and BACSPP with a Tapeats ridge in background.



5/19/2006 1:14 PM Post Treatment

Same view but fewer TAMRAM.



View # 2 Bearing: 168

5/18/2005 10:00 AM Pre Treatment

Taken from start point. Looking across the creek towards the opposite bank. Shows scattered TAMRAM among BACSAL.



5/19/2006 1:23 PM Post Treatment

Photo update.

PP Trail T1A Start

Photopoints printed on:
Monday, October 15, 2007

RM: 219 RS: R

Easting: 289295 Northing: 3968587 Height:

Project: Phase IIa

Photopoint Description: No description on info sheet.

View # 3 Bearing: 226

5/18/2005 10:00 AM Pre Treatment

Taken from the start point. Looking across creek showing a distinct white granite slope below a Tapeats ridge. Good for relocating this spot.



5/19/2006 1:25 PM Post Treatment

Photo update.



View # 4 Bearing: 260

5/18/2005 10:00 AM Pre Treatment

Taken from start point. Looking up canyon and shows a conglomerate waterfall with ACAGRE below the granite slope in the background. Note the open cobbly stream bed with TAMRAM.

5/19/2006 1:27 PM Post Treatment

Same view, but less water over the conglomerate pourover and fewer TAMRAM in the stream bed.

PP Trail T1A Start

Photopoints printed on:
Monday, October 15, 2007

RM: 219 RS: R

Easting: 289295 Northing: 3968587 Height:

Project: Phase IIa

Photopoint Description: No description on info sheet.

View # A Bearing:

5/18/2005 9:52 AM Pre Treatment

Looking up canyon from 7m downstream of start point. Amy is at start point with conglomerate pourover in the bottom left. Distinct redwall ridgeline in the far background.



View # B Bearing:

5/18/2005 9:52 AM Pre Treatment

Looking upstream at start point (from streambed 5m below). Showing distinct Tapeats outcroppings above the start point with distant Supai/Redwall butte in the background.

PP Trail T1A Start

Photopoints printed on:
Monday, October 15, 2007

RM: 219 RS: R

Easting: 289295 Northing: 3968587 Height:

Project: Phase IIa

Photopoint No description on info sheet.
Description:

View # C Bearing:

5/18/2005 9:52 AM Pre Treatment

Taken from the same point as view B. Shows stream and cut bank and a somewhat distinct granite boulder below Amy.

PP Transept 2

Photopoints printed on:
Friday, October 19, 2007

RM: 88 RS: R

Easting: 406173 Northing: 4004025 Height:

Project: Phase IIa

Photopoint Description: Taken from on a ledge in the Dox about 6m up on creek right.

Description: Did not retake this photopoint on 4/3/06 because we felt like it was too sketchy for up to safely do.

View # 1

Bearing: 156

10/1/2005

Post Treatment

Post work.



View # 2

Bearing: 58

10/1/2005

8:49 AM

Pre Treatment

Looking across the creek from creek right to left. There is a juniper on the left side of the photo.



10/1/2005

8:43 AM

Pre Treatment

Looking downstream to creek right with southwest wall in view.



10/1/2005

Post Treatment

Post work.



PP Transept 2

Photopoints printed on:
Friday, October 19, 2007

RM: 88 RS: R

Easting: 406173 Northing: 4004025 Height:

Project: Phase IIa

Photopoint Description: Taken from on a ledge in the Dox about 6m up on creek right.

Description: Did not retake this photopoint on 4/3/06 because we felt like it was too sketchy for up to safely do.

View # 3

Bearing: 356

10/1/2005

Post Treatment

Post work.



View # A

Bearing: 186

10/1/2005

8:43 AM

Pre Treatment

Person at photopoint with shrub live oak growing out of ledge.



10/1/2005 8:49 AM Pre Treatment

Looking upstream to creek right with a box elder in the center of the photo.



PP Unkar 21

Photopoints printed on:
Friday, October 19, 2007

RM: 72.5 RS: R

Easting: 415675 Northing: 3997999 Height: 5'02

Project: Phase IIa

Photopoint Description: Taken approx. 50m into section 21 standing on creek left in front of a juniper and some Gooding's willows.

View # 1

Bearing: 282

11/6/2006 9:15 AM Post Treatment

Post work.



View # 2

Bearing: 112

11/6/2006 8:34 AM Pre Treatment

Looking downstream at TAMRAM.



11/6/2006 8:32 AM Pre Treatment

Looking upstream.



11/6/2006 9:17 AM Post Treatment

Post work.



PP Unkar 21

Photopoints printed on:
Friday, October 19, 2007

RM: 72.5 RS: R

Easting: 415675 Northing: 3997999 Height: 5'02

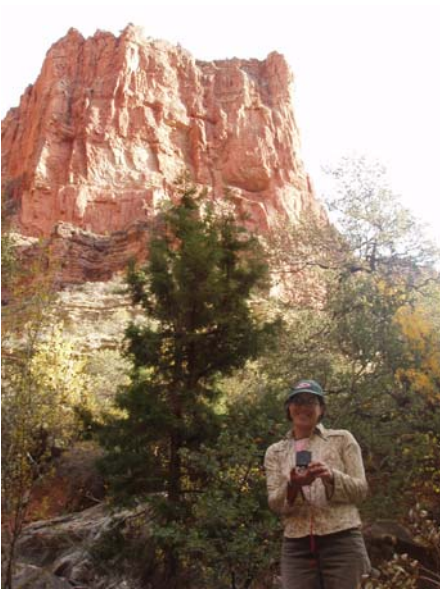
Project: Phase IIa

Photopoint Description: Taken approx. 50m into section 21 standing on creek left in front of a juniper and some Gooding's willows.

View # A Bearing: 50

11/6/2006 8:31 AM Pre Treatment

Kate standing on creek left at photopoint.
Redwall in the background.



PP Unkar 9-2

Photopoints printed on:
Friday, October 19, 2007

RM: 72.5 RS: R

Easting: 419074 Northing: 3994781 Height: 5'00

Project: Phase IIa

Photopoint Description: Taken about 150m upstream of fork (creek right). There is an arching chunky wall of sandstone about 90m long and 70m tall.

View # 1 Bearing: 20

10/29/2005 11:17 AM Post Treatment

Post work, looking downstream.



10/29/2005 11:17 AM Pre Treatment

Looking downstream.



View # 2 Bearing: 290

10/29/2005 11:17 AM Post Treatment

Post work, looking upstream.



10/29/2005 11:17 AM Pre Treatment

Looking upstream.



PP Unkar 9-2

Photopoints printed on:
Friday, October 19, 2007

RM: 72.5 RS: R

Easting: 419074 Northing: 3994781 Height: 5'00

Project: Phase IIa

Photopoint Description: Taken about 150m upstream of fork (creek right). There is an arching chunky wall of sandstone about 90m long and 70m tall.

View # A

Bearing: 202

10/29/2005 11:17 AM Pre Treatment

Nate at photopoint site. Photo taken from downstream of photopoint looking upstream.



PP Unkar T2A End

Photopoints printed on:
Friday, October 19, 2007

RM: 72.5 RS: R

Easting: 419075 Northing: 3994568 Height: 5'00

Project: Phase IIa

Photopoint Description: Check UTM's not sure if correct. No other description.

View # 1

Bearing:

10/8/2004 3:00 PM Pre Treatment

Looking at end of transect.



View # 3

Bearing:

10/8/2004 3:00 PM Pre Treatment

Looking at the start from the endpoint.



View # 2

Bearing:

10/8/2004 3:00 PM Pre Treatment

Looking at transect end?



View # A

Bearing:

10/8/2004 3:00 PM Pre Treatment

Looking at end?



PP Unkar T2A start

Photopoints printed on:
Friday, October 19, 2007

RM: 72.5 RS: R

Easting: 419039 Northing: 3994608 Height: 5'00

Project: Phase IIa

Photopoint Transect T2A Bottom?
Description:

View # 1

Bearing:

10/8/2004 3:00 PM Pre Treatment

Looking downstream from the start to end.



View # 3

Bearing:

10/8/2004 2:11 PM Pre Treatment

Not sure of bearing or description.



View # 2

Bearing:

10/8/2004 3:00 PM Pre Treatment

No bearing or description.



PP Upper Lava 1-2

Photopoints printed on:
Friday, October 19, 2007

RM: 65.5 RS: R

Easting: 419259 Northing: 4002619 Height: 5'00

Project: Phase Ila

Photopoint Description: Taken from a 3m high boulder in the right center of the creek. The boulder is sloped at a 45 degree angle facing downstream. There is a 9x9 ft standing pool of water on creek right just below the boulder.

View # 1 Bearing: 252

2/24/2006 10:35 AM Pre Treatment

Looking upstream towards the N. Rim.



2/24/2006 12:30 PM Post Treatment

Post work.



View # 2 Bearing: 52

2/24/2006 12:31 PM Post Treatment

Post work.



2/24/2006 10:36 AM Pre Treatment

Looking downstream.



PP Upper Lava 1-2

Photopoints printed on:
Friday, October 19, 2007

RM: 65.5 RS: R

Easting: 419259 Northing: 4002619 Height: 5'00

Project: Phase IIa

Photopoint Description: Taken from a 3m high boulder in the right center of the creek. The boulder is sloped at a 45 degree angle facing downstream. There is a 9x9 ft standing pool of water on creek right just below the boulder.

View # 3

Bearing: 284

2/24/2006 12:32 PM Post Treatment

Post work.



View # 4

Bearing: 336

2/24/2006 12:33 PM Post Treatment

Post work.



2/24/2006 10:37 AM Pre Treatment

View slightly upstream on creek left.



2/24/2006 10:38 AM Pre Treatment

View slightly downstream on creek left.



PP Upper Lava 1-2

Photopoints printed on:
Friday, October 19, 2007

RM: 65.5 RS: R

Easting: 419259 Northing: 4002619 Height: 6'00

Project: Phase IIa

Photopoint Description: Taken from a 3m high boulder in the right center of the creek. The boulder is sloped at a 45 degree angle facing downstream. There is a 9x9 ft standing pool of water on creek right just below the boulder.

View # A Bearing: 202

2/24/2006 10:30 AM Pre Treatment

Melissa on photopoint. Taken from downstream.



PP Upper Pipe W Fork 1-2

Photopoints printed on:
Monday, October 15, 2007

RM: 89 RS: L

Easting: 399987 Northing: 3993026 Height: 5'02

Project: Phase IIa

Photopoint Description: Start where the Tonto trail crosses the drainage; at that point walk downstream about 90m. On creek left there is a huge (5mx5m) sandstone boulder that slopes upstream. Looking straight across the drainage there is a sandstone outcropping the shape of half dome. It's about 20m from the creek bottom.

View # 1

Bearing:

9/16/2005 9:25 AM Pre Treatment

Looking upstream. No bearing was recorded.



View # 2

Bearing:

9/16/2005 9:25 AM Pre Treatment

Looking directly across at the lone tammie. No bearing recorded.



9/16/2005 9:25 AM Post Treatment

Looking directly across after the tammie was removed. No bearing was recorded.



PP Upper Pipe W Fork 1-2

Photopoints printed on:
Monday, October 15, 2007

RM: 89 RS: L

Easting: 399987 Northing: 3993026 Height: 5'02

Project: Phase IIa

Photopoint Description: Start where the Tonto trail crosses the drainage; at that point walk downstream about 90m. On creek left there is a huge (5mx5m) sandstone boulder that slopes upstream. Looking straight across the drainage there is a sandstone outcropping the shape of half dome. It's about 20m from the creek bottom.

View # A

Bearing:

9/16/2005 9:25 AM Pre Treatment

Photopoint.



Appendix C - Habitat Assessment Data

Canyon/Park Area: **Badger** River mile: 8 R
Location description: Badger 1 Date: 5/4/2005

| | Start point | End point |
|------------------|-------------|-----------|
| Easting | 441358 | 441110 |
| Northing | 4069828 | 4069973 |
| GPS accuracy (m) | 13 | 7 |

Surface water within 25m Surface water type:
Soil moisture: dry Surface rocks: sandstone
Associated species: Bromus rubens L., Chrysothamnus spp., Ephedra spp., Fallugia paradoxa (D. Don) Endl. ex Torr., Phacelia spp., Sphaeralcea spp., Stanleya pinnata (Pursh) Britt.
Dominant species: Atriplex spp., Brickellia longifolia S. Wats.
Habitat type: GB 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

Canyon/Park Area: **Badger** River mile: 8 R
Location description: Badger 2 Date: 5/4/2005

| | Start point | End point |
|------------------|-------------|-----------|
| Easting | 441110 | 440829 |
| Northing | 4069973 | 4069989 |
| GPS accuracy (m) | 7 | 7 |

Surface water within 25m Surface water type: pothole
Soil moisture: dry Surface rocks: sandstone
Associated species: Stanleya pinnata (Pursh) Britt., Tamarix ramosissima Ledeb.
Dominant species: Brickellia longifolia S. Wats., Chrysothamnus spp.
Habitat type: GB desert scrub
Vegetation density: Sparse Average height of vegetation (m): 1.5
Tamarisk estimate: Low
Other info:
SWIFL determination: Not suitable or potential southwestern willow flycatcher habitat

Appendix C - Habitat Assessment Data

Canyon/Park Area: **Badger** River mile: 8 R
Location description: Badger 3 Date: 5/4/2005

| | Start point | End point |
|--|--|-----------------------------|
| Easting | 440829 | 440570 |
| Northing | 4069989 | 4070039 |
| GPS accuracy (m) | 7 | 7 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: pothole |
| Soil moisture: dry | | Surface rocks: shale |
| Associated species: | Bromus rubens L., Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird, Stanleya pinnata (Pursh) Britt. | |
| Dominant species: | Brickellia longifolia S. Wats. | |
| Habitat type: | GB desert scrub | |
| Vegetation density: Sparse | Average height of vegetation (m): 1 | |
| Tamarisk estimate: Low | | |
| Other info: | | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: **Badger** River mile: 8 R
Location description: Badger 4 Date: 5/4/2005

| | Start point | End point |
|--|--|-----------------------------|
| Easting | 440570 | 440354 |
| Northing | 4070039 | 4070141 |
| GPS accuracy (m) | 7 | 14 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: pothole |
| Soil moisture: dry | | Surface rocks: shale |
| Associated species: | Bromus rubens L., Ephedra spp., Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird, Nicotiana obtusifolia Mertens & Galeotti, Stanleya pinnata (Pursh) Britt. | |
| Dominant species: | Brickellia longifolia S. Wats. | |
| Habitat type: | GB desert scrub | |
| Vegetation density: Sparse | Average height of vegetation (m): 1 | |
| Tamarisk estimate: Low | | |
| Other info: | | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: **Badger** River mile: 8 R
Location description: Badger 5 Date: 5/4/2005

| | Start point | End point |
|--|--|-----------------------------|
| Easting | 440354 | 440268 |
| Northing | 4070141 | 4070219 |
| GPS accuracy (m) | 14 | 20 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: pothole |
| Soil moisture: dry | | Surface rocks: shale |
| Associated species: | Bromus rubens L., Ephedra spp., Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird, Nicotiana obtusifolia Mertens & Galeotti, Stanleya pinnata (Pursh) Britt. | |
| Dominant species: | Brickellia longifolia S. Wats. | |
| Habitat type: | GB desert scrub | |
| Vegetation density: Sparse | Average height of vegetation (m): 0 | |
| Tamarisk estimate: None | | |
| Other info: | | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: **South Canyon** River mile: 31.6 R
Location description: South Canyon 1 Date: 5/6/2005

| | Start point | End point |
|--|--|-----------------------------|
| Easting | 417413 | 418244 |
| Northing | 4036685 | 4037211 |
| GPS accuracy (m) | 7 | 8 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: pothole |
| Soil moisture: dry | | Surface rocks: shale |
| Associated species: | Bromus tectorum L., Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird, Robinia neomexicana Gray, Stanleya pinnata (Pursh) Britt., Tamarix ramosissima Ledeb. | |
| Dominant species: | Brickellia longifolia S. Wats., Fallugia paradoxa (D. Don) Endl. ex Torr. | |
| Habitat type: | Mojave desert scrub | |
| Vegetation density: Low | Average height of vegetation (m): 1 | |
| Tamarisk estimate: Sparse | | |
| Other info: | Started mapping from top of canyon. No tamarisk up canyon to large dry fall - just down canyon from where trail heads out to rim. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: South Canyon River mile: 31.6 R
Location description: South Canyon 2 Date: 5/6/2005

| | Start point | End point |
|--|--|-------------------------------------|
| Easting | 418244 | 418423 |
| Northing | 4037211 | 4037380 |
| GPS accuracy (m) | 8 | 4 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: pothole |
| Soil moisture: | dry | Surface rocks: shale |
| Associated species: | Bromus tectorum L., Opuntia basilaris Engelm. & Bigelow, Sphaeralcea spp., Stanleya pinnata (Pursh) Britt., Tamarix ramosissima Ledeb. | |
| Dominant species: | Brickellia longifolia S. Wats., Fallugia paradoxa (D. Don) Endl. ex Torr. | |
| Habitat type: | Mojave desert scrub | |
| Vegetation density: | Sparse | Average height of vegetation (m): 1 |
| Tamarisk estimate: | Sparse | |
| Other info: | | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: South Canyon River mile: 31.6 R
Location description: South Canyon 3 Date: 5/6/2005

| | Start point | End point |
|--|---|-------------------------------------|
| Easting | 418423 | 419769 |
| Northing | 4037380 | 4038116 |
| GPS accuracy (m) | 4 | 8 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: pothole |
| Soil moisture: | dry | Surface rocks: sandstone |
| Associated species: | Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth, Bromus rubens L., Bromus tectorum L., Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird, Fallugia paradoxa (D. Don) Endl. ex Torr., Opuntia basilaris Engelm. & Bigelow, Stanleya pinnata (Pursh) Britt. | |
| Dominant species: | Brickellia longifolia S. Wats. | |
| Habitat type: | Mojave desert scrub | |
| Vegetation density: | Sparse | Average height of vegetation (m): 1 |
| Tamarisk estimate: | Sparse | |
| Other info: | From South 3 to Transect 2 area. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: **South Canyon** River mile: 31.6 R
Location description: South Canyon 4 Date: 5/6/2005

| | | |
|--|---|---------------------------------------|
| | Start point | End point |
| Easting | 419769 | 420713 |
| Northing | 4038116 | 4039253 |
| GPS accuracy (m) | 8 | 12 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: pothole |
| Soil moisture: | dry | Surface rocks: shale |
| Associated species: | Atriplex spp., Bromus rubens L., Bromus tectorum L., Ephedra spp., Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird, Fallugia paradoxa (D. Don) Endl. ex Torr., Tamarix ramosissima Ledeb. | |
| Dominant species: | Brickellia longifolia S. Wats. | |
| Habitat type: | Mojave desert scrub | |
| Vegetation density: | Sparse | Average height of vegetation (m): 0.8 |
| Tamarisk estimate: | Sparse | |
| Other info: | From transect 2 down canyon to where trail drops in. Very rocky within sparse vegetation. No potential habitat from this spot and no tamarisk to the river. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: **Saddle Canyon** River mile: 47.2 L
Location description: Saddle Bottom 1 Date: 5/7/2005

| | | |
|--|---|-------------------------------------|
| | Start point | End point |
| Easting | 420096 | 419771 |
| Northing | 4024913 | 4024759 |
| GPS accuracy (m) | 7 | 7 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: pothole |
| Soil moisture: | moist | Surface rocks: limestone |
| Associated species: | Acer negundo L. var. californicum (Torr. & Gray) Sarg., Atriplex spp. | |
| Dominant species: | Acacia greggii Gray, Brickellia longifolia S. Wats., Celtis laevigata Willd. var. reticulata (Torr.) L. Benson, Prosopis glandulosa Torr., Yucca spp. | |
| Habitat type: | GB desert scrub | Riparian |
| Vegetation density: | Moderate | Average height of vegetation (m): 3 |
| Tamarisk estimate: | None | |
| Other info: | Riparian but too thin for SWIFL. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: Saddle Canyon River mile: 47.2 L
Location description: Saddle Bottom 2 Date: 5/7/2005

| | Start point | End point |
|--|---|----------------------------|
| Easting | 419771 | 419317 |
| Northing | 4024759 | 4024441 |
| GPS accuracy (m) | 7 | 9 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: moist | | Surface rocks: limestone |
| Associated species: | Fallugia paradoxa (D. Don) Endl. ex Torr., Mahonia spp., Rhus trilobata Nutt. var. simplicifolia (Greene) Barkl. | |
| Dominant species: | Acer negundo L. var. californicum (Torr. & Gray) Sarg., Celtis laevigata Willd. var. reticulata (Torr.) L. Benson, Cercis orbiculata Greene | |
| Habitat type: | Riparian | |
| Vegetation density: High | Average height of vegetation (m): 3 | |
| Tamarisk estimate: Low | | |
| Other info: | Removal of TAMRAM will have no effect on species. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: Saddle Canyon River mile: 47.2 L
Location description: Saddle Upper 1 - 2 Date: 5/7/2005

| | Start point | End point |
|--|--|----------------------------|
| Easting | 418775 | 419336 |
| Northing | 4024225 | 4024456 |
| GPS accuracy (m) | | 12 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: saturated | | Surface rocks: sandstone |
| Associated species: | Adiantum capillus-veneris L., Aquilegia L., Bromus rubens L., Cercis orbiculata Greene, Mimulus spp., Populus fremontii S. Wats. | |
| Dominant species: | Acer negundo L. var. californicum (Torr. & Gray) Sarg., Brickellia longifolia S. Wats., Mahonia fremontii (Torr.) Fedde | |
| Habitat type: | Riparian | |
| Vegetation density: Moderate | Average height of vegetation (m): 2.5 | |
| Tamarisk estimate: None | | |
| Other info: | Transect from waterfall to open spot in canyon - some dense patches of box elder and cottonwood but very small and scattered. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: **Saddle Canyon** River mile: 47.2 L
Location description: Saddle Upper 2 - 3 Date: 5/7/2005

| | Start point | End point |
|--|---|----------------------------|
| Easting | 419336 | 419317 |
| Northing | 4024456 | 4024441 |
| GPS accuracy (m) | 12 | 9 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: saturated | | Surface rocks: sandstone |
| Associated species: | Acer negundo L. var. californicum (Torr. & Gray) Sarg., Apocynum androsaemifolium L., Bromus rubens L., Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird | |
| Dominant species: | Brickellia longifolia S. Wats. | |
| Habitat type: | Riparian | |
| Vegetation density: Low | Average height of vegetation (m): 2 | |
| Tamarisk estimate: None | | |
| Other info: | Only ~40m from photopoint 2 to 3; we met up with the second transect group. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: **Little Nankoweap** River mile: 51.8 R
Location description: Little Nankoweap 1 Date: 5/8/2005

| | Start point | End point |
|---|--|----------------------|
| Easting | 422131 | 421317 |
| Northing | 4018434 | 4018310 |
| GPS accuracy (m) | 50 | 10 |
| Surface water within 25m <input type="checkbox"/> | | Surface water type: |
| Soil moisture: dry | | Surface rocks: shale |
| Associated species: | Atriplex canescens (Pursh) Nutt., Bromus rubens L., Ephedra spp., Opuntia spp., Sphaeralcea spp. | |
| Dominant species: | Acacia P. Mill., Brickellia longifolia S. Wats. | |
| Habitat type: | GB 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 | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: Little Nankoweap River mile: 51.8 R
Location description: Little Nankoweap 2 & 3 Date: 5/8/2005

| | Start point | End point |
|----------|-------------|-----------|
| Easting | 421317 | 422813 |
| Northing | 4018310 | 4018325 |

GPS accuracy (m) 10

Surface water within 25m Surface water type:

Soil moisture: dry Surface rocks: limestone

Associated species: Atriplex canescens (Pursh) Nutt., Bromus rubens L., Ephedra spp., Opuntia spp., Sphaeralcea spp.

Dominant species: Acacia P. Mill., Brickellia longifolia S. Wats.

Habitat type: GB 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

Canyon/Park Area: Nankoweap Creek River mile: 52.1 R
Location description: Nankoweap Creek-Lower Date: 10/5/2005

| | Start point | End point |
|----------|-------------|-----------|
| Easting | 422725 | 422134 |
| Northing | 4018138 | 4017957 |

GPS accuracy (m)

Surface water within 25m Surface water type: stream

Soil moisture: moist dry Surface rocks: limestone

Associated species: Bromus rubens L., Populus fremontii S. Wats.

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

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

Appendix C - Habitat Assessment Data

Canyon/Park Area: Nankoweap Creek River mile: 52.1 R
Location description: Nankoweap Creek-Middle Date: 10/5/2005

| | Start point | End point |
|----------|-------------|-----------|
| Easting | 419832 | 420172 |
| Northing | 4015276 | 4015490 |

GPS accuracy (m)

Surface water within 25m Surface water type: stream

Soil moisture: dry moist Surface rocks: limestone

Associated species: Ephedra spp., Fallugia paradoxa (D. Don) Endl. ex Torr., Populus fremontii S. Wats.

Dominant species: Bromus rubens L., Equisetum ×ferrissii Clute (pro sp.), Salix exigua Nutt.

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

Canyon/Park Area: Nankoweap Creek River mile: 52.1 R
Location description: Nankoweap Creek-Upper Date: 10/5/2005

| | Start point | End point |
|----------|-------------|-----------|
| Easting | 418485 | 418061 |
| Northing | 4015119 | 4015284 |

GPS accuracy (m)

Surface water within 25m Surface water type: stream

Soil moisture: dry Surface rocks: GC supergroup

Associated species: Cercis orbiculata Greene, Gutierrezia sarothrae (Pursh) Britt. & Rusby, Juniperus osteosperma (Torr.) Little, Purshia mexicana (D. Don) Henrickson, Salix exigua Nutt.

Dominant species: Artemisia tridentata Nutt., Brickellia longifolia S. Wats., Bromus rubens L.

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

Appendix C - Habitat Assessment Data

Canyon/Park Area: Carbon Creek River mile: 64.7 R
Location description: Carbon 15, 16, 17 Date: 5/9/2005

| | Start point | End point |
|--|--|-------------------------------------|
| Easting | 425047 | 424754 |
| Northing | 4001271 | 4002003 |
| GPS accuracy (m) | 7 | 4 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: moist | | Surface rocks: other |
| Associated species: | | |
| Dominant species: | Prosopis glandulosa Torr., Tamarix ramosissima Ledeb. | |
| Habitat type: | GB desert scrub | |
| Vegetation density: | Low | Average height of vegetation (m): 3 |
| Tamarisk estimate: | Low | |
| Other info: | | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: Carbon Creek River mile: 64.7 R
Location description: Carbon East Fork 1, 2, 3, 4, 5 Date: 5/9/2005

| | Start point | End point |
|--|--|---------------------------------------|
| Easting | 424754 | 424673 |
| Northing | 4002003 | 4003644 |
| GPS accuracy (m) | 7 | 4 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: dry | | Surface rocks: other |
| Associated species: | Fallugia paradoxa (D. Don) Endl. ex Torr., Stanleya pinnata (Pursh) Britt. | |
| Dominant species: | Prosopis glandulosa Torr., Tamarix ramosissima Ledeb., Yucca spp. | |
| Habitat type: | GB desert scrub | |
| Vegetation density: | Sparse | Average height of vegetation (m): 2.5 |
| Tamarisk estimate: | Low | |
| Other info: | | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: Carbon Creek River mile: 64.7 R
Location description: Carbon Photopoint WF4 - WF6 Date: 5/9/2005

| | | |
|---|--|---------------------------------------|
| | Start point | End point |
| Easting | 423720 | 424578 |
| Northing | 4002483 | 4001994 |
| GPS accuracy (m) | 6 | 3 |
| Surface water within 25m <input type="checkbox"/> | | Surface water type: |
| Soil moisture: | dry | Surface rocks: shale |
| Associated species: | Atriplex spp., Bromus rubens L., Bromus tectorum L., Encelia spp., Gutierrezia spp., Opuntia spp., Prosopis glandulosa Torr., Sphaeralcea spp., Yucca spp. | |
| Dominant species: | Coleogyne ramosissima Torr., Ephedra spp. | |
| Habitat type: | Mojave desert scrub | |
| Vegetation density: | Sparse | Average height of vegetation (m): 0.5 |
| Tamarisk estimate: | None | |
| Other info: | From South 3 to Transect 2 area. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: Carbon Creek River mile: 64.7 R
Location description: Carbon ppt. WF1 to WF4 Date: 5/9/2005

| | | |
|---|---|---------------------------------------|
| | Start point | End point |
| Easting | 422889 | 423720 |
| Northing | 4004825 | 4002483 |
| GPS accuracy (m) | 4 | 6 |
| Surface water within 25m <input type="checkbox"/> | | Surface water type: |
| Soil moisture: | dry | Surface rocks: shale |
| Associated species: | Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth, Atriplex spp., Brickellia longifolia S. Wats., Bromus rubens L., Coleogyne ramosissima Torr., Echinocactus spp., Ephedra spp., Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird, Juniperus spp., Opuntia spp., Sphaeralcea spp., Yucca spp. | |
| Dominant species: | Coleogyne ramosissima Torr., Ephedra spp., Gutierrezia spp. | |
| Habitat type: | Mojave desert scrub | |
| Vegetation density: | Sparse | Average height of vegetation (m): 0.5 |
| Tamarisk estimate: | None | |
| Other info: | Start from top of west fork of carbon (just below Galeros Butte); very dry and rocky with little vegetation. Start is 5.7km from main east/west split in Carbon. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

| | | | |
|--------------------------|--|-----------------------------------|-----------|
| Canyon/Park Area: | Lava Chuar | River mile: | 65.5 R |
| Location description: | Lava Chuar-Upper | Date: | 10/7/2005 |
| | Start point | End point | |
| Easting | 420470 | 420089 | |
| Northing | 4002770 | 4002591 | |
| GPS accuracy (m) | | | |
| Surface water within 25m | <input checked="" type="checkbox"/> | Surface water type: | stream |
| Soil moisture: | dry moist | Surface rocks: | sandstone |
| Associated species: | Agave utahensis Engelm., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Populus fremontii S. Wats., Purshia mexicana (D. Don) Henrickson | | |
| Dominant species: | Equisetum ×ferrissii Clute (pro sp.), Juniperus osteosperma (Torr.) Little, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | | |
| 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 | | |
| Canyon/Park Area: | 70.2 Cardenas Hillside Spring | River mile: | 70.2 L |
| Location description: | Cardenas hillside spring 1,2 | Date: | 5/10/2005 |
| | Start point | End point | |
| Easting | 423223 | 423158 | |
| Northing | 3993478 | 3993503 | |
| GPS accuracy (m) | 7 | 4 | |
| Surface water within 25m | <input checked="" type="checkbox"/> | Surface water type: | seep |
| Soil moisture: | dry | Surface rocks: | sandstone |
| Associated species: | Acacia P. Mill., Atriplex spp., Ephedra spp., Stanleya pinnata (Pursh) Britt., Tamarix ramosissima Ledeb. | | |
| Dominant species: | Cladium californicum (S. Wats.) O'Neill, Phragmites australis (Cav.) Trin. ex Steud., Prosopis glandulosa Torr. | | |
| Habitat type: | Riparian | | |
| Vegetation density: | Moderate | Average height of vegetation (m): | 2.5 |
| Tamarisk estimate: | Low | | |
| Other info: | Very small seep area on hillside. Treed area is 2 acres. Seep area w/ riparian grasses is <5 acres. No surface water found. Area around seep is very sparse. ~600m from Cardenas beach on Escalante trail. | | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: 70.8 mile drainage River mile: 70.8 L
Location description: 70.8 mile drainage photopoint 1 - 2 Date: 5/10/2005

| | Start point | End point |
|--|--|--------------------------|
| Easting | 423076 | 422964 |
| Northing | 3992849 | 3993123 |
| GPS accuracy (m) | 4 | 4 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: seep |
| Soil moisture: dry | | Surface rocks: sandstone |
| Associated species: | Bromus rubens L., Encelia spp., Ephedra spp., Tamarix ramosissima Ledeb. | |
| Dominant species: | Acacia P. Mill., Prosopis glandulosa Torr. | |
| Habitat type: | Mojave desert scrub | |
| Vegetation density: Low | Average height of vegetation (m): 3 | |
| Tamarisk estimate: Low | | |
| Other info: | | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: Cardenas Creek River mile: 71 L
Location description: Cardenas 1 Date: 5/10/2005

| | Start point | End point |
|---|--|--------------------------|
| Easting | 422872 | 422318 |
| Northing | 3990978 | 3991654 |
| GPS accuracy (m) | 7 | 5 |
| Surface water within 25m <input type="checkbox"/> | | Surface water type: |
| Soil moisture: dry | | Surface rocks: sandstone |
| Associated species: | Ephedra spp., Fallugia paradoxa (D. Don) Endl. ex Torr. | |
| Dominant species: | Acacia P. Mill., Cercis orbiculata Greene, Rhus spp. | |
| Habitat type: | GB 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 | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: Cardenas Creek

River mile: 71 L

Location description: Cardenas 2, 3, 4, 5

Date: 5/10/2005

| | | |
|---|--|---------------------------------------|
| | Start point | End point |
| Easting | 422318 | 422257 |
| Northing | 3991654 | 3993524 |
| GPS accuracy (m) | 5 | 14 |
| Surface water within 25m <input type="checkbox"/> | | Surface water type: |
| Soil moisture: | dry | Surface rocks: sandstone |
| Associated species: | Fallugia paradoxa (D. Don) Endl. ex Torr., Opuntia spp. | |
| Dominant species: | Acacia P. Mill., Cercis orbiculata Greene, Rhus spp. | |
| Habitat type: | GB desert scrub | |
| Vegetation density: | Sparse | Average height of vegetation (m): 1.5 |
| Tamarisk estimate: | None | |
| Other info: | | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: Unkar Creek

River mile: 72.3 R

Location description: Upper Unkar

Date: 10/29/2005

| | | |
|---|--|-------------------------------------|
| | Start point | End point |
| Easting | 418881 | 418451 |
| Northing | 3994718 | 3994700 |
| GPS accuracy (m) | 5 | 6 |
| Surface water within 25m <input type="checkbox"/> | | Surface water type: |
| Soil moisture: | moist | Surface rocks: sandstone shale |
| Associated species: | Baccharis emoryi Gray, Brickellia longifolia S. Wats., Datura wrightii Regel, Petradoria pumila (Nutt.) Greene, Tamarix ramosissima Ledeb. | |
| Dominant species: | Acacia greggii Gray, Encelia farinosa Gray ex Torr., Isocoma acradenia (Greene) Greene, Populus fremontii S. Wats. | |
| Habitat type: | Riparian | GB desert scrub |
| Vegetation density: | Sparse | Average height of vegetation (m): 3 |
| Tamarisk estimate: | High | |
| Other info: | | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: Papago Canyon

River mile: 76 L

Location description: Papago 1

Date: 3/12/2007

Start point End point

Easting 418244 418283

Northing 3989278 3988146

GPS accuracy (m)

Surface water within 25m

Surface water type:

Soil moisture: dry

Surface rocks: GC supergroup

Associated species:

Dominant species: Brickellia longifolia S. Wats., Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi

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

Canyon/Park Area: Hance Creek

River mile: 76.6 L

Location description: Hance 1

Date: 6/8/2005

Start point End point

Easting 413577 413412

Northing 3986230 3986374

GPS accuracy (m) 10 13

Surface water within 25m

Surface water type: seep spring

Soil moisture: dry saturated Surface rocks: sandstone

Associated species: Brickellia longifolia S. Wats., Cercis orbiculata Greene, Fraxinus anomala Torr. ex S. Wats., Salix gooddingii Ball, Tamarix ramosissima Ledeb.

Dominant species: Baccharis salicifolia (Ruiz & Pavón) Pers., Fallugia paradoxa (D. Don) Endl. ex Torr.

Habitat type: Riparian

Vegetation density: Moderate Average height of vegetation (m): 2

Tamarisk estimate:

Other info:

SWIFL determination: Not suitable or potential southwestern willow flycatcher habitat

Appendix C - Habitat Assessment Data

Canyon/Park Area: Hance Creek River mile: 76.6 L
Location description: Hance 2 Date: 6/8/2005

| | Start point | End point |
|--|--|-------------------------------------|
| Easting | 413412 | 413210 |
| Northing | 3986374 | 3986580 |
| GPS accuracy (m) | 13 | 30 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: seep stream |
| Soil moisture: | saturated | Surface rocks: sandstone |
| Associated species: | Andropogon glomeratus (Walt.) B.S.P., Brickellia longifolia S. Wats., Cladium californicum (S. Wats.) O'Neill, Fallugia paradoxa (D. Don) Endl. ex Torr., Isocoma acradenia (Greene) Greene, Purshia stansburiana (Torr.) Henrickson, Tamarix ramosissima Ledeb., Typha spp. | |
| Dominant species: | Baccharis salicifolia (Ruiz & Pavón) Pers., Populus fremontii S. Wats. | |
| Habitat type: | Riparian | |
| Vegetation density: | Moderate | Average height of vegetation (m): 3 |
| Tamarisk estimate: | | |
| Other info: | | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: Hance Creek River mile: 76.6 L
Location description: Hance 3 Date: 6/8/2005

| | Start point | End point |
|--|--|---------------------------------------|
| Easting | 413210 | 413090 |
| Northing | 3986580 | 3987060 |
| GPS accuracy (m) | 30 | 30 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: | saturated | Surface rocks: sandstone |
| Associated species: | Cercis orbiculata Greene, Rhus trilobata Nutt., Tamarix ramosissima Ledeb., Typha spp. | |
| Dominant species: | Baccharis salicifolia (Ruiz & Pavón) Pers., Salix exigua Nutt. | |
| Habitat type: | Riparian | |
| Vegetation density: | Moderate | Average height of vegetation (m): 2.5 |
| Tamarisk estimate: | | |
| Other info: | | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: Hance Creek River mile: 76.6 L
Location description: Hance 4 Date: 6/8/2005

| | Start point | End point |
|--|--|---------------------------------------|
| Easting | 413090 | 413395 |
| Northing | 3987060 | 3987790 |
| GPS accuracy (m) | 20 | 9 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: saturated | | Surface rocks: granite |
| Associated species: | Andropogon glomeratus (Walt.) B.S.P., Brickellia longifolia S. Wats., Populus fremontii S. Wats. | |
| Dominant species: | Baccharis salicifolia (Ruiz & Pavón) Pers., Salix exigua Nutt. | |
| Habitat type: | Riparian | |
| Vegetation density: | Moderate | Average height of vegetation (m): 2.5 |
| Tamarisk estimate: | | |
| Other info: | | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: Hance Creek River mile: 76.6 L
Location description: Hance 5 Date: 6/8/2005

| | Start point | End point |
|--|--|-------------------------------------|
| Easting | 413395 | 413406 |
| Northing | 3987790 | 3988356 |
| GPS accuracy (m) | 9 | 7 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: saturated | | Surface rocks: sandstone |
| Associated species: | Andropogon glomeratus (Walt.) B.S.P. | |
| Dominant species: | Baccharis salicifolia (Ruiz & Pavón) Pers., Salix exigua Nutt. | |
| Habitat type: | Riparian | |
| Vegetation density: | Low | Average height of vegetation (m): 3 |
| Tamarisk estimate: | | |
| Other info: | | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: Hance Creek River mile: 76.6 L
Location description: Hance 6 Date: 6/8/2005

| | Start point | End point |
|--|--|-------------------------------------|
| Easting | 413406 | 413500 |
| Northing | 3988356 | 3988400 |
| GPS accuracy (m) | 7 | 30 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: saturated | | Surface rocks: granite |
| Associated species: | Brickellia longifolia S. Wats. | |
| Dominant species: | Baccharis salicifolia (Ruiz & Pavón) Pers., Salix exigua Nutt., Tamarix ramosissima Ledeb. | |
| Habitat type: | Riparian | |
| Vegetation density: | Low | Average height of vegetation (m): 3 |
| Tamarisk estimate: | | |
| Other info: | | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: Red Canyon River mile: 76.6 L
Location description: Red Canyon 2 Date: 10/6/2005

| | Start point | End point |
|---|---|-------------------------------------|
| Easting | 416438 | 416260 |
| Northing | 3987368 | 3987191 |
| GPS accuracy (m) | | |
| Surface water within 25m <input type="checkbox"/> | | Surface water type: |
| Soil moisture: dry | | Surface rocks: GC supergroup |
| Associated species: | Agave L., Populus fremontii S. Wats. | |
| Dominant species: | Acacia greggii Gray, Ephedra spp., Gutierrezia sarothrae (Pursh) Britt. & Rusby | |
| Habitat type: | Riparian | |
| Vegetation density: | Low | Average height of vegetation (m): 2 |
| Tamarisk estimate: | None | |
| Other info: | | |
| SWIFL determination: | Not Suitable or Potential Southwestern Willow Flycatcher Habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: Cottonwood Creek River mile: 80.5 L
Location description: Cottonwood 1 Date: 6/9/2005

| | | |
|--|---|---------------------------------------|
| | Start point | End point |
| Easting | 410871 | 410725 |
| Northing | 3988030 | 3988674 |
| GPS accuracy (m) | 8 | 15 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: | saturated | Surface rocks: sandstone |
| Associated species: | Agave utahensis Engelm., Apocynum cannabinum L., Artemisia ludoviciana Nutt., Bromus rubens L., Bromus tectorum L., Cercis orbiculata Greene, Ephedra spp., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Isocoma acradenia (Greene) Greene, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Polypogon monspeliensis (L.) Desf., Populus fremontii S. Wats., Solidago spp. | |
| Dominant species: | Purshia stansburiana (Torr.) Henrickson, Rhus trilobata Nutt., Tamarix ramosissima Ledeb. | |
| Habitat type: | Riparian | |
| Vegetation density: | Sparse | Average height of vegetation (m): 1.5 |
| Tamarisk estimate: | | |
| Other info: | Upper Tapeats | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: Cottonwood Creek River mile: 80.5 L
Location description: Cottonwood 2 Date: 6/9/2005

| | | |
|--|---|---------------------------------------|
| | Start point | End point |
| Easting | 410725 | 411001 |
| Northing | 3988674 | 3989020 |
| GPS accuracy (m) | 15 | 14 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: | moist | Surface rocks: schist |
| Associated species: | Populus fremontii S. Wats. | |
| Dominant species: | Baccharis salicifolia (Ruiz & Pavón) Pers., Brickellia longifolia S. Wats., Cercis orbiculata Greene, Isocoma acradenia (Greene) Greene | |
| Habitat type: | Riparian | |
| Vegetation density: | Low | Average height of vegetation (m): 2.5 |
| Tamarisk estimate: | | |
| Other info: | Below Tapeats gorge | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: Grapevine Creek River mile: 81.5 L
Location description: Grapevine 1 Date: 6/9/2005

| | | |
|--|---|-------------------------------------|
| | Start point | End point |
| Easting | 409169 | 409385 |
| Northing | 3989560 | 3989485 |
| GPS accuracy (m) | 30 | 6 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: seep |
| Soil moisture: moist | | Surface rocks: sandstone |
| Associated species: | Agave L., Bromus rubens L., Coleogyne ramosissima Torr., Eriogonum heermannii Dur. & Hilg. var. subracemosum (S. Stokes) Reveal, Fallugia paradoxa (D. Don) Endl. ex Torr., Hesperodoria salicina (Blake) Nesom, Rhus trilobata Nutt., Tamarix ramosissima Ledeb. | |
| Dominant species: | Acacia greggii Gray, Gutierrezia sarothrae (Pursh) Britt. & Rusby | |
| Habitat type: | Riparian | |
| Vegetation density: | Sparse | Average height of vegetation (m): 1 |
| Tamarisk estimate: | | |
| Other info: | East rim of Grapevine Canyon, salty seep | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: Grapevine Creek River mile: 81.5 L
Location description: Grapevine 2 Date: 6/9/2005

| | | |
|--|--|---------------------------------------|
| | Start point | End point |
| Easting | 408639 | 408707 |
| Northing | 3989174 | 3989046 |
| GPS accuracy (m) | 12 | 12 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: seep |
| Soil moisture: saturated | | Surface rocks: sandstone |
| Associated species: | Acacia greggii Gray, Bernardia incana Morton, Cercis orbiculata Greene, Cirsium neomexicanum Gray, Fallugia paradoxa (D. Don) Endl. ex Torr., Iva acerosa (Nutt.) R.C. Jackson, Juniperus spp. | |
| Dominant species: | Fraxinus anomala Torr. ex S. Wats., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Polypogon monspeliensis (L.) Desf., Rhus trilobata Nutt. | |
| Habitat type: | Riparian | |
| Vegetation density: | High | Average height of vegetation (m): 3.5 |
| Tamarisk estimate: | | |
| Other info: | Spring on east rim | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: Grapevine Creek River mile: 81.5 L
Location description: Grapevine 3 Date: 6/9/2005

| | Start point | End point |
|---|---|-------------------------------------|
| Easting | 408491 | 408491 |
| Northing | 3989044 | 3989044 |
| GPS accuracy (m) | 8 | 8 |
| Surface water within 25m <input type="checkbox"/> | | Surface water type: |
| Soil moisture: | moist | Surface rocks: sandstone |
| Associated species: | Isocoma acradenia (Greene) Greene, Polypogon monspeliensis (L.) Desf. | |
| Dominant species: | Tamarix ramosissima Ledeb. | |
| Habitat type: | Riparian | |
| Vegetation density: | Low | Average height of vegetation (m): 1 |
| Tamarisk estimate: | | |
| Other info: | Seep on east rim | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: Grapevine Creek River mile: 81.5 L
Location description: Grapevine 4 Date: 6/10/2005

| | Start point | End point |
|--|--|---------------------------------------|
| Easting | 407444 | 407825 |
| Northing | 3988615 | 3988682 |
| GPS accuracy (m) | 7 | 16 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: | moist | Surface rocks: shale |
| Associated species: | Aristida arizonica Vasey, Bromus rubens L. | |
| Dominant species: | Brickellia longifolia S. Wats., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Tamarix ramosissima Ledeb. | |
| Habitat type: | Riparian | |
| Vegetation density: | Sparse | Average height of vegetation (m): 0.5 |
| Tamarisk estimate: | | |
| Other info: | West fork. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: Grapevine Creek River mile: 81.5 L
Location description: Grapevine 5 Date: 6/10/2005

| | Start point | End point |
|------------------|-------------|-----------|
| Easting | 407825 | 408616 |
| Northing | 3988682 | 3989381 |
| GPS accuracy (m) | 16 | 27 |

Surface water within 25m Surface water type: stream
Soil moisture: moist Surface rocks: sandstone
Associated species: Cercis orbiculata Greene, Cladium californicum (S. Wats.) O'Neill, Gutierrezia sarothrae (Pursh) Britt. & Rusby, Haplopappus spp., Heterotheca villosa (Pursh) Shinnery, Typha spp.
Dominant species: Acacia greggii Gray, Brickellia longifolia S. Wats.
Habitat type: Riparian
Vegetation density: Sparse Average height of vegetation (m): 1
Tamarisk estimate:
Other info:
SWIFL determination: Not suitable or potential southwestern willow flycatcher habitat

Canyon/Park Area: Grapevine Creek River mile: 81.5 L
Location description: Grapevine 6 Date: 6/10/2005

| | Start point | End point |
|------------------|-------------|-----------|
| Easting | 408616 | 408973 |
| Northing | 3989381 | 3989691 |
| GPS accuracy (m) | 27 | 12 |

Surface water within 25m Surface water type: stream
Soil moisture: moist saturated Surface rocks: sandstone
Associated species: Adiantum capillus-veneris L., Cladium californicum (S. Wats.) O'Neill
Dominant species: Baccharis salicifolia (Ruiz & Pavón) Pers., Brickellia longifolia S. Wats., Populus fremontii S. Wats., Purshia spp., Solidago spp.
Habitat type: Riparian
Vegetation density: Low Average height of vegetation (m): 2
Tamarisk estimate:
Other info:
SWIFL determination: Not suitable or potential southwestern willow flycatcher habitat

Appendix C - Habitat Assessment Data

Canyon/Park Area: Grapevine Creek River mile: 81.5 L
Location description: Grapevine 7 Date: 6/10/2005

| | Start point | End point |
|--|-------------|----------------------------|
| Easting | 408973 | 409206 |
| Northing | 3989691 | 3989750 |
| GPS accuracy (m) | 12 | 10 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: moist saturated | | Surface rocks: schist |

Associated species:
Dominant species: Baccharis salicifolia (Ruiz & Pavón) Pers., Populus fremontii S. Wats., Solidago spp., Tamarix ramosissima Ledeb.
Habitat type: Riparian
Vegetation density: Sparse Average height of vegetation (m): 2
Tamarisk estimate:
Other info: Mid-schist.
SWIFL determination: Not suitable or potential southwestern willow flycatcher habitat

Canyon/Park Area: Grapevine Creek River mile: 81.5 L
Location description: Grapevine 8 Date: 6/10/2005

| | Start point | End point |
|--|-------------|----------------------------|
| Easting | 409206 | 409780 |
| Northing | 3989691 | 3990320 |
| GPS accuracy (m) | 10 | 10 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: saturated | | Surface rocks: sandstone |

Associated species: Baccharis salicifolia (Ruiz & Pavón) Pers., Oenothera elata Kunth, Salix gooddingii Ball
Dominant species: Populus fremontii S. Wats., Tamarix ramosissima Ledeb.
Habitat type: Riparian
Vegetation density: Low Average height of vegetation (m): 0
Tamarisk estimate:
Other info:
SWIFL determination: Not suitable or potential southwestern willow flycatcher habitat

Appendix C - Habitat Assessment Data

Canyon/Park Area: Grapevine Creek River mile: 81.5 L
Location description: Grapevine 9 Date: 6/11/2005

| | Start point | End point |
|--|---|----------------------------|
| Easting | 407899 | 407171 |
| Northing | 3988422 | 3987424 |
| GPS accuracy (m) | 7 | 8 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: moist | | Surface rocks: sandstone |
| Associated species: | Baccharis salicifolia (Ruiz & Pavón) Pers., Celtis spp., Cercis orbiculata Greene, Fraxinus anomala Torr. ex S. Wats. | |
| Dominant species: | Salix gooddingii Ball, Tamarix ramosissima Ledeb. | |
| Habitat type: | Riparian | |
| Vegetation density: Sparse | Average height of vegetation (m): 1 | |
| Tamarisk estimate: | | |
| Other info: | East fork. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: Trib Btwn Boulder and Grapevine River mile: 82.3 L
Location description: Trib Btwn Boulder and Grapevine 1 Date: 6/10/2005

| | Start point | End point |
|---|--|--------------------------|
| Easting | 408362 | 408362 |
| Northing | 3990648 | 3990648 |
| GPS accuracy (m) | 8 | 8 |
| Surface water within 25m <input type="checkbox"/> | | Surface water type: |
| Soil moisture: moist | | Surface rocks: sandstone |
| Associated species: | Atriplex canescens (Pursh) Nutt., Fraxinus anomala Torr. ex S. Wats., Gutierrezia sarothrae (Pursh) Britt. & Rusby | |
| Dominant species: | Bromus rubens L. | |
| Habitat type: | Dry wash next to upland bench | |
| Vegetation density: Sparse | Average height of vegetation (m): 0.5 | |
| Tamarisk estimate: | | |
| Other info: | | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: **Boulder Creek** River mile: 82.8 L
Location description: Boulder 1 Date: 6/10/2005

| | Start point | End point |
|--|---|---------------------------------|
| Easting | 406800 | 406109 |
| Northing | 3990793 | 3990674 |
| GPS accuracy (m) | 8 | 10 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: seep spring |
| Soil moisture: moist | | Surface rocks: shale |
| Associated species: | Artemisia ludoviciana Nutt. | |
| Dominant species: | Brickellia longifolia S. Wats., Fallugia paradoxa (D. Don) Endl. ex Torr. | |
| Habitat type: | Riparian | |
| Vegetation density: Moderate | Average height of vegetation (m): 1.5 | |
| Tamarisk estimate: | | |
| Other info: | From the confluence of east and west fork up the west fork. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: **Boulder Creek** River mile: 82.8 L
Location description: Boulder 2 Date: 6/10/2005

| | Start point | End point |
|--|---|--------------------------|
| Easting | 406664 | 406867 |
| Northing | 3990358 | 3990840 |
| GPS accuracy (m) | 8 | 11 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: seep |
| Soil moisture: saturated | | Surface rocks: sandstone |
| Associated species: | Coleogyne ramosissima Torr., Fallugia paradoxa (D. Don) Endl. ex Torr., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Purshia stansburiana (Torr.) Henrickson, Rhus trilobata Nutt. | |
| Dominant species: | Fraxinus anomala Torr. ex S. Wats. | |
| Habitat type: | Riparian | |
| Vegetation density: High | Average height of vegetation (m): 2.5 | |
| Tamarisk estimate: | | |
| Other info: | Middle fork. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: **Boulder Creek** River mile: 82.8 L
Location description: Boulder 3 Date: 6/10/2005

| | Start point | End point |
|--|--|----------------------------|
| Easting | 407139 | 406867 |
| Northing | 3991023 | 3990840 |
| GPS accuracy (m) | 7 | 6 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: spring |
| Soil moisture: saturated | | Surface rocks: sandstone |
| Associated species: | Brickellia longifolia S. Wats., Isocoma acradenia (Greene) Greene, Populus fremontii S. Wats., Salix gooddingii Ball | |
| Dominant species: | Cercis orbiculata Greene | |
| Habitat type: | Riparian | |
| Vegetation density: Low | Average height of vegetation (m): 2.5 | |
| Tamarisk estimate: | | |
| Other info: | Top of Tapeats Gorge. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: **Boulder Creek** River mile: 82.8 L
Location description: Boulder 4 Date: 6/10/2005

| | Start point | End point |
|--|--|----------------------------|
| Easting | 406867 | 407603 |
| Northing | 3990840 | 3991335 |
| GPS accuracy (m) | 6 | 7 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: saturated | | Surface rocks: schist |
| Associated species: | Acacia greggii Gray, Artemisia ludoviciana Nutt., Baccharis salicifolia (Ruiz & Pavón) Pers., Bromus rubens L., Erodium cicutarium (L.) L'Hér. ex Ait., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Sonchus spp. | |
| Dominant species: | Tamarix ramosissima Ledeb. | |
| Habitat type: | Riparian | |
| Vegetation density: Low | Average height of vegetation (m): 2 | |
| Tamarisk estimate: | | |
| Other info: | Start point for Archean. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

| | | | |
|--------------------------|--|-----------------------------------|-----------|
| Canyon/Park Area: | Clear Creek | River mile: | 84.1 R |
| Location description: | Clear Creek 1 | Date: | 9/8/2005 |
| | Start point | End point | |
| Easting | 407000 | 406839 | |
| Northing | 3993950 | 3994372 | |
| GPS accuracy (m) | | 19 | |
| Surface water within 25m | <input checked="" type="checkbox"/> | Surface water type: | stream |
| Soil moisture: | moist | Surface rocks: | schist |
| Associated species: | Encelia farinosa Gray ex Torr., Populus fremontii S. Wats., Trixis californica Kellogg | | |
| Dominant species: | Baccharis emoryi Gray, Imperata brevifolia Vasey, Isocoma acradenia (Greene) Greene | | |
| Habitat type: | Riparian | | |
| Vegetation density: | Sparse | Average height of vegetation (m): | 1 |
| Tamarisk estimate: | Sparse | | |
| Other info: | Close to river; from below double waterfall to just above waterfall. | | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | | |
| | | | |
| Canyon/Park Area: | Clear Creek | River mile: | 84.1 R |
| Location description: | Clear Creek 10 | Date: | 9/9/2005 |
| | Start point | End point | |
| Easting | 411707 | 411707 | |
| Northing | 3996907 | 3996907 | |
| GPS accuracy (m) | 14 | 14 | |
| Surface water within 25m | <input type="checkbox"/> | Surface water type: | |
| Soil moisture: | dry | Surface rocks: | sandstone |
| Associated species: | Achnatherum speciosum (Trin. & Rupr.) Barkworth, Datura wrightii Regel, Ephedra spp., Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird, Eriogonum corymbosum Benth., Setaria spp. | | |
| Dominant species: | Artemisia ludoviciana Nutt., Bromus rubens L., Fallugia paradoxa (D. Don) Endl. ex Torr., Gutierrezia sarothrae (Pursh) Britt. & Rusby | | |
| Habitat type: | Riparian | | |
| Vegetation density: | Sparse | Average height of vegetation (m): | 0.5 |
| Tamarisk estimate: | Sparse | | |
| Other info: | North arm of the East arm of Clear Creek | | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: Clear Creek River mile: 84.1 R
Location description: Clear Creek 11 Date: 9/9/2005

| | Start point | End point |
|--|---|-------------------------------------|
| Easting | 409108 | 409219 |
| Northing | 3996523 | 3998130 |
| GPS accuracy (m) | 12 | 7 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: moist | | Surface rocks: sandstone shale |
| Associated species: | Bothriochloa barbinodis (Lag.) Herter, Cladium californicum (S. Wats.) O'Neill, Heterotheca villosa (Pursh) Shinnery, Imperata brevifolia Vasey | |
| Dominant species: | Baccharis emoryi Gray, Populus fremontii S. Wats., Salix exigua Nutt. | |
| Habitat type: | Riparian | |
| Vegetation density: | Low | Average height of vegetation (m): 4 |
| Tamarisk estimate: | Sparse | |
| Other info: | Main canyon between Obi Canyon and East Fork. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: Clear Creek River mile: 84.1 R
Location description: Clear Creek 12 Date: 9/10/2005

| | Start point | End point |
|--|--|-------------------------------------|
| Easting | 409294 | 409548 |
| Northing | 3998112 | 3998413 |
| GPS accuracy (m) | 7 | 7 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: moist | | Surface rocks: sandstone |
| Associated species: | Bothriochloa barbinodis (Lag.) Herter, Brickellia longifolia S. Wats., Fallugia paradoxa (D. Don) Endl. ex Torr., Heterotheca villosa (Pursh) Shinnery, Pseudognaphalium stramineum (Kunth) W.A. Weber | |
| Dominant species: | Baccharis emoryi Gray, Populus fremontii S. Wats., Salix exigua Nutt. | |
| Habitat type: | Riparian | |
| Vegetation density: | Low | Average height of vegetation (m): 4 |
| Tamarisk estimate: | Sparse | |
| Other info: | Between Obi & Ariel Canyons. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: Clear Creek River mile: 84.1 R
Location description: Clear Creek 13 Date: 9/10/2005

| | Start point | End point |
|--|---|----------------------------|
| Easting | 409510 | 409917 |
| Northing | 3998505 | 3999226 |
| GPS accuracy (m) | 12 | 8 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: moist | | Surface rocks: sandstone |
| Associated species: | Artemisia dracunculus L., Cirsium arizonicum (Gray) Petrak, Heterotheca villosa (Pursh) Shinnery | |
| Dominant species: | Baccharis emoryi Gray, Brickellia longifolia S. Wats., Equisetum spp., Populus fremontii S. Wats., Salix exigua Nutt. | |
| Habitat type: | Riparian | |
| Vegetation density: Low | Average height of vegetation (m): 4 | |
| Tamarisk estimate: Sparse | | |
| Other info: | Lower Tapeats gorge of Ariel Canyon. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: Clear Creek River mile: 84.1 R
Location description: Clear Creek 14 Date: 9/10/2005

| | Start point | End point |
|--|--|----------------------------|
| Easting | 409917 | 409795 |
| Northing | 3999226 | 3999674 |
| GPS accuracy (m) | 8 | 8 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: moist | | Surface rocks: sandstone |
| Associated species: | Agave utahensis Engelm., Baccharis salicifolia (Ruiz & Pavón) Pers., Brickellia californica (Torr. & Gray) Gray, Brickellia longifolia S. Wats., Cercis orbiculata Greene, Cirsium arizonicum (Gray) Petrak, Cladium californicum (S. Wats.) O'Neill, Lobelia cardinalis L., Poa fendleriana (Steud.) Vasey, Pseudognaphalium stramineum (Kunth) W.A. Weber, Typha domingensis Pers. | |
| Dominant species: | Equisetum spp., Populus fremontii S. Wats., Salix exigua Nutt. | |
| Habitat type: | Riparian | |
| Vegetation density: Low | Average height of vegetation (m): 4 | |
| Tamarisk estimate: Sparse | | |
| Other info: | Upper Tapeats to fork in Ariel Canyon | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: Clear Creek River mile: 84.1 R
Location description: Clear Creek 15 Date: 9/10/2005

| | | |
|--|---|-------------------------------------|
| | Start point | End point |
| Easting | 409795 | 409527 |
| Northing | 3999226 | 4000036 |
| GPS accuracy (m) | 8 | 8 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: | moist | Surface rocks: |
| Associated species: | Acer negundo L. var. californicum (Torr. & Gray) Sarg., Andropogon glomeratus (Walt.) B.S.P., Bromus rigidus Roth, Cercis orbiculata Greene, Cirsium arizonicum (Gray) Petrak, Cladium californicum (S. Wats.) O'Neill, Eurybia glauca (Nutt.) Nesom, Frangula betulifolia (Greene) V. Grub. ssp. betulifolia, Imperata brevifolia Vasey, Iva acerosa (Nutt.) R.C. Jackson, Lobelia cardinalis L., Mimulus cardinalis Dougl. ex Benth., Oenothera elata Kunth ssp. hookeri (Torr. & Gray) W. Dietr. & W.L. Wagner, Pinus ponderosa P. & C. Lawson | |
| Dominant species: | Baccharis emoryi Gray, Bromus rubens L., Isocoma acradenia (Greene) Greene, Populus fremontii S. Wats., Salix exigua Nutt. | |
| Habitat type: | | |
| Vegetation density: | Moderate | Average height of vegetation (m): 4 |
| Tamarisk estimate: | Sparse | |
| Other info: | West fork of Ariel Creek | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: Clear Creek River mile: 84.1 R
Location description: Clear Creek 16 Date: 9/10/2005

| | | |
|--|---|-------------------------------------|
| | Start point | End point |
| Easting | 409527 | 409448 |
| Northing | 4000036 | 4000307 |
| GPS accuracy (m) | 8 | 12 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: | moist | Surface rocks: shale |
| Associated species: | Andropogon glomeratus (Walt.) B.S.P., Arctostaphylos Adans., Lobelia cardinalis L., Mimulus cardinalis Dougl. ex Benth., Oenothera elata Kunth, Phragmites australis (Cav.) Trin. ex Steud., Quercus turbinella Greene, Typha domingensis Pers. | |
| Dominant species: | Acer negundo L. var. californicum (Torr. & Gray) Sarg., Brickellia longifolia S. Wats., Cercis orbiculata Greene, Populus fremontii S. Wats. | |
| Habitat type: | Riparian | |
| Vegetation density: | Low | Average height of vegetation (m): 4 |
| Tamarisk estimate: | Sparse | |
| Other info: | West fork Ariel Creek to the falls and beyond. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: Clear Creek River mile: 84.1 R
Location description: Clear Creek 17 Date: 9/10/2005

| | | |
|--|--|---------------------------------------|
| | Start point | End point |
| Easting | 409961 | 410162 |
| Northing | 3999853 | 3999978 |
| GPS accuracy (m) | 9 | 100 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: moist | | Surface rocks: shale |
| Associated species: | Imperata brevifolia Vasey, Salix gooddingii Ball | |
| Dominant species: | Equisetum spp., Populus fremontii S. Wats., Salix exigua Nutt., Salix spp. | |
| Habitat type: | Riparian | |
| Vegetation density: | Low | Average height of vegetation (m): 2.5 |
| Tamarisk estimate: | Sparse | |
| Other info: | East fork of Ariel Creek | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: Clear Creek River mile: 84.1 R
Location description: Clear Creek 18 Date: 9/10/2005

| | | |
|--|---|---------------------------------------|
| | Start point | End point |
| Easting | 410365 | 409548 |
| Northing | 3998655 | 3998413 |
| GPS accuracy (m) | 11 | 7 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: dry moist | | Surface rocks: sandstone |
| Associated species: | Fraxinus anomala Torr. ex S. Wats., Juniperus scopulorum Sarg. | |
| Dominant species: | Acer negundo L. var. californicum (Torr. & Gray) Sarg., Baccharis emoryi Gray, Brickellia longifolia S. Wats., Cercis orbiculata Greene, Populus fremontii S. Wats. | |
| Habitat type: | Riparian | |
| Vegetation density: | Low | Average height of vegetation (m): 2.5 |
| Tamarisk estimate: | Sparse | |
| Other info: | Tapeats gorge; main canyon | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: Clear Creek River mile: 84.1 R
Location description: Clear Creek 19 Date: 9/11/2005

| | Start point | End point |
|---|---|---------------------------------------|
| Easting | 411445 | 411445 |
| Northing | 3999954 | 3999954 |
| GPS accuracy (m) | 7 | 7 |
| Surface water within 25m <input type="checkbox"/> | | Surface water type: |
| Soil moisture: | dry | Surface rocks: shale |
| Associated species: | Agave utahensis Engelm., Bothriochloa barbinodis (Lag.) Herter, Poa fendleriana (Steud.) Vasey, Populus fremontii S. Wats., Purshia stansburiana (Torr.) Henrickson | |
| Dominant species: | Artemisia dracunculus L., Artemisia ludoviciana Nutt., Fallugia paradoxa (D. Don) Endl. ex Torr., Heterotheca villosa (Pursh) Shinnars | |
| Habitat type: | Riparian | |
| Vegetation density: | Low | Average height of vegetation (m): 1.5 |
| Tamarisk estimate: | Sparse | |
| Other info: | About 1km downstream of Cheyava Falls | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: Clear Creek River mile: 84.1 R
Location description: Clear Creek 2 Date: 9/8/2005

| | Start point | End point |
|--|--|-------------------------------------|
| Easting | 406839 | 407061 |
| Northing | 3994372 | 3994550 |
| GPS accuracy (m) | 19 | 31 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: | moist | Surface rocks: schist |
| Associated species: | Encelia farinosa Gray ex Torr., Populus fremontii S. Wats. | |
| Dominant species: | Baccharis emoryi Gray, Isocoma acradenia (Greene) Greene | |
| Habitat type: | Riparian | |
| Vegetation density: | Low | Average height of vegetation (m): 2 |
| Tamarisk estimate: | Low | |
| Other info: | This is a short section upstream of double waterfall | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: Clear Creek River mile: 84.1 R
Location description: Clear Creek 20 Date: 9/12/2005

| | | |
|--|--|---------------------------------------|
| | Start point | End point |
| Easting | 409143 | 409143 |
| Northing | 3998370 | 3998370 |
| GPS accuracy (m) | 11 | 11 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: seep |
| Soil moisture: | dry | Surface rocks: |
| Associated species: | Acacia greggii Gray, Agave utahensis Engelm., Anulocaulis leiosolenus (Torr.) Standl. var. leiosolenus, Bromus rubens L., Encelia farinosa Gray ex Torr., Isocoma acradenia (Greene) Greene, Mentzelia spp., Stephanomeria parryi Gray, Thelypodium wrightii Gray, Yucca baccata Torr. | |
| Dominant species: | Ephedra spp., Eriogonum corymbosum Benth., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Opuntia basilaris Engelm. & Bigelow | |
| Habitat type: | Mojave desert scrub | |
| Vegetation density: | Sparse | Average height of vegetation (m): 0.3 |
| Tamarisk estimate: | Sparse | |
| Other info: | South facing salty seep near mouth of Obi Canyon | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: Clear Creek River mile: 84.1 R
Location description: Clear Creek 21 Date: 9/12/2005

| | | |
|---|--|-------------------------------------|
| | Start point | End point |
| Easting | 408398 | 408398 |
| Northing | 3997575 | 3997575 |
| GPS accuracy (m) | 6 | 6 |
| Surface water within 25m <input type="checkbox"/> | | Surface water type: |
| Soil moisture: | dry | Surface rocks: GC supergroup |
| Associated species: | Baccharis sergiloides Gray, Fallugia paradoxa (D. Don) Endl. ex Torr., Hesperodoria salicina (Blake) Nesom, Juniperus osteosperma (Torr.) Little | |
| Dominant species: | Acacia greggii Gray, Artemisia dracunculus L., Artemisia ludoviciana Nutt., Brickellia longifolia S. Wats., Heterotheca villosa (Pursh) Shinnars, Populus fremontii S. Wats. | |
| Habitat type: | Riparian | |
| Vegetation density: | Low | Average height of vegetation (m): 1 |
| Tamarisk estimate: | Sparse | |
| Other info: | Where trail enters canyon above the dry falls. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: Clear Creek River mile: 84.1 R
Location description: Clear Creek 22 Date: 9/12/2005

| | Start point | End point |
|------------------|-------------|-----------|
| Easting | 408824 | 408824 |
| Northing | 3997280 | 3997280 |
| GPS accuracy (m) | 11 | 11 |

Surface water within 25m Surface water type: spring stream
Soil moisture: moist Surface rocks: shale

Associated species: *Andropogon glomeratus* (Walt.) B.S.P., *Aristida* spp., *Bothriochloa barbinodis* (Lag.) Herter, *Encelia farinosa* Gray ex Torr., *Muhlenbergia* spp., *Purshia* spp., *Sporobolus* spp.

Dominant species: *Heterotheca villosa* (Pursh) Shinners, *Isocoma acradenia* (Greene) Greene, *Populus fremontii* S. Wats., *Salix exigua* Nutt.

Habitat type: Riparian

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

Tamarisk estimate: Sparse

Other info: Located where the trail enters Clear Creek Canyon.

SWIFL determination: Not suitable or potential southwestern willow flycatcher habitat

Canyon/Park Area: Clear Creek River mile: 84.1 R
Location description: Clear Creek 3 Date: 9/8/2005

| | Start point | End point |
|------------------|-------------|-----------|
| Easting | 407061 | 407343 |
| Northing | 3994550 | 3994887 |
| GPS accuracy (m) | 31 | 7 |

Surface water within 25m Surface water type: stream
Soil moisture: moist Surface rocks: schist

Associated species: *Brickellia longifolia* S. Wats., *Imperata brevifolia* Vasey

Dominant species: *Baccharis emoryi* Gray, *Isocoma acradenia* (Greene) Greene, *Populus fremontii* S. Wats.

Habitat type: Riparian

Vegetation density: Low Average height of vegetation (m): 2

Tamarisk estimate: Sparse

Other info: Mid part of inner gorge.

SWIFL determination: Not suitable or potential southwestern willow flycatcher habitat

Appendix C - Habitat Assessment Data

Canyon/Park Area: Clear Creek River mile: 84.1 R
Location description: Clear Creek 4 Date: 9/8/2005

| | Start point | End point |
|--|--|----------------------------|
| Easting | 407343 | 407553 |
| Northing | 3994887 | 3994961 |
| GPS accuracy (m) | 7 | 9 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: moist | | Surface rocks: schist |
| Associated species: | Bebbia juncea (Benth.) Greene var. aspera Greene, Conyza canadensis (L.) Cronq., Imperata brevifolia Vasey, Populus fremontii S. Wats., Porophyllum gracile Benth. | |
| Dominant species: | Baccharis emoryi Gray, Isocoma acradenia (Greene) Greene, Salix exigua Nutt. | |
| Habitat type: | Riparian | |
| Vegetation density: Low | Average height of vegetation (m): 1.5 | |
| Tamarisk estimate: Sparse | | |
| Other info: | Middle part of inner gorge. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: Clear Creek River mile: 84.1 R
Location description: Clear Creek 5 Date: 9/8/2005

| | Start point | End point |
|---|--|----------------------------|
| Easting | 407553 | 407929 |
| Northing | 3994961 | 3995653 |
| GPS accuracy (m) | 9 | 11 |
| Surface water within 25m <input type="checkbox"/> | | Surface water type: stream |
| Soil moisture: moist | | Surface rocks: schist |
| Associated species: | Encelia farinosa Gray ex Torr., Equisetum ×ferrissii Clute (pro sp.), Imperata brevifolia Vasey, Mimulus cardinalis Dougl. ex Benth. | |
| Dominant species: | Baccharis emoryi Gray, Cladium californicum (S. Wats.) O'Neill, Imperata brevifolia Vasey, Isocoma acradenia (Greene) Greene, Populus fremontii S. Wats., Salix exigua Nutt. | |
| Habitat type: | Riparian | |
| Vegetation density: Low | Average height of vegetation (m): 2 | |
| Tamarisk estimate: Sparse | | |
| Other info: | Middle part of inner gorge. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: Clear Creek River mile: 84.1 R
Location description: Clear Creek 6 Date: 9/8/2005

| | | |
|--|--|----------------------------|
| | Start point | End point |
| Easting | 407929 | 408942 |
| Northing | 3995653 | 3996152 |
| GPS accuracy (m) | 11 | 9 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: moist | | Surface rocks: schist |
| Associated species: | Brickellia longifolia S. Wats., Encelia farinosa Gray ex Torr., Equisetum ×ferrissii Clute (pro sp.), Imperata brevifolia Vasey, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | |
| Dominant species: | Baccharis emoryi Gray, Isocoma acradenia (Greene) Greene, Populus fremontii S. Wats., Salix exigua Nutt. | |
| Habitat type: | Riparian | |
| Vegetation density: Low | Average height of vegetation (m): 2 | |
| Tamarisk estimate: Sparse | | |
| Other info: | Upper part of Vishnu gorge. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: Clear Creek River mile: 84.1 R
Location description: Clear Creek 7 Date: 9/8/2005

| | | |
|--|---|-----------------------------------|
| | Start point | End point |
| Easting | 408942 | 410168 |
| Northing | 3996152 | 3996373 |
| GPS accuracy (m) | 9 | 6 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: spring stream |
| Soil moisture: moist | | Surface rocks: GC supergroup |
| Associated species: | Cercis orbiculata Greene, Imperata brevifolia Vasey | |
| Dominant species: | Brickellia longifolia S. Wats., Isocoma acradenia (Greene) Greene, Populus fremontii S. Wats., Salix exigua Nutt. | |
| Habitat type: | Riparian | |
| Vegetation density: Low | Average height of vegetation (m): 2 | |
| Tamarisk estimate: Low | | |
| Other info: | Open area near the confluence of the east fork and the main fork. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: Clear Creek River mile: 84.1 R
Location description: Clear Creek 8 Date: 9/8/2005

| | Start point | End point |
|--|--|-----------------------------|
| Easting | 411602 | 410596 |
| Northing | 3996622 | 3996718 |
| GPS accuracy (m) | 7 | 18 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: pothole |
| Soil moisture: dry | | Surface rocks: sandstone |
| Associated species: | | |
| Dominant species: | Cercis orbiculata Greene | |
| Habitat type: | Riparian | |
| Vegetation density: Sparse | Average height of vegetation (m): 2 | |
| Tamarisk estimate: Sparse | | |
| Other info: | East arm in the Tapeats gorge. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: Clear Creek River mile: 84.1 R
Location description: Clear Creek 9 Date: 9/9/2005

| | Start point | End point |
|--|---|----------------------------|
| Easting | 411839 | 412478 |
| Northing | 3996782 | 3996795 |
| GPS accuracy (m) | 7 | 12 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: dry | | Surface rocks: shale |
| Associated species: | Acacia greggii Gray, Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth, Agave utahensis Engelm., Artemisia dracuncululus L., Bromus tectorum L., Carex spp., Cirsium arizonicum (Gray) Petrak, Datura wrightii Regel, Heterotheca villosa (Pursh) Shinnars, Oenothera elata Kunth ssp. hookeri (Torr. & Gray) W. Dietr. & W.L. Wagner, Populus fremontii S. Wats., Rhus trilobata Nutt., Shepherdia rotundifolia Parry, Yucca baccata Torr. | |
| Dominant species: | Baccharis emoryi Gray, Fallugia paradoxa (D. Don) Endl. ex Torr., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Salix exigua Nutt. | |
| Habitat type: | Riparian | |
| Vegetation density: Low | Average height of vegetation (m): 1 | |
| Tamarisk estimate: Sparse | | |
| Other info: | East arm above the Tapeats sandstone | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

| | | | |
|--------------------------|---|-----------------------------------|----------------|
| Canyon/Park Area: | Bright Angel Creek | River mile: | 88 R |
| Location description: | Bright Angel 1 | Date: | 6/7/2005 |
| | Start point | End point | |
| Easting | 403709 | 404413 | |
| Northing | 3999427 | 4000348 | |
| GPS accuracy (m) | 11.7 | 5 | |
| Surface water within 25m | <input checked="" type="checkbox"/> | Surface water type: | stream |
| Soil moisture: | dry | Surface rocks: | cobbles schist |
| Associated species: | Acacia greggii Gray, Bromus diandrus Roth, Gutierrezia sarothrae (Pursh) Britt. & Rusby, Populus fremontii S. Wats., Sporobolus cryptandrus (Torr.) Gray, Stephanomeria pauciflora (Torr.) A. Nels., Vulpia microstachys (Nutt.) Munro | | |
| Dominant species: | Baccharis salicifolia (Ruiz & Pavón) Pers., Bromus rubens L., Isocoma acradenia (Greene) Greene, Salix exigua Nutt., Tamarix ramosissima Ledeb. | | |
| Habitat type: | Riparian | | |
| Vegetation density: | Moderate | Average height of vegetation (m): | 3 |
| Tamarisk estimate: | High | | |
| Other info: | Canyon opens up out of the box and creek. Riparian vegetation widens and becomes more dense at end point. First cottonwood trees were spotted. | | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | | |
| | | | |
| Canyon/Park Area: | Bright Angel Creek | River mile: | 88 R |
| Location description: | Bright Angel 2 | Date: | 9/29/2005 |
| | Start point | End point | |
| Easting | 406241 | 406408 | |
| Northing | 4003240 | 4003420 | |
| GPS accuracy (m) | 6.4 | 5.2 | |
| Surface water within 25m | <input checked="" type="checkbox"/> | Surface water type: | stream |
| Soil moisture: | dry | Surface rocks: | sandstone |
| Associated species: | Acacia greggii Gray, Acer negundo L. var. californicum (Torr. & Gray) Sarg., Baccharis salicifolia (Ruiz & Pavón) Pers., Fallugia paradoxa (D. Don) Endl. ex Torr., Heterotheca villosa (Pursh) Shinnars, Opuntia spp., Populus fremontii S. Wats., Solanum elaeagnifolium Cav. | | |
| Dominant species: | Baccharis emoryi Gray, Populus fremontii S. Wats., Salix exigua Nutt. | | |
| Habitat type: | Riparian | | |
| Vegetation density: | High | Average height of vegetation (m): | 3 |
| Tamarisk estimate: | High | | |
| Other info: | Upper Bright Angel Creek. | | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: Ribbon Falls

River mile: 88 R

Location description: Ribbon Falls

Date: 10/2/2005

| | | |
|--|---|----------------------------|
| | Start point | End point |
| Easting | 405180 | 405009 |
| Northing | 4001824 | 4002163 |
| GPS accuracy (m) | 4.5 | 6.9 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: saturated | | Surface rocks: sandstone |
| Associated species: | Acacia greggii Gray, Imperata brevifolia Vasey, Mimulus cardinalis Dougl. ex Benth., Mimulus guttatus DC., Populus fremontii S. Wats. | |
| Dominant species: | Baccharis emoryi Gray, Equisetum ×ferrissii Clute (pro sp.), Quercus turbinella Greene, Salix exigua Nutt. | |
| 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 | |

Canyon/Park Area: Transept Canyon

River mile: 88 R

Location description: Transept

Date: 9/30/2005

| | | |
|--|--|----------------------------|
| | Start point | End point |
| Easting | 406316 | 406120 |
| Northing | 4003711 | 4004241 |
| GPS accuracy (m) | 6.7 | 6.1 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: moist saturated | | Surface rocks: sandstone |
| Associated species: | Andropogon glomeratus (Walt.) B.S.P., Fallugia paradoxa (D. Don) Endl. ex Torr., Imperata brevifolia Vasey, Lobelia cardinalis L., Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Oenothera elata Kunth, Populus fremontii S. Wats., Typha domingensis Pers. | |
| Dominant species: | Baccharis emoryi Gray, Salix exigua Nutt. | |
| 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 | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: Garden Creek

River mile: 89 L

Location description: Garden Creek

Date: 8/24/1999

| | | |
|---|--|-----------------------|
| | Start point | End point |
| Easting | 398850 | |
| Northing | 3994137 | 0 |
| GPS accuracy (m) | 6 | |
| Surface water within 25m <input type="checkbox"/> | | Surface water type: |
| Soil moisture: moist | | Surface rocks: basalt |
| Associated species: | Cercis occidentalis Torr. ex Gray, Populus fremontii S. Wats. | |
| Dominant species: | Bromus spp., Salix exigua Nutt. | |
| Habitat type: | Interior wetlands | |
| Vegetation density: Moderate | Average height of vegetation (m): 2 | |
| Tamarisk estimate: Low | | |
| Other info: | | |
| SWIFL determination: | Not Suitable or Potential Southwestern Willow Flycatcher Habitat | |

Canyon/Park Area: Pipe Creek

River mile: 89 L

Location description: Pipe Creek

Date: 8/24/1999

| | | |
|--|---|----------------------------|
| | Start point | End point |
| Easting | 399963 | 398850 |
| Northing | 3994523 | 3993835 |
| GPS accuracy (m) | | |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: moist | | Surface rocks: sandstone |
| Associated species: | Brassica tournefortii Gouan, Cercis orbiculata Greene, Populus fremontii S. Wats. | |
| Dominant species: | Acacia greggii Gray, Baccharis salicifolia (Ruiz & Pavón) Pers., Bromus rubens L., Salix exigua Nutt. | |
| Habitat type: | Riparian | |
| Vegetation density: High | Average height of vegetation (m): 2.5 | |
| Tamarisk estimate: Sparse | | |
| Other info: | | |
| SWIFL determination: | Not Suitable or Potential Southwestern Willow Flycatcher Habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: Pipe Creek River mile: 89 L
Location description: Pipe Creek-Upper Date: 8/24/1999

| | Start point | End point |
|----------|-------------|-----------|
| Easting | 400782 | 400735 |
| Northing | 3992381 | 3992469 |

GPS accuracy (m)

Surface water within 25m Surface water type: stream

Soil moisture: moist Surface rocks: sandstone

Associated species: Populus fremontii S. Wats.

Dominant species: Acacia greggii Gray, Baccharis salicifolia (Ruiz & Pavón) Pers., Salix exigua Nutt.

Habitat type: Riparian

Vegetation density: High Average height of vegetation (m): 3

Tamarisk estimate: Sparse

Other info: Patches are too small and lack dense cover.

SWIFL determination: Not Suitable or Potential Southwestern Willow Flycatcher Habitat



Appendix C - Habitat Assessment Data

Canyon/Park Area: Boucher Creek River mile: 96.7 L
Location description: Boucher-Upper Date: 10/9/2005

| | Start point | End point |
|----------|-------------|-----------|
| Easting | 386577 | 385503 |
| Northing | 3994724 | 3993703 |

GPS accuracy (m)

Surface water within 25m Surface water type: stream
Soil moisture: dry Surface rocks: limestone

Associated species:
Dominant species: Brickellia longifolia S. Wats., Bromus rubens L., 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



Appendix C - Habitat Assessment Data

Canyon/Park Area: Crystal Creek River mile: 99 R
Location description: Crystal 1 Date: 5/12/2005

| | Start point | End point |
|--|--|----------------------------|
| Easting | 388153 | 388515 |
| Northing | 3999517 | 3999786 |
| GPS accuracy (m) | 5 | 6 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: dry | | Surface rocks: schist |
| Associated species: | Encelia spp., Ephedra spp., Mammillaria spp. | |
| Dominant species: | Baccharis salicifolia (Ruiz & Pavón) Pers., Salix exigua Nutt., Tamarix ramosissima Ledeb. | |
| Habitat type: | Riparian | |
| Vegetation density: High | Average height of vegetation (m): 4 | |
| Tamarisk estimate: High | | |
| Other info: | | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: Crystal Creek River mile: 99 R
Location description: Crystal 2 Date: 5/12/2005

| | Start point | End point |
|--|--|----------------------------|
| Easting | 388515 | 388741 |
| Northing | 3999517 | 4000169 |
| GPS accuracy (m) | 6 | 6 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: dry | | Surface rocks: other |
| Associated species: | | |
| Dominant species: | Baccharis salicifolia (Ruiz & Pavón) Pers., Encelia spp., Ephedra spp., Tamarix ramosissima Ledeb. | |
| 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 | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: Crystal Creek River mile: 99 R
Location description: Crystal 3 Date: 5/12/2005

| | Start point | End point |
|--|---|----------------------------|
| Easting | 388741 | 389002 |
| Northing | 4000169 | 4000259 |
| GPS accuracy (m) | 6 | 8 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: dry | | Surface rocks: schist |
| Associated species: | Ephedra spp., Salix exigua Nutt. | |
| Dominant species: | Baccharis spp., Pluchea sericea (Nutt.) Coville, Tamarix ramosissima Ledeb. | |
| Habitat type: | Riparian | |
| Vegetation density: Low | Average height of vegetation (m): 1.6 | |
| Tamarisk estimate: Low | | |
| Other info: | | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: Crystal Creek River mile: 99 R
Location description: Crystal 4 Date: 5/13/2005

| | Start point | End point |
|--|--|----------------------------|
| Easting | 389002 | 389202 |
| Northing | 4000259 | 4000583 |
| GPS accuracy (m) | 8 | 13 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: dry | | Surface rocks: other |
| Associated species: | Encelia spp., Ephedra spp. | |
| Dominant species: | Pluchea sericea (Nutt.) Coville, Tamarix ramosissima Ledeb. | |
| Habitat type: | Riparian | |
| Vegetation density: Moderate | Average height of vegetation (m): 3 | |
| Tamarisk estimate: Low | | |
| Other info: | | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: Crystal Creek River mile: 99 R
Location description: Crystal 5 Date: 5/13/2005

| | Start point | End point |
|--|---|----------------------------|
| Easting | 389202 | 389449 |
| Northing | 4000583 | 4000867 |
| GPS accuracy (m) | 13 | 9 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: dry | | Surface rocks: other |
| Associated species: | Baccharis spp., Bromus rubens L., Encelia spp., Ephedra spp., Isocoma acradenia (Greene) Greene, Typha spp. | |
| Dominant species: | Pluchea sericea (Nutt.) Coville, 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 | |

Canyon/Park Area: Crystal Creek River mile: 99 R
Location description: Crystal 6 Date: 5/13/2005

| | Start point | End point |
|--|--|----------------------------|
| Easting | 389449 | 389716 |
| Northing | 4000867 | 4000699 |
| GPS accuracy (m) | 9 | 14 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: dry | | Surface rocks: other |
| Associated species: | Acacia P. Mill., Baccharis spp., Bromus rubens L., Ephedra spp. | |
| Dominant species: | Pluchea sericea (Nutt.) Coville, Tamarix ramosissima Ledeb. | |
| Habitat type: | Riparian | |
| Vegetation density: Low | Average height of vegetation (m): 1.5 | |
| Tamarisk estimate: Moderate | | |
| Other info: | | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: **Copper Canyon** River mile: 110.5 L
Location description: Copper Canyon 2 Date: 3/14/2007

| | Start point | End point |
|---|--|-----------------------|
| Easting | 376645 | 376499 |
| Northing | 4011666 | 4011420 |
| GPS accuracy (m) | 10 | 10 |
| Surface water within 25m <input type="checkbox"/> | | Surface water type: |
| Soil moisture: dry | | Surface rocks: schist |
| Associated species: | Encelia farinosa Gray ex Torr., Opuntia spp., Porophyllum gracile Benth. | |
| Dominant species: | Acacia greggii Gray, Baccharis emoryi Gray | |
| 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 | |

Canyon/Park Area: **112 Mile Canyon** River mile: 112.2 L
Location description: 112 Mile 1 Date: 5/14/2005

| | Start point | End point |
|--|--|--------------------------|
| Easting | 373814 | 374028 |
| Northing | 4011093 | 4011212 |
| GPS accuracy (m) | 3 | |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: seep |
| Soil moisture: moist | | Surface rocks: schist |
| Associated species: | Encelia spp. | |
| Dominant species: | Acacia greggii Gray, Ephedra fasciculata A. Nels. | |
| Habitat type: | Mojave desert scrub | Riparian |
| Vegetation density: Low | Average height of vegetation (m): 3 | |
| Tamarisk estimate: Low | | |
| Other info: | | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: 127 Mile River mile: 127 R
Location description: 127 Mile 1 Date: 3/3/2006

| | Start point | End point |
|--|---|-------------------------------------|
| Easting | 365387 | 365511 |
| Northing | 4017075 | 4017049 |
| GPS accuracy (m) | 13 | 7.3 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: pothole |
| Soil moisture: | dry | Surface rocks: |
| Associated species: | Eucnide urens (Parry ex Gray) Parry, Porophyllum gracile Benth. | |
| Dominant species: | Acacia greggii Gray, Brickellia longifolia S. Wats., Encelia farinosa Gray ex Torr., Ephedra fasciculata A. Nels. | |
| Habitat type: | Mojave desert scrub | |
| Vegetation density: | Sparse | Average height of vegetation (m): 2 |
| Tamarisk estimate: | None | |
| Other info: | This is a narrow slot canyon in the Shinumo. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: 130 Mile - 30 Second Waterfall River mile: 130 R
Location description: 130 Mile 1 Date: 10/17/2005

| | Start point | End point |
|--|--|-------------------------------------|
| Easting | 368274 | 0 |
| Northing | 4020698 | 0 |
| GPS accuracy (m) | | |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: seep |
| Soil moisture: | moist | Surface rocks: limestone |
| Associated species: | Baccharis spp., Cercis occidentalis Torr. ex Gray, Ephedra spp., Stephanomeria thurberi Gray | |
| Dominant species: | Brickellia longifolia S. Wats., Encelia farinosa Gray ex Torr. | |
| Habitat type: | Riparian | |
| Vegetation density: | Low | Average height of vegetation (m): 1 |
| Tamarisk estimate: | Sparse | |
| Other info: | | |
| SWIFL determination: | Not Suitable or Potential Southwestern Willow Flycatcher Habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: Trail Canyon River mile: 219 R
Location description: Trail Canyon 1 Date: 5/18/2005

| | | |
|--|--|---------------------------------------|
| | Start point | End point |
| Easting | 289763 | 289273 |
| Northing | 3968388 | 3968741 |
| GPS accuracy (m) | 10 | 12 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: moist | | Surface rocks: schist |
| Associated species: | Acacia greggii Gray, Baccharis salicifolia (Ruiz & Pavón) Pers., Bromus rubens L., Encelia farinosa Gray ex Torr., Larrea tridentata (Sessé & Moc. ex DC.) Coville, Polypogon monspeliensis (L.) Desf., Sonchus spp. | |
| Dominant species: | Tamarix ramosissima Ledeb. | |
| Habitat type: | Mojave desert scrub | Riparian |
| Vegetation density: | Sparse | Average height of vegetation (m): 1.5 |
| Tamarisk estimate: | Low | |
| Other info: | Mouth to 500m up canyon. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: Trail Canyon River mile: 219 R
Location description: Trail Canyon 3 Date: 5/18/2005

| | | |
|--|---|---------------------------------------|
| | Start point | End point |
| Easting | 289273 | 289069 |
| Northing | 3968714 | 3969017 |
| GPS accuracy (m) | 12 | 9 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: stream |
| Soil moisture: moist | | Surface rocks: granite |
| Associated species: | Acacia greggii Gray, Baccharis salicifolia (Ruiz & Pavón) Pers., Baccharis sarothroides Gray, Bromus rubens L., Cryptantha spp., Typha spp. | |
| Dominant species: | Tamarix ramosissima Ledeb. | |
| Habitat type: | Riparian | |
| Vegetation density: | Moderate | Average height of vegetation (m): 2.5 |
| Tamarisk estimate: | Moderate | |
| Other info: | From 500m to 1km. At ~850 meters from mouth density increases & BACSAL begins. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: Trail Canyon River mile: 219 R
Location description: Trail Canyon 4, 5, 6, 7, 8, 9 Date: 5/18/2005

| | Start point | End point |
|---|---|--------------------------|
| Easting | 289069 | 0 |
| Northing | 3969017 | 0 |
| GPS accuracy (m) | 9 | |
| Surface water within 25m <input type="checkbox"/> | | Surface water type: seep |
| Soil moisture: moist | | Surface rocks: granite |
| Associated species: | Baccharis sarothroides Gray, Bromus rubens L., Encelia farinosa Gray ex Torr., Encelia spp. | |
| Dominant species: | Acacia greggii Gray | |
| Habitat type: | Mojave desert scrub | |
| Vegetation density: Sparse | Average height of vegetation (m): 1 | |
| Tamarisk estimate: | None | |
| Other info: | No satellites for ending GPS - ends at 20m cliff with waterfall atop Tapeats. Water intermittent depending on width of canyon. Water ends at ~100m above start point. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Canyon/Park Area: 220 Mile Canyon River mile: 220 R
Location description: 220 Mile 1 Date: 5/19/2005

| | Start point | End point |
|---|--|--------------------------------|
| Easting | 289747 | 286307 |
| Northing | 3967507 | 3966218 |
| GPS accuracy (m) | 8 | 10 |
| Surface water within 25m <input type="checkbox"/> | | Surface water type: |
| Soil moisture: dry | | Surface rocks: sandstone shale |
| Associated species: | Datura wrightii Regel, Fouquieria splendens Engelm., Porophyllum gracile Benth. | |
| Dominant species: | Acacia greggii Gray, Encelia farinosa Gray ex Torr., Larrea tridentata (Sessé & Moc. ex DC.) Coville | |
| Habitat type: | Riparian | |
| Vegetation density: Sparse | Average height of vegetation (m): 3 | |
| Tamarisk estimate: | None | |
| Other info: | 220 mile canyon is a dry tributary with sparse vegetation. Dominant species is ACAGRE (1 every 25 m). Creek bed is wide, cobbly and without much vegetation. Need to return again to see if TAMRAM begins to encroach. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: 224 Mile Canyon River mile: 223.6 L
Location description: 224 Mile 1 Date: 5/20/2006

| | | |
|--|-------------|----------------------------|
| | Start point | End point |
| Easting | 288075 | 288733 |
| Northing | 3962622 | 3961881 |
| GPS accuracy (m) | 8 | 18 |
| Surface water within 25m <input checked="" type="checkbox"/> | | 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

Canyon/Park Area: 225.5 Mile Creek River mile: 225.5 R
Location description: 225.5 Mile 1 Canyon mouth Date: 5/19/2005

| | | |
|--|-------------|--|
| | Start point | End point |
| Easting | 285951 | 0 |
| Northing | 3960884 | 0 |
| GPS accuracy (m) | 5 | |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: seep stream |
| Soil moisture: moist | | Surface rocks: granite |

Associated species: Acacia greggii Gray, Aristida spp., Bromus rubens L., Encelia farinosa Gray ex Torr., Sonchus asper (L.) Hill

Dominant species: Tamarix ramosissima Ledeb.

Habitat type: Mojave desert scrub Riparian

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

Tamarisk estimate: Low

Other info: Some tadpoles in standing water. Intermittent stream with many standing pools. Stretch mapped ended at 10m falls ~250m from mouth of canyon. Area above falls was also surveyed, no potential habitat, scattered TAMRAM.

SWIFL determination: Not suitable or potential southwestern willow flycatcher habitat

Appendix C - Habitat Assessment Data

Canyon/Park Area: 225.5 Mile Creek River mile: 225.5 R
Location description: 225.5 Mile 2 Date: 5/19/2005

| | Start point | End point |
|--|--|---------------------------------------|
| Easting | 285178 | 285592 |
| Northing | 3961766 | 3961013 |
| GPS accuracy (m) | 3 | 10 |
| Surface water within 25m <input checked="" type="checkbox"/> | | Surface water type: spring |
| Soil moisture: moist | | Surface rocks: granite sandstone |
| Associated species: | Eriogonum racemosum Nutt., Ferocactus cylindraceus (Engelm.) Orcutt var. cylindraceus, Larrea tridentata (Sessé & Moc. ex DC.) Coville, Perityle emoryi, Porophyllum gracile Benth., Typha latifolia L., Viguiera dentata (Cav.) Spreng. | |
| Dominant species: | Acacia greggii Gray, Encelia farinosa Gray ex Torr., Polypogon monspeliensis (L.) Desf., Prosopis glandulosa Torr. | |
| Habitat type: | Riparian | |
| Vegetation density: | Sparse | Average height of vegetation (m): 1.5 |
| Tamarisk estimate: | High | |
| Other info: | Saw six juvenile owls in this area. | |
| SWIFL determination: | Not suitable or potential southwestern willow flycatcher habitat | |

Appendix C - Habitat Assessment Data

Canyon/Park Area: 36.5 Mile Wash River mile: 36.6 R
Location description: 36.5 Mile Wash 1 Project (Phase): Phase IIa
Start point End point Date: 5/10/2004
Easting 424121 423959
Northing 4033951 4034061
GPS accuracy (m)
Surface water within 25m Surface water type: seep
Soil moisture: dry moist Surface rocks: limestone
Associated species: *Datura wrightii* Regel, *Maurandella antirrhiniflora* (Humb. & Bonpl. ex Willd.) Rothm., *Nicotiana glauca* Graham
Dominant species: *Brickellia longifolia* S. Wats., *Bromus rubens* L.
Habitat type: Riparian
Vegetation density: Sparse Average height of vegetation (m): 1
Tamarisk estimate: Sparse
Other info: Site ends in an alcove/bowl about 200m from the river, no GPS was available for survey end point.
SWIFL determination: Not Suitable or Potential Southwestern Willow Flycatcher Habitat

Appendix D - Hydrology Data

Date of Survey: 5/14/2005 Time Measurements Began: 9:30 Observer: CM Chris Murphy

Canyon Name: 112 Mile Canyon

Location Description: 112 Mile Hydro 1

Project: Phase IIa

Measurement Location Details: Water flows over falls (5m tall) with measurable discharge about 3m above sample, then becomes intermittent creek in narrow gorge confined by schist granite, gneiss walls.

UTM Easting: 373750 UTM Northing: 4011293 GPS Accuracy (m): 3

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

Elevation (m): 657 Slope (degrees):

Soil Type: loamy sand Aspect: 270

Weather: thin, high altitude cirrus but sun coming through

Weather over previous 3 days: Clear, warm (85-90f) low breeze, stabilizing trend

Current Temperature Air: 22 C Water: 21 C

Description of Water Source: Flow is at depth in alluvial gravel. Flow not measured due to time constraints.

Water Quality Measurements

Last Calibration-----> Date: 5/14/2005 Time: 10:00

| <u>Meter Reading #</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>Average</u> |
|------------------------|----------|----------|----------|----------------|
| Water Temp (C) | 21.5 | 21.4 | 21.5 | 21.5 |
| pH | 8.03 | 8.06 | 8.06 | 8.1 |
| EC (mS) | 2525 | 2525 | 2535 | 2528.3 |
| TDS (ppm) | 1258 | 1264 | 1265 | 1262.3 |

Water Quantity Measurements

Discharge Type:

Average Discharge (m3/sec):

Additional Comments/Information No real soil just rounded gravel and sand alluvium, discharge is very low, barely measureable, trickle. TAMRAM 6m upstream of sample point. Green algae grows in small pools. Alkalinity not measured due to time constraints.

Date of Survey: 5/19/2005 Time Measurements Began: 11:00 Observer: CM Chris Murphy

Canyon Name: 225.5 Mile Canyon Location Description: 225.5 Mile Hydro 1

Project: Phase IIa

Measurement Location Details:

UTM Easting: 285686 UTM Northing: 3961084 GPS Accuracy (m): 5

Type of Water Feature: stream Light Exposure: open

Elevation (m): 404 Slope (degrees): 3

Soil Type: loamy sand Aspect: 168

Weather: Clear, hot, stable with low to 0 breeze

Weather over previous 3 days: Warming, stabilizing, clear last 2 days. Past week, cold front 3 days ago with wind.

Current Temperature Air: 30 C Water: 28 C

Description of Water Source:

Water Quality Measurements

Last Calibration-----> **Date:** 5/19/2005 **Time:** 11:15

| <u>Meter Reading #</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>Average</u> |
|------------------------|----------|----------|----------|----------------|
| Water Temp (C) | 27.8 | 27.7 | 28.1 | 27.9 |
| pH | 8.74 | 8.76 | 8.77 | 8.8 |
| EC (mS) | 3999 | 3999 | 3999 | 3999.0 |
| TDS (ppm) | 3999 | 3999 | 3999 | 3999.0 |

Water Quantity Measurements

Discharge Type: Container

Average Discharge (m3/sec): 0.00

Additional Comments/Information Sample point located 3m below last large TAMRAM sapling and about 10m above/upstream of where all flow disappears into gravelly alluvial fan at canyon mouth. Soil has salt precipitate on surface discharge measured 45m upstream at first pour off of 1m size. Four small unidentified minnow (little fish) in lowest large plunge pool 15m up from sample point. Container used was 3.5 GALLON

Date of Survey: 5/10/2005 Time Measurements Began: 13:30 Observer: CM Chris Murphy

Canyon Name: 70.8 mile drainage Location Description: 70.8 Mile Hydro 1

Project: Phase IIa

Measurement Location Details: Creek; seep with TAMRAM is about 500m from Escalante Trail and 150m below top of Drainage #1 at 70.8 Mile TAMRAM mapping

UTM Easting: 422917 UTM Northing: 3993176 GPS Accuracy (m): 5.6

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

Elevation (m): 898 Slope (degrees): 12

Soil Type: sand Aspect: 345

Weather: Thin overcast, very breezy with occasional gusts from down canyon

Weather over previous 3 days: Last 2 clear, sunny (rare cloud) 75-80F

Current Temperature Air: 20 C Water: 10 C

Description of Water Source: Flow is too minimal and widely distributed to measure. Drips to salt encrusted gravelly alluvium and ephemeral "channel" 25m long that never really flows.

Water Quality Measurements

Last Calibration-----> Date: 5/10/2005 Time: 13:45

| <u>Meter Reading #</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>Average</u> |
|------------------------|----------|----------|----------|----------------|
| Water Temp (C) | 16.3 | 15.4 | 15.4 | 15.7 |
| pH | 8.13 | 8.13 | 8.17 | 8.1 |
| EC (mS) | 2465 | 2491 | 2490 | 2482.0 |
| TDS (ppm) | 1235 | 1247 | 1246 | 1242.7 |

Water Quantity Measurements

Discharge Type:

Average Discharge (m3/sec):

Additional Comments/Information This is the only spot w/ TAMRAM (patch is 15m long) soil is coarse sand with occasional loamy sand patches.

Date of Survey: 5/9/2005 Time Measurements Began: 9:15 Observer: CM Chris Murphy
Canyon Name: Carbon Creek Location Description: Carbon Hydro 1
Project: Phase IIa

Measurement Location Details: Border of treated reach (downstream) and untreated reach (upstream). See photopoint description for Carbon 15.

UTM Easting: 424986 UTM Northing: 4001485 GPS Accuracy (m): 6

Type of Water Feature: stream Light Exposure: open
Elevation (m): 983 Slope (degrees): 2
Soil Type: sand Aspect: 48

Weather: Clear, full sun, no wind gusts only light periodic breeze.
Weather over previous 3 days: Progressive warming and clearing (mostly cloudy, occasional showers 3 days ago)
Current Temperature Air: 32 C Water: 20 C

Description of Water Source: Stream is fed by spring emanating from beneath limestone ledge in gravel creek bottom.
Samplers walked up creek bottom causing sediment to entre channel; stream is flowing this year due to above average precipitation. Creek flow filled smaller tube to maximum capacity with some minor leakage through small dam.

Water Quality Measurements

Last Calibration-----> Date: 5/9/2005 **Time:** 9:15

| <u>Meter Reading #</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>Average</u> |
|------------------------|----------|----------|----------|----------------|
| Water Temp (C) | 22.4 | 22.3 | 22.3 | 22.3 |
| pH | 7.85 | 7.83 | 7.84 | 7.8 |
| EC (mS) | 3389 | 3407 | 3418 | 3404.7 |
| TDS (ppm) | 1706 | 1709 | 1710 | 1708.3 |

Water Quantity Measurements

Discharge Type: Container

Average Discharge (m³/sec):

Additional Comments/Information Site flood scours regularly with much alluvial gravel and cobble subsequently deposited. Soil is gravelly and salt deposits on stream banks. Only two samples for titration due to lack of bromacil indicator powder.

Date of Survey: 5/6/2006 Time Measurements Began: 9:00 Observer: ST Steve Till

Canyon Name: Carbon Creek

Location Description: Carbon Hydro 1

Project: Phase IIa

Measurement Location Details: About 300m up the main carbon drainage past the Butte Fault. There is a large patch of arrowweed and mesquite on creek left and exposed supergroup shale outcrops at creek level.

UTM Easting: 424986

UTM Northing: 4001485

GPS Accuracy (m): 6

Type of Water Feature: stream

Light Exposure: open

Elevation (m): 983

Slope (degrees): 2

Soil Type: sand

Aspect: 48

Weather: blue skies - no clouds warm 70-80 degree morning and about 90 by mid afternoon.

Weather over previous 3 days: clear and hot except for a quick stormy front that moved through yesterday afternoon with strong wind and sprinkles.

Current Temperature Air: 20 C Water: C

Description of Water Source: Streambed is mostly moist with small areas of intermittent water appearing in narrow areas, but not flowing, water depth is less than one centimeter deep at the most.

Water Quality Measurements

Last Calibration-----> Date: 5/6/2006 Time: 7:00

| <u>Meter Reading #</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>Average</u> |
|------------------------|----------|----------|----------|----------------|
| Water Temp (C) | 23.2 | 23.2 | 23.2 | 23.2 |
| pH | 8.02 | 8.01 | 8.02 | 8.0 |
| EC (mS) | 3576 | 3586 | 3581 | 3581.0 |
| TDS (ppm) | 1792 | 1795 | 1789 | 1792.0 |

Water Quantity Measurements

Discharge Type:

Average Discharge (m3/sec):

Additional Comments/Information The 'stream' is faint and does not carry enough flow to move floaters downstream. There is enough to pool up and sample the still water.

Date of Survey: 5/9/2005 Time Measurements Began: 10:34 Observer: CM Chris Murphy

Canyon Name: Carbon Creek

Location Description: Carbon Hydro 2

Project: Phase IIa

Measurement Location Details: Sample point is at small sandstone capped blue/maroon mud stone outcrop on creek Right.
Sample point is 5m below downstream end of carbon#4 tammy transect

UTM Easting: 424653

UTM Northing: 4001898

GPS Accuracy (m): 9

Type of Water Feature:

Light Exposure: open

Elevation (m): 1008

Slope (degrees): 2

Soil Type: sand

Aspect: 138

Weather: Clear, full sun, warm, no wind gusts only light periodic breeze

Weather over previous 3 days: Progressive warming and clearing (mostly cloudy, occasional showers three days ago)

Current Temperature Air: 20 C Water: 20 C

Description of Water Source: Stream is flowing and feeding intermittent reach. Creek bottom is very sandy and gravelly.

Water Quality Measurements

Last Calibration-----> Date: 5/9/2005 Time: 9:30

| <u>Meter Reading #</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>Average</u> |
|------------------------|----------|----------|----------|----------------|
| Water Temp (C) | 24.8 | 24.4 | 24.4 | 24.5 |
| pH | 8.19 | 8.2 | 8.2 | 8.2 |
| EC (mS) | 3284 | 3304 | 3311 | 3299.7 |
| TDS (ppm) | 1604 | 1645 | 1653 | 1634.0 |

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 1179.83

Additional Comments/Information No alkalinity due to no Bromacil indicator powder.

Date of Survey: 5/6/2006 Time Measurements Began: 9:30 Observer: ST Steve Till

Canyon Name: Carbon Creek Location Description: Carbon Hydro 2
Project: Phase IIa

Measurement Location Details: 2 meters above the small supergroup outcrop that is between the control and tamarisk transects of Carbon 2, very little water present.

UTM Easting: 424653 UTM Northing: 4001898 GPS Accuracy (m): 9

Type of Water Feature: Light Exposure: open

Elevation (m): 1008 Slope (degrees): 2

Soil Type: sand Aspect: 138

Weather: sunny 80s, no clouds, no wind

Weather over previous 3 days: sunny with some stormy front that blew through yesterday afternoon with some light sprinkles.

Current Temperature Air: 20 C Water: 20 C

Description of Water Source: Water does not flow but barely seeps for about 4 meters near a rocky section of the creek bottom. It then is dry (above and below). This is a much drier year than the previous year.

Water Quality Measurements

Last Calibration-----> Date: 5/6/2006 Time: 7:00

| <u>Meter Reading #</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>Average</u> |
|------------------------|----------|----------|----------|----------------|
| Water Temp (C) | 18.9 | 18.9 | 18.9 | 18.9 |
| pH | 7.85 | 7.94 | 7.95 | 7.9 |
| EC (mS) | 3195 | 3193 | 3205 | 3197.7 |
| TDS (ppm) | 1622 | 1586 | 1612 | 1606.7 |

Water Quantity Measurements

Discharge Type:

Average Discharge (m3/sec):

Additional Comments/Information

Date of Survey: 5/9/2005 Time Measurements Began: 12:00 Observer: CM Chris Murphy

Canyon Name: Carbon Creek

Location Description: Carbon Hydro 3

Project: Phase IIa

Measurement Location Details: At confluence between East and West forks of carbon creek. See photopoint description for confluence #1 middle fork seep is 25m upstream of sample point. Upstream of confluence east fork is flowing intermittently until POPFRE marking seep/spring source above which is dry.

UTM Easting: 424665 UTM Northing: 4002169 GPS Accuracy (m): 3

Type of Water Feature: stream Light Exposure: open

Elevation (m): 1021 Slope (degrees): 13

Soil Type: loamy sand Aspect: 29

Weather: Mostly clear, warm, slight breeze, 80-85F

Weather over previous 3 days: Progressive warming and clearing (mostly cloudy, occasional showers 3 days ago).

Current Temperature Air: 20 C Water: 30 C

Description of Water Source:

Water Quality Measurements

Last Calibration-----> Date: 5/9/2005 Time: 12:00

| <u>Meter Reading #</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>Average</u> |
|------------------------|----------|----------|----------|----------------|
| Water Temp (C) | 27.3 | 26.6 | 26.7 | 26.9 |
| pH | 8.02 | 8.03 | 8.03 | 8.0 |
| EC (mS) | 3640 | 3640 | 3999 | 3759.7 |
| TDS (ppm) | | | | |

Water Quantity Measurements

Discharge Type: Container

Average Discharge (m3/sec): 0.00

Additional Comments/Information East Fork has flowing water continuing downstream to Carbon #16 without drying. West Fork is dry. Middle fork has spring/seep at its mouth, otherwise soil is very sandy with coarse gravel. East fork is intermittent with two 50-15m dry stretches. Bed remains gravelly. TAMRAM is patchy. About 12m above seep/spring source on East Fork is a long, half-dead POPFRE. Could not measure TDS, reading too high for measurement unit.

Date of Survey: 5/12/2005 Time Measurements Began: 17:15 Observer: CM Chris Murphy

Canyon Name: Crystal Creek Location Description: Crystal Hydro T1A
Project: Phase IIa

Measurement Location Details: Seep located on toe slope of drainage about 60-70m downstream of end of TAMRAM removal transect.

UTM Easting: 388695 UTM Northing: 4000027 GPS Accuracy (m): 18

Type of Water Feature: seep Light Exposure: open

Elevation (m): 767 Slope (degrees): 8

Soil Type: loamy sand Aspect: 118

Weather: Clear, warm, light breeze.

Weather over previous 3 days: Clear and warming trend to 85+ degrees the last 2 days; 75 degrees prior with evening cloud build up, a few raindrops and decreasing wind.

Current Temperature Air: 30 C Water: 20 C

Description of Water Source: Site may be influenced by subsurface flow from Crystal Creek (upstream side). Seep flow is barely noticeable, discharge too low to measure. Measurements taken in small pool.

Water Quality Measurements

| Last Calibration-----> | Date: | | | Time: |
|----------------------------------|-----------------|-----------------|-----------------|-----------------------|
| <u>Meter Reading #</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>Average</u> |
| Water Temp (C) | 25.5 | 24.7 | 24.5 | 24.9 |
| pH | 8.09 | 8.26 | 8.31 | 8.2 |
| EC (mS) | 3999 | 3999 | 3999 | 3999.0 |
| TDS (ppm) | | | | |

Water Quantity Measurements

Discharge Type:

Average Discharge (m3/sec):

Additional Comments/Information Soil is salt encrusted at margins. TYPDOM patch 2x2.5m at margin of small pool at bottom of rock (marks end of 8m long wet seep area. Source of seep supports long stretch of PLUSER. One mature TAMRAM was near source, a few seedlings and saplings in area, invasion in progress. Another 2.5x2.5m TYPDOM patch above seep, but no surface water. Both EC and TDS were too high for measurement instruments.

Date of Survey: 5/11/2007 Time Measurements Began: 14:07 Observer: Kate Kate Watters

Canyon Name: Crystal Creek

Location Description: Crystal Hydro T1A

Project: Phase IIa

Measurement Location Details:

UTM Easting: 388695 UTM Northing: 4000027 GPS Accuracy (m): 18

Type of Water Feature: seep Light Exposure: open

Elevation (m): 767 Slope (degrees): 8

Soil Type: loamy sand Aspect: 118

Weather: Partly cloudy, hot and dry

Weather over previous 3 days: same as above

Current Temperature Air: 26 C Water: 34 C

Description of Water Source: 2007, could not do the water quantity measurements because seepy area was dried up. Channel above location had changed. We were able to do water quality with a small amount of water present.

Water Quality Measurements

Last Calibration-----> Date: 5/11/2007 Time: 14:08

| <u>Meter Reading #</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>Average</u> |
|------------------------|----------|----------|----------|----------------|
| Water Temp (C) | 32.8 | 32.9 | 34 | 33.2 |
| pH | 7.76 | 7.3 | 7.95 | 7.7 |
| EC (mS) | 3999 | 3999 | 3999 | 3999.0 |
| TDS (ppm) | 2000 | 2000 | 2000 | 2000.0 |

Water Quantity Measurements

Discharge Type:

Average Discharge (m3/sec):

Additional Comments/Information

Date of Survey: 5/13/2005 Time Measurements Began: 9:00 Observer: CM Chris Murphy

Canyon Name: Crystal Creek

Location Description: Crystal Hydro T2A

Project: Phase IIa

Measurement Location Details: Sample taken downstream end of T2A transect.

UTM Easting: 388444 UTM Northing: 3999631 GPS Accuracy (m): 7

Type of Water Feature: stream Light Exposure: open

Elevation (m): 727 Slope (degrees): 5

Soil Type: sandy loam Aspect: 280

Weather: Clear, stable, 75 degrees by mid-morning.

Weather over previous 3 days: Clearing, stabilizing, decreasing breeze, warming trend.

Current Temperature Air: 19 C Water: 10 C

Description of Water Source: Perennial stream with good flow. Flow is high due to high precipitation this winter.

Water Quality Measurements

Last Calibration-----> Date: 5/13/2005 **Time:** 9:30

| <u>Meter Reading #</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>Average</u> |
|------------------------|----------|----------|----------|----------------|
| Water Temp (C) | 14.5 | 14.2 | 14.2 | 14.3 |
| pH | 8.39 | 8.42 | 8.43 | 8.4 |
| EC (mS) | 413 | 416 | 417 | 415.3 |
| TDS (ppm) | 208 | 208 | 208 | 208.0 |

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m³/sec): 894736.84

Additional Comments/Information Soil is poorly developd gravelly sandy loam.

Date of Survey: 5/11/2007 Time Measurements Began: 15:15 Observer: DH Dan Hall

Canyon Name: Crystal Creek

Location Description: Crystal Hydro T2A

Project: Phase IIa

Measurement Location Details:

UTM Easting: 388444 UTM Northing: 3999631 GPS Accuracy (m): 7

Type of Water Feature: stream Light Exposure: open

Elevation (m): 727 Slope (degrees): 5

Soil Type: sandy loam Aspect: 280

Weather: Hot and dry

Weather over previous 3 days: Hot and dry

Current Temperature Air: 23 C Water: C

Description of Water Source:

Water Quality Measurements

Last Calibration-----> Date: 5/11/2007 **Time:** 15:15

| <u>Meter Reading #</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>Average</u> |
|------------------------|----------|----------|----------|----------------|
| Water Temp (C) | 31 | 31 | 30 | 30.7 |
| pH | 8.7 | 8.7 | 8.7 | 8.7 |
| EC (mS) | 1882 | 1891 | 1899 | 1890.7 |
| TDS (ppm) | 942 | 945 | 948 | 945.0 |

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec):

Additional Comments/Information Could not completely duplicate photo, but took best guess. Creek bed has changed, new UTMs at 8m accuracy. Bio notes: viewed numerous tadpoles, speckled dace, 2 foot long garter snake, western tanager.

Date of Survey: 5/6/2005 Time Measurements Began: 11:00 Observer: CM Chris Murphy
Canyon Name: South Canyon Location Description: South Canyon Hydro 1
Project: Phase IIa
Measurement Location Details: Above 1.2 km upstream of large side drainage entering from North.
UTM Easting: 420225 UTM Northing: 4038942 GPS Accuracy (m): 3.5
Type of Water Feature: seep Light Exposure: partial-shade
Elevation (m): 1003 Slope (degrees): 75
Soil Type: loamy sand Aspect: 333
Weather: Thunderstorm passed by ~10:00, Clear to partly cloudy, wind gusts occasional.
Weather over previous 3 days: Partly cloudy to clear trace precip) temp 75-80F
Current Temperature Air: 20 C Water: 10 C
Description of Water Source: Seep/spring at base of white sandstone within Supai formation where it forms a 3.5m high pouroff.

Water Quality Measurements

Last Calibration-----> Date: 5/6/2005 **Time:** 10:30

| <u>Meter Reading #</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>Average</u> |
|------------------------|----------|----------|----------|----------------|
| Water Temp (C) | 14.9 | 14.7 | 14.6 | 14.7 |
| pH | 7.54 | 7.56 | 7.57 | 7.6 |
| EC (mS) | 2524 | 2532 | 2532 | 2529.3 |
| TDS (ppm) | 1262 | 1266 | 1268 | 1265.3 |

Water Quantity Measurements

Discharge Type: Container

Average Discharge (m3/sec): 0.00

Additional Comments/Information Seep consists of 4 crack seeps within 7m wide rock wall. Single TAMRAM 25m downstream, lone TAMRAM 75m upstream. Spring/seep is low volume but supports algal community; minimal precipitate at edge; probably a seep in early summer or drought (had to hold beaker against rock wall to measure discharge at highest volume outflow - measured at southern end of wall). Base of wall with coarse angular gravelly sand and loamy sand.

Date of Survey: 4/23/2006 Time Measurements Began: Observer:
Canyon Name: South Canyon Location Description: South Canyon Hydro 1
Project: Phase IIa

Measurement Location Details:

UTM Easting: 420225 UTM Northing: 4038942 GPS Accuracy (m): 3.5

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

Elevation (m): 1003 Slope (degrees): 75

Soil Type: loamy sand Aspect: 333

Weather:

Weather over previous 3 days:

Current Temperature Air: C Water: C

Description of Water Source: South Hydro 1 was dry on this date.

Water Quality Measurements

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

Water Quantity Measurements

Discharge Type:

Average Discharge (m3/sec):

Additional Comments/Information

Date of Survey: 5/6/2005 Time Measurements Began: 13:15 Observer: CM Chris Murphy
Canyon Name: South Canyon Location Description: South Canyon Hydro 2
Project: Phase IIa

Measurement Location Details: Sample is 100m downstream of nearest TAMRAM. Base of poulover and around plunge pool with gravelly (coarse angular) loamy sand.

UTM Easting: 420106 UTM Northing: 4038764 GPS Accuracy (m): 4

Type of Water Feature: stream Light Exposure: open
Elevation (m): 1118 Slope (degrees): 15
Soil Type: loamy sand Aspect: 48

Weather: Thunderstorm passed by ~10:00. Clear to partly cloudy, wind gusts occasional
Weather over previous 3 days: Partly cloudy to clear (trace precip) temp 75-80F
Current Temperature Air: 15 C Water: 20 C

Description of Water Source: A series of pools or rivulets across rock shelf pouring over into small pools (poulovers <1-2m tall & rivulet channel avg. 40-60cm wide). Much algal growth in small pools upstream.

Water Quality Measurements

Last Calibration-----> **Date:** 5/6/2005 **Time:** 10:30

| <u>Meter Reading #</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>Average</u> |
|------------------------|----------|----------|----------|----------------|
| Water Temp (C) | 19.9 | 19.2 | 19.1 | 19.4 |
| pH | 8.39 | 8.38 | 8.4 | 8.4 |
| EC (mS) | 2521 | 2546 | 2552 | 2539.7 |
| TDS (ppm) | | | | |

Water Quantity Measurements

Discharge Type: Container

Average Discharge (m3/sec): 0.00

Additional Comments/Information Downstream end may not carry water every year, but pools upstream become progressively more persistently wet (evidenced by algal growth).

Date of Survey: 5/6/2005 Time Measurements Began: 14:47 Observer: CM Chris Murphy
Canyon Name: South Canyon Location Description: South Canyon Hydro 3
Project: Phase IIa
Measurement Location Details: Sample #3 is 6m below TAMRAM and 7m upstream of another. Another TAMRAM is 3m away on alluvial deposit.
UTM Easting: 420041 UTM Northing: 4038724 GPS Accuracy (m): 4.6
Type of Water Feature: spring Light Exposure: open
Elevation (m): 1142 Slope (degrees): 15
Soil Type: sand Aspect: 62
Weather: Thunderstorm passed by ~10:00. Clear to partly cloudy, wind gusts occasional.
Weather over previous 3 days: Partly cloudy to clear (trace precip) temp 75-80F
Current Temperature Air: 10 C Water: 20 C
Description of Water Source: Upstream of rock shelf that is source of sample 2. There is a small waterfall to north with steep gorge. This pool system is along base of rock shelf lining creek but in bottom of bedrock and alluvium filled creek.

Water Quality Measurements

Last Calibration-----> Date: 5/6/2005 **Time:** 10:00

| <u>Meter Reading #</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>Average</u> |
|------------------------|----------|----------|----------|----------------|
| Water Temp (C) | 19.9 | 19.7 | 19.7 | 19.8 |
| pH | 8.06 | 8.11 | 8.12 | 8.1 |
| EC (mS) | 2447 | 2448 | 2452 | 2449.0 |
| TDS (ppm) | | | | |

Water Quantity Measurements

Discharge Type: Container

Average Discharge (m3/sec): 0.00

Additional Comments/Information Sample #3 is 6m below TAMRAM and 7m upstream of another. Another TAMRAM is 3m away on alluvial deposit. Water has numerous mosquito larvae in it and thin algal coating on most of rock. Soil below lowest water pool is very coarse rounded gravel and coarse sand. Small dam/weir built to force H2O into tube for measurement.

Date of Survey: 4/23/2006 Time Measurements Began: Observer:
Canyon Name: South Canyon Location Description: South Canyon Hydro 3
Project: Phase IIa

Measurement Location Details:

UTM Easting: 420041 UTM Northing: 4038724 GPS Accuracy (m): 4.6

Type of Water Feature: spring Light Exposure: open

Elevation (m): 1142 Slope (degrees): 15

Soil Type: sand Aspect: 62

Weather:

Weather over previous 3 days:

Current Temperature Air: C Water: C

Description of Water Source: South Hydro 3 was dry on this date.

Water Quality Measurements

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

Water Quantity Measurements

Discharge Type:

Average Discharge (m3/sec):

Additional Comments/Information

Date of Survey: 5/6/2005 Time Measurements Began: 16:30 Observer: CM Chris Murphy

Canyon Name: South Canyon Location Description: South Canyon Hydro 4

Project: Phase IIa

Measurement Location Details: This reach "flows" across white sandstone member of Supai (crossed by eroded cracks with H2O pools). Downstream end is 15m upstream of lip of falls. Upstream end is end of Transect 2A (10m upstream).

UTM Easting: 419728 UTM Northing: 4038332 GPS Accuracy (m): 5.7

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

Elevation (m): 1188 Slope (degrees): 5

Soil Type: sand loamy sand Aspect: 34

Weather: Thunderstorm passed by ~10:00. Clear to partly cloudy, wind gusts occasional.

Weather over previous 3 days: Partly cloudy to clear (trace precip) temp 75-80F

Current Temperature Air: 16 C Water: 20 C

Description of Water Source: Flow is nearly imperceptible, discharge not measurable with our instruments.

Water Quality Measurements

Last Calibration-----> Date: 5/6/2005 Time: 10:00

| <u>Meter Reading #</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>Average</u> |
|------------------------|----------|----------|----------|----------------|
| Water Temp (C) | 18.4 | 18.4 | 18.4 | 18.4 |
| pH | 8.2 | 8.23 | 8.23 | 8.2 |
| EC (mS) | 2988 | 2991 | 2989 | 2989.3 |
| TDS (ppm) | | | | |

Water Quantity Measurements

Discharge Type:

Average Discharge (m3/sec):

Additional Comments/Information Rock pools w/ scattered sand & gravel deposits. TDS may be low due to influx of rain water from thunderstorm earlier in day.

Date of Survey: 4/23/2006 Time Measurements Began: 16:43 Observer: Kate Kate Watters
Canyon Name: South Canyon Location Description: South Canyon Hydro 4
Project: Phase IIa
Measurement Location Details: At largest pool in flat purely bedrock stretch. Near the end of transect T2A.
UTM Easting: 419728 UTM Northing: 4038332 GPS Accuracy (m): 5.7
Type of Water Feature: pothole Light Exposure: partial-shade
Elevation (m): 1188 Slope (degrees): 5
Soil Type: sand loamy sand Aspect: 34
Weather: overcast; 75% cloud cover and windy
Weather over previous 3 days: windy and clear
Current Temperature Air: 25 C Water: 18 C
Description of Water Source: Non-flowing pool created by an ephemeral flow with possible spring source maintaining water.

Water Quality Measurements

Last Calibration-----> Date: 4/23/2006 **Time:** 11:18

| <u>Meter Reading #</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>Average</u> |
|------------------------|----------|----------|----------|----------------|
| Water Temp (C) | 18.1 | 1737 | 18.1 | 591.1 |
| pH | 8.86 | 8.87 | 8.73 | 8.8 |
| EC (mS) | 3130 | 3146 | 3134 | 3136.7 |
| TDS (ppm) | 1565 | 1573 | 1561 | 1566.3 |

Water Quantity Measurements

Discharge Type:

Average Discharge (m3/sec):

Additional Comments/Information No flowing water present.

Date of Survey: 5/19/2005 Time Measurements Began: 8:15 Observer: CM Chris Murphy
Canyon Name: Trail Canyon Location Description: Trail Creek - Hydro 1
Project: Phase IIa

Measurement Location Details: Sample is at the downstream end of Trail T1A, just adjacent to the endpoint, which is in a distinct granite wall with Tapeats above it.

UTM Easting: 289191 UTM Northing: 3968785 GPS Accuracy (m): 4.4

Type of Water Feature: stream Light Exposure: open partial-shade
Elevation (m): 460 Slope (degrees): 3
Soil Type: loamy sand sand Aspect: 90

Weather: Stable, clear to thin high clouse, 85 degrees, light to no breeze.
Weather over previous 3 days: Possible cold front passage 2 days ago with wind and cloudiness (no precipitation), stable and warm prior.

Current Temperature Air: 20 C Water: 20 C

Description of Water Source: Creek flash flooded on small scale within last year but scouring was limited. Flow is nearly constant to river where creek goes subterranean in alluvial fan. Flow too high to measure by container.

Water Quality Measurements

Last Calibration-----> Date: 5/19/2005 **Time:** 8:50

| <u>Meter Reading #</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>Average</u> |
|------------------------|----------|----------|----------|----------------|
| Water Temp (C) | 25.2 | 24.9 | 24.6 | 24.9 |
| pH | 8.32 | 8.4 | 8.43 | 8.4 |
| EC (mS) | 1144 | 1160 | 1166 | 1156.7 |
| TDS (ppm) | 576 | 580 | 583 | 579.7 |

Water Quantity Measurements

Discharge Type: Float

Average Discharge (m3/sec): 12702.99

Additional Comments/Information Stream is mostly subsurface until Tapeats rock surfaces as you go upstream.

Date of Survey: 5/21/2007 Time Measurements Began: 13:07 Observer: SJ Sam Jones
Canyon Name: Trail Canyon Location Description: Trail Creek - Hydro 1
Project: Phase IIa
Measurement Location Details: Creek bed of Trail Canyon, mostly dried up, a few pools remain, river left 7x2x2m, green moss/algae, clear water.
UTM Easting: 289191 UTM Northing: 3968785 GPS Accuracy (m): 4.4
Type of Water Feature: stream Light Exposure: open partial-shade
Elevation (m): 460 Slope (degrees): 3
Soil Type: loamy sand sand Aspect: 90
Weather: Hot, sun-filled day
Weather over previous 3 days: hot and dry
Current Temperature Air: 30 C Water: 27 C
Description of Water Source: Clear water, green moss/algae on sides of small stream, trickle current, river left.

Water Quality Measurements

Last Calibration-----> Date: 5/21/2007 Time:

| <u>Meter Reading #</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>Average</u> |
|-------------------------------|-----------------|-----------------|-----------------|-----------------------|
| Water Temp (C) | 28.3 | 28 | 28 | 28.1 |
| pH | 7.62 | 7.54 | 7.54 | 7.6 |
| EC (mS) | 752 | 752 | 751 | 751.7 |
| TDS (ppm) | 376 | 376 | 376 | 376.0 |

Water Quantity Measurements

Discharge Type:

Average Discharge (m3/sec):

Additional Comments/Information

Date of Survey: 5/19/2005 Time Measurements Began: 12:20 Observer: CM Chris Murphy
 Canyon Name: Trail Canyon Location Description: Trail Creek - Hydro 2
 Project: Phase IIa

Measurement Location Details: Sample point #2 is furthest N/NE spring, and the largest spring in complex.

UTM Easting: 288820 UTM Northing: 3969481 GPS Accuracy (m): 4.9

Type of Water Feature: stream Light Exposure: open
 Elevation (m): 516 Slope (degrees): 4
 Soil Type: sand Aspect: 150

Weather: Very warm, clear, minimal breeze

Weather over previous 3 days: Possible cold front passage 2 days ago with wind and cloudiness but no precipitation

Current Temperature Air: 33 C Water: 20 C

Description of Water Source: Water is forced to surface as it comes into less permeable subsurface tapeats layer that is buried by copious cobbly alluvium at base of bright angel.

Water Quality Measurements

Last Calibration-----> **Date:** 5/19/2005 **Time:** 12:20

| <u>Meter Reading #</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>Average</u> |
|------------------------|----------|----------|----------|----------------|
| Water Temp (C) | 25.3 | 24.6 | 24.2 | 24.7 |
| pH | 7.54 | 7.7 | 7.77 | 7.7 |
| EC (mS) | 841 | 846 | 851 | 846.0 |
| TDS (ppm) | 421 | 421 | 425 | 422.3 |

Water Quantity Measurements

Discharge Type: Container

Average Discharge (m3/sec): 0.00

Additional Comments/Information Spring is marked by arrow weed (upstream it disappears) with associated ACAGRE, Isocoma, algae, ENCFAR, BRORUB, mimulus, Aristida spp. Discharge was not measured because at least 5 springs emanate from alluvial gravel/cobble wash and join into braided mainstream. Additional seeps and springs come in immediately above falls on Tapeats sandstone. Flow could be measured below falls (but was not) where flow is consolidated. It appears similar in discharge to sample 1.

Date of Survey: 5/19/2006 Time Measurements Began: 10:35 Observer: FH Frank Hays

Canyon Name: Trail Canyon

Location Description: Trail Creek - Hydro 2

Project: Phase IIa

Measurement Location Details: Discharge measurements were taken by collecting water pouring over 2.5m pouroff just below a large Tapeats sandstone patio. This is near the top of the Tapeats sandstone layer.

UTM Easting: 288820 UTM Northing: 3969481 GPS Accuracy (m): 4.9

Type of Water Feature: stream Light Exposure: open

Elevation (m): 516 Slope (degrees): 4

Soil Type: sand Aspect: 150

Weather: hot and sweaty, clear, calm

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

Current Temperature Air: 30 C Water: 30 C

Description of Water Source: Intermittent stream flowing over Tapeats sandstone patio and a 2.5 m pourover.

Water Quality Measurements

Last Calibration-----> Date: 5/19/2006 Time: 7:15

| <u>Meter Reading #</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>Average</u> |
|------------------------|----------|----------|----------|----------------|
| Water Temp (C) | 31.5 | 31.2 | 31.1 | 31.3 |
| pH | 8.34 | 8.33 | 8.32 | 8.3 |
| EC (mS) | 532 | 533 | 531 | 532.0 |
| TDS (ppm) | 266 | 266 | 265 | 265.7 |

Water Quantity Measurements

Discharge Type: Container

Average Discharge (m3/sec): 0.00

Additional Comments/Information

Date of Survey: 5/21/2007 Time Measurements Began: 12:15 Observer: SJ Sam Jones
Canyon Name: Trail Canyon Location Description: Trail Creek - Hydro 2
Project: Phase IIa
Measurement Location Details: Pot hole in drainage, 3rd drop from the patio. Tapeats narrows, 3x2m.
UTM Easting: 288820 UTM Northing: 3969481 GPS Accuracy (m): 4.9
Type of Water Feature: stream Light Exposure: open
Elevation (m): 516 Slope (degrees): 4
Soil Type: sand Aspect: 150
Weather: Warm and clear
Weather over previous 3 days: Warm and clear
Current Temperature Air: 25 C Water: 27 C
Description of Water Source:

Water Quality Measurements

Last Calibration-----> Date: 5/21/2007 Time: 12:30

| <u>Meter Reading #</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>Average</u> |
|------------------------|----------|----------|----------|----------------|
| Water Temp (C) | 27.7 | 27.6 | 27.7 | 27.7 |
| pH | 8.07 | 8.06 | 8.03 | 8.1 |
| EC (mS) | 651 | 648 | 645 | 648.0 |
| TDS (ppm) | 325 | 324 | 324 | 324.3 |

Water Quantity Measurements

Discharge Type:

Average Discharge (m³/sec):

Additional Comments/Information

Appendix E - Monitoring Transect Data

Canyon/Park Area: Bright Angel Creek River mile: 88 R Project (Phase): Phase IIa
 Transect Name: Bright Angel Creek 1 Transect Type: Tamarisk Area

| | Start point | | End point |
|----------------------------|--|------------------------|------------------|
| Easting: | 403657 | Easting: | 403646 |
| Northing: | 3999637 | Northing: | 3999627 |
| GPS accuracy (m): | 11.7 | GPS accuracy (m): | 16.3 |
| Elevation (m): | 967 | Elevation (m): | |
| Bearing: | 222 | | |
| Aspect (0-360): | 230 | Slope (degrees): | 2 |
| Transect description: | Transect is located 12km (7.5 miles) from Phantom Ranch heading north on N. Kaibab trail. Transect end is located about 300m north from the 4th bridge on the North Kaibab Trail heading north. Transect start is about 4m from the trail on terrace above the creek on creek left. In 2006 the Soil Measurements were not done. They were completed using the old method, but the data was not entered. | | |
| Additional Info:: | Start point is on creek left 250m downstream of prominent seep flowing from west wall of canyon. From other side at contact between tapeats and schist to creek level. Transect is on west side of N. Kaibab trail paralleling a mortar wall. Transect start is located about 100m downstream of a prominent seep in the Vishnu Schist entering the drainage on creek right. | | |
| Geological layer: | Vishnu schist metamorphic complex. Note also limestone in surface rock category. | | |
| Habitat type: | Riparian | | |
| Dominant species: | Baccharis salicifolia (Ruiz & Pavón) Pers., Brickellia longifolia S. Wats., Bromus rubens L., Isocoma acradenia (Greene) Greene, Salix exigua Nutt. | | |
| Associated species: | Acacia greggii Gray, Aristida purpurea Nutt., Artemisia ludoviciana Nutt., Baccharis salicifolia (Ruiz & Pavón) Pers., Bebbia juncea (Benth.) Greene var. aspera Greene, Bernardia incana Morton, Brickellia longifolia S. Wats., Bromus diandrus Roth, Bromus rubens L., Bromus tectorum L., Cryptantha spp., Cynodon dactylon (L.) Pers., Datura wrightii Regel, Ephedra fasciculata A. Nels., Ephedra torreyana S. Wats., Erigeron lobatus A. Nels., Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm., Mentzelia spp., Poa bigelovii Vasey & Scribn., Porophyllum gracile Benth., Pseudognaphalium stramineum (Kunth) W.A. Weber, Silene antirrhina L., Sonchus asper (L.) Hill, Sporobolus cryptandrus (Torr.) Gray, Stephanomeria pauciflora (Torr.) A. Nels., Vulpia microstachys (Nutt.) Munro | | |
| Surface water within 25m? | <input checked="" type="checkbox"/> | Surface water type: | |
| Landform: Drainage channel | | Surface rocks: cobbles | sandstone |
| Soil type: sand | | Topo position: | |
| Light exposure: open | partial-shade | Soil moisture: dry | |

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 1

Transect Type: Tamarisk Area

Date: 6/7/2005 Revisit? Pre-tamarisk removal

Recorder: Kate Watters Reader: Emma Benenati

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

Weather: Clear, sunny, breezy

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|---|----------------|
| Bare Soil | 10 | | 5 |
| Boulder | 3 | Aristida purpurea Nutt. | 2 |
| Coarse woody debris | 26 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 3 |
| Cobble | 10 | Brickellia longifolia S. Wats. | 4 |
| Gravel | 16 | Bromus rubens L. | 58 |
| Litter (duff) | 75 | Bromus tectorum L. | 9 |
| Stone | 3 | Cynodon dactylon (L.) Pers. | 7 |
| Woody debris structure | 4 | Isocoma acradenia (Greene) Greene | 5 |
| | | Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm. | 2 |
| | | Porophyllum gracile Benth. | 3 |
| | | Salix exigua Nutt. | 5 |
| | | Sporobolus cryptandrus (Torr.) Gray | 1 |
| | | Stephanomeria pauciflora (Torr.) A. Nels. | 1 |
| | | Tamarix ramosissima Ledeb. | 32 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Sand | 7 | 3 | 5 | 8 | 1 |
| Bare Soil | 0 | 0 | 0 | 1 | 1 |
| Gravel | 0 | 3 | 5 | 8 | 3 |
| Woody debris structure | 0 | 0 | 0 | 1 | 3 |
| Stone | 3 | 7 | 12 | 19 | 8 |
| Coarse woody debris | 3 | 7 | 25 | 3 | 8 |
| Litter (duff) | 86 | 78 | 42 | 41 | 68 |
| Cobble | 0 | 3 | 12 | 19 | 8 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | <1% | | | | | | | | | |
| Aristida purpurea Nutt. | | | | | | | | | <1% | |
| Artemisia ludoviciana Nutt. | | | | | | | | | 1-5% | |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | 1-5% | | 1-5% | | 5-10% | | | | | |
| Bebbia juncea (Benth.) Greene var. aspera Greene | | | | | 1-5% | | | | 1-5% | |

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 1

Transect Type: Tamarisk Area

| | | | | | |
|---|--------|--------|--------|--------|--------|
| Bernardia incana Morton | | 1-5% | | 1-5% | 1-5% |
| Brickellia longifolia S. Wats. | 10-25% | 10-25% | | 1-5% | 5-10% |
| Bromus diandrus Roth | 25-50% | | <1% | | |
| Bromus rubens L. | 25-50% | 50-75% | 10-25% | 5-10% | 25-50% |
| Bromus tectorum L. | 1-5% | <1% | | | <1% |
| Cryptantha spp. | <1% | | | <1% | |
| Cryptobiotic soil | 5-10% | <1% | 1-5% | 5-10% | 1-5% |
| Cynodon dactylon (L.) Pers. | | 1-5% | 5-10% | | 5-10% |
| Datura wrightii Regel | | | 1-5% | <1% | <1% |
| Erigeron lobatus A. Nels. | | | | | <1% |
| Isocoma acradenia (Greene) Greene | | <1% | | | 5-10% |
| Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm. | | | | 5-10% | <1% |
| Poa bigelovii Vasey & Scribn. | | | | <1% | |
| Porophyllum gracile Benth. | | <1% | 1-5% | 1-5% | <1% |
| Salix exigua Nutt. | | 25-50% | 25-50% | 10-25% | 5-10% |
| Silene antirrhina L. | | | | <1% | |
| Sonchus asper (L.) Hill | | | | | <1% |
| Sporobolus cryptandrus (Torr.) Gray | 1-5% | | | | |
| Stephanomeria pauciflora (Torr.) A. Nels. | | | <1% | 1-5% | 1-5% |
| Tamarix ramosissima Ledeb. | 25-50% | 50-75% | 10-25% | | 10-25% |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|-------------------------------------|---------------|-------------|-------------|
| 5 | Sporobolus cryptandrus (Torr.) Gray | 7 | | |
| 5 | Tamarix ramosissima Ledeb. | 2 | 10 | |
| 15 | Bromus rubens L. | 9 | | |
| 15 | Tamarix ramosissima Ledeb. | | 3 | 15 |
| 25 | Salix exigua Nutt. | 2 | | |
| 45 | Bromus rubens L. | 3 | | |
| 45 | Isocoma acradenia (Greene) Greene | 3 | | |
| 45 | Tamarix ramosissima Ledeb. | 18 | 1 | |

Vegetation Structure Data - New

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|----|-----------|----|-----------|----|---------|----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0 | | 0 | | 0 | | 0.00 | |

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 1

Transect Type: Tamarisk Area

| | | | | |
|----|------|---|------|------|
| 15 | 0 | 0 | 0.03 | 0.01 |
| 25 | 0.03 | 0 | 0 | 0.01 |
| 35 | 0 | 0 | 0 | 0.00 |
| 45 | 0.01 | 0 | 0.01 | 0.01 |

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 1

Transect Type: Tamarisk Area

Date: 4/15/2006 Revisit? Post-tamarisk removal

Recorder: Kelsey Forrest Reader: Kate Watters

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

Weather: Partly cloudy about 70F with a 10mph wind.

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--|----------------|
| Cobble | 9 | Aster spp. | 6 |
| Gravel | 2 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 4 |
| Litter (duff) | 74 | Brickellia longifolia S. Wats. | 9 |
| Plant | 2 | Bromus diandrus Roth | 1 |
| Sand | 2 | Bromus rubens L. | 23 |
| Stone | 11 | Bromus tectorum L. | 1 |
| | | Ephedra torreyana S. Wats. | 1 |
| | | Isocoma acradenia (Greene) Greene | 2 |
| | | Moss spp. | 3 |
| | | Salix exigua Nutt. | 5 |
| | | Stephanomeria pauciflora (Torr.) A. Nels. | 4 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Sand | 2 | 0 | 4 | 8 | 3 |
| Gravel | 0 | 2 | 4 | 20 | 3 |
| Bare Soil | 2 | 0 | 1 | 8 | 1 |
| Cobble | 2 | 5 | 11 | 20 | 3 |
| Stone | 0 | 2 | 11 | 20 | 8 |
| Litter (duff) | 45 | 44 | 54 | 8 | 38 |
| Boulder | 2 | 2 | 4 | 8 | 3 |
| Woody debris structure | 0 | 0 | 0 | 1 | 3 |
| Coarse woody debris | 45 | 44 | 11 | 8 | 38 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | <1% | S | | | | | | | | |
| Aristida purpurea Nutt. | <0% | | <0% | | <1% | | <1% | | <0% | |
| Artemisia ludoviciana Nutt. | <0% | | <0% | | <1% | | <0% | | <1% | |
| Aster spp. | | | 1-5% | | | | | | | |
| Aster spp. | <0% | | <0% | | <0% | | <1% | | | |
| Baccharis emoryi Gray | 5-10% | | 1-5% | | | | | | | |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | 1-5% | | <0% | | 5-10% | | | | | |
| Bebbia juncea (Benth.) Greene var. aspera Greene | <0% | | <0% | | 5-10% | | <0% | | 1-5% | |
| Bernardia incana Morton | <0% | | <0% | | <0% | | 1-5% | | 1-5% | |

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 1

Transect Type: Tamarisk Area

| | | | | | |
|---|------|--------|--------|-------|--------|
| Brickellia longifolia S. Wats. | 1-5% | <0% | <1% | <0% | 5-10% |
| Bromus diandrus Roth | 1-5% | | | | |
| Bromus rubens L. | 1-5% | 25-50% | 5-10% | 1-5% | 10-25% |
| Bromus tectorum L. | 1-5% | | | | |
| Cryptobiotic soil | <0% | <1% | <1% | 1-5% | <1% |
| Datura wrightii Regel | <0% | <1% | <1% | <1% | <0% |
| Ephedra torreyana S. Wats. | | | <1% | | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <0% | <0% | <1% | <1% | <1% |
| forb spp | <0% | <0% | <0% | <0% | <1% |
| Grass spp | | | 5-10% | | |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | | <1% | | | |
| Isocoma acradenia (Greene) Greene | <0% | <1% | <0% | <1% | 5-10% |
| Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm. | | | | 1-5% | |
| Moss spp. | <0% | <1% | 1-5% | 1-5% | 10-25% |
| Muhlenbergia porteri Scribn. ex Beal | <0% | <0% | <0% | <1% | 5-10% |
| Porophyllum gracile Benth. | <0% | <1% | <0% | <1% | <1% |
| Salix exigua Nutt. | <0% | <0% | 25-50% | 5-10% | 1-5% |
| Setaria viridis (L.) Beauv. | | | <1% | | |
| Sonchus asper (L.) Hill | <0% | <0% | <0% | <0% | <1% |
| Sonchus oleraceus L. | | | | | <1% |
| Sporobolus cryptandrus (Torr.) Gray | 1-5% | | | | |
| Stephanomeria pauciflora (Torr.) A. Nels. | <0% | <0% | 1-5% | 1-5% | 1-5% |
| Tamarix ramosissima Ledeb. | <1% | P | | | |
| Verbascum thapsus L. | <0% | <0% | <0% | <1% | <1% |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------------------------------|---------------|-------------|-------------|
| 25 Bromus rubens L. | 2 | | |
| 45 Bromus rubens L. | 2 | | |
| 45 Isocoma acradenia (Greene) Greene | 7 | | |

Vegetation Structure Data - New

Soil Data

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 1

Transect Type: Tamarisk Area

Date: 6/7/2005 Revisit? Pre-tamarisk removal

Recorder: Kate Watters Reader: Emma Benenati

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

Weather: Clear, sunny, breezy

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|---|----------------|
| Bare Soil | 10 | | 5 |
| Boulder | 3 | Aristida purpurea Nutt. | 2 |
| Coarse woody debris | 26 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 3 |
| Cobble | 10 | Brickellia longifolia S. Wats. | 4 |
| Gravel | 16 | Bromus rubens L. | 58 |
| Litter (duff) | 75 | Bromus tectorum L. | 9 |
| Stone | 3 | Cynodon dactylon (L.) Pers. | 7 |
| Woody debris structure | 4 | Isocoma acradenia (Greene) Greene | 5 |
| | | Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm. | 2 |
| | | Porophyllum gracile Benth. | 3 |
| | | Salix exigua Nutt. | 5 |
| | | Sporobolus cryptandrus (Torr.) Gray | 1 |
| | | Stephanomeria pauciflora (Torr.) A. Nels. | 1 |
| | | Tamarix ramosissima Ledeb. | 32 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Sand | 7 | 3 | 5 | 8 | 1 |
| Bare Soil | 0 | 0 | 0 | 1 | 1 |
| Gravel | 0 | 3 | 5 | 8 | 3 |
| Woody debris structure | 0 | 0 | 0 | 1 | 3 |
| Stone | 3 | 7 | 12 | 19 | 8 |
| Coarse woody debris | 3 | 7 | 25 | 3 | 8 |
| Litter (duff) | 86 | 78 | 42 | 41 | 68 |
| Cobble | 0 | 3 | 12 | 19 | 8 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | <1% | | | | | | | | | |
| Aristida purpurea Nutt. | | | | | | | | | <1% | |
| Artemisia ludoviciana Nutt. | | | | | | | | | 1-5% | |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | 1-5% | | 1-5% | | 5-10% | | | | | |
| Bebbia juncea (Benth.) Greene var. aspera Greene | | | | | 1-5% | | | | 1-5% | |

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 1

Transect Type: Tamarisk Area

| | | | | | |
|---|--------|--------|--------|--------|--------|
| Bernardia incana Morton | | 1-5% | | 1-5% | 1-5% |
| Brickellia longifolia S. Wats. | 10-25% | 10-25% | | 1-5% | 5-10% |
| Bromus diandrus Roth | 25-50% | | <1% | | |
| Bromus rubens L. | 25-50% | 50-75% | 10-25% | 5-10% | 25-50% |
| Bromus tectorum L. | 1-5% | <1% | | | <1% |
| Cryptantha spp. | <1% | | | <1% | |
| Cryptobiotic soil | 5-10% | <1% | 1-5% | 5-10% | 1-5% |
| Cynodon dactylon (L.) Pers. | | 1-5% | 5-10% | | 5-10% |
| Datura wrightii Regel | | | 1-5% | <1% | <1% |
| Erigeron lobatus A. Nels. | | | | | <1% |
| Isocoma acradenia (Greene) Greene | | <1% | | | 5-10% |
| Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm. | | | | 5-10% | <1% |
| Poa bigelovii Vasey & Scribn. | | | | <1% | |
| Porophyllum gracile Benth. | | <1% | 1-5% | 1-5% | <1% |
| Salix exigua Nutt. | | 25-50% | 25-50% | 10-25% | 5-10% |
| Silene antirrhina L. | | | | <1% | |
| Sonchus asper (L.) Hill | | | | | <1% |
| Sporobolus cryptandrus (Torr.) Gray | 1-5% | | | | |
| Stephanomeria pauciflora (Torr.) A. Nels. | | | <1% | 1-5% | 1-5% |
| Tamarix ramosissima Ledeb. | 25-50% | 50-75% | 10-25% | | 10-25% |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|-------------------------------------|---------------|-------------|-------------|
| 5 | Sporobolus cryptandrus (Torr.) Gray | 7 | | |
| 5 | Tamarix ramosissima Ledeb. | 2 | 10 | |
| 15 | Bromus rubens L. | 9 | | |
| 15 | Tamarix ramosissima Ledeb. | | 3 | 15 |
| 25 | Salix exigua Nutt. | 2 | | |
| 45 | Bromus rubens L. | 3 | | |
| 45 | Isocoma acradenia (Greene) Greene | 3 | | |
| 45 | Tamarix ramosissima Ledeb. | 18 | 1 | |

Vegetation Structure Data - New

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|--------------|------------------|-----------|------------------|-----------|------------------|-----------|----------------|-----------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0 | | 0 | | 0 | | 0.00 | |

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 1

Transect Type: Tamarisk Area

| | | | | |
|----|------|---|------|------|
| 15 | 0 | 0 | 0.03 | 0.01 |
| 25 | 0.03 | 0 | 0 | 0.01 |
| 35 | 0 | 0 | 0 | 0.00 |
| 45 | 0.01 | 0 | 0.01 | 0.01 |

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 1

Transect Type: Tamarisk Area

Date: 4/15/2006 Revisit? Post-tamarisk removal

Recorder: Kelsey Forrest Reader: Kate Watters

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

Weather: Partly cloudy about 70F with a 10mph wind.

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--|----------------|
| Cobble | 9 | Aster spp. | 6 |
| Gravel | 2 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 4 |
| Litter (duff) | 74 | Brickellia longifolia S. Wats. | 9 |
| Plant | 2 | Bromus diandrus Roth | 1 |
| Sand | 2 | Bromus rubens L. | 23 |
| Stone | 11 | Bromus tectorum L. | 1 |
| | | Ephedra torreyana S. Wats. | 1 |
| | | Isocoma acradenia (Greene) Greene | 2 |
| | | Moss spp. | 3 |
| | | Salix exigua Nutt. | 5 |
| | | Stephanomeria pauciflora (Torr.) A. Nels. | 4 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Sand | 2 | 0 | 4 | 8 | 3 |
| Gravel | 0 | 2 | 4 | 20 | 3 |
| Bare Soil | 2 | 0 | 1 | 8 | 1 |
| Cobble | 2 | 5 | 11 | 20 | 3 |
| Stone | 0 | 2 | 11 | 20 | 8 |
| Litter (duff) | 45 | 44 | 54 | 8 | 38 |
| Boulder | 2 | 2 | 4 | 8 | 3 |
| Woody debris structure | 0 | 0 | 0 | 1 | 3 |
| Coarse woody debris | 45 | 44 | 11 | 8 | 38 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | <1% | S | | | | | | | | |
| Aristida purpurea Nutt. | <0% | | <0% | | <1% | | <1% | | <0% | |
| Artemisia ludoviciana Nutt. | <0% | | <0% | | <1% | | <0% | | <1% | |
| Aster spp. | | | 1-5% | | | | | | | |
| Aster spp. | <0% | | <0% | | <0% | | <1% | | | |
| Baccharis emoryi Gray | 5-10% | | 1-5% | | | | | | | |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | 1-5% | | <0% | | 5-10% | | | | | |
| Bebbia juncea (Benth.) Greene var. aspera Greene | <0% | | <0% | | 5-10% | | <0% | | 1-5% | |
| Bernardia incana Morton | <0% | | <0% | | <0% | | 1-5% | | 1-5% | |

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 1

Transect Type: Tamarisk Area

| | | | | | |
|---|------|--------|--------|-------|--------|
| Brickellia longifolia S. Wats. | 1-5% | <0% | <1% | <0% | 5-10% |
| Bromus diandrus Roth | 1-5% | | | | |
| Bromus rubens L. | 1-5% | 25-50% | 5-10% | 1-5% | 10-25% |
| Bromus tectorum L. | 1-5% | | | | |
| Cryptobiotic soil | <0% | <1% | <1% | 1-5% | <1% |
| Datura wrightii Regel | <0% | <1% | <1% | <1% | <0% |
| Ephedra torreyana S. Wats. | | | <1% | | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <0% | <0% | <1% | <1% | <1% |
| forb spp | <0% | <0% | <0% | <0% | <1% |
| Grass spp | | | 5-10% | | |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | | <1% | | | |
| Isocoma acradenia (Greene) Greene | <0% | <1% | <0% | <1% | 5-10% |
| Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm. | | | | 1-5% | |
| Moss spp. | <0% | <1% | 1-5% | 1-5% | 10-25% |
| Muhlenbergia porteri Scribn. ex Beal | <0% | <0% | <0% | <1% | 5-10% |
| Porophyllum gracile Benth. | <0% | <1% | <0% | <1% | <1% |
| Salix exigua Nutt. | <0% | <0% | 25-50% | 5-10% | 1-5% |
| Setaria viridis (L.) Beauv. | | | <1% | | |
| Sonchus asper (L.) Hill | <0% | <0% | <0% | <0% | <1% |
| Sonchus oleraceus L. | | | | | <1% |
| Sporobolus cryptandrus (Torr.) Gray | 1-5% | | | | |
| Stephanomeria pauciflora (Torr.) A. Nels. | <0% | <0% | 1-5% | 1-5% | 1-5% |
| Tamarix ramosissima Ledeb. | <1% | P | | | |
| Verbascum thapsus L. | <0% | <0% | <0% | <1% | <1% |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|-----------------------------------|---------------|-------------|-------------|
| 25 | Bromus rubens L. | 2 | | |
| 45 | Bromus rubens L. | 2 | | |
| 45 | Isocoma acradenia (Greene) Greene | 7 | | |

Vegetation Structure Data - New

Soil Data

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 2

Transect Type: Tamarisk Area

| | Start point | | End point |
|----------------------------|---|--------------------------|------------------|
| Easting: | 404280 | Easting: | 404239 |
| Northing: | 4000513 | Northing: | 4000480 |
| GPS accuracy (m): | 6.2 | GPS accuracy (m): | 7.7 |
| Elevation (m): | 1025 | Elevation (m): | |
| Bearing: | 230 | | |
| Aspect (0-360): | 210 | Slope (degrees): | 4 |
| Transect description: | In a side drainage on creek left of Bright Angel Creek, near the trail, 6.5km (~4miles) up from Phantom Ranch. About 2.5km (~1.5 miles) downcreek from Ribbon Falls. Further up canyon on creek left is small, shallow canyon coming in. Tamarisk transect is located about 35m downcanyon of reference on terrace on creek left of B.A. creek. In 2006, soil data was not collected. | | |
| Additional Info:: | End point is near mud / cobble embankment created by drainage. Some large TAMRAM present. | | |
| Geological layer: | Granite and schist | | |
| Habitat type: | Riparian | Mojave desert scrub | |
| Dominant species: | Acacia greggii Gray, Artemisia dracunculul L., Brickellia longifolia S. Wats., Bromus rubens L., Fallugia paradoxa (D. Don) Endl. ex Torr., Isocoma acradenia (Greene) Greene | | |
| Associated species: | Achnatherum speciosum (Trin. & Rupr.) Barkworth, Argemone L., Aristida adscensionis L., Aristida arizonica Vasey, Aster spp., Astragalus nuttallianus DC., Bothriochloa barbinodis (Lag.) Herter, Brickellia longifolia S. Wats., Bromus diandrus Roth, Bromus tectorum L., Cryptantha confertiflora (Greene) Payson, Cryptobiotic soil, Cynodon dactylon (L.) Pers., Datura wrightii Regel, Erodium cicutarium (L.) L'Hér. ex Ait., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Lepidium lasiocarpum Nutt. var. lasiocarpum, Mirabilis bigelovii Gray, Muhlenbergia porteri Scribn. ex Beal, Opuntia basilaris Engelm. & Bigelow, Opuntia phaeacantha Engelm., Plantago patagonica Jacq., Poa bigelovii Vasey & Scribn., Poa fendleriana (Steud.) Vasey, Rhus trilobata Nutt. var. simplicifolia (Greene) Barkl., Salix exigua Nutt., Sporobolus contractus A.S. Hitchc., Sporobolus cryptandrus (Torr.) Gray, Sporobolus giganteus Nash, Stephanomeria pauciflora (Torr.) A. Nels., Tridens muticus (Torr.) Nash, Vitis arizonica Engelm., Vulpia microstachys (Nutt.) Munro, Yucca baccata Torr. | | |
| Surface water within 25m? | <input checked="" type="checkbox"/> | Surface water type: | |
| Landform: Drainage channel | | Surface rocks: sandstone | limestone |
| Soil type: sand | | Topo position: | |
| Light exposure: open | | Soil moisture: dry | |

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 2

Transect Type: Tamarisk Area

Date: 6/7/2005 Revisit? Pre-tamarisk removal

Recorder: Kate Watters Reader: Kate Watters

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

Weather: Sunny, no clouds, VERY hot!

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|---|----------------|
| Bare Soil | 18 | | 9 |
| Coarse woody debris | 36 | Acacia greggii Gray | 1 |
| Gravel | 3 | Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | 1 |
| Litter (duff) | 73 | Achnatherum speciosum (Trin. & Rupr.) Barkworth | 1 |
| Stone | 4 | Artemisia dracunculus L. | 21 |
| Woody debris structure | 7 | Brickellia longifolia S. Wats. | 11 |
| | | Bromus diandrus Roth | 5 |
| | | Bromus rubens L. | 51 |
| | | Cryptantha spp. | 1 |
| | | Erodium cicutarium (L.) L'Hér. ex Ait. | 1 |
| | | Fallugia paradoxa (D. Don) Endl. ex Torr. | 11 |
| | | Isocoma acradenia (Greene) Greene | 1 |
| | | Salix exigua Nutt. | 3 |
| | | Tamarix ramosissima Ledeb. | 27 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Woody debris structure | 0 | 1 | 0 | 0 | 3 |
| Gravel | 0 | 5 | 5 | 0 | 0 |
| Stone | 0 | 5 | 13 | 3 | 1 |
| Sand | 1 | 5 | 5 | 3 | 1 |
| Boulder | 0 | 0 | 1 | 3 | 3 |
| Cobble | 1 | 13 | 5 | 3 | 1 |
| Litter (duff) | 98 | 65 | 65 | 85 | 92 |
| Bare Soil | 1 | 1 | 1 | 0 | 0 |
| Coarse woody debris | 0 | 5 | 5 | 3 | 0 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | | | 1-5% | | <1% | | | | | |
| Achnatherum speciosum (Trin. & Rupr.) Barkworth | | | <1% | | | | | | | |
| Aristida adscensionis L. | | | <1% | | | | | | | |
| Aristida purpurea Nutt. | | | 1-5% | | <1% | | <1% | | | |
| Artemisia dracunculus L. | 5-10% | | 1-5% | | 1-5% | | 1-5% | | | |

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 2

Transect Type: Tamarisk Area

| | | | | | |
|--|--------|--------|--------|--------|--------|
| Artemisia ludoviciana Nutt. | | 1-5% | | | |
| Astragalus nuttallianus DC. | | <1% | <1% | | |
| Bothriochloa barbinodis (Lag.) Herter | | <1% | | | |
| Brickellia longifolia S. Wats. | <1% | 10-25% | 10-25% | 10-25% | 25-50% |
| Bromus diandrus Roth | | | <1% | 5-10% | 5-10% |
| Bromus rubens L. | 5-10% | 5-10% | 5-10% | 25-50% | 25-50% |
| Bromus tectorum L. | | <1% | <1% | 5-10% | |
| Cryptantha spp. | | | | <1% | |
| Cryptobiotic soil | | 50-75% | 50-75% | 5-10% | |
| Cynodon dactylon (L.) Pers. | | 1-5% | 5-10% | | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | 1-5% | | | |
| Fallugia paradoxa (D. Don) Endl. ex Torr. | 50-75% | | <1% | 5-10% | 5-10% |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | | <1% | | | |
| Isocoma acradenia (Greene) Greene | 1-5% | <1% | 1-5% | <1% | 1-5% |
| Lepidium lasiocarpum Nutt. var. lasiocarpum | | | <1% | <1% | |
| Mirabilis bigelovii Gray | | 1-5% | <1% | | |
| Muhlenbergia porteri Scribn. ex Beal | <1% | | | <1% | |
| Opuntia basilaris Engelm. & Bigelow | | <1% | | | |
| Opuntia phaeacantha Engelm. | | 1-5% | | | |
| Plantago patagonica Jacq. | <1% | <1% | 1-5% | <1% | |
| Poa bigelovii Vasey & Scribn. | <1% | | | | |
| Poa fendleriana (Steud.) Vasey | | <1% | | | |
| Salix exigua Nutt. | | | | | 10-25% |
| Sporobolus contractus A.S. Hitchc. | | | | | <1% |
| Sporobolus cryptandrus (Torr.) Gray | <1% | 1-5% | 1-5% | <1% | |
| Stephanomeria pauciflora (Torr.) A. Nels. | | 1-5% | 1-5% | <1% | |
| Tamarix ramosissima Ledeb. | 10-25% | | | 10-25% | 50-75% |
| Tridens muticus (Torr.) Nash | | <1% | <1% | | |
| Vitis arizonica Engelm. | | | <1% | | |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|-----------------------------|---------------|-------------|-------------|
| 5 Artemisia dracunculus L. | 3 | | |
| 5 Bromus rubens L. | 2 | | |
| 15 Artemisia dracunculus L. | 4 | | |
| 15 Bromus rubens L. | 4 | | |
| 25 Bromus rubens L. | 2 | | |
| 35 Artemisia dracunculus L. | 9 | 5 | |
| 45 Bromus rubens L. | 5 | | |

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 2

Transect Type: Tamarisk Area

| | | | | |
|----|----------------------------|---|---|---|
| 45 | Tamarix ramosissima Ledeb. | 5 | 3 | 5 |
|----|----------------------------|---|---|---|

Vegetation Structure Data - New**Soil Data**

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|----|-----------|----|-----------|----|---------|----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0 | | 0 | | 0 | | 0.00 | |
| 15 | 0.01 | | 0 | | 0 | | 0.00 | |
| 25 | 0 | | 0 | | 0 | | 0.00 | |
| 35 | 0 | | 0 | | 0 | | 0.00 | |
| 45 | 0.07 | | 0.03 | | 0.04 | | 0.05 | |

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 2

Transect Type: Tamarisk Area

Date: 4/16/2006 Revisit? Post-tamarisk removal

Recorder: Kate Watters Reader: Kate Watters

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

Weather: Breezy, 20mph/ gusty. 75F and sunny and clear.

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|--|----------------|
| Boulder | 1 | Acacia greggii Gray | 1 |
| Coarse woody debris | 5 | Artemisia dracunculus L. | 5 |
| Cobble | 1 | Brickellia longifolia S. Wats. | 12 |
| Gravel | 2 | Bromus rubens L. | 4 |
| Litter (duff) | 68 | Bromus spp. | 14 |
| Plant | 4 | Cryptobiotic soil | 4 |
| Sand | 14 | Cynodon dactylon (L.) Pers. | 2 |
| Stone | 3 | Fallugia paradoxa (D. Don) Endl. ex Torr. | 6 |
| Woody debris structure | 1 | Isocoma acradenia (Greene) Greene | 1 |
| | | Opuntia engelmannii Salm-Dyck var. engelmannii | 1 |
| | | Sporobolus cryptandrus (Torr.) Gray | 5 |
| | | Stephanomeria pauciflora (Torr.) A. Nels. | 2 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Sand | 3 | 33 | 16 | 4 | 0 |
| Bare Soil | 3 | 33 | 16 | 1 | 0 |
| Gravel | 0 | 6 | 6 | 1 | 0 |
| Litter (duff) | 35 | 6 | 37 | 53 | 52 |
| Boulder | 0 | 0 | 6 | 11 | 0 |
| Cobble | 0 | 6 | 6 | 1 | 0 |
| Woody debris structure | 0 | 6 | 0 | 1 | 10 |
| Coarse woody debris | 59 | 6 | 6 | 25 | 37 |
| Stone | 0 | 6 | 6 | 4 | 0 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---------------------------------------|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | 1-5% | P | 1-5% | P | 1-5% | S | <0% | | <0% | |
| Aristida arizonica Vasey | <0% | | <1% | | 1-5% | | <1% | | <0% | |
| Artemisia dracunculus L. | 1-5% | | <1% | | 1-5% | | 1-5% | | <0% | |
| Artemisia ludoviciana Nutt. | <0% | | 1-5% | | <0% | | <0% | | <0% | |
| Baccharis emoryi Gray | <0% | | <0% | | <1% | | <0% | | <0% | |
| Bothriochloa barbinodis (Lag.) Herter | <0% | | <1% | | | | | | | |
| Bouteloua eriopoda (Torr.) Torr. | <0% | | <1% | | | | | | | |
| Brickellia longifolia S. Wats. | 1-5% | | 5-10% | | 10-25% | | 10-25% | | 1-5% | |

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 2

Transect Type: Tamarisk Area

| | | | | | |
|--|--------|--------|--------|--------|--------|
| Bromus rubens L. | 10-25% | 1-5% | <1% | 10-25% | 10-25% |
| Cryptobiotic soil | 1-5% | 10-25% | 10-25% | 5-10% | <0% |
| Cynodon dactylon (L.) Pers. | <0% | 1-5% | 5-10% | 1-5% | <0% |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <0% | <1% | | | |
| Fallugia paradoxa (D. Don) Endl. ex Torr. | 10-25% | <1% | 1-5% | <0% | 1-5% |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | <0% | <1% | <0% | <0% | <0% |
| Isocoma acradenia (Greene) Greene | 1-5% | 1-5% | 1-5% | 1-5% | <0% |
| Mirabilis bigelovii Gray | <1% | <1% | <1% | <0% | <0% |
| Moss spp. | <0% | <1% | <1% | <1% | <0% |
| Opuntia engelmannii Salm-Dyck var. engelmannii | <0% | 1-5% | <0% | <0% | <0% |
| Salix exigua Nutt. | | | | | <1% |
| Sporobolus cryptandrus (Torr.) Gray | <1% | 1-5% | 1-5% | 1-5% | <0% |
| Stephanomeria pauciflora (Torr.) A. Nels. | <0% | <1% | 1-5% | <1% | <0% |
| Tridens muticus (Torr.) Nash | | | 1-5% | | |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--|---------------|-------------|-------------|
| 15 Artemisia dracunculus L. | 1 | | |
| 15 Sporobolus cryptandrus (Torr.) Gray | 5 | | |
| 25 Brickellia longifolia S. Wats. | 7 | | |
| 35 Brickellia longifolia S. Wats. | 3 | | |
| 35 Bromus rubens L. | 1 | | |
| 45 Bromus rubens L. | 1 | | |

Vegetation Structure Data - New**Soil Data**

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 2

Transect Type: Tamarisk Area

Date: 6/7/2005 Revisit? Pre-tamarisk removal

Recorder: Kate Watters Reader: Kate Watters

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

Weather: Sunny, no clouds, VERY hot!

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|---|----------------|
| Bare Soil | 18 | | 9 |
| Coarse woody debris | 36 | Acacia greggii Gray | 1 |
| Gravel | 3 | Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | 1 |
| Litter (duff) | 73 | Achnatherum speciosum (Trin. & Rupr.) Barkworth | 1 |
| Stone | 4 | Artemisia dracunculus L. | 21 |
| Woody debris structure | 7 | Brickellia longifolia S. Wats. | 11 |
| | | Bromus diandrus Roth | 5 |
| | | Bromus rubens L. | 51 |
| | | Cryptantha spp. | 1 |
| | | Erodium cicutarium (L.) L'Hér. ex Ait. | 1 |
| | | Fallugia paradoxa (D. Don) Endl. ex Torr. | 11 |
| | | Isocoma acradenia (Greene) Greene | 1 |
| | | Salix exigua Nutt. | 3 |
| | | Tamarix ramosissima Ledeb. | 27 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Woody debris structure | 0 | 1 | 0 | 0 | 3 |
| Gravel | 0 | 5 | 5 | 0 | 0 |
| Stone | 0 | 5 | 13 | 3 | 1 |
| Sand | 1 | 5 | 5 | 3 | 1 |
| Boulder | 0 | 0 | 1 | 3 | 3 |
| Cobble | 1 | 13 | 5 | 3 | 1 |
| Litter (duff) | 98 | 65 | 65 | 85 | 92 |
| Bare Soil | 1 | 1 | 1 | 0 | 0 |
| Coarse woody debris | 0 | 5 | 5 | 3 | 0 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | | | 1-5% | | <1% | | | | | |
| Achnatherum speciosum (Trin. & Rupr.) Barkworth | | | <1% | | | | | | | |
| Aristida adscensionis L. | | | <1% | | | | | | | |
| Aristida purpurea Nutt. | | | 1-5% | | <1% | | <1% | | | |
| Artemisia dracunculus L. | 5-10% | | 1-5% | | 1-5% | | 1-5% | | | |

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 2

Transect Type: Tamarisk Area

| | | | | | |
|--|--------|--------|--------|--------|--------|
| Artemisia ludoviciana Nutt. | | 1-5% | | | |
| Astragalus nuttallianus DC. | | <1% | <1% | | |
| Bothriochloa barbinodis (Lag.) Herter | | <1% | | | |
| Brickellia longifolia S. Wats. | <1% | 10-25% | 10-25% | 10-25% | 25-50% |
| Bromus diandrus Roth | | | <1% | 5-10% | 5-10% |
| Bromus rubens L. | 5-10% | 5-10% | 5-10% | 25-50% | 25-50% |
| Bromus tectorum L. | | <1% | <1% | 5-10% | |
| Cryptantha spp. | | | | <1% | |
| Cryptobiotic soil | | 50-75% | 50-75% | 5-10% | |
| Cynodon dactylon (L.) Pers. | | 1-5% | 5-10% | | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | 1-5% | | | |
| Fallugia paradoxa (D. Don) Endl. ex Torr. | 50-75% | | <1% | 5-10% | 5-10% |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | | <1% | | | |
| Isocoma acradenia (Greene) Greene | 1-5% | <1% | 1-5% | <1% | 1-5% |
| Lepidium lasiocarpum Nutt. var. lasiocarpum | | | <1% | <1% | |
| Mirabilis bigelovii Gray | | 1-5% | <1% | | |
| Muhlenbergia porteri Scribn. ex Beal | <1% | | | <1% | |
| Opuntia basilaris Engelm. & Bigelow | | <1% | | | |
| Opuntia phaeacantha Engelm. | | 1-5% | | | |
| Plantago patagonica Jacq. | <1% | <1% | 1-5% | <1% | |
| Poa bigelovii Vasey & Scribn. | <1% | | | | |
| Poa fendleriana (Steud.) Vasey | | <1% | | | |
| Salix exigua Nutt. | | | | | 10-25% |
| Sporobolus contractus A.S. Hitchc. | | | | | <1% |
| Sporobolus cryptandrus (Torr.) Gray | <1% | 1-5% | 1-5% | <1% | |
| Stephanomeria pauciflora (Torr.) A. Nels. | | 1-5% | 1-5% | <1% | |
| Tamarix ramosissima Ledeb. | 10-25% | | | 10-25% | 50-75% |
| Tridens muticus (Torr.) Nash | | <1% | <1% | | |
| Vitis arizonica Engelm. | | | <1% | | |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|-----------------------------|---------------|-------------|-------------|
| 5 Artemisia dracunculus L. | 3 | | |
| 5 Bromus rubens L. | 2 | | |
| 15 Artemisia dracunculus L. | 4 | | |
| 15 Bromus rubens L. | 4 | | |
| 25 Bromus rubens L. | 2 | | |
| 35 Artemisia dracunculus L. | 9 | 5 | |
| 45 Bromus rubens L. | 5 | | |

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 2

Transect Type: Tamarisk Area

45 Tamarix ramosissima Ledeb. 5 3 5

Vegetation Structure Data - New

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|----|-----------|----|-----------|----|---------|----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0 | | 0 | | 0 | | 0.00 | |
| 15 | 0.01 | | 0 | | 0 | | 0.00 | |
| 25 | 0 | | 0 | | 0 | | 0.00 | |
| 35 | 0 | | 0 | | 0 | | 0.00 | |
| 45 | 0.07 | | 0.03 | | 0.04 | | 0.05 | |

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 2

Transect Type: Tamarisk Area

Date: 4/16/2006 Revisit? Post-tamarisk removal

Recorder: Kate Watters Reader: Kate Watters

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

Weather: Breezy, 20mph/ gusty. 75F and sunny and clear.

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|--|----------------|
| Boulder | 1 | Acacia greggii Gray | 1 |
| Coarse woody debris | 5 | Artemisia dracunculus L. | 5 |
| Cobble | 1 | Brickellia longifolia S. Wats. | 12 |
| Gravel | 2 | Bromus rubens L. | 4 |
| Litter (duff) | 68 | Bromus spp. | 14 |
| Plant | 4 | Cryptobiotic soil | 4 |
| Sand | 14 | Cynodon dactylon (L.) Pers. | 2 |
| Stone | 3 | Fallugia paradoxa (D. Don) Endl. ex Torr. | 6 |
| Woody debris structure | 1 | Isocoma acradenia (Greene) Greene | 1 |
| | | Opuntia engelmannii Salm-Dyck var. engelmannii | 1 |
| | | Sporobolus cryptandrus (Torr.) Gray | 5 |
| | | Stephanomeria pauciflora (Torr.) A. Nels. | 2 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Sand | 3 | 33 | 16 | 4 | 0 |
| Bare Soil | 3 | 33 | 16 | 1 | 0 |
| Gravel | 0 | 6 | 6 | 1 | 0 |
| Litter (duff) | 35 | 6 | 37 | 53 | 52 |
| Boulder | 0 | 0 | 6 | 11 | 0 |
| Cobble | 0 | 6 | 6 | 1 | 0 |
| Woody debris structure | 0 | 6 | 0 | 1 | 10 |
| Coarse woody debris | 59 | 6 | 6 | 25 | 37 |
| Stone | 0 | 6 | 6 | 4 | 0 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---------------------------------------|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | 1-5% | P | 1-5% | P | 1-5% | S | <0% | | <0% | |
| Aristida arizonica Vasey | <0% | | <1% | | 1-5% | | <1% | | <0% | |
| Artemisia dracunculus L. | 1-5% | | <1% | | 1-5% | | 1-5% | | <0% | |
| Artemisia ludoviciana Nutt. | <0% | | 1-5% | | <0% | | <0% | | <0% | |
| Baccharis emoryi Gray | <0% | | <0% | | <1% | | <0% | | <0% | |
| Bothriochloa barbinodis (Lag.) Herter | <0% | | <1% | | | | | | | |
| Bouteloua eriopoda (Torr.) Torr. | <0% | | <1% | | | | | | | |
| Brickellia longifolia S. Wats. | 1-5% | | 5-10% | | 10-25% | | 10-25% | | 1-5% | |

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 2

Transect Type: Tamarisk Area

| | | | | | |
|--|--------|--------|--------|--------|--------|
| Bromus rubens L. | 10-25% | 1-5% | <1% | 10-25% | 10-25% |
| Cryptobiotic soil | 1-5% | 10-25% | 10-25% | 5-10% | <0% |
| Cynodon dactylon (L.) Pers. | <0% | 1-5% | 5-10% | 1-5% | <0% |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <0% | <1% | | | |
| Fallugia paradoxa (D. Don) Endl. ex Torr. | 10-25% | <1% | 1-5% | <0% | 1-5% |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | <0% | <1% | <0% | <0% | <0% |
| Isocoma acradenia (Greene) Greene | 1-5% | 1-5% | 1-5% | 1-5% | <0% |
| Mirabilis bigelovii Gray | <1% | <1% | <1% | <0% | <0% |
| Moss spp. | <0% | <1% | <1% | <1% | <0% |
| Opuntia engelmannii Salm-Dyck var. engelmannii | <0% | 1-5% | <0% | <0% | <0% |
| Salix exigua Nutt. | | | | | <1% |
| Sporobolus cryptandrus (Torr.) Gray | <1% | 1-5% | 1-5% | 1-5% | <0% |
| Stephanomeria pauciflora (Torr.) A. Nels. | <0% | <1% | 1-5% | <1% | <0% |
| Tridens muticus (Torr.) Nash | | | 1-5% | | |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--|---------------|-------------|-------------|
| 15 Artemisia dracunculus L. | 1 | | |
| 15 Sporobolus cryptandrus (Torr.) Gray | 5 | | |
| 25 Brickellia longifolia S. Wats. | 7 | | |
| 35 Brickellia longifolia S. Wats. | 3 | | |
| 35 Bromus rubens L. | 1 | | |
| 45 Bromus rubens L. | 1 | | |

Vegetation Structure Data - New**Soil Data**

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 2

Transect Type: Tamarisk Control

| | Start point | | End point |
|----------------------------|--|-----------------------|------------------|
| Easting: | 404350 | Easting: | 404306 |
| Northing: | 4000548 | Northing: | 4000528 |
| GPS accuracy (m): | 5 | GPS accuracy (m): | 5.3 |
| Elevation (m): | 1033 | Elevation (m): | |
| Bearing: | 220 | | |
| Aspect (0-360): | 210 | Slope (degrees): | 5 |
| Transect description: | Transect start is 7.25km (4.5 miles and 2.5 hours of steady hiking) from Phantom Ranch, where canyon opens up and you start going up hills almost to Ribbon Falls. Transect start is located at a small side channel less than a meter from the N. Kaibab trail. Transect 2 is about 1.3km N or T1 on the trail. Look for the lone scrawny cottonwood on the upper terrace of the creek about 25m from the trail. In 2006 Soil Measurements were not recorded. | | |
| Additional Info:: | Where a drainage comes in from East and first large (though struggling) cottonwood is on west side of trail, in small tributary running Southwest to Bright Angel Creek. Transect start is visible from North Kaibab trail, at junction of small dry tributary and trail. | | |
| Geological layer: | Vishnu schist | | |
| Habitat type: | Riparian | GB desert scrub | |
| Dominant species: | Acacia greggii Gray, Bromus rubens L., Heterotheca villosa (Pursh) Shinners, Isocoma acradenia (Greene) Greene | | |
| Associated species: | Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth, Achnatherum speciosum (Trin. & Rupr.) Barkworth, Agave utahensis Engelm., Argemone munita Dur. & Hilg., Aristida purpurea Nutt., Artemisia ludoviciana Nutt., Astragalus nuttallianus DC., Bebbia juncea (Benth.) Greene var. aspera Greene, Bothriochloa barbinodis (Lag.) Herter, Bouteloua eriopoda (Torr.) Torr., Brickellia longifolia S. Wats., Cryptobiotic soil, Descurainia pinnata (Walt.) Britt., Echinocereus engelmannii (Parry ex Engelm.) Lem., Elymus elymoides (Raf.) Swezey, Encelia farinosa Gray ex Torr., Ephedra fasciculata A. Nels., Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird, Erodium cicutarium (L.) L'Hér. ex Ait., Fallugia paradoxa (D. Don) Endl. ex Torr., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Heterotheca villosa (Pursh) Shinners, Lepidium lasiocarpum Nutt. var. lasiocarpum, Mirabilis bigelovii Gray, Opuntia basilaris Engelm. & Bigelow, Opuntia phaeacantha Engelm., Phlox longifolia Nutt., Plantago patagonica Jacq., Pleuraphis jamesii Torr., Poa bigelovii Vasey & Scribn., Porophyllum gracile Benth., Quercus turbinella Greene, Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb., Sporobolus contractus A.S. Hitchc., Sporobolus cryptandrus (Torr.) Gray, Stephanomeria pauciflora (Torr.) A. Nels., Thymophylla pentachaeta (DC.) Small, Vulpia microstachys (Nutt.) Munro, Yucca baccata Torr. | | |
| Surface water within 25m? | <input checked="" type="checkbox"/> | Surface water type: | |
| Landform: Drainage channel | | Surface rocks: schist | granite |
| Soil type: sand | | Topo position: | |
| Light exposure: open | | Soil moisture: dry | |

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 2

Transect Type: Tamarisk Control

Date: 6/7/2005 Revisit? Pre-tamarisk removal

Recorder: Kate Watters Reader: Kate Watters

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

Weather: Hot, sunny, breezy

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|---|----------------|
| Bare Soil | 34 | | 5 |
| Boulder | 15 | Acacia greggii Gray | 7 |
| Coarse woody debris | 18 | Achnatherum speciosum (Trin. & Rupr.) Barkworth | 3 |
| Cobble | 15 | Agave utahensis Engelm. | 1 |
| Gravel | 12 | Bromus rubens L. | 18 |
| Litter (duff) | 26 | Fallugia paradoxa (D. Don) Endl. ex Torr. | 3 |
| Stone | 6 | Gutierrezia sarothrae (Pursh) Britt. & Rusby | 1 |
| Woody debris structure | 4 | Heterotheca villosa (Pursh) Shinnery | 2 |
| | | Isocoma acradenia (Greene) Greene | 19 |
| | | Salix exigua Nutt. | 1 |
| | | Sporobolus cryptandrus (Torr.) Gray | 2 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Stone | 19 | 12 | 34 | 39 | 7 |
| Litter (duff) | 3 | 28 | 14 | 17 | 19 |
| Sand | 1 | 5 | 1 | 1 | 7 |
| Bare Soil | 1 | 1 | 0 | 1 | 1 |
| Woody debris structure | 1 | 5 | 0 | 0 | 0 |
| Boulder | 8 | 12 | 34 | 17 | 43 |
| Coarse woody debris | 1 | 5 | 6 | 1 | 7 |
| Bedrock | 8 | 1 | 0 | 0 | 0 |
| Cobble | 19 | 5 | 6 | 7 | 7 |
| Gravel | 41 | 28 | 6 | 17 | 7 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | 5-10% | | | | 1-5% | | 5-10% | | 5-10% | |
| Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | | | | | | | | | <1% | |
| Achnatherum speciosum (Trin. & Rupr.) Barkworth | 1-5% | | | | <1% | | <1% | | 1-5% | |
| Agave utahensis Engelm. | | | | | | | <1% | | 1-5% | |
| Aristida purpurea Nutt. | 1-5% | | 1-5% | | 1-5% | | <1% | | | |
| Artemisia ludoviciana Nutt. | | | | | | | <1% | | | |
| Astragalus nuttallianus DC. | <1% | | <1% | | <1% | | <1% | | <1% | |

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 2

Transect Type: Tamarisk Control

| | | | | | |
|---|--------|--------|--------|--------|--------|
| Bebbia juncea (Benth.) Greene var. aspera Greene | | | <1% | | |
| Bothriochloa barbinodis (Lag.) Herter | 1-5% | 1-5% | | <1% | |
| Bouteloua eriopoda (Torr.) Torr. | | | <1% | | |
| Brickellia longifolia S. Wats. | | | | <1% | |
| Bromus rubens L. | 1-5% | <1% | 1-5% | 1-5% | 10-25% |
| Cryptantha spp. | | <1% | <1% | | <1% |
| Cryptobiotic soil | <1% | <1% | 25-50% | 10-25% | 25-50% |
| Descurainia pinnata (Walt.) Britt. | <1% | | | | <1% |
| Echinocereus engelmannii (Parry ex Engelm.) Lem. | | | | | <1% |
| Elymus elymoides (Raf.) Swezey | | | | | <1% |
| Encelia farinosa Gray ex Torr. | | 1-5% | | | |
| Ephedra fasciculata A. Nels. | | | | | <1% |
| Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird | 1-5% | | | | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | | | | <1% |
| Fallugia paradoxa (D. Don) Endl. ex Torr. | | | 5-10% | 5-10% | |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | | | 1-5% | | |
| Heterotheca villosa (Pursh) Shinnery | | 5-10% | 1-5% | 1-5% | |
| Isocoma acradenia (Greene) Greene | 10-25% | 10-25% | 10-25% | 10-25% | 25-50% |
| Lepidium lasiocarpum Nutt. var. lasiocarpum | <1% | <1% | <1% | | <1% |
| Mirabilis bigelovii Gray | <1% | | | | <1% |
| Opuntia basilaris Engelm. & Bigelow | <1% | | | <1% | <1% |
| Opuntia phaeacantha Engelm. | | | <1% | | |
| Phlox longifolia Nutt. | | | <1% | | |
| Plantago patagonica Jacq. | | | <1% | <1% | |
| Pleuraphis jamesii Torr. | | | | <1% | |
| Poa bigelovii Vasey & Scribn. | <1% | | | <1% | <1% |
| Porophyllum gracile Benth. | <1% | | | <1% | |
| Quercus turbinella Greene | | 5-10% | | | |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | | | | | 1-5% |
| Sporobolus cryptandrus (Torr.) Gray | <1% | <1% | <1% | <1% | <1% |
| Stephanomeria pauciflora (Torr.) A. Nels. | <1% | | <1% | <1% | <1% |
| Thymophylla pentachaeta (DC.) Small | | | | <1% | |
| Yucca baccata Torr. | | 1-5% | | | |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--|---------------|-------------|-------------|
| 35 Fallugia paradoxa (D. Don) Endl. ex Torr. | 9 | | |

Vegetation Structure Data - New

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 2

Transect Type: Tamarisk Control

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|--------------|------------------|-----------|------------------|-----------|------------------|-----------|----------------|-----------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0.01 | | 0 | | 0 | | 0.00 | |
| 15 | 0 | | 0 | | 0 | | 0.00 | |
| 25 | 0 | | 0 | | 0 | | 0.00 | |
| 35 | 0 | | 0 | | 0 | | 0.00 | |
| 45 | 0 | | 0 | | 0 | | 0.00 | |

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 2

Transect Type: Tamarisk Control

Date: 4/16/2006 Revisit? Post-tamarisk removal

Recorder: Kate Watters Reader: Kelsey Forrest

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

Weather: Clear, sunny, no breeze, 63F

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|---|----------------|
| Bare Soil | 1 | Acacia greggii Gray | 10 |
| Boulder | 23 | Achnatherum speciosum (Trin. & Rupr.) Barkworth | 1 |
| Coarse woody debris | 2 | Aristida arizonica Vasey | 2 |
| Cobble | 4 | Bothriochloa barbinodis (Lag.) Herter | 1 |
| Gravel | 9 | Bromus rubens L. | 2 |
| Litter (duff) | 39 | Cryptobiotic soil | 5 |
| Plant | 5 | Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird | 1 |
| Sand | 4 | Fallugia paradoxa (D. Don) Endl. ex Torr. | 5 |
| Stone | 13 | Grass spp | 4 |
| | | Heterotheca villosa (Pursh) Shinnery | 5 |
| | | Isocoma acradenia (Greene) Greene | 19 |
| | | Moss spp. | 1 |
| | | Setaria spp. | 1 |
| | | Sporobolus cryptandrus (Torr.) Gray | 2 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Cobble | 18 | 9 | 5 | 13 | 1 |
| Boulder | 18 | 20 | 58 | 29 | 35 |
| Coarse woody debris | 8 | 3 | 5 | 5 | 6 |
| Woody debris structure | 3 | 9 | 0 | 0 | 1 |
| Bedrock | 3 | 3 | 0 | 0 | 0 |
| Litter (duff) | 3 | 20 | 12 | 13 | 35 |
| Stone | 3 | 9 | 12 | 29 | 15 |
| Gravel | 38 | 9 | 5 | 5 | 1 |
| Sand | 3 | 9 | 5 | 5 | 6 |
| Bare Soil | 3 | 9 | 1 | 1 | 1 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | 10-25% | S+M | <0% | | 1-5% | P | 1-5% | S+P+M | 1-5% | M |
| Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | | | | | | | | | <1% | |
| Achnatherum speciosum (Trin. & Rupr.) Barkworth | 1-5% | | <0% | | <0% | | <0% | | <1% | |

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 2

Transect Type: Tamarisk Control

| | | | | | |
|--|-------|--------|--------|--------|--------|
| Agave utahensis Engelm. var. kaibabensis (McKelvey) Breitung | | | | <1% | 1-5% |
| Aristida arizonica Vasey | 1-5% | 1-5% | 1-5% | 1-5% | <1% |
| Artemisia ludoviciana Nutt. | | | | <1% | |
| Aster spp. | <0% | <1% | <1% | | |
| Bothriochloa barbinodis (Lag.) Herter | 1-5% | 1-5% | <1% | <0% | <1% |
| Bouteloua eriopoda (Torr.) Torr. | <1% | <0% | <1% | <0% | <0% |
| Brickellia longifolia S. Wats. | | | | <1% | |
| Bromus rubens L. | <0% | <0% | <1% | <0% | <1% |
| Cheilanthes feei T. Moore | <0% | <0% | <1% | | |
| Cryptantha racemosa (S. Wats.) Greene | <0% | <0% | <1% | 1-5% | <0% |
| Cryptobiotic soil | 1-5% | <1% | 25-50% | 5-10% | 1-5% |
| Echinocereus engelmannii (Parry ex Engelm.) Lem. | <1% | <0% | <0% | <1% | <0% |
| Ephedra fasciculata A. Nels. | | | | | 10-25% |
| Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird | 1-5% | <0% | <0% | <1% | <0% |
| Eurybia glauca (Nutt.) Nesom | | | | | <1% |
| Fallugia paradoxa (D. Don) Endl. ex Torr. | <0% | <0% | 5-10% | 10-25% | 1-5% |
| forb spp | <1% | <0% | <0% | <0% | |
| Grass spp | | | | | <1% |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | <0% | <0% | <1% | <0% | <0% |
| Heterotheca villosa (Pursh) Shinnars | <1% | 5-10% | 1-5% | 1-5% | 25-50% |
| Isocoma acradenia (Greene) Greene | 5-10% | 10-25% | 10-25% | 5-10% | <0% |
| Mammillaria grahamii Engelm. var. grahamii | <1% | <0% | <0% | <0% | <0% |
| Mirabilis bigelovii Gray | <1% | <0% | <0% | <0% | <1% |
| Moss spp. | <1% | <1% | <1% | 1-5% | <1% |
| Opuntia basilaris Engelm. & Bigelow | <1% | <1% | <0% | <1% | <1% |
| Porophyllum gracile Benth. | <1% | <0% | <0% | <1% | <0% |
| Quercus turbinella Greene | <0% | 1-5% | | | |
| Setaria spp. | <1% | <0% | <1% | <0% | <0% |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | | | | | <1% |
| Sporobolus cryptandrus (Torr.) Gray | <1% | <1% | 1-5% | <1% | <1% |
| Stephanomeria pauciflora (Torr.) A. Nels. | 1-5% | <0% | <1% | <0% | <1% |
| Thymophylla pentachaeta (DC.) Small | | | | <1% | |
| Tridens muticus (Torr.) Nash | | | | <1% | |
| Yucca baccata Torr. | <0% | 1-5% | | | |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------------------------------|---------------|-------------|-------------|
| 15 Isocoma acradenia (Greene) Greene | 6 | | |
| 25 Isocoma acradenia (Greene) Greene | 1 | | |

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 2

Transect Type: Tamarisk Control

Vegetation Structure Data - New

Soil Data

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 2

Transect Type: Tamarisk Control

Date: 6/7/2005 Revisit? Pre-tamarisk removal
 Recorder: Kate Watters Reader: Kate Watters
 Wind Speed: Air Temp (F): Cloud Cover:
 Weather: Hot, sunny, breezy

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|---|----------------|
| Bare Soil | 34 | | 5 |
| Boulder | 15 | Acacia greggii Gray | 7 |
| Coarse woody debris | 18 | Achnatherum speciosum (Trin. & Rupr.) Barkworth | 3 |
| Cobble | 15 | Agave utahensis Engelm. | 1 |
| Gravel | 12 | Bromus rubens L. | 18 |
| Litter (duff) | 26 | Fallugia paradoxa (D. Don) Endl. ex Torr. | 3 |
| Stone | 6 | Gutierrezia sarothrae (Pursh) Britt. & Rusby | 1 |
| Woody debris structure | 4 | Heterotheca villosa (Pursh) Shinnery | 2 |
| | | Isocoma acradenia (Greene) Greene | 19 |
| | | Salix exigua Nutt. | 1 |
| | | Sporobolus cryptandrus (Torr.) Gray | 2 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Stone | 19 | 12 | 34 | 39 | 7 |
| Litter (duff) | 3 | 28 | 14 | 17 | 19 |
| Sand | 1 | 5 | 1 | 1 | 7 |
| Bare Soil | 1 | 1 | 0 | 1 | 1 |
| Woody debris structure | 1 | 5 | 0 | 0 | 0 |
| Boulder | 8 | 12 | 34 | 17 | 43 |
| Coarse woody debris | 1 | 5 | 6 | 1 | 7 |
| Bedrock | 8 | 1 | 0 | 0 | 0 |
| Cobble | 19 | 5 | 6 | 7 | 7 |
| Gravel | 41 | 28 | 6 | 17 | 7 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | 5-10% | | | | 1-5% | | 5-10% | | 5-10% | |
| Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | | | | | | | | | <1% | |
| Achnatherum speciosum (Trin. & Rupr.) Barkworth | 1-5% | | | | <1% | | <1% | | 1-5% | |
| Agave utahensis Engelm. | | | | | | | <1% | | 1-5% | |
| Aristida purpurea Nutt. | 1-5% | | 1-5% | | 1-5% | | <1% | | | |
| Artemisia ludoviciana Nutt. | | | | | | | <1% | | | |
| Astragalus nuttallianus DC. | <1% | | <1% | | <1% | | <1% | | <1% | |

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 2

Transect Type: Tamarisk Control

| | | | | | |
|---|--------|--------|--------|--------|--------|
| Bebbia juncea (Benth.) Greene var. aspera Greene | | | <1% | | |
| Bothriochloa barbinodis (Lag.) Herter | 1-5% | 1-5% | | <1% | |
| Bouteloua eriopoda (Torr.) Torr. | | | <1% | | |
| Brickellia longifolia S. Wats. | | | | <1% | |
| Bromus rubens L. | 1-5% | <1% | 1-5% | 1-5% | 10-25% |
| Cryptantha spp. | | <1% | <1% | | <1% |
| Cryptobiotic soil | <1% | <1% | 25-50% | 10-25% | 25-50% |
| Descurainia pinnata (Walt.) Britt. | <1% | | | | <1% |
| Echinocereus engelmannii (Parry ex Engelm.) Lem. | | | | | <1% |
| Elymus elymoides (Raf.) Swezey | | | | | <1% |
| Encelia farinosa Gray ex Torr. | | 1-5% | | | |
| Ephedra fasciculata A. Nels. | | | | | <1% |
| Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird | 1-5% | | | | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | | | | <1% |
| Fallugia paradoxa (D. Don) Endl. ex Torr. | | | 5-10% | 5-10% | |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | | | 1-5% | | |
| Heterotheca villosa (Pursh) Shinnery | | 5-10% | 1-5% | 1-5% | |
| Isocoma acradenia (Greene) Greene | 10-25% | 10-25% | 10-25% | 10-25% | 25-50% |
| Lepidium lasiocarpum Nutt. var. lasiocarpum | <1% | <1% | <1% | | <1% |
| Mirabilis bigelovii Gray | <1% | | | | <1% |
| Opuntia basilaris Engelm. & Bigelow | <1% | | | <1% | <1% |
| Opuntia phaeacantha Engelm. | | | <1% | | |
| Phlox longifolia Nutt. | | | <1% | | |
| Plantago patagonica Jacq. | | | <1% | <1% | |
| Pleuraphis jamesii Torr. | | | | <1% | |
| Poa bigelovii Vasey & Scribn. | <1% | | | <1% | <1% |
| Porophyllum gracile Benth. | <1% | | | <1% | |
| Quercus turbinella Greene | | 5-10% | | | |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | | | | | 1-5% |
| Sporobolus cryptandrus (Torr.) Gray | <1% | <1% | <1% | <1% | <1% |
| Stephanomeria pauciflora (Torr.) A. Nels. | <1% | | <1% | <1% | <1% |
| Thymophylla pentachaeta (DC.) Small | | | | <1% | |
| Yucca baccata Torr. | | 1-5% | | | |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--|---------------|-------------|-------------|
| 35 Fallugia paradoxa (D. Don) Endl. ex Torr. | 9 | | |

Vegetation Structure Data - New

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 2

Transect Type: Tamarisk Control

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|--------------|------------------|-----------|------------------|-----------|------------------|-----------|----------------|-----------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0.01 | | 0 | | 0 | | 0.00 | |
| 15 | 0 | | 0 | | 0 | | 0.00 | |
| 25 | 0 | | 0 | | 0 | | 0.00 | |
| 35 | 0 | | 0 | | 0 | | 0.00 | |
| 45 | 0 | | 0 | | 0 | | 0.00 | |

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 2

Transect Type: Tamarisk Control

Date: 4/16/2006 Revisit? Post-tamarisk removal

Recorder: Kate Watters Reader: Kelsey Forrest

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

Weather: Clear, sunny, no breeze, 63F

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|---|----------------|
| Bare Soil | 1 | Acacia greggii Gray | 10 |
| Boulder | 23 | Achnatherum speciosum (Trin. & Rupr.) Barkworth | 1 |
| Coarse woody debris | 2 | Aristida arizonica Vasey | 2 |
| Cobble | 4 | Bothriochloa barbinodis (Lag.) Herter | 1 |
| Gravel | 9 | Bromus rubens L. | 2 |
| Litter (duff) | 39 | Cryptobiotic soil | 5 |
| Plant | 5 | Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird | 1 |
| Sand | 4 | Fallugia paradoxa (D. Don) Endl. ex Torr. | 5 |
| Stone | 13 | Grass spp | 4 |
| | | Heterotheca villosa (Pursh) Shinnery | 5 |
| | | Isocoma acradenia (Greene) Greene | 19 |
| | | Moss spp. | 1 |
| | | Setaria spp. | 1 |
| | | Sporobolus cryptandrus (Torr.) Gray | 2 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Cobble | 18 | 9 | 5 | 13 | 1 |
| Boulder | 18 | 20 | 58 | 29 | 35 |
| Coarse woody debris | 8 | 3 | 5 | 5 | 6 |
| Woody debris structure | 3 | 9 | 0 | 0 | 1 |
| Bedrock | 3 | 3 | 0 | 0 | 0 |
| Litter (duff) | 3 | 20 | 12 | 13 | 35 |
| Stone | 3 | 9 | 12 | 29 | 15 |
| Gravel | 38 | 9 | 5 | 5 | 1 |
| Sand | 3 | 9 | 5 | 5 | 6 |
| Bare Soil | 3 | 9 | 1 | 1 | 1 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | 10-25% | S+M | <0% | | 1-5% | P | 1-5% | S+P+M | 1-5% | M |
| Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | | | | | | | | | <1% | |
| Achnatherum speciosum (Trin. & Rupr.) Barkworth | 1-5% | | <0% | | <0% | | <0% | | <1% | |

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 2

Transect Type: Tamarisk Control

| | | | | | |
|--|-------|--------|--------|--------|--------|
| Agave utahensis Engelm. var. kaibabensis (McKelvey) Breitung | | | | <1% | 1-5% |
| Aristida arizonica Vasey | 1-5% | 1-5% | 1-5% | 1-5% | <1% |
| Artemisia ludoviciana Nutt. | | | | <1% | |
| Aster spp. | <0% | <1% | <1% | | |
| Bothriochloa barbinodis (Lag.) Herter | 1-5% | 1-5% | <1% | <0% | <1% |
| Bouteloua eriopoda (Torr.) Torr. | <1% | <0% | <1% | <0% | <0% |
| Brickellia longifolia S. Wats. | | | | <1% | |
| Bromus rubens L. | <0% | <0% | <1% | <0% | <1% |
| Cheilanthes feei T. Moore | <0% | <0% | <1% | | |
| Cryptantha racemosa (S. Wats.) Greene | <0% | <0% | <1% | 1-5% | <0% |
| Cryptobiotic soil | 1-5% | <1% | 25-50% | 5-10% | 1-5% |
| Echinocereus engelmannii (Parry ex Engelm.) Lem. | <1% | <0% | <0% | <1% | <0% |
| Ephedra fasciculata A. Nels. | | | | | 10-25% |
| Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird | 1-5% | <0% | <0% | <1% | <0% |
| Eurybia glauca (Nutt.) Nesom | | | | | <1% |
| Fallugia paradoxa (D. Don) Endl. ex Torr. | <0% | <0% | 5-10% | 10-25% | 1-5% |
| forb spp | <1% | <0% | <0% | <0% | |
| Grass spp | | | | | <1% |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | <0% | <0% | <1% | <0% | <0% |
| Heterotheca villosa (Pursh) Shinnery | <1% | 5-10% | 1-5% | 1-5% | 25-50% |
| Isocoma acradenia (Greene) Greene | 5-10% | 10-25% | 10-25% | 5-10% | <0% |
| Mammillaria grahamii Engelm. var. grahamii | <1% | <0% | <0% | <0% | <0% |
| Mirabilis bigelovii Gray | <1% | <0% | <0% | <0% | <1% |
| Moss spp. | <1% | <1% | <1% | 1-5% | <1% |
| Opuntia basilaris Engelm. & Bigelow | <1% | <1% | <0% | <1% | <1% |
| Porophyllum gracile Benth. | <1% | <0% | <0% | <1% | <0% |
| Quercus turbinella Greene | <0% | 1-5% | | | |
| Setaria spp. | <1% | <0% | <1% | <0% | <0% |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | | | | | <1% |
| Sporobolus cryptandrus (Torr.) Gray | <1% | <1% | 1-5% | <1% | <1% |
| Stephanomeria pauciflora (Torr.) A. Nels. | 1-5% | <0% | <1% | <0% | <1% |
| Thymophylla pentachaeta (DC.) Small | | | | <1% | |
| Tridens muticus (Torr.) Nash | | | | <1% | |
| Yucca baccata Torr. | <0% | 1-5% | | | |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------------------------------|---------------|-------------|-------------|
| 15 Isocoma acradenia (Greene) Greene | 6 | | |
| 25 Isocoma acradenia (Greene) Greene | 1 | | |

Canyon/Park Area: Bright Angel Creek

River mile: 88 R

Project (Phase): Phase IIa

Transect Name: Bright Angel Creek 2

Transect Type: Tamarisk Control

Vegetation Structure Data - New

Soil Data

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 1

Transect Type: Tamarisk Area

| | Start point | | End point |
|---------------------------|---|---------------------|------------------|
| Easting: | 425709 | Easting: | 425657 |
| Northing: | 4001412 | Northing: | 4001296 |
| GPS accuracy (m): | | GPS accuracy (m): | |
| Elevation (m): | | Elevation (m): | |
| Bearing: | 243 | | |
| Aspect (0-360): | 58 | Slope (degrees): | 4 |
| Transect description: | The transect installed in the narrows section of Carbon Creek, about 150 meters above where the trail drops down into the narrows. The area has sparse vegetation, but there are a significant number of new tamarisk seedlings during transect installation. The transect is in the shadscale-Mormon tea-beavertail cactus plant community. The beginning of the transect is 372 meters below where the trail goes over to Lava Canyon. There is a large mesquite near the transect start point. The transect end point is up canyon. The transect primarily occurs in the Tapeats sandstone geological layer. Transect start is located in the middle of Tapeats pourover shelf next to a big PROGLA. Look for distinct notching in the rock. Start point is halfway through the Tapeats narrows. | | |
| Additional Info:: | Got end GPS point from GIS so field verify. | | |
| Geological layer: | Sandstone | | |
| Habitat type: | Riparian | GB desert scrub | |
| Dominant species: | Gutierrezia sarothrae (Pursh) Britt. & Rusby, Prosopis glandulosa Torr. | | |
| Associated species: | Aristida purpurea Nutt., Artemisia ludoviciana Nutt., Bromus rubens L., Encelia farinosa Gray ex Torr., Stanleya pinnata (Pursh) Britt. | | |
| Surface water within 25m? | <input type="checkbox"/> | Surface water type: | |
| Landform: | Drainage channel | Surface rocks: | sandstone |
| Soil type: | loamy sand | Topo position: | |
| Light exposure: | partial-shade | Soil moisture: | dry |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 1

Transect Type: Tamarisk Area

Date: 5/6/2006 Revisit? Post-tamarisk removal

Recorder: Steve Till Reader: Kate Watters

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

Weather: Clear, sunny

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|-------------------------|----------------|
| Bedrock | 18 | Aristida purpurea Nutt. | 1 |
| Boulder | 3 | | |
| Cobble | 11 | | |
| Gravel | 13 | | |
| Plant | 1 | | |
| Sand | 51 | | |
| Stone | 3 | | |

Daubenmire Scale Cover Data

Vegetation Structure Data - Old

Vegetation Structure Data - New

Soil Data

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 2

Transect Type: Tamarisk Area

| | Start point | | End point |
|---------------------------|---|---------------------|------------------|
| Easting: | 425365 | Easting: | 425314 |
| Northing: | 4001386 | Northing: | 4001397 |
| GPS accuracy (m): | 6 | GPS accuracy (m): | |
| Elevation (m): | 971 | Elevation (m): | |
| Bearing: | 60 | | |
| Aspect (0-360): | 345 | Slope (degrees): | 2 |
| Transect description: | The start point is now at the new brain rock. Lots of flood evidence still, no vegetation growing. The transect start point was the brain rock, which is located where the trails goes to the west-southwest over to Lava Canyon. The brain rock moved during a large flash flood, so the start point was relocated based on the photographs. The end point is down canyon, towards the narrows of Carbon Creek. There are a few mesquite trees located near the transect. The transect occurs in the shadscale-Mormon tea-beavertail cactus plant community. | | |
| Additional Info:: | Got the GPS for end point from GIS so field verify | | |
| Geological layer: | Tapeats | | |
| Habitat type: | GB desert scrub | | |
| Dominant species: | Acacia greggii Gray, Prosopis glandulosa Torr. | | |
| Associated species: | Aristida purpurea Nutt., Atriplex canescens (Pursh) Nutt., Bromus rubens L., Echinocactus polycephalus Engelm. & Bigelow, Echinocereus engelmannii (Parry ex Engelm.) Lem., Ephedra spp., Erodium cicutarium (L.) L'Hér. ex Ait., Gutierrezia spp., Lycium spp., Mirabilis bigelovii Gray, Psoralea fremontii (Torr. ex Gray) Barneby var. attenuatus Barneby, Sporobolus cryptandrus (Torr.) Gray | | |
| Surface water within 25m? | <input checked="" type="checkbox"/> | Surface water type: | stream |
| Landform: | Drainage channel | Surface rocks: | sandstone |
| Soil type: | loamy sand | Topo position: | |
| Light exposure: | partial-shade | Soil moisture: | moist |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 2

Transect Type: Tamarisk Area

Date: 5/6/2006 Revisit? Post-tamarisk removal

Recorder: Lori Makarick Reader: Amy Prince

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

Weather: 1% clouds and the wind has really picked up

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> |
|---------------------|----------------|
| Bedrock | 4 |
| Boulder | 3 |
| Cobble | 9 |
| Gravel | 50 |
| Litter (duff) | 1 |
| Sand | 31 |
| Stone | 2 |

Daubenmire Scale Cover Data

Vegetation Structure Data - Old

Vegetation Structure Data - New

Soil Data

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 3

Transect Type: Tamarisk Area

| | Start point | | End point |
|---------------------------|--|---------------------|------------------|
| Easting: | 425191 | Easting: | 425141 |
| Northing: | 4001476 | Northing: | 4001264 |
| GPS accuracy (m): | 4.1 | GPS accuracy (m): | 6 |
| Elevation (m): | 988 | Elevation (m): | 987 |
| Bearing: | 242 | | |
| Aspect (0-360): | 56 | Slope (degrees): | 5 |
| Transect description: | The transect was located in the dense tamarisk thicket above the Carbon Creek narrows. Transect tape is on the N side of the drainage. The end point is up canyon - with the start point down canyon toward the narrows. End point is on the edge of the drainage go by the GPS readings, just west of the phragmites clump. Note: the old reading had the tape in the drainage with the readings 2 meters in. The new start/end is on the bank of the creek. This is an old transect - point intercept only. Crew put in newly named photopoints. | | |
| Additional Info:: | | | |
| Geological layer: | | | |
| Habitat type: | Riparian | | |
| Dominant species: | Phragmites australis (Cav.) Trin. ex Steud., Prosopis glandulosa Torr. | | |
| Associated species: | Ephedra spp., Isocoma acradenia (Greene) Greene, Polypogon monspeliensis (L.) Desf., Stanleya pinnata (Pursh) Britt., Suaeda moquinii (Torr.) Greene | | |
| Surface water within 25m? | <input checked="" type="checkbox"/> | Surface water type: | seep |
| Landform: | Drainage channel | Surface rocks: | |
| Soil type: | loamy sand | Topo position: | |
| Light exposure: | partial-shade | Soil moisture: | dry |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 3

Transect Type: Tamarisk Area

Date: 5/6/2006 Revisit? Post-tamarisk removal

Recorder: Lori Makarick Reader: Amy Prince

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

Weather: 10% wispy clouds, very warm, slight breeze

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|---|----------------|
| Boulder | 1 | Phragmites australis (Cav.) Trin. ex Steud. | 8 |
| Coarse woody debris | 3 | Stanleya pinnata (Pursh) Britt. | 1 |
| Gravel | 6 | | |
| Litter (duff) | 58 | | |
| Sand | 27 | | |
| Woody debris structure | 5 | | |

Daubenmire Scale Cover Data

Vegetation Structure Data - Old

Vegetation Structure Data - New

Soil Data

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 4

Transect Type: Tamarisk Area

| | Start point | | End point |
|---------------------------|--|--------------------------|------------------|
| Easting: | 424667 | Easting: | 424639 |
| Northing: | 4001939 | Northing: | 4001899 |
| GPS accuracy (m): | 3.8 | GPS accuracy (m): | 4 |
| Elevation (m): | 1010 | Elevation (m): | 1004 |
| Bearing: | 212 | | |
| Aspect (0-360): | 130 | Slope (degrees): | 6 |
| Transect description: | Transect is on creek right, starting at reddish sandstone boulder. Remaining along creek right, ending near where creek bends ~110degrees. Down creek from forked zone in Carbon drainage. Note~ most woody debris is standing dead TAMRAM. Mike Kearsley was also a reader on 5/6/06. | | |
| Additional Info:: | Across creek from burn pit area. | | |
| Geological layer: | Supergroup | | |
| Habitat type: | Riparian | GB desert scrub | |
| Dominant species: | Bromus rubens L., Prosopis glandulosa Torr. | | |
| Associated species: | Acacia greggii Gray, Artemisia ludoviciana Nutt., Aster spp., Astragalus spp., Atriplex canescens (Pursh) Nutt., Calycoseris parryi Gray, Camissonia spp., Chaenactis stevioides Hook. & Arn., Cirsium neomexicanum Gray, Dasyochloa pulchella (Kunth) Willd. ex Rydb., Descurainia pinnata (Walt.) Britt., Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake, Ephedra spp., Eriogonum inflatum Torr. & Frém., Erodium cicutarium (L.) L'Hér. ex Ait., Gilia scopulorum M.E. Jones, Gutierrezia sarothrae (Pursh) Britt. & Rusby, Isocoma acradenia (Greene) Greene, Layia glandulosa (Hook.) Hook. & Arn., Lepidium lasiocarpum Nutt. var. lasiocarpum, Lepidium spp., Lycium spp., Machaeranthera pinnatifida (Hook.) Shinners, Mirabilis bigelovii Gray, Nicotiana obtusifolia Mertens & Galeotti var. obtusifolia, Phacelia crenulata Torr. ex S. Wats., Plantago patagonica Jacq., Pleuraphis jamesii Torr., Psoralea fremontii (Torr. ex Gray) Barneby var. fremontii, Senna covesii (Gray) Irwin & Barneby, Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb., Sphaeralcea spp., Stanleya pinnata (Pursh) Britt. | | |
| Surface water within 25m? | <input checked="" type="checkbox"/> | Surface water type: | |
| Landform: Side slope | Lower slope | Surface rocks: sandstone | shale |
| Soil type: sandy loam | | Topo position: | |
| Light exposure: open | | Soil moisture: moist | dry |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 4

Transect Type: Tamarisk Area

Date: 5/8/2005 Revisit? Pre-tamarisk removal

Recorder: Kari Malen Reader: Amy Prince

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

Weather: Blue skies, sunny upper 70-80F

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--|----------------|
| Boulder | 2 | Acacia greggii Gray | 5 |
| Cobble | 5 | Artemisia ludoviciana Nutt. | 1 |
| Gravel | 8 | Astragalus spp. | 1 |
| Litter (duff) | 71 | Bromus rubens L. | 24 |
| Sand | 55 | Descurainia pinnata (Walt.) Britt. | 8 |
| Stone | 3 | Erodium cicutarium (L.) L'Hér. ex Ait. | 23 |
| | | Prosopis glandulosa Torr. | 14 |
| | | Stanleya pinnata (Pursh) Britt. | 1 |
| | | Tamarix ramosissima Ledeb. | 37 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|---------------------|-----------|------------|------------|------------|------------|
| Boulder | 0 | 3 | 0 | 0 | 0 |
| Cobble | 7 | 0 | 0 | 0 | 5 |
| Litter (duff) | 7 | 9 | 0 | 71 | 0 |
| Stone | 0 | 9 | 1 | 0 | 1 |
| Coarse woody debris | 0 | 9 | 11 | 9 | 0 |
| Sand | 85 | 71 | 89 | 20 | 95 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | | | | | 5-10% | | <1% | | 1-5% | |
| Artemisia ludoviciana Nutt. | | | | | | | <1% | | | |
| Astragalus spp. | | | | | | | | | <1% | |
| Atriplex canescens (Pursh) Nutt. | | | | | | | 5-10% | | 5-10% | |
| Brickellia microphylla (Nutt.) Gray var. scabra Gray | | | | | | | | | <1% | |
| Bromus rubens L. | | 10-25% | | 25-50% | 10-25% | | 10-25% | | 1-5% | |
| Calibrachoa parviflora (Juss.) D'Arcy | | | | | <1% | | <1% | | <1% | |
| Chaenactis stevioides Hook. & Arn. | | | | | | | | | <1% | |
| Cirsium neomexicanum Gray | | | | | | | | | <1% | |
| Descurainia pinnata (Walt.) Britt. | <1% | | <1% | | 1-5% | | 1-5% | | 1-5% | |
| Encelia spp. | | | | | | | | | <1% | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | 5-10% | | <1% | | 1-5% | | <1% | | 1-5% | |
| Gilia scopulorum M.E. Jones | | | | | | | | | <1% | |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | | | | | <1% | | | | <1% | |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 4

Transect Type: Tamarisk Area

| | | | |
|---|--------|--------|--------|
| Isocoma acradenia (Greene) Greene | | | <1% |
| Layia glandulosa (Hook.) Hook. & Arn. | | | <1% |
| Mirabilis bigelovii Gray | | <1% | |
| Phacelia crenulata Torr. ex S. Wats. | | | <1% |
| Plantago patagonica Jacq. | | | <1% |
| Prosopis glandulosa Torr. | 25-50% | 10-25% | |
| Psoralea fremontii (Torr. ex Gray) | | | <1% |
| Barneby var. fremontii | | | |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | <1% | <1% | <1% |
| Stanleya pinnata (Pursh) Britt. | | | <1% |
| Tamarix ramosissima Ledeb. | | 50-75% | 50-75% |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|--|---------------|-------------|-------------|
| 5 | Bromus rubens L. | 8 | | |
| 5 | Erodium cicutarium (L.) L'Hér. ex Ait. | 4 | | |
| 15 | Tamarix ramosissima Ledeb. | | 4 | 2 |
| 25 | Descurainia pinnata (Walt.) Britt. | 3 | | |
| 35 | Bromus rubens L. | 3 | | |
| 35 | Tamarix ramosissima Ledeb. | 13 | 13 | 7 |
| 45 | Bromus rubens L. | 6 | | |

Vegetation Structure Data - New

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|--------------|------------------|-----------|------------------|-----------|------------------|-----------|----------------|-----------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0.09 | | 0.09 | | 0.14 | | 0.11 | |
| 15 | 0.2 | | 0.19 | | 0.22 | | 0.20 | |
| 25 | 0.39 | | 0.39 | | 0.39 | | 0.39 | |
| 35 | 5 | | 0.04 | | 0.06 | | 1.70 | |
| 45 | 0.2 | | 0.18 | | 0.17 | | 0.18 | |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 4

Transect Type: Tamarisk Area

Date: 5/6/2006 Revisit? Post-tamarisk removal

Recorder: Lori Makarick Reader: Amy Prince

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

Weather: 0% clouds, very calm, 17.6 C

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|---|----------------|
| Boulder | 2 | Acacia greggii Gray | 5 |
| Cobble | 2 | Atriplex canescens (Pursh) Nutt. | 4 |
| Gravel | 3 | Baccharis brachyphylla Gray | 3 |
| Litter (duff) | 64 | Prosopis glandulosa Torr. | 10 |
| Sand | 24 | Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | 1 |
| Stone | 3 | | |
| Woody debris structure | 2 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Sand | 40 | 3 | 11 | 4 | 23 |
| Cobble | 3 | 3 | 11 | 1 | 10 |
| Woody debris structure | 0 | 20 | 0 | 0 | 4 |
| Litter (duff) | 19 | 43 | 55 | 84 | 23 |
| Coarse woody debris | 19 | 9 | 11 | 10 | 10 |
| Gravel | 8 | 9 | 1 | 1 | 10 |
| Boulder | 3 | 3 | 0 | 0 | 10 |
| Stone | 8 | 9 | 11 | 0 | 10 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | <1% | P | <0% | | 5-10% | | 5-10% | | 1-5% | |
| Aristida purpurea Nutt. | <1% | | <0% | | <0% | | <0% | | <0% | |
| Artemisia ludoviciana Nutt. | | | | | | | <1% | | | |
| Atriplex canescens (Pursh) Nutt. | <1% | | <0% | | <1% | | 5-10% | | 5-10% | |
| Baccharis brachyphylla Gray | <0% | | <0% | | <0% | | <0% | | 1-5% | |
| Gutierrezia spp. | 1-5% | | <1% | | 1-5% | | <1% | | <1% | |
| Isocoma acradenia (Greene) Greene | <0% | | <0% | | 1-5% | | <0% | | <0% | |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | <0% | | <0% | | <1% | | <0% | | <0% | |
| Polypogon monspeliensis (L.) Desf. | <0% | | <0% | | <0% | | <1% | | <0% | |
| Prosopis glandulosa Torr. | 25-50% | M | 10-25% | M | <0% | | 5-10% | | <0% | |
| Psoralea fremontii (Torr. ex Gray) Barneby var. attenuatus Barneby | | | | | | | | | 1-5% | |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | 1-5% | | <1% | | 1-5% | | <0% | | <1% | |
| Sporobolus airoides (Torr.) Torr. | <0% | | <0% | | <0% | | <1% | | <0% | |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 4

Transect Type: Tamarisk Area

| | | | | | |
|--|-----|-----|-----|-----|-----|
| Stanleya pinnata (Pursh) Britt. | <0% | <1% | <0% | <1% | <1% |
| Stephanomeria pauciflora (Torr.) A. Nels. | | | | <1% | <0% |
| Tamarix ramosissima Ledeb. | <0% | <1% | M | <0% | <1% |

Vegetation Structure Data - Old

Vegetation Structure Data - New

Soil Data

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 4

Transect Type: Tamarisk Area

Date: 5/8/2005 Revisit? Pre-tamarisk removal

Recorder: Kari Malen Reader: Amy Prince

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

Weather: Blue skies, sunny upper 70-80F

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--|----------------|
| Boulder | 2 | Acacia greggii Gray | 5 |
| Cobble | 5 | Artemisia ludoviciana Nutt. | 1 |
| Gravel | 8 | Astragalus spp. | 1 |
| Litter (duff) | 71 | Bromus rubens L. | 24 |
| Sand | 55 | Descurainia pinnata (Walt.) Britt. | 8 |
| Stone | 3 | Erodium cicutarium (L.) L'Hér. ex Ait. | 23 |
| | | Prosopis glandulosa Torr. | 14 |
| | | Stanleya pinnata (Pursh) Britt. | 1 |
| | | Tamarix ramosissima Ledeb. | 37 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|---------------------|-----------|------------|------------|------------|------------|
| Boulder | 0 | 3 | 0 | 0 | 0 |
| Cobble | 7 | 0 | 0 | 0 | 5 |
| Litter (duff) | 7 | 9 | 0 | 71 | 0 |
| Stone | 0 | 9 | 1 | 0 | 1 |
| Coarse woody debris | 0 | 9 | 11 | 9 | 0 |
| Sand | 85 | 71 | 89 | 20 | 95 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | | | | | 5-10% | | <1% | | 1-5% | |
| Artemisia ludoviciana Nutt. | | | | | | | <1% | | | |
| Astragalus spp. | | | | | | | | | <1% | |
| Atriplex canescens (Pursh) Nutt. | | | | | | | 5-10% | | 5-10% | |
| Brickellia microphylla (Nutt.) Gray var. scabra Gray | | | | | | | | | <1% | |
| Bromus rubens L. | | 10-25% | | 25-50% | 10-25% | | 10-25% | | 1-5% | |
| Calibrachoa parviflora (Juss.) D'Arcy | | | | | <1% | | <1% | | <1% | |
| Chaenactis stevioides Hook. & Arn. | | | | | | | | | <1% | |
| Cirsium neomexicanum Gray | | | | | | | | | <1% | |
| Descurainia pinnata (Walt.) Britt. | <1% | | <1% | | 1-5% | | 1-5% | | 1-5% | |
| Encelia spp. | | | | | | | | | <1% | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | 5-10% | | <1% | | 1-5% | | <1% | | 1-5% | |
| Gilia scopulorum M.E. Jones | | | | | | | | | <1% | |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | | | | | <1% | | | | <1% | |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 4

Transect Type: Tamarisk Area

| | | | |
|---|--------|--------|--------|
| Isocoma acradenia (Greene) Greene | | | <1% |
| Layia glandulosa (Hook.) Hook. & Arn. | | | <1% |
| Mirabilis bigelovii Gray | | <1% | |
| Phacelia crenulata Torr. ex S. Wats. | | | <1% |
| Plantago patagonica Jacq. | | | <1% |
| Prosopis glandulosa Torr. | 25-50% | 10-25% | |
| Psorothamnus fremontii (Torr. ex Gray) | | | <1% |
| Barneby var. fremontii | | | |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | <1% | <1% | <1% |
| Stanleya pinnata (Pursh) Britt. | | | <1% |
| Tamarix ramosissima Ledeb. | | 50-75% | 50-75% |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|--|---------------|-------------|-------------|
| 5 | Bromus rubens L. | 8 | | |
| 5 | Erodium cicutarium (L.) L'Hér. ex Ait. | 4 | | |
| 15 | Tamarix ramosissima Ledeb. | | 4 | 2 |
| 25 | Descurainia pinnata (Walt.) Britt. | 3 | | |
| 35 | Bromus rubens L. | 3 | | |
| 35 | Tamarix ramosissima Ledeb. | 13 | 13 | 7 |
| 45 | Bromus rubens L. | 6 | | |

Vegetation Structure Data - New

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|--------------|------------------|-----------|------------------|-----------|------------------|-----------|----------------|-----------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0.09 | | 0.09 | | 0.14 | | 0.11 | |
| 15 | 0.2 | | 0.19 | | 0.22 | | 0.20 | |
| 25 | 0.39 | | 0.39 | | 0.39 | | 0.39 | |
| 35 | 5 | | 0.04 | | 0.06 | | 1.70 | |
| 45 | 0.2 | | 0.18 | | 0.17 | | 0.18 | |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 4

Transect Type: Tamarisk Area

Date: 5/6/2006 Revisit? Post-tamarisk removal

Recorder: Lori Makarick Reader: Amy Prince

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

Weather: 0% clouds, very calm, 17.6 C

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|---|----------------|
| Boulder | 2 | Acacia greggii Gray | 5 |
| Cobble | 2 | Atriplex canescens (Pursh) Nutt. | 4 |
| Gravel | 3 | Baccharis brachyphylla Gray | 3 |
| Litter (duff) | 64 | Prosopis glandulosa Torr. | 10 |
| Sand | 24 | Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | 1 |
| Stone | 3 | | |
| Woody debris structure | 2 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Sand | 40 | 3 | 11 | 4 | 23 |
| Cobble | 3 | 3 | 11 | 1 | 10 |
| Woody debris structure | 0 | 20 | 0 | 0 | 4 |
| Litter (duff) | 19 | 43 | 55 | 84 | 23 |
| Coarse woody debris | 19 | 9 | 11 | 10 | 10 |
| Gravel | 8 | 9 | 1 | 1 | 10 |
| Boulder | 3 | 3 | 0 | 0 | 10 |
| Stone | 8 | 9 | 11 | 0 | 10 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | <1% | P | <0% | | 5-10% | | 5-10% | | 1-5% | |
| Aristida purpurea Nutt. | <1% | | <0% | | <0% | | <0% | | <0% | |
| Artemisia ludoviciana Nutt. | | | | | | | <1% | | | |
| Atriplex canescens (Pursh) Nutt. | <1% | | <0% | | <1% | | 5-10% | | 5-10% | |
| Baccharis brachyphylla Gray | <0% | | <0% | | <0% | | <0% | | 1-5% | |
| Gutierrezia spp. | 1-5% | | <1% | | 1-5% | | <1% | | <1% | |
| Isocoma acradenia (Greene) Greene | <0% | | <0% | | 1-5% | | <0% | | <0% | |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | <0% | | <0% | | <1% | | <0% | | <0% | |
| Polypogon monspeliensis (L.) Desf. | <0% | | <0% | | <0% | | <1% | | <0% | |
| Prosopis glandulosa Torr. | 25-50% | M | 10-25% | M | <0% | | 5-10% | | <0% | |
| Psoralea fremontii (Torr. ex Gray) Barneby var. attenuatus Barneby | | | | | | | | | 1-5% | |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | 1-5% | | <1% | | 1-5% | | <0% | | <1% | |
| Sporobolus airoides (Torr.) Torr. | <0% | | <0% | | <0% | | <1% | | <0% | |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 4

Transect Type: Tamarisk Area

| | | | | | |
|---|-----|-----|-----|-----|-----|
| Stanleya pinnata (Pursh) Britt. | <0% | <1% | <0% | <1% | <1% |
| Stephanomeria pauciflora (Torr.) A. Nels. | | | | <1% | <0% |
| Tamarix ramosissima Ledeb. | <0% | <1% | M | <0% | <1% |

Vegetation Structure Data - Old

Vegetation Structure Data - New

Soil Data

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 4

Transect Type: Tamarisk Control

| | Start point | | End point |
|-------------------------------|--|-------------------|------------------|
| Easting: | 424656 | Easting: | 424664 |
| Northing: | 4001849 | Northing: | 4001806 |
| GPS accuracy (m): | 2.8 | GPS accuracy (m): | 1.3 |
| Elevation (m): | 1008 | Elevation (m): | 1006 |
| Bearing: | 169 | | |
| Aspect (0-360): | 83 | Slope (degrees): | 19 |
| Transect description: | About 1km above where trail forks to Lava Chuar. Also down canyon from where three forks converge. Transect is on creek right 50m downcanyon from T4A. 5/6/06 Transect begins in the center of a mesquite tree about 6m high and 6m in diameter. Transect tape begins attached to a dead branch below another dead branch which has been stripped of half of it's bark. Just downstream of the start point is another large, but dead mesquite in the streambed. Transect stops about 4m downstream and across the drainage from a huge sandstone boulder on the right side of the transect, looking downstream at stop point, is the end of a sloping hill which intersects a wash just downstream from the end transect point. Molly Boyter and Mike Kearsley were also readers. | | |
| Additional Info:: | Starts in branch of 5x5m PROGLA tree, heading down canyon through huge PROGLA ending in BRISCA. Parallel to creek bed ~10m from base of slope. Starts at peak of slope on opposite bank and SE tip of end of temple butte. | | |
| Geological layer: | Supergroup | | |
| Habitat type: | Riparian GB desert scrub | | |
| Dominant species: | Atriplex canescens (Pursh) Nutt., Bromus rubens L., Prosopis glandulosa Torr. | | |
| Associated species: | Acacia greggii Gray, Artemisia ludoviciana Nutt., Chaenactis stevioides Hook. & Arn., Dasyochloa pulchella (Kunth) Willd. ex Rydb., Descurainia pinnata (Walt.) Britt., Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake, Erodium cicutarium (L.) L'Hér. ex Ait., Gilia stellata Heller, Gutierrezia sarothrae (Pursh) Britt. & Rusby, Isocoma acradenia (Greene) Greene, Lycium spp., Opuntia basilaris Engelm. & Bigelow, Phacelia crenulata Torr. ex S. Wats., Pleuraphis jamesii Torr., Psoralea fremontii (Torr. ex Gray) Barneby var. attenuatus Barneby, Schismus spp., Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb., Stanleya pinnata (Pursh) Britt., Yucca baccata Torr. | | |
| Surface water within 25m? | <input checked="" type="checkbox"/> Surface water type: | | |
| Landform: Lower slope | Surface rocks: sandstone shale | | |
| Soil type: sandy loam | Topo position: | | |
| Light exposure: partial-shade | Soil moisture: dry | | |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 4

Transect Type: Tamarisk Control

Date: 5/8/2005 Revisit? Pre-tamarisk removal

Recorder: Kari Malen Reader: Amy Prince

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

Weather: Blue sky, breezy

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--|----------------|
| Coarse woody debris | 2 | Acacia greggii Gray | 10 |
| Litter (duff) | 85 | Atriplex canescens (Pursh) Nutt. | 15 |
| Sand | 33 | Baccharis brachyphylla Gray | 2 |
| | | Bromus rubens L. | 34 |
| | | Descurainia pinnata (Walt.) Britt. | 42 |
| | | Erodium cicutarium (L.) L'Hér. ex Ait. | 6 |
| | | Gutierrezia sarothrae (Pursh) Britt. & Rusby | 2 |
| | | Lepidium perfoliatum L. | 1 |
| | | Lycium spp. | 4 |
| | | Prosopis glandulosa Torr. | 32 |
| | | Psoralea fremontii (Torr. ex Gray) Barneby var. attenuatus Barneby | 1 |
| | | Schismus spp. | 9 |
| | | Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | 3 |
| | | Stanleya pinnata (Pursh) Britt. | 4 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Cobble | 1 | 1 | 0 | 0 | 0 |
| Litter (duff) | 49 | 47 | 0 | 0 | 0 |
| Woody debris structure | 1 | 1 | 0 | 0 | 0 |
| Gravel | 1 | 4 | 0 | 0 | 0 |
| Sand | 49 | 47 | 0 | 0 | 0 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | | | 5-10% | | | | | | <1% | |
| Artemisia ludoviciana Nutt. | <1% | | | | | | | | | |
| Atriplex canescens (Pursh) Nutt. | 5-10% | | 5-10% | | 1-5% | | 1-5% | | 5-10% | |
| Bromus rubens L. | 10-25% | | 10-25% | | 25-50% | | 10-25% | | 10-25% | |
| Chaenactis stevioides Hook. & Arn. | | | <1% | | | | | | <1% | |
| Descurainia pinnata (Walt.) Britt. | <1% | | 1-5% | | 5-10% | | 1-5% | | 1-5% | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | | | | | | <1% | | <1% | |
| Gilia stellata Heller | | | | | | | | | <1% | |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | | | | | <1% | | | | | |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 4

Transect Type: Tamarisk Control

| | | | | | |
|---|-------|------|---------|--------|--------|
| Isocoma acradenia (Greene) Greene | | <1% | | | |
| Lepidium spp. | <1% | <1% | <1% | <1% | <1% |
| Lycium spp. | | | | <1% | |
| Phacelia crenulata Torr. ex S. Wats. | | <1% | <1% | <1% | |
| Pleuraphis jamesii Torr. | | | <1% | | |
| Prosopis glandulosa Torr. | | | 75-100% | 10-25% | 25-50% |
| Psorothamnus fremontii (Torr. ex Gray) | | <1% | | | <1% |
| Barneby var. attenuatus Barneby | | | | | |
| Schismus spp. | <1% | | <1% | <1% | <1% |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | | 1-5% | | 1-5% | 1-5% |
| Stanleya pinnata (Pursh) Britt. | <1% | | <1% | | |
| Suaeda moquinii (Torr.) Greene | 5-10% | | | | |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|---|---------------|-------------|-------------|
| 15 | Atriplex canescens (Pursh) Nutt. | 8 | | |
| 15 | Descurainia pinnata (Walt.) Britt. | 6 | | |
| 25 | Gutierrezia spp. | 7 | | |
| 25 | Prosopis glandulosa Torr. | 3 | 9 | 7 |
| 35 | Bromus rubens L. | 2 | | |
| 35 | Descurainia pinnata (Walt.) Britt. | 6 | | |
| 35 | Prosopis glandulosa Torr. | | | 3 |
| 35 | Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | 1 | | |
| 45 | Bromus rubens L. | 1 | | |
| 45 | Descurainia pinnata (Walt.) Britt. | 5 | | |
| 45 | Prosopis glandulosa Torr. | 15 | 9 | |

Vegetation Structure Data - New

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|----|-----------|----|-----------|----|---------|----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0.13 | | 0.19 | | 0.21 | | 0.18 | |
| 15 | 0.07 | | 0.02 | | 0.08 | | 0.06 | |
| 25 | 0.24 | | 0.22 | | 0.2 | | 0.22 | |
| 35 | 0.16 | | 0.09 | | 0.16 | | 0.14 | |
| 45 | 0.08 | | 0.1 | | 0.09 | | 0.09 | |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 4

Transect Type: Tamarisk Control

Date: 5/6/2006 Revisit? Post-tamarisk removal

Recorder: Lori Makarick Reader: Amy Prince

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

Weather: Wispy clouds moving in about 50%.

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|---|----------------|
| Gravel | 6 | | 1 |
| Litter (duff) | 71 | Acacia greggii Gray | 9 |
| Sand | 24 | Atriplex argentea Nutt. | 1 |
| Woody debris structure | 2 | Atriplex canescens (Pursh) Nutt. | 7 |
| | | Gutierrezia spp. | 1 |
| | | Prosopis glandulosa Torr. | 29 |
| | | Psorothamnus fremontii (Torr. ex Gray) Barneby var. attenuatus Barneby | 1 |
| | | Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | 1 |
| | | Stanleya pinnata (Pursh) Britt. | 3 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Litter (duff) | 43 | 54 | 55 | 20 | 20 |
| Sand | 43 | 25 | 26 | 42 | 3 |
| Woody debris structure | 0 | 0 | 0 | 8 | 0 |
| Coarse woody debris | 7 | 4 | 0 | 3 | 0 |
| Gravel | 7 | 11 | 11 | 20 | 72 |
| Stone | 0 | 1 | 4 | 3 | 3 |
| Boulder | 0 | 0 | 0 | 3 | 0 |
| Cobble | 0 | 4 | 4 | 1 | 1 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | <0% | | 5-10% | M | <0% | | <0% | | <1% | P |
| Atriplex canescens (Pursh) Nutt. | 5-10% | | 10-25% | | 1-5% | | 1-5% | | 1-5% | |
| Atriplex canescens (Pursh) Nutt. | | | | | | | | | <1% | |
| Baccharis brachyphylla Gray | | | | | | | | | <1% | |
| Eriogonum inflatum Torr. & Frém. | <0% | | <0% | | <0% | | <1% | | <0% | |
| Gutierrezia spp. | <0% | | <0% | | 1-5% | | <0% | | <0% | |
| Isocoma acradenia (Greene) Greene | <0% | | <1% | | <0% | | <0% | | <0% | |
| Lycium spp. | <0% | | <1% | | <0% | | <1% | | <1% | |
| Prosopis glandulosa Torr. | 5-10% | M | <0% | | 50-75% | M | 5-10% | M | 5-10% | M |
| Psorothamnus fremontii (Torr. ex Gray) Barneby var. attenuatus Barneby | | | | | | | | | 1-5% | |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | <0% | | 1-5% | | <0% | | 1-5% | | <1% | |
| Stanleya pinnata (Pursh) Britt. | <1% | | <1% | | 1-5% | | 1-5% | | <0% | |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 4

Transect Type: Tamarisk Control

| | | | | | |
|---|-----|-----|-----|-----|-----|
| Stephanomeria pauciflora (Torr.) A. Nels. | <0% | <1% | <0% | <0% | <0% |
|---|-----|-----|-----|-----|-----|

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|--------------------------------|---------------|-------------|-------------|
| 5 | Suaeda moquinii (Torr.) Greene | 10 | 2 | |
| 25 | Prosopis glandulosa Torr. | 0 | 4 | 14 |

Vegetation Structure Data - New

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|--------------------------------|---------------|-------------|-------------|
| 5 | Suaeda moquinii (Torr.) Greene | 8 | 1 | |
| 25 | Prosopis glandulosa Torr. | 0 | 5 | 9 |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|--------------|------------------|-----------|------------------|-----------|------------------|-----------|----------------|-----------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 9.98 | 7 | 10.06 | 7 | 10.06 | 10 | 10.03 | 8 |
| 15 | 8.74 | 56 | 8.74 | 50 | 8.75 | 51 | 8.74 | 52 |
| 25 | 7.64 | 14 | 7.62 | 14 | 7.62 | 14 | 7.63 | 14 |
| 35 | 8.31 | 133 | 8.31 | 134 | 8.33 | 139 | 8.32 | 135 |
| 45 | 8.05 | 101 | 8.04 | 100 | 8.03 | 100 | 8.04 | 100 |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 4

Transect Type: Tamarisk Control

Date: 5/8/2005 Revisit? Pre-tamarisk removal

Recorder: Kari Malen Reader: Amy Prince

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

Weather: Blue sky, breezy

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|---|----------------|
| Coarse woody debris | 2 | Acacia greggii Gray | 10 |
| Litter (duff) | 85 | Atriplex canescens (Pursh) Nutt. | 15 |
| Sand | 33 | Baccharis brachyphylla Gray | 2 |
| | | Bromus rubens L. | 34 |
| | | Descurainia pinnata (Walt.) Britt. | 42 |
| | | Erodium cicutarium (L.) L'Hér. ex Ait. | 6 |
| | | Gutierrezia sarothrae (Pursh) Britt. & Rusby | 2 |
| | | Lepidium perfoliatum L. | 1 |
| | | Lycium spp. | 4 |
| | | Prosopis glandulosa Torr. | 32 |
| | | Psoralea fremontii (Torr. ex Gray) Barneby var. attenuatus Barneby | 1 |
| | | Schismus spp. | 9 |
| | | Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | 3 |
| | | Stanleya pinnata (Pursh) Britt. | 4 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Cobble | 1 | 1 | 0 | 0 | 0 |
| Litter (duff) | 49 | 47 | 0 | 0 | 0 |
| Woody debris structure | 1 | 1 | 0 | 0 | 0 |
| Gravel | 1 | 4 | 0 | 0 | 0 |
| Sand | 49 | 47 | 0 | 0 | 0 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | | | 5-10% | | | | | | <1% | |
| Artemisia ludoviciana Nutt. | <1% | | | | | | | | | |
| Atriplex canescens (Pursh) Nutt. | 5-10% | | 5-10% | | 1-5% | | 1-5% | | 5-10% | |
| Bromus rubens L. | 10-25% | | 10-25% | | 25-50% | | 10-25% | | 10-25% | |
| Chaenactis stevioides Hook. & Arn. | | | <1% | | | | | | <1% | |
| Descurainia pinnata (Walt.) Britt. | <1% | | 1-5% | | 5-10% | | 1-5% | | 1-5% | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | | | | | | <1% | | <1% | |
| Gilia stellata Heller | | | | | | | | | <1% | |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | | | | | <1% | | | | | |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 4

Transect Type: Tamarisk Control

| | | | | | |
|---|-------|------|---------|--------|--------|
| Isocoma acradenia (Greene) Greene | | <1% | | | |
| Lepidium spp. | <1% | <1% | <1% | <1% | <1% |
| Lycium spp. | | | | <1% | |
| Phacelia crenulata Torr. ex S. Wats. | | <1% | <1% | <1% | |
| Pleuraphis jamesii Torr. | | | <1% | | |
| Prosopis glandulosa Torr. | | | 75-100% | 10-25% | 25-50% |
| Psoralea fremontii (Torr. ex Gray) | | <1% | | | <1% |
| Barneby var. attenuatus Barneby | | | | | |
| Schismus spp. | <1% | | <1% | <1% | <1% |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | | 1-5% | | 1-5% | 1-5% |
| Stanleya pinnata (Pursh) Britt. | <1% | | <1% | | |
| Suaeda moquinii (Torr.) Greene | 5-10% | | | | |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|---|---------------|-------------|-------------|
| 15 | Atriplex canescens (Pursh) Nutt. | 8 | | |
| 15 | Descurainia pinnata (Walt.) Britt. | 6 | | |
| 25 | Gutierrezia spp. | 7 | | |
| 25 | Prosopis glandulosa Torr. | 3 | 9 | 7 |
| 35 | Bromus rubens L. | 2 | | |
| 35 | Descurainia pinnata (Walt.) Britt. | 6 | | |
| 35 | Prosopis glandulosa Torr. | | | 3 |
| 35 | Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | 1 | | |
| 45 | Bromus rubens L. | 1 | | |
| 45 | Descurainia pinnata (Walt.) Britt. | 5 | | |
| 45 | Prosopis glandulosa Torr. | 15 | 9 | |

Vegetation Structure Data - New

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|----|-----------|----|-----------|----|---------|----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0.13 | | 0.19 | | 0.21 | | 0.18 | |
| 15 | 0.07 | | 0.02 | | 0.08 | | 0.06 | |
| 25 | 0.24 | | 0.22 | | 0.2 | | 0.22 | |
| 35 | 0.16 | | 0.09 | | 0.16 | | 0.14 | |
| 45 | 0.08 | | 0.1 | | 0.09 | | 0.09 | |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 4

Transect Type: Tamarisk Control

Date: 5/6/2006 Revisit? Post-tamarisk removal

Recorder: Lori Makarick Reader: Amy Prince

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

Weather: Wispy clouds moving in about 50%.

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|---|----------------|
| Gravel | 6 | | 1 |
| Litter (duff) | 71 | Acacia greggii Gray | 9 |
| Sand | 24 | Atriplex argentea Nutt. | 1 |
| Woody debris structure | 2 | Atriplex canescens (Pursh) Nutt. | 7 |
| | | Gutierrezia spp. | 1 |
| | | Prosopis glandulosa Torr. | 29 |
| | | Psorothamnus fremontii (Torr. ex Gray) Barneby var. attenuatus Barneby | 1 |
| | | Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | 1 |
| | | Stanleya pinnata (Pursh) Britt. | 3 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Litter (duff) | 43 | 54 | 55 | 20 | 20 |
| Sand | 43 | 25 | 26 | 42 | 3 |
| Woody debris structure | 0 | 0 | 0 | 8 | 0 |
| Coarse woody debris | 7 | 4 | 0 | 3 | 0 |
| Gravel | 7 | 11 | 11 | 20 | 72 |
| Stone | 0 | 1 | 4 | 3 | 3 |
| Boulder | 0 | 0 | 0 | 3 | 0 |
| Cobble | 0 | 4 | 4 | 1 | 1 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | <0% | | 5-10% | M | <0% | | <0% | | <1% | P |
| Atriplex canescens (Pursh) Nutt. | 5-10% | | 10-25% | | 1-5% | | 1-5% | | 1-5% | |
| Atriplex canescens (Pursh) Nutt. | | | | | | | | | <1% | |
| Baccharis brachyphylla Gray | | | | | | | | | <1% | |
| Eriogonum inflatum Torr. & Frém. | <0% | | <0% | | <0% | | <1% | | <0% | |
| Gutierrezia spp. | <0% | | <0% | | 1-5% | | <0% | | <0% | |
| Isocoma acradenia (Greene) Greene | <0% | | <1% | | <0% | | <0% | | <0% | |
| Lycium spp. | <0% | | <1% | | <0% | | <1% | | <1% | |
| Prosopis glandulosa Torr. | 5-10% | M | <0% | | 50-75% | M | 5-10% | M | 5-10% | M |
| Psorothamnus fremontii (Torr. ex Gray) Barneby var. attenuatus Barneby | | | | | | | | | 1-5% | |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | <0% | | 1-5% | | <0% | | 1-5% | | <1% | |
| Stanleya pinnata (Pursh) Britt. | <1% | | <1% | | 1-5% | | 1-5% | | <0% | |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 4

Transect Type: Tamarisk Control

| | | | | | |
|---|-----|-----|-----|-----|-----|
| Stephanomeria pauciflora (Torr.) A. Nels. | <0% | <1% | <0% | <0% | <0% |
|---|-----|-----|-----|-----|-----|

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|--------------------------------|---------------|-------------|-------------|
| 5 | Suaeda moquinii (Torr.) Greene | 10 | 2 | |
| 25 | Prosopis glandulosa Torr. | 0 | 4 | 14 |

Vegetation Structure Data - New

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|--------------------------------|---------------|-------------|-------------|
| 5 | Suaeda moquinii (Torr.) Greene | 8 | 1 | |
| 25 | Prosopis glandulosa Torr. | 0 | 5 | 9 |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|--------------|------------------|-----------|------------------|-----------|------------------|-----------|----------------|-----------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 9.98 | 7 | 10.06 | 7 | 10.06 | 10 | 10.03 | 8 |
| 15 | 8.74 | 56 | 8.74 | 50 | 8.75 | 51 | 8.74 | 52 |
| 25 | 7.64 | 14 | 7.62 | 14 | 7.62 | 14 | 7.63 | 14 |
| 35 | 8.31 | 133 | 8.31 | 134 | 8.33 | 139 | 8.32 | 135 |
| 45 | 8.05 | 101 | 8.04 | 100 | 8.03 | 100 | 8.04 | 100 |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 5

Transect Type: Tamarisk Area

| | Start point | | End point |
|---------------------------|--|--------------------------|------------------|
| Easting: | 424720 | Easting: | 424729 |
| Northing: | 4002275 | Northing: | 4002236 |
| GPS accuracy (m): | 6 | GPS accuracy (m): | 6 |
| Elevation (m): | 1022 | Elevation (m): | 1022 |
| Bearing: | 170 | | |
| Aspect (0-360): | 235 | Slope (degrees): | 6 |
| Transect description: | Near the confluence of east and west branches of carbon, about 100 meters up east branch. Transect start is located at the base of Chuar Group near creek right in drainage upstream from 3x1.5m sandstone boulder that is in drainage center. Where water is present or has dried up there is about 1cm layer of white calcium carbonate looking crust but it doesn't taste salty. Sample collected. | | |
| Additional Info:: | Start of transect is in middle of drainage just past large gray/purple sandy layers on creek right. Transect is dominated by standing dead tamarisk. SDT was hit 7 times on PI transect. Coarse woody and woody debris are largely tamarisk debris. Litter was hit 10 times in addition to another ground cover class. | | |
| Geological layer: | Chuar Group | | |
| Habitat type: | Riparian | GB desert scrub | |
| Dominant species: | Bromus rubens L., Prosopis glandulosa Torr. | | |
| Associated species: | Acacia greggii Gray, Artemisia ludoviciana Nutt., Atriplex canescens (Pursh) Nutt., Bromus tectorum L., Camissonia walkeri (A. Nels.) Raven, Cryptantha maritima (Greene) Greene, Dasyochloa pulchella (Kunth) Willd. ex Rydb., Descurainia pinnata (Walt.) Britt., Draba cuneifolia Nutt. ex Torr. & Gray, Encelia frutescens (Gray) Gray, Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake, Erodium cicutarium (L.) L'Hér. ex Ait., Gilia stellata Heller, Gutierrezia sarothrae (Pursh) Britt. & Rusby, Isocoma acradenia (Greene) Greene, Lepidium spp., Linanthus bigelovii (Gray) Greene, Phacelia crenulata Torr. ex S. Wats., Plantago patagonica Jacq., Pleuraphis jamesii Torr., Silene antirrhina L., Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb., Sporobolus cryptandrus (Torr.) Gray, Stanleya pinnata (Pursh) Britt., Stephanomeria pauciflora (Torr.) A. Nels., Thymophylla pentachaeta (DC.) Small, Tiquilia latior (I.M. Johnston) A. Richards., Vulpia octoflora (Walt.) Rydb. | | |
| Surface water within 25m? | <input checked="" type="checkbox"/> | Surface water type: | |
| Landform: Lower slope | | Surface rocks: sandstone | shale |
| Soil type: sandy loam | | Topo position: | |
| Light exposure: open | | Soil moisture: moist | dry |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 5

Transect Type: Tamarisk Area

Date: 5/9/2005 Revisit? Pre-tamarisk removal

Recorder: Amy Prince Reader: Kari Malen

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

Weather: Sunny, partly cloudy, breezy, hot

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|-----------------------------------|----------------|
| Bare Soil | 37 | Artemisia ludoviciana Nutt. | 1 |
| Boulder | 4 | Bromus rubens L. | 7 |
| Cobble | 2 | Isocoma acradenia (Greene) Greene | 2 |
| Gravel | 16 | Lepidium spp. | 1 |
| Litter (duff) | 52 | Plantago patagonica Jacq. | 1 |
| Sand | 18 | Prosopis glandulosa Torr. | 7 |
| Stone | 13 | Stanleya pinnata (Pursh) Britt. | 2 |
| | | Tamarix ramosissima Ledeb. | 58 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Litter (duff) | 3 | 4 | 14 | 69 | 0 |
| Cobble | 7 | 4 | 6 | 2 | 0 |
| Gravel | 36 | 11 | 50 | 2 | 0 |
| Woody debris structure | 3 | 4 | 2 | 12 | 0 |
| Bare Soil | 0 | 1 | 0 | 2 | 0 |
| Boulder | 7 | 11 | 0 | 0 | 0 |
| Sand | 36 | 54 | 14 | 12 | 0 |
| Stone | 7 | 11 | 14 | 2 | 0 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | | | | | | | | | <1% | |
| Artemisia ludoviciana Nutt. | <1% | | | | | | | | | |
| Atriplex canescens (Pursh) Nutt. | | | | | | | | | <1% | |
| Bromus rubens L. | <1% | | 1-5% | | 5-10% | | 1-5% | | 5-10% | |
| Bromus tectorum L. | | | | | <1% | | | | | |
| Camissonia walkeri (A. Nels.) Raven | | | | | | | | | <1% | |
| Cryptantha maritima (Greene) Greene | | | <1% | | | | <1% | | <1% | |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | <1% | | | | | | | | | |
| Descurainia pinnata (Walt.) Britt. | | | <1% | | <1% | | <1% | | <1% | |
| Draba cuneifolia Nutt. ex Torr. & Gray | | | <1% | | | | | | <1% | |
| Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake | <1% | | <1% | | | | | | | |
| Encelia spp. | <1% | | <1% | | | | | | | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | | <1% | | | | | | | |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 5

Transect Type: Tamarisk Area

| | | | | | |
|---|--------|--------|--------|--------|--------|
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | | <1% | | | |
| Isocoma acradenia (Greene) Greene | 1-5% | 5-10% | | | |
| Lepidium spp. | | <1% | <1% | <1% | <1% |
| Linanthus bigelovii (Gray) Greene | | <1% | | | |
| Phacelia crenulata Torr. ex S. Wats. | | | | | <1% |
| Plantago patagonica Jacq. | <1% | <1% | <1% | <1% | <1% |
| Prosopis glandulosa Torr. | | 25-50% | 10-25% | | |
| Silene antirrhina L. | | | | | <1% |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | <1% | | | | |
| Sporobolus cryptandrus (Torr.) Gray | | <1% | | | |
| Stanleya pinnata (Pursh) Britt. | | 1-5% | <1% | <1% | 1-5% |
| Stephanomeria pauciflora (Torr.) A. Nels. | | | <1% | | |
| Tamarix ramosissima Ledeb. | 10-25% | | 50-75% | 50-75% | 25-50% |
| Thymophylla pentachaeta (DC.) Small | <1% | | | | |
| Tiquilia latior (I.M. Johnston) A. Richards. | <1% | | | | |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|----------------------------|---------------|-------------|-------------|
| 15 | Prosopis glandulosa Torr. | 5 | 2 | |
| 25 | Tamarix ramosissima Ledeb. | | | 6 |
| 35 | Tamarix ramosissima Ledeb. | 6 | 7 | 15 |
| 45 | Tamarix ramosissima Ledeb. | 7 | 7 | 7 |

Vegetation Structure Data - New

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|----|-----------|----|-----------|----|---------|----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0.22 | | 0.26 | | 0.22 | | 0.23 | |
| 15 | 0.59 | | 0.64 | | 0.65 | | 0.63 | |
| 25 | 0.78 | | 0.82 | | 0.8 | | 0.80 | |
| 35 | 0.13 | | 0.15 | | 0.15 | | 0.14 | |
| 45 | 0.41 | | 0.62 | | 0.53 | | 0.52 | |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 5

Transect Type: Tamarisk Area

Date: 5/6/2006 Revisit? Post-tamarisk removal

Recorder: Lisa Hahn Reader: Kate Watters

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

Weather: Clear and sunny.

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|-----------------------------------|----------------|
| Bare Soil | 2 | Isocoma acradenia (Greene) Greene | 1 |
| Boulder | 7 | Prosopis glandulosa Torr. | 8 |
| Coarse woody debris | 10 | standing dead tamarisk | 7 |
| Cobble | 4 | Stanleya pinnata (Pursh) Britt. | 2 |
| Gravel | 19 | | |
| Litter (duff) | 33 | | |
| Sand | 9 | | |
| Stone | 8 | | |
| Woody debris structure | 8 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Cobble | 16 | 9 | 7 | 2 | 2 |
| Sand | 7 | 21 | 7 | 2 | 2 |
| Bare Soil | 0 | 4 | 3 | 2 | 2 |
| Litter (duff) | 3 | 4 | 17 | 38 | 44 |
| Woody debris structure | 0 | 0 | 7 | 23 | 12 |
| Stone | 7 | 9 | 7 | 2 | 2 |
| Gravel | 57 | 45 | 17 | 23 | 2 |
| Bedrock | 0 | 0 | 0 | 5 | 5 |
| Boulder | 7 | 9 | 0 | 0 | 0 |
| Coarse woody debris | 3 | 0 | 36 | 5 | 27 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Atriplex canescens (Pursh) Nutt. | | | | | | | | | <1% | |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | <1% | | | | | | | | | |
| Eriogonum inflatum Torr. & Frém. | <1% | | | | | | | | | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <1% | | <0% | | | | | | | |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | <0% | | 1-5% | | | | | | | |
| Isocoma acradenia (Greene) Greene | 1-5% | | 1-5% | | | | | | | |
| Pleuraphis jamesii Torr. | <1% | | | | | | | | | |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | <1% | | | | | | | | | |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 5

Transect Type: Tamarisk Area

| | | | | | | | | |
|--|-----|---|------|------|---|--------|---|------|
| standing dead tamarisk | | | | | | 25-50% | M | |
| Stanleya pinnata (Pursh) Britt. | <0% | | 1-5% | <1% | | <0% | | 1-5% |
| Tamarix ramosissima Ledeb. | <1% | M | <0% | 1-5% | M | <1% | M | <0% |
| Tiquilia latior (I.M. Johnston) A. Richards. | <1% | | | | | | | |

Vegetation Structure Data - Old

Vegetation Structure Data - New

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|---------------------------|---------------|-------------|-------------|
| 25 | Prosopis glandulosa Torr. | 2 | | |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|------|-----------|------|-----------|------|---------|------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 8.85 | 608 | 8.65 | 622 | 8.61 | 627 | 8.70 | 619 |
| 15 | 8.39 | 1411 | 8.38 | 1461 | 8.35 | 1461 | 8.37 | 1444 |
| 25 | 9.01 | 3999 | 9.04 | 3999 | 9.04 | 3999 | 9.03 | 3999 |
| 35 | 8.4 | 1207 | 8.42 | 1217 | 8.41 | 1238 | 8.41 | 1221 |
| 45 | 8.66 | 770 | 8.65 | 792 | 8.64 | 799 | 8.65 | 787 |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 5

Transect Type: Tamarisk Area

Date: 5/9/2005 Revisit? Pre-tamarisk removal

Recorder: Amy Prince Reader: Kari Malen

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

Weather: Sunny, partly cloudy, breezy, hot

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|-----------------------------------|----------------|
| Bare Soil | 37 | Artemisia ludoviciana Nutt. | 1 |
| Boulder | 4 | Bromus rubens L. | 7 |
| Cobble | 2 | Isocoma acradenia (Greene) Greene | 2 |
| Gravel | 16 | Lepidium spp. | 1 |
| Litter (duff) | 52 | Plantago patagonica Jacq. | 1 |
| Sand | 18 | Prosopis glandulosa Torr. | 7 |
| Stone | 13 | Stanleya pinnata (Pursh) Britt. | 2 |
| | | Tamarix ramosissima Ledeb. | 58 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Litter (duff) | 3 | 4 | 14 | 69 | 0 |
| Cobble | 7 | 4 | 6 | 2 | 0 |
| Gravel | 36 | 11 | 50 | 2 | 0 |
| Woody debris structure | 3 | 4 | 2 | 12 | 0 |
| Bare Soil | 0 | 1 | 0 | 2 | 0 |
| Boulder | 7 | 11 | 0 | 0 | 0 |
| Sand | 36 | 54 | 14 | 12 | 0 |
| Stone | 7 | 11 | 14 | 2 | 0 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | | | | | | | | | <1% | |
| Artemisia ludoviciana Nutt. | <1% | | | | | | | | | |
| Atriplex canescens (Pursh) Nutt. | | | | | | | | | <1% | |
| Bromus rubens L. | <1% | | 1-5% | | 5-10% | | 1-5% | | 5-10% | |
| Bromus tectorum L. | | | | | <1% | | | | | |
| Camissonia walkeri (A. Nels.) Raven | | | | | | | | | <1% | |
| Cryptantha maritima (Greene) Greene | | | <1% | | | | <1% | | <1% | |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | <1% | | | | | | | | | |
| Descurainia pinnata (Walt.) Britt. | | | <1% | | <1% | | <1% | | <1% | |
| Draba cuneifolia Nutt. ex Torr. & Gray | | | <1% | | | | | | <1% | |
| Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake | <1% | | <1% | | | | | | | |
| Encelia spp. | <1% | | <1% | | | | | | | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | | <1% | | | | | | | |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 5

Transect Type: Tamarisk Area

| | | | | | |
|---|--------|--------|--------|--------|--------|
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | | <1% | | | |
| Isocoma acradenia (Greene) Greene | 1-5% | 5-10% | | | |
| Lepidium spp. | | <1% | <1% | <1% | <1% |
| Linanthus bigelovii (Gray) Greene | | <1% | | | |
| Phacelia crenulata Torr. ex S. Wats. | | | | | <1% |
| Plantago patagonica Jacq. | <1% | <1% | <1% | <1% | <1% |
| Prosopis glandulosa Torr. | | 25-50% | 10-25% | | |
| Silene antirrhina L. | | | | | <1% |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | <1% | | | | |
| Sporobolus cryptandrus (Torr.) Gray | | <1% | | | |
| Stanleya pinnata (Pursh) Britt. | | 1-5% | <1% | <1% | 1-5% |
| Stephanomeria pauciflora (Torr.) A. Nels. | | | <1% | | |
| Tamarix ramosissima Ledeb. | 10-25% | | 50-75% | 50-75% | 25-50% |
| Thymophylla pentachaeta (DC.) Small | <1% | | | | |
| Tiquilia latior (I.M. Johnston) A. Richards. | <1% | | | | |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|----------------------------|---------------|-------------|-------------|
| 15 | Prosopis glandulosa Torr. | 5 | 2 | |
| 25 | Tamarix ramosissima Ledeb. | | | 6 |
| 35 | Tamarix ramosissima Ledeb. | 6 | 7 | 15 |
| 45 | Tamarix ramosissima Ledeb. | 7 | 7 | 7 |

Vegetation Structure Data - New

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|--------------|------------------|-----------|------------------|-----------|------------------|-----------|----------------|-----------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0.22 | | 0.26 | | 0.22 | | 0.23 | |
| 15 | 0.59 | | 0.64 | | 0.65 | | 0.63 | |
| 25 | 0.78 | | 0.82 | | 0.8 | | 0.80 | |
| 35 | 0.13 | | 0.15 | | 0.15 | | 0.14 | |
| 45 | 0.41 | | 0.62 | | 0.53 | | 0.52 | |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 5

Transect Type: Tamarisk Area

Date: 5/6/2006 Revisit? Post-tamarisk removal

Recorder: Lisa Hahn Reader: Kate Watters

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

Weather: Clear and sunny.

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|-----------------------------------|----------------|
| Bare Soil | 2 | Isocoma acradenia (Greene) Greene | 1 |
| Boulder | 7 | Prosopis glandulosa Torr. | 8 |
| Coarse woody debris | 10 | standing dead tamarisk | 7 |
| Cobble | 4 | Stanleya pinnata (Pursh) Britt. | 2 |
| Gravel | 19 | | |
| Litter (duff) | 33 | | |
| Sand | 9 | | |
| Stone | 8 | | |
| Woody debris structure | 8 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Cobble | 16 | 9 | 7 | 2 | 2 |
| Sand | 7 | 21 | 7 | 2 | 2 |
| Bare Soil | 0 | 4 | 3 | 2 | 2 |
| Litter (duff) | 3 | 4 | 17 | 38 | 44 |
| Woody debris structure | 0 | 0 | 7 | 23 | 12 |
| Stone | 7 | 9 | 7 | 2 | 2 |
| Gravel | 57 | 45 | 17 | 23 | 2 |
| Bedrock | 0 | 0 | 0 | 5 | 5 |
| Boulder | 7 | 9 | 0 | 0 | 0 |
| Coarse woody debris | 3 | 0 | 36 | 5 | 27 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Atriplex canescens (Pursh) Nutt. | | | | | | | | | <1% | |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | <1% | | | | | | | | | |
| Eriogonum inflatum Torr. & Frém. | <1% | | | | | | | | | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <1% | | <0% | | | | | | | |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | <0% | | 1-5% | | | | | | | |
| Isocoma acradenia (Greene) Greene | 1-5% | | 1-5% | | | | | | | |
| Pleuraphis jamesii Torr. | <1% | | | | | | | | | |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | <1% | | | | | | | | | |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 5

Transect Type: Tamarisk Area

| | | | | | | | | |
|--|-----|---|------|------|---|--------|---|------|
| standing dead tamarisk | | | | | | 25-50% | M | |
| Stanleya pinnata (Pursh) Britt. | <0% | | 1-5% | <1% | | <0% | | 1-5% |
| Tamarix ramosissima Ledeb. | <1% | M | <0% | 1-5% | M | <1% | M | <0% |
| Tiquilia latior (I.M. Johnston) A. Richards. | <1% | | | | | | | |

Vegetation Structure Data - Old

Vegetation Structure Data - New

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|---------------------------|---------------|-------------|-------------|
| 25 | Prosopis glandulosa Torr. | 2 | | |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|------|-----------|------|-----------|------|---------|------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 8.85 | 608 | 8.65 | 622 | 8.61 | 627 | 8.70 | 619 |
| 15 | 8.39 | 1411 | 8.38 | 1461 | 8.35 | 1461 | 8.37 | 1444 |
| 25 | 9.01 | 3999 | 9.04 | 3999 | 9.04 | 3999 | 9.03 | 3999 |
| 35 | 8.4 | 1207 | 8.42 | 1217 | 8.41 | 1238 | 8.41 | 1221 |
| 45 | 8.66 | 770 | 8.65 | 792 | 8.64 | 799 | 8.65 | 787 |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 5

Transect Type: Tamarisk Control

| | Start point | | End point |
|-----------------------|---|-------------------|------------------|
| Easting: | 424746 | Easting: | 424729 |
| Northing: | 4002320 | Northing: | 4002274 |
| GPS accuracy (m): | 10 | GPS accuracy (m): | 20 |
| Elevation (m): | 1037 | Elevation (m): | 1030 |
| Bearing: | 205 | | |
| Aspect (0-360): | 280 | Slope (degrees): | 4 |
| Transect description: | Start point is about 50m up canyon from start point of 5A. ~0.5m from base of ACAGRE on a pile of three huge boulders. Start is on the 5x4m boulder just across creek from 2 stromatalites. On creek left ~4m from center of channel. End of 5B just farther stream left (5m) than start of 5A - they almost overlap. Note - Got endpoint from GIS, so use photographs to find it. In 2006, no surface water. Kari Malen was also a reader. | | |

Additional Info::

Geological layer: Supergroup

Habitat type: Riparian GB desert scrub

Dominant species: *Acacia greggii* Gray, *Atriplex canescens* (Pursh) Nutt., *Bromus rubens* L., *Prosopis glandulosa* Torr.

Associated species: *Acacia greggii* Gray, *Achnatherum hymenoides* (Roemer & J.A. Schultes) Barkworth, *Aristida purpurea* Nutt., *Aristida* spp., *Artemisia ludoviciana* Nutt., *Atriplex canescens* (Pursh) Nutt., *Baccharis brachyphylla* Gray, *Bebbia juncea* (Benth.) Greene var. *aspera* Greene, *Bromus rubens* L., *Camissonia* spp., *Camissonia walkeri* (A. Nels.) Raven, *Cirsium neomexicanum* Gray, *Cryptantha barbiger* (Gray) Greene, *Cryptantha pterocarya* (Torr.) Greene, *Cryptantha* spp., *Dasyochloa pulchella* (Kunth) Willd. ex Rydb., *Descurainia pinnata* (Walt.) Britt., *Draba cuneifolia* Nutt. ex Torr. & Gray, *Echinocereus triglochidiatus* Engelm., *Encelia farinosa* Gray ex Torr., *Encelia frutescens* (Gray) Gray var. *resinosa* M.E. Jones ex Blake, *Ephedra torreyana* S. Wats., *Erigeron* spp., *Erodium cicutarium* (L.) L'Hér. ex Ait., *Eucryphia micrantha* (Torr.) Heller, *Gutierrezia sarothrae* (Pursh) Britt. & Rusby, *Hesperostipa* spp., *Isocoma acradenia* (Greene) Greene, *Lappula occidentalis* (S. Wats.) Greene var. *occidentalis*, *Lepidium* spp., *Linanthus bigelovii* (Gray) Greene, *Lycium* spp., *Mammillaria* spp., *Moss* spp., *Muhlenbergia asperifolia* (Nees & Meyen ex Trin.) Parodi, *Muhlenbergia porteri* Scribn. ex Beal, *Nicotiana obtusifolia* Mertens & Galeotti var. *obtusifolia*, *Plantago patagonica* Jacq., *Pleuraphis jamesii* Torr., *Schismus* spp., *Silene antirrhina* L., *Sphaeralcea grossulariifolia* (Hook. & Arn.) Rydb., *Sporobolus cryptandrus* (Torr.) Gray, *Stanleya pinnata* (Pursh) Britt., *Stephanomeria exigua* Nutt., *Thymophylla pentachaeta* (DC.) Small, *Thymophylla pentachaeta* (DC.) Small var. *belenidium* (DC.) Strother, *Vulpia octoflora* (Walt.) Rydb.

Surface water within 25m? Surface water type:

Landform: Lower slope

Surface rocks: sandstone other

Soil type: sandy loam

Topo position:

Light exposure: open

Soil moisture: dry

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 5

Transect Type: Tamarisk Control

Date: 5/9/2005 Revisit? Pre-tamarisk removal

Recorder: Amy Prince Reader: Kari Malen

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

Weather: Windy, sunny/partly cloudy, hot

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|---|----------------|
| Bare Soil | 19 | Acacia greggii Gray | 4 |
| Boulder | 8 | Atriplex canescens (Pursh) Nutt. | 1 |
| Cobble | 3 | Bromus rubens L. | 17 |
| Gravel | 14 | Cryptantha barbiger (Gray) Greene | 1 |
| Litter (duff) | 53 | Descurainia pinnata (Walt.) Britt. | 5 |
| Sand | 19 | Hesperostipa spp. | 1 |
| Stone | 12 | Isocoma acradenia (Greene) Greene | 5 |
| | | Lepidium spp. | 1 |
| | | Moss spp. | 1 |
| | | Plantago patagonica Jacq. | 1 |
| | | Prosopis glandulosa Torr. | 30 |
| | | Schismus spp. | 1 |
| | | Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | 2 |
| | | Stanleya pinnata (Pursh) Britt. | 5 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|---------------------|-----------|------------|------------|------------|------------|
| Stone | 4 | 10 | 1 | 8 | 19 |
| Litter (duff) | 4 | 24 | 49 | 38 | 3 |
| Gravel | 23 | 24 | 23 | 8 | 40 |
| Sand | 50 | 24 | 23 | 38 | 8 |
| Cobble | 10 | 4 | 1 | 3 | 19 |
| Boulder | 4 | 10 | 4 | 3 | 8 |
| Coarse woody debris | 4 | 4 | 1 | 3 | 3 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | 5-10% | | | | | | | | 1-5% | |
| Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | | | | | | | <1% | | | |
| Aristida spp. | <1% | | <1% | | | | | | <1% | |
| Artemisia ludoviciana Nutt. | <1% | | | | | | <1% | | | |
| Astragalus spp. | <1% | | | | | | | | | |
| Atriplex canescens (Pursh) Nutt. | <1% | | 1-5% | | <1% | | <1% | | <1% | |
| Bromus rubens L. | <1% | | <1% | | 25-50% | | 25-50% | | 1-5% | |
| Camissonia walkeri (A. Nels.) Raven | | | <1% | | | | | | | |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 5

Transect Type: Tamarisk Control

| | | | | | |
|---|--------|-------|--------|--------|-------|
| Cirsium neomexicanum Gray | | <1% | | | |
| Cryptantha barbiger (Gray) Greene | | | <1% | | |
| Cryptantha maritima (Greene) Greene | | | | <1% | |
| Cryptantha pterocarya (Torr.) Greene | | <1% | | | |
| Cryptantha spp. | <1% | | <1% | | <1% |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | | | | | <1% |
| Descurainia pinnata (Walt.) Britt. | <1% | 1-5% | 5-10% | 10-25% | |
| Draba cuneifolia Nutt. ex Torr. & Gray | | | | <1% | |
| Encelia spp. | <1% | | | | 1-5% |
| Erigeron spp. | <1% | <1% | | | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <1% | <1% | <1% | | <1% |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | <1% | <1% | | <1% | 1-5% |
| Hesperostipa spp. | <1% | | | | <1% |
| Isocoma acradenia (Greene) Greene | 10-25% | <1% | <1% | <1% | 5-10% |
| Lepidium spp. | <1% | <1% | <1% | <1% | <1% |
| Linanthus bigelovii (Gray) Greene | <1% | <1% | | <1% | |
| Lycium spp. | | | | | <1% |
| Mammillaria spp. | | | | | <1% |
| Mirabilis bigelovii Gray | | | | | <1% |
| Plantago patagonica Jacq. | <1% | <1% | | <1% | 1-5% |
| Prosopis glandulosa Torr. | | 5-10% | 25-50% | 25-50% | |
| Silene antirrhina L. | | | | <1% | <1% |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | <1% | | | | 1-5% |
| Sporobolus cryptandrus (Torr.) Gray | <1% | | | | |
| Stanleya pinnata (Pursh) Britt. | | | 1-5% | <1% | |
| Stephanomeria exigua Nutt. | | <1% | | | |
| Thymophylla pentachaeta (DC.) Small | | | | | <1% |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|------------------------------------|---------------|-------------|-------------|
| 5 | Acacia greggii Gray | 2 | | |
| 25 | Prosopis glandulosa Torr. | 2 | 1 | |
| 35 | Bromus rubens L. | 5 | | |
| 35 | Descurainia pinnata (Walt.) Britt. | 1 | | |
| 35 | Prosopis glandulosa Torr. | 2 | 3 | 1 |
| 45 | Bromus rubens L. | 2 | | |
| 45 | Isocoma acradenia (Greene) Greene | 4 | | |

Vegetation Structure Data - New

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 5

Transect Type: Tamarisk Control

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|--------------|------------------|-----------|------------------|-----------|------------------|-----------|----------------|-----------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0 | | 0 | | 0 | | 0.00 | |
| 15 | 0.15 | | 0.16 | | 0.15 | | 0.15 | |
| 25 | 0.35 | | 0.18 | | 0.2 | | 0.24 | |
| 35 | 0.03 | | 0.03 | | 0.04 | | 0.03 | |
| 45 | 0.03 | | 0.02 | | 0.02 | | 0.02 | |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 5

Transect Type: Tamarisk Control

Date: 5/6/2006 Revisit? Post-tamarisk removal

Recorder: Lisa Hahn Reader: Kate Watters

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

Weather: Hot, partly cloudy with fire (very smoky) on the South Rim. 85-90 F.
Light winds.

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|---|----------------|
| Bare Soil | 9 | Acacia greggii Gray | 1 |
| Bedrock | 1 | Artemisia ludoviciana Nutt. | 1 |
| Boulder | 5 | Isocoma acradenia (Greene) Greene | 9 |
| Coarse woody debris | 3 | Pleuraphis jamesii Torr. | 1 |
| Cobble | 8 | Prosopis glandulosa Torr. | 26 |
| Gravel | 14 | Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | 1 |
| Litter (duff) | 26 | Stanleya pinnata (Pursh) Britt. | 2 |
| Plant | 5 | | |
| Sand | 15 | | |
| Stone | 12 | | |
| Woody debris structure | 2 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Coarse woody debris | 22 | 2 | 2 | 1 | 1 |
| Cobble | 22 | 6 | 6 | 5 | 21 |
| Litter (duff) | 4 | 31 | 31 | 58 | 4 |
| Stone | 9 | 6 | 6 | 5 | 9 |
| Woody debris structure | 0 | 2 | 0 | 0 | 0 |
| Boulder | 9 | 6 | 6 | 5 | 9 |
| Bare Soil | 4 | 0 | 2 | 5 | 1 |
| Sand | 22 | 14 | 14 | 12 | 9 |
| Gravel | 9 | 31 | 31 | 12 | 46 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | 10-25% | S+M | <0% | | <0% | | <0% | | 5-10% | P+M |
| Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | <0% | | <0% | | <0% | | <1% | | <0% | |
| Aristida purpurea Nutt. | <0% | | <1% | | <0% | | <0% | | <1% | |
| Artemisia ludoviciana Nutt. | 1-5% | | <0% | | <0% | | <1% | | <0% | |
| Astragalus spp. | <0% | | <1% | | <0% | | <0% | | <0% | |
| Atriplex canescens (Pursh) Nutt. | 1-5% | | 1-5% | | 1-5% | | 1-5% | | 1-5% | |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | <0% | | <0% | | <0% | | <0% | | <1% | |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 5

Transect Type: Tamarisk Control

| | | | | | |
|--|--------|--------|-----|--------|-------|
| Encelia farinosa Gray ex Torr. | <0% | <0% | <0% | <0% | <1% |
| Ephedra torreyana S. Wats. | <0% | <0% | <0% | <0% | 1-5% |
| Eriogonum inflatum Torr. & Frém. | <0% | <1% | <1% | <0% | <0% |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <0% | <1% | <0% | <0% | <1% |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | 1-5% | 1-5% | <0% | 1-5% | 1-5% |
| Isocoma acradenia (Greene) Greene | 10-25% | <1% | <1% | 1-5% | 5-10% |
| Mirabilis bigelovii Gray | <0% | <0% | <0% | <0% | <1% |
| Moss spp. | <0% | <1% | <0% | <0% | 1-5% |
| Muhlenbergia porteri Scribn. ex Beal | <1% | <0% | <0% | <0% | <1% |
| Plantago patagonica Jacq. | <0% | <0% | <0% | <0% | <1% |
| Pleuraphis jamesii Torr. | <1% | <1% | | | |
| Prosopis glandulosa Torr. | <0% | 10-25% | M | 25-50% | M |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | 1-5% | <0% | | <0% | 1-5% |
| Stanleya pinnata (Pursh) Britt. | <1% | <0% | | 1-5% | <0% |
| Thymophylla pentachaeta (DC.) Small var. belenidium (DC.) Strother | <0% | <0% | | <0% | <1% |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|------------------------------|---------------|-------------|-------------|
| 35 Prosopis glandulosa Torr. | 0 | 4 | |

Vegetation Structure Data - New

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|------------------------------|---------------|-------------|-------------|
| 25 Prosopis glandulosa Torr. | | 2 | |
| 35 Prosopis glandulosa Torr. | 1 | 3 | |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|-----|-----------|-----|-----------|-----|---------|-----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 8.88 | 122 | 8.88 | 113 | 8.88 | 105 | 8.88 | 113 |
| 15 | 8.8 | 234 | 8.82 | 242 | 8.82 | 245 | 8.81 | 240 |
| 25 | 8.59 | 257 | 8.61 | 316 | 8.61 | 344 | 8.60 | 306 |
| 35 | 8.19 | 277 | 8.18 | 296 | 8.16 | 304 | 8.18 | 292 |
| 45 | 8.5 | 143 | 8.46 | 150 | 8.41 | 158 | 8.46 | 150 |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 5

Transect Type: Tamarisk Control

Date: 5/9/2005 Revisit? Pre-tamarisk removal

Recorder: Amy Prince Reader: Kari Malen

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

Weather: Windy, sunny/partly cloudy, hot

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|---|----------------|
| Bare Soil | 19 | Acacia greggii Gray | 4 |
| Boulder | 8 | Atriplex canescens (Pursh) Nutt. | 1 |
| Cobble | 3 | Bromus rubens L. | 17 |
| Gravel | 14 | Cryptantha barbiger (Gray) Greene | 1 |
| Litter (duff) | 53 | Descurainia pinnata (Walt.) Britt. | 5 |
| Sand | 19 | Hesperostipa spp. | 1 |
| Stone | 12 | Isocoma acradenia (Greene) Greene | 5 |
| | | Lepidium spp. | 1 |
| | | Moss spp. | 1 |
| | | Plantago patagonica Jacq. | 1 |
| | | Prosopis glandulosa Torr. | 30 |
| | | Schismus spp. | 1 |
| | | Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | 2 |
| | | Stanleya pinnata (Pursh) Britt. | 5 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|---------------------|-----------|------------|------------|------------|------------|
| Stone | 4 | 10 | 1 | 8 | 19 |
| Litter (duff) | 4 | 24 | 49 | 38 | 3 |
| Gravel | 23 | 24 | 23 | 8 | 40 |
| Sand | 50 | 24 | 23 | 38 | 8 |
| Cobble | 10 | 4 | 1 | 3 | 19 |
| Boulder | 4 | 10 | 4 | 3 | 8 |
| Coarse woody debris | 4 | 4 | 1 | 3 | 3 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | 5-10% | | | | | | | | 1-5% | |
| Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | | | | | | | <1% | | | |
| Aristida spp. | <1% | | <1% | | | | | | <1% | |
| Artemisia ludoviciana Nutt. | <1% | | | | | | <1% | | | |
| Astragalus spp. | <1% | | | | | | | | | |
| Atriplex canescens (Pursh) Nutt. | <1% | | 1-5% | | <1% | | <1% | | <1% | |
| Bromus rubens L. | <1% | | <1% | | 25-50% | | 25-50% | | 1-5% | |
| Camissonia walkeri (A. Nels.) Raven | | | <1% | | | | | | | |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 5

Transect Type: Tamarisk Control

| | | | | | |
|---|--------|-------|--------|--------|-------|
| Cirsium neomexicanum Gray | | <1% | | | |
| Cryptantha barbiger (Gray) Greene | | | <1% | | |
| Cryptantha maritima (Greene) Greene | | | | <1% | |
| Cryptantha pterocarya (Torr.) Greene | | <1% | | | |
| Cryptantha spp. | <1% | | <1% | | <1% |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | | | | | <1% |
| Descurainia pinnata (Walt.) Britt. | <1% | 1-5% | 5-10% | 10-25% | |
| Draba cuneifolia Nutt. ex Torr. & Gray | | | | <1% | |
| Encelia spp. | <1% | | | | 1-5% |
| Erigeron spp. | <1% | <1% | | | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <1% | <1% | <1% | | <1% |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | <1% | <1% | | <1% | 1-5% |
| Hesperostipa spp. | <1% | | | | <1% |
| Isocoma acradenia (Greene) Greene | 10-25% | <1% | <1% | <1% | 5-10% |
| Lepidium spp. | <1% | <1% | <1% | <1% | <1% |
| Linanthus bigelovii (Gray) Greene | <1% | <1% | | <1% | |
| Lycium spp. | | | | | <1% |
| Mammillaria spp. | | | | | <1% |
| Mirabilis bigelovii Gray | | | | | <1% |
| Plantago patagonica Jacq. | <1% | <1% | | <1% | 1-5% |
| Prosopis glandulosa Torr. | | 5-10% | 25-50% | 25-50% | |
| Silene antirrhina L. | | | | <1% | <1% |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | <1% | | | | 1-5% |
| Sporobolus cryptandrus (Torr.) Gray | <1% | | | | |
| Stanleya pinnata (Pursh) Britt. | | | 1-5% | <1% | |
| Stephanomeria exigua Nutt. | | <1% | | | |
| Thymophylla pentachaeta (DC.) Small | | | | | <1% |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|------------------------------------|---------------|-------------|-------------|
| 5 | Acacia greggii Gray | 2 | | |
| 25 | Prosopis glandulosa Torr. | 2 | 1 | |
| 35 | Bromus rubens L. | 5 | | |
| 35 | Descurainia pinnata (Walt.) Britt. | 1 | | |
| 35 | Prosopis glandulosa Torr. | 2 | 3 | 1 |
| 45 | Bromus rubens L. | 2 | | |
| 45 | Isocoma acradenia (Greene) Greene | 4 | | |

Vegetation Structure Data - New

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 5

Transect Type: Tamarisk Control

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|--------------|------------------|-----------|------------------|-----------|------------------|-----------|----------------|-----------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0 | | 0 | | 0 | | 0.00 | |
| 15 | 0.15 | | 0.16 | | 0.15 | | 0.15 | |
| 25 | 0.35 | | 0.18 | | 0.2 | | 0.24 | |
| 35 | 0.03 | | 0.03 | | 0.04 | | 0.03 | |
| 45 | 0.03 | | 0.02 | | 0.02 | | 0.02 | |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 5

Transect Type: Tamarisk Control

Date: 5/6/2006 Revisit? Post-tamarisk removal

Recorder: Lisa Hahn Reader: Kate Watters

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

Weather: Hot, partly cloudy with fire (very smoky) on the South Rim. 85-90 F.
Light winds.

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|---|----------------|
| Bare Soil | 9 | Acacia greggii Gray | 1 |
| Bedrock | 1 | Artemisia ludoviciana Nutt. | 1 |
| Boulder | 5 | Isocoma acradenia (Greene) Greene | 9 |
| Coarse woody debris | 3 | Pleuraphis jamesii Torr. | 1 |
| Cobble | 8 | Prosopis glandulosa Torr. | 26 |
| Gravel | 14 | Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | 1 |
| Litter (duff) | 26 | Stanleya pinnata (Pursh) Britt. | 2 |
| Plant | 5 | | |
| Sand | 15 | | |
| Stone | 12 | | |
| Woody debris structure | 2 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Coarse woody debris | 22 | 2 | 2 | 1 | 1 |
| Cobble | 22 | 6 | 6 | 5 | 21 |
| Litter (duff) | 4 | 31 | 31 | 58 | 4 |
| Stone | 9 | 6 | 6 | 5 | 9 |
| Woody debris structure | 0 | 2 | 0 | 0 | 0 |
| Boulder | 9 | 6 | 6 | 5 | 9 |
| Bare Soil | 4 | 0 | 2 | 5 | 1 |
| Sand | 22 | 14 | 14 | 12 | 9 |
| Gravel | 9 | 31 | 31 | 12 | 46 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | 10-25% | S+M | <0% | | <0% | | <0% | | 5-10% | P+M |
| Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | <0% | | <0% | | <0% | | <1% | | <0% | |
| Aristida purpurea Nutt. | <0% | | <1% | | <0% | | <0% | | <1% | |
| Artemisia ludoviciana Nutt. | 1-5% | | <0% | | <0% | | <1% | | <0% | |
| Astragalus spp. | <0% | | <1% | | <0% | | <0% | | <0% | |
| Atriplex canescens (Pursh) Nutt. | 1-5% | | 1-5% | | 1-5% | | 1-5% | | 1-5% | |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | <0% | | <0% | | <0% | | <0% | | <1% | |

Canyon/Park Area: Carbon Creek

River mile: 64.7 R

Project (Phase): Phase IIa

Transect Name: Carbon Canyon 5

Transect Type: Tamarisk Control

| | | | | | |
|--|--------|--------|------|--------|-------|
| Encelia farinosa Gray ex Torr. | <0% | <0% | <0% | <0% | <1% |
| Ephedra torreyana S. Wats. | <0% | <0% | <0% | <0% | 1-5% |
| Eriogonum inflatum Torr. & Frém. | <0% | <1% | <1% | <0% | <0% |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <0% | <1% | <0% | <0% | <1% |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | 1-5% | 1-5% | <0% | 1-5% | 1-5% |
| Isocoma acradenia (Greene) Greene | 10-25% | <1% | <1% | 1-5% | 5-10% |
| Mirabilis bigelovii Gray | <0% | <0% | <0% | <0% | <1% |
| Moss spp. | <0% | <1% | <0% | <0% | 1-5% |
| Muhlenbergia porteri Scribn. ex Beal | <1% | <0% | <0% | <0% | <1% |
| Plantago patagonica Jacq. | <0% | <0% | <0% | <0% | <1% |
| Pleuraphis jamesii Torr. | <1% | <1% | | | |
| Prosopis glandulosa Torr. | <0% | 10-25% | M | 25-50% | M |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | 1-5% | <0% | <0% | <0% | 1-5% |
| Stanleya pinnata (Pursh) Britt. | <1% | <0% | 1-5% | 1-5% | <0% |
| Thymophylla pentachaeta (DC.) Small var. belenidium (DC.) Strother | <0% | <0% | <0% | <0% | <1% |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|------------------------------|---------------|-------------|-------------|
| 35 Prosopis glandulosa Torr. | 0 | 4 | |

Vegetation Structure Data - New

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|------------------------------|---------------|-------------|-------------|
| 25 Prosopis glandulosa Torr. | | 2 | |
| 35 Prosopis glandulosa Torr. | 1 | 3 | |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|-----|-----------|-----|-----------|-----|---------|-----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 8.88 | 122 | 8.88 | 113 | 8.88 | 105 | 8.88 | 113 |
| 15 | 8.8 | 234 | 8.82 | 242 | 8.82 | 245 | 8.81 | 240 |
| 25 | 8.59 | 257 | 8.61 | 316 | 8.61 | 344 | 8.60 | 306 |
| 35 | 8.19 | 277 | 8.18 | 296 | 8.16 | 304 | 8.18 | 292 |
| 45 | 8.5 | 143 | 8.46 | 150 | 8.41 | 158 | 8.46 | 150 |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 1

Transect Type: Tamarisk Area

| | Start point | | End point |
|----------------------------|--|---------------------|------------------|
| Easting: | 388620 | Easting: | 388656 |
| Northing: | 4000319 | Northing: | 4000336 |
| GPS accuracy (m): | 6.7 | GPS accuracy (m): | 1.3 |
| Elevation (m): | 738 | Elevation (m): | 739 |
| Bearing: | 184 | | |
| Aspect (0-360): | 190 | Slope (degrees): | 3 |
| Transect description: | Transect start point is about 1km up canyon at a point where the canyon narrows and takes a right turn (as you go up canyon). Reddish rock wall on the left. Start point is in a notch at the base of a red wall. Transect runs along the creek on creek right about 5m away from the creek. This transect about 250m above T1B. | | |
| Additional Info:: | Start point is on creek right on 30cm white rock at base of 20m flat schist wall w/ a distinctive notch at base. Just past start point of transect as you are hiking upstream, creek curves right (NE). Also some seeps coming in out at base of schist. Open but in +/- narrow section of canyon. Start point is 80m downcanyon from waterfall. | | |
| Geological layer: | Schist | | |
| Habitat type: | Riparian | Mojave desert scrub | |
| Dominant species: | Isocoma acradenia (Greene) Greene, Tamarix ramosissima Ledeb. | | |
| Associated species: | Acacia greggii Gray, Baccharis emoryi Gray, Bromus rubens L., Cryptantha barbiger (Gray) Greene, Cryptantha maritima (Greene) Greene, Cryptantha spp., Cryptobiotic soil, Encelia farinosa Gray ex Torr., Ephedra spp., Eragrostis cilianensis (All.) Vign. ex Janchen, Erodium cicutarium (L.) L'Hér. ex Ait., Galium aparine L., Iva acerosa (Nutt.) R.C. Jackson, Lepidium lasiocarpum Nutt. var. lasiocarpum, Mammillaria grahamii Engelm. var. grahamii, Mirabilis bigelovii Gray, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Pectocarya recurvata I.M. Johnston, Plantago patagonica Jacq., Poa bigelovii Vasey & Scribn., Pseudognaphalium stramineum (Kunth) W.A. Weber, Sporobolus cryptandrus (Torr.) Gray, Stylocline micropoides Gray, Typha latifolia L., Vulpia microstachys (Nutt.) Munro | | |
| Surface water within 25m? | <input checked="" type="checkbox"/> | Surface water type: | |
| Landform: Drainage channel | | Surface rocks: | other |
| Soil type: sand | | Topo position: | |
| Light exposure: open | | Soil moisture: | moist |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 1

Transect Type: Tamarisk Area

Date: 5/12/2005 Revisit? Pre-tamarisk removal

Recorder: Lori Makarick Reader: Steve Till

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

Weather: Warm, sunny 10% clouds

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|---|----------------|
| Boulder | 19 | Isocoma acradenia (Greene) Greene | 13 |
| Cobble | 5 | Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 2 |
| Gravel | 6 | Plantago patagonica Jacq. | 1 |
| Litter (duff) | 25 | Tamarix ramosissima Ledeb. | 32 |
| Sand | 67 | | |
| Stone | 11 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|---------------------|-----------|------------|------------|------------|------------|
| Cobble | 3 | 3 | 4 | 4 | 15 |
| Litter (duff) | 8 | 8 | 9 | 21 | 6 |
| Coarse woody debris | 0 | 8 | 1 | 4 | 1 |
| Gravel | 3 | 3 | 9 | 21 | 15 |
| Boulder | 3 | 3 | 9 | 9 | 15 |
| Sand | 41 | 66 | 46 | 21 | 34 |
| Stone | 41 | 8 | 22 | 21 | 15 |
| Bedrock | 1 | 0 | 0 | 0 | 0 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | 1-5% | | | | | | | | | |
| Baccharis emoryi Gray | | | | | | | | | 5-10% | |
| Bromus rubens L. | <1% | | <1% | | <1% | | 1-5% | | <1% | |
| Cryptantha barbiger (Gray) Greene | | | <1% | | | | <1% | | <1% | |
| Cryptantha maritima (Greene) Greene | <1% | | | | <1% | | <1% | | | |
| Cryptobiotic soil | | | <1% | | <1% | | <1% | | <1% | |
| Encelia farinosa Gray ex Torr. | <1% | | <0% | | <1% | | <1% | | <0% | |
| Eragrostis cilianensis (All.) Vign. ex Janchen | | | | | | | <1% | | <1% | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | | | | <1% | | | | | |
| Isocoma acradenia (Greene) Greene | 5-10% | | 10-25% | | 10-25% | | 25-50% | | 5-10% | |
| Lepidium lasiocarpum Nutt. var. lasiocarpum | <1% | | <1% | | <1% | | <1% | | <1% | |
| Mammillaria grahamii Engelm. var. grahamii | | | | | | | <1% | | | |
| Mirabilis bigelovii Gray | | | | | | | <1% | | | |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | <1% | | <1% | | <1% | | 1-5% | | 5-10% | |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 1

Transect Type: Tamarisk Area

| | | | | | |
|-------------------------------------|------|-------|-------|--------|------|
| Pectocarya recurvata I.M. Johnston | | | <1% | | |
| Plantago patagonica Jacq. | <1% | <1% | <1% | <1% | <1% |
| Poa bigelovii Vasey & Scribn. | | | | | <1% |
| Sporobolus cryptandrus (Torr.) Gray | | | | <1% | <1% |
| Stylocline micropoides Gray | | | | <1% | <1% |
| Tamarix ramosissima Ledeb. | 1-5% | 5-10% | 5-10% | 10-25% | 1-5% |
| Typha latifolia L. | | <1% | | | |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|-------------------------------|---------------|-------------|-------------|
| 35 Tamarix ramosissima Ledeb. | 2 | 3 | |

Vegetation Structure Data - New**Soil Data**

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|----|-----------|----|-----------|----|---------|----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0.07 | | 0.09 | | 0.11 | | 0.09 | |
| 15 | 0 | | 0 | | 0 | | 0.00 | |
| 25 | 0 | | 0.02 | | 0.02 | | 0.01 | |
| 35 | 0 | | 0 | | 0 | | 0.00 | |
| 45 | 0.45 | | 0.44 | | 0.49 | | 0.46 | |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 1

Transect Type: Tamarisk Area

Date: 5/11/2007 Revisit? Post-tamarisk removal
 Recorder: Lori Makarick Reader: Amy Prince
 Wind Speed: Air Temp (F): Cloud Cover: 0
 Weather: Hot sunny, few clouds, hazy

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|---|----------------|
| Boulder | 16 | Isocoma acradenia (Greene) Greene | 12 |
| Cobble | 5 | Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 1 |
| Gravel | 9 | | |
| Litter (duff) | 33 | | |
| Sand | 20 | | |
| Stone | 16 | | |
| Woody debris structure | 1 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Basal Veg | 1 | 1 | 1 | 1 | 1 |
| Gravel | 5 | 3 | 4 | 20 | 7 |
| Cobble | 8 | 11 | 7 | 4 | 8 |
| Crypto | 4 | 2 | 1 | 1 | 7 |
| Litter (duff) | 10 | 9 | 15 | 19 | 18 |
| Stone | 25 | 15 | 13 | 15 | 17 |
| Boulder | 15 | 19 | 27 | 17 | 20 |
| Bare Soil | 0 | 0 | 0 | 0 | 0 |
| Coarse woody debris | 2 | 4 | 2 | 8 | 1 |
| Woody debris structure | 0 | 2 | 0 | 0 | 0 |
| Sand | 29 | 34 | 30 | 15 | 21 |
| Moss (ground) | 1 | 0 | 0 | 0 | 0 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | 1-5% | M | <0% | | <0% | | <1% | | P | |
| Aristida purpurea Nutt. | | | | | | | <1% | | | |
| Baccharis emoryi Gray | | | | | | | | | 1-5% | |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | | | | | | | <1% | | | |
| Encelia farinosa Gray ex Torr. | | | | | 1-5% | | <1% | | | |
| Isocoma acradenia (Greene) Greene | 10-25% | | 5-10% | | 10-25% | | 10-25% | | 10-25% | |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | | | 1-5% | | <1% | | | | 5-10% | |
| Polypogon viridis (Gouan) Breistr. | <1% | | <1% | | | | | | | |
| Sporobolus cryptandrus (Torr.) Gray | | | | | | | <1% | | | |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 1

Transect Type: Tamarisk Area

| | | | |
|-------------------------------------|-----|-----|-----|
| Tamarix ramosissima Ledeb. | <1% | <1% | <1% |
| Thymophylla pentachaeta (DC.) Small | <1% | | |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|-----------------------------------|---------------|-------------|-------------|
| 45 | Isocoma acradenia (Greene) Greene | 2 | | |

Vegetation Structure Data - New

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|-----------------------------------|---------------|-------------|-------------|
| 25 | Isocoma acradenia (Greene) Greene | 2 | | |
| 35 | Isocoma acradenia (Greene) Greene | 1 | | |
| 45 | Isocoma acradenia (Greene) Greene | 6 | | |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|------|-----------|------|-----------|------|---------|------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 8.92 | 3999 | 8.92 | 3999 | 8.91 | 3999 | 8.92 | 3999 |
| 15 | 9.22 | 3999 | 9.24 | 3999 | 9.22 | 3999 | 9.23 | 3999 |
| 25 | 9.13 | 3456 | 8.93 | 3419 | 8.8 | 3360 | 8.95 | 3412 |
| 35 | 8.95 | 539 | 8.83 | 4444 | 8.73 | 464 | 8.84 | 1816 |
| 45 | 8.68 | 3999 | 8.8 | 3999 | 8.81 | 3999 | 8.76 | 3999 |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 1

Transect Type: Tamarisk Area

Date: 5/12/2005 Revisit? Pre-tamarisk removal

Recorder: Lori Makarick Reader: Steve Till

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

Weather: Warm, sunny 10% clouds

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|---|----------------|
| Boulder | 19 | Isocoma acradenia (Greene) Greene | 13 |
| Cobble | 5 | Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 2 |
| Gravel | 6 | Plantago patagonica Jacq. | 1 |
| Litter (duff) | 25 | Tamarix ramosissima Ledeb. | 32 |
| Sand | 67 | | |
| Stone | 11 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|---------------------|-----------|------------|------------|------------|------------|
| Cobble | 3 | 3 | 4 | 4 | 15 |
| Litter (duff) | 8 | 8 | 9 | 21 | 6 |
| Coarse woody debris | 0 | 8 | 1 | 4 | 1 |
| Gravel | 3 | 3 | 9 | 21 | 15 |
| Boulder | 3 | 3 | 9 | 9 | 15 |
| Sand | 41 | 66 | 46 | 21 | 34 |
| Stone | 41 | 8 | 22 | 21 | 15 |
| Bedrock | 1 | 0 | 0 | 0 | 0 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | 1-5% | | | | | | | | | |
| Baccharis emoryi Gray | | | | | | | | | 5-10% | |
| Bromus rubens L. | <1% | | <1% | | <1% | | 1-5% | | <1% | |
| Cryptantha barbiger (Gray) Greene | | | <1% | | | | <1% | | <1% | |
| Cryptantha maritima (Greene) Greene | <1% | | | | <1% | | <1% | | | |
| Cryptobiotic soil | | | <1% | | <1% | | <1% | | <1% | |
| Encelia farinosa Gray ex Torr. | <1% | | <0% | | <1% | | <1% | | <0% | |
| Eragrostis cilianensis (All.) Vign. ex Janchen | | | | | | | <1% | | <1% | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | | | | <1% | | | | | |
| Isocoma acradenia (Greene) Greene | 5-10% | | 10-25% | | 10-25% | | 25-50% | | 5-10% | |
| Lepidium lasiocarpum Nutt. var. lasiocarpum | <1% | | <1% | | <1% | | <1% | | <1% | |
| Mammillaria grahamii Engelm. var. grahamii | | | | | | | <1% | | | |
| Mirabilis bigelovii Gray | | | | | | | <1% | | | |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | <1% | | <1% | | <1% | | 1-5% | | 5-10% | |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 1

Transect Type: Tamarisk Area

| | | | | | |
|-------------------------------------|------|-------|-------|--------|------|
| Pectocarya recurvata I.M. Johnston | | | <1% | | |
| Plantago patagonica Jacq. | <1% | <1% | <1% | <1% | <1% |
| Poa bigelovii Vasey & Scribn. | | | | | <1% |
| Sporobolus cryptandrus (Torr.) Gray | | | | <1% | <1% |
| Stylocline micropoides Gray | | | | <1% | <1% |
| Tamarix ramosissima Ledeb. | 1-5% | 5-10% | 5-10% | 10-25% | 1-5% |
| Typha latifolia L. | | <1% | | | |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|-------------------------------|---------------|-------------|-------------|
| 35 Tamarix ramosissima Ledeb. | 2 | 3 | |

Vegetation Structure Data - New

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|----|-----------|----|-----------|----|---------|----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0.07 | | 0.09 | | 0.11 | | 0.09 | |
| 15 | 0 | | 0 | | 0 | | 0.00 | |
| 25 | 0 | | 0.02 | | 0.02 | | 0.01 | |
| 35 | 0 | | 0 | | 0 | | 0.00 | |
| 45 | 0.45 | | 0.44 | | 0.49 | | 0.46 | |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 1

Transect Type: Tamarisk Area

Date: 5/11/2007 Revisit? Post-tamarisk removal
 Recorder: Lori Makarick Reader: Amy Prince
 Wind Speed: Air Temp (F): Cloud Cover: 0
 Weather: Hot sunny, few clouds, hazy

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|---|----------------|
| Boulder | 16 | Isocoma acradenia (Greene) Greene | 12 |
| Cobble | 5 | Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 1 |
| Gravel | 9 | | |
| Litter (duff) | 33 | | |
| Sand | 20 | | |
| Stone | 16 | | |
| Woody debris structure | 1 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Basal Veg | 1 | 1 | 1 | 1 | 1 |
| Gravel | 5 | 3 | 4 | 20 | 7 |
| Cobble | 8 | 11 | 7 | 4 | 8 |
| Crypto | 4 | 2 | 1 | 1 | 7 |
| Litter (duff) | 10 | 9 | 15 | 19 | 18 |
| Stone | 25 | 15 | 13 | 15 | 17 |
| Boulder | 15 | 19 | 27 | 17 | 20 |
| Bare Soil | 0 | 0 | 0 | 0 | 0 |
| Coarse woody debris | 2 | 4 | 2 | 8 | 1 |
| Woody debris structure | 0 | 2 | 0 | 0 | 0 |
| Sand | 29 | 34 | 30 | 15 | 21 |
| Moss (ground) | 1 | 0 | 0 | 0 | 0 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | 1-5% | M | <0% | | <0% | | <1% | | P | |
| Aristida purpurea Nutt. | | | | | | | <1% | | | |
| Baccharis emoryi Gray | | | | | | | | | | 1-5% |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | | | | | | | <1% | | | |
| Encelia farinosa Gray ex Torr. | | | | | 1-5% | | <1% | | | |
| Isocoma acradenia (Greene) Greene | 10-25% | | 5-10% | | 10-25% | | 10-25% | | | 10-25% |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | | | 1-5% | | <1% | | | | | 5-10% |
| Polypogon viridis (Gouan) Breistr. | <1% | | <1% | | | | | | | |
| Sporobolus cryptandrus (Torr.) Gray | | | | | | | <1% | | | |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 1

Transect Type: Tamarisk Area

| | | | |
|-------------------------------------|-----|-----|-----|
| Tamarix ramosissima Ledeb. | <1% | <1% | <1% |
| Thymophylla pentachaeta (DC.) Small | <1% | | |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|-----------------------------------|---------------|-------------|-------------|
| 45 | Isocoma acradenia (Greene) Greene | 2 | | |

Vegetation Structure Data - New

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|-----------------------------------|---------------|-------------|-------------|
| 25 | Isocoma acradenia (Greene) Greene | 2 | | |
| 35 | Isocoma acradenia (Greene) Greene | 1 | | |
| 45 | Isocoma acradenia (Greene) Greene | 6 | | |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|------|-----------|------|-----------|------|---------|------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 8.92 | 3999 | 8.92 | 3999 | 8.91 | 3999 | 8.92 | 3999 |
| 15 | 9.22 | 3999 | 9.24 | 3999 | 9.22 | 3999 | 9.23 | 3999 |
| 25 | 9.13 | 3456 | 8.93 | 3419 | 8.8 | 3360 | 8.95 | 3412 |
| 35 | 8.95 | 539 | 8.83 | 4444 | 8.73 | 464 | 8.84 | 1816 |
| 45 | 8.68 | 3999 | 8.8 | 3999 | 8.81 | 3999 | 8.76 | 3999 |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 1

Transect Type: Tamarisk Control

| | Start point | | End point |
|----------------------------|--|---------------------------|------------------|
| Easting: | 388550 | Easting: | 388516 |
| Northing: | 4000136 | Northing: | 4000110 |
| GPS accuracy (m): | 4.1 | GPS accuracy (m): | 2.6 |
| Elevation (m): | 750 | Elevation (m): | 731 |
| Bearing: | 219 | | |
| Aspect (0-360): | 213 | Slope (degrees): | 3 |
| Transect description: | Transect runs along creek right, beginning about 100m downcreek from where canyon bends to north. Start is about 10m to NW of creek edge, on top of a 3m tall cobble/gravel pile above schist bedrock. The start point is about 4m from an opuntia chlorotica the transect runs downcreek thru a PLUSER patch. Transect end point is 1m toward creek from a 3m tall schist bedrock outcropping. The end point is 4m from active creek channel. | | |
| Additional Info:: | Transect end is located at beginning of schist bedrock on creek right. Near start point look for small side drainage on creek right with one small and lone large acacia. Start point is located ~6m upslope from creek on debris pile of rock below schist outcrop. Transect runs gradually closer to the creek with the endpoint being 1.5-2.0m from creek. Endpoint is at 3m high schist cliff at slight bend to left in creek. | | |
| Geological layer: | schist | | |
| Habitat type: | Riparian | Mojave desert scrub | |
| Dominant species: | Encelia farinosa Gray ex Torr., Pluchea sericea (Nutt.) Coville, Tamarix ramosissima Ledeb. | | |
| Associated species: | Aristida purpurea Nutt., Artemisia ludoviciana Nutt., Azenia filiformis S. Wats., Baccharis emoryi Gray, Baccharis salicifolia (Ruiz & Pavón) Pers., Bebbia juncea (Benth.) Greene var. aspera Greene, Bromus rubens L., Cryptantha barbiger (Gray) Greene, Cryptantha spp., Dasyochloa pulchella (Kunth) Willd. ex Rydb., Descurainia pinnata (Walt.) Britt., Echinocereus engelmannii (Parry ex Engelm.) Lem., Ephedra fasciculata A. Nels., Eragrostis cilianensis (All.) Vign. ex Janchen, Eriogonum deflexum Torr., Eriogonum inflatum Torr. & Frém., Janusia gracilis Gray, Mammillaria grahamii Engelm. var. grahamii, Mirabilis bigelovii Gray, Moss spp., Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Opuntia basilaris Engelm. & Bigelow var. longiareolata (Clover & Jotter) L. Benson, Opuntia chlorotica Engelm. & Bigelow, Plantago patagonica Jacq., Poa bigelovii Vasey & Scribn., Porophyllum gracile Benth., Pseudognaphalium stramineum (Kunth) W.A. Weber, Salix exigua Nutt., Silene antirrhina L., Stylocline micropoides Gray, Thymophylla pentachaeta (DC.) Small, Typha domingensis Pers., Typha latifolia L., Vulpia microstachys (Nutt.) Munro | | |
| Surface water within 25m? | <input checked="" type="checkbox"/> | Surface water type: | |
| Landform: Drainage channel | Side slope | Surface rocks: schist | |
| Soil type: sandy loam | | Topo position: Interfluve | |
| Light exposure: open | partial-shade | Soil moisture: dry | |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 1

Transect Type: Tamarisk Control

Date: 5/12/2005 Revisit? Pre-tamarisk removal

Recorder: Lisa Hahn Reader: Kate Watters

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

Weather: Clear sky, light wind, 83F

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|-----------------------------------|----------------|
| Boulder | 2 | | 4 |
| Cobble | 21 | Bromus rubens L. | 4 |
| Gravel | 12 | Cryptantha barbiger (Gray) Greene | 2 |
| Litter (duff) | 27 | Cryptobiotic soil | 2 |
| Sand | 44 | Encelia farinosa Gray ex Torr. | 6 |
| Stone | 12 | Ephedra fasciculata A. Nels. | 3 |
| | | Pluchea sericea (Nutt.) Coville | 30 |
| | | Tamarix ramosissima Ledeb. | 11 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Stone | 15 | 22 | 4 | 11 | 19 |
| Litter (duff) | 15 | 9 | 26 | 11 | 19 |
| Woody debris structure | 0 | 0 | 0 | 1 | 1 |
| Gravel | 15 | 4 | 11 | 4 | 3 |
| Coarse woody debris | 1 | 1 | 4 | 4 | 3 |
| Bedrock | 15 | 47 | 11 | 11 | 19 |
| Cobble | 15 | 4 | 11 | 26 | 8 |
| Bare Soil | 1 | 4 | 1 | 1 | 1 |
| Sand | 6 | 9 | 26 | 26 | 19 |
| Boulder | 15 | 1 | 4 | 4 | 8 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Aristida purpurea Nutt. | 1-5% | | 1-5% | | | | | | | |
| Artemisia ludoviciana Nutt. | | | 25-50% | | | | | | | |
| Ayenia filiformis S. Wats. | <1% | | | | | | | | | |
| Baccharis emoryi Gray | <1% | | <1% | | <1% | | | | | |
| Bebbia juncea (Benth.) Greene var. aspera Greene | | | | | | | <1% | | | |
| Bromus rubens L. | <1% | | <1% | | <1% | | | | | |
| Cryptantha barbiger (Gray) Greene | <1% | | | | | | | | | |
| Cryptobiotic soil | <1% | | 1-5% | | | | | | | |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | <1% | | | | | | | | | |
| Descurainia pinnata (Walt.) Britt. | <1% | | | | | | | | | |
| Encelia farinosa Gray ex Torr. | 10-25% | | <1% | | <1% | | | | | |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 1

Transect Type: Tamarisk Control

| | | | | | |
|--|------|--------|--------|--------|--------|
| Ephedra fasciculata A. Nels. | 1-5% | | | | |
| Eragrostis cilianensis (All.) Vign. ex Janchen | | <1% | | | |
| Eriogonum inflatum Torr. & Frém. | <1% | | | | |
| Mammillaria grahamii Engelm. var. grahamii | <1% | | | <1% | |
| Mirabilis bigelovii Gray | <1% | | | | |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | | <1% | | | |
| Opuntia basilaris Engelm. & Bigelow var. longiareolata (Clover & Jotter) L. Benson | <1% | | | | |
| Plantago patagonica Jacq. | <1% | | | | |
| Pluchea sericea (Nutt.) Coville | | 25-50% | 10-25% | 10-25% | 10-25% |
| Poa bigelovii Vasey & Scribn. | <1% | | | | |
| Porophyllum gracile Benth. | 1-5% | | | | |
| Salix exigua Nutt. | | | | | <1% |
| Silene antirrhina L. | <1% | | | | |
| Stylocline micropoides Gray | <1% | <1% | | | |
| Tamarix ramosissima Ledeb. | 1-5% | 5-10% | 10-25% | 10-25% | 10-25% |
| Thymophylla pentachaeta (DC.) Small | <1% | <1% | | | |
| Typha latifolia L. | | | | | <1% |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|---------------------------------|---------------|-------------|-------------|
| 5 | Encelia farinosa Gray ex Torr. | 2 | | |
| 25 | Tamarix ramosissima Ledeb. | 2 | | |
| 35 | Pluchea sericea (Nutt.) Coville | | 2 | 1 |
| 35 | Tamarix ramosissima Ledeb. | 5 | 2 | |

Vegetation Structure Data - New

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|--------------|------------------|-----------|------------------|-----------|------------------|-----------|----------------|-----------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0.04 | | 0.03 | | 0.08 | | 0.05 | |
| 15 | 0.16 | | 0.19 | | 0.22 | | 0.19 | |
| 25 | 0.06 | | 0.08 | | 0.08 | | 0.07 | |
| 35 | 0.6 | | 0.59 | | 0.63 | | 0.61 | |
| 45 | 0.67 | | 0.08 | | 0.1 | | 0.28 | |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 1

Transect Type: Tamarisk Control

Date: 5/11/2007 Revisit? Post-tamarisk removal
 Recorder: Kate Watters Reader: Lisa Hahn
 Wind Speed: Air Temp (F): Cloud Cover: 0
 Weather: Clear blue sky with few billowy clouds, feels hot, high 80's or 90's

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|---------------------------------|----------------|
| Boulder | 7 | Encelia farinosa Gray ex Torr. | 3 |
| Cobble | 12 | Ephedra fasciculata A. Nels. | 3 |
| Gravel | 5 | Grass spp | 1 |
| Litter (duff) | 51 | Pluchea sericea (Nutt.) Coville | 35 |
| Sand | 15 | | |
| Stone | 10 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Moss (ground) | 1 | 0 | 0 | 0 | 0 |
| Lichen | 1 | 1 | 0 | 0 | 0 |
| Cobble | 15 | 12 | 15 | 11 | 9 |
| Boulder | 8 | 3 | 2 | 5 | 16 |
| Gravel | 22 | 9 | 7 | 8 | 8 |
| Litter (duff) | 20 | 25 | 30 | 25 | 16 |
| Woody debris structure | 1 | 0 | 0 | 0 | 0 |
| Stone | 13 | 13 | 11 | 12 | 22 |
| Sand | 10 | 24 | 27 | 32 | 20 |
| Bedrock | 6 | 9 | 2 | 3 | 6 |
| Crypto | 1 | 2 | 1 | 0 | 0 |
| Coarse woody debris | 1 | 1 | 3 | 3 | 1 |
| Basal Veg | 1 | 1 | 2 | 1 | 1 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Aristida purpurea Nutt. | 1-5% | | 1-5% | | | | | | | |
| Bouteloua trifida Thurb. | <1% | | | | | | | | | |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | <1% | | | | | | | | | |
| Encelia farinosa Gray ex Torr. | 5-10% | | | | | | | | | |
| Ephedra fasciculata A. Nels. | 1-5% | | | | | | | | | |
| Mammillaria grahamii Engelm. var. grahamii | <1% | | | | | | | | | |
| Opuntia basilaris Engelm. & Bigelow | <1% | | | | | | | | | |
| Pluchea sericea (Nutt.) Coville | 1-5% | | 25-50% | | 25-50% | | 5-10% | | 5-10% | |
| Polypogon viridis (Gouan) Breistr. | | | | | | | <1% | | <1% | |
| Porophyllum gracile Benth. | <1% | | | | | | | | | |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 1

Transect Type: Tamarisk Control

| | | | | | | |
|--------------------------------|-----|-----|-----|-----|-----|---|
| Tamarix ramosissima Ledeb. | | <1% | S+P | <0% | <1% | S |
| Vulpia octoflora (Walt.) Rydb. | <1% | | | | | |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|---------------------------------|---------------|-------------|-------------|
| 5 | Encelia farinosa Gray ex Torr. | 4 | | |
| 15 | Pluchea sericea (Nutt.) Coville | 10 | 6 | |
| 35 | Pluchea sericea (Nutt.) Coville | | | 5 |

Vegetation Structure Data - New

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|---------------------------------|---------------|-------------|-------------|
| 5 | Encelia farinosa Gray ex Torr. | 7 | | |
| 15 | Pluchea sericea (Nutt.) Coville | 9 | 6 | |
| 35 | Pluchea sericea (Nutt.) Coville | | 1 | 1 |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|------|-----------|------|-----------|------|---------|------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 9.17 | 304 | 8.64 | 227 | 8.58 | 224 | 8.80 | 252 |
| 15 | 8.68 | 3999 | 8.78 | 3999 | 8.8 | 3999 | 8.75 | 3999 |
| 25 | 9.13 | 3999 | 9.18 | 3999 | 9.25 | 3999 | 9.19 | 3999 |
| 35 | 9.6 | 3999 | 9.39 | 3999 | 9.38 | 3999 | 9.46 | 3999 |
| 45 | 8.84 | 2854 | 8.76 | 2836 | 8.67 | 2784 | 8.76 | 2825 |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 1

Transect Type: Tamarisk Control

Date: 5/12/2005 Revisit? Pre-tamarisk removal

Recorder: Lisa Hahn Reader: Kate Watters

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

Weather: Clear sky, light wind, 83F

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|-----------------------------------|----------------|
| Boulder | 2 | | 4 |
| Cobble | 21 | Bromus rubens L. | 4 |
| Gravel | 12 | Cryptantha barbiger (Gray) Greene | 2 |
| Litter (duff) | 27 | Cryptobiotic soil | 2 |
| Sand | 44 | Encelia farinosa Gray ex Torr. | 6 |
| Stone | 12 | Ephedra fasciculata A. Nels. | 3 |
| | | Pluchea sericea (Nutt.) Coville | 30 |
| | | Tamarix ramosissima Ledeb. | 11 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Stone | 15 | 22 | 4 | 11 | 19 |
| Litter (duff) | 15 | 9 | 26 | 11 | 19 |
| Woody debris structure | 0 | 0 | 0 | 1 | 1 |
| Gravel | 15 | 4 | 11 | 4 | 3 |
| Coarse woody debris | 1 | 1 | 4 | 4 | 3 |
| Bedrock | 15 | 47 | 11 | 11 | 19 |
| Cobble | 15 | 4 | 11 | 26 | 8 |
| Bare Soil | 1 | 4 | 1 | 1 | 1 |
| Sand | 6 | 9 | 26 | 26 | 19 |
| Boulder | 15 | 1 | 4 | 4 | 8 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Aristida purpurea Nutt. | 1-5% | | 1-5% | | | | | | | |
| Artemisia ludoviciana Nutt. | | | 25-50% | | | | | | | |
| Ayenia filiformis S. Wats. | <1% | | | | | | | | | |
| Baccharis emoryi Gray | <1% | | <1% | | <1% | | | | | |
| Bebbia juncea (Benth.) Greene var. aspera Greene | | | | | | | <1% | | | |
| Bromus rubens L. | <1% | | <1% | | <1% | | | | | |
| Cryptantha barbiger (Gray) Greene | <1% | | | | | | | | | |
| Cryptobiotic soil | <1% | | 1-5% | | | | | | | |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | <1% | | | | | | | | | |
| Descurainia pinnata (Walt.) Britt. | <1% | | | | | | | | | |
| Encelia farinosa Gray ex Torr. | 10-25% | | <1% | | <1% | | | | | |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 1

Transect Type: Tamarisk Control

| | | | | | |
|--|------|--------|--------|--------|--------|
| Ephedra fasciculata A. Nels. | 1-5% | | | | |
| Eragrostis cilianensis (All.) Vign. ex Janchen | | <1% | | | |
| Eriogonum inflatum Torr. & Frém. | <1% | | | | |
| Mammillaria grahamii Engelm. var. grahamii | <1% | | | <1% | |
| Mirabilis bigelovii Gray | <1% | | | | |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | | <1% | | | |
| Opuntia basilaris Engelm. & Bigelow var. longiareolata (Clover & Jotter) L. Benson | <1% | | | | |
| Plantago patagonica Jacq. | <1% | | | | |
| Pluchea sericea (Nutt.) Coville | | 25-50% | 10-25% | 10-25% | 10-25% |
| Poa bigelovii Vasey & Scribn. | <1% | | | | |
| Porophyllum gracile Benth. | 1-5% | | | | |
| Salix exigua Nutt. | | | | | <1% |
| Silene antirrhina L. | <1% | | | | |
| Stylocline micropoides Gray | <1% | <1% | | | |
| Tamarix ramosissima Ledeb. | 1-5% | 5-10% | 10-25% | 10-25% | 10-25% |
| Thymophylla pentachaeta (DC.) Small | <1% | <1% | | | |
| Typha latifolia L. | | | | | <1% |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|---------------------------------|---------------|-------------|-------------|
| 5 | Encelia farinosa Gray ex Torr. | 2 | | |
| 25 | Tamarix ramosissima Ledeb. | 2 | | |
| 35 | Pluchea sericea (Nutt.) Coville | | 2 | 1 |
| 35 | Tamarix ramosissima Ledeb. | 5 | 2 | |

Vegetation Structure Data - New

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|--------------|------------------|-----------|------------------|-----------|------------------|-----------|----------------|-----------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0.04 | | 0.03 | | 0.08 | | 0.05 | |
| 15 | 0.16 | | 0.19 | | 0.22 | | 0.19 | |
| 25 | 0.06 | | 0.08 | | 0.08 | | 0.07 | |
| 35 | 0.6 | | 0.59 | | 0.63 | | 0.61 | |
| 45 | 0.67 | | 0.08 | | 0.1 | | 0.28 | |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 1

Transect Type: Tamarisk Control

Date: 5/11/2007 Revisit? Post-tamarisk removal
 Recorder: Kate Watters Reader: Lisa Hahn
 Wind Speed: Air Temp (F): Cloud Cover: 0
 Weather: Clear blue sky with few billowy clouds, feels hot, high 80's or 90's

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|---------------------------------|----------------|
| Boulder | 7 | Encelia farinosa Gray ex Torr. | 3 |
| Cobble | 12 | Ephedra fasciculata A. Nels. | 3 |
| Gravel | 5 | Grass spp | 1 |
| Litter (duff) | 51 | Pluchea sericea (Nutt.) Coville | 35 |
| Sand | 15 | | |
| Stone | 10 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Moss (ground) | 1 | 0 | 0 | 0 | 0 |
| Lichen | 1 | 1 | 0 | 0 | 0 |
| Cobble | 15 | 12 | 15 | 11 | 9 |
| Boulder | 8 | 3 | 2 | 5 | 16 |
| Gravel | 22 | 9 | 7 | 8 | 8 |
| Litter (duff) | 20 | 25 | 30 | 25 | 16 |
| Woody debris structure | 1 | 0 | 0 | 0 | 0 |
| Stone | 13 | 13 | 11 | 12 | 22 |
| Sand | 10 | 24 | 27 | 32 | 20 |
| Bedrock | 6 | 9 | 2 | 3 | 6 |
| Crypto | 1 | 2 | 1 | 0 | 0 |
| Coarse woody debris | 1 | 1 | 3 | 3 | 1 |
| Basal Veg | 1 | 1 | 2 | 1 | 1 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Aristida purpurea Nutt. | 1-5% | | 1-5% | | | | | | | |
| Bouteloua trifida Thurb. | <1% | | | | | | | | | |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | <1% | | | | | | | | | |
| Encelia farinosa Gray ex Torr. | 5-10% | | | | | | | | | |
| Ephedra fasciculata A. Nels. | 1-5% | | | | | | | | | |
| Mammillaria grahamii Engelm. var. grahamii | <1% | | | | | | | | | |
| Opuntia basilaris Engelm. & Bigelow | <1% | | | | | | | | | |
| Pluchea sericea (Nutt.) Coville | 1-5% | | 25-50% | | 25-50% | | 5-10% | | 5-10% | |
| Polypogon viridis (Gouan) Breistr. | | | | | | | <1% | | <1% | |
| Porophyllum gracile Benth. | <1% | | | | | | | | | |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 1

Transect Type: Tamarisk Control

| | | | | | | |
|--------------------------------|-----|-----|-----|-----|-----|---|
| Tamarix ramosissima Ledeb. | | <1% | S+P | <0% | <1% | S |
| Vulpia octoflora (Walt.) Rydb. | <1% | | | | | |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|---------------------------------|---------------|-------------|-------------|
| 5 | Encelia farinosa Gray ex Torr. | 4 | | |
| 15 | Pluchea sericea (Nutt.) Coville | 10 | 6 | |
| 35 | Pluchea sericea (Nutt.) Coville | | | 5 |

Vegetation Structure Data - New

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|---------------------------------|---------------|-------------|-------------|
| 5 | Encelia farinosa Gray ex Torr. | 7 | | |
| 15 | Pluchea sericea (Nutt.) Coville | 9 | 6 | |
| 35 | Pluchea sericea (Nutt.) Coville | | 1 | 1 |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|------|-----------|------|-----------|------|---------|------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 9.17 | 304 | 8.64 | 227 | 8.58 | 224 | 8.80 | 252 |
| 15 | 8.68 | 3999 | 8.78 | 3999 | 8.8 | 3999 | 8.75 | 3999 |
| 25 | 9.13 | 3999 | 9.18 | 3999 | 9.25 | 3999 | 9.19 | 3999 |
| 35 | 9.6 | 3999 | 9.39 | 3999 | 9.38 | 3999 | 9.46 | 3999 |
| 45 | 8.84 | 2854 | 8.76 | 2836 | 8.67 | 2784 | 8.76 | 2825 |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 2

Transect Type: Tamarisk Area

| | Start point | | End point |
|-------------------------------|---|---------------------------|------------------|
| Easting: | 388400 | Easting: | 388378 |
| Northing: | 3999880 | Northing: | 3999836 |
| GPS accuracy (m): | 2.6 | GPS accuracy (m): | 1.3 |
| Elevation (m): | 725 | Elevation (m): | 726 |
| Bearing: | 206 | | |
| Aspect (0-360): | 221 | Slope (degrees): | 3 |
| Transect description: | Transect start point is on an open terrace along creek left on a 1x.5m boulder just upstream of a dense patch of BACSAL. Transect stretches through the BACSAL to the end point which is downstream with a bearing of 208. The BACSAL patch is on the terrace just off the creek. The transect end point is 1m downslope of a sizable tamarisk dead stump, in a small break within the dense BACSAL patch. There is a 1.5x.75m boulder in the middle of the creek perpendicular to where the end point is on the terrace | | |
| Additional Info:: | Bench co-dominated by mature TAMRAM and BACEMO. | | |
| Geological layer: | Canyon walls are Vishnu schist with occasional granite outcrop. | | |
| Habitat type: | Riparian | | |
| Dominant species: | Baccharis emoryi Gray, Baccharis salicifolia (Ruiz & Pavón) Pers., Bromus rubens L., Salix exigua Nutt., Tamarix ramosissima Ledeb. | | |
| Associated species: | Acacia greggii Gray, Aristida spp., Baccharis salicifolia (Ruiz & Pavón) Pers., Camissonia chamaenerioides (Gray) Raven, Cirsium neomexicanum Gray, Cryptantha maritima (Greene) Greene, Cryptantha spp., Cryptobiotic soil, Dasyochloa pulchella (Kunth) Willd. ex Rydb., Encelia farinosa Gray ex Torr., Ephedra fasciculata A. Nels., Eragrostis cilianensis (All.) Vign. ex Janchen, Isocoma acradenia (Greene) Greene, Iva acerosa (Nutt.) R.C. Jackson, Machaeranthera pinnatifida (Hook.) Shinnery, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Parietaria hespera Hinton, Phragmites australis (Cav.) Trin. ex Steud., Plantago ovata Forsk., Plantago patagonica Jacq., Polypogon viridis (Gouan) Breistr., Sporobolus cryptandrus (Torr.) Gray, Thymophylla pentachaeta (DC.) Small, Trixis californica Kellogg, Vulpia microstachys (Nutt.) Munro | | |
| Surface water within 25m? | <input checked="" type="checkbox"/> Surface water type: | | |
| Landform: Terrace | Drainage channel | Surface rocks: sandstone | schist |
| Soil type: sandy loam | loamy sand | Topo position: Interfluve | |
| Light exposure: partial-shade | open | Soil moisture: dry | |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 2

Transect Type: Tamarisk Area

Date: 5/13/2005 Revisit? Pre-tamarisk removal

Recorder: Chris Murphy Reader: Kate Watters

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

Weather: <15% clouds, stable, low breeze

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--|----------------|
| Boulder | 1 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 63 |
| Cobble | 4 | Salix exigua Nutt. | 17 |
| Gravel | 3 | Sporobolus cryptandrus (Torr.) Gray | 1 |
| Litter (duff) | 89 | Tamarix ramosissima Ledeb. | 51 |
| Sand | 16 | | |
| Stone | 2 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Gravel | 36 | 4 | 0 | 1 | 4 |
| Woody debris structure | 0 | 1 | 0 | 1 | 0 |
| Sand | 36 | 1 | 3 | 1 | 4 |
| Coarse woody debris | 0 | 4 | 7 | 4 | 4 |
| Stone | 7 | 4 | 3 | 4 | 4 |
| Cobble | 7 | 4 | 3 | 4 | 4 |
| Litter (duff) | 7 | 80 | 83 | 78 | 80 |
| Boulder | 7 | 4 | 0 | 9 | 1 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Baccharis salicifolia (Ruiz & Pavón) Pers. | 10-25% | | 25-50% | | 10-25% | | <1% | | 25-50% | |
| Bromus rubens L. | <1% | | 1-5% | | 1-5% | | <1% | | 1-5% | |
| Cryptantha maritima (Greene) Greene | | | | | | | | | <1% | |
| Cryptobiotic soil | 5-10% | | <1% | | <1% | | | | | |
| Encelia farinosa Gray ex Torr. | | | <1% | | | | | | | |
| Eragrostis cilianensis (All.) Vign. ex Janchen | | | | | | | | | <1% | |
| Machaeranthera pinnatifida (Hook.) Shinnery | | | <1% | | | | | | | |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 1-5% | | | | <1% | | | | | |
| Muhlenbergia spp. | | | | | | | | | <1% | |
| Salix exigua Nutt. | 1-5% | | 25-50% | | 10-25% | | 1-5% | | <1% | |
| Sporobolus cryptandrus (Torr.) Gray | <1% | | <1% | | | | | | | |
| Tamarix ramosissima Ledeb. | 1-5% | | 10-25% | | 10-25% | | 50-75% | | 10-25% | |
| Trixis californica Kellogg | | | 50-75% | | 1-5% | | | | | |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 2

Transect Type: Tamarisk Area

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|---|---------------|-------------|-------------|
| 5 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 1 | | |
| 5 | Tamarix ramosissima Ledeb. | 3 | | |
| 15 | Salix exigua Nutt. | 2 | 3 | |
| 15 | Tamarix ramosissima Ledeb. | 1 | 2 | |
| 25 | Salix exigua Nutt. | | 2 | 3 |
| 25 | Tamarix ramosissima Ledeb. | 3 | | |
| 35 | Tamarix ramosissima Ledeb. | 1 | 10 | 37 |
| 45 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 5 | | |
| 45 | Tamarix ramosissima Ledeb. | 2 | 23 | 8 |

Vegetation Structure Data - New**Soil Data**

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|--------------|------------------|-----------|------------------|-----------|------------------|-----------|----------------|-----------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0 | | 0 | | 0 | | 0.00 | |
| 15 | 0.03 | | 0.04 | | 0.5 | | 0.19 | |
| 25 | 0.12 | | 0.12 | | 0.01 | | 0.08 | |
| 35 | 0.03 | | 0.04 | | 0.04 | | 0.04 | |
| 45 | 0.01 | | 0.01 | | 0.01 | | 0.01 | |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 2

Transect Type: Tamarisk Area

Date: 5/12/2007 Revisit? Post-tamarisk removal

Recorder: Lisa Hahn Reader: Kate Watters

Wind Speed: Air Temp (F): Cloud Cover: 0

Weather: Few wispy clouds, early in the day, so not too hot yet.

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--|----------------|
| Boulder | 2 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 60 |
| Coarse woody debris | 1 | Bromus rubens L. | 1 |
| Litter (duff) | 88 | Salix exigua Nutt. | 6 |
| Sand | 8 | Tamarix ramosissima Ledeb. | 1 |
| Stone | 1 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Basal Veg | 2 | 3 | 2 | 1 | 1 |
| Crypto | 10 | 1 | 1 | 0 | 0 |
| Sand | 20 | 10 | 10 | 9 | 10 |
| Woody debris structure | 0 | 1 | 0 | 3 | 1 |
| Coarse woody debris | 1 | 2 | 4 | 5 | 6 |
| Boulder | 6 | 7 | 7 | 11 | 1 |
| Water | 1 | 2 | 0 | 0 | 1 |
| Cobble | 15 | 3 | 1 | 3 | 7 |
| Litter (duff) | 22 | 52 | 68 | 54 | 57 |
| Stone | 14 | 9 | 7 | 12 | 13 |
| Moss (ground) | 1 | 0 | 0 | 0 | 0 |
| Gravel | 8 | 10 | 0 | 2 | 3 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Aristida purpurea Nutt. | <1% | | | | | | | | | |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | 25-50% | | 25-50% | | 25-50% | | 1-5% | | 10-25% | |
| Bouteloua trifida Thurb. | <1% | | | | | | | | | |
| Cryptantha spp. | <1% | | | | | | | | | |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 1-5% | | | | | | | | | |
| Salix exigua Nutt. | 1-5% | | 25-50% | | 10-25% | | 1-5% | | 1-5% | |
| Sporobolus cryptandrus (Torr.) Gray | 1-5% | | | | | | | | | |
| Stephanomeria pauciflora (Torr.) A. Nels. | <1% | | | | | | | | | |
| Tamarix ramosissima Ledeb. | <1% | S | 1-5% | S+P | <1% | P | <1% | S | <1% | P |
| Trixis californica Kellogg | | | | | <1% | | | | | |
| Vulpia octoflora (Walt.) Rydb. | <1% | | | | | | | | | |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 2

Transect Type: Tamarisk Area

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|---|---------------|-------------|-------------|
| 15 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 3 | 8 | |
| 25 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 3 | 6 | |
| 25 | Salix exigua Nutt. | | | 12 |
| 45 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 2 | | |

Vegetation Structure Data - New

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|---|---------------|-------------|-------------|
| 5 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 1 | 2 | |
| 15 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 8 | 9 | 3 |
| 15 | Tamarix ramosissima Ledeb. | | 3 | |
| 25 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 3 | 8 | 6 |
| 45 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 2 | 1 | |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|--------------|------------------|-----------|------------------|-----------|------------------|-----------|----------------|-----------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 6.86 | 736 | 9.95 | 762 | 7.1 | 724 | 7.97 | 741 |
| 15 | 8.31 | 3999 | 8.59 | 3999 | 8.67 | 3999 | 8.52 | 3999 |
| 25 | 8.53 | 3999 | 8.62 | 3999 | 8.46 | 3999 | 8.54 | 3999 |
| 35 | 8.1 | 3467 | 8.14 | 3444 | 8.15 | 3477 | 8.13 | 3463 |
| 45 | 8.36 | 1444 | 8.46 | 1459 | 8.5 | 1486 | 8.44 | 1463 |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 2

Transect Type: Tamarisk Area

Date: 5/13/2005 Revisit? Pre-tamarisk removal

Recorder: Chris Murphy Reader: Kate Watters

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

Weather: <15% clouds, stable, low breeze

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--|----------------|
| Boulder | 1 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 63 |
| Cobble | 4 | Salix exigua Nutt. | 17 |
| Gravel | 3 | Sporobolus cryptandrus (Torr.) Gray | 1 |
| Litter (duff) | 89 | Tamarix ramosissima Ledeb. | 51 |
| Sand | 16 | | |
| Stone | 2 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Gravel | 36 | 4 | 0 | 1 | 4 |
| Woody debris structure | 0 | 1 | 0 | 1 | 0 |
| Sand | 36 | 1 | 3 | 1 | 4 |
| Coarse woody debris | 0 | 4 | 7 | 4 | 4 |
| Stone | 7 | 4 | 3 | 4 | 4 |
| Cobble | 7 | 4 | 3 | 4 | 4 |
| Litter (duff) | 7 | 80 | 83 | 78 | 80 |
| Boulder | 7 | 4 | 0 | 9 | 1 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Baccharis salicifolia (Ruiz & Pavón) Pers. | 10-25% | | 25-50% | | 10-25% | | <1% | | 25-50% | |
| Bromus rubens L. | <1% | | 1-5% | | 1-5% | | <1% | | 1-5% | |
| Cryptantha maritima (Greene) Greene | | | | | | | | | <1% | |
| Cryptobiotic soil | 5-10% | | <1% | | <1% | | | | | |
| Encelia farinosa Gray ex Torr. | | | <1% | | | | | | | |
| Eragrostis cilianensis (All.) Vign. ex Janchen | | | | | | | | | <1% | |
| Machaeranthera pinnatifida (Hook.) Shinnery | | | <1% | | | | | | | |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 1-5% | | | | <1% | | | | | |
| Muhlenbergia spp. | | | | | | | | | <1% | |
| Salix exigua Nutt. | 1-5% | | 25-50% | | 10-25% | | 1-5% | | <1% | |
| Sporobolus cryptandrus (Torr.) Gray | <1% | | <1% | | | | | | | |
| Tamarix ramosissima Ledeb. | 1-5% | | 10-25% | | 10-25% | | 50-75% | | 10-25% | |
| Trixis californica Kellogg | | | 50-75% | | 1-5% | | | | | |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 2

Transect Type: Tamarisk Area

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|---|---------------|-------------|-------------|
| 5 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 1 | | |
| 5 | Tamarix ramosissima Ledeb. | 3 | | |
| 15 | Salix exigua Nutt. | 2 | 3 | |
| 15 | Tamarix ramosissima Ledeb. | 1 | 2 | |
| 25 | Salix exigua Nutt. | | 2 | 3 |
| 25 | Tamarix ramosissima Ledeb. | 3 | | |
| 35 | Tamarix ramosissima Ledeb. | 1 | 10 | 37 |
| 45 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 5 | | |
| 45 | Tamarix ramosissima Ledeb. | 2 | 23 | 8 |

Vegetation Structure Data - New**Soil Data**

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|--------------|------------------|-----------|------------------|-----------|------------------|-----------|----------------|-----------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0 | | 0 | | 0 | | 0.00 | |
| 15 | 0.03 | | 0.04 | | 0.5 | | 0.19 | |
| 25 | 0.12 | | 0.12 | | 0.01 | | 0.08 | |
| 35 | 0.03 | | 0.04 | | 0.04 | | 0.04 | |
| 45 | 0.01 | | 0.01 | | 0.01 | | 0.01 | |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 2

Transect Type: Tamarisk Area

Date: 5/12/2007 Revisit? Post-tamarisk removal
 Recorder: Lisa Hahn Reader: Kate Watters
 Wind Speed: Air Temp (F): Cloud Cover: 0
 Weather: Few wispy clouds, early in the day, so not too hot yet.

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--|----------------|
| Boulder | 2 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 60 |
| Coarse woody debris | 1 | Bromus rubens L. | 1 |
| Litter (duff) | 88 | Salix exigua Nutt. | 6 |
| Sand | 8 | Tamarix ramosissima Ledeb. | 1 |
| Stone | 1 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Basal Veg | 2 | 3 | 2 | 1 | 1 |
| Crypto | 10 | 1 | 1 | 0 | 0 |
| Sand | 20 | 10 | 10 | 9 | 10 |
| Woody debris structure | 0 | 1 | 0 | 3 | 1 |
| Coarse woody debris | 1 | 2 | 4 | 5 | 6 |
| Boulder | 6 | 7 | 7 | 11 | 1 |
| Water | 1 | 2 | 0 | 0 | 1 |
| Cobble | 15 | 3 | 1 | 3 | 7 |
| Litter (duff) | 22 | 52 | 68 | 54 | 57 |
| Stone | 14 | 9 | 7 | 12 | 13 |
| Moss (ground) | 1 | 0 | 0 | 0 | 0 |
| Gravel | 8 | 10 | 0 | 2 | 3 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Aristida purpurea Nutt. | <1% | | | | | | | | | |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | 25-50% | | 25-50% | | 25-50% | | 1-5% | | 10-25% | |
| Bouteloua trifida Thurb. | <1% | | | | | | | | | |
| Cryptantha spp. | <1% | | | | | | | | | |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 1-5% | | | | | | | | | |
| Salix exigua Nutt. | 1-5% | | 25-50% | | 10-25% | | 1-5% | | 1-5% | |
| Sporobolus cryptandrus (Torr.) Gray | 1-5% | | | | | | | | | |
| Stephanomeria pauciflora (Torr.) A. Nels. | <1% | | | | | | | | | |
| Tamarix ramosissima Ledeb. | <1% | S | 1-5% | S+P | <1% | P | <1% | S | <1% | P |
| Trixis californica Kellogg | | | | | <1% | | | | | |
| Vulpia octoflora (Walt.) Rydb. | <1% | | | | | | | | | |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 2

Transect Type: Tamarisk Area

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|---|---------------|-------------|-------------|
| 15 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 3 | 8 | |
| 25 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 3 | 6 | |
| 25 | Salix exigua Nutt. | | | 12 |
| 45 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 2 | | |

Vegetation Structure Data - New

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|---|---------------|-------------|-------------|
| 5 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 1 | 2 | |
| 15 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 8 | 9 | 3 |
| 15 | Tamarix ramosissima Ledeb. | | 3 | |
| 25 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 3 | 8 | 6 |
| 45 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 2 | 1 | |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|--------------|------------------|-----------|------------------|-----------|------------------|-----------|----------------|-----------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 6.86 | 736 | 9.95 | 762 | 7.1 | 724 | 7.97 | 741 |
| 15 | 8.31 | 3999 | 8.59 | 3999 | 8.67 | 3999 | 8.52 | 3999 |
| 25 | 8.53 | 3999 | 8.62 | 3999 | 8.46 | 3999 | 8.54 | 3999 |
| 35 | 8.1 | 3467 | 8.14 | 3444 | 8.15 | 3477 | 8.13 | 3463 |
| 45 | 8.36 | 1444 | 8.46 | 1459 | 8.5 | 1486 | 8.44 | 1463 |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 2

Transect Type: Tamarisk Control

| | Start point | | End point |
|----------------------------|---|---------------------|------------------|
| Easting: | 388443 | Easting: | 388423 |
| Northing: | 3999957 | Northing: | 3999914 |
| GPS accuracy (m): | 2.4 | GPS accuracy (m): | 6 |
| Elevation (m): | 735 | Elevation (m): | |
| Bearing: | 190 | | |
| Aspect (0-360): | 211 | Slope (degrees): | 3 |
| Transect description: | transect starts on creek left about 600m from the mouth or creek about 130m up creek from where the creek makes a sharp turn around a rocky delta. The start point is about 5m from edge of creek about 1.5m up on a schist wall, about 2m below an agave clump and just above a seep willow. Transect runs along the terrace, toward a pink granite boulder on far downcreek slope, staying 5.8m from creek edge. We went by previous photo bearing of 190 degrees to line out transect-the line is further from the creek than in 2005. Use the 2007 line out for future transects. | | |
| Additional Info:: | Start point is on creek left about 30cm above ground in crack in schist - just below AGAUTA. Start is about 3m from edge of creek. Across creek is 2m tall cut bank - and about 25m down canyon from large flat schist slanted into creek. Could not find any nearby area without TAMRAM so chose this with only limited numbers. | | |
| Geological layer: | Schist | | |
| Habitat type: | Riparian | | |
| Dominant species: | Baccharis emoryi Gray, Baccharis salicifolia (Ruiz & Pavón) Pers., Isocoma acradenia (Greene) Greene | | |
| Associated species: | Acacia greggii Gray, Aristida purpurea Nutt., Astragalus spp., Bebbia juncea (Benth.) Greene var. aspera Greene, Bromus rubens L., Camissonia walkeri (A. Nels.) Raven, Chaenactis stevioides Hook. & Arn., Chamaesyce fendleri (Torr. & Gray) Small, Chorizanthe spp., Cryptantha barbiger (Gray) Greene, Cryptantha pterocarya (Torr.) Greene, Cryptantha spp., Cryptobiotic soil, Cynodon dactylon (L.) Pers., Draba cuneifolia Nutt. ex Torr. & Gray, Encelia farinosa Gray ex Torr., Equisetum ×ferrissii Clute (pro sp.), Eucrypta micrantha (Torr.) Heller, Galium aparine L., Gilia spp., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Isocoma acradenia (Greene) Greene, Iva acerosa (Nutt.) R.C. Jackson, Lepidium lasiocarpum Nutt. var. lasiocarpum, Linanthus bigelovii (Gray) Greene, Mammillaria grahamii Engelm. var. grahamii, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Opuntia basilaris Engelm. & Bigelow, Porophyllum gracile Benth., Pseudognaphalium stramineum (Kunth) W.A. Weber, Rafinesquia neomexicana Gray, Salix exigua Nutt., Stylocline micropoides Gray, Tamarix ramosissima Ledeb., Typha latifolia L., Vulpia microstachys (Nutt.) Munro | | |
| Surface water within 25m? | <input checked="" type="checkbox"/> | Surface water type: | |
| Landform: Drainage channel | Terrace | Surface rocks: | cobbles schist |
| Soil type: sand | loamy sand | Topo position: | Step in Slope |
| Light exposure: open | partial-shade | Soil moisture: | moist dry |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 2

Transect Type: Tamarisk Control

Date: 5/13/2005 Revisit? Pre-tamarisk removal

Recorder: Lori Makarick Reader: Lisa Hahn

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

Weather: No clouds, clear sky, getting warmer, to 80F

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|--|----------------|
| Bedrock | 1 | Baccharis emoryi Gray | 83 |
| Boulder | 3 | Cryptobiotic soil | 4 |
| Cobble | 15 | Draba cuneifolia Nutt. ex Torr. & Gray | 1 |
| Gravel | 16 | Isocoma acradenia (Greene) Greene | 2 |
| Litter (duff) | 74 | Plantago patagonica Jacq. | 1 |
| Sand | 53 | Salix exigua Nutt. | 1 |
| Stone | 14 | Tamarix ramosissima Ledeb. | 15 |
| Woody debris structure | 10 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Stone | 14 | 7 | 25 | 16 | 19 |
| Boulder | 2 | 3 | 5 | 7 | 8 |
| Litter (duff) | 14 | 33 | 41 | 33 | 19 |
| Bedrock | 2 | 0 | 0 | 0 | 0 |
| Woody debris structure | 2 | 7 | 5 | 7 | 8 |
| Gravel | 30 | 3 | 2 | 7 | 19 |
| Cobble | 6 | 15 | 11 | 16 | 19 |
| Sand | 30 | 33 | 11 | 16 | 8 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | <1% | | | | | | <1% | | | |
| Aristida purpurea Nutt. | | | | | <1% | | <1% | | <1% | |
| Astragalus spp. | | | | | | | 25-50% | | | |
| Baccharis emoryi Gray | | 10-25% | | 25-50% | | 50-75% | | 50-75% | | 10-25% |
| Bromus rubens L. | <1% | | <1% | | | | <1% | | <1% | |
| Camissonia walkeri (A. Nels.) Raven | | | | | <1% | | | | | |
| Chaenactis stevioides Hook. & Arn. | | | | | | | | | <1% | |
| Chamaesyce fendleri (Torr. & Gray) Small | <1% | | | | | | | | | |
| Chorizanthe spp. | | | | | | | | | <1% | |
| Cryptantha barbigera (Gray) Greene | <1% | | 1-5% | | | | | | <1% | |
| Cryptantha maritima (Greene) Greene | <1% | | <1% | | | | | | | |
| Cryptantha pterocarya (Torr.) Greene | | | <1% | | | | <1% | | | |
| Cryptantha spp. | <1% | | <1% | | <1% | | <1% | | <1% | |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 2

Transect Type: Tamarisk Control

| | | | | | |
|--|--------|--------|--------|-------|--------|
| Cryptobiotic soil | 5-10% | 5-10% | 10-25% | 5-10% | 10-25% |
| <i>Draba cuneifolia</i> Nutt. ex Torr. & Gray | <1% | | | | |
| <i>Encelia farinosa</i> Gray ex Torr. | <1% | | <1% | | |
| <i>Equisetum</i> × <i>ferrissii</i> Clute (pro sp.) | | | <1% | | |
| <i>Eucrypta micrantha</i> (Torr.) Heller | <1% | | | | |
| <i>Galium aparine</i> L. | <1% | <1% | | | |
| <i>Gilia</i> spp. | <1% | <1% | | | |
| <i>Gutierrezia sarothrae</i> (Pursh) Britt. & Rusby | | | | <1% | |
| <i>Isocoma acradenia</i> (Greene) Greene | 25-50% | <1% | <1% | <1% | <1% |
| <i>Iva acerosa</i> (Nutt.) R.C. Jackson | | 1-5% | <1% | | |
| <i>Linanthus bigelovii</i> (Gray) Greene | <1% | | | | |
| <i>Mammillaria grahamii</i> Engelm. var. <i>grahamii</i> | <1% | | | | |
| <i>Muhlenbergia asperifolia</i> (Nees & Meyen ex Trin.) Parodi | | 5-10% | 5-10% | 1-5% | <1% |
| <i>Pluchea sericea</i> (Nutt.) Coville | | | | | <1% |
| <i>Salix exigua</i> Nutt. | | 1-5% | 1-5% | 1-5% | |
| <i>Sporobolus cryptandrus</i> (Torr.) Gray | | | | <1% | <1% |
| <i>Stylocline micropoides</i> Gray | <1% | <1% | | | <1% |
| <i>Tamarix ramosissima</i> Ledeb. | 5-10% | 10-25% | 5-10% | 1-5% | 10-25% |
| <i>Typha latifolia</i> L. | | <1% | <1% | | |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|-----------------------------------|---------------|-------------|-------------|
| 5 | <i>Baccharis emoryi</i> Gray | 8 | 2 | |
| 15 | <i>Tamarix ramosissima</i> Ledeb. | 1 | | |
| 25 | <i>Baccharis emoryi</i> Gray | 3 | | |
| 35 | <i>Baccharis emoryi</i> Gray | 5 | 2 | |
| 45 | <i>Tamarix ramosissima</i> Ledeb. | 5 | | |

Vegetation Structure Data - New

Soil Data

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 2

Transect Type: Tamarisk Control

Date: 5/12/2007 Revisit? Post-tamarisk removal
 Recorder: Amy Prince Reader: Lori Makarick
 Wind Speed: Air Temp (F): Cloud Cover: 0
 Weather: 0% clouds, sunny, very warm

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--|----------------|
| Bedrock | 2 | Aristida adscensionis L. | 1 |
| Boulder | 9 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 37 |
| Coarse woody debris | 3 | Encelia farinosa Gray ex Torr. | 1 |
| Cobble | 2 | Isocoma acradenia (Greene) Greene | 23 |
| Gravel | 7 | Salix exigua Nutt. | 2 |
| Litter (duff) | 48 | Tamarix ramosissima Ledeb. | 2 |
| Moss (ground) | 4 | | |
| Sand | 19 | | |
| Stone | 6 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Litter (duff) | 26 | 39 | 34 | 16 | 7 |
| Moss (ground) | 0 | 8 | 9 | 8 | 1 |
| Crypto | 3 | 6 | 3 | 4 | 5 |
| Stone | 7 | 4 | 3 | 20 | 19 |
| Sand | 19 | 15 | 5 | 8 | 10 |
| Bedrock | 20 | 0 | 17 | 0 | 0 |
| Cobble | 5 | 8 | 5 | 10 | 14 |
| Coarse woody debris | 8 | 12 | 4 | 6 | 2 |
| Woody debris structure | 0 | 3 | 1 | 0 | 0 |
| Gravel | 9 | 3 | 6 | 14 | 31 |
| Boulder | 2 | 0 | 1 | 13 | 10 |
| Basal Veg | 1 | 2 | 2 | 1 | 1 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Aristida adscensionis L. | | | <1% | | | | <1% | | | |
| Aristida arizonica Vasey | <1% | | | | | | | | | |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | 5-10% | | 10-25% | | 50-75% | | 1-5% | | | |
| Bromus rubens L. | | | <1% | | | | | | | |
| Cryptantha spp. | | | <1% | | | | <1% | | <1% | |
| Echinocereus engelmannii (Parry ex Engelm.) Lem. | | | | | | | | | <1% | |
| Encelia farinosa Gray ex Torr. | <1% | | | | | | 1-5% | | 1-5% | |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 2

Transect Type: Tamarisk Control

| | | | | |
|--|--------|------|------|-------|
| Eriogonum deflexum Torr. | <1% | | | |
| forb spp | <1% | | | |
| Galium stellatum Kellogg | <1% | | | |
| Isocoma acradenia (Greene) Greene | 25-50% | 1-5% | 1-5% | 5-10% |
| Mammillaria grahamii Engelm. var. grahamii | <1% | | | |
| Opuntia basilaris Engelm. & Bigelow | | | <1% | |
| Pluchea sericea (Nutt.) Coville | | | | 1-5% |
| Salix exigua Nutt. | | 1-5% | 1-5% | |
| Sporobolus cryptandrus (Torr.) Gray | | | <1% | 1-5% |
| Stephanomeria pauciflora (Torr.) A. Nels. | <1% | | | |
| Tamarix ramosissima Ledeb. | <1% | | <1% | <1% |
| Vulpia microstachys (Nutt.) Munro | | | <1% | <1% |
| Vulpia octoflora (Walt.) Rydb. | | <1% | | |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|--|---------------|-------------|-------------|
| 5 | Isocoma acradenia (Greene) Greene | 17 | | |
| 15 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 8 | | |
| 25 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 7 | 27 | 6 |

Vegetation Structure Data - New

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|--|---------------|-------------|-------------|
| 5 | Isocoma acradenia (Greene) Greene | 8 | | |
| 15 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 4 | | |
| 25 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 4 | 10 | 7 |
| 45 | Isocoma acradenia (Greene) Greene | 3 | | |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|--------------|------------------|-----------|------------------|-----------|------------------|-----------|----------------|-----------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 8.1 | 698 | 8.65 | 586 | 8.67 | 607 | 8.47 | 630 |
| 15 | 8.75 | 478 | 8.89 | 487 | 8.91 | 498 | 8.85 | 488 |
| 25 | 8.89 | 153 | 9.05 | 156 | 9.01 | 156 | 8.98 | 155 |
| 35 | 8.87 | 168 | 8.88 | 171 | 8.87 | 172 | 8.87 | 170 |
| 45 | 8.57 | 279 | 8.61 | 283 | 8.71 | 285 | 8.63 | 282 |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 2

Transect Type: Tamarisk Control

Date: 5/13/2005 Revisit? Pre-tamarisk removal

Recorder: Lori Makarick Reader: Lisa Hahn

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

Weather: No clouds, clear sky, getting warmer, to 80F

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|--|----------------|
| Bedrock | 1 | Baccharis emoryi Gray | 83 |
| Boulder | 3 | Cryptobiotic soil | 4 |
| Cobble | 15 | Draba cuneifolia Nutt. ex Torr. & Gray | 1 |
| Gravel | 16 | Isocoma acradenia (Greene) Greene | 2 |
| Litter (duff) | 74 | Plantago patagonica Jacq. | 1 |
| Sand | 53 | Salix exigua Nutt. | 1 |
| Stone | 14 | Tamarix ramosissima Ledeb. | 15 |
| Woody debris structure | 10 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Stone | 14 | 7 | 25 | 16 | 19 |
| Boulder | 2 | 3 | 5 | 7 | 8 |
| Litter (duff) | 14 | 33 | 41 | 33 | 19 |
| Bedrock | 2 | 0 | 0 | 0 | 0 |
| Woody debris structure | 2 | 7 | 5 | 7 | 8 |
| Gravel | 30 | 3 | 2 | 7 | 19 |
| Cobble | 6 | 15 | 11 | 16 | 19 |
| Sand | 30 | 33 | 11 | 16 | 8 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | <1% | | | | | | <1% | | | |
| Aristida purpurea Nutt. | | | | | <1% | | <1% | | <1% | |
| Astragalus spp. | | | | | | | 25-50% | | | |
| Baccharis emoryi Gray | | 10-25% | | 25-50% | | 50-75% | | 50-75% | | 10-25% |
| Bromus rubens L. | <1% | | <1% | | | | <1% | | <1% | |
| Camissonia walkeri (A. Nels.) Raven | | | | | <1% | | | | | |
| Chaenactis stevioides Hook. & Arn. | | | | | | | | | <1% | |
| Chamaesyce fendleri (Torr. & Gray) Small | <1% | | | | | | | | | |
| Chorizanthe spp. | | | | | | | | | <1% | |
| Cryptantha barbigera (Gray) Greene | <1% | | 1-5% | | | | | | <1% | |
| Cryptantha maritima (Greene) Greene | <1% | | <1% | | | | | | | |
| Cryptantha pterocarya (Torr.) Greene | | | <1% | | | | <1% | | | |
| Cryptantha spp. | <1% | | <1% | | <1% | | <1% | | <1% | |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 2

Transect Type: Tamarisk Control

| | | | | | |
|--|--------|--------|--------|-------|--------|
| Cryptobiotic soil | 5-10% | 5-10% | 10-25% | 5-10% | 10-25% |
| <i>Draba cuneifolia</i> Nutt. ex Torr. & Gray | <1% | | | | |
| <i>Encelia farinosa</i> Gray ex Torr. | <1% | | <1% | | |
| <i>Equisetum</i> × <i>ferrissii</i> Clute (pro sp.) | | | <1% | | |
| <i>Eucrypta micrantha</i> (Torr.) Heller | <1% | | | | |
| <i>Galium aparine</i> L. | <1% | <1% | | | |
| <i>Gilia</i> spp. | <1% | <1% | | | |
| <i>Gutierrezia sarothrae</i> (Pursh) Britt. & Rusby | | | | <1% | |
| <i>Isocoma acradenia</i> (Greene) Greene | 25-50% | <1% | <1% | <1% | <1% |
| <i>Iva acerosa</i> (Nutt.) R.C. Jackson | | 1-5% | <1% | | |
| <i>Linanthus bigelovii</i> (Gray) Greene | <1% | | | | |
| <i>Mammillaria grahamii</i> Engelm. var. <i>grahamii</i> | <1% | | | | |
| <i>Muhlenbergia asperifolia</i> (Nees & Meyen ex Trin.) Parodi | | 5-10% | 5-10% | 1-5% | <1% |
| <i>Pluchea sericea</i> (Nutt.) Coville | | | | | <1% |
| <i>Salix exigua</i> Nutt. | | 1-5% | 1-5% | 1-5% | |
| <i>Sporobolus cryptandrus</i> (Torr.) Gray | | | | <1% | <1% |
| <i>Stylocline micropoides</i> Gray | <1% | <1% | | | <1% |
| <i>Tamarix ramosissima</i> Ledeb. | 5-10% | 10-25% | 5-10% | 1-5% | 10-25% |
| <i>Typha latifolia</i> L. | | <1% | <1% | | |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|-----------------------------------|---------------|-------------|-------------|
| 5 | <i>Baccharis emoryi</i> Gray | 8 | 2 | |
| 15 | <i>Tamarix ramosissima</i> Ledeb. | 1 | | |
| 25 | <i>Baccharis emoryi</i> Gray | 3 | | |
| 35 | <i>Baccharis emoryi</i> Gray | 5 | 2 | |
| 45 | <i>Tamarix ramosissima</i> Ledeb. | 5 | | |

Vegetation Structure Data - New

Soil Data

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 2

Transect Type: Tamarisk Control

Date: 5/12/2007 Revisit? Post-tamarisk removal
 Recorder: Amy Prince Reader: Lori Makarick
 Wind Speed: Air Temp (F): Cloud Cover: 0
 Weather: 0% clouds, sunny, very warm

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--|----------------|
| Bedrock | 2 | Aristida adscensionis L. | 1 |
| Boulder | 9 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 37 |
| Coarse woody debris | 3 | Encelia farinosa Gray ex Torr. | 1 |
| Cobble | 2 | Isocoma acradenia (Greene) Greene | 23 |
| Gravel | 7 | Salix exigua Nutt. | 2 |
| Litter (duff) | 48 | Tamarix ramosissima Ledeb. | 2 |
| Moss (ground) | 4 | | |
| Sand | 19 | | |
| Stone | 6 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Litter (duff) | 26 | 39 | 34 | 16 | 7 |
| Moss (ground) | 0 | 8 | 9 | 8 | 1 |
| Crypto | 3 | 6 | 3 | 4 | 5 |
| Stone | 7 | 4 | 3 | 20 | 19 |
| Sand | 19 | 15 | 5 | 8 | 10 |
| Bedrock | 20 | 0 | 17 | 0 | 0 |
| Cobble | 5 | 8 | 5 | 10 | 14 |
| Coarse woody debris | 8 | 12 | 4 | 6 | 2 |
| Woody debris structure | 0 | 3 | 1 | 0 | 0 |
| Gravel | 9 | 3 | 6 | 14 | 31 |
| Boulder | 2 | 0 | 1 | 13 | 10 |
| Basal Veg | 1 | 2 | 2 | 1 | 1 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Aristida adscensionis L. | | | <1% | | | | <1% | | | |
| Aristida arizonica Vasey | <1% | | | | | | | | | |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | 5-10% | | 10-25% | | 50-75% | | 1-5% | | | |
| Bromus rubens L. | | | <1% | | | | | | | |
| Cryptantha spp. | | | <1% | | | | <1% | | <1% | |
| Echinocereus engelmannii (Parry ex Engelm.) Lem. | | | | | | | | | <1% | |
| Encelia farinosa Gray ex Torr. | <1% | | | | | | 1-5% | | 1-5% | |

Canyon/Park Area: Crystal Creek

River mile: 99 R

Project (Phase): Phase IIa

Transect Name: Crystal Creek 2

Transect Type: Tamarisk Control

| | | | | |
|--|--------|------|------|-------|
| Eriogonum deflexum Torr. | <1% | | | |
| forb spp | <1% | | | |
| Galium stellatum Kellogg | <1% | | | |
| Isocoma acradenia (Greene) Greene | 25-50% | 1-5% | 1-5% | 5-10% |
| Mammillaria grahamii Engelm. var. grahamii | <1% | | | |
| Opuntia basilaris Engelm. & Bigelow | | | <1% | |
| Pluchea sericea (Nutt.) Coville | | | | 1-5% |
| Salix exigua Nutt. | | 1-5% | 1-5% | |
| Sporobolus cryptandrus (Torr.) Gray | | | <1% | 1-5% |
| Stephanomeria pauciflora (Torr.) A. Nels. | <1% | | | |
| Tamarix ramosissima Ledeb. | <1% | | <1% | <1% |
| Vulpia microstachys (Nutt.) Munro | | | <1% | <1% |
| Vulpia octoflora (Walt.) Rydb. | | <1% | | |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|--|---------------|-------------|-------------|
| 5 | Isocoma acradenia (Greene) Greene | 17 | | |
| 15 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 8 | | |
| 25 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 7 | 27 | 6 |

Vegetation Structure Data - New

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|--|---------------|-------------|-------------|
| 5 | Isocoma acradenia (Greene) Greene | 8 | | |
| 15 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 4 | | |
| 25 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 4 | 10 | 7 |
| 45 | Isocoma acradenia (Greene) Greene | 3 | | |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|--------------|------------------|-----------|------------------|-----------|------------------|-----------|----------------|-----------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 8.1 | 698 | 8.65 | 586 | 8.67 | 607 | 8.47 | 630 |
| 15 | 8.75 | 478 | 8.89 | 487 | 8.91 | 498 | 8.85 | 488 |
| 25 | 8.89 | 153 | 9.05 | 156 | 9.01 | 156 | 8.98 | 155 |
| 35 | 8.87 | 168 | 8.88 | 171 | 8.87 | 172 | 8.87 | 170 |
| 45 | 8.57 | 279 | 8.61 | 283 | 8.71 | 285 | 8.63 | 282 |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 1

Transect Type: Tamarisk Area

| | Start point | | End point |
|---------------------------|--|---------------------|------------------|
| Easting: | 422395 | Easting: | 422430 |
| Northing: | 4018009 | Northing: | 4018035 |
| GPS accuracy (m): | 6 | GPS accuracy (m): | 6 |
| Elevation (m): | 888 | Elevation (m): | 886 |
| Bearing: | 43 | | |
| Aspect (0-360): | 40 | Slope (degrees): | 2 |
| Transect description: | T1A starts on an orange, basketball-sized river cobble in the center of the wide mouth of the Nanko drainage, but 20m left of the flowing creek (creek left by 20m). There is a large stump with tammy debris in the first 3m of the transect. The line then runs down canyon towards a young damaged cottonwood tree that is just barely past the 50m mark. The lower end of the transect is starting to erode away in the streambed. | | |
| Additional Info.: | No water in this braid of channel, a few TAMRAM of all age classes. Need to get rest of site information during next reading.(2004) Trail from the lower Nanko camp drops into the canyon just above the start of T1A. On a quiet day you can still hear the river. The purple wall of BA Shale at the mouth of the canyon is just downstream on the left (2007) | | |
| Geological layer: | BA Shale | | |
| Habitat type: | Riparian | GB desert scrub | |
| Dominant species: | Aristida arizonica Vasey, Brickellia longifolia S. Wats., Stephanomeria pauciflora (Torr.) A. Nels., Tamarix ramosissima Ledeb. | | |
| Associated species: | , Aristida purpurea Nutt., Astragalus lentiginosus Dougl. ex Hook., Baccharis emoryi Gray, Bromus rubens L., Camissonia walkeri (A. Nels.) Raven, Encelia resinifera C. Clark ssp. tenuifolia C. Clark, Ephedra spp., Erodium cicutarium (L.) L'Hér. ex Ait., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Nicotiana obtusifolia Mertens & Galeotti var. obtusifolia, Oenothera caespitosa Nutt., Plantago patagonica Jacq., Populus fremontii S. Wats., Sphaeralcea ambigua Gray, Sporobolus flexuosus (Thurb. ex Vasey) Rydb., Stanleya pinnata (Pursh) Britt. | | |
| Surface water within 25m? | <input checked="" type="checkbox"/> | Surface water type: | stream |
| Landform: | Drainage channel | Surface rocks: | shale |
| Soil type: | sand | Topo position: | Interfluve |
| Light exposure: | open | Soil moisture: | dry |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 1

Transect Type: Tamarisk Area

Date: 10/1/2004 Revisit? Pre-tamarisk removal

Recorder: Kari Malen Reader: Suzanne Rhodes

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

Weather: Stormy weather, clouds and overcast

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--|----------------|
| Bare Soil | 55 | Aristida purpurea Nutt. | 2 |
| Cobble | 19 | Brickellia longifolia S. Wats. | 13 |
| Litter (duff) | 25 | Bromus rubens L. | 2 |
| | | Gutierrezia sarothrae (Pursh) Britt. & Rusby | 4 |
| | | Populus fremontii S. Wats. | 5 |
| | | Stephanomeria pauciflora (Torr.) A. Nels. | 6 |
| | | Tamarix ramosissima Ledeb. | 19 |

Daubenmire Scale Cover Data

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Aristida purpurea Nutt. | <1% | | <1% | | 1-5% | | <1% | | | |
| Baccharis emoryi Gray | 1-5% | | | | | | 1-5% | | | |
| Brickellia longifolia S. Wats. | 1-5% | | 1-5% | | 5-10% | | 5-10% | | 5-10% | |
| Bromus rubens L. | 5-10% | | | | | | | | <1% | |
| Ephedra spp. | | | | | 1-5% | | | | | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <1% | | | | | | <1% | | | |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | | | | | 1-5% | | 1-5% | | | |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | | | | | 1-5% | | | | | |
| Populus fremontii S. Wats. | | | | | | | 1-5% | | | |
| Sphaeralcea ambigua Gray | <1% | | | | | | | | | |
| Sporobolus flexuosus (Thurb. ex Vasey) Rydb. | | | | | <1% | | <1% | | 1-5% | |
| Stephanomeria pauciflora (Torr.) A. Nels. | 10-25% | | 1-5% | | 1-5% | | 1-5% | | | |
| Tamarix ramosissima Ledeb. | 25-50% | | 1-5% | | | | | | | |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|--|---------------|-------------|-------------|
| 5 | Tamarix ramosissima Ledeb. | 6 | 1 | |
| 15 | Aristida purpurea Nutt. | 1 | | |
| 15 | Stephanomeria pauciflora (Torr.) A. Nels. | 3 | | |
| 25 | Gutierrezia sarothrae (Pursh) Britt. & Rusby | 1 | | |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 1

Transect Type: Tamarisk Area

Vegetation Structure Data - New

Soil Data

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 1

Transect Type: Tamarisk Area

Date: 5/6/2007 Revisit? Post-tamarisk removal
 Recorder: Steve Till Reader: Kate Watters
 Wind Speed: Air Temp (F): Cloud Cover: 0
 Weather: About 75 F Sunny with a sun halo present

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--|----------------|
| Bare Soil | 3 | Aristida arizonica Vasey | 3 |
| Coarse woody debris | 2 | Brickellia longifolia S. Wats. | 12 |
| Cobble | 8 | Gutierrezia sarothrae (Pursh) Britt. & Rusby | 1 |
| Gravel | 18 | Stephanomeria pauciflora (Torr.) A. Nels. | 12 |
| Lichen | 4 | | |
| Litter (duff) | 13 | | |
| Sand | 43 | | |
| Stone | 9 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Lichen | 0 | 0 | 0 | 0 | 0 |
| Basal Veg | 1 | 1 | 1 | 1 | 1 |
| Stone | 16 | 13 | 20 | 9 | 9 |
| Litter (duff) | 30 | 2 | 17 | 4 | 9 |
| Bedrock | 0 | 0 | 0 | 0 | 0 |
| Gravel | 5 | 28 | 7 | 9 | 35 |
| Crypto | 0 | 0 | 1 | 0 | 0 |
| Coarse woody debris | 10 | 2 | 1 | 1 | 0 |
| Woody debris structure | 3 | 3 | 1 | 4 | 0 |
| Boulder | 3 | 5 | 7 | 5 | 5 |
| Bare Soil | 0 | 0 | 0 | 0 | 0 |
| Water | 0 | 0 | 0 | 0 | 4 |
| Cobble | 14 | 22 | 11 | 7 | 10 |
| Sand | 18 | 24 | 34 | 60 | 27 |
| Moss (ground) | 0 | 0 | 1 | 0 | 0 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | <1% | S | <0% | | <0% | | <0% | | <0% | |
| Aristida arizonica Vasey | <1% | | <1% | | 1-5% | | <1% | | <1% | |
| Artemisia ludoviciana Nutt. | <0% | | <0% | | <1% | | <0% | | <0% | |
| Astragalus nuttallianus DC. | <0% | | <1% | | <0% | | <0% | | <0% | |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | <0% | | <0% | | <0% | | <1% | | <0% | |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 1

Transect Type: Tamarisk Area

| | | | | | |
|---|-------|-------|-------|-------|-------|
| Brickellia longifolia S. Wats. | 1-5% | 1-5% | 5-10% | 5-10% | 5-10% |
| Bromus rubens L. | <1% | <1% | <1% | <0% | <0% |
| Bromus tectorum L. | <0% | <0% | <0% | <0% | <1% |
| Cryptantha spp. | <0% | <0% | <0% | <0% | <1% |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | <1% | <0% | <1% | <0% | <0% |
| Encelia farinosa Gray ex Torr. | <1% | <0% | <0% | <1% | <0% |
| Ephedra fasciculata A. Nels. | <0% | <0% | 1-5% | <0% | <0% |
| Eriogonum inflatum Torr. & Frém. | <1% | <0% | <0% | <0% | <0% |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <1% | <0% | <1% | <0% | <1% |
| Grass spp | <0% | <0% | <0% | <0% | <1% |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | <1% | <1% | 5-10% | 1-5% | <0% |
| Hesperostipa neomexicana (Thurb. ex Coult.) Barkworth | <1% | <0% | 1-5% | 1-5% | <0% |
| Machaeranthera pinnatifida (Hook.) Shinnery | <1% | <0% | <1% | <0% | <1% |
| Mentzelia multiflora (Nutt.) Gray | <0% | <0% | <0% | <0% | <1% |
| Muhlenbergia porteri Scribn. ex Beal | <0% | <0% | 1-5% | <0% | <0% |
| Polypogon monspeliensis (L.) Desf. | <0% | <0% | <0% | <1% | <1% |
| Polypogon viridis (Gouan) Breistr. | <0% | <0% | <0% | <1% | <1% |
| Salix exigua Nutt. | <0% | <0% | <0% | <0% | <1% |
| Salsola tragus L. | <1% | <0% | <0% | <0% | <0% |
| Schismus spp. | <1% | <0% | <1% | <0% | <0% |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | <1% | <0% | <0% | <0% | <0% |
| Sporobolus cryptandrus (Torr.) Gray | <0% | <0% | 1-5% | <0% | 1-5% |
| Stephanomeria pauciflora (Torr.) A. Nels. | 5-10% | 5-10% | 5-10% | 5-10% | <1% |
| Tamarix ramosissima Ledeb. | <1% | <1% | S | <1% | S |
| Thymophylla pentachaeta (DC.) Small | <1% | <0% | <1% | <0% | <1% |

Vegetation Structure Data - Old

Vegetation Structure Data - New

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--|---------------|-------------|-------------|
| 5 Stephanomeria pauciflora (Torr.) A. Nels. | 2 | | |
| 15 Stephanomeria pauciflora (Torr.) A. Nels. | 5 | | |
| 35 Stephanomeria pauciflora (Torr.) A. Nels. | 1 | | |

Soil Data

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 1

Transect Type: Tamarisk Area

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|-----|-----------|-----|-----------|-----|---------|-----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 7.56 | 351 | 7.66 | 327 | 7.66 | 339 | 7.63 | 339 |
| 15 | 7.9 | 344 | 8 | 409 | 7.95 | 395 | 7.95 | 383 |
| 25 | 8.48 | 100 | 8.47 | 100 | 8.45 | 98 | 8.47 | 99 |
| 35 | 8.57 | 121 | 8.64 | 123 | 8.64 | 122 | 8.62 | 122 |
| 45 | 8.35 | 167 | 8.3 | 168 | 8.27 | 177 | 8.31 | 171 |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 1

Transect Type: Tamarisk Area

Date: 10/1/2004 Revisit? Pre-tamarisk removal

Recorder: Kari Malen Reader: Suzanne Rhodes

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

Weather: Stormy weather, clouds and overcast

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--|----------------|
| Bare Soil | 55 | Aristida purpurea Nutt. | 2 |
| Cobble | 19 | Brickellia longifolia S. Wats. | 13 |
| Litter (duff) | 25 | Bromus rubens L. | 2 |
| | | Gutierrezia sarothrae (Pursh) Britt. & Rusby | 4 |
| | | Populus fremontii S. Wats. | 5 |
| | | Stephanomeria pauciflora (Torr.) A. Nels. | 6 |
| | | Tamarix ramosissima Ledeb. | 19 |

Daubenmire Scale Cover Data

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Aristida purpurea Nutt. | <1% | | <1% | | 1-5% | | <1% | | | |
| Baccharis emoryi Gray | 1-5% | | | | | | 1-5% | | | |
| Brickellia longifolia S. Wats. | 1-5% | | 1-5% | | 5-10% | | 5-10% | | 5-10% | |
| Bromus rubens L. | 5-10% | | | | | | | | <1% | |
| Ephedra spp. | | | | | 1-5% | | | | | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <1% | | | | | | <1% | | | |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | | | | | 1-5% | | 1-5% | | | |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | | | | | 1-5% | | | | | |
| Populus fremontii S. Wats. | | | | | | | 1-5% | | | |
| Sphaeralcea ambigua Gray | <1% | | | | | | | | | |
| Sporobolus flexuosus (Thurb. ex Vasey) Rydb. | | | | | <1% | | <1% | | 1-5% | |
| Stephanomeria pauciflora (Torr.) A. Nels. | 10-25% | | 1-5% | | 1-5% | | 1-5% | | | |
| Tamarix ramosissima Ledeb. | 25-50% | | 1-5% | | | | | | | |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|--|---------------|-------------|-------------|
| 5 | Tamarix ramosissima Ledeb. | 6 | 1 | |
| 15 | Aristida purpurea Nutt. | 1 | | |
| 15 | Stephanomeria pauciflora (Torr.) A. Nels. | 3 | | |
| 25 | Gutierrezia sarothrae (Pursh) Britt. & Rusby | 1 | | |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 1

Transect Type: Tamarisk Area

Vegetation Structure Data - New

Soil Data

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 1

Transect Type: Tamarisk Area

Date: 5/6/2007 Revisit? Post-tamarisk removal
 Recorder: Steve Till Reader: Kate Watters
 Wind Speed: Air Temp (F): Cloud Cover: 0
 Weather: About 75 F Sunny with a sun halo present

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--|----------------|
| Bare Soil | 3 | Aristida arizonica Vasey | 3 |
| Coarse woody debris | 2 | Brickellia longifolia S. Wats. | 12 |
| Cobble | 8 | Gutierrezia sarothrae (Pursh) Britt. & Rusby | 1 |
| Gravel | 18 | Stephanomeria pauciflora (Torr.) A. Nels. | 12 |
| Lichen | 4 | | |
| Litter (duff) | 13 | | |
| Sand | 43 | | |
| Stone | 9 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Lichen | 0 | 0 | 0 | 0 | 0 |
| Basal Veg | 1 | 1 | 1 | 1 | 1 |
| Stone | 16 | 13 | 20 | 9 | 9 |
| Litter (duff) | 30 | 2 | 17 | 4 | 9 |
| Bedrock | 0 | 0 | 0 | 0 | 0 |
| Gravel | 5 | 28 | 7 | 9 | 35 |
| Crypto | 0 | 0 | 1 | 0 | 0 |
| Coarse woody debris | 10 | 2 | 1 | 1 | 0 |
| Woody debris structure | 3 | 3 | 1 | 4 | 0 |
| Boulder | 3 | 5 | 7 | 5 | 5 |
| Bare Soil | 0 | 0 | 0 | 0 | 0 |
| Water | 0 | 0 | 0 | 0 | 4 |
| Cobble | 14 | 22 | 11 | 7 | 10 |
| Sand | 18 | 24 | 34 | 60 | 27 |
| Moss (ground) | 0 | 0 | 1 | 0 | 0 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | <1% | S | <0% | | <0% | | <0% | | <0% | |
| Aristida arizonica Vasey | <1% | | <1% | | 1-5% | | <1% | | <1% | |
| Artemisia ludoviciana Nutt. | <0% | | <0% | | <1% | | <0% | | <0% | |
| Astragalus nuttallianus DC. | <0% | | <1% | | <0% | | <0% | | <0% | |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | <0% | | <0% | | <0% | | <1% | | <0% | |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 1

Transect Type: Tamarisk Area

| | | | | | |
|---|-------|-------|-------|-------|-------|
| Brickellia longifolia S. Wats. | 1-5% | 1-5% | 5-10% | 5-10% | 5-10% |
| Bromus rubens L. | <1% | <1% | <1% | <0% | <0% |
| Bromus tectorum L. | <0% | <0% | <0% | <0% | <1% |
| Cryptantha spp. | <0% | <0% | <0% | <0% | <1% |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | <1% | <0% | <1% | <0% | <0% |
| Encelia farinosa Gray ex Torr. | <1% | <0% | <0% | <1% | <0% |
| Ephedra fasciculata A. Nels. | <0% | <0% | 1-5% | <0% | <0% |
| Eriogonum inflatum Torr. & Frém. | <1% | <0% | <0% | <0% | <0% |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <1% | <0% | <1% | <0% | <1% |
| Grass spp | <0% | <0% | <0% | <0% | <1% |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | <1% | <1% | 5-10% | 1-5% | <0% |
| Hesperostipa neomexicana (Thurb. ex Coult.) Barkworth | <1% | <0% | 1-5% | 1-5% | <0% |
| Machaeranthera pinnatifida (Hook.) Shinnery | <1% | <0% | <1% | <0% | <1% |
| Mentzelia multiflora (Nutt.) Gray | <0% | <0% | <0% | <0% | <1% |
| Muhlenbergia porteri Scribn. ex Beal | <0% | <0% | 1-5% | <0% | <0% |
| Polypogon monspeliensis (L.) Desf. | <0% | <0% | <0% | <1% | <1% |
| Polypogon viridis (Gouan) Breistr. | <0% | <0% | <0% | <1% | <1% |
| Salix exigua Nutt. | <0% | <0% | <0% | <0% | <1% |
| Salsola tragus L. | <1% | <0% | <0% | <0% | <0% |
| Schismus spp. | <1% | <0% | <1% | <0% | <0% |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | <1% | <0% | <0% | <0% | <0% |
| Sporobolus cryptandrus (Torr.) Gray | <0% | <0% | 1-5% | <0% | 1-5% |
| Stephanomeria pauciflora (Torr.) A. Nels. | 5-10% | 5-10% | 5-10% | 5-10% | <1% |
| Tamarix ramosissima Ledeb. | <1% | <1% | S | <1% | S |
| Thymophylla pentachaeta (DC.) Small | <1% | <0% | <1% | <0% | <1% |

Vegetation Structure Data - Old

Vegetation Structure Data - New

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--|---------------|-------------|-------------|
| 5 Stephanomeria pauciflora (Torr.) A. Nels. | 2 | | |
| 15 Stephanomeria pauciflora (Torr.) A. Nels. | 5 | | |
| 35 Stephanomeria pauciflora (Torr.) A. Nels. | 1 | | |

Soil Data

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 1

Transect Type: Tamarisk Area

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|-----|-----------|-----|-----------|-----|---------|-----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 7.56 | 351 | 7.66 | 327 | 7.66 | 339 | 7.63 | 339 |
| 15 | 7.9 | 344 | 8 | 409 | 7.95 | 395 | 7.95 | 383 |
| 25 | 8.48 | 100 | 8.47 | 100 | 8.45 | 98 | 8.47 | 99 |
| 35 | 8.57 | 121 | 8.64 | 123 | 8.64 | 122 | 8.62 | 122 |
| 45 | 8.35 | 167 | 8.3 | 168 | 8.27 | 177 | 8.31 | 171 |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 1

Transect Type: Tamarisk Control

| | Start point | | End point |
|----------------------------|--|---------------------------|------------------|
| Easting: | 422372 | Easting: | 422418 |
| Northing: | 4018045 | Northing: | 4918065 |
| GPS accuracy (m): | 5.6 | GPS accuracy (m): | 1.7 |
| Elevation (m): | 883 | Elevation (m): | 884 |
| Bearing: | 61 | | |
| Aspect (0-360): | 61 | Slope (degrees): | 2 |
| Transect description: | Top and bottom are at driftwood logs. Transect 1B is located 25m left of and parallel to 1A at about the same level canyon slope. Top is on limestone boulder at a high point next to an ancient driftwood pile. A large ACENEG is located to the left of the transect at 15m mark. Start boulder has a dimple in the top (see photo). Bottom is a red sandstone boulder next to a log 30cm x 1.5m. Top and bottom are marked with red veg knob. | | |
| Additional Info.: | Higher on debris fan, through boulder field. | | |
| Geological layer: | Muav limestone / Bright Angel Shale | | |
| Habitat type: | Riparian | GB desert scrub | |
| Dominant species: | Aristida purpurea Nutt., Encelia farinosa Gray ex Torr., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Stephanomeria pauciflora (Torr.) A. Nels., Thymophylla pentachaeta (DC.) Small | | |
| Associated species: | Acacia greggii Gray, Aristida spp., Artemisia ludoviciana Nutt., Bouteloua eriopoda (Torr.) Torr., Brickellia longifolia S. Wats., Bromus rubens L., Cercis orbiculata Greene, Dasyochloa pulchella (Kunth) Willd. ex Rydb., Ephedra nevadensis S. Wats., Eriogonum inflatum Torr. & Frém., Erodium cicutarium (L.) L'Hér. ex Ait., Fallugia paradoxa (D. Don) Endl. ex Torr., Lepidium lasiocarpum Nutt. var. lasiocarpum, Machaeranthera pinnatifida (Hook.) Shinn. & Gardner, Muhlenbergia porteri Scribn. ex Beal, Opuntia basilaris Engelm. & Bigelow, Opuntia erinacea Engelm. & Bigelow ex Engelm., Sphaeralcea ambigua Gray, Sporobolus flexuosus (Thurb. ex Vasey) Rydb., Thamnosma montana Torr. & Frém., Tiquilia latior (I.M. Johnston) A. Richards. | | |
| Surface water within 25m? | <input type="checkbox"/> | Surface water type: | |
| Landform: Drainage channel | | Surface rocks: sandstone | limestone |
| Soil type: sand | | Topo position: Interfluve | |
| Light exposure: open | | Soil moisture: dry | |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 1

Transect Type: Tamarisk Control

Date: 10/2/2004 Revisit? Pre-tamarisk removal
 Recorder: Kari Malen Reader: Suzanne Rhodes
 Wind Speed: Air Temp (F): Cloud Cover:
 Weather: Stormy weather, clouds and overcast

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|--|----------------|
| Bare Soil | 24 | Acacia greggii Gray | 2 |
| Cobble | 52 | Aristida purpurea Nutt. | 1 |
| Litter (duff) | 12 | Aristida spp. | 2 |
| Woody debris structure | 1 | Bouteloua eriopoda (Torr.) Torr. | 5 |
| | | Bromus rubens L. | 8 |
| | | Cryptobiotic soil | 10 |
| | | Encelia farinosa Gray ex Torr. | 1 |
| | | Gutierrezia sarothrae (Pursh) Britt. & Rusby | 2 |
| | | Stephanomeria pauciflora (Torr.) A. Nels. | 4 |
| | | Thymophylla pentachaeta (DC.) Small | 2 |

Daubenmire Scale Cover Data

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | | | 5-10% | | <1% | | | | | |
| Aristida spp. | 1-5% | | 1-5% | | | | <1% | | 1-5% | |
| Bouteloua eriopoda (Torr.) Torr. | 1-5% | | <1% | | 1-5% | | <1% | | | |
| Brickellia longifolia S. Wats. | | | | | | | <1% | | | |
| Bromus rubens L. | | | <1% | | 1-5% | | 1-5% | | <1% | |
| Encelia farinosa Gray ex Torr. | <1% | | <1% | | 1-5% | | <1% | | 1-5% | |
| Ephedra nevadensis S. Wats. | | | | | 1-5% | | | | | |
| Eriogonum inflatum Torr. & Frém. | | | 1-5% | | | | | | <1% | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | | | | <1% | | | | | |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | 1-5% | | 5-10% | | 1-5% | | 1-5% | | <1% | |
| Machaeranthera pinnatifida (Hook.) Shinnery | | | | | 1-5% | | | | | |
| Muhlenbergia porteri Scribn. ex Beal | | | <1% | | | | | | | |
| Opuntia basilaris Engelm. & Bigelow | | | | | <1% | | <1% | | <1% | |
| Opuntia erinacea Engelm. & Bigelow ex Engelm. | | | | | 1-5% | | | | 1-5% | |
| Sphaeralcea ambigua Gray | | | | | <1% | | | | <1% | |
| Sporobolus flexuosus (Thurb. ex Vasey) Rydb. | <1% | | <1% | | <1% | | 1-5% | | <1% | |
| Stephanomeria pauciflora (Torr.) A. Nels. | 1-5% | | 1-5% | | 5-10% | | 5-10% | | 1-5% | |
| Thymophylla pentachaeta (DC.) Small | 1-5% | | 1-5% | | 1-5% | | 1-5% | | 1-5% | |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 1

Transect Type: Tamarisk Control

| | | | | |
|---|------|-----|-------|------|
| Tiquilia latior (I.M. Johnston) A. Richards. | 1-5% | <1% | 5-10% | 1-5% |
|---|------|-----|-------|------|

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|---|---------------|-------------|-------------|
| 15 Stephanomeria pauciflora (Torr.) A. Nels. | 3 | | |
| 25 Bouteloua eriopoda (Torr.) Torr. | 1 | | |
| 25 Bromus rubens L. | 1 | | |

Vegetation Structure Data - New

Soil Data

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 1

Transect Type: Tamarisk Control

Date: 5/6/2007 Revisit? Post-tamarisk removal
 Recorder: Melissa McMaster Reader: Lori Makarick
 Wind Speed: Air Temp (F): Cloud Cover: 0
 Weather: Partly cloudy with dark clouds at the head of Nankoweap Canyon

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|---|----------------|
| Boulder | 4 | Acacia greggii Gray | 4 |
| Coarse woody debris | 2 | Aristida arizonica Vasey | 2 |
| Cobble | 11 | Aristida purpurea Nutt. | 5 |
| Gravel | 24 | Dasyochloa pulchella (Kunth) Willd. ex Rydb. | 4 |
| Litter (duff) | 16 | Encelia farinosa Gray ex Torr. | 1 |
| Moss (ground) | 2 | Gutierrezia sarothrae (Pursh) Britt. & Rusby | 3 |
| Sand | 18 | Plantago ovata Forsk. | 2 |
| Stone | 21 | Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | 1 |
| Woody debris structure | 1 | Sporobolus cryptandrus (Torr.) Gray | 3 |
| | | Stephanomeria pauciflora (Torr.) A. Nels. | 6 |
| | | Thymophylla pentachaeta (DC.) Small | 4 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Litter (duff) | 2 | 12 | 15 | 8 | 4 |
| Woody debris structure | 2 | 0 | 1 | 1 | 1 |
| Gravel | 55 | 28 | 45 | 20 | 31 |
| Crypto | 1 | 1 | 1 | 1 | 1 |
| Moss (ground) | 1 | 3 | 5 | 2 | 1 |
| Sand | 7 | 2 | 5 | 20 | 18 |
| Boulder | 2 | 5 | 0 | 10 | 5 |
| Bedrock | 0 | 0 | 0 | 0 | 0 |
| Basal Veg | 1 | 1 | 1 | 1 | 1 |
| Coarse woody debris | 2 | 3 | 2 | 1 | 3 |
| Stone | 18 | 29 | 7 | 19 | 15 |
| Water | 0 | 0 | 0 | 0 | 0 |
| Cobble | 9 | 16 | 18 | 17 | 20 |
| Bare Soil | 0 | 0 | 0 | 0 | 0 |
| Lichen | 0 | 0 | 0 | 0 | 0 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---------------------|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | <0% | | <1% | | <1% | | <1% | | <1% | |
| | <0% | | <0% | | <0% | | <0% | | 1-5% | |
| Acacia greggii Gray | <0% | | 1-5% | M | <1% | S | <1% | P | <1% | S |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 1

Transect Type: Tamarisk Control

| | | | | | |
|---|------|-------|-------|-------|------|
| Allionia incarnata L. | <0% | <0% | <0% | <1% | <0% |
| Aristida arizonica Vasey | <0% | 1-5% | <1% | 1-5% | <0% |
| Aristida purpurea Nutt. | 1-5% | <1% | 1-5% | 1-5% | 1-5% |
| Brickellia longifolia S. Wats. | <0% | <1% | <0% | <1% | <0% |
| Bromus rubens L. | <1% | <1% | <1% | <1% | <1% |
| Camissonia walkeri (A. Nels.) Raven | <1% | <1% | <0% | <0% | <0% |
| Cryptantha spp. | <0% | <1% | <1% | <1% | <1% |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | 1-5% | 1-5% | 1-5% | <1% | <1% |
| Echinocereus engelmannii (Parry ex Engelm.) Lem. | <0% | <0% | <0% | <1% | <1% |
| Encelia farinosa Gray ex Torr. | 1-5% | 1-5% | 1-5% | 1-5% | 1-5% |
| Ephedra torreyana S. Wats. | <0% | <0% | 1-5% | <0% | <0% |
| Eriogonum deflexum Torr. | <0% | <0% | <0% | <0% | <1% |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <0% | <0% | <1% | <1% | <0% |
| Gilia spp. | <0% | <1% | <0% | <0% | <0% |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | 1-5% | 1-5% | <1% | <1% | <1% |
| Mammillaria grahamii Engelm. var. grahamii | <0% | <0% | <0% | <1% | <0% |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | <0% | <1% | <0% | <0% | <0% |
| Opuntia basilaris Engelm. & Bigelow | <1% | <0% | <1% | <0% | <0% |
| Opuntia engelmannii Salm-Dyck var. engelmannii | <0% | <0% | <0% | <0% | <1% |
| Plantago ovata Forsk. | <0% | <0% | <1% | <1% | <1% |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | <0% | <0% | <1% | <1% | <1% |
| Sporobolus contractus A.S. Hitchc. | <0% | <0% | <0% | <0% | <1% |
| Sporobolus cryptandrus (Torr.) Gray | 1-5% | <1% | 1-5% | <0% | <0% |
| Stanleya pinnata (Pursh) Britt. | <0% | <1% | <0% | <0% | <0% |
| Stephanomeria pauciflora (Torr.) A. Nels. | 1-5% | 5-10% | 5-10% | 5-10% | 1-5% |
| Thymophylla pentachaeta (DC.) Small | <1% | 1-5% | 1-5% | 1-5% | <1% |
| Tiquilia latior (I.M. Johnston) A. Richards. | 1-5% | <0% | <1% | 1-5% | 1-5% |
| Tridens muticus (Torr.) Nash | <0% | <1% | <0% | <1% | <0% |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--|---------------|-------------|-------------|
| 15 Stephanomeria pauciflora (Torr.) A. Nels. | 3 | | |
| 25 Stephanomeria pauciflora (Torr.) A. Nels. | 12 | | |
| 45 Stephanomeria pauciflora (Torr.) A. Nels. | 5 | | |

Vegetation Structure Data - New

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 1

Transect Type: Tamarisk Control

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|--|---------------|-------------|-------------|
| 5 | Aristida purpurea Nutt. | 3 | | |
| 15 | Stephanomeria pauciflora (Torr.) A. Nels. | 6 | | |
| 25 | Erodium cicutarium (L.) L'Hér. ex Ait. | 1 | | |
| 25 | Stephanomeria pauciflora (Torr.) A. Nels. | 5 | | |
| 35 | Plantago ovata Forsk. | 1 | | |
| 35 | Thymophylla pentachaeta (DC.) Small | 1 | | |
| 45 | Stephanomeria pauciflora (Torr.) A. Nels. | 4 | | |
| 45 | Thymophylla pentachaeta (DC.) Small | 1 | | |
| 45 | Tiquilia latior (I.M. Johnston) A. Richards. | 1 | | |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|--------------|------------------|-----------|------------------|-----------|------------------|-----------|----------------|-----------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 8.14 | 133 | 8.05 | 180 | 8.02 | 137 | 8.07 | 150 |
| 15 | 8.16 | 92 | 8.28 | 199 | 8.33 | 126 | 8.26 | 139 |
| 25 | 8.43 | 177 | 8.38 | 307 | 8.44 | 206 | 8.42 | 230 |
| 35 | 8.49 | 76 | 8.42 | 66 | 8.39 | 63 | 8.43 | 68 |
| 45 | 8.4 | 134 | 8.5 | 154 | 8.49 | 153 | 8.46 | 147 |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 1

Transect Type: Tamarisk Control

Date: 10/2/2004 Revisit? Pre-tamarisk removal

Recorder: Kari Malen Reader: Suzanne Rhodes

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

Weather: Stormy weather, clouds and overcast

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|--|----------------|
| Bare Soil | 24 | Acacia greggii Gray | 2 |
| Cobble | 52 | Aristida purpurea Nutt. | 1 |
| Litter (duff) | 12 | Aristida spp. | 2 |
| Woody debris structure | 1 | Bouteloua eriopoda (Torr.) Torr. | 5 |
| | | Bromus rubens L. | 8 |
| | | Cryptobiotic soil | 10 |
| | | Encelia farinosa Gray ex Torr. | 1 |
| | | Gutierrezia sarothrae (Pursh) Britt. & Rusby | 2 |
| | | Stephanomeria pauciflora (Torr.) A. Nels. | 4 |
| | | Thymophylla pentachaeta (DC.) Small | 2 |

Daubenmire Scale Cover Data

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | | | 5-10% | | <1% | | | | | |
| Aristida spp. | 1-5% | | 1-5% | | | | <1% | | 1-5% | |
| Bouteloua eriopoda (Torr.) Torr. | 1-5% | | <1% | | 1-5% | | <1% | | | |
| Brickellia longifolia S. Wats. | | | | | | | <1% | | | |
| Bromus rubens L. | | | <1% | | 1-5% | | 1-5% | | <1% | |
| Encelia farinosa Gray ex Torr. | <1% | | <1% | | 1-5% | | <1% | | 1-5% | |
| Ephedra nevadensis S. Wats. | | | | | 1-5% | | | | | |
| Eriogonum inflatum Torr. & Frém. | | | 1-5% | | | | | | <1% | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | | | | <1% | | | | | |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | 1-5% | | 5-10% | | 1-5% | | 1-5% | | <1% | |
| Machaeranthera pinnatifida (Hook.) Shinnery | | | | | 1-5% | | | | | |
| Muhlenbergia porteri Scribn. ex Beal | | | <1% | | | | | | | |
| Opuntia basilaris Engelm. & Bigelow | | | | | <1% | | <1% | | <1% | |
| Opuntia erinacea Engelm. & Bigelow ex Engelm. | | | | | 1-5% | | | | 1-5% | |
| Sphaeralcea ambigua Gray | | | | | <1% | | | | <1% | |
| Sporobolus flexuosus (Thurb. ex Vasey) Rydb. | <1% | | <1% | | <1% | | 1-5% | | <1% | |
| Stephanomeria pauciflora (Torr.) A. Nels. | 1-5% | | 1-5% | | 5-10% | | 5-10% | | 1-5% | |
| Thymophylla pentachaeta (DC.) Small | 1-5% | | 1-5% | | 1-5% | | 1-5% | | 1-5% | |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 1

Transect Type: Tamarisk Control

| | | | | |
|---|------|-----|-------|------|
| Tiquilia latior (I.M. Johnston) A. Richards. | 1-5% | <1% | 5-10% | 1-5% |
|---|------|-----|-------|------|

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|---|---------------|-------------|-------------|
| 15 Stephanomeria pauciflora (Torr.) A. Nels. | 3 | | |
| 25 Bouteloua eriopoda (Torr.) Torr. | 1 | | |
| 25 Bromus rubens L. | 1 | | |

Vegetation Structure Data - New

Soil Data

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 1

Transect Type: Tamarisk Control

Date: 5/6/2007 Revisit? Post-tamarisk removal
 Recorder: Melissa McMaster Reader: Lori Makarick
 Wind Speed: Air Temp (F): Cloud Cover: 0
 Weather: Partly cloudy with dark clouds at the head of Nankoweap Canyon

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|---|----------------|
| Boulder | 4 | Acacia greggii Gray | 4 |
| Coarse woody debris | 2 | Aristida arizonica Vasey | 2 |
| Cobble | 11 | Aristida purpurea Nutt. | 5 |
| Gravel | 24 | Dasyochloa pulchella (Kunth) Willd. ex Rydb. | 4 |
| Litter (duff) | 16 | Encelia farinosa Gray ex Torr. | 1 |
| Moss (ground) | 2 | Gutierrezia sarothrae (Pursh) Britt. & Rusby | 3 |
| Sand | 18 | Plantago ovata Forsk. | 2 |
| Stone | 21 | Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | 1 |
| Woody debris structure | 1 | Sporobolus cryptandrus (Torr.) Gray | 3 |
| | | Stephanomeria pauciflora (Torr.) A. Nels. | 6 |
| | | Thymophylla pentachaeta (DC.) Small | 4 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Litter (duff) | 2 | 12 | 15 | 8 | 4 |
| Woody debris structure | 2 | 0 | 1 | 1 | 1 |
| Gravel | 55 | 28 | 45 | 20 | 31 |
| Crypto | 1 | 1 | 1 | 1 | 1 |
| Moss (ground) | 1 | 3 | 5 | 2 | 1 |
| Sand | 7 | 2 | 5 | 20 | 18 |
| Boulder | 2 | 5 | 0 | 10 | 5 |
| Bedrock | 0 | 0 | 0 | 0 | 0 |
| Basal Veg | 1 | 1 | 1 | 1 | 1 |
| Coarse woody debris | 2 | 3 | 2 | 1 | 3 |
| Stone | 18 | 29 | 7 | 19 | 15 |
| Water | 0 | 0 | 0 | 0 | 0 |
| Cobble | 9 | 16 | 18 | 17 | 20 |
| Bare Soil | 0 | 0 | 0 | 0 | 0 |
| Lichen | 0 | 0 | 0 | 0 | 0 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---------------------|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | <0% | | <1% | | <1% | | <1% | | <1% | |
| | <0% | | <0% | | <0% | | <0% | | 1-5% | |
| Acacia greggii Gray | <0% | | 1-5% | M | <1% | S | <1% | P | <1% | S |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 1

Transect Type: Tamarisk Control

| | | | | | |
|---|------|-------|-------|-------|------|
| Allionia incarnata L. | <0% | <0% | <0% | <1% | <0% |
| Aristida arizonica Vasey | <0% | 1-5% | <1% | 1-5% | <0% |
| Aristida purpurea Nutt. | 1-5% | <1% | 1-5% | 1-5% | 1-5% |
| Brickellia longifolia S. Wats. | <0% | <1% | <0% | <1% | <0% |
| Bromus rubens L. | <1% | <1% | <1% | <1% | <1% |
| Camissonia walkeri (A. Nels.) Raven | <1% | <1% | <0% | <0% | <0% |
| Cryptantha spp. | <0% | <1% | <1% | <1% | <1% |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | 1-5% | 1-5% | 1-5% | <1% | <1% |
| Echinocereus engelmannii (Parry ex Engelm.) Lem. | <0% | <0% | <0% | <1% | <1% |
| Encelia farinosa Gray ex Torr. | 1-5% | 1-5% | 1-5% | 1-5% | 1-5% |
| Ephedra torreyana S. Wats. | <0% | <0% | 1-5% | <0% | <0% |
| Eriogonum deflexum Torr. | <0% | <0% | <0% | <0% | <1% |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <0% | <0% | <1% | <1% | <0% |
| Gilia spp. | <0% | <1% | <0% | <0% | <0% |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | 1-5% | 1-5% | <1% | <1% | <1% |
| Mammillaria grahamii Engelm. var. grahamii | <0% | <0% | <0% | <1% | <0% |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | <0% | <1% | <0% | <0% | <0% |
| Opuntia basilaris Engelm. & Bigelow | <1% | <0% | <1% | <0% | <0% |
| Opuntia engelmannii Salm-Dyck var. engelmannii | <0% | <0% | <0% | <0% | <1% |
| Plantago ovata Forsk. | <0% | <0% | <1% | <1% | <1% |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | <0% | <0% | <1% | <1% | <1% |
| Sporobolus contractus A.S. Hitchc. | <0% | <0% | <0% | <0% | <1% |
| Sporobolus cryptandrus (Torr.) Gray | 1-5% | <1% | 1-5% | <0% | <0% |
| Stanleya pinnata (Pursh) Britt. | <0% | <1% | <0% | <0% | <0% |
| Stephanomeria pauciflora (Torr.) A. Nels. | 1-5% | 5-10% | 5-10% | 5-10% | 1-5% |
| Thymophylla pentachaeta (DC.) Small | <1% | 1-5% | 1-5% | 1-5% | <1% |
| Tiquilia latior (I.M. Johnston) A. Richards. | 1-5% | <0% | <1% | 1-5% | 1-5% |
| Tridens muticus (Torr.) Nash | <0% | <1% | <0% | <1% | <0% |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--|---------------|-------------|-------------|
| 15 Stephanomeria pauciflora (Torr.) A. Nels. | 3 | | |
| 25 Stephanomeria pauciflora (Torr.) A. Nels. | 12 | | |
| 45 Stephanomeria pauciflora (Torr.) A. Nels. | 5 | | |

Vegetation Structure Data - New

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 1

Transect Type: Tamarisk Control

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|--|---------------|-------------|-------------|
| 5 | Aristida purpurea Nutt. | 3 | | |
| 15 | Stephanomeria pauciflora (Torr.) A. Nels. | 6 | | |
| 25 | Erodium cicutarium (L.) L'Hér. ex Ait. | 1 | | |
| 25 | Stephanomeria pauciflora (Torr.) A. Nels. | 5 | | |
| 35 | Plantago ovata Forsk. | 1 | | |
| 35 | Thymophylla pentachaeta (DC.) Small | 1 | | |
| 45 | Stephanomeria pauciflora (Torr.) A. Nels. | 4 | | |
| 45 | Thymophylla pentachaeta (DC.) Small | 1 | | |
| 45 | Tiquilia latior (I.M. Johnston) A. Richards. | 1 | | |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|--------------|------------------|-----------|------------------|-----------|------------------|-----------|----------------|-----------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 8.14 | 133 | 8.05 | 180 | 8.02 | 137 | 8.07 | 150 |
| 15 | 8.16 | 92 | 8.28 | 199 | 8.33 | 126 | 8.26 | 139 |
| 25 | 8.43 | 177 | 8.38 | 307 | 8.44 | 206 | 8.42 | 230 |
| 35 | 8.49 | 76 | 8.42 | 66 | 8.39 | 63 | 8.43 | 68 |
| 45 | 8.4 | 134 | 8.5 | 154 | 8.49 | 153 | 8.46 | 147 |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 2

Transect Type: Tamarisk Area

| | Start point | | End point |
|----------------------------|--|---------------------------|------------------|
| Easting: | 421153 | Easting: | 421175 |
| Northing: | 4017203 | Northing: | 4017251 |
| GPS accuracy (m): | 2.8 | GPS accuracy (m): | 2.8 |
| Elevation (m): | 955 | Elevation (m): | |
| Bearing: | 27 | | |
| Aspect (0-360): | 5 | Slope (degrees): | 6 |
| Transect description: | Transect start point is at the SE base of an 8m tall and 35cm dbh cottonwood tree that is 2m to the E side (creek right) of the active stream channel. From the start point, the transect runs down creek remaining on creek right and is 2m to the left of a cottonwood at the 26.5m mark on the tape. Transect endpoint is 1m below the base of a 1.5m wide BACSER on a muav ledge, about 1m up creek from where the spring is seeping out of a ledge. A 30cmx25cm whitish limestone with a 10cmx15cm red sandstone cobble mark the 50m point on the tape. The start point of Nanko T2B is 23.4m away at a 104 degree bearing from this transect's start point. Nanko T2B runs up creek from that point. | | |
| Additional Info:: | No water here, it appears it has disappeared for 500m. (2004) | | |
| Geological layer: | Muav limestone | | |
| Habitat type: | Riparian | GB desert scrub | |
| Dominant species: | Acacia greggii Gray, Artemisia ludoviciana Nutt., Brickellia longifolia S. Wats., Populus fremontii S. Wats., Tamarix ramosissima Ledeb. | | |
| Associated species: | Anulocaulis leiosolenus (Torr.) Standl., Aristida purpurea Nutt., Baccharis emoryi Gray, Baccharis sergiloides Gray, Brickellia longifolia S. Wats., Bromus rubens L., Cercis orbiculata Greene, Echinocereus spp., Encelia frutescens (Gray) Gray, Ephedra nevadensis S. Wats., Ephedra spp., Ephedra torreyana S. Wats., Eriogonum inflatum Torr. & Frém., Erodium cicutarium (L.) L'Hér. ex Ait., Eurybia glauca (Nutt.) Nesom, Gutierrezia sarothrae (Pursh) Britt. & Rusby, Hesperostipa neomexicana (Thurb. ex Coult.) Barkworth, Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb., Sporobolus flexuosus (Thurb. ex Vasey) Rydb., Tiquilia latior (L.M. Johnston) A. Richards. | | |
| Surface water within 25m? | <input checked="" type="checkbox"/> | Surface water type: | |
| Landform: Drainage channel | | Surface rocks: sandstone | limestone |
| Soil type: loamy sand | | Topo position: Interfluve | |
| Light exposure: open | | Soil moisture: dry | moist |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 2

Transect Type: Tamarisk Area

Date: 10/2/2004 Revisit? Pre-tamarisk removal

Recorder: Kari Malen Reader: Suzanne Rhodes

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

Weather: Stormy weather, clouds and overcast

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|--|----------------|
| Bare Soil | 36 | Acacia greggii Gray | 4 |
| Cobble | 42 | Artemisia ludoviciana Nutt. | 3 |
| Litter (duff) | 14 | Baccharis emoryi Gray | 6 |
| Woody debris structure | 7 | Brickellia longifolia S. Wats. | 1 |
| | | Bromus rubens L. | 11 |
| | | Cryptobiotic soil | 1 |
| | | Erodium cicutarium (L.) L'Hér. ex Ait. | 1 |
| | | Tamarix ramosissima Ledeb. | 16 |

Daubenmire Scale Cover Data

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | 1-5% | | 1-5% | | | | <1% | | | |
| Aristida purpurea Nutt. | 1-5% | | | | | | <1% | | | |
| Artemisia ludoviciana Nutt. | 1-5% | | 1-5% | | 1-5% | | 5-10% | | | |
| Baccharis emoryi Gray | | | | | | | | | 5-10% | |
| Baccharis sergiloides Gray | | | | | | | | | 1-5% | |
| Brickellia longifolia S. Wats. | | | | | | | 1-5% | | | |
| Bromus rubens L. | 5-10% | | 1-5% | | 1-5% | | 1-5% | | 1-5% | |
| Echinocereus spp. | 1-5% | | | | | | | | | |
| Encelia frutescens (Gray) Gray | | | | | | | <1% | | | |
| Ephedra nevadensis S. Wats. | 1-5% | | | | | | | | | |
| Ephedra spp. | | | | | 1-5% | | 1-5% | | | |
| Erigeron speciosus (Lindl.) DC. var. macranthus (Nutt.) Cronq. | | | | | <1% | | | | | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <1% | | | | 1-5% | | | | | |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | 1-5% | | | | 1-5% | | 5-10% | | | |
| Sporobolus flexuosus (Thurb. ex Vasey) Rydb. | <1% | | | | | | <1% | | | |
| Tamarix ramosissima Ledeb. | 1-5% | | 25-50% | | 1-5% | | 10-25% | | 10-25% | |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|----------------------------|---------------|-------------|-------------|
| 5 | Tamarix ramosissima Ledeb. | 4 | 2 | |
| 15 | Tamarix ramosissima Ledeb. | 1 | 3 | |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 2

Transect Type: Tamarisk Area

| | | | |
|----|----------------------------|---|---|
| 35 | Bromus rubens L. | 1 | |
| 45 | Baccharis emoryi Gray | 1 | 2 |
| 45 | Tamarix ramosissima Ledeb. | | 1 |

Vegetation Structure Data - New

Soil Data

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 2

Transect Type: Tamarisk Area

Date: 5/6/2007 Revisit? Post-tamarisk removal
 Recorder: Lori Makarick Reader: Kate Watters
 Wind Speed: Air Temp (F): Cloud Cover: 0
 Weather: 62 degrees F, 5% cloud cover, 8mph winds A lovely day!

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|--|----------------|
| Bedrock | 5 | Aristida purpurea Nutt. | 1 |
| Boulder | 5 | Artemisia ludoviciana Nutt. | 1 |
| Cobble | 11 | Baccharis sergiloides Gray | 3 |
| Gravel | 23 | Bromus rubens L. | 1 |
| Litter (duff) | 4 | Bromus tectorum L. | 1 |
| Sand | 34 | Encelia resinifera C. Clark ssp. tenuifolia C. Clark | 1 |
| Stone | 16 | Eurybia glauca (Nutt.) Nesom | 1 |
| Woody debris structure | 2 | forb spp | 1 |
| | | Populus fremontii S. Wats. | 7 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|---------------------|-----------|------------|------------|------------|------------|
| Stone | 28 | 32 | 21 | 18 | 7 |
| Coarse woody debris | 1 | 6 | 5 | 7 | 1 |
| Crypto | 0 | 0 | 0 | 0 | 0 |
| Moss (ground) | 0 | 0 | 0 | 0 | 0 |
| Lichen | 0 | 0 | 0 | 0 | 0 |
| Litter (duff) | 1 | 4 | 11 | 13 | 5 |
| Boulder | 9 | 6 | 13 | 12 | 5 |
| Cobble | 23 | 21 | 14 | 10 | 13 |
| Bare Soil | 0 | 0 | 0 | 0 | 0 |
| Bedrock | 0 | 0 | 0 | 0 | 37 |
| Water | 0 | 0 | 0 | 0 | 3 |
| Gravel | 30 | 14 | 17 | 17 | 10 |
| Water | 0 | 6 | 4 | 3 | 0 |
| Basal Veg | 1 | 1 | 1 | 1 | 1 |
| Sand | 7 | 10 | 14 | 19 | 18 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | <0% | | <0% | | <1% | S | <1% | S | <0% | |
| Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | <0% | | <1% | | <0% | | <1% | | <0% | |
| Aristida purpurea Nutt. | <1% | | <1% | | <1% | | <1% | | <1% | |
| Aristida spp. | | | | | | | <1% | | <0% | |
| Artemisia ludoviciana Nutt. | <0% | | <1% | | 1-5% | | <1% | | <1% | |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 2

Transect Type: Tamarisk Area

| | | | | | | | | | |
|---|-------|-----|------|---|--------|---|------|---|------|
| Artemisia tridentata Nutt. | | | | | | | 1-5% | | <1% |
| Astragalus lentiginosus Dougl. ex Hook. | <0% | | <0% | | <0% | | <1% | | <0% |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | <0% | | <0% | | 1-5% | | <1% | | 1-5% |
| Brickellia longifolia S. Wats. | <0% | | <0% | | 1-5% | | 1-5% | | <1% |
| Bromus anomalus Rupr. ex Fourn. | <0% | | <0% | | <0% | | <1% | | <0% |
| Bromus rubens L. | <1% | | <1% | | <1% | | 1-5% | | <1% |
| Bromus tectorum L. | <1% | | <1% | | <1% | | <1% | | <1% |
| Camissonia walkeri (A. Nels.) Raven | <1% | | <1% | | <1% | | <0% | | <0% |
| Cryptantha spp. | <0% | | <0% | | <1% | | <1% | | <0% |
| Datura wrightii Regel | <0% | | 1-5% | | <0% | | <1% | | <0% |
| Encelia resinifera C. Clark ssp. tenuifolia C. Clark | <1% | | <1% | | <0% | | 1-5% | | <1% |
| Equisetum ×ferrissii Clute (pro sp.) | <0% | | <1% | | <0% | | <0% | | <0% |
| Equisetum spp. | <0% | | <1% | | <0% | | <0% | | <0% |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <0% | | <1% | | <0% | | <1% | | <0% |
| Fallugia paradoxa (D. Don) Endl. ex Torr. | <0% | | <0% | | <1% | | <0% | | <1% |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | <0% | | <0% | | <1% | | <0% | | <0% |
| Iva acerosa (Nutt.) R.C. Jackson | <1% | | <0% | | <0% | | <0% | | <0% |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | <1% | | <1% | | <0% | | <1% | | <0% |
| Nicotiana obtusifolia Mertens & Galeotti var. obtusifolia | <0% | | <0% | | <0% | | 1-5% | | <1% |
| Oenothera elata Kunth | <0% | | <0% | | <0% | | <1% | | <0% |
| Opuntia polyacantha Haw. | <0% | | <0% | | <0% | | <1% | | <0% |
| Polypogon monspeliensis (L.) Desf. | <1% | | <0% | | <0% | | <1% | | <1% |
| Polypogon viridis (Gouan) Breistr. | <0% | | <0% | | <0% | | <1% | | <0% |
| Populus fremontii S. Wats. | 5-10% | S+M | 1-5% | S | 10-25% | M | 1-5% | S | 1-5% |
| Schizachyrium scoparium (Michx.) Nash | <0% | | <1% | | <0% | | <1% | | <0% |
| Sporobolus cryptandrus (Torr.) Gray | <0% | | <0% | | <0% | | <0% | | <1% |
| Stanleya pinnata (Pursh) Britt. | <0% | | <1% | | <1% | | <1% | | <0% |
| Stephanomeria pauciflora (Torr.) A. Nels. | <0% | | <0% | | <1% | | <0% | | <1% |
| Tamarix ramosissima Ledeb. | <1% | S | <0% | | <0% | | <1% | S | <1% |
| Thymophylla pentachaeta (DC.) Small | <0% | | <0% | | <0% | | <0% | | <1% |
| Tridens muticus (Torr.) Nash | <0% | | <0% | | <0% | | <0% | | <1% |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|-------------------------------|---------------|-------------|-------------|
| 5 Populus fremontii S. Wats. | | | |
| 35 Populus fremontii S. Wats. | 7 | | |

Vegetation Structure Data - New

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 2

Transect Type: Tamarisk Area

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|---|---------------|-------------|-------------|
| 5 | Populus fremontii S. Wats. | | | |
| 15 | Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 1 | | |
| 25 | Bromus rubens L. | 1 | | |
| 35 | Bromus rubens L. | 2 | | |
| 35 | Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 2 | | |
| 35 | Populus fremontii S. Wats. | 8 | | |
| 45 | Encelia resinifera C. Clark ssp. tenuifolia C. Clark | 3 | | |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|--------------|------------------|-----------|------------------|-----------|------------------|-----------|----------------|-----------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 7.27 | 1044 | 7.92 | 870 | 8.36 | 914 | 7.85 | 943 |
| 15 | 8.94 | 133 | 9.01 | 133 | 9.05 | 114 | 9.00 | 127 |
| 25 | 9.08 | 62 | 8.94 | 79 | 8.84 | 70 | 8.95 | 70 |
| 35 | 8.96 | 470 | 9.27 | 460 | 9.31 | 490 | 9.18 | 473 |
| 45 | 9.25 | 728 | 9.24 | 706 | 9.21 | 675 | 9.23 | 703 |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 2

Transect Type: Tamarisk Area

Date: 10/2/2004 Revisit? Pre-tamarisk removal
 Recorder: Kari Malen Reader: Suzanne Rhodes
 Wind Speed: Air Temp (F): Cloud Cover:
 Weather: Stormy weather, clouds and overcast

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|--|----------------|
| Bare Soil | 36 | Acacia greggii Gray | 4 |
| Cobble | 42 | Artemisia ludoviciana Nutt. | 3 |
| Litter (duff) | 14 | Baccharis emoryi Gray | 6 |
| Woody debris structure | 7 | Brickellia longifolia S. Wats. | 1 |
| | | Bromus rubens L. | 11 |
| | | Cryptobiotic soil | 1 |
| | | Erodium cicutarium (L.) L'Hér. ex Ait. | 1 |
| | | Tamarix ramosissima Ledeb. | 16 |

Daubenmire Scale Cover Data

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | 1-5% | | 1-5% | | | | <1% | | | |
| Aristida purpurea Nutt. | 1-5% | | | | | | <1% | | | |
| Artemisia ludoviciana Nutt. | 1-5% | | 1-5% | | 1-5% | | 5-10% | | | |
| Baccharis emoryi Gray | | | | | | | | | 5-10% | |
| Baccharis sergiloides Gray | | | | | | | | | 1-5% | |
| Brickellia longifolia S. Wats. | | | | | | | 1-5% | | | |
| Bromus rubens L. | 5-10% | | 1-5% | | 1-5% | | 1-5% | | 1-5% | |
| Echinocereus spp. | 1-5% | | | | | | | | | |
| Encelia frutescens (Gray) Gray | | | | | | | <1% | | | |
| Ephedra nevadensis S. Wats. | 1-5% | | | | | | | | | |
| Ephedra spp. | | | | | 1-5% | | 1-5% | | | |
| Erigeron speciosus (Lindl.) DC. var. macranthus (Nutt.) Cronq. | | | | | <1% | | | | | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <1% | | | | 1-5% | | | | | |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | 1-5% | | | | 1-5% | | 5-10% | | | |
| Sporobolus flexuosus (Thurb. ex Vasey) Rydb. | <1% | | | | | | <1% | | | |
| Tamarix ramosissima Ledeb. | 1-5% | | 25-50% | | 1-5% | | 10-25% | | 10-25% | |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|----------------------------|---------------|-------------|-------------|
| 5 | Tamarix ramosissima Ledeb. | 4 | 2 | |
| 15 | Tamarix ramosissima Ledeb. | 1 | 3 | |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 2

Transect Type: Tamarisk Area

| | | | |
|----|----------------------------|---|---|
| 35 | Bromus rubens L. | 1 | |
| 45 | Baccharis emoryi Gray | 1 | 2 |
| 45 | Tamarix ramosissima Ledeb. | | 1 |

Vegetation Structure Data - New

Soil Data

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 2

Transect Type: Tamarisk Area

Date: 5/6/2007 Revisit? Post-tamarisk removal
 Recorder: Lori Makarick Reader: Kate Watters
 Wind Speed: Air Temp (F): Cloud Cover: 0
 Weather: 62 degrees F, 5% cloud cover, 8mph winds A lovely day!

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|--|----------------|
| Bedrock | 5 | Aristida purpurea Nutt. | 1 |
| Boulder | 5 | Artemisia ludoviciana Nutt. | 1 |
| Cobble | 11 | Baccharis sergiloides Gray | 3 |
| Gravel | 23 | Bromus rubens L. | 1 |
| Litter (duff) | 4 | Bromus tectorum L. | 1 |
| Sand | 34 | Encelia resinifera C. Clark ssp. tenuifolia C. Clark | 1 |
| Stone | 16 | Eurybia glauca (Nutt.) Nesom | 1 |
| Woody debris structure | 2 | forb spp | 1 |
| | | Populus fremontii S. Wats. | 7 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|---------------------|-----------|------------|------------|------------|------------|
| Stone | 28 | 32 | 21 | 18 | 7 |
| Coarse woody debris | 1 | 6 | 5 | 7 | 1 |
| Crypto | 0 | 0 | 0 | 0 | 0 |
| Moss (ground) | 0 | 0 | 0 | 0 | 0 |
| Lichen | 0 | 0 | 0 | 0 | 0 |
| Litter (duff) | 1 | 4 | 11 | 13 | 5 |
| Boulder | 9 | 6 | 13 | 12 | 5 |
| Cobble | 23 | 21 | 14 | 10 | 13 |
| Bare Soil | 0 | 0 | 0 | 0 | 0 |
| Bedrock | 0 | 0 | 0 | 0 | 37 |
| Water | 0 | 0 | 0 | 0 | 3 |
| Gravel | 30 | 14 | 17 | 17 | 10 |
| Water | 0 | 6 | 4 | 3 | 0 |
| Basal Veg | 1 | 1 | 1 | 1 | 1 |
| Sand | 7 | 10 | 14 | 19 | 18 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | <0% | | <0% | | <1% | S | <1% | S | <0% | |
| Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | <0% | | <1% | | <0% | | <1% | | <0% | |
| Aristida purpurea Nutt. | <1% | | <1% | | <1% | | <1% | | <1% | |
| Aristida spp. | | | | | | | <1% | | <0% | |
| Artemisia ludoviciana Nutt. | <0% | | <1% | | 1-5% | | <1% | | <1% | |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 2

Transect Type: Tamarisk Area

| | | | | | | | | | |
|---|-------|-----|------|---|--------|---|------|---|------|
| Artemisia tridentata Nutt. | | | | | | | 1-5% | | <1% |
| Astragalus lentiginosus Dougl. ex Hook. | <0% | | <0% | | <0% | | <1% | | <0% |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | <0% | | <0% | | 1-5% | | <1% | | 1-5% |
| Brickellia longifolia S. Wats. | <0% | | <0% | | 1-5% | | 1-5% | | <1% |
| Bromus anomalus Rupr. ex Fourn. | <0% | | <0% | | <0% | | <1% | | <0% |
| Bromus rubens L. | <1% | | <1% | | <1% | | 1-5% | | <1% |
| Bromus tectorum L. | <1% | | <1% | | <1% | | <1% | | <1% |
| Camissonia walkeri (A. Nels.) Raven | <1% | | <1% | | <1% | | <0% | | <0% |
| Cryptantha spp. | <0% | | <0% | | <1% | | <1% | | <0% |
| Datura wrightii Regel | <0% | | 1-5% | | <0% | | <1% | | <0% |
| Encelia resinifera C. Clark ssp. tenuifolia C. Clark | <1% | | <1% | | <0% | | 1-5% | | <1% |
| Equisetum ×ferrissii Clute (pro sp.) | <0% | | <1% | | <0% | | <0% | | <0% |
| Equisetum spp. | <0% | | <1% | | <0% | | <0% | | <0% |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <0% | | <1% | | <0% | | <1% | | <0% |
| Fallugia paradoxa (D. Don) Endl. ex Torr. | <0% | | <0% | | <1% | | <0% | | <1% |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | <0% | | <0% | | <1% | | <0% | | <0% |
| Iva acerosa (Nutt.) R.C. Jackson | <1% | | <0% | | <0% | | <0% | | <0% |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | <1% | | <1% | | <0% | | <1% | | <0% |
| Nicotiana obtusifolia Mertens & Galeotti var. obtusifolia | <0% | | <0% | | <0% | | 1-5% | | <1% |
| Oenothera elata Kunth | <0% | | <0% | | <0% | | <1% | | <0% |
| Opuntia polyacantha Haw. | <0% | | <0% | | <0% | | <1% | | <0% |
| Polypogon monspeliensis (L.) Desf. | <1% | | <0% | | <0% | | <1% | | <1% |
| Polypogon viridis (Gouan) Breistr. | <0% | | <0% | | <0% | | <1% | | <0% |
| Populus fremontii S. Wats. | 5-10% | S+M | 1-5% | S | 10-25% | M | 1-5% | S | 1-5% |
| Schizachyrium scoparium (Michx.) Nash | <0% | | <1% | | <0% | | <1% | | <0% |
| Sporobolus cryptandrus (Torr.) Gray | <0% | | <0% | | <0% | | <0% | | <1% |
| Stanleya pinnata (Pursh) Britt. | <0% | | <1% | | <1% | | <1% | | <0% |
| Stephanomeria pauciflora (Torr.) A. Nels. | <0% | | <0% | | <1% | | <0% | | <1% |
| Tamarix ramosissima Ledeb. | <1% | S | <0% | | <0% | | <1% | S | <1% |
| Thymophylla pentachaeta (DC.) Small | <0% | | <0% | | <0% | | <0% | | <1% |
| Tridens muticus (Torr.) Nash | <0% | | <0% | | <0% | | <0% | | <1% |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|-------------------------------|---------------|-------------|-------------|
| 5 Populus fremontii S. Wats. | | | |
| 35 Populus fremontii S. Wats. | 7 | | |

Vegetation Structure Data - New

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 2

Transect Type: Tamarisk Area

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|---|---------------|-------------|-------------|
| 5 | Populus fremontii S. Wats. | | | |
| 15 | Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 1 | | |
| 25 | Bromus rubens L. | 1 | | |
| 35 | Bromus rubens L. | 2 | | |
| 35 | Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 2 | | |
| 35 | Populus fremontii S. Wats. | 8 | | |
| 45 | Encelia resinifera C. Clark ssp. tenuifolia C. Clark | 3 | | |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|--------------|------------------|-----------|------------------|-----------|------------------|-----------|----------------|-----------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 7.27 | 1044 | 7.92 | 870 | 8.36 | 914 | 7.85 | 943 |
| 15 | 8.94 | 133 | 9.01 | 133 | 9.05 | 114 | 9.00 | 127 |
| 25 | 9.08 | 62 | 8.94 | 79 | 8.84 | 70 | 8.95 | 70 |
| 35 | 8.96 | 470 | 9.27 | 460 | 9.31 | 490 | 9.18 | 473 |
| 45 | 9.25 | 728 | 9.24 | 706 | 9.21 | 675 | 9.23 | 703 |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 2

Transect Type: Tamarisk Control

| | Start point | | End point |
|----------------------------|--|---------------------|------------------|
| Easting: | 421177 | Easting: | 421179 |
| Northing: | 4017196 | Northing: | 4017152 |
| GPS accuracy (m): | 1.6 | GPS accuracy (m): | 4.6 |
| Elevation (m): | 958 | Elevation (m): | 960 |
| Bearing: | 350 | | |
| Aspect (0-360): | 2 | Slope (degrees): | 2 |
| Transect description: | Transect start is 20m from T2A start, almost directly across, it is 1m from the creek right cliff, 4m from an acacia on creek right at the base of the cliff, where the trail goes upslope. Actual start is between two .4x.3x.5m limestone stones. Transect end is upstream of start, about 18m midstream of creek right cliff, 1m upstream of a 12m tall cottonwood that is 70cm dbh. Transect crosses the creek between the 29-33m mark. The creek was flowing in 2007. The transect runs upstream. | | |
| Additional Info:: | No water in this area, no TAMRAM in transect. In 2007, there was water present. | | |
| Geological layer: | Muav limestone | | |
| Habitat type: | Riparian GB desert scrub | | |
| Dominant species: | Brickellia longifolia S. Wats., Populus tremuloides Michx., Stephanomeria pauciflora (Torr.) A. Nels. | | |
| Associated species: | Acacia greggii Gray, Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth, Aristida arizonica Vasey, Artemisia ludoviciana Nutt., Astragalus preussii Gray, Brickellia longifolia S. Wats., Bromus rubens L., Datura wrightii Regel, Encelia frutescens (Gray) Gray, Encelia resinifera C. Clark ssp. tenuifolia C. Clark, Eriogonum inflatum Torr. & Frém., Erodium cicutarium (L.) L'Hér. ex Ait., Eurybia glauca (Nutt.) Nesom, Gutierrezia sarothrae (Pursh) Britt. & Rusby, Machaeranthera pinnatifida (Hook.) Shinnery, Mentzelia albicaulis (Dougl. ex Hook.) Dougl. ex Torr. & Gray, Opuntia erinacea Engelm. & Bigelow ex Engelm., Sphaeralcea ambigua Gray, Sporobolus flexuosus (Thurb. ex Vasey) Rydb., Stanleya pinnata (Pursh) Britt., Tiquilia latior (I.M. Johnston) A. Richards. | | |
| Surface water within 25m? | <input checked="" type="checkbox"/> | Surface water type: | stream |
| Landform: Drainage channel | | Surface rocks: | limestone |
| Soil type: sandy loam | | Topo position: | |
| Light exposure: open | | Soil moisture: | dry |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 2

Transect Type: Tamarisk Control

Date: 10/2/2004 Revisit? Pre-tamarisk removal

Recorder: Kari Malen Reader: Suzanne Rhodes

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

Weather: Stormy weather, clouds and overcast

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|--|----------------|
| Bare Soil | 40 | Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | 2 |
| Cobble | 48 | Aristida purpurea Nutt. | 1 |
| Litter (duff) | 4 | Bromus rubens L. | 2 |
| Woody debris structure | 9 | Encelia frutescens (Gray) Gray | 1 |
| | | Erodium cicutarium (L.) L'Hér. ex Ait. | 3 |
| | | Gutierrezia sarothrae (Pursh) Britt. & Rusby | 1 |
| | | Populus tremuloides Michx. | 7 |
| | | Stanleya pinnata (Pursh) Britt. | 1 |

Daubenmire Scale Cover Data

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | | | <1% | | | | | | | |
| Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | | | | | | | | | 1-5% | |
| Artemisia ludoviciana Nutt. | <1% | | | | | | | | 1-5% | |
| Brickellia longifolia S. Wats. | | | 1-5% | | | | | | | |
| Bromus rubens L. | <1% | | | | 1-5% | | 1-5% | | 1-5% | |
| Datura wrightii Regel | | | | | <1% | | | | 1-5% | |
| Encelia frutescens (Gray) Gray | | | | | | | | | 1-5% | |
| Eriogonum inflatum Torr. & Frém. | | | | | | | 1-5% | | | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | | | | <1% | | 5-10% | | <1% | |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | | | | | 1-5% | | | | | |
| Machaeranthera pinnatifida (Hook.) Shinnery | | | <1% | | | | | | | |
| Mentzelia albicaulis (Dougl. ex Hook.) Dougl. ex Torr. & Gray | | | | | <1% | | 1-5% | | | |
| Sphaeralcea ambigua Gray | | | | | | | <1% | | | |
| Sporobolus flexuosus (Thurb. ex Vasey) Rydb. | | | | | | | | | <1% | |
| Stephanomeria pauciflora (Torr.) A. Nels. | <1% | | 1-5% | | 1-5% | | | | <1% | |
| Tiquilia latior (I.M. Johnston) A. Richards. | | | | | | | | | <1% | |

Vegetation Structure Data - Old

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 2

Transect Type: Tamarisk Control

Vegetation Structure Data - New

Soil Data

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 2

Transect Type: Tamarisk Control

Date: 5/7/2007 Revisit? Post-tamarisk removal
 Recorder: Lisa Hahn Reader: Melissa McMaster
 Wind Speed: Air Temp (F): Cloud Cover: 0
 Weather: Blue clear sky overhead.

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|----------------------------|----------------|
| Basal Veg | 1 | Populus fremontii S. Wats. | 1 |
| Boulder | 3 | | |
| Cobble | 24 | | |
| Gravel | 24 | | |
| Litter (duff) | 3 | | |
| Sand | 14 | | |
| Stone | 27 | | |
| Water | 3 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Bedrock | 20 | 0 | 0 | 0 | 0 |
| Litter (duff) | 1 | 1 | 1 | 1 | 2 |
| Cobble | 13 | 13 | 21 | 13 | 24 |
| Stone | 19 | 20 | 20 | 19 | 9 |
| Moss (ground) | 0 | 0 | 0 | 0 | 0 |
| Woody debris structure | 0 | 0 | 0 | 0 | 0 |
| Coarse woody debris | 1 | 1 | 1 | 0 | 1 |
| Basal Veg | 1 | 1 | 1 | 1 | 1 |
| Sand | 5 | 4 | 36 | 19 | 49 |
| Crypto | 0 | 0 | 0 | 0 | 0 |
| Lichen | 0 | 0 | 0 | 0 | 0 |
| Boulder | 7 | 3 | 4 | 22 | 2 |
| Water | 0 | 0 | 0 | 1 | 0 |
| Bare Soil | 0 | 0 | 0 | 0 | 0 |
| Gravel | 33 | 57 | 16 | 24 | 12 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | <0% | | <1% | | <1% | | <0% | | <0% | |
| | <0% | | <0% | | <1% | | <0% | | <0% | |
| Acacia greggii Gray | <1% | S | <0% | | <0% | | <0% | | <0% | |
| Anulocaulis leiosolenus (Torr.) Standl. | <0% | | <0% | | <1% | | <0% | | <0% | |
| Aristida purpurea Nutt. | <0% | | <1% | | <1% | | <1% | | <1% | |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 2

Transect Type: Tamarisk Control

| Species | 1 | 2 | 3 | 4 | 5 | 6 |
|---|------|-----|-----|------|-----|----------|
| Baccharis salicifolia (Ruiz & Pavón) Pers. | <0% | <0% | <0% | <1% | <0% | |
| Brickellia longifolia S. Wats. | <0% | <1% | <0% | <0% | <1% | |
| Bromus rubens L. | <1% | <1% | <1% | <1% | <0% | |
| Camissonia walkeri (A. Nels.) Raven | <0% | <1% | <1% | <1% | <0% | |
| Datura wrightii Regel | 1-5% | <0% | <0% | <0% | <0% | |
| Encelia resinifera C. Clark ssp. tenuifolia C. Clark | <0% | <1% | <0% | <0% | <0% | |
| Eriogonum corymbosum Benth. | <0% | <1% | <0% | <0% | <0% | |
| Eriogonum deflexum Torr. | <1% | <1% | <0% | <1% | <0% | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <1% | <0% | <0% | <0% | <0% | |
| Eurybia glauca (Nutt.) Nesom | <0% | <1% | <0% | <1% | <0% | |
| forb spp | <0% | <0% | <1% | <0% | <0% | |
| Hesperostipa neomexicana (Thurb. ex Coult.) Barkworth | <1% | <1% | <0% | <0% | <0% | |
| Oenothera caespitosa Nutt. | <0% | <0% | <0% | <0% | <1% | |
| Polypogon viridis (Gouan) Breistr. | <0% | <0% | <0% | <1% | <0% | |
| Populus fremontii S. Wats. | <0% | <0% | <1% | S | <0% | 10-25% M |
| Rhus trilobata Nutt. var. simplicifolia (Greene) Barkl. | <0% | <0% | <1% | <0% | <0% | |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | <1% | <0% | <1% | <0% | <0% | |
| Sporobolus contractus A.S. Hitchc. | <1% | <0% | <0% | <0% | <0% | |
| Sporobolus spp. | | | | | | <1% |
| Stanleya pinnata (Pursh) Britt. | 1-5% | <1% | <0% | <0% | <0% | |
| Stephanomeria pauciflora (Torr.) A. Nels. | <0% | <1% | <1% | 1-5% | <1% | |
| Tamarix ramosissima Ledeb. | <0% | <0% | <1% | S | <1% | S |
| Thymophylla pentachaeta (DC.) Small | <0% | <1% | <1% | <0% | <0% | |

Vegetation Structure Data - Old

Vegetation Structure Data - New

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|-----|-----------|-----|-----------|-----|---------|-----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 8.46 | 366 | 8.44 | 349 | 8.42 | 343 | 8.44 | 353 |
| 15 | 8.86 | 83 | 8.83 | 84 | 0.83 | 84 | 6.17 | 84 |
| 25 | 9.12 | 75 | 8.99 | 73 | 8.93 | 74 | 9.01 | 74 |
| 35 | 8.67 | 550 | 8.67 | 557 | 8.69 | 551 | 8.68 | 553 |
| 45 | 8.84 | 141 | 8.81 | 136 | 8.75 | 135 | 8.80 | 137 |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 2

Transect Type: Tamarisk Control

Date: 10/2/2004 Revisit? Pre-tamarisk removal

Recorder: Kari Malen Reader: Suzanne Rhodes

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

Weather: Stormy weather, clouds and overcast

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|--|----------------|
| Bare Soil | 40 | Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | 2 |
| Cobble | 48 | Aristida purpurea Nutt. | 1 |
| Litter (duff) | 4 | Bromus rubens L. | 2 |
| Woody debris structure | 9 | Encelia frutescens (Gray) Gray | 1 |
| | | Erodium cicutarium (L.) L'Hér. ex Ait. | 3 |
| | | Gutierrezia sarothrae (Pursh) Britt. & Rusby | 1 |
| | | Populus tremuloides Michx. | 7 |
| | | Stanleya pinnata (Pursh) Britt. | 1 |

Daubenmire Scale Cover Data

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | | | <1% | | | | | | | |
| Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | | | | | | | | | 1-5% | |
| Artemisia ludoviciana Nutt. | <1% | | | | | | | | 1-5% | |
| Brickellia longifolia S. Wats. | | | 1-5% | | | | | | | |
| Bromus rubens L. | <1% | | | | 1-5% | | 1-5% | | 1-5% | |
| Datura wrightii Regel | | | | | <1% | | | | 1-5% | |
| Encelia frutescens (Gray) Gray | | | | | | | | | 1-5% | |
| Eriogonum inflatum Torr. & Frém. | | | | | | | 1-5% | | | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | | | | <1% | | 5-10% | | <1% | |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | | | | | 1-5% | | | | | |
| Machaeranthera pinnatifida (Hook.) Shinnery | | | <1% | | | | | | | |
| Mentzelia albicaulis (Dougl. ex Hook.) Dougl. ex Torr. & Gray | | | | | <1% | | 1-5% | | | |
| Sphaeralcea ambigua Gray | | | | | | | <1% | | | |
| Sporobolus flexuosus (Thurb. ex Vasey) Rydb. | | | | | | | | | <1% | |
| Stephanomeria pauciflora (Torr.) A. Nels. | <1% | | 1-5% | | 1-5% | | | | <1% | |
| Tiquilia latior (I.M. Johnston) A. Richards. | | | | | | | | | <1% | |

Vegetation Structure Data - Old

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 2

Transect Type: Tamarisk Control

Vegetation Structure Data - New

Soil Data

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 2

Transect Type: Tamarisk Control

Date: 5/7/2007 Revisit? Post-tamarisk removal
 Recorder: Lisa Hahn Reader: Melissa McMaster
 Wind Speed: Air Temp (F): Cloud Cover: 0
 Weather: Blue clear sky overhead.

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|----------------------------|----------------|
| Basal Veg | 1 | Populus fremontii S. Wats. | 1 |
| Boulder | 3 | | |
| Cobble | 24 | | |
| Gravel | 24 | | |
| Litter (duff) | 3 | | |
| Sand | 14 | | |
| Stone | 27 | | |
| Water | 3 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Bedrock | 20 | 0 | 0 | 0 | 0 |
| Litter (duff) | 1 | 1 | 1 | 1 | 2 |
| Cobble | 13 | 13 | 21 | 13 | 24 |
| Stone | 19 | 20 | 20 | 19 | 9 |
| Moss (ground) | 0 | 0 | 0 | 0 | 0 |
| Woody debris structure | 0 | 0 | 0 | 0 | 0 |
| Coarse woody debris | 1 | 1 | 1 | 0 | 1 |
| Basal Veg | 1 | 1 | 1 | 1 | 1 |
| Sand | 5 | 4 | 36 | 19 | 49 |
| Crypto | 0 | 0 | 0 | 0 | 0 |
| Lichen | 0 | 0 | 0 | 0 | 0 |
| Boulder | 7 | 3 | 4 | 22 | 2 |
| Water | 0 | 0 | 0 | 1 | 0 |
| Bare Soil | 0 | 0 | 0 | 0 | 0 |
| Gravel | 33 | 57 | 16 | 24 | 12 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | <0% | | <1% | | <1% | | <0% | | <0% | |
| | <0% | | <0% | | <1% | | <0% | | <0% | |
| Acacia greggii Gray | <1% | S | <0% | | <0% | | <0% | | <0% | |
| Anulocaulis leiosolenus (Torr.) Standl. | <0% | | <0% | | <1% | | <0% | | <0% | |
| Aristida purpurea Nutt. | <0% | | <1% | | <1% | | <1% | | <1% | |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 2

Transect Type: Tamarisk Control

| Species | 1 | 2 | 3 | 4 | 5 | 6 |
|---|------|-----|-----|------|-----|----------|
| Baccharis salicifolia (Ruiz & Pavón) Pers. | <0% | <0% | <0% | <1% | <0% | |
| Brickellia longifolia S. Wats. | <0% | <1% | <0% | <0% | <1% | |
| Bromus rubens L. | <1% | <1% | <1% | <1% | <0% | |
| Camissonia walkeri (A. Nels.) Raven | <0% | <1% | <1% | <1% | <0% | |
| Datura wrightii Regel | 1-5% | <0% | <0% | <0% | <0% | |
| Encelia resinifera C. Clark ssp. tenuifolia C. Clark | <0% | <1% | <0% | <0% | <0% | |
| Eriogonum corymbosum Benth. | <0% | <1% | <0% | <0% | <0% | |
| Eriogonum deflexum Torr. | <1% | <1% | <0% | <1% | <0% | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <1% | <0% | <0% | <0% | <0% | |
| Eurybia glauca (Nutt.) Nesom | <0% | <1% | <0% | <1% | <0% | |
| forb spp | <0% | <0% | <1% | <0% | <0% | |
| Hesperostipa neomexicana (Thurb. ex Coult.) Barkworth | <1% | <1% | <0% | <0% | <0% | |
| Oenothera caespitosa Nutt. | <0% | <0% | <0% | <0% | <1% | |
| Polypogon viridis (Gouan) Breistr. | <0% | <0% | <0% | <1% | <0% | |
| Populus fremontii S. Wats. | <0% | <0% | <1% | S | <0% | 10-25% M |
| Rhus trilobata Nutt. var. simplicifolia (Greene) Barkl. | <0% | <0% | <1% | <0% | <0% | |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | <1% | <0% | <1% | <0% | <0% | |
| Sporobolus contractus A.S. Hitchc. | <1% | <0% | <0% | <0% | <0% | |
| Sporobolus spp. | | | | | | <1% |
| Stanleya pinnata (Pursh) Britt. | 1-5% | <1% | <0% | <0% | <0% | |
| Stephanomeria pauciflora (Torr.) A. Nels. | <0% | <1% | <1% | 1-5% | <1% | |
| Tamarix ramosissima Ledeb. | <0% | <0% | <1% | S | <1% | S |
| Thymophylla pentachaeta (DC.) Small | <0% | <1% | <1% | <0% | <0% | |

Vegetation Structure Data - Old

Vegetation Structure Data - New

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|-----|-----------|-----|-----------|-----|---------|-----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 8.46 | 366 | 8.44 | 349 | 8.42 | 343 | 8.44 | 353 |
| 15 | 8.86 | 83 | 8.83 | 84 | 0.83 | 84 | 6.17 | 84 |
| 25 | 9.12 | 75 | 8.99 | 73 | 8.93 | 74 | 9.01 | 74 |
| 35 | 8.67 | 550 | 8.67 | 557 | 8.69 | 551 | 8.68 | 553 |
| 45 | 8.84 | 141 | 8.81 | 136 | 8.75 | 135 | 8.80 | 137 |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 3

Transect Type: Tamarisk Area

| | Start point | | End point |
|---------------------------|---|---------------------|--------------------------------|
| Easting: | 420901 | Easting: | 420906 |
| Northing: | 4016800 | Northing: | 4016846 |
| GPS accuracy (m): | 5.9 | GPS accuracy (m): | 5.1 |
| Elevation (m): | 947 | Elevation (m): | 960 |
| Bearing: | 13 | | |
| Aspect (0-360): | | Slope (degrees): | |
| Transect description: | Transect start is located on a 1.5x1.5m rounded muav limestone boulder on the creek left side of the drainage, right across from where the creek narrows and the right side is a muav limestone wall. Transect runs along the creek left side. Transect end is right in the center of a 2x2m tan limestone boulder embedded in the wash, about 10m downstream of a mature mesquite tree perched on creek left bank. | | |
| Additional Info:: | No water, TAMRAMs are mature and sapling. Water present in 2007 | | |
| Geological layer: | Muav limestone | | |
| Habitat type: | Riparian | GB desert scrub | |
| Dominant species: | Artemisia ludoviciana Nutt., Brickellia longifolia S. Wats., Eurybia glauca (Nutt.) Nesom, Tamarix ramosissima Ledeb. | | |
| Associated species: | Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth, Aristida spp., Aster spp., Baccharis emoryi Gray, Bromus rubens L., Cercis orbiculata Greene, Chrysothamnus spp., Descurainia pinnata (Walt.) Britt., Ephedra spp., Equisetum ×ferrissii Clute (pro sp.), Gutierrezia sarothrae (Pursh) Britt. & Rusby, Machaeranthera pinnatifida (Hook.) Shinnery, Machaeranthera spp., Oenothera spp., Opuntia erinacea Engelm. & Bigelow ex Engelm., Polypogon monspeliensis (L.) Desf., Populus fremontii S. Wats., Pseudognaphalium stramineum (Kunth) W.A. Weber, Purshia mexicana (D. Don) Henrickson, Sporobolus flexuosus (Thurb. ex Vasey) Rydb., Stephanomeria pauciflora (Torr.) A. Nels., Tiquilia latior (I.M. Johnston) A. Richards. | | |
| Surface water within 25m? | <input checked="" type="checkbox"/> | Surface water type: | stream |
| Landform: | Drainage channel | Surface rocks: | limestone |
| Soil type: | sand loamy sand | Topo position: | Interfluve |
| Light exposure: | open partial-shade | Soil moisture: | dry moist |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 3

Transect Type: Tamarisk Area

Date: 10/3/2004 Revisit? Pre-tamarisk removal
 Recorder: Lori Makarick Reader: Suzanne Rhodes
 Wind Speed: Air Temp (F): Cloud Cover:
 Weather: Clear, warm

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|---|----------------|
| Bare Soil | 66 | Artemisia ludoviciana Nutt. | 2 |
| Cobble | 23 | Aster spp. | 54 |
| Litter (duff) | 42 | Baccharis emoryi Gray | 1 |
| | | Brickellia longifolia S. Wats. | 7 |
| | | Bromus rubens L. | 1 |
| | | Equisetum ×ferrissii Clute (pro sp.) | 2 |
| | | Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 1 |
| | | Purshia spp. | 2 |
| | | Stephanomeria pauciflora (Torr.) A. Nels. | 6 |
| | | Tamarix ramosissima Ledeb. | 15 |

Daubenmire Scale Cover Data

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | <1% | | | | | | 1-5% | | 1-5% | |
| Aristida spp. | <1% | | 1-5% | | <1% | | | | | |
| Artemisia ludoviciana Nutt. | 1-5% | | 1-5% | | 1-5% | | 5-10% | | | |
| Aster spp. | 10-25% | | 1-5% | | 5-10% | | 1-5% | | 5-10% | |
| Baccharis emoryi Gray | 5-10% | | 5-10% | | | | | | | |
| Brickellia longifolia S. Wats. | 1-5% | | 5-10% | | 1-5% | | 5-10% | | 5-10% | |
| Bromus rubens L. | 5-10% | | 1-5% | | | | 1-5% | | 1-5% | |
| Cercis orbiculata Greene | | | 5-10% | | | | | | | |
| Chrysothamnus spp. | | | 1-5% | | | | | | | |
| Ephedra spp. | 1-5% | | | | | | | | | |
| Equisetum ×ferrissii Clute (pro sp.) | 1-5% | | | | | | | | | |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | | | 1-5% | | <1% | | | | | |
| Machaeranthera spp. | | | 1-5% | | | | | | | |
| Oenothera spp. | <1% | | | | | | | | | |
| Populus fremontii S. Wats. | | | | | 10-25% | | | | | |
| Purshia mexicana (D. Don) Henrickson | 1-5% | | <1% | | | | | | | |
| Sporobolus flexuosus (Thurb. ex Vasey) Rydb. | | | | | | | 1-5% | | | |
| Stephanomeria pauciflora (Torr.) A. Nels. | | | 1-5% | | 1-5% | | 1-5% | | <1% | |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 3

Transect Type: Tamarisk Area

Tamarix ramosissima Ledeb. 10-25% 10-25%

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--|---------------|-------------|-------------|
| 5 Equisetum ×ferrissii Clute (pro sp.) | 2 | | |
| 5 Tamarix ramosissima Ledeb. | 5 | | |
| 15 Brickellia longifolia S. Wats. | 5 | | |
| 45 Aster spp. | 1 | | |

Vegetation Structure Data - New

Soil Data

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 3

Transect Type: Tamarisk Area

Date: 5/7/2007 Revisit? Post-tamarisk removal
 Recorder: Kate Watters Reader: Lori Makarick
 Wind Speed: Air Temp (F): Cloud Cover: 0
 Weather: Breezy, 15% clouds, about 77F Very Nice!

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--|----------------|
| Boulder | 17 | Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | 3 |
| Coarse woody debris | 2 | Artemisia ludoviciana Nutt. | 2 |
| Cobble | 3 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 1 |
| Gravel | 7 | Brickellia longifolia S. Wats. | 12 |
| Litter (duff) | 43 | Bromus rubens L. | 1 |
| Sand | 24 | Equisetum ×ferrissii Clute (pro sp.) | 4 |
| Stone | 4 | Eurybia glauca (Nutt.) Nesom | 27 |
| | | Gutierrezia sarothrae (Pursh) Britt. & Rusby | 1 |
| | | Purshia stansburiana (Torr.) Henrickson | 1 |
| | | Sporobolus cryptandrus (Torr.) Gray | 1 |
| | | Stephanomeria pauciflora (Torr.) A. Nels. | 3 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Lichen | 0 | 0 | 0 | 0 | 0 |
| Woody debris structure | 1 | 0 | 4 | 0 | 0 |
| Stone | 12 | 19 | 5 | 9 | 12 |
| Basal Veg | 1 | 1 | 2 | 1 | 1 |
| Water | 0 | 0 | 0 | 0 | 0 |
| Coarse woody debris | 1 | 1 | 15 | 2 | 2 |
| Moss (ground) | 1 | 3 | 1 | 1 | 0 |
| Sand | 25 | 31 | 20 | 32 | 33 |
| Gravel | 10 | 22 | 5 | 10 | 13 |
| Cobble | 5 | 14 | 2 | 8 | 11 |
| Litter (duff) | 24 | 14 | 34 | 19 | 16 |
| Boulder | 20 | 5 | 11 | 17 | 11 |
| Crypto | 0 | 0 | 1 | 1 | 1 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | | | | | <1% | | | | | |
| Acacia greggii Gray | <0% | S | <0% | | <1% | S | <0% | | <1% | S |
| Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | <1% | | <0% | | <0% | | 1-5% | | <1% | |
| Aristida purpurea Nutt. | <0% | | 1-5% | | <1% | | <1% | | <1% | |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 3

Transect Type: Tamarisk Area

| | | | | | |
|---|--------|------|--------|--------|--------|
| Artemisia ludoviciana Nutt. | 1-5% | 1-5% | 1-5% | 1-5% | <0% |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | <1% | | | | <0% |
| Brickellia longifolia S. Wats. | <1% | <1% | 1-5% | 10-25% | 5-10% |
| Bromus rubens L. | <1% | <1% | <1% | <1% | <1% |
| Bromus tectorum L. | | <1% | | | |
| Cercis orbiculata Greene | | 1-5% | P | | |
| Cryptantha confertiflora (Greene) Payson | <0% | <1% | | | <1% |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | <0% | | | <1% | <1% |
| Elymus elymoides (Raf.) Swezey | <1% | | | | <0% |
| Ephedra torreyana S. Wats. | <0% | <0% | <1% | | <1% |
| Ephedra viridis Coville | <1% | | | | <0% |
| Equisetum ×ferrissii Clute (pro sp.) | 1-5% | | | | <0% |
| Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird | | 1-5% | <1% | | |
| Erigeron utahensis Gray | | <1% | | | |
| Eriogonum inflatum Torr. & Frém. | <0% | | | | <1% |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <0% | | | | <1% |
| Eurybia glauca (Nutt.) Nesom | 10-25% | 1-5% | 10-25% | 1-5% | 10-25% |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | <0% | <1% | <1% | <1% | 1-5% |
| Hesperostipa neomexicana (Thurb. ex Coult.) Barkworth | <1% | 1-5% | 1-5% | <1% | <1% |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 1-5% | | | | <0% |
| Oenothera elata Kunth | <1% | | | | <0% |
| Populus fremontii S. Wats. | <1% | S | 5-10% | M | <0% |
| Purshia stansburiana (Torr.) Henrickson | 1-5% | | 1-5% | | 1-5% |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | <0% | | <0% | <1% | <1% |
| Sporobolus cryptandrus (Torr.) Gray | <1% | | <1% | | <0% |
| Stephanomeria pauciflora (Torr.) A. Nels. | <1% | | 1-5% | <1% | 1-5% |
| Tamarix ramosissima Ledeb. | <1% | S | | | <0% |
| Thymophylla pentachaeta (DC.) Small | <0% | | | | <1% |
| Vulpia octoflora (Walt.) Rydb. | <0% | | <0% | <1% | |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|---|---------------|-------------|-------------|
| 5 Eurybia glauca (Nutt.) Nesom | 4 | | |
| 5 Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 3 | | |
| 15 Brickellia longifolia S. Wats. | 0 | | |
| 25 Eurybia glauca (Nutt.) Nesom | 5 | | |
| 25 Populus ×acuminata Rydb. (pro sp.) | | | |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 3

Transect Type: Tamarisk Area

25 Populus fremontii S. Wats.
 45 Brickellia longifolia S. Wats. 12

Vegetation Structure Data - New

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|---|---------------|-------------|-------------|
| 5 | Equisetum ×ferrissii Clute (pro sp.) | 5 | | |
| 5 | Eurybia glauca (Nutt.) Nesom | 4 | | |
| 5 | Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 2 | | |
| 15 | Brickellia longifolia S. Wats. | 8 | | |
| 25 | Eurybia glauca (Nutt.) Nesom | 4 | | |
| 25 | Populus fremontii S. Wats. | | | |
| 45 | Brickellia longifolia S. Wats. | 8 | | |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|--------------|------------------|-----------|------------------|-----------|------------------|-----------|----------------|-----------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 8.67 | 127 | 8.77 | 370 | 8.87 | 329 | 8.77 | 275 |
| 15 | 8.46 | 87 | 71 | 8 | 8.3 | 86 | 29.25 | 60 |
| 25 | 8.67 | 128 | 8.67 | 131 | 8.63 | 121 | 8.66 | 127 |
| 35 | 8.6 | 132 | 8.5 | 92 | 8.5 | 178 | 8.53 | 134 |
| 45 | 8.47 | 577 | 8.35 | 402 | 8.29 | 339 | 8.37 | 439 |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 3

Transect Type: Tamarisk Area

Date: 10/3/2004 Revisit? Pre-tamarisk removal
 Recorder: Lori Makarick Reader: Suzanne Rhodes
 Wind Speed: Air Temp (F): Cloud Cover:
 Weather: Clear, warm

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|---|----------------|
| Bare Soil | 66 | Artemisia ludoviciana Nutt. | 2 |
| Cobble | 23 | Aster spp. | 54 |
| Litter (duff) | 42 | Baccharis emoryi Gray | 1 |
| | | Brickellia longifolia S. Wats. | 7 |
| | | Bromus rubens L. | 1 |
| | | Equisetum ×ferrissii Clute (pro sp.) | 2 |
| | | Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 1 |
| | | Purshia spp. | 2 |
| | | Stephanomeria pauciflora (Torr.) A. Nels. | 6 |
| | | Tamarix ramosissima Ledeb. | 15 |

Daubenmire Scale Cover Data

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | <1% | | | | | | 1-5% | | 1-5% | |
| Aristida spp. | <1% | | 1-5% | | <1% | | | | | |
| Artemisia ludoviciana Nutt. | 1-5% | | 1-5% | | 1-5% | | 5-10% | | | |
| Aster spp. | 10-25% | | 1-5% | | 5-10% | | 1-5% | | 5-10% | |
| Baccharis emoryi Gray | 5-10% | | 5-10% | | | | | | | |
| Brickellia longifolia S. Wats. | 1-5% | | 5-10% | | 1-5% | | 5-10% | | 5-10% | |
| Bromus rubens L. | 5-10% | | 1-5% | | | | 1-5% | | 1-5% | |
| Cercis orbiculata Greene | | | 5-10% | | | | | | | |
| Chrysothamnus spp. | | | 1-5% | | | | | | | |
| Ephedra spp. | 1-5% | | | | | | | | | |
| Equisetum ×ferrissii Clute (pro sp.) | 1-5% | | | | | | | | | |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | | | 1-5% | | <1% | | | | | |
| Machaeranthera spp. | | | 1-5% | | | | | | | |
| Oenothera spp. | <1% | | | | | | | | | |
| Populus fremontii S. Wats. | | | | | 10-25% | | | | | |
| Purshia mexicana (D. Don) Henrickson | 1-5% | | <1% | | | | | | | |
| Sporobolus flexuosus (Thurb. ex Vasey) Rydb. | | | | | | | 1-5% | | | |
| Stephanomeria pauciflora (Torr.) A. Nels. | | | 1-5% | | 1-5% | | 1-5% | | <1% | |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 3

Transect Type: Tamarisk Area

| | | |
|----------------------------|--------|--------|
| Tamarix ramosissima Ledeb. | 10-25% | 10-25% |
|----------------------------|--------|--------|

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--|---------------|-------------|-------------|
| 5 Equisetum ×ferrissii Clute (pro sp.) | 2 | | |
| 5 Tamarix ramosissima Ledeb. | 5 | | |
| 15 Brickellia longifolia S. Wats. | 5 | | |
| 45 Aster spp. | 1 | | |

Vegetation Structure Data - New

Soil Data

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 3

Transect Type: Tamarisk Area

Date: 5/7/2007 Revisit? Post-tamarisk removal
 Recorder: Kate Watters Reader: Lori Makarick
 Wind Speed: Air Temp (F): Cloud Cover: 0
 Weather: Breezy, 15% clouds, about 77F Very Nice!

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--|----------------|
| Boulder | 17 | Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | 3 |
| Coarse woody debris | 2 | Artemisia ludoviciana Nutt. | 2 |
| Cobble | 3 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 1 |
| Gravel | 7 | Brickellia longifolia S. Wats. | 12 |
| Litter (duff) | 43 | Bromus rubens L. | 1 |
| Sand | 24 | Equisetum ×ferrissii Clute (pro sp.) | 4 |
| Stone | 4 | Eurybia glauca (Nutt.) Nesom | 27 |
| | | Gutierrezia sarothrae (Pursh) Britt. & Rusby | 1 |
| | | Purshia stansburiana (Torr.) Henrickson | 1 |
| | | Sporobolus cryptandrus (Torr.) Gray | 1 |
| | | Stephanomeria pauciflora (Torr.) A. Nels. | 3 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Lichen | 0 | 0 | 0 | 0 | 0 |
| Woody debris structure | 1 | 0 | 4 | 0 | 0 |
| Stone | 12 | 19 | 5 | 9 | 12 |
| Basal Veg | 1 | 1 | 2 | 1 | 1 |
| Water | 0 | 0 | 0 | 0 | 0 |
| Coarse woody debris | 1 | 1 | 15 | 2 | 2 |
| Moss (ground) | 1 | 3 | 1 | 1 | 0 |
| Sand | 25 | 31 | 20 | 32 | 33 |
| Gravel | 10 | 22 | 5 | 10 | 13 |
| Cobble | 5 | 14 | 2 | 8 | 11 |
| Litter (duff) | 24 | 14 | 34 | 19 | 16 |
| Boulder | 20 | 5 | 11 | 17 | 11 |
| Crypto | 0 | 0 | 1 | 1 | 1 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | | | | | <1% | | | | | |
| Acacia greggii Gray | <0% | S | <0% | | <1% | S | <0% | | <1% | S |
| Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | <1% | | <0% | | <0% | | 1-5% | | <1% | |
| Aristida purpurea Nutt. | <0% | | 1-5% | | <1% | | <1% | | <1% | |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 3

Transect Type: Tamarisk Area

| | | | | | |
|---|--------|------|--------|--------|--------|
| Artemisia ludoviciana Nutt. | 1-5% | 1-5% | 1-5% | 1-5% | <0% |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | <1% | | | | <0% |
| Brickellia longifolia S. Wats. | <1% | <1% | 1-5% | 10-25% | 5-10% |
| Bromus rubens L. | <1% | <1% | <1% | <1% | <1% |
| Bromus tectorum L. | | <1% | | | |
| Cercis orbiculata Greene | | 1-5% | P | | |
| Cryptantha confertiflora (Greene) Payson | <0% | <1% | | | <1% |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | <0% | | | <1% | <1% |
| Elymus elymoides (Raf.) Swezey | <1% | | | | <0% |
| Ephedra torreyana S. Wats. | <0% | <0% | <1% | | <1% |
| Ephedra viridis Coville | <1% | | | | <0% |
| Equisetum ×ferrissii Clute (pro sp.) | 1-5% | | | | <0% |
| Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird | | 1-5% | <1% | | |
| Erigeron utahensis Gray | | <1% | | | |
| Eriogonum inflatum Torr. & Frém. | <0% | | | | <1% |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <0% | | | | <1% |
| Eurybia glauca (Nutt.) Nesom | 10-25% | 1-5% | 10-25% | 1-5% | 10-25% |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | <0% | <1% | <1% | <1% | 1-5% |
| Hesperostipa neomexicana (Thurb. ex Coult.) Barkworth | <1% | 1-5% | 1-5% | <1% | <1% |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 1-5% | | | | <0% |
| Oenothera elata Kunth | <1% | | | | <0% |
| Populus fremontii S. Wats. | <1% | S | 5-10% | M | <0% |
| Purshia stansburiana (Torr.) Henrickson | 1-5% | | 1-5% | | 1-5% |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | <0% | | <0% | <1% | <1% |
| Sporobolus cryptandrus (Torr.) Gray | <1% | | <1% | | <0% |
| Stephanomeria pauciflora (Torr.) A. Nels. | <1% | | 1-5% | <1% | 1-5% |
| Tamarix ramosissima Ledeb. | <1% | S | | | <0% |
| Thymophylla pentachaeta (DC.) Small | <0% | | | | <1% |
| Vulpia octoflora (Walt.) Rydb. | <0% | | <0% | <1% | |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|---|---------------|-------------|-------------|
| 5 Eurybia glauca (Nutt.) Nesom | 4 | | |
| 5 Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 3 | | |
| 15 Brickellia longifolia S. Wats. | 0 | | |
| 25 Eurybia glauca (Nutt.) Nesom | 5 | | |
| 25 Populus ×acuminata Rydb. (pro sp.) | | | |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 3

Transect Type: Tamarisk Area

- 25 Populus fremontii S. Wats.
- 45 Brickellia longifolia S. Wats. 12

Vegetation Structure Data - New

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|---|---------------|-------------|-------------|
| 5 | Equisetum ×ferrissii Clute (pro sp.) | 5 | | |
| 5 | Eurybia glauca (Nutt.) Nesom | 4 | | |
| 5 | Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 2 | | |
| 15 | Brickellia longifolia S. Wats. | 8 | | |
| 25 | Eurybia glauca (Nutt.) Nesom | 4 | | |
| 25 | Populus fremontii S. Wats. | | | |
| 45 | Brickellia longifolia S. Wats. | 8 | | |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|--------------|------------------|-----------|------------------|-----------|------------------|-----------|----------------|-----------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 8.67 | 127 | 8.77 | 370 | 8.87 | 329 | 8.77 | 275 |
| 15 | 8.46 | 87 | 71 | 8 | 8.3 | 86 | 29.25 | 60 |
| 25 | 8.67 | 128 | 8.67 | 131 | 8.63 | 121 | 8.66 | 127 |
| 35 | 8.6 | 132 | 8.5 | 92 | 8.5 | 178 | 8.53 | 134 |
| 45 | 8.47 | 577 | 8.35 | 402 | 8.29 | 339 | 8.37 | 439 |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 3

Transect Type: Tamarisk Control

| | Start point | | End point |
|---------------------------|--|---------------------|---------------------|
| Easting: | 420858 | Easting: | 420976 |
| Northing: | 4016764 | Northing: | 4016898 |
| GPS accuracy (m): | 5.3 | GPS accuracy (m): | 16 |
| Elevation (m): | 971 | Elevation (m): | 966 |
| Bearing: | 61 | | |
| Aspect (0-360): | 46 | Slope (degrees): | 2 |
| Transect description: | Transect next to 2 house-sized limestone boulders. Transect start near 2 large house size boulders closest to creek bed. On NW side of creekbed (creek left). Start point on NW corner of 3x4m large flat gray limestone boulder tucked between white and red rocks. End point ~2m from POPFRE 15m tall, 15cm dbh, near 1m red sandstone boulder. Transect end is .2m downstream of a 1x.5m red sandstone boulder | | |
| Additional Info:: | No water, only 4 sapling TAMRAM in length of transect, sandy soil w/ cobbles. Recent flash flood evidence. | | |
| Geological layer: | Muav limestone | | |
| Habitat type: | Riparian | GB desert scrub | |
| Dominant species: | Aristida purpurea Nutt., Artemisia ludoviciana Nutt., Baccharis emoryi Gray, Brickellia longifolia S. Wats., Sporobolus cryptandrus (Torr.) Gray | | |
| Associated species: | Acacia greggii Gray, Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth, Agave utahensis Engelm., Aristida spp., Artemisia ludoviciana Nutt., Aster spp., Bromus rubens L., Encelia frutescens (Gray) Gray, Ephedra spp., Equisetum ×ferrissii Clute (pro sp.), Fallugia paradoxa (D. Don) Endl. ex Torr., Juniperus osteosperma (Torr.) Little, Machaeranthera pinnatifida (Hook.) Shinnery, Machaeranthera spp., Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Oenothera spp., Populus fremontii S. Wats., Sporobolus flexuosus (Thurb. ex Vasey) Rydb., Stephanomeria pauciflora (Torr.) A. Nels. | | |
| Surface water within 25m? | <input checked="" type="checkbox"/> | Surface water type: | stream |
| Landform: | Drainage channel | Surface rocks: | limestone sandstone |
| Soil type: | sand | Topo position: | Interfluve |
| Light exposure: | open partial-shade | Soil moisture: | dry moist |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 3

Transect Type: Tamarisk Control

Date: 10/3/2004 Revisit? Pre-tamarisk removal

Recorder: Suzanne Rhodes Reader: Lori Makarick

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

Weather: Clear, warm

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--|----------------|
| Bare Soil | 66 | Artemisia ludoviciana Nutt. | 2 |
| Cobble | 51 | Baccharis emoryi Gray | 5 |
| Litter (duff) | 22 | Brickellia longifolia S. Wats. | 14 |
| | | Sporobolus flexuosus (Thurb. ex Vasey) Rydb. | 1 |
| | | Stephanomeria pauciflora (Torr.) A. Nels. | 3 |

Daubermire Scale Cover Data

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Agave utahensis Engelm. | | | <1% | | | | | | | |
| Aristida spp. | | | 1-5% | | 1-5% | | <1% | | <1% | |
| Artemisia ludoviciana Nutt. | | | | | 5-10% | | 1-5% | | <1% | |
| Aster spp. | | | | | | | 1-5% | | | |
| Baccharis emoryi Gray | 1-5% | | 1-5% | | 5-10% | | | | | |
| Brickellia longifolia S. Wats. | 5-10% | | 5-10% | | 5-10% | | 5-10% | | 10-25% | |
| Bromus rubens L. | | | | | <1% | | | | 1-5% | |
| Echinocereus spp. | 1-5% | | | | | | | | | |
| Encelia frutescens (Gray) Gray | | | | | | | | | <1% | |
| Ephedra spp. | <1% | | | | | | | | | |
| Equisetum ×ferrissii Clute (pro sp.) | <1% | | | | | | | | | |
| Juniperus osteosperma (Torr.) Little | | | 1-5% | | | | | | | |
| Machaeranthera spp. | | | 1-5% | | | | | | | |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 1-5% | | | | | | | | | |
| Oenothera spp. | <1% | | | | | | | | | |
| Purshia spp. | 5-10% | | | | | | | | | |
| Sporobolus flexuosus (Thurb. ex Vasey) Rydb. | | | | | | | 1-5% | | 1-5% | |
| Stephanomeria pauciflora (Torr.) A. Nels. | | | | | 1-5% | | 1-5% | | <1% | |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|----------------------------------|---------------|-------------|-------------|
| 5 Brickellia longifolia S. Wats. | 5 | | |
| 25 Baccharis emoryi Gray | 1 | | |

Vegetation Structure Data - New

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 3

Transect Type: Tamarisk Control

Soil Data

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 3

Transect Type: Tamarisk Control

Date: 5/7/2007 Revisit? Post-tamarisk removal

Recorder: Melissa McMaster Reader: Lisa Hahn

Wind Speed: Air Temp (F): Cloud Cover: 0

Weather: 10% clouds, mostly sunny and warm, breezy, about 75 F

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|---|----------------|
| Boulder | 21 | Aristida purpurea Nutt. | 1 |
| Cobble | 4 | Artemisia ludoviciana Nutt. | 1 |
| Gravel | 7 | Brickellia longifolia S. Wats. | 4 |
| Litter (duff) | 18 | Bromus rubens L. | 1 |
| Sand | 41 | Eurybia glauca (Nutt.) Nesom | 1 |
| Stone | 9 | Purshia stansburiana (Torr.) Henrickson | 3 |
| | | Stephanomeria pauciflora (Torr.) A. Nels. | 1 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Stone | 11 | 13 | 14 | 18 | 18 |
| Basal Veg | 1 | 1 | 1 | 1 | 1 |
| Bedrock | 0 | 0 | 0 | 0 | 0 |
| Coarse woody debris | 1 | 1 | 0 | 0 | 2 |
| Litter (duff) | 4 | 6 | 15 | 7 | 11 |
| Bare Soil | 0 | 0 | 0 | 0 | 0 |
| Moss (ground) | 0 | 0 | 1 | 1 | 0 |
| Woody debris structure | 0 | 0 | 1 | 1 | 0 |
| Sand | 39 | 21 | 32 | 46 | 25 |
| Crypto | 0 | 0 | 0 | 1 | 1 |
| Cobble | 8 | 11 | 5 | 15 | 15 |
| Gravel | 11 | 21 | 9 | 6 | 18 |
| Water | 2 | 0 | 0 | 0 | 0 |
| Boulder | 23 | 26 | 22 | 4 | 9 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Agave utahensis Engelm. var. kaibabensis (McKelvey) Breitung | <0% | | <1% | | | | <1% | | | |
| Aristida purpurea Nutt. | | | <0% | | <1% | | | | <1% | |
| Artemisia ludoviciana Nutt. | | | 1-5% | | 1-5% | | 1-5% | | <1% | |
| Astragalus lentiginosus Dougl. ex Hook. | | | | | | | | | <1% | |
| Astragalus nuttallianus DC. | <1% | | <1% | | <0% | | <0% | | <0% | |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | <1% | | <0% | | 1-5% | | <0% | | <0% | |
| Brickellia longifolia S. Wats. | <1% | | 1-5% | | 5-10% | | 5-10% | | 5-10% | |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 3

Transect Type: Tamarisk Control

| | | | | | | | | | |
|---|--------|-----|------|-----|------|--|------|------|-----|
| Bromus rubens L. | <1% | | <1% | | <1% | | <1% | | <1% |
| Bromus tectorum L. | <1% | | <1% | | <1% | | | | |
| Cercis orbiculata Greene | <1% | S | | | | | | | |
| Chenopodium album L. | <1% | | <1% | | | | | | |
| Cirsium arizonicum (Gray) Petrak | <0% | | <1% | | | | | | |
| Descurainia pinnata (Walt.) Britt. | | | <1% | | | | | | |
| Elymus elymoides (Raf.) Swezey | | | <1% | | | | | | |
| Encelia resinifera C. Clark ssp. tenuifolia C. Clark | <0% | | <1% | | | | | | <1% |
| Ephedra torreyana S. Wats. | 1-5% | | <1% | | | | | | |
| Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird | | | | | | | | 1-5% | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | | <1% | | | | | | |
| Eurybia glauca (Nutt.) Nesom | | | | | | | | <1% | |
| Hesperostipa neomexicana (Thurb. ex Coult.) Barkworth | <0% | | <1% | | 1-5% | | 1-5% | | <1% |
| Juniperus osteosperma (Torr.) Little | | | 1-5% | S+P | | | | | |
| Opuntia spp. | | | | | | | <1% | | |
| Plantago patagonica Jacq. | | | <1% | | | | | | |
| Polypogon monspeliensis (L.) Desf. | <0% | | <1% | | | | | | |
| Polypogon viridis (Gouan) Breistr. | <1% | | <1% | | <0% | | <0% | | <0% |
| Purshia stansburiana (Torr.) Henrickson | 10-25% | | <1% | | <0% | | <0% | | <0% |
| Rhus trilobata Nutt. var. simplicifolia (Greene) Barkl. | | | <1% | | | | | | |
| Sporobolus cryptandrus (Torr.) Gray | | | | | <1% | | <1% | | <1% |
| Stanleya pinnata (Pursh) Britt. | <0% | | <1% | | | | | | |
| Stephanomeria pauciflora (Torr.) A. Nels. | | | 1-5% | | 1-5% | | 1-5% | | <1% |
| Tamarix ramosissima Ledeb. | <1% | S+P | <1% | S | <0% | | <0% | | <0% |
| Thymophylla pentachaeta (DC.) Small | | | | | <1% | | | | |

Vegetation Structure Data - Old

Vegetation Structure Data - New

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|------|-----------|------|-----------|------|---------|------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 9.1 | 1462 | 9.06 | 1437 | 9.04 | 1450 | 9.07 | 1450 |
| 15 | 8.68 | 217 | 8.77 | 184 | 8.71 | 211 | 8.72 | 204 |
| 25 | 8.98 | 46 | 8.99 | 41 | 9 | 38 | 8.99 | 42 |
| 35 | 9 | 140 | 8.92 | 78 | 8.84 | 104 | 8.92 | 107 |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 3

Transect Type: Tamarisk Control

45 8.87 44 8.93 46 8.92 48 8.91 46

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 3

Transect Type: Tamarisk Control

Date: 10/3/2004 Revisit? Pre-tamarisk removal

Recorder: Suzanne Rhodes Reader: Lori Makarick

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

Weather: Clear, warm

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--|----------------|
| Bare Soil | 66 | Artemisia ludoviciana Nutt. | 2 |
| Cobble | 51 | Baccharis emoryi Gray | 5 |
| Litter (duff) | 22 | Brickellia longifolia S. Wats. | 14 |
| | | Sporobolus flexuosus (Thurb. ex Vasey) Rydb. | 1 |
| | | Stephanomeria pauciflora (Torr.) A. Nels. | 3 |

Daubenmire Scale Cover Data

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Agave utahensis Engelm. | | | <1% | | | | | | | |
| Aristida spp. | | | 1-5% | | 1-5% | | <1% | | <1% | |
| Artemisia ludoviciana Nutt. | | | | | 5-10% | | 1-5% | | <1% | |
| Aster spp. | | | | | | | 1-5% | | | |
| Baccharis emoryi Gray | 1-5% | | 1-5% | | 5-10% | | | | | |
| Brickellia longifolia S. Wats. | 5-10% | | 5-10% | | 5-10% | | 5-10% | | 10-25% | |
| Bromus rubens L. | | | | | <1% | | | | 1-5% | |
| Echinocereus spp. | 1-5% | | | | | | | | | |
| Encelia frutescens (Gray) Gray | | | | | | | | | <1% | |
| Ephedra spp. | <1% | | | | | | | | | |
| Equisetum ×ferrissii Clute (pro sp.) | <1% | | | | | | | | | |
| Juniperus osteosperma (Torr.) Little | | | 1-5% | | | | | | | |
| Machaeranthera spp. | | | 1-5% | | | | | | | |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 1-5% | | | | | | | | | |
| Oenothera spp. | <1% | | | | | | | | | |
| Purshia spp. | 5-10% | | | | | | | | | |
| Sporobolus flexuosus (Thurb. ex Vasey) Rydb. | | | | | | | 1-5% | | 1-5% | |
| Stephanomeria pauciflora (Torr.) A. Nels. | | | | | 1-5% | | 1-5% | | <1% | |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|----------------------------------|---------------|-------------|-------------|
| 5 Brickellia longifolia S. Wats. | 5 | | |
| 25 Baccharis emoryi Gray | 1 | | |

Vegetation Structure Data - New

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 3

Transect Type: Tamarisk Control

Soil Data

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 3

Transect Type: Tamarisk Control

Date: 5/7/2007 Revisit? Post-tamarisk removal

Recorder: Melissa McMaster Reader: Lisa Hahn

Wind Speed: Air Temp (F): Cloud Cover: 0

Weather: 10% clouds, mostly sunny and warm, breezy, about 75 F

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|---|----------------|
| Boulder | 21 | Aristida purpurea Nutt. | 1 |
| Cobble | 4 | Artemisia ludoviciana Nutt. | 1 |
| Gravel | 7 | Brickellia longifolia S. Wats. | 4 |
| Litter (duff) | 18 | Bromus rubens L. | 1 |
| Sand | 41 | Eurybia glauca (Nutt.) Nesom | 1 |
| Stone | 9 | Purshia stansburiana (Torr.) Henrickson | 3 |
| | | Stephanomeria pauciflora (Torr.) A. Nels. | 1 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Stone | 11 | 13 | 14 | 18 | 18 |
| Basal Veg | 1 | 1 | 1 | 1 | 1 |
| Bedrock | 0 | 0 | 0 | 0 | 0 |
| Coarse woody debris | 1 | 1 | 0 | 0 | 2 |
| Litter (duff) | 4 | 6 | 15 | 7 | 11 |
| Bare Soil | 0 | 0 | 0 | 0 | 0 |
| Moss (ground) | 0 | 0 | 1 | 1 | 0 |
| Woody debris structure | 0 | 0 | 1 | 1 | 0 |
| Sand | 39 | 21 | 32 | 46 | 25 |
| Crypto | 0 | 0 | 0 | 1 | 1 |
| Cobble | 8 | 11 | 5 | 15 | 15 |
| Gravel | 11 | 21 | 9 | 6 | 18 |
| Water | 2 | 0 | 0 | 0 | 0 |
| Boulder | 23 | 26 | 22 | 4 | 9 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Agave utahensis Engelm. var. kaibabensis (McKelvey) Breitung | <0% | | <1% | | | | <1% | | | |
| Aristida purpurea Nutt. | | | <0% | | <1% | | | | <1% | |
| Artemisia ludoviciana Nutt. | | | 1-5% | | 1-5% | | 1-5% | | <1% | |
| Astragalus lentiginosus Dougl. ex Hook. | | | | | | | | | <1% | |
| Astragalus nuttallianus DC. | <1% | | <1% | | <0% | | <0% | | <0% | |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | <1% | | <0% | | 1-5% | | <0% | | <0% | |
| Brickellia longifolia S. Wats. | <1% | | 1-5% | | 5-10% | | 5-10% | | 5-10% | |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 3

Transect Type: Tamarisk Control

| | | | | | | | | | |
|---|--------|-----|------|-----|------|--|------|------|-----|
| Bromus rubens L. | <1% | | <1% | | <1% | | <1% | | <1% |
| Bromus tectorum L. | <1% | | <1% | | <1% | | | | |
| Cercis orbiculata Greene | <1% | S | | | | | | | |
| Chenopodium album L. | <1% | | <1% | | | | | | |
| Cirsium arizonicum (Gray) Petrak | <0% | | <1% | | | | | | |
| Descurainia pinnata (Walt.) Britt. | | | <1% | | | | | | |
| Elymus elymoides (Raf.) Swezey | | | <1% | | | | | | |
| Encelia resinifera C. Clark ssp. tenuifolia C. Clark | <0% | | <1% | | | | | | <1% |
| Ephedra torreyana S. Wats. | 1-5% | | <1% | | | | | | |
| Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird | | | | | | | | 1-5% | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | | <1% | | | | | | |
| Eurybia glauca (Nutt.) Nesom | | | | | | | | <1% | |
| Hesperostipa neomexicana (Thurb. ex Coult.) Barkworth | <0% | | <1% | | 1-5% | | 1-5% | | <1% |
| Juniperus osteosperma (Torr.) Little | | | 1-5% | S+P | | | | | |
| Opuntia spp. | | | | | | | <1% | | |
| Plantago patagonica Jacq. | | | <1% | | | | | | |
| Polypogon monspeliensis (L.) Desf. | <0% | | <1% | | | | | | |
| Polypogon viridis (Gouan) Breistr. | <1% | | <1% | | <0% | | <0% | | <0% |
| Purshia stansburiana (Torr.) Henrickson | 10-25% | | <1% | | <0% | | <0% | | <0% |
| Rhus trilobata Nutt. var. simplicifolia (Greene) Barkl. | | | <1% | | | | | | |
| Sporobolus cryptandrus (Torr.) Gray | | | | | <1% | | <1% | | <1% |
| Stanleya pinnata (Pursh) Britt. | <0% | | <1% | | | | | | |
| Stephanomeria pauciflora (Torr.) A. Nels. | | | 1-5% | | 1-5% | | 1-5% | | <1% |
| Tamarix ramosissima Ledeb. | <1% | S+P | <1% | S | <0% | | <0% | | <0% |
| Thymophylla pentachaeta (DC.) Small | | | | | | | <1% | | |

Vegetation Structure Data - Old

Vegetation Structure Data - New

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|------|-----------|------|-----------|------|---------|------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 9.1 | 1462 | 9.06 | 1437 | 9.04 | 1450 | 9.07 | 1450 |
| 15 | 8.68 | 217 | 8.77 | 184 | 8.71 | 211 | 8.72 | 204 |
| 25 | 8.98 | 46 | 8.99 | 41 | 9 | 38 | 8.99 | 42 |
| 35 | 9 | 140 | 8.92 | 78 | 8.84 | 104 | 8.92 | 107 |

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Project (Phase): Phase IIa

Transect Name: Nankoweap Creek 3

Transect Type: Tamarisk Control

45 8.87 44 8.93 46 8.92 48 8.91 46

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 1

Transect Type: Tamarisk Area

| | Start point | | End point |
|---------------------------|--|---------------------|------------------|
| Easting: | 421021 | Easting: | 421067 |
| Northing: | 4039658 | Northing: | 4039672 |
| GPS accuracy (m): | 9 | GPS accuracy (m): | 5 |
| Elevation (m): | 1038 | Elevation (m): | 1173 |
| Bearing: | 79 | | |
| Aspect (0-360): | 76 | Slope (degrees): | 5 |
| Transect description: | Start point is on boulder on creek left just below mouth of bedrock canyon (fork on creek left). Endpoint is down canyon. From camp, head up S.Canyon Trail. Transect 1A start point is at the mouth of fork of bedrock canyon on creek left ~0.6km from where trail dropped into drainage. | | |
| Additional Info:: | | | |
| Geological layer: | Supai | | |
| Habitat type: | Mojave desert scrub GB desert scrub | | |
| Dominant species: | Atriplex canescens (Pursh) Nutt., Brickellia longifolia S. Wats., Stephanomeria pauciflora (Torr.) A. Nels. | | |
| Associated species: | Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth, Allionia L., Amaranthus albus L., Aristida spp., Aster spp., Atriplex canescens (Pursh) Nutt., Bromus rigidus Roth, Bromus tectorum L., Camissonia walkeri (A. Nels.) Raven, Chenopodium album L., Cryptantha angustifolia (Torr.) Greene, Cryptantha spp., Dasyochloa pulchella (Kunth) Willd. ex Rydb., Datura wrightii Regel, Descurainia pinnata (Walt.) Britt., Ephedra spp., Erodium cicutarium (L.) L'Hér. ex Ait., Gilia spp., Gutierrezia spp., Lepidium perfoliatum L., Loeseliastrum schottii (Torr.) Timbrook, Lycium spp., Machaeranthera pinnatifida (Hook.) Shinnery, Melilotus spp., Mentzelia spp., Mirabilis multiflora (Torr.) Gray, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Nicotiana obtusifolia Mertens & Galeotti, Opuntia basilaris Engelm. & Bigelow, Phacelia crenulata Torr. ex S. Wats., Phacelia rotundifolia Torr. ex S. Wats., Plagiobothrys arizonicus (Gray) Greene ex Gray, Salsola tragus L., Schismus spp., Sisymbrium altissimum L., Sisymbrium irio L., Sphaeralcea spp., Sporobolus cryptandrus (Torr.) Gray, Stanleya pinnata (Pursh) Britt., Stephanomeria exigua Nutt., Stephanomeria pauciflora (Torr.) A. Nels., Thymophylla pentachaeta (DC.) Small, Tiquilia latior (I.M. Johnston) A. Richards. | | |
| Surface water within 25m? | <input checked="" type="checkbox"/> | Surface water type: | |
| Landform: Side slope | | Surface rocks: | sandstone |
| Soil type: sand | | Topo position: | |
| Light exposure: open | | Soil moisture: | moist |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 1

Transect Type: Tamarisk Area

Date: 5/6/2005 Revisit? Pre-tamarisk removal

Recorder: Maggie Drechsler Reader: Lisa Hahn

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

Weather: Dense cloud cover ~70F, raining

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|---|----------------|
| Boulder | 20 | Aristida spp. | 1 |
| Cobble | 10 | Brickellia longifolia S. Wats. | 11 |
| Gravel | 11 | Bromus rubens L. | 6 |
| Litter (duff) | 20 | Bromus tectorum L. | 3 |
| Sand | 38 | Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake | 1 |
| Stone | 11 | Ephedra spp. | 2 |
| | | Gutierrezia spp. | 1 |
| | | Sphaeralcea spp. | 2 |
| | | Stephanomeria pauciflora (Torr.) A. Nels. | 6 |
| | | Tamarix ramosissima Ledeb. | 18 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|---------------------|-----------|------------|------------|------------|------------|
| Boulder | 64 | 35 | 48 | 6 | 29 |
| Stone | 0 | 16 | 10 | 6 | 2 |
| Sand | 18 | 16 | 23 | 69 | 49 |
| Gravel | 0 | 16 | 10 | 6 | 14 |
| Cobble | 18 | 16 | 10 | 14 | 6 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Aristida spp. | | | <1% | | | | | | | |
| Aster spp. | | | | | | | <1% | | | |
| Astragalus spp. | | | | | | | <1% | | | |
| Atriplex canescens (Pursh) Nutt. | | | 1-5% | | 1-5% | | <1% | | | |
| Atriplex spp. | | | | | | | | | <1% | |
| Brickellia longifolia S. Wats. | 1-5% | | 1-5% | | 1-5% | | | | 1-5% | |
| Bromus rubens L. | <1% | | 1-5% | | 1-5% | | 1-5% | | <1% | |
| Bromus tectorum L. | 1-5% | | 1-5% | | 1-5% | | <1% | | <1% | |
| Camissonia walkeri (A. Nels.) Raven | | | <1% | | <1% | | <1% | | <1% | |
| Chrysothamnus spp. | | | 1-5% | | 1-5% | | | | | |
| Cryptantha angustifolia (Torr.) Greene | | | | | <1% | | <1% | | | |
| Cryptobiotic soil | | | <1% | | <1% | | <1% | | | |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | | | <1% | | | | | | | |
| Datura wrightii Regel | <1% | | | | | | | | | |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 1

Transect Type: Tamarisk Area

| | | | | | |
|--|--------|--------|--------|--------|-------|
| Descurainia pinnata (Walt.) Britt. | | 1-5% | | | |
| Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake | | 1-5% | | | |
| Ephedra spp. | | | <1% | | <1% |
| Erigeron speciosus (Lindl.) DC. var. macranthus (Nutt.) Cronq. | | | | <1% | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | <1% | | 1-5% | |
| Gilia spp. | | | | | <1% |
| Gutierrezia spp. | 1-5% | | | | |
| Lepidium perfoliatum L. | | 1-5% | 1-5% | <1% | <1% |
| Lithophragma tenellum Nutt. | 5-10% | 10-25% | 10-25% | 10-25% | 5-10% |
| Loeseliastrum schottii (Torr.) Timbrook | | | | | <1% |
| Lycium spp. | | <1% | <1% | | |
| Melilotus spp. | | | <1% | | <1% |
| Mentzelia spp. | | | | <1% | |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | | <1% | | | |
| Nicotiana obtusifolia Mertens & Galeotti | | | | <1% | |
| Opuntia basilaris Engelm. & Bigelow | | | 1-5% | | |
| Phacelia crenulata Torr. ex S. Wats. | | <1% | <1% | | <1% |
| Phacelia rotundifolia Torr. ex S. Wats. | <1% | | | | |
| Plagiobothrys arizonicus (Gray) Greene ex Gray | | <1% | <1% | | <1% |
| Salsola tragus L. | | | | | <1% |
| Schismus spp. | | 1-5% | <1% | <1% | <1% |
| Sisymbrium altissimum L. | | | <1% | <1% | |
| Sisymbrium irio L. | | 1-5% | | | |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | | | 1-5% | 1-5% | |
| Sporobolus cryptandrus (Torr.) Gray | <1% | | | 1-5% | 1-5% |
| Stephanomeria exigua Nutt. | | | <1% | | |
| Stephanomeria pauciflora (Torr.) A. Nels. | <1% | 1-5% | | 5-10% | 1-5% |
| Tamarix ramosissima Ledeb. | 25-50% | | 25-50% | 10-25% | 1-5% |
| Thymophylla pentachaeta (DC.) Small | | | <1% | | <1% |
| Tiquilia latior (I.M. Johnston) A. Richards. | | | <1% | | <1% |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|-------------------------------|---------------|-------------|-------------|
| 5 Tamarix ramosissima Ledeb. | 4 | | |
| 25 Tamarix ramosissima Ledeb. | 6 | | |
| 35 Bromus tectorum L. | 1 | | |
| 35 Tamarix ramosissima Ledeb. | 3 | | |

Vegetation Structure Data - New

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 1

Transect Type: Tamarisk Area

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|----|-----------|----|-----------|----|---------|----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0 | | 0 | | 0 | | 0.00 | |
| 15 | 0 | | 0 | | 0 | | 0.00 | |
| 25 | 0 | | 0 | | 0 | | 0.00 | |
| 35 | 0.03 | | 0 | | 0.01 | | 0.01 | |
| 45 | 0 | | 0 | | 0 | | 0.00 | |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 1

Transect Type: Tamarisk Area

Date: 4/22/2006 Revisit? Post-tamarisk removal

Recorder: Eric Krouse Reader: Kate Watters

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

Weather: Clear, sunny, breezy about 75F.

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|--|----------------|
| Bare Soil | 5 | | 1 |
| Boulder | 12 | Aristida purpurea Nutt. var. nealleyi (Vasey) Allred | 1 |
| Coarse woody debris | 2 | Brickellia longifolia S. Wats. | 10 |
| Cobble | 10 | Bromus tectorum L. | 2 |
| Gravel | 22 | Ephedra torreyana S. Wats. | 2 |
| Litter (duff) | 32 | Gutierrezia sarothrae (Pursh) Britt. & Rusby | 1 |
| Sand | 9 | Stephanomeria pauciflora (Torr.) A. Nels. | 5 |
| Stone | 7 | Tamarix ramosissima Ledeb. | 1 |
| Woody debris structure | 1 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Sand | 2 | 3 | 0 | 24 | 7 |
| Cobble | 13 | 40 | 7 | 24 | 17 |
| Stone | 5 | 19 | 16 | 10 | 7 |
| Litter (duff) | 13 | 8 | 16 | 10 | 3 |
| Gravel | 13 | 8 | 3 | 10 | 36 |
| Woody debris structure | 2 | 0 | 0 | 0 | 0 |
| Boulder | 45 | 19 | 34 | 10 | 17 |
| Coarse woody debris | 5 | 1 | 3 | 4 | 3 |
| Bedrock | 0 | 0 | 16 | 4 | 7 |
| Bare Soil | 2 | 3 | 7 | 4 | 3 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Aristida arizonica Vasey | | | | | | | | | <1% | |
| Aristida purpurea Nutt. | | | | | <1% | | | | | |
| Atriplex canescens (Pursh) Nutt. | | | | | 1-5% | | 5-10% | | 1-5% | <1% |
| Brickellia longifolia S. Wats. | | | 1-5% | | 5-10% | | 1-5% | | <1% | 1-5% |
| Bromus rubens L. | | | <1% | | <1% | | <0% | | <1% | <0% |
| Bromus tectorum L. | | | <1% | | <0% | | | | | |
| Cryptobiotic soil | | | <0% | | <1% | | <1% | | <0% | <0% |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | | | | | <1% | | | | | |
| Datura wrightii Regel | | | | | | | | | | <1% |
| Ephedra torreyana S. Wats. | | | <0% | | <1% | | 1-5% | | <0% | <1% |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 1

Transect Type: Tamarisk Area

| | | | | | | | |
|--|------|-------|-------|-------|---|------|---|
| Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird | | 1-5% | 1-5% | | | | |
| Eriogonum inflatum Torr. & Frém. | | | | <1% | | | |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | 1-5% | <1% | <1% | <0% | | <0% | |
| Lycium spp. | | <1% | <1% | | | | |
| Moss spp. | <0% | <1% | <0% | <0% | | <0% | |
| Opuntia basilaris Engelm. & Bigelow | | | 5-10% | | | | |
| Sisymbrium altissimum L. | <1% | | | | | | |
| Sphaeralcea ambigua Gray | | | <1% | <1% | | <0% | |
| Sporobolus cryptandrus (Torr.) Gray | <1% | <0% | <1% | <1% | | <1% | |
| Stanleya pinnata (Pursh) Britt. | | | | <1% | | | |
| Stephanomeria pauciflora (Torr.) A. Nels. | <0% | 5-10% | <1% | 5-10% | | 1-5% | |
| Tamarix ramosissima Ledeb. | | | | 1-5% | P | 1-5% | P |
| Thymophylla pentachaeta (DC.) Small | | <1% | 1-5% | <1% | | | |
| Tiquilia latior (I.M. Johnston) A. Richards. | | | <1% | <0% | | <1% | |

Vegetation Structure Data - Old

Vegetation Structure Data - New

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|-----|-----------|-----|-----------|-----|---------|-----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 8.22 | 498 | 8.26 | 515 | 8.56 | 512 | 8.35 | 508 |
| 15 | 8.3 | 464 | 8.28 | 494 | 8.3 | 587 | 8.29 | 515 |
| 25 | 8.83 | 507 | 8.8 | 500 | 8.77 | 494 | 8.80 | 500 |
| 35 | 8.4 | 353 | 8.47 | 397 | 8.46 | 292 | 8.44 | 347 |
| 45 | 9.14 | 341 | 8.92 | 399 | 8.85 | 428 | 8.97 | 389 |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 1

Transect Type: Tamarisk Area

Date: 5/6/2005 Revisit? Pre-tamarisk removal

Recorder: Maggie Drechsler Reader: Lisa Hahn

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

Weather: Dense cloud cover ~70F, raining

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|---|----------------|
| Boulder | 20 | Aristida spp. | 1 |
| Cobble | 10 | Brickellia longifolia S. Wats. | 11 |
| Gravel | 11 | Bromus rubens L. | 6 |
| Litter (duff) | 20 | Bromus tectorum L. | 3 |
| Sand | 38 | Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake | 1 |
| Stone | 11 | Ephedra spp. | 2 |
| | | Gutierrezia spp. | 1 |
| | | Sphaeralcea spp. | 2 |
| | | Stephanomeria pauciflora (Torr.) A. Nels. | 6 |
| | | Tamarix ramosissima Ledeb. | 18 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|---------------------|-----------|------------|------------|------------|------------|
| Boulder | 64 | 35 | 48 | 6 | 29 |
| Stone | 0 | 16 | 10 | 6 | 2 |
| Sand | 18 | 16 | 23 | 69 | 49 |
| Gravel | 0 | 16 | 10 | 6 | 14 |
| Cobble | 18 | 16 | 10 | 14 | 6 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Aristida spp. | | | <1% | | | | | | | |
| Aster spp. | | | | | | | <1% | | | |
| Astragalus spp. | | | | | | | <1% | | | |
| Atriplex canescens (Pursh) Nutt. | | | 1-5% | | 1-5% | | <1% | | | |
| Atriplex spp. | | | | | | | | | <1% | |
| Brickellia longifolia S. Wats. | 1-5% | | 1-5% | | 1-5% | | | | 1-5% | |
| Bromus rubens L. | <1% | | 1-5% | | 1-5% | | 1-5% | | <1% | |
| Bromus tectorum L. | 1-5% | | 1-5% | | 1-5% | | <1% | | <1% | |
| Camissonia walkeri (A. Nels.) Raven | | | <1% | | <1% | | <1% | | <1% | |
| Chrysothamnus spp. | | | 1-5% | | 1-5% | | | | | |
| Cryptantha angustifolia (Torr.) Greene | | | | | <1% | | <1% | | | |
| Cryptobiotic soil | | | <1% | | <1% | | <1% | | | |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | | | <1% | | | | | | | |
| Datura wrightii Regel | <1% | | | | | | | | | |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 1

Transect Type: Tamarisk Area

| | | | | | |
|--|--------|--------|--------|--------|-------|
| Descurainia pinnata (Walt.) Britt. | | 1-5% | | | |
| Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake | | 1-5% | | | |
| Ephedra spp. | | | <1% | | <1% |
| Erigeron speciosus (Lindl.) DC. var. macranthus (Nutt.) Cronq. | | | | <1% | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | <1% | | 1-5% | |
| Gilia spp. | | | | | <1% |
| Gutierrezia spp. | 1-5% | | | | |
| Lepidium perfoliatum L. | | 1-5% | 1-5% | <1% | <1% |
| Lithophragma tenellum Nutt. | 5-10% | 10-25% | 10-25% | 10-25% | 5-10% |
| Loeseliastrum schottii (Torr.) Timbrook | | | | | <1% |
| Lycium spp. | | <1% | <1% | | |
| Melilotus spp. | | | <1% | | <1% |
| Mentzelia spp. | | | | <1% | |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | | <1% | | | |
| Nicotiana obtusifolia Mertens & Galeotti | | | | <1% | |
| Opuntia basilaris Engelm. & Bigelow | | | 1-5% | | |
| Phacelia crenulata Torr. ex S. Wats. | | <1% | <1% | | <1% |
| Phacelia rotundifolia Torr. ex S. Wats. | <1% | | | | |
| Plagiobothrys arizonicus (Gray) Greene ex Gray | | <1% | <1% | | <1% |
| Salsola tragus L. | | | | | <1% |
| Schismus spp. | | 1-5% | <1% | <1% | <1% |
| Sisymbrium altissimum L. | | | <1% | <1% | |
| Sisymbrium irio L. | | 1-5% | | | |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | | | 1-5% | 1-5% | |
| Sporobolus cryptandrus (Torr.) Gray | <1% | | | 1-5% | 1-5% |
| Stephanomeria exigua Nutt. | | | <1% | | |
| Stephanomeria pauciflora (Torr.) A. Nels. | <1% | 1-5% | | 5-10% | 1-5% |
| Tamarix ramosissima Ledeb. | 25-50% | | 25-50% | 10-25% | 1-5% |
| Thymophylla pentachaeta (DC.) Small | | | <1% | | <1% |
| Tiquilia latior (I.M. Johnston) A. Richards. | | | <1% | | <1% |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|-------------------------------|---------------|-------------|-------------|
| 5 Tamarix ramosissima Ledeb. | 4 | | |
| 25 Tamarix ramosissima Ledeb. | 6 | | |
| 35 Bromus tectorum L. | 1 | | |
| 35 Tamarix ramosissima Ledeb. | 3 | | |

Vegetation Structure Data - New

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 1

Transect Type: Tamarisk Area

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|----|-----------|----|-----------|----|---------|----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0 | | 0 | | 0 | | 0.00 | |
| 15 | 0 | | 0 | | 0 | | 0.00 | |
| 25 | 0 | | 0 | | 0 | | 0.00 | |
| 35 | 0.03 | | 0 | | 0.01 | | 0.01 | |
| 45 | 0 | | 0 | | 0 | | 0.00 | |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 1

Transect Type: Tamarisk Area

Date: 4/22/2006 Revisit? Post-tamarisk removal

Recorder: Eric Krouse Reader: Kate Watters

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

Weather: Clear, sunny, breezy about 75F.

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|--|----------------|
| Bare Soil | 5 | | 1 |
| Boulder | 12 | Aristida purpurea Nutt. var. nealleyi (Vasey) Allred | 1 |
| Coarse woody debris | 2 | Brickellia longifolia S. Wats. | 10 |
| Cobble | 10 | Bromus tectorum L. | 2 |
| Gravel | 22 | Ephedra torreyana S. Wats. | 2 |
| Litter (duff) | 32 | Gutierrezia sarothrae (Pursh) Britt. & Rusby | 1 |
| Sand | 9 | Stephanomeria pauciflora (Torr.) A. Nels. | 5 |
| Stone | 7 | Tamarix ramosissima Ledeb. | 1 |
| Woody debris structure | 1 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Sand | 2 | 3 | 0 | 24 | 7 |
| Cobble | 13 | 40 | 7 | 24 | 17 |
| Stone | 5 | 19 | 16 | 10 | 7 |
| Litter (duff) | 13 | 8 | 16 | 10 | 3 |
| Gravel | 13 | 8 | 3 | 10 | 36 |
| Woody debris structure | 2 | 0 | 0 | 0 | 0 |
| Boulder | 45 | 19 | 34 | 10 | 17 |
| Coarse woody debris | 5 | 1 | 3 | 4 | 3 |
| Bedrock | 0 | 0 | 16 | 4 | 7 |
| Bare Soil | 2 | 3 | 7 | 4 | 3 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Aristida arizonica Vasey | | | | | | | | | <1% | |
| Aristida purpurea Nutt. | | | | | <1% | | | | | |
| Atriplex canescens (Pursh) Nutt. | | | | | 1-5% | | 5-10% | | 1-5% | <1% |
| Brickellia longifolia S. Wats. | | | 1-5% | | 5-10% | | 1-5% | | <1% | 1-5% |
| Bromus rubens L. | | | <1% | | <1% | | <0% | | <1% | <0% |
| Bromus tectorum L. | | | <1% | | <0% | | | | | |
| Cryptobiotic soil | | | <0% | | <1% | | <1% | | <0% | <0% |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | | | | | <1% | | | | | |
| Datura wrightii Regel | | | | | | | | | | <1% |
| Ephedra torreyana S. Wats. | | | <0% | | <1% | | 1-5% | | <0% | <1% |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 1

Transect Type: Tamarisk Area

| | | | | | | | |
|--|------|-------|-------|-------|---|------|---|
| Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird | | 1-5% | 1-5% | | | | |
| Eriogonum inflatum Torr. & Frém. | | | | <1% | | | |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | 1-5% | <1% | <1% | <0% | | <0% | |
| Lycium spp. | | <1% | <1% | | | | |
| Moss spp. | <0% | <1% | <0% | <0% | | <0% | |
| Opuntia basilaris Engelm. & Bigelow | | | 5-10% | | | | |
| Sisymbrium altissimum L. | <1% | | | | | | |
| Sphaeralcea ambigua Gray | | | <1% | <1% | | <0% | |
| Sporobolus cryptandrus (Torr.) Gray | <1% | <0% | <1% | <1% | | <1% | |
| Stanleya pinnata (Pursh) Britt. | | | | <1% | | | |
| Stephanomeria pauciflora (Torr.) A. Nels. | <0% | 5-10% | <1% | 5-10% | | 1-5% | |
| Tamarix ramosissima Ledeb. | | | | 1-5% | P | 1-5% | P |
| Thymophylla pentachaeta (DC.) Small | | <1% | 1-5% | <1% | | | |
| Tiquilia latior (I.M. Johnston) A. Richards. | | | <1% | <0% | | <1% | |

Vegetation Structure Data - Old

Vegetation Structure Data - New

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|-----|-----------|-----|-----------|-----|---------|-----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 8.22 | 498 | 8.26 | 515 | 8.56 | 512 | 8.35 | 508 |
| 15 | 8.3 | 464 | 8.28 | 494 | 8.3 | 587 | 8.29 | 515 |
| 25 | 8.83 | 507 | 8.8 | 500 | 8.77 | 494 | 8.80 | 500 |
| 35 | 8.4 | 353 | 8.47 | 397 | 8.46 | 292 | 8.44 | 347 |
| 45 | 9.14 | 341 | 8.92 | 399 | 8.85 | 428 | 8.97 | 389 |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 1

Transect Type: Tamarisk Control

| | Start point | | End point |
|---------------------------|---|---------------------|------------------|
| Easting: | 420968 | Easting: | 420990 |
| Northing: | 4039618 | Northing: | 4039651 |
| GPS accuracy (m): | 11 | GPS accuracy (m): | 13 |
| Elevation (m): | 1148 | Elevation (m): | 1158 |
| Bearing: | 31 | | |
| Aspect (0-360): | 130 | Slope (degrees): | 8 |
| Transect description: | Begins less than 100m above transect 1A in stream bed on creek left. Goes through nook in large boulders. Follows along sediment deposit on creek left. Start is on slanted 2x2m boulder. | | |
| Additional Info: | | | |
| Geological layer: | Supai | | |
| Habitat type: | GB desert scrub | | |
| Dominant species: | Atriplex canescens (Pursh) Nutt., Bromus rubens L., Ephedra spp., Ephedra torreyana S. Wats. | | |
| Associated species: | Allionia incarnata L., Aristida spp., Atriplex canescens (Pursh) Nutt., Brickellia atractyloides Gray, Brickellia longifolia S. Wats., Bromus tectorum L., Camissonia walkeri (A. Nels.) Raven, Cryptantha angustifolia (Torr.) Greene, Cryptantha muricata (Hook. & Arn.) A. Nels. & J.F. Macbr. var. jonesii (Gray) I.M. Johnston, Cryptantha spp., Cryptobiotic soil, Dasyochloa pulchella (Kunth) Willd. ex Rydb., Descurainia pinnata (Walt.) Britt., Ephedra spp., Erodium cicutarium (L.) L'Hér. ex Ait., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Lappula occidentalis (S. Wats.) Greene var. occidentalis, Machaeranthera pinnatifida (Hook.) Shinners, Nicotiana obtusifolia Mertens & Galeotti var. obtusifolia, Opuntia basilaris Engelm. & Bigelow, Phacelia crenulata Torr. ex S. Wats., Schismus spp., Sisymbrium altissimum L., Sisymbrium irio L., Sphaeralcea spp., Sporobolus cryptandrus (Torr.) Gray, Stephanomeria pauciflora (Torr.) A. Nels., Thamnosma montana Torr. & Frém., Thymophylla pentachaeta (DC.) Small, Tiquilia latior (I.M. Johnston) A. Richards. | | |
| Surface water within 25m? | <input checked="" type="checkbox"/> | Surface water type: | |
| Landform: | Lower slope | Surface rocks: | sandstone |
| Soil type: | sand | Topo position: | |
| Light exposure: | open | Soil moisture: | dry |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 1

Transect Type: Tamarisk Control

Date: 5/6/2005 Revisit? Pre-tamarisk removal

Recorder: Nicole Corbo Reader: Amy Prince

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

Weather: Rainy, with spots of sun, major cloud cover

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|---|----------------|
| Bedrock | 12 | Atriplex canescens (Pursh) Nutt. | 1 |
| Boulder | 36 | Bromus rubens L. | 11 |
| Cobble | 6 | Bromus tectorum L. | 2 |
| Gravel | 8 | Camissonia walkeri (A. Nels.) Raven | 2 |
| Litter (duff) | 17 | Cryptantha muricata (Hook. & Arn.) A. Nels. & J.F. Macbr. var. jonesii (Gray) I.M. Johnston | 1 |
| Sand | 44 | Ephedra spp. | 8 |
| | | Erodium cicutarium (L.) L'Hér. ex Ait. | 1 |
| | | Lepidium perfoliatum L. | 1 |
| | | Opuntia basilaris Engelm. & Bigelow | 1 |
| | | Sphaeralcea spp. | 3 |
| | | Stephanomeria pauciflora (Torr.) A. Nels. | 1 |
| | | Thymophylla pentachaeta (DC.) Small | 1 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|---------------------|-----------|------------|------------|------------|------------|
| Bedrock | 49 | 63 | 74 | 78 | 0 |
| Boulder | 23 | 13 | 0 | 9 | 37 |
| Litter (duff) | 1 | 5 | 1 | 1 | 6 |
| Sand | 4 | 5 | 9 | 4 | 37 |
| Cobble | 23 | 5 | 9 | 4 | 6 |
| Stone | 0 | 5 | 4 | 4 | 6 |
| Gravel | 0 | 5 | 4 | 1 | 6 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Allionia incarnata L. | | | | | | | <1% | | | |
| Aristida spp. | <1% | | | | | | | | <1% | |
| Atriplex canescens (Pursh) Nutt. | <1% | | <1% | | <1% | | <1% | | <1% | |
| Brickellia atractyloides Gray | | | | | | | | | <1% | |
| Brickellia longifolia S. Wats. | 5-10% | | <1% | | | | | | | |
| Bromus rubens L. | <1% | | <1% | | 1-5% | | <1% | | 1-5% | |
| Bromus tectorum L. | <1% | | <1% | | | | <1% | | <1% | |
| Camissonia walkeri (A. Nels.) Raven | | | <1% | | | | | | | |
| Cryptantha angustifolia (Torr.) Greene | | | | | | | | | <1% | |
| Cryptantha spp. | | | | | | | | | <1% | |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 1

Transect Type: Tamarisk Control

| | | | | |
|--|------|------|------|------|
| Cryptobiotic soil | | 1-5% | <1% | 1-5% |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | | | <1% | <1% |
| Descurainia pinnata (Walt.) Britt. | | <1% | | 1-5% |
| Ephedra spp. | | <1% | <1% | 1-5% |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | | | <1% |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | | | <1% | |
| Lepidium spp. | | | <1% | |
| Machaeranthera pinnatifida (Hook.) Shinnery | | | 1-5% | <1% |
| Opuntia basilaris Engelm. & Bigelow | | | | <1% |
| Phacelia crenulata Torr. ex S. Wats. | | | <1% | <1% |
| Sisymbrium irio L. | | <1% | | |
| Sphaeralcea spp. | <1% | <1% | | 1-5% |
| Sporobolus cryptandrus (Torr.) Gray | | <1% | <1% | <1% |
| Stephanomeria pauciflora (Torr.) A. Nels. | <1% | <1% | | |
| Thamnosma montana Torr. & Frém. | 1-5% | | | |
| Thymophylla pentachaeta (DC.) Small | | | <1% | 1-5% |
| Tiquilia latior (I.M. Johnston) A. Richards. | <1% | <1% | <1% | <1% |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|--|---------------|-------------|-------------|
| 5 | Stephanomeria pauciflora (Torr.) A. Nels. | 7 | | |
| 15 | Bromus rubens L. | 2 | | |
| 15 | Plagiobothrys arizonicus (Gray) Greene ex Gray | 2 | | |
| 45 | Bromus rubens L. | 1 | | |
| 45 | Ephedra spp. | 1 | | |

Vegetation Structure Data - New

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|----|-----------|----|-----------|----|---------|----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0 | | 0 | | 0 | | 0.00 | |
| 15 | 0 | | 0.01 | | 0 | | 0.00 | |
| 25 | 0 | | 0 | | 0 | | 0.00 | |
| 35 | 0 | | 0 | | 0 | | 0.00 | |
| 45 | 0 | | 0 | | 0 | | 0.00 | |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 1

Transect Type: Tamarisk Control

Date: 4/22/2006 Revisit? Post-tamarisk removal

Recorder: Eric Krouse Reader: Kate Watters

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

Weather: Clear, sunny, breezy. About 85F

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--|----------------|
| Bare Soil | 1 | Atriplex canescens (Pursh) Nutt. | 4 |
| Bedrock | 23 | Cryptobiotic soil | 1 |
| Boulder | 20 | Dasyochloa pulchella (Kunth) Willd. ex Rydb. | 1 |
| Cobble | 5 | Ephedra spp. | 4 |
| Gravel | 11 | Ephedra torreyana S. Wats. | 3 |
| Litter (duff) | 16 | Erodium cicutarium (L.) L'Hér. ex Ait. | 1 |
| Plant | 3 | Lepidium perfoliatum L. | 1 |
| Sand | 7 | Moss spp. | 1 |
| Stone | 14 | Opuntia basilaris Engelm. & Bigelow | 2 |
| | | Sphaeralcea ambigua Gray | 1 |
| | | Sporobolus cryptandrus (Torr.) Gray | 1 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Litter (duff) | 2 | 2 | 8 | 3 | 10 |
| Stone | 6 | 14 | 3 | 7 | 10 |
| Woody debris structure | 0 | 2 | 0 | 0 | 0 |
| Bedrock | 48 | 14 | 69 | 56 | 0 |
| Sand | 6 | 6 | 3 | 3 | 10 |
| Gravel | 2 | 2 | 3 | 7 | 4 |
| Coarse woody debris | 0 | 2 | 3 | 3 | 4 |
| Boulder | 29 | 50 | 0 | 16 | 52 |
| Cobble | 6 | 6 | 8 | 7 | 4 |
| Bare Soil | 2 | 0 | 1 | 0 | 4 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Aristida arizonica Vasey | <1% | | | | | | <1% | | <1% | |
| Brickellia atractyloides Gray | | | | | | | | | <1% | |
| Brickellia longifolia S. Wats. | 5-10% | | 1-5% | | | | | | | |
| Bromus rubens L. | <1% | | <1% | | | | | | | |
| Camissonia walkeri (A. Nels.) Raven | <1% | | | | | | | | | |
| Cryptantha spp. | <1% | | | | | | | | | |
| Cryptobiotic soil | <0% | | <1% | | <1% | | <0% | | 1-5% | |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | | | | | <1% | | | | | |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 1

Transect Type: Tamarisk Control

| | | | | |
|--|------|------|-------|--------|
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | | | <1% | 1-5% |
| Ephedra torreyana S. Wats. | | 1-5% | 5-10% | 10-25% |
| Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird | 1-5% | | | |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | <1% | <1% | 1-5% | |
| Lycium spp. | | | 1-5% | |
| Machaeranthera pinnatifida (Hook.) Shinnars | <1% | | 1-5% | 1-5% |
| Moss spp. | | <1% | | <1% |
| Nicotiana obtusifolia Mertens & Galeotti var. obtusifolia | <1% | | | |
| Opuntia basilaris Engelm. & Bigelow | <1% | | | 10-25% |
| Sphaeralcea ambigua Gray | <1% | | | 1-5% |
| Sporobolus cryptandrus (Torr.) Gray | | <1% | | 1-5% |
| Sporobolus spp. | <1% | | | |
| Stephanomeria pauciflora (Torr.) A. Nels. | 1-5% | 1-5% | | |
| Thamnosma montana Torr. & Frém. | 1-5% | | | |
| Thymophylla pentachaeta (DC.) Small var. belenidium (DC.) Strother | | 1-5% | 1-5% | 5-10% |
| Tiquilia latior (I.M. Johnston) A. Richards. | 1-5% | 1-5% | 1-5% | <1% |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|---|---------------|-------------|-------------|
| 5 Stephanomeria pauciflora (Torr.) A. Nels. | 2 | | |

Vegetation Structure Data - New

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|------|-----------|------|-----------|------|---------|------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 8.4 | 3600 | 8.28 | 2498 | 8.11 | 2569 | 8.26 | 2889 |
| 15 | 7.92 | 364 | 7.72 | 413 | 7.79 | 471 | 7.81 | 416 |
| 25 | 7.93 | 320 | 7.93 | 432 | 7.91 | 490 | 7.92 | 414 |
| 35 | 8.35 | 760 | 8.16 | 1065 | 8.09 | 1139 | 8.20 | 988 |
| 45 | 8.32 | 63 | 8.24 | 49 | 8.39 | 86 | 8.32 | 66 |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 1

Transect Type: Tamarisk Control

Date: 5/6/2005 Revisit? Pre-tamarisk removal

Recorder: Nicole Corbo Reader: Amy Prince

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

Weather: Rainy, with spots of sun, major cloud cover

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|---|----------------|
| Bedrock | 12 | Atriplex canescens (Pursh) Nutt. | 1 |
| Boulder | 36 | Bromus rubens L. | 11 |
| Cobble | 6 | Bromus tectorum L. | 2 |
| Gravel | 8 | Camissonia walkeri (A. Nels.) Raven | 2 |
| Litter (duff) | 17 | Cryptantha muricata (Hook. & Arn.) A. Nels. & J.F. Macbr. var. jonesii (Gray) I.M. Johnston | 1 |
| Sand | 44 | Ephedra spp. | 8 |
| | | Erodium cicutarium (L.) L'Hér. ex Ait. | 1 |
| | | Lepidium perfoliatum L. | 1 |
| | | Opuntia basilaris Engelm. & Bigelow | 1 |
| | | Sphaeralcea spp. | 3 |
| | | Stephanomeria pauciflora (Torr.) A. Nels. | 1 |
| | | Thymophylla pentachaeta (DC.) Small | 1 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|---------------------|-----------|------------|------------|------------|------------|
| Bedrock | 49 | 63 | 74 | 78 | 0 |
| Boulder | 23 | 13 | 0 | 9 | 37 |
| Litter (duff) | 1 | 5 | 1 | 1 | 6 |
| Sand | 4 | 5 | 9 | 4 | 37 |
| Cobble | 23 | 5 | 9 | 4 | 6 |
| Stone | 0 | 5 | 4 | 4 | 6 |
| Gravel | 0 | 5 | 4 | 1 | 6 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Allionia incarnata L. | | | | | | | <1% | | | |
| Aristida spp. | <1% | | | | | | | | <1% | |
| Atriplex canescens (Pursh) Nutt. | <1% | | <1% | | <1% | | <1% | | <1% | |
| Brickellia atractyloides Gray | | | | | | | | | <1% | |
| Brickellia longifolia S. Wats. | 5-10% | | <1% | | | | | | | |
| Bromus rubens L. | <1% | | <1% | | 1-5% | | <1% | | 1-5% | |
| Bromus tectorum L. | <1% | | <1% | | | | <1% | | <1% | |
| Camissonia walkeri (A. Nels.) Raven | | | <1% | | | | | | | |
| Cryptantha angustifolia (Torr.) Greene | | | | | | | | | <1% | |
| Cryptantha spp. | | | | | | | | | <1% | |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 1

Transect Type: Tamarisk Control

| | | | | |
|--|------|------|------|------|
| Cryptobiotic soil | | 1-5% | <1% | 1-5% |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | | | <1% | <1% |
| Descurainia pinnata (Walt.) Britt. | | <1% | | 1-5% |
| Ephedra spp. | | <1% | <1% | 1-5% |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | | | <1% |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | | | <1% | |
| Lepidium spp. | | | <1% | |
| Machaeranthera pinnatifida (Hook.) Shinnery | | | 1-5% | <1% |
| Opuntia basilaris Engelm. & Bigelow | | | | <1% |
| Phacelia crenulata Torr. ex S. Wats. | | | <1% | <1% |
| Sisymbrium irio L. | | <1% | | |
| Sphaeralcea spp. | <1% | <1% | | 1-5% |
| Sporobolus cryptandrus (Torr.) Gray | | <1% | <1% | <1% |
| Stephanomeria pauciflora (Torr.) A. Nels. | <1% | <1% | | |
| Thamnosma montana Torr. & Frém. | 1-5% | | | |
| Thymophylla pentachaeta (DC.) Small | | | <1% | <1% |
| Tiquilia latior (I.M. Johnston) A. Richards. | <1% | <1% | <1% | <1% |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|--|---------------|-------------|-------------|
| 5 | Stephanomeria pauciflora (Torr.) A. Nels. | 7 | | |
| 15 | Bromus rubens L. | 2 | | |
| 15 | Plagiobothrys arizonicus (Gray) Greene ex Gray | 2 | | |
| 45 | Bromus rubens L. | 1 | | |
| 45 | Ephedra spp. | 1 | | |

Vegetation Structure Data - New

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|----|-----------|----|-----------|----|---------|----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0 | | 0 | | 0 | | 0.00 | |
| 15 | 0 | | 0.01 | | 0 | | 0.00 | |
| 25 | 0 | | 0 | | 0 | | 0.00 | |
| 35 | 0 | | 0 | | 0 | | 0.00 | |
| 45 | 0 | | 0 | | 0 | | 0.00 | |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 1

Transect Type: Tamarisk Control

Date: 4/22/2006 Revisit? Post-tamarisk removal

Recorder: Eric Krouse Reader: Kate Watters

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

Weather: Clear, sunny, breezy. About 85F

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--|----------------|
| Bare Soil | 1 | Atriplex canescens (Pursh) Nutt. | 4 |
| Bedrock | 23 | Cryptobiotic soil | 1 |
| Boulder | 20 | Dasyochloa pulchella (Kunth) Willd. ex Rydb. | 1 |
| Cobble | 5 | Ephedra spp. | 4 |
| Gravel | 11 | Ephedra torreyana S. Wats. | 3 |
| Litter (duff) | 16 | Erodium cicutarium (L.) L'Hér. ex Ait. | 1 |
| Plant | 3 | Lepidium perfoliatum L. | 1 |
| Sand | 7 | Moss spp. | 1 |
| Stone | 14 | Opuntia basilaris Engelm. & Bigelow | 2 |
| | | Sphaeralcea ambigua Gray | 1 |
| | | Sporobolus cryptandrus (Torr.) Gray | 1 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Litter (duff) | 2 | 2 | 8 | 3 | 10 |
| Stone | 6 | 14 | 3 | 7 | 10 |
| Woody debris structure | 0 | 2 | 0 | 0 | 0 |
| Bedrock | 48 | 14 | 69 | 56 | 0 |
| Sand | 6 | 6 | 3 | 3 | 10 |
| Gravel | 2 | 2 | 3 | 7 | 4 |
| Coarse woody debris | 0 | 2 | 3 | 3 | 4 |
| Boulder | 29 | 50 | 0 | 16 | 52 |
| Cobble | 6 | 6 | 8 | 7 | 4 |
| Bare Soil | 2 | 0 | 1 | 0 | 4 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Aristida arizonica Vasey | <1% | | | | | | <1% | | <1% | |
| Brickellia atractyloides Gray | | | | | | | | | <1% | |
| Brickellia longifolia S. Wats. | 5-10% | | 1-5% | | | | | | | |
| Bromus rubens L. | <1% | | <1% | | | | | | | |
| Camissonia walkeri (A. Nels.) Raven | <1% | | | | | | | | | |
| Cryptantha spp. | <1% | | | | | | | | | |
| Cryptobiotic soil | <0% | | <1% | | <1% | | <0% | | 1-5% | |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | | | | | <1% | | | | | |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 1

Transect Type: Tamarisk Control

| | | | | |
|--|------|------|-------|--------|
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | | | <1% | 1-5% |
| Ephedra torreyana S. Wats. | | 1-5% | 5-10% | 10-25% |
| Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird | 1-5% | | | |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | <1% | <1% | 1-5% | |
| Lycium spp. | | | 1-5% | |
| Machaeranthera pinnatifida (Hook.) Shinnars | <1% | | 1-5% | 1-5% |
| Moss spp. | | <1% | | <1% |
| Nicotiana obtusifolia Mertens & Galeotti var. obtusifolia | <1% | | | |
| Opuntia basilaris Engelm. & Bigelow | | <1% | | 10-25% |
| Sphaeralcea ambigua Gray | <1% | | | 1-5% |
| Sporobolus cryptandrus (Torr.) Gray | | <1% | | 1-5% |
| Sporobolus spp. | <1% | | | |
| Stephanomeria pauciflora (Torr.) A. Nels. | 1-5% | 1-5% | | |
| Thamnosma montana Torr. & Frém. | 1-5% | | | |
| Thymophylla pentachaeta (DC.) Small var. belenidium (DC.) Strother | | | 1-5% | 1-5% |
| Tiquilia latior (I.M. Johnston) A. Richards. | 1-5% | 1-5% | 1-5% | <1% |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|---|---------------|-------------|-------------|
| 5 Stephanomeria pauciflora (Torr.) A. Nels. | 2 | | |

Vegetation Structure Data - New

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|------|-----------|------|-----------|------|---------|------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 8.4 | 3600 | 8.28 | 2498 | 8.11 | 2569 | 8.26 | 2889 |
| 15 | 7.92 | 364 | 7.72 | 413 | 7.79 | 471 | 7.81 | 416 |
| 25 | 7.93 | 320 | 7.93 | 432 | 7.91 | 490 | 7.92 | 414 |
| 35 | 8.35 | 760 | 8.16 | 1065 | 8.09 | 1139 | 8.20 | 988 |
| 45 | 8.32 | 63 | 8.24 | 49 | 8.39 | 86 | 8.32 | 66 |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 2

Transect Type: Tamarisk Area

| | Start point | | End point |
|---------------------------|---|---------------------|------------------|
| Easting: | 419706 | Easting: | 419748 |
| Northing: | 4038318 | Northing: | 4038327 |
| GPS accuracy (m): | 9 | GPS accuracy (m): | 5 |
| Elevation (m): | 1172 | Elevation (m): | 1160 |
| Bearing: | 85 | | |
| Aspect (0-360): | 170 | Slope (degrees): | 12 |
| Transect description: | Less than 100m past 25m boulder on creek left. Just opposite 8m tall sheer Supai face - look for 4x7m pock-marked Supai boulder. | | |
| Additional Info:: | | | |
| Geological layer: | Supai | | |
| Habitat type: | GB desert scrub | | |
| Dominant species: | Brickellia longifolia S. Wats., Bromus tectorum L., Fallugia paradoxa (D. Don) Endl. ex Torr., Stanleya pinnata (Pursh) Britt. | | |
| Associated species: | Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth, Aristida spp., Artemisia ludoviciana Nutt., Astragalus spp., Atriplex canescens (Pursh) Nutt., Bromus rubens L., Bromus tectorum L., Elymus elymoides (Raf.) Swezey, Encelia frutescens (Gray) Gray var. resinosa M.E. Jones ex Blake, Ephedra torreyana S. Wats., Erigeron spp., Erodium cicutarium (L.) L'Hér. ex Ait., Gilia spp., Gutierrezia spp., Hesperostipa comata (Trin. & Rupr.) Barkworth ssp. comata, Ipomopsis polycladon (Torr.) V. Grant, Lupinus spp., Melilotus spp., Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Oenothera cavernae Munz, Pectocarya recurvata I.M. Johnston, Salsola tragus L., Schismus spp., Sisymbrium altissimum L., Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb., Stephanomeria pauciflora (Torr.) A. Nels., Streptanthella longirostris (S. Wats.) Rydb., Tiquilia latior (I.M. Johnston) A. Richards. | | |
| Surface water within 25m? | <input checked="" type="checkbox"/> | Surface water type: | pothole |
| Landform: | Lower slope | Surface rocks: | sandstone |
| Soil type: | sand | Topo position: | |
| Light exposure: | open | Soil moisture: | dry |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 2

Transect Type: Tamarisk Area

Date: 5/6/2005 Revisit? Pre-tamarisk removal

Recorder: Lori Makarick Reader: Maggie Drechsler

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

Weather: 75% cloudswith rain intermittent, 65F

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--------------------------------|----------------|
| Bedrock | 2 | Brickellia longifolia S. Wats. | 7 |
| Boulder | 30 | Bromus rubens L. | 1 |
| Cobble | 7 | Bromus tectorum L. | 15 |
| Gravel | 13 | Sisymbrium altissimum L. | 1 |
| Litter (duff) | 16 | Tamarix ramosissima Ledeb. | 40 |
| Sand | 44 | | |
| Stone | 7 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|---------------------|-----------|------------|------------|------------|------------|
| Sand | 28 | 10 | 57 | 43 | 51 |
| Gravel | 1 | 4 | 3 | 20 | 22 |
| Stone | 5 | 23 | 0 | 9 | 1 |
| Boulder | 61 | 4 | 34 | 9 | 9 |
| Cobble | 0 | 10 | 3 | 20 | 9 |
| Litter (duff) | 5 | 49 | 3 | 1 | 9 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | <1% | | | | <1% | | <1% | | <1% | |
| Artemisia ludoviciana Nutt. | | | | | | | | | <1% | |
| Astragalus spp. | | | | | | | <1% | | | |
| Atriplex canescens (Pursh) Nutt. | | | | | | | | | <1% | |
| Brickellia longifolia S. Wats. | | | 10-25% | | <1% | | | | <1% | |
| Bromus rubens L. | | | <1% | | 1-5% | | <1% | | <1% | 1-5% |
| Bromus tectorum L. | | | 1-5% | | 25-50% | | 1-5% | | 1-5% | 10-25% |
| Elymus elymoides (Raf.) Swezey | | | | | <1% | | <1% | | | |
| Erigeron spp. | | | | | | | | | | <1% |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | | | | <1% | | <1% | | | |
| Fallugia paradoxa (D. Don) Endl. ex Torr. | | | 1-5% | | | | 5-10% | | 1-5% | |
| Gilia spp. | | | | | | | <1% | | | |
| Gutierrezia spp. | | | | | | | <1% | | | <1% |
| Hesperostipa comata (Trin. & Rupr.) Barkworth ssp. comata | | | <1% | | | | <1% | | | |
| Lupinus spp. | | | <1% | | <1% | | <1% | | | |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 2

Transect Type: Tamarisk Area

| | | | | | |
|---|-----|--------|--------|------|--------|
| Melilotus spp. | | <1% | <1% | <1% | <1% |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | <1% | | | | |
| Oenothera cavernae Munz | | | | <1% | |
| Pectocarya recurvata I.M. Johnston | <1% | | | | |
| Salsola tragus L. | <1% | | | | |
| Schismus spp. | | | | | <1% |
| Sisymbrium altissimum L. | <1% | <1% | <1% | | <1% |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | | | | <1% | |
| Stanleya pinnata (Pursh) Britt. | | | 1-5% | 1-5% | <1% |
| Stephanomeria pauciflora (Torr.) A. Nels. | | | | 1-5% | |
| Streptanthella longirostris (S. Wats.) Rydb. | | | | <1% | |
| Tamarix ramosissima Ledeb. | | 25-50% | 25-50% | <1% | 25-50% |
| Tiquilia latior (I.M. Johnston) A. Richards. | | <1% | | | <1% |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|--------------------------------|---------------|-------------|-------------|
| 5 | Brickellia longifolia S. Wats. | 3 | | |
| 15 | Tamarix ramosissima Ledeb. | 6 | 1 | 3 |
| 25 | Tamarix ramosissima Ledeb. | 13 | 9 | |
| 45 | Tamarix ramosissima Ledeb. | | 3 | |

Vegetation Structure Data - New

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|----|-----------|----|-----------|----|---------|----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 45 | 0.63 | | 0.64 | | 0.65 | | 0.64 | |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 2

Transect Type: Tamarisk Area

Date: 4/23/2006 Revisit? Post-tamarisk removal

Recorder: Eric Krouse Reader: Kate Watters

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

Weather: Clear, sunny, breezy, winds about 5mph.

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--|----------------|
| Bare Soil | 4 | Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | 2 |
| Boulder | 32 | Aster spp. | 1 |
| Cobble | 3 | Brickellia longifolia S. Wats. | 7 |
| Gravel | 7 | Bromus tectorum L. | 9 |
| Litter (duff) | 39 | Euphorbia aaron-rossii A.& N. Holmgren | 2 |
| Sand | 12 | Fallugia paradoxa (D. Don) Endl. ex Torr. | 1 |
| Stone | 1 | Tamarix ramosissima Ledeb. | 2 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|---------------------|-----------|------------|------------|------------|------------|
| Bare Soil | 3 | 0 | 3 | 4 | 7 |
| Cobble | 3 | 7 | 3 | 25 | 3 |
| Gravel | 3 | 3 | 3 | 25 | 7 |
| Boulder | 57 | 16 | 35 | 25 | 35 |
| Sand | 16 | 3 | 16 | 11 | 7 |
| Litter (duff) | 3 | 34 | 35 | 4 | 35 |
| Stone | 16 | 3 | 3 | 4 | 3 |
| Coarse woody debris | 0 | 34 | 3 | 0 | 3 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | 5-10% | | | | | | | | | |
| Artemisia bigelovii Gray | 1-5% | | | | | | | | | |
| Artemisia ludoviciana Nutt. | | | | | | | | | <1% | |
| Aster spp. | | | | 1-5% | | | | | | |
| Aster spp. | | | | | | | | | <1% | |
| Astragalus praelongus Sheldon | | | | | | | 1-5% | | | |
| Atriplex canescens (Pursh) Nutt. | | | | 1-5% | | | <1% | | <1% | |
| Brickellia longifolia S. Wats. | | 10-25% | | 1-5% | | <0% | <1% | | <1% | |
| Bromus rubens L. | | <1% | | <1% | | <1% | <1% | | 1-5% | |
| Bromus tectorum L. | | <1% | | 10-25% | | 1-5% | 1-5% | | 10-25% | |
| Camissonia walkeri (A. Nels.) Raven | | | | | | | <1% | | | |
| Cryptantha spp. | | | | | | | <1% | | | |
| Cryptobiotic soil | | | | | | | | | <1% | |
| Ephedra torreyana S. Wats. | | | | | | | <1% | | | |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 2

Transect Type: Tamarisk Area

| | | | | | |
|---|------|------|--------|-------|------|
| Erodium cicutarium (L.) L'Hér. ex Ait. | | | | <1% | |
| Fallugia paradoxa (D. Don) Endl. ex Torr. | 1-5% | | 10-25% | 5-10% | |
| forb spp | | | | <1% | |
| forb spp | | | | | <1% |
| Grass spp | | | | | <1% |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | | | | 1-5% | <1% |
| Hesperostipa comata (Trin. & Rupr.) Barkworth ssp. comata | | 1-5% | | | |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | <0% | <0% | <0% | <0% | 1-5% |
| Phacelia spp. | | | | <1% | <0% |
| Polypogon spp | | | | | 1-5% |
| Sphaeralcea spp. | | | | <1% | |
| Sporobolus spp. | | <1% | | 1-5% | |
| Stanleya pinnata (Pursh) Britt. | | <1% | 1-5% | 1-5% | |
| Stephanomeria pauciflora (Torr.) A. Nels. | | | | 1-5% | |
| Tamarix ramosissima Ledeb. | | <0% | <1% | <0% | <1% |
| Tiquilia latior (I.M. Johnston) A. Richards. | | 1-5% | | | |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|----------------------------------|---------------|-------------|-------------|
| 5 Brickellia longifolia S. Wats. | 3 | | |

Vegetation Structure Data - New

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|------|-----------|------|-----------|------|---------|------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 9.1 | 122 | 9.01 | 93 | 9.15 | 149 | 9.09 | 121 |
| 15 | 8.31 | 2707 | 8.19 | 2583 | 8.2 | 3181 | 8.23 | 2824 |
| 25 | 8.82 | 405 | 8.67 | 460 | 8.68 | 527 | 8.72 | 464 |
| 35 | 9.4 | 172 | 9.38 | 187 | 9.3 | 205 | 9.36 | 188 |
| 45 | 8.88 | 2044 | 8.89 | 2075 | 8.89 | 2168 | 8.89 | 2096 |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 2

Transect Type: Tamarisk Area

Date: 5/6/2005 Revisit? Pre-tamarisk removal

Recorder: Lori Makarick Reader: Maggie Drechsler

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

Weather: 75% cloudswith rain intermittent, 65F

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--------------------------------|----------------|
| Bedrock | 2 | Brickellia longifolia S. Wats. | 7 |
| Boulder | 30 | Bromus rubens L. | 1 |
| Cobble | 7 | Bromus tectorum L. | 15 |
| Gravel | 13 | Sisymbrium altissimum L. | 1 |
| Litter (duff) | 16 | Tamarix ramosissima Ledeb. | 40 |
| Sand | 44 | | |
| Stone | 7 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|---------------------|-----------|------------|------------|------------|------------|
| Sand | 28 | 10 | 57 | 43 | 51 |
| Gravel | 1 | 4 | 3 | 20 | 22 |
| Stone | 5 | 23 | 0 | 9 | 1 |
| Boulder | 61 | 4 | 34 | 9 | 9 |
| Cobble | 0 | 10 | 3 | 20 | 9 |
| Litter (duff) | 5 | 49 | 3 | 1 | 9 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | <1% | | | | <1% | | <1% | | <1% | |
| Artemisia ludoviciana Nutt. | | | | | | | | | <1% | |
| Astragalus spp. | | | | | | | <1% | | | |
| Atriplex canescens (Pursh) Nutt. | | | | | | | | | <1% | |
| Brickellia longifolia S. Wats. | | 10-25% | | <1% | | | | | <1% | |
| Bromus rubens L. | | <1% | | 1-5% | | <1% | <1% | | 1-5% | |
| Bromus tectorum L. | | 1-5% | | 25-50% | | 1-5% | 1-5% | | 10-25% | |
| Elymus elymoides (Raf.) Swezey | | | | | | <1% | <1% | | | |
| Erigeron spp. | | | | | | | | | <1% | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | | | <1% | | | <1% | | | |
| Fallugia paradoxa (D. Don) Endl. ex Torr. | | 1-5% | | | | 5-10% | 1-5% | | | |
| Gilia spp. | | | | | | | <1% | | | |
| Gutierrezia spp. | | | | | | | <1% | | <1% | |
| Hesperostipa comata (Trin. & Rupr.) Barkworth ssp. comata | | <1% | | | | | <1% | | | |
| Lupinus spp. | | <1% | | <1% | | | <1% | | | |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 2

Transect Type: Tamarisk Area

| | | | | | |
|---|-----|--------|--------|------|--------|
| Melilotus spp. | | <1% | <1% | <1% | <1% |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | <1% | | | | |
| Oenothera cavernae Munz | | | | <1% | |
| Pectocarya recurvata I.M. Johnston | <1% | | | | |
| Salsola tragus L. | <1% | | | | |
| Schismus spp. | | | | | <1% |
| Sisymbrium altissimum L. | <1% | <1% | <1% | | <1% |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | | | | <1% | |
| Stanleya pinnata (Pursh) Britt. | | | 1-5% | 1-5% | <1% |
| Stephanomeria pauciflora (Torr.) A. Nels. | | | | 1-5% | |
| Streptanthella longirostris (S. Wats.) Rydb. | | | | <1% | |
| Tamarix ramosissima Ledeb. | | 25-50% | 25-50% | <1% | 25-50% |
| Tiquilia latior (I.M. Johnston) A. Richards. | | <1% | | | <1% |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|--------------------------------|---------------|-------------|-------------|
| 5 | Brickellia longifolia S. Wats. | 3 | | |
| 15 | Tamarix ramosissima Ledeb. | 6 | 1 | 3 |
| 25 | Tamarix ramosissima Ledeb. | 13 | 9 | |
| 45 | Tamarix ramosissima Ledeb. | | 3 | |

Vegetation Structure Data - New

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|----|-----------|----|-----------|----|---------|----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 45 | 0.63 | | 0.64 | | 0.65 | | 0.64 | |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 2

Transect Type: Tamarisk Area

Date: 4/23/2006 Revisit? Post-tamarisk removal

Recorder: Eric Krouse Reader: Kate Watters

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

Weather: Clear, sunny, breezy, winds about 5mph.

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--|----------------|
| Bare Soil | 4 | Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | 2 |
| Boulder | 32 | Aster spp. | 1 |
| Cobble | 3 | Brickellia longifolia S. Wats. | 7 |
| Gravel | 7 | Bromus tectorum L. | 9 |
| Litter (duff) | 39 | Euphorbia aaron-rossii A.& N. Holmgren | 2 |
| Sand | 12 | Fallugia paradoxa (D. Don) Endl. ex Torr. | 1 |
| Stone | 1 | Tamarix ramosissima Ledeb. | 2 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|---------------------|-----------|------------|------------|------------|------------|
| Bare Soil | 3 | 0 | 3 | 4 | 7 |
| Cobble | 3 | 7 | 3 | 25 | 3 |
| Gravel | 3 | 3 | 3 | 25 | 7 |
| Boulder | 57 | 16 | 35 | 25 | 35 |
| Sand | 16 | 3 | 16 | 11 | 7 |
| Litter (duff) | 3 | 34 | 35 | 4 | 35 |
| Stone | 16 | 3 | 3 | 4 | 3 |
| Coarse woody debris | 0 | 34 | 3 | 0 | 3 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | 5-10% | | | | | | | | | |
| Artemisia bigelovii Gray | 1-5% | | | | | | | | | |
| Artemisia ludoviciana Nutt. | | | | | | | | | <1% | |
| Aster spp. | | | | 1-5% | | | | | | |
| Aster spp. | | | | | | | | | <1% | |
| Astragalus praelongus Sheldon | | | | | | | 1-5% | | | |
| Atriplex canescens (Pursh) Nutt. | | | | 1-5% | | | <1% | | <1% | |
| Brickellia longifolia S. Wats. | | 10-25% | | 1-5% | | <0% | <1% | | <1% | |
| Bromus rubens L. | | <1% | | <1% | | <1% | <1% | | 1-5% | |
| Bromus tectorum L. | | <1% | | 10-25% | | 1-5% | 1-5% | | 10-25% | |
| Camissonia walkeri (A. Nels.) Raven | | | | | | | <1% | | | |
| Cryptantha spp. | | | | | | | <1% | | | |
| Cryptobiotic soil | | | | | | | | | <1% | |
| Ephedra torreyana S. Wats. | | | | | | | <1% | | | |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 2

Transect Type: Tamarisk Area

| | | | | | |
|---|------|------|--------|-------|------|
| Erodium cicutarium (L.) L'Hér. ex Ait. | | | | <1% | |
| Fallugia paradoxa (D. Don) Endl. ex Torr. | 1-5% | | 10-25% | 5-10% | |
| forb spp | | | | <1% | |
| forb spp | | | | | <1% |
| Grass spp | | | | | <1% |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | | | | 1-5% | <1% |
| Hesperostipa comata (Trin. & Rupr.) Barkworth ssp. comata | | 1-5% | | | |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | <0% | <0% | <0% | <0% | 1-5% |
| Phacelia spp. | | | | <1% | <0% |
| Polypogon spp | | | | | 1-5% |
| Sphaeralcea spp. | | | | <1% | |
| Sporobolus spp. | | <1% | | 1-5% | |
| Stanleya pinnata (Pursh) Britt. | | <1% | 1-5% | 1-5% | |
| Stephanomeria pauciflora (Torr.) A. Nels. | | | | 1-5% | |
| Tamarix ramosissima Ledeb. | | <0% | <1% | <0% | <1% |
| Tiquilia latior (I.M. Johnston) A. Richards. | | 1-5% | | | |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|----------------------------------|---------------|-------------|-------------|
| 5 Brickellia longifolia S. Wats. | 3 | | |

Vegetation Structure Data - New

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|------|-----------|------|-----------|------|---------|------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 9.1 | 122 | 9.01 | 93 | 9.15 | 149 | 9.09 | 121 |
| 15 | 8.31 | 2707 | 8.19 | 2583 | 8.2 | 3181 | 8.23 | 2824 |
| 25 | 8.82 | 405 | 8.67 | 460 | 8.68 | 527 | 8.72 | 464 |
| 35 | 9.4 | 172 | 9.38 | 187 | 9.3 | 205 | 9.36 | 188 |
| 45 | 8.88 | 2044 | 8.89 | 2075 | 8.89 | 2168 | 8.89 | 2096 |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 2

Transect Type: Tamarisk Control

| | Start point | | End point |
|---------------------------|---|--------------------------|------------------|
| Easting: | 419663 | Easting: | 419703 |
| Northing: | 4038301 | Northing: | 4038310 |
| GPS accuracy (m): | 7 | GPS accuracy (m): | 6 |
| Elevation (m): | 1178 | Elevation (m): | 1180 |
| Bearing: | 88 | | |
| Aspect (0-360): | 350 | Slope (degrees): | 5 |
| Transect description: | Transect is on creek right near T2A. Start point on NW side of 8x6m boulder within 1m of Ptelia directly on top of roundish smaller boulder. End point heads toward Ptelia nestled among delivery truck sized boulders. | | |
| Additional Info:: | Bottom of transect B overlaps with start of Transect A by about 3m but on other side of creek bed. | | |
| Geological layer: | Supai | | |
| Habitat type: | GB desert scrub | | |
| Dominant species: | Atriplex canescens (Pursh) Nutt., Bromus rubens L., Bromus tectorum L., Ephedra spp., Fallugia paradoxa (D. Don) Endl. ex Torr. | | |
| Associated species: | Aristida spp., Bouteloua eriopoda (Torr.) Torr., Brickellia longifolia S. Wats., Cirsium neomexicanum Gray, Cryptantha spp., Descurainia pinnata (Walt.) Britt., Ephedra fasciculata A. Nels., Eriogonum corymbosum Benth., Lappula occidentalis (S. Wats.) Greene var. occidentalis, Lycium spp., Mirabilis multiflora (Torr.) Gray, Moss spp., Opuntia polyacantha Haw., Ptelea trifoliata L., Sisymbrium altissimum L., Sporobolus cryptandrus (Torr.) Gray, Stanleya pinnata (Pursh) Britt., Tiquilia latior (I.M. Johnston) A. Richards. | | |
| Surface water within 25m? | <input type="checkbox"/> | Surface water type: | |
| Landform: Lower slope | | Surface rocks: limestone | |
| Soil type: sand | | Topo position: | |
| Light exposure: open | partial-shade | Soil moisture: dry | |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 2

Transect Type: Tamarisk Control

Date: 5/6/2005 Revisit? Pre-tamarisk removal

Recorder: Amy Prince Reader: Lori Makarick

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

Weather: Sunny, some clouds with intermittent rain

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|---|----------------|
| Boulder | 21 | | 2 |
| Litter (duff) | 60 | Atriplex canescens (Pursh) Nutt. | 13 |
| Sand | 76 | Bromus rubens L. | 28 |
| Woody debris structure | 1 | Bromus tectorum L. | 49 |
| | | Descurainia pinnata (Walt.) Britt. | 1 |
| | | Ephedra spp. | 5 |
| | | Fallugia paradoxa (D. Don) Endl. ex Torr. | 27 |
| | | Mirabilis multiflora (Torr.) Gray | 1 |
| | | Stanleya pinnata (Pursh) Britt. | 6 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|---------------------|-----------|------------|------------|------------|------------|
| Cobble | 0 | 0 | 0 | 6 | 15 |
| Sand | 4 | 0 | 33 | 38 | 38 |
| Gravel | 0 | 0 | 0 | 6 | 15 |
| Litter (duff) | 4 | 5 | 33 | 0 | 15 |
| Boulder | 91 | 95 | 0 | 38 | 15 |
| Coarse woody debris | 0 | 0 | 33 | 6 | 0 |
| Stone | 1 | 0 | 0 | 6 | 0 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Aristida spp. | | | <1% | | | | | | | |
| Atriplex canescens (Pursh) Nutt. | | | | | 10-25% | | 5-10% | | <1% | |
| Brickellia longifolia S. Wats. | | | | | | | | | <1% | |
| Bromus rubens L. | | 5-10% | 1-5% | | 5-10% | | 5-10% | | 1-5% | |
| Bromus tectorum L. | | 5-10% | 1-5% | | 5-10% | | 5-10% | | 50-75% | |
| Cirsium neomexicanum Gray | | | | | <1% | | | | | |
| Cryptantha spp. | | | <1% | | | | | | | |
| Ephedra spp. | | 10-25% | | | | | 1-5% | | <1% | |
| Fallugia paradoxa (D. Don) Endl. ex Torr. | | | 25-50% | | 25-50% | | | | 10-25% | |
| Mirabilis multiflora (Torr.) Gray | | | | | | | 1-5% | | | |
| Opuntia polyacantha Haw. | | | <1% | | | | | | | |
| Sisymbrium altissimum L. | | | | | | | | | <1% | |
| Sporobolus cryptandrus (Torr.) Gray | | | | | | | <1% | | | |
| Stanleya pinnata (Pursh) Britt. | <1% | | | | <1% | | <1% | | 1-5% | |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 2

Transect Type: Tamarisk Control

Tiquilia latior (I.M. Johnston) A.
Richards.

<1%

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|---|---------------|-------------|-------------|
| 15 | Fallugia paradoxa (D. Don) Endl. ex Torr. | 6 | 2 | |
| 25 | Bromus tectorum L. | 3 | | |
| 25 | Fallugia paradoxa (D. Don) Endl. ex Torr. | 3 | | |
| 35 | Bromus tectorum L. | 8 | | |
| 35 | Ephedra spp. | 6 | | |
| 45 | Bromus tectorum L. | 2 | | |
| 45 | Fallugia paradoxa (D. Don) Endl. ex Torr. | 10 | | |

Vegetation Structure Data - New**Soil Data**

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 2

Transect Type: Tamarisk Control

Date: 4/23/2006 Revisit? Post-tamarisk removal

Recorder: Eric Krouse Reader: Kate Watters

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

Weather: Very windy, about 20mph, cloudy and about 60F.

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|---|----------------|
| Bare Soil | 5 | Aristida spp. | 1 |
| Boulder | 14 | Atriplex canescens (Pursh) Nutt. | 14 |
| Coarse woody debris | 1 | Bromus tectorum L. | 21 |
| Litter (duff) | 73 | Cryptobiotic soil | 3 |
| Plant | 5 | Ephedra torreyana S. Wats. | 4 |
| Sand | 2 | Fallugia paradoxa (D. Don) Endl. ex Torr. | 24 |
| | | Moss spp. | 1 |
| | | Sporobolus cryptandrus (Torr.) Gray | 2 |
| | | Stanleya pinnata (Pursh) Britt. | 4 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Cobble | 0 | 1 | 0 | 1 | 4 |
| Litter (duff) | 33 | 10 | 86 | 80 | 75 |
| Stone | 3 | 4 | 0 | 4 | 4 |
| Bare Soil | 0 | 0 | 1 | 4 | 1 |
| Coarse woody debris | 0 | 0 | 4 | 4 | 1 |
| Sand | 7 | 4 | 4 | 4 | 4 |
| Woody debris structure | 0 | 0 | 4 | 0 | 0 |
| Gravel | 0 | 1 | 1 | 1 | 4 |
| Boulder | 56 | 81 | 1 | 4 | 9 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | | | | | | | | | <1% | |
| Aristida spp. | | | <1% | | | | | | | |
| Artemisia bigelovii Gray | | | | | | | | | <1% | |
| Atriplex canescens (Pursh) Nutt. | | | | | 10-25% | | 25-50% | | 1-5% | |
| Brickellia longifolia S. Wats. | | | | | <0% | | <1% | | <1% | |
| Bromus rubens L. | | 1-5% | <1% | | 1-5% | | 1-5% | | <1% | |
| Bromus tectorum L. | | 10-25% | 1-5% | | 10-25% | | 10-25% | | 5-10% | |
| Cryptobiotic soil | | <1% | 1-5% | | <0% | | <0% | | <0% | |
| Ephedra torreyana S. Wats. | | 1-5% | <1% | | <0% | | 5-10% | | 5-10% | |
| Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird | | | 5-10% | | | | | | | |
| Eriogonum corymbosum Benth. | | | <1% | | | | | | | |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 2

Transect Type: Tamarisk Control

| | | | | | |
|--|------|--------|--------|------|--------|
| Fallugia paradoxa (D. Don) Endl. ex Torr. | <1% | 10-25% | 25-50% | <0% | 25-50% |
| Grass spp | 1-5% | | | | |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | | | | <1% | <1% |
| Moss spp. | <1% | 1-5% | 1-5% | <0% | <1% |
| Muhlenbergia porteri Scribn. ex Beal | <1% | <1% | | | |
| Opuntia spp. | | <1% | | | |
| Ptelea trifoliata L. | <1% | | | | |
| Sporobolus spp. | | | | 1-5% | |
| Stanleya pinnata (Pursh) Britt. | <1% | <1% | <0% | 1-5% | 5-10% |
| Stephanomeria pauciflora (Torr.) A. Nels. | | | | | <1% |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|---|---------------|-------------|-------------|
| 25 | Bromus rubens L. | 1 | | |
| 25 | Fallugia paradoxa (D. Don) Endl. ex Torr. | 5 | | |
| 35 | Bromus tectorum L. | 2 | | |
| 35 | Ephedra torreyana S. Wats. | 4 | | |
| 45 | Fallugia paradoxa (D. Don) Endl. ex Torr. | 5 | | |

Vegetation Structure Data - New

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|-----|-----------|-----|-----------|------|---------|-----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 8.94 | 109 | 8.91 | 124 | 8.88 | 128 | 8.91 | 120 |
| 15 | 9.21 | 232 | 9.19 | 241 | 9.16 | 251 | 9.19 | 241 |
| 25 | 9.84 | 67 | 9.71 | 75 | 9.64 | 99 | 9.73 | 80 |
| 35 | 9 | 749 | 8.93 | 9 | 8.881 | 1163 | 8.94 | 640 |
| 45 | 9.45 | 231 | 9.26 | 315 | 9.16 | 351 | 9.29 | 299 |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 2

Transect Type: Tamarisk Control

Date: 5/6/2005 Revisit? Pre-tamarisk removal

Recorder: Amy Prince Reader: Lori Makarick

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

Weather: Sunny, some clouds with intermittent rain

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|---|----------------|
| Boulder | 21 | | 2 |
| Litter (duff) | 60 | Atriplex canescens (Pursh) Nutt. | 13 |
| Sand | 76 | Bromus rubens L. | 28 |
| Woody debris structure | 1 | Bromus tectorum L. | 49 |
| | | Descurainia pinnata (Walt.) Britt. | 1 |
| | | Ephedra spp. | 5 |
| | | Fallugia paradoxa (D. Don) Endl. ex Torr. | 27 |
| | | Mirabilis multiflora (Torr.) Gray | 1 |
| | | Stanleya pinnata (Pursh) Britt. | 6 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|---------------------|-----------|------------|------------|------------|------------|
| Cobble | 0 | 0 | 0 | 6 | 15 |
| Sand | 4 | 0 | 33 | 38 | 38 |
| Gravel | 0 | 0 | 0 | 6 | 15 |
| Litter (duff) | 4 | 5 | 33 | 0 | 15 |
| Boulder | 91 | 95 | 0 | 38 | 15 |
| Coarse woody debris | 0 | 0 | 33 | 6 | 0 |
| Stone | 1 | 0 | 0 | 6 | 0 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Aristida spp. | | | <1% | | | | | | | |
| Atriplex canescens (Pursh) Nutt. | | | | | 10-25% | | 5-10% | | <1% | |
| Brickellia longifolia S. Wats. | | | | | | | | | <1% | |
| Bromus rubens L. | | 5-10% | 1-5% | | 5-10% | | 5-10% | | 1-5% | |
| Bromus tectorum L. | | 5-10% | 1-5% | | 5-10% | | 5-10% | | 50-75% | |
| Cirsium neomexicanum Gray | | | | | <1% | | | | | |
| Cryptantha spp. | | | <1% | | | | | | | |
| Ephedra spp. | | 10-25% | | | | | 1-5% | | <1% | |
| Fallugia paradoxa (D. Don) Endl. ex Torr. | | | 25-50% | | 25-50% | | | | 10-25% | |
| Mirabilis multiflora (Torr.) Gray | | | | | | | 1-5% | | | |
| Opuntia polyacantha Haw. | | | <1% | | | | | | | |
| Sisymbrium altissimum L. | | | | | | | | | <1% | |
| Sporobolus cryptandrus (Torr.) Gray | | | | | | | <1% | | | |
| Stanleya pinnata (Pursh) Britt. | <1% | | | | <1% | | <1% | | 1-5% | |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 2

Transect Type: Tamarisk Control

Tiquilia latior (I.M. Johnston) A.
Richards.

<1%

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|---|---------------|-------------|-------------|
| 15 | Fallugia paradoxa (D. Don) Endl. ex Torr. | 6 | 2 | |
| 25 | Bromus tectorum L. | 3 | | |
| 25 | Fallugia paradoxa (D. Don) Endl. ex Torr. | 3 | | |
| 35 | Bromus tectorum L. | 8 | | |
| 35 | Ephedra spp. | 6 | | |
| 45 | Bromus tectorum L. | 2 | | |
| 45 | Fallugia paradoxa (D. Don) Endl. ex Torr. | 10 | | |

Vegetation Structure Data - New**Soil Data**

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 2

Transect Type: Tamarisk Control

Date: 4/23/2006 Revisit? Post-tamarisk removal

Recorder: Eric Krouse Reader: Kate Watters

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

Weather: Very windy, about 20mph, cloudy and about 60F.

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|---|----------------|
| Bare Soil | 5 | Aristida spp. | 1 |
| Boulder | 14 | Atriplex canescens (Pursh) Nutt. | 14 |
| Coarse woody debris | 1 | Bromus tectorum L. | 21 |
| Litter (duff) | 73 | Cryptobiotic soil | 3 |
| Plant | 5 | Ephedra torreyana S. Wats. | 4 |
| Sand | 2 | Fallugia paradoxa (D. Don) Endl. ex Torr. | 24 |
| | | Moss spp. | 1 |
| | | Sporobolus cryptandrus (Torr.) Gray | 2 |
| | | Stanleya pinnata (Pursh) Britt. | 4 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Cobble | 0 | 1 | 0 | 1 | 4 |
| Litter (duff) | 33 | 10 | 86 | 80 | 75 |
| Stone | 3 | 4 | 0 | 4 | 4 |
| Bare Soil | 0 | 0 | 1 | 4 | 1 |
| Coarse woody debris | 0 | 0 | 4 | 4 | 1 |
| Sand | 7 | 4 | 4 | 4 | 4 |
| Woody debris structure | 0 | 0 | 4 | 0 | 0 |
| Gravel | 0 | 1 | 1 | 1 | 4 |
| Boulder | 56 | 81 | 1 | 4 | 9 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth | | | | | | | | | <1% | |
| Aristida spp. | | | <1% | | | | | | | |
| Artemisia bigelovii Gray | | | | | | | | | <1% | |
| Atriplex canescens (Pursh) Nutt. | | | | | 10-25% | | 25-50% | | 1-5% | |
| Brickellia longifolia S. Wats. | | | | | <0% | | <1% | | <1% | |
| Bromus rubens L. | | 1-5% | <1% | | 1-5% | | 1-5% | | <1% | |
| Bromus tectorum L. | | 10-25% | 1-5% | | 10-25% | | 10-25% | | 5-10% | |
| Cryptobiotic soil | | <1% | 1-5% | | <0% | | <0% | | <0% | |
| Ephedra torreyana S. Wats. | | 1-5% | <1% | | <0% | | 5-10% | | 5-10% | |
| Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird | | | 5-10% | | | | | | | |
| Eriogonum corymbosum Benth. | | | <1% | | | | | | | |

Canyon/Park Area: South Canyon

River mile: 31.9 R

Project (Phase): Phase IIa

Transect Name: South Canyon 2

Transect Type: Tamarisk Control

| | | | | | |
|--|------|--------|--------|------|--------|
| Fallugia paradoxa (D. Don) Endl. ex Torr. | <1% | 10-25% | 25-50% | <0% | 25-50% |
| Grass spp | 1-5% | | | | |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | | | | <1% | <1% |
| Moss spp. | <1% | 1-5% | 1-5% | <0% | <1% |
| Muhlenbergia porteri Scribn. ex Beal | <1% | <1% | | | |
| Opuntia spp. | | <1% | | | |
| Ptelea trifoliata L. | <1% | | | | |
| Sporobolus spp. | | | | 1-5% | |
| Stanleya pinnata (Pursh) Britt. | <1% | <1% | <0% | 1-5% | 5-10% |
| Stephanomeria pauciflora (Torr.) A. Nels. | | | | | <1% |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|---|---------------|-------------|-------------|
| 25 | Bromus rubens L. | 1 | | |
| 25 | Fallugia paradoxa (D. Don) Endl. ex Torr. | 5 | | |
| 35 | Bromus tectorum L. | 2 | | |
| 35 | Ephedra torreyana S. Wats. | 4 | | |
| 45 | Fallugia paradoxa (D. Don) Endl. ex Torr. | 5 | | |

Vegetation Structure Data - New

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|-----|-----------|-----|-----------|------|---------|-----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 8.94 | 109 | 8.91 | 124 | 8.88 | 128 | 8.91 | 120 |
| 15 | 9.21 | 232 | 9.19 | 241 | 9.16 | 251 | 9.19 | 241 |
| 25 | 9.84 | 67 | 9.71 | 75 | 9.64 | 99 | 9.73 | 80 |
| 35 | 9 | 749 | 8.93 | 9 | 8.881 | 1163 | 8.94 | 640 |
| 45 | 9.45 | 231 | 9.26 | 315 | 9.16 | 351 | 9.29 | 299 |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 1

Transect Type: Tamarisk Area

| | Start point | | End point |
|-------------------------------|--|---------------------|------------------|
| Easting: | 289231 | Easting: | 289270 |
| Northing: | 3968787 | Northing: | 3968767 |
| GPS accuracy (m): | 2 | GPS accuracy (m): | 7 |
| Elevation (m): | 465 | Elevation (m): | |
| Bearing: | 102 | | |
| Aspect (0-360): | 193 | Slope (degrees): | 6 |
| Transect description: | Transect is ~850m from mouth of canyon on creek left, about 1m from creek and ~8m down canyon from 1m tall conglomerate pourover. Transect is ~1m above stream on bench. The end point is in a distinct granite wall with tapeats above it. Tape end tucks in behind Pleurocoronis pleuriseta. | | |
| Additional Info:: | Across creek from obvious white granite concave surface below tapeats. At up canyon end of concave tapeats band / mesa on stream left. Prominent skyline features on stream R and L shown in photos. | | |
| Geological layer: | Zoroaster granite and tapeats | | |
| Habitat type: | Riparian | Mojave desert scrub | |
| Dominant species: | Acacia greggii Gray, Baccharis salicifolia (Ruiz & Pavón) Pers., Pluchea sericea (Nutt.) Coville | | |
| Associated species: | Aristida spp., Atriplex canescens (Pursh) Nutt., Baccharis sarothroides Gray, Bromus rubens L., Cryptantha pterocarya (Torr.) Greene, Cryptantha spp., Cryptobiotic soil, Descurainia pinnata (Walt.) Britt., Draba cuneifolia Nutt. ex Torr. & Gray, Encelia farinosa Gray ex Torr., Ephedra spp., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Isocoma acradenia (Greene) Greene, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Plantago patagonica Jacq., Pleurocoronis pluriseta (Gray) King & H.E. Robins., Polypogon monspeliensis (L.) Desf., Porophyllum gracile Benth., Prosopis glandulosa Torr., Sonchus asper (L.) Hill, Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb., Sphaeralcea spp., Sporobolus cryptandrus (Torr.) Gray, Sporobolus spp., Vulpia octoflora (Walt.) Rydb. | | |
| Surface water within 25m? | <input checked="" type="checkbox"/> | Surface water type: | |
| Landform: Lower slope | Drainage channel | Surface rocks: | granite |
| Soil type: sandy loam | | Topo position: | |
| Light exposure: partial-shade | | Soil moisture: | dry |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 1

Transect Type: Tamarisk Area

Date: 5/18/2005 Revisit? Pre-tamarisk removal

Recorder: Amy Prince Reader: Lori Makarick

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

Weather: Sunny, high clouds, 90F

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|---|----------------|
| Bedrock | 2 | | 17 |
| Coarse woody debris | 5 | Acacia greggii Gray | 4 |
| Cobble | 12 | Aristida spp. | 4 |
| Gravel | 42 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 20 |
| Litter (duff) | 76 | Baccharis spp. | 2 |
| Sand | 10 | Bromus rubens L. | 19 |
| Stone | 1 | Cryptantha spp. | 1 |
| | | Draba cuneifolia Nutt. ex Torr. & Gray | 2 |
| | | Encelia farinosa Gray ex Torr. | 3 |
| | | Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 14 |
| | | Polypogon monspeliensis (L.) Desf. | 1 |
| | | Sonchus asper (L.) Hill | 1 |
| | | Sporobolus contractus A.S. Hitchc. | 1 |
| | | Sporobolus cryptandrus (Torr.) Gray | 1 |
| | | Tamarix ramosissima Ledeb. | 56 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|---------------------|-----------|------------|------------|------------|------------|
| Boulder | 5 | 1 | 0 | 0 | 0 |
| Sand | 30 | 23 | 3 | 4 | 17 |
| Gravel | 30 | 23 | 36 | 47 | 36 |
| Cobble | 5 | 23 | 17 | 22 | 17 |
| Litter (duff) | 30 | 23 | 36 | 22 | 17 |
| Bedrock | 0 | 0 | 3 | 1 | 7 |
| Stone | 1 | 4 | 3 | 4 | 3 |
| Coarse woody debris | 0 | 4 | 3 | 1 | 3 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | 1-5% | | 1-5% | | | | | | | |
| Aristida spp. | <1% | | <1% | | <1% | | 1-5% | | <1% | |
| Artemisia ludoviciana Nutt. | | | | | | | | | <1% | |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | <1% | | 10-25% | | 5-10% | | 1-5% | | | |
| Baccharis sarothroides Gray | 1-5% | | | | | | | | | |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 1

Transect Type: Tamarisk Area

| | | | | | |
|---|--------|--------|--------|--------|--------|
| Brickellia longifolia S. Wats. | | | | | <1% |
| Bromus rubens L. | 10-25% | | 5-10% | <1% | 1-5% |
| Cryptantha maritima (Greene) Greene | | | <1% | | |
| Cryptantha pterocarya (Torr.) Greene | | <1% | | | |
| Cryptantha spp. | <1% | <1% | 1-5% | <1% | <1% |
| Cryptobiotic soil | 10-25% | 1-5% | | | |
| Cynodon dactylon (L.) Pers. | 1-5% | 1-5% | | 25-50% | <1% |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | | | | | <1% |
| Descurainia pinnata (Walt.) Britt. | <1% | | <1% | | |
| Draba cuneifolia Nutt. ex Torr. & Gray | | | <1% | <1% | <1% |
| Encelia farinosa Gray ex Torr. | 1-5% | 5-10% | 1-5% | 5-10% | 1-5% |
| Eucnide urens (Parry ex Gray) Parry | | | | | 1-5% |
| Hedeoma spp. | | | | | <1% |
| Isocoma acradenia (Greene) Greene | 1-5% | <1% | | | |
| Lepidium lasiocarpum Nutt. var. lasiocarpum | <1% | | | <1% | <1% |
| Linanthus bigelovii (Gray) Greene | | | <1% | | <1% |
| Linum lewisii Pursh | | | | | <1% |
| Machaeranthera pinnatifida (Hook.) Shinnery | | | | | <1% |
| Nemacladus glanduliferus Jepson | | | <1% | | <1% |
| Nicotiana obtusifolia Mertens & Galeotti var. obtusifolia | | | <1% | | |
| Oenothera caespitosa Nutt. | <1% | | <1% | | <1% |
| Plantago patagonica Jacq. | <1% | | | | |
| Pleurocoronis pluriseta (Gray) King & H.E. Robins. | | | | <1% | |
| Pluchea sericea (Nutt.) Coville | | | 1-5% | 10-25% | 5-10% |
| Poa bigelovii Vasey & Scribn. | <1% | <1% | <1% | <1% | 1-5% |
| Polypogon monspeliensis (L.) Desf. | <1% | <1% | <1% | <1% | <1% |
| Porophyllum gracile Benth. | | | | 1-5% | <1% |
| Prosopis glandulosa Torr. | 25-50% | 1-5% | | | |
| Silene antirrhina L. | | | | <1% | <1% |
| Sonchus asper (L.) Hill | <1% | <1% | <1% | <1% | <1% |
| Sphaeralcea spp. | | | <1% | | |
| Sporobolus spp. | 5-10% | 1-5% | <1% | | |
| Stephanomeria exigua Nutt. | | | <1% | | |
| Stylocline micropoides Gray | | | | <1% | <1% |
| Tamarix ramosissima Ledeb. | 25-50% | 25-50% | 25-50% | 10-25% | 25-50% |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|--|---------------|-------------|-------------|
| 5 | Sporobolus cryptandrus (Torr.) Gray | 1 | | |
| 15 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 1 | | |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 1

Transect Type: Tamarisk Area

| | | | |
|----|---|---|---|
| 15 | Tamarix ramosissima Ledeb. | 5 | |
| 25 | Tamarix ramosissima Ledeb. | 4 | 2 |
| 35 | Cryptantha spp. | 5 | |
| 35 | Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 3 | |
| 35 | Tamarix ramosissima Ledeb. | 2 | |
| 45 | Tamarix ramosissima Ledeb. | | 5 |

Vegetation Structure Data - New**Soil Data**

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|----|-----------|----|-----------|----|---------|----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0 | | 0 | | 0 | | 0.00 | |
| 15 | 0.01 | | 0.03 | | 0.02 | | 0.02 | |
| 25 | 0.01 | | 0.02 | | 0.03 | | 0.02 | |
| 35 | 0.01 | | 0.05 | | 0.03 | | 0.03 | |
| 45 | 0.01 | | 0.01 | | 0.01 | | 0.01 | |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 1

Transect Type: Tamarisk Area

Date: 5/19/2006 Revisit? Post-tamarisk removal

Recorder: Lori Makarick Reader: Mike Kearsley

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

Weather: 5% clouds which is not enough! Very still. Approaching brutally hot. 100F.

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|--|----------------|
| Bedrock | 3 | Acacia greggii Gray | 2 |
| Coarse woody debris | 1 | Aristida adscensionis L. | 1 |
| Cobble | 5 | Aristida arizonica Vasey | 1 |
| Gravel | 18 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 13 |
| Litter (duff) | 65 | Baccharis sarothroides Gray | 5 |
| Plant | 1 | Cynodon dactylon (L.) Pers. | 12 |
| Sand | 4 | Encelia farinosa Gray ex Torr. | 4 |
| Woody debris structure | 1 | Pluchea sericea (Nutt.) Coville | 6 |
| | | Prosopis glandulosa Torr. | 1 |
| | | Tamarix ramosissima Ledeb. | 4 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Litter (duff) | 45 | 39 | 47 | 25 | 37 |
| Woody debris structure | 0 | 3 | 0 | 0 | 3 |
| Gravel | 21 | 8 | 9 | 54 | 17 |
| Stone | 4 | 18 | 22 | 4 | 7 |
| Sand | 9 | 3 | 4 | 1 | 3 |
| Cobble | 9 | 18 | 9 | 11 | 7 |
| Coarse woody debris | 4 | 8 | 4 | 4 | 7 |
| Bedrock | 0 | 0 | 4 | 0 | 17 |
| Boulder | 9 | 3 | 1 | 0 | 0 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | 1-5% | S+P | 5-10% | M | <1% | | <1% | | <0% | |
| Argythamnia neomexicana Muell.-Arg. | | | | | | | <1% | | | |
| Aristida adscensionis L. | | | <1% | | <1% | | <1% | | | |
| Aristida arizonica Vasey | <0% | | <1% | | <1% | | 1-5% | | <1% | |
| Aristida purpurea Nutt. | <1% | | <1% | | 1-5% | | <0% | | <0% | |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | 1-5% | | 5-10% | | 5-10% | | 5-10% | | <0% | |
| Baccharis sarothroides Gray | 1-5% | | | | | | | | | |
| Bromus rubens L. | 1-5% | | <1% | | <1% | | <1% | | <1% | |
| Cryptantha spp. | | | | | | | 1-5% | | <1% | |
| Cryptobiotic soil | 1-5% | | <1% | | <0% | | <0% | | <1% | |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 1

Transect Type: Tamarisk Area

| | | | | | | | | | |
|---|--------|-----|-------|-----|------|---|--------|---|--------|
| Cynodon dactylon (L.) Pers. | 1-5% | | 1-5% | | <1% | | 10-25% | | 1-5% |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | | | | | | | <1% | | <1% |
| Encelia farinosa Gray ex Torr. | <1% | | 5-10% | | 1-5% | | 1-5% | | 1-5% |
| Eucnide urens (Parry ex Gray) Parry | | | | | | | | | 1-5% |
| Isocoma acradenia (Greene) Greene | 1-5% | | 1-5% | | 1-5% | | <1% | | <1% |
| Juncus torreyi Coville | 1-5% | | <0% | | <1% | | <0% | | <0% |
| Lepidium lasiocarpum Nutt. var. lasiocarpum | | | | | | | <1% | | |
| Machaeranthera pinnatifida (Hook.) Shinnery | | | | | | | | | <1% |
| Mammillaria grahamii Engelm. var. grahamii | | | | | <1% | | | | |
| Nicotiana obtusifolia Mertens & Galeotti var. obtusifolia | <0% | | <1% | | <1% | | <1% | | <1% |
| Pluchea sericea (Nutt.) Coville | | | | | | | 10-25% | | 10-25% |
| Polypogon monspeliensis (L.) Desf. | <1% | | <0% | | <1% | | | | |
| Prosopis glandulosa Torr. | 10-25% | M | 1-5% | M | | | | | |
| Sonchus asper (L.) Hill | <1% | | <0% | | <0% | | <1% | | |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | | | <1% | | <1% | | <1% | | <0% |
| Sporobolus cryptandrus (Torr.) Gray | <1% | | <1% | | <1% | | <1% | | <0% |
| Tamarix ramosissima Ledeb. | 1-5% | S+P | 1-5% | S+P | 1-5% | P | <1% | P | 1-5% |
| Thymophylla pentachaeta (DC.) Small | <0% | | <1% | | <0% | | <0% | | <0% |
| Water | <1% | | <0% | | <0% | | <0% | | <0% |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|-----------------------|---------------|-------------|-------------|
| 5 Acacia greggii Gray | 21 | | |

Vegetation Structure Data - New

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|---|---------------|-------------|-------------|
| 5 Acacia greggii Gray | 7 | | |
| 15 Baccharis salicifolia (Ruiz & Pavón) Pers. | 0 | | |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|-----|-----------|-----|-----------|-----|---------|-----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 8.43 | 122 | 8.4 | 125 | 8.38 | 127 | 8.40 | 125 |
| 15 | 8.58 | 174 | 8.69 | 182 | 8.68 | 180 | 8.65 | 179 |
| 25 | 8.79 | 267 | 8.82 | 269 | 8.81 | 272 | 8.81 | 269 |
| 35 | 7.96 | 435 | 7.81 | 388 | 7.8 | 430 | 7.86 | 418 |
| 45 | 8.25 | 246 | 8.24 | 247 | 8.28 | 249 | 8.26 | 247 |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 1

Transect Type: Tamarisk Area

Date: 5/18/2005 Revisit? Pre-tamarisk removal

Recorder: Amy Prince Reader: Lori Makarick

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

Weather: Sunny, high clouds, 90F

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|---|----------------|
| Bedrock | 2 | | 17 |
| Coarse woody debris | 5 | Acacia greggii Gray | 4 |
| Cobble | 12 | Aristida spp. | 4 |
| Gravel | 42 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 20 |
| Litter (duff) | 76 | Baccharis spp. | 2 |
| Sand | 10 | Bromus rubens L. | 19 |
| Stone | 1 | Cryptantha spp. | 1 |
| | | Draba cuneifolia Nutt. ex Torr. & Gray | 2 |
| | | Encelia farinosa Gray ex Torr. | 3 |
| | | Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 14 |
| | | Polypogon monspeliensis (L.) Desf. | 1 |
| | | Sonchus asper (L.) Hill | 1 |
| | | Sporobolus contractus A.S. Hitchc. | 1 |
| | | Sporobolus cryptandrus (Torr.) Gray | 1 |
| | | Tamarix ramosissima Ledeb. | 56 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|---------------------|-----------|------------|------------|------------|------------|
| Boulder | 5 | 1 | 0 | 0 | 0 |
| Sand | 30 | 23 | 3 | 4 | 17 |
| Gravel | 30 | 23 | 36 | 47 | 36 |
| Cobble | 5 | 23 | 17 | 22 | 17 |
| Litter (duff) | 30 | 23 | 36 | 22 | 17 |
| Bedrock | 0 | 0 | 3 | 1 | 7 |
| Stone | 1 | 4 | 3 | 4 | 3 |
| Coarse woody debris | 0 | 4 | 3 | 1 | 3 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | 1-5% | | 1-5% | | | | | | | |
| Aristida spp. | <1% | | <1% | | <1% | | 1-5% | | <1% | |
| Artemisia ludoviciana Nutt. | | | | | | | | | <1% | |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | <1% | | 10-25% | | 5-10% | | 1-5% | | | |
| Baccharis sarothroides Gray | 1-5% | | | | | | | | | |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 1

Transect Type: Tamarisk Area

| | | | | | |
|---|--------|--------|--------|--------|--------|
| Brickellia longifolia S. Wats. | | | | | <1% |
| Bromus rubens L. | 10-25% | | 5-10% | <1% | 1-5% |
| Cryptantha maritima (Greene) Greene | | | <1% | | |
| Cryptantha pterocarya (Torr.) Greene | | <1% | | | |
| Cryptantha spp. | <1% | <1% | 1-5% | <1% | <1% |
| Cryptobiotic soil | 10-25% | 1-5% | | | |
| Cynodon dactylon (L.) Pers. | 1-5% | 1-5% | | 25-50% | <1% |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | | | | | <1% |
| Descurainia pinnata (Walt.) Britt. | <1% | | <1% | | |
| Draba cuneifolia Nutt. ex Torr. & Gray | | | <1% | <1% | <1% |
| Encelia farinosa Gray ex Torr. | 1-5% | 5-10% | 1-5% | 5-10% | 1-5% |
| Eucnide urens (Parry ex Gray) Parry | | | | | 1-5% |
| Hedeoma spp. | | | | | <1% |
| Isocoma acradenia (Greene) Greene | 1-5% | <1% | | | |
| Lepidium lasiocarpum Nutt. var. lasiocarpum | <1% | | | <1% | <1% |
| Linanthus bigelovii (Gray) Greene | | | <1% | | <1% |
| Linum lewisii Pursh | | | | | <1% |
| Machaeranthera pinnatifida (Hook.) Shinnery | | | | | <1% |
| Nemacladus glanduliferus Jepson | | | <1% | | <1% |
| Nicotiana obtusifolia Mertens & Galeotti var. obtusifolia | | | <1% | | |
| Oenothera caespitosa Nutt. | <1% | | <1% | | <1% |
| Plantago patagonica Jacq. | <1% | | | | |
| Pleurocoronis pluriseta (Gray) King & H.E. Robins. | | | | <1% | |
| Pluchea sericea (Nutt.) Coville | | | 1-5% | 10-25% | 5-10% |
| Poa bigelovii Vasey & Scribn. | <1% | <1% | <1% | <1% | 1-5% |
| Polypogon monspeliensis (L.) Desf. | <1% | <1% | <1% | <1% | <1% |
| Porophyllum gracile Benth. | | | | 1-5% | <1% |
| Prosopis glandulosa Torr. | 25-50% | 1-5% | | | |
| Silene antirrhina L. | | | | <1% | <1% |
| Sonchus asper (L.) Hill | <1% | <1% | <1% | <1% | <1% |
| Sphaeralcea spp. | | | <1% | | |
| Sporobolus spp. | 5-10% | 1-5% | <1% | | |
| Stephanomeria exigua Nutt. | | | <1% | | |
| Stylocline micropoides Gray | | | | <1% | <1% |
| Tamarix ramosissima Ledeb. | 25-50% | 25-50% | 25-50% | 10-25% | 25-50% |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|--|---------------|-------------|-------------|
| 5 | Sporobolus cryptandrus (Torr.) Gray | 1 | | |
| 15 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 1 | | |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 1

Transect Type: Tamarisk Area

| | | | |
|----|---|---|---|
| 15 | Tamarix ramosissima Ledeb. | 5 | |
| 25 | Tamarix ramosissima Ledeb. | 4 | 2 |
| 35 | Cryptantha spp. | 5 | |
| 35 | Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 3 | |
| 35 | Tamarix ramosissima Ledeb. | 2 | |
| 45 | Tamarix ramosissima Ledeb. | | 5 |

Vegetation Structure Data - New**Soil Data**

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|----|-----------|----|-----------|----|---------|----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0 | | 0 | | 0 | | 0.00 | |
| 15 | 0.01 | | 0.03 | | 0.02 | | 0.02 | |
| 25 | 0.01 | | 0.02 | | 0.03 | | 0.02 | |
| 35 | 0.01 | | 0.05 | | 0.03 | | 0.03 | |
| 45 | 0.01 | | 0.01 | | 0.01 | | 0.01 | |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 1

Transect Type: Tamarisk Area

Date: 5/19/2006 Revisit? Post-tamarisk removal

Recorder: Lori Makarick Reader: Mike Kearsley

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

Weather: 5% clouds which is not enough! Very still. Approaching brutally hot. 100F.

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|--|----------------|
| Bedrock | 3 | Acacia greggii Gray | 2 |
| Coarse woody debris | 1 | Aristida adscensionis L. | 1 |
| Cobble | 5 | Aristida arizonica Vasey | 1 |
| Gravel | 18 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 13 |
| Litter (duff) | 65 | Baccharis sarothroides Gray | 5 |
| Plant | 1 | Cynodon dactylon (L.) Pers. | 12 |
| Sand | 4 | Encelia farinosa Gray ex Torr. | 4 |
| Woody debris structure | 1 | Pluchea sericea (Nutt.) Coville | 6 |
| | | Prosopis glandulosa Torr. | 1 |
| | | Tamarix ramosissima Ledeb. | 4 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Litter (duff) | 45 | 39 | 47 | 25 | 37 |
| Woody debris structure | 0 | 3 | 0 | 0 | 3 |
| Gravel | 21 | 8 | 9 | 54 | 17 |
| Stone | 4 | 18 | 22 | 4 | 7 |
| Sand | 9 | 3 | 4 | 1 | 3 |
| Cobble | 9 | 18 | 9 | 11 | 7 |
| Coarse woody debris | 4 | 8 | 4 | 4 | 7 |
| Bedrock | 0 | 0 | 4 | 0 | 17 |
| Boulder | 9 | 3 | 1 | 0 | 0 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | 1-5% | S+P | 5-10% | M | <1% | | <1% | | <0% | |
| Argythamnia neomexicana Muell.-Arg. | | | | | | | <1% | | | |
| Aristida adscensionis L. | | | <1% | | <1% | | <1% | | | |
| Aristida arizonica Vasey | <0% | | <1% | | <1% | | 1-5% | | <1% | |
| Aristida purpurea Nutt. | <1% | | <1% | | 1-5% | | <0% | | <0% | |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | 1-5% | | 5-10% | | 5-10% | | 5-10% | | <0% | |
| Baccharis sarothroides Gray | 1-5% | | | | | | | | | |
| Bromus rubens L. | 1-5% | | <1% | | <1% | | <1% | | <1% | |
| Cryptantha spp. | | | | | | | 1-5% | | <1% | |
| Cryptobiotic soil | 1-5% | | <1% | | <0% | | <0% | | <1% | |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 1

Transect Type: Tamarisk Area

| | | | | | |
|---|--------|-------|------|--------|--------|
| Cynodon dactylon (L.) Pers. | 1-5% | 1-5% | <1% | 10-25% | 1-5% |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | | | | <1% | <1% |
| Encelia farinosa Gray ex Torr. | <1% | 5-10% | 1-5% | 1-5% | 1-5% |
| Eucnide urens (Parry ex Gray) Parry | | | | | 1-5% |
| Isocoma acradenia (Greene) Greene | 1-5% | 1-5% | 1-5% | <1% | <1% |
| Juncus torreyi Coville | 1-5% | <0% | <1% | <0% | <0% |
| Lepidium lasiocarpum Nutt. var. lasiocarpum | | | | <1% | |
| Machaeranthera pinnatifida (Hook.) Shinnery | | | | | <1% |
| Mammillaria grahamii Engelm. var. grahamii | | | <1% | | |
| Nicotiana obtusifolia Mertens & Galeotti var. obtusifolia | <0% | <1% | <1% | <1% | <1% |
| Pluchea sericea (Nutt.) Coville | | | 1-5% | 10-25% | 10-25% |
| Polypogon monspeliensis (L.) Desf. | <1% | <0% | <1% | | |
| Prosopis glandulosa Torr. | 10-25% | M | 1-5% | M | |
| Sonchus asper (L.) Hill | <1% | <0% | <0% | <1% | |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | | <1% | <1% | <1% | <0% |
| Sporobolus cryptandrus (Torr.) Gray | <1% | <1% | <1% | <1% | <0% |
| Tamarix ramosissima Ledeb. | 1-5% | S+P | 1-5% | S+P | 1-5% |
| Thymophylla pentachaeta (DC.) Small | <0% | | <0% | | <0% |
| Water | <1% | <0% | <0% | <0% | <0% |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|-----------------------|---------------|-------------|-------------|
| 5 Acacia greggii Gray | 21 | | |

Vegetation Structure Data - New

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|---|---------------|-------------|-------------|
| 5 Acacia greggii Gray | 7 | | |
| 15 Baccharis salicifolia (Ruiz & Pavón) Pers. | 0 | | |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|-----|-----------|-----|-----------|-----|---------|-----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 8.43 | 122 | 8.4 | 125 | 8.38 | 127 | 8.40 | 125 |
| 15 | 8.58 | 174 | 8.69 | 182 | 8.68 | 180 | 8.65 | 179 |
| 25 | 8.79 | 267 | 8.82 | 269 | 8.81 | 272 | 8.81 | 269 |
| 35 | 7.96 | 435 | 7.81 | 388 | 7.8 | 430 | 7.86 | 418 |
| 45 | 8.25 | 246 | 8.24 | 247 | 8.28 | 249 | 8.26 | 247 |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 1

Transect Type: Tamarisk Control

| | Start point | | End point |
|---------------------------|---|---------------------|------------------|
| Easting: | 289158 | Easting: | 289161 |
| Northing: | 3968821 | Northing: | 3968810 |
| GPS accuracy (m): | 8 | GPS accuracy (m): | 25 |
| Elevation (m): | 536 | Elevation (m): | |
| Bearing: | 157 | | |
| Aspect (0-360): | 236 | Slope (degrees): | 5 |
| Transect description: | Transect is ~983m upstream from mouth of trail canyon on creek left, near first dense BACSAL area. When hiking up canyon, forge through two granite slickrock waterfalls. Drainage channel widens to ~25m in transect area. 5/19/06~ Transect start is located on a 2x2m boulder on creek left and parallels creek bottom on a higher terrace of the drainage. Look for a large mesquite to help you find the transect start boulder. Mike Kearsley was also a reader. | | |
| Additional Info:: | Transect start is 25m downstream of flat-topped terrace at granite/tapeats contact with ocotillo. There are abundant ISOACR, BACSAL, and ACAGRE seedlings along the transect. | | |
| Geological layer: | Zoroaster granite | | |
| Habitat type: | Riparian | | |
| Dominant species: | Baccharis salicifolia (Ruiz & Pavón) Pers., Isocoma acradenia (Greene) Greene | | |
| Associated species: | Acacia greggii Gray, Allionia incarnata L., Aristida spp., Artemisia ludoviciana Nutt., Astragalus nuttallianus DC., Baccharis salicifolia (Ruiz & Pavón) Pers., Bebbia juncea (Benth.) Greene var. aspera Greene, Brickellia longifolia S. Wats., Bromus japonicus Thunb. ex Murr., Bromus rubens L., Bromus tectorum L., Camissonia spp., Cirsium spp., Conyza canadensis (L.) Cronq., Cryptantha pterocarya (Torr.) Greene, Cryptantha spp., Cynodon dactylon (L.) Pers., Datura wrightii Regel, Daucus spp., Descurainia pinnata (Walt.) Britt., Draba cuneifolia Nutt. ex Torr. & Gray, Encelia farinosa Gray ex Torr., Erigeron divergens Torr. & Gray, Erigeron spp., Eriogonum spp., Funastrum cynanchoides (Dcne.) Schlechter ssp. cynanchoides, Galium spp., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Hedeoma oblongifolia (Gray) Heller, Isocoma acradenia (Greene) Greene, Juncus torreyi Coville, Lepidium lasiocarpum Nutt. var. lasiocarpum, Linanthus bigelovii (Gray) Greene, Linum lewisii Pursh, Loeseliastrum schottii (Torr.) Timbrook, Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm., Mimulus guttatus DC., Mirabilis bigelovii Gray, Nemacladus glanduliferus Jepson, Oenothera caespitosa Nutt., Parietaria hespera Hinton, Penstemon spp., Plantago patagonica Jacq., Pluchea sericea (Nutt.) Coville, Poa bigelovii Vasey & Scribn., Polypogon monspeliensis (L.) Desf., Prosopis glandulosa Torr., Pseudognaphalium stramineum (Kunth) W.A. Weber, Rorippa nasturtium-aquaticum (L.) Hayek, Senna covesii (Gray) Irwin & Barneby, Silene antirrhina L., Sonchus asper (L.) Hill, Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb., Sporobolus cryptandrus (Torr.) Gray, Stylocline micropoides Gray, Tamarix ramosissima Ledeb., Trixis californica Kellogg, Typha angustifolia L., Vulpia octoflora (Walt.) Rydb. | | |
| Surface water within 25m? | <input checked="" type="checkbox"/> | Surface water type: | |
| Landform: | Drainage channel | Surface rocks: | granite |
| Soil type: | loamy sand | Topo position: | |
| Light exposure: | open | Soil moisture: | moist |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 1

Transect Type: Tamarisk Control

Date: 5/18/2005 Revisit? Pre-tamarisk removal

Recorder: Kate Watters Reader: Lisa Hahn

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

Weather: Clear, warm with high cirrus clouds

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|---|----------------|
| Boulder | 10 | Aristida spp. | 1 |
| Coarse woody debris | 9 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 27 |
| Cobble | 4 | Bebbia juncea (Benth.) Greene var. aspera Greene | 6 |
| Gravel | 38 | Bromus rubens L. | 2 |
| Litter (duff) | 37 | Funastrum cynanchoides (Dcne.) Schlechter | 1 |
| Sand | 55 | Gutierrezia sarothrae (Pursh) Britt. & Rusby | 2 |
| Stone | 2 | Isocoma acradenia (Greene) Greene | 11 |
| | | Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 3 |
| | | Polypogon monspeliensis (L.) Desf. | 1 |
| | | Tamarix ramosissima Ledeb. | 4 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Sand | 3 | 22 | 42 | 15 | 35 |
| Woody debris structure | 0 | 0 | 1 | 0 | 0 |
| Gravel | 7 | 47 | 42 | 52 | 35 |
| Cobble | 16 | 22 | 8 | 15 | 7 |
| Boulder | 16 | 0 | 0 | 6 | 16 |
| Litter (duff) | 35 | 4 | 3 | 6 | 0 |
| Stone | 16 | 4 | 3 | 6 | 7 |
| Coarse woody debris | 7 | 1 | 0 | 0 | 0 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | <1% | | | | <1% | | | | | |
| Allionia incarnata L. | <1% | | | | | | | | | |
| Aristida spp. | <1% | | <1% | | | | <1% | | | |
| Artemisia ludoviciana Nutt. | <1% | | | | <1% | | | | | |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | 10-25% | | 25-50% | | 25-50% | | 10-25% | | 10-25% | |
| Bebbia juncea (Benth.) Greene var. aspera Greene | | | | | | | <1% | | | |
| Brickellia longifolia S. Wats. | | | | | | | 1-5% | | | |
| Bromus japonicus Thunb. ex Murr. | <1% | | | | | | | | | <1% |
| Bromus rubens L. | 1-5% | | 1-5% | | 1-5% | | 1-5% | | 1-5% | <1% |
| Bromus tectorum L. | | | | | <1% | | <1% | | <1% | |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 1

Transect Type: Tamarisk Control

| | | | | | |
|---|-------|--------|--------|-------|--------|
| Cirsium spp. | | <1% | | <1% | |
| Conyza canadensis (L.) Cronq. | <1% | | | | |
| Cryptantha maritima (Greene) Greene | <1% | | | | |
| Cryptantha pterocarya (Torr.) Greene | <1% | | | | |
| Cryptantha spp. | <1% | <1% | <1% | <1% | <1% |
| Cryptobiotic soil | | 1-5% | 1-5% | 1-5% | <1% |
| Cynodon dactylon (L.) Pers. | | <1% | 1-5% | 5-10% | <1% |
| Datura wrightii Regel | | <1% | | | <1% |
| Daucus pusillus Michx. | | | | <1% | <1% |
| Daucus spp. | | | | <1% | |
| Descurainia pinnata (Walt.) Britt. | <1% | <1% | | | |
| Draba cuneifolia Nutt. ex Torr. & Gray | | | | | <1% |
| Encelia farinosa Gray ex Torr. | | <1% | | | <1% |
| Erigeron divergens Torr. & Gray | <1% | | | <1% | |
| Erigeron spp. | <1% | | | | |
| Eriogonum spp. | | | | | <1% |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | | <1% | | |
| Funastrum cynanchoides (Dcne.) Schlechter | 1-5% | | | | |
| Galium spp. | <1% | <1% | <1% | | <1% |
| Gilia spp. | | | <1% | | <1% |
| Hedeoma oblongifolia (Gray) Heller | | <1% | <1% | | <1% |
| Isocoma acradenia (Greene) Greene | 5-10% | 25-50% | 10-25% | 5-10% | 10-25% |
| Lepidium lasiocarpum Nutt. var. lasiocarpum | <1% | <1% | <1% | <1% | <1% |
| Linanthus bigelovii (Gray) Greene | | | | | <1% |
| Loeseliastrum schottii (Torr.) Timbrook | | | | | <1% |
| Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm. | <1% | | | | |
| Mimulus guttatus DC. | | | <1% | | |
| Nemacladus glanduliferus Jepson | | | | | <1% |
| Oenothera caespitosa Nutt. | <1% | <1% | <1% | <1% | <1% |
| Parietaria hespera Hinton | <1% | <1% | | | |
| Penstemon spp. | <1% | | | | <1% |
| Plantago patagonica Jacq. | <1% | <1% | | | <1% |
| Poa bigelovii Vasey & Scribn. | <1% | <1% | <1% | <1% | <1% |
| Polypogon monspeliensis (L.) Desf. | <1% | 1-5% | 1-5% | 5-10% | 1-5% |
| Prosopis glandulosa Torr. | 1-5% | | | | |
| Rorippa nasturtium-aquaticum (L.) Hayek | | | <1% | | |
| Senna covesii (Gray) Irwin & Barneby | 1-5% | | | | |
| Silene antirrhina L. | <1% | <1% | <1% | <1% | <1% |
| Sonchus asper (L.) Hill | | | <1% | | |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | <1% | | | | |
| Sporobolus cryptandrus (Torr.) Gray | 1-5% | <1% | <1% | | |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 1

Transect Type: Tamarisk Control

| | | | | |
|-----------------------------|-----|------|------|------------|
| Stylocline micropoides Gray | <1% | <1% | | |
| Tamarix ramosissima Ledeb. | | 1-5% | 1-5% | 5-10% 1-5% |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|--|---------------|-------------|-------------|
| 25 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 3 | | |
| 35 | Bebbia juncea (Benth.) Greene var. aspera Greene | 4 | | |
| 35 | Tamarix ramosissima Ledeb. | 3 | | |

Vegetation Structure Data - New**Soil Data**

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|--------------|------------------|-----------|------------------|-----------|------------------|-----------|----------------|-----------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0.01 | | 0.02 | | 0.02 | | 0.02 | |
| 15 | 0.04 | | 0.03 | | 0.04 | | 0.04 | |
| 25 | 0.05 | | 0.07 | | 0.08 | | 0.07 | |
| 35 | 0.05 | | 0.04 | | 0.03 | | 0.04 | |
| 45 | 0.02 | | 0.01 | | 0.01 | | 0.01 | |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 1

Transect Type: Tamarisk Control

Date: 5/19/2006 Revisit? Post-tamarisk removal

Recorder: Kate Watters Reader: Lisa Hahn

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

Weather: HOT!

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--|----------------|
| Boulder | 11 | Aristida arizonica Vasey | 1 |
| Coarse woody debris | 1 | Aristida purpurea Nutt. | 2 |
| Cobble | 5 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 19 |
| Gravel | 24 | Bromus rubens L. | 1 |
| Litter (duff) | 38 | Cynodon dactylon (L.) Pers. | 7 |
| Plant | 2 | Gutierrezia sarothrae (Pursh) Britt. & Rusby | 2 |
| Sand | 17 | Isocoma acradenia (Greene) Greene | 25 |
| Stone | 2 | Juncus torreyi Coville | 1 |
| | | Polypogon monspeliensis (L.) Desf. | 4 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Cobble | 7 | 19 | 5 | 14 | 11 |
| Litter (duff) | 16 | 19 | 13 | 14 | 11 |
| Woody debris structure | 3 | 0 | 0 | 0 | 0 |
| Stone | 16 | 8 | 5 | 6 | 4 |
| Boulder | 34 | 0 | 0 | 14 | 25 |
| Coarse woody debris | 16 | 3 | 5 | 6 | 1 |
| Gravel | 7 | 41 | 66 | 33 | 25 |
| Sand | 3 | 8 | 5 | 14 | 25 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | <1% | S | <1% | S | <1% | S | <1% | S | <1% | S |
| Algae spp | <0% | | <0% | | 1-5% | | 1-5% | | <0% | |
| Aristida adscensionis L. | | | | | | | | | <1% | |
| Aristida arizonica Vasey | 1-5% | | <0% | | <0% | | <0% | | <1% | |
| Artemisia ludoviciana Nutt. | | | | | | | | | <1% | |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | 25-50% | | 25-50% | | 25-50% | | 10-25% | | 1-5% | |
| Bebbia juncea (Benth.) Greene var. aspera Greene | <1% | | | | | | | | | |
| Bebbia juncea (Benth.) Greene var. aspera Greene | | | | | | | | | <1% | |
| Brickellia longifolia S. Wats. | | | | | | | 1-5% | | | |
| Bromus rubens L. | <1% | | <1% | | <1% | | <1% | | <1% | |
| Camissonia walkeri (A. Nels.) Raven | | | | | | | | | <1% | |
| Cynodon dactylon (L.) Pers. | <0% | | 1-5% | | 1-5% | | 5-10% | | 1-5% | |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 1

Transect Type: Tamarisk Control

| | | | | | | | | |
|--|--------|--------|-------|--------|--------|-----|---|------|
| Funastrum cynanchoides (Dcne.) Schlechter | 1-5% | | | | | | | |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | 1-5% | | | | | | | |
| Isocoma acradenia (Greene) Greene | 10-25% | 10-25% | 5-10% | 10-25% | 10-25% | | | |
| Juncus torreyi Coville | <0% | <1% | 1-5% | 1-5% | 1-5% | | | |
| Lactuca serriola L. | <0% | <1% | <0% | <0% | <0% | | | |
| Lepidium lasiocarpum Nutt. var. lasiocarpum | | | | | | | | <1% |
| Oenothera caespitosa Nutt. | <1% | <0% | <0% | <0% | <0% | | | <1% |
| Polypogon monspeliensis (L.) Desf. | <1% | 1-5% | 1-5% | <1% | <1% | | | 1-5% |
| Prosopis glandulosa Torr. | 1-5% | M | <0% | <0% | <0% | | | |
| Pseudognaphalium luteoalbum | <0% | <0% | <1% | <0% | <0% | | | <0% |
| Senna covesii (Gray) Irwin & Barneby | <1% | | | | | | | |
| Sonchus asper (L.) Hill | | | <1% | | | | | |
| Sporobolus cryptandrus (Torr.) Gray | 1-5% | <1% | <0% | <0% | <0% | | | <1% |
| Tamarix ramosissima Ledeb. | <0% | <1% | S | 1-5% | S+P | <1% | S | <1% |
| Typha domingensis Pers. | <0% | <0% | <1% | <1% | <1% | | | <0% |
| Water | <0% | <0% | 1-5% | 1-5% | 1-5% | | | <0% |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|---|---------------|-------------|-------------|
| 15 Baccharis salicifolia (Ruiz & Pavón) Pers. | 3 | | |
| 25 Baccharis salicifolia (Ruiz & Pavón) Pers. | 2 | 1 | |
| 25 Cynodon dactylon (L.) Pers. | 3 | | |
| 45 Isocoma acradenia (Greene) Greene | 2 | | |

Vegetation Structure Data - New

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|---|---------------|-------------|-------------|
| 5 Baccharis salicifolia (Ruiz & Pavón) Pers. | | 2 | |
| 15 Baccharis salicifolia (Ruiz & Pavón) Pers. | 1 | | |
| 25 Baccharis salicifolia (Ruiz & Pavón) Pers. | 3 | 7 | |
| 25 Cynodon dactylon (L.) Pers. | 1 | | |
| 25 Vacant Space | 6 | | |
| 45 Isocoma acradenia (Greene) Greene | 2 | | |

Soil Data

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 1

Transect Type: Tamarisk Control

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|------|-----------|------|-----------|------|---------|------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 8.31 | 450 | 8.27 | 454 | 8.25 | 446 | 8.28 | 450 |
| 15 | 8.97 | 538 | 9.1 | 540 | 9.23 | 446 | 9.10 | 508 |
| 25 | 9.62 | 194 | 9.29 | 193 | 9.28 | 199 | 9.40 | 195 |
| 35 | 9.23 | 1017 | 9.24 | 1004 | 9.25 | 1021 | 9.24 | 1014 |
| 45 | 8.79 | 3999 | 8.79 | 3999 | 8.78 | 3999 | 8.79 | 3999 |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 1

Transect Type: Tamarisk Control

Date: 5/18/2005 Revisit? Pre-tamarisk removal

Recorder: Kate Watters Reader: Lisa Hahn

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

Weather: Clear, warm with high cirrus clouds

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|---|----------------|
| Boulder | 10 | Aristida spp. | 1 |
| Coarse woody debris | 9 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 27 |
| Cobble | 4 | Bebbia juncea (Benth.) Greene var. aspera Greene | 6 |
| Gravel | 38 | Bromus rubens L. | 2 |
| Litter (duff) | 37 | Funastrum cynanchoides (Dcne.) Schlechter | 1 |
| Sand | 55 | Gutierrezia sarothrae (Pursh) Britt. & Rusby | 2 |
| Stone | 2 | Isocoma acradenia (Greene) Greene | 11 |
| | | Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 3 |
| | | Polypogon monspeliensis (L.) Desf. | 1 |
| | | Tamarix ramosissima Ledeb. | 4 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Sand | 3 | 22 | 42 | 15 | 35 |
| Woody debris structure | 0 | 0 | 1 | 0 | 0 |
| Gravel | 7 | 47 | 42 | 52 | 35 |
| Cobble | 16 | 22 | 8 | 15 | 7 |
| Boulder | 16 | 0 | 0 | 6 | 16 |
| Litter (duff) | 35 | 4 | 3 | 6 | 0 |
| Stone | 16 | 4 | 3 | 6 | 7 |
| Coarse woody debris | 7 | 1 | 0 | 0 | 0 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | <1% | | | | <1% | | | | | |
| Allionia incarnata L. | <1% | | | | | | | | | |
| Aristida spp. | <1% | | <1% | | | | <1% | | | |
| Artemisia ludoviciana Nutt. | <1% | | | | <1% | | | | | |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | 10-25% | | 25-50% | | 25-50% | | 10-25% | | 10-25% | |
| Bebbia juncea (Benth.) Greene var. aspera Greene | | | | | | | <1% | | | |
| Brickellia longifolia S. Wats. | | | | | | | 1-5% | | | |
| Bromus japonicus Thunb. ex Murr. | <1% | | | | | | | | | <1% |
| Bromus rubens L. | 1-5% | | 1-5% | | 1-5% | | 1-5% | | 1-5% | <1% |
| Bromus tectorum L. | | | | | <1% | | <1% | | <1% | |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 1

Transect Type: Tamarisk Control

| | | | | | |
|---|-------|--------|--------|-------|--------|
| Cirsium spp. | | <1% | | <1% | |
| Conyza canadensis (L.) Cronq. | <1% | | | | |
| Cryptantha maritima (Greene) Greene | <1% | | | | |
| Cryptantha pterocarya (Torr.) Greene | <1% | | | | |
| Cryptantha spp. | <1% | <1% | <1% | <1% | <1% |
| Cryptobiotic soil | | 1-5% | 1-5% | 1-5% | <1% |
| Cynodon dactylon (L.) Pers. | | <1% | 1-5% | 5-10% | <1% |
| Datura wrightii Regel | | <1% | | | <1% |
| Daucus pusillus Michx. | | | | <1% | <1% |
| Daucus spp. | | | | <1% | |
| Descurainia pinnata (Walt.) Britt. | <1% | <1% | | | |
| Draba cuneifolia Nutt. ex Torr. & Gray | | | | | <1% |
| Encelia farinosa Gray ex Torr. | | <1% | | | <1% |
| Erigeron divergens Torr. & Gray | <1% | | | <1% | |
| Erigeron spp. | <1% | | | | |
| Eriogonum spp. | | | | | <1% |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | | <1% | | |
| Funastrum cynanchoides (Dcne.) Schlechter | 1-5% | | | | |
| Galium spp. | <1% | <1% | <1% | | <1% |
| Gilia spp. | | | <1% | | <1% |
| Hedeoma oblongifolia (Gray) Heller | | <1% | <1% | | <1% |
| Isocoma acradenia (Greene) Greene | 5-10% | 25-50% | 10-25% | 5-10% | 10-25% |
| Lepidium lasiocarpum Nutt. var. lasiocarpum | <1% | <1% | <1% | <1% | <1% |
| Linanthus bigelovii (Gray) Greene | | | | | <1% |
| Loeseliastrum schottii (Torr.) Timbrook | | | | | <1% |
| Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm. | <1% | | | | |
| Mimulus guttatus DC. | | | <1% | | |
| Nemacladus glanduliferus Jepson | | | | | <1% |
| Oenothera caespitosa Nutt. | <1% | <1% | <1% | <1% | <1% |
| Parietaria hespera Hinton | <1% | <1% | | | |
| Penstemon spp. | <1% | | | | <1% |
| Plantago patagonica Jacq. | <1% | <1% | | | <1% |
| Poa bigelovii Vasey & Scribn. | <1% | <1% | <1% | <1% | <1% |
| Polypogon monspeliensis (L.) Desf. | <1% | 1-5% | 1-5% | 5-10% | 1-5% |
| Prosopis glandulosa Torr. | 1-5% | | | | |
| Rorippa nasturtium-aquaticum (L.) Hayek | | | <1% | | |
| Senna covesii (Gray) Irwin & Barneby | 1-5% | | | | |
| Silene antirrhina L. | <1% | <1% | <1% | <1% | <1% |
| Sonchus asper (L.) Hill | | | <1% | | |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | <1% | | | | |
| Sporobolus cryptandrus (Torr.) Gray | 1-5% | <1% | <1% | | |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 1

Transect Type: Tamarisk Control

| | | | | | |
|-----------------------------|-----|------|------|-------|------|
| Stylocline micropoides Gray | <1% | | <1% | | |
| Tamarix ramosissima Ledeb. | | 1-5% | 1-5% | 5-10% | 1-5% |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|--|---------------|-------------|-------------|
| 25 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 3 | | |
| 35 | Bebbia juncea (Benth.) Greene var. aspera Greene | 4 | | |
| 35 | Tamarix ramosissima Ledeb. | 3 | | |

Vegetation Structure Data - New**Soil Data**

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|--------------|------------------|-----------|------------------|-----------|------------------|-----------|----------------|-----------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0.01 | | 0.02 | | 0.02 | | 0.02 | |
| 15 | 0.04 | | 0.03 | | 0.04 | | 0.04 | |
| 25 | 0.05 | | 0.07 | | 0.08 | | 0.07 | |
| 35 | 0.05 | | 0.04 | | 0.03 | | 0.04 | |
| 45 | 0.02 | | 0.01 | | 0.01 | | 0.01 | |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 1

Transect Type: Tamarisk Control

Date: 5/19/2006 Revisit? Post-tamarisk removal

Recorder: Kate Watters Reader: Lisa Hahn

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

Weather: HOT!

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--|----------------|
| Boulder | 11 | Aristida arizonica Vasey | 1 |
| Coarse woody debris | 1 | Aristida purpurea Nutt. | 2 |
| Cobble | 5 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 19 |
| Gravel | 24 | Bromus rubens L. | 1 |
| Litter (duff) | 38 | Cynodon dactylon (L.) Pers. | 7 |
| Plant | 2 | Gutierrezia sarothrae (Pursh) Britt. & Rusby | 2 |
| Sand | 17 | Isocoma acradenia (Greene) Greene | 25 |
| Stone | 2 | Juncus torreyi Coville | 1 |
| | | Polypogon monspeliensis (L.) Desf. | 4 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Cobble | 7 | 19 | 5 | 14 | 11 |
| Litter (duff) | 16 | 19 | 13 | 14 | 11 |
| Woody debris structure | 3 | 0 | 0 | 0 | 0 |
| Stone | 16 | 8 | 5 | 6 | 4 |
| Boulder | 34 | 0 | 0 | 14 | 25 |
| Coarse woody debris | 16 | 3 | 5 | 6 | 1 |
| Gravel | 7 | 41 | 66 | 33 | 25 |
| Sand | 3 | 8 | 5 | 14 | 25 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | <1% | S | <1% | S | <1% | S | <1% | S | <1% | S |
| Algae spp | <0% | | <0% | | 1-5% | | 1-5% | | <0% | |
| Aristida adscensionis L. | | | | | | | | | <1% | |
| Aristida arizonica Vasey | 1-5% | | <0% | | <0% | | <0% | | <1% | |
| Artemisia ludoviciana Nutt. | | | | | | | | | <1% | |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | 25-50% | | 25-50% | | 25-50% | | 10-25% | | 1-5% | |
| Bebbia juncea (Benth.) Greene var. aspera Greene | <1% | | | | | | | | | |
| Bebbia juncea (Benth.) Greene var. aspera Greene | | | | | | | | | <1% | |
| Brickellia longifolia S. Wats. | | | | | | | 1-5% | | | |
| Bromus rubens L. | <1% | | <1% | | <1% | | <1% | | <1% | |
| Camissonia walkeri (A. Nels.) Raven | | | | | | | | | <1% | |
| Cynodon dactylon (L.) Pers. | <0% | | 1-5% | | 1-5% | | 5-10% | | 1-5% | |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 1

Transect Type: Tamarisk Control

| | | | | | | | | |
|--|--------|--------|-------|--------|--------|-----|---|------|
| Funastrum cynanchoides (Dcne.) Schlechter | 1-5% | | | | | | | |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | 1-5% | | | | | | | |
| Isocoma acradenia (Greene) Greene | 10-25% | 10-25% | 5-10% | 10-25% | 10-25% | | | |
| Juncus torreyi Coville | <0% | <1% | 1-5% | 1-5% | 1-5% | | | |
| Lactuca serriola L. | <0% | <1% | <0% | <0% | <0% | | | |
| Lepidium lasiocarpum Nutt. var. lasiocarpum | | | | | | | | <1% |
| Oenothera caespitosa Nutt. | <1% | <0% | <0% | <0% | <0% | | | <1% |
| Polypogon monspeliensis (L.) Desf. | <1% | 1-5% | 1-5% | <1% | <1% | | | 1-5% |
| Prosopis glandulosa Torr. | 1-5% | M | <0% | <0% | <0% | | | |
| Pseudognaphalium luteoalbum | <0% | <0% | <1% | <0% | <0% | | | <0% |
| Senna covesii (Gray) Irwin & Barneby | <1% | | | | | | | |
| Sonchus asper (L.) Hill | | | <1% | | | | | |
| Sporobolus cryptandrus (Torr.) Gray | 1-5% | <1% | <0% | <0% | <0% | | | <1% |
| Tamarix ramosissima Ledeb. | <0% | <1% | S | 1-5% | S+P | <1% | S | <1% |
| Typha domingensis Pers. | <0% | <0% | <1% | <1% | <1% | | | <0% |
| Water | <0% | <0% | 1-5% | 1-5% | 1-5% | | | <0% |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|---|---------------|-------------|-------------|
| 15 Baccharis salicifolia (Ruiz & Pavón) Pers. | 3 | | |
| 25 Baccharis salicifolia (Ruiz & Pavón) Pers. | 2 | 1 | |
| 25 Cynodon dactylon (L.) Pers. | 3 | | |
| 45 Isocoma acradenia (Greene) Greene | 2 | | |

Vegetation Structure Data - New

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|---|---------------|-------------|-------------|
| 5 Baccharis salicifolia (Ruiz & Pavón) Pers. | | 2 | |
| 15 Baccharis salicifolia (Ruiz & Pavón) Pers. | 1 | | |
| 25 Baccharis salicifolia (Ruiz & Pavón) Pers. | 3 | 7 | |
| 25 Cynodon dactylon (L.) Pers. | 1 | | |
| 25 Vacant Space | 6 | | |
| 45 Isocoma acradenia (Greene) Greene | 2 | | |

Soil Data

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 1

Transect Type: Tamarisk Control

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|------|-----------|------|-----------|------|---------|------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 8.31 | 450 | 8.27 | 454 | 8.25 | 446 | 8.28 | 450 |
| 15 | 8.97 | 538 | 9.1 | 540 | 9.23 | 446 | 9.10 | 508 |
| 25 | 9.62 | 194 | 9.29 | 193 | 9.28 | 199 | 9.40 | 195 |
| 35 | 9.23 | 1017 | 9.24 | 1004 | 9.25 | 1021 | 9.24 | 1014 |
| 45 | 8.79 | 3999 | 8.79 | 3999 | 8.78 | 3999 | 8.79 | 3999 |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 2

Transect Type: Tamarisk Area

Date: 5/18/2005 Revisit? Pre-tamarisk removal

Recorder: Amy Prince Reader: Lori Makarick

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

Weather: Sunny, hot, no clouds

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|------------------------------------|----------------|
| Bedrock | 19 | | 2 |
| Boulder | 6 | Bromus rubens L. | 4 |
| Cobble | 12 | Cynodon dactylon (L.) Pers. | 11 |
| Gravel | 32 | Isocoma acradenia (Greene) Greene | 1 |
| Litter (duff) | 13 | Polypogon monspeliensis (L.) Desf. | 21 |
| Sand | 31 | Sonchus asper (L.) Hill | 2 |
| Stone | 1 | Tamarix ramosissima Ledeb. | 32 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|---------------------|-----------|------------|------------|------------|------------|
| Coarse woody debris | 0 | 2 | 0 | 0 | 1 |
| Boulder | 0 | 0 | 0 | 0 | 4 |
| Litter (duff) | 3 | 5 | 3 | 3 | 22 |
| Gravel | 56 | 27 | 17 | 35 | 22 |
| Cobble | 16 | 13 | 7 | 17 | 22 |
| Stone | 3 | 13 | 3 | 3 | 22 |
| Bedrock | 16 | 27 | 62 | 35 | 0 |
| Sand | 7 | 13 | 7 | 7 | 9 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | | | | | | | <1% | | <1% | |
| Allionia incarnata L. | | | | | | | <1% | | | |
| Aristida spp. | <1% | | | | | | | | | |
| Artemisia ludoviciana Nutt. | | | | | <1% | | <1% | | <1% | |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | | | <1% | | <1% | | <1% | | 1-5% | |
| Bebbia juncea (Benth.) Greene var. aspera Greene | 1-5% | | | | | | | | | |
| Bromus japonicus Thunb. ex Murr. | | | | | <1% | | | | | |
| Bromus rubens L. | 1-5% | | 1-5% | | 1-5% | | 1-5% | | 1-5% | |
| Cirsium neomexicanum Gray | | | | | | | | | <1% | |
| Cryptantha spp. | <1% | | <1% | | <1% | | 1-5% | | <1% | |
| Cryptobiotic soil | | | | | <1% | | <1% | | <1% | |
| Cynodon dactylon (L.) Pers. | <1% | | 5-10% | | 5-10% | | <1% | | 5-10% | |
| Draba cuneifolia Nutt. ex Torr. & Gray | | | | | <1% | | <1% | | <1% | |
| Encelia farinosa Gray ex Torr. | 1-5% | | <1% | | | | | | | |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 2

Transect Type: Tamarisk Area

| | | | | | |
|---|-------|--------|--------|------|--------|
| Erigeron divergens Torr. & Gray | <1% | | <1% | | <1% |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | <1% | | <1% | <1% |
| Eucrypta micrantha (Torr.) Heller | | | | <1% | |
| Galium spp. | | | | <1% | <1% |
| Gilia spp. | | | <1% | <1% | <1% |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | 1-5% | | | <1% | |
| Hedeoma oblongifolia (Gray) Heller | | | | <1% | <1% |
| Isocoma acradenia (Greene) Greene | <1% | <1% | | 1-5% | 1-5% |
| Juncus spp. | | <1% | | | 1-5% |
| Lepidium lasiocarpum Nutt. var. lasiocarpum | | <1% | <1% | <1% | <1% |
| Linanthus bigelovii (Gray) Greene | | | <1% | <1% | |
| Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm. | 5-10% | | | | |
| Mimulus rubellus Gray | | | | | <1% |
| Mirabilis bigelovii Gray | | | | | <1% |
| Nemacladus glanduliferus Jepson | | | | <1% | |
| Parietaria hespera Hinton | <1% | | | <1% | <1% |
| Penstemon palmeri Gray | | | | | <1% |
| Plantago patagonica Jacq. | | | <1% | <1% | <1% |
| Poa bigelovii Vasey & Scribn. | | <1% | <1% | <1% | <1% |
| Polypogon monspeliensis (L.) Desf. | 5-10% | 5-10% | 1-5% | 1-5% | 10-25% |
| Silene antirrhina L. | <1% | <1% | <1% | <1% | <1% |
| Sonchus asper (L.) Hill | <1% | | | | <1% |
| Sphaeralcea spp. | 1-5% | | | | |
| Sporobolus spp. | | <1% | | <1% | <1% |
| Stylocline micropoides Gray | | | | | <1% |
| Tamarix ramosissima Ledeb. | 5-10% | 10-25% | 10-25% | 1-5% | 25-50% |
| Tidestromia lanuginosa (Nutt.) Standl. | <1% | | | | |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------------------------|---------------|-------------|-------------|
| 5 Bromus rubens L. | 2 | | |
| 15 Tamarix ramosissima Ledeb. | 3 | | |
| 25 Tamarix ramosissima Ledeb. | 9 | | |
| 35 Tamarix ramosissima Ledeb. | 10 | | |
| 45 Artemisia ludoviciana Nutt. | 1 | | |
| 45 Tamarix ramosissima Ledeb. | 20 | 1 | |

Vegetation Structure Data - New

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 2

Transect Type: Tamarisk Area

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|----|-----------|----|-----------|----|---------|----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0 | | 0 | | 0 | | 0.00 | |
| 15 | 0.02 | | 0.01 | | 0 | | 0.01 | |
| 25 | 0.05 | | 0.02 | | 0.03 | | 0.03 | |
| 25 | 0.1 | | 0.07 | | 0.09 | | 0.09 | |
| 35 | 0.05 | | 0.05 | | 0.07 | | 0.06 | |
| 45 | 0.08 | | 0.08 | | 0.06 | | 0.07 | |
| 45 | 0.2 | | 0.13 | | 0.14 | | 0.16 | |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 2

Transect Type: Tamarisk Area

Date: 5/19/2006 Revisit? Post-tamarisk removal

Recorder: Pamela Walls Reader: Lori Makarick

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

Weather: Sunny and warm, 1% clouds, 73 F, calm and still with a very light breeze.

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--|----------------|
| Bedrock | 27 | Aristida purpurea Nutt. | 1 |
| Cobble | 7 | Bebbia juncea (Benth.) Greene var. aspera Greene | 1 |
| Gravel | 12 | Bromus rubens L. | 5 |
| Litter (duff) | 28 | Cynodon dactylon (L.) Pers. | 21 |
| Sand | 22 | Isocoma acradenia (Greene) Greene | 6 |
| Stone | 4 | Juncus torreyi Coville | 1 |
| | | Oenothera caespitosa Nutt. | 1 |
| | | Polypogon monspeliensis (L.) Desf. | 2 |
| | | Sonchus asper (L.) Hill | 2 |
| | | Sporobolus contractus A.S. Hitchc. | 3 |
| | | Sporobolus flexuosus (Thurb. ex Vasey) Rydb. | 1 |
| | | Tamarix ramosissima Ledeb. | 1 |
| | | Water | 1 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|---------------------|-----------|------------|------------|------------|------------|
| Stone | 8 | 12 | 8 | 7 | 20 |
| Cobble | 8 | 12 | 8 | 17 | 9 |
| Sand | 18 | 5 | 3 | 17 | 9 |
| Litter (duff) | 8 | 12 | 3 | 3 | 43 |
| Coarse woody debris | 0 | 2 | 0 | 0 | 3 |
| Gravel | 38 | 27 | 8 | 36 | 9 |
| Bedrock | 18 | 27 | 69 | 17 | 0 |
| Boulder | 3 | 2 | 0 | 3 | 9 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | <1% | S | <1% | S | <0% | | 1-5% | S+P | <0% | |
| Algae spp | | | | | | | | | <1% | |
| Allionia incarnata L. | <0% | | <0% | | <0% | | <1% | | <0% | |
| Aristida arizonica Vasey | <0% | | <1% | | <0% | | <1% | | <1% | |
| Aristida purpurea Nutt. | 1-5% | | <1% | | <0% | | <0% | | <1% | |
| Artemisia ludoviciana Nutt. | <0% | | <0% | | <1% | | <0% | | <1% | |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | <0% | | 1-5% | | <0% | | <1% | | <1% | |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 2

Transect Type: Tamarisk Area

| | | | | | | | | | |
|---|--------|--------|--------|-------|--------|-----|---|-------|-----|
| Bebbia juncea (Benth.) Greene var. aspera Greene | 1-5% | | | | | | | | |
| Bromus rubens L. | 10-25% | <1% | 1-5% | 1-5% | <1% | | | | |
| Bromus tectorum L. | <0% | <0% | <0% | <1% | <0% | | | | |
| Camissonia walkeri (A. Nels.) Raven | <1% | <1% | <0% | <1% | <0% | | | | |
| Cryptantha spp. | 1-5% | <0% | <0% | <1% | <0% | | | | |
| Cynodon dactylon (L.) Pers. | <0% | 10-25% | 5-10% | 1-5% | 25-50% | | | | |
| Encelia farinosa Gray ex Torr. | 1-5% | <1% | <0% | <0% | <0% | | | | |
| Erigeron divergens Torr. & Gray | <0% | <0% | <1% | <0% | <0% | | | | |
| Funastrum cynanchoides (Dcne.) Schlechter | <1% | | | | | | | | |
| Gutierrezia spp. | 1-5% | <0% | | | | | | | |
| Isocoma acradenia (Greene) Greene | 1-5% | 1-5% | <1% | 5-10% | 25-50% | | | | |
| Juncus torreyi Coville | <0% | <1% | | | 1-5% | | | | |
| Lepidium lasiocarpum Nutt. var. lasiocarpum | <1% | <1% | | | | | | | |
| Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm. | 1-5% | | | | | | | | |
| Muhlenbergia porteri Scribn. ex Beal | <1% | | | | | | | | |
| Oenothera caespitosa Nutt. | 1-5% | 1-5% | <0% | <1% | <0% | | | | |
| Parietaria hespera Hinton | <1% | <1% | | | | | | | |
| Perityle emoryi | <0% | <1% | <0% | | | | | | |
| Polypogon monspeliensis (L.) Desf. | <1% | 1-5% | <1% | <1% | 5-10% | | | | |
| Sonchus asper (L.) Hill | <1% | <1% | <0% | <1% | 1-5% | | | | |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | 1-5% | | | | | | | | |
| Sporobolus contractus A.S. Hitchc. | <1% | <0% | <0% | <1% | 1-5% | | | | |
| Tamarix ramosissima Ledeb. | <0% | 1-5% | S+P | <1% | S | <1% | S | 5-10% | S+P |
| Tidestromia lanuginosa (Nutt.) Standl. | 1-5% | | | | | | | | |
| Typha domingensis Pers. | | | <1% | | | | | | |
| Water | <0% | <0% | 10-25% | <0% | 1-5% | | | | |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|---------------------------------------|---------------|-------------|-------------|
| 15 Polypogon monspeliensis (L.) Desf. | 3 | | |

Vegetation Structure Data - New

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|---------------------------------------|---------------|-------------|-------------|
| 5 Bromus rubens L. | 2 | | |
| 15 Cynodon dactylon (L.) Pers. | 2 | | |
| 15 Isocoma acradenia (Greene) Greene | 2 | | |
| 15 Polypogon monspeliensis (L.) Desf. | 4 | | |
| 15 Vacant Space | 6 | | |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 2

Transect Type: Tamarisk Area

| | | |
|----|-----------------------------|---|
| 45 | Cynodon dactylon (L.) Pers. | 1 |
|----|-----------------------------|---|

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|------|-----------|------|-----------|------|---------|------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 7.56 | 961 | 8.07 | 971 | 8.08 | 953 | 7.90 | 962 |
| 15 | 8.9 | 506 | 9.2 | 487 | 9.9 | 524 | 9.33 | 506 |
| 25 | 8.99 | 2898 | 8.99 | 2962 | 9.04 | 2951 | 9.01 | 2937 |
| 35 | 8.89 | 807 | 8.89 | 816 | 8.85 | 800 | 8.88 | 808 |
| 45 | 8.06 | 3999 | 9 | 3999 | 9.09 | 3999 | 8.72 | 3999 |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 2

Transect Type: Tamarisk Area

Date: 5/18/2005 Revisit? Pre-tamarisk removal

Recorder: Amy Prince Reader: Lori Makarick

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

Weather: Sunny, hot, no clouds

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|------------------------------------|----------------|
| Bedrock | 19 | | 2 |
| Boulder | 6 | Bromus rubens L. | 4 |
| Cobble | 12 | Cynodon dactylon (L.) Pers. | 11 |
| Gravel | 32 | Isocoma acradenia (Greene) Greene | 1 |
| Litter (duff) | 13 | Polypogon monspeliensis (L.) Desf. | 21 |
| Sand | 31 | Sonchus asper (L.) Hill | 2 |
| Stone | 1 | Tamarix ramosissima Ledeb. | 32 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|---------------------|-----------|------------|------------|------------|------------|
| Coarse woody debris | 0 | 2 | 0 | 0 | 1 |
| Boulder | 0 | 0 | 0 | 0 | 4 |
| Litter (duff) | 3 | 5 | 3 | 3 | 22 |
| Gravel | 56 | 27 | 17 | 35 | 22 |
| Cobble | 16 | 13 | 7 | 17 | 22 |
| Stone | 3 | 13 | 3 | 3 | 22 |
| Bedrock | 16 | 27 | 62 | 35 | 0 |
| Sand | 7 | 13 | 7 | 7 | 9 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | | | | | | | <1% | | <1% | |
| Allionia incarnata L. | | | | | | | <1% | | | |
| Aristida spp. | <1% | | | | | | | | | |
| Artemisia ludoviciana Nutt. | | | | | <1% | | <1% | | <1% | |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | | | <1% | | <1% | | <1% | | 1-5% | |
| Bebbia juncea (Benth.) Greene var. aspera Greene | 1-5% | | | | | | | | | |
| Bromus japonicus Thunb. ex Murr. | | | | | <1% | | | | | |
| Bromus rubens L. | 1-5% | | 1-5% | | 1-5% | | 1-5% | | 1-5% | |
| Cirsium neomexicanum Gray | | | | | | | | | <1% | |
| Cryptantha spp. | <1% | | <1% | | <1% | | 1-5% | | <1% | |
| Cryptobiotic soil | | | | | <1% | | <1% | | <1% | |
| Cynodon dactylon (L.) Pers. | <1% | | 5-10% | | 5-10% | | <1% | | 5-10% | |
| Draba cuneifolia Nutt. ex Torr. & Gray | | | | | <1% | | <1% | | <1% | |
| Encelia farinosa Gray ex Torr. | 1-5% | | <1% | | | | | | | |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 2

Transect Type: Tamarisk Area

| | | | | | |
|---|-------|--------|--------|------|--------|
| Erigeron divergens Torr. & Gray | <1% | | <1% | | <1% |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | <1% | | <1% | <1% |
| Eucrypta micrantha (Torr.) Heller | | | | <1% | |
| Galium spp. | | | | <1% | <1% |
| Gilia spp. | | | <1% | <1% | <1% |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | 1-5% | | | <1% | |
| Hedeoma oblongifolia (Gray) Heller | | | | <1% | <1% |
| Isocoma acradenia (Greene) Greene | <1% | <1% | | 1-5% | 1-5% |
| Juncus spp. | | <1% | | | 1-5% |
| Lepidium lasiocarpum Nutt. var. lasiocarpum | | <1% | <1% | <1% | <1% |
| Linanthus bigelovii (Gray) Greene | | | <1% | <1% | |
| Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm. | 5-10% | | | | |
| Mimulus rubellus Gray | | | | | <1% |
| Mirabilis bigelovii Gray | | | | | <1% |
| Nemacladus glanduliferus Jepson | | | | <1% | |
| Parietaria hespera Hinton | <1% | | | <1% | <1% |
| Penstemon palmeri Gray | | | | | <1% |
| Plantago patagonica Jacq. | | | <1% | <1% | <1% |
| Poa bigelovii Vasey & Scribn. | | <1% | <1% | <1% | <1% |
| Polypogon monspeliensis (L.) Desf. | 5-10% | 5-10% | 1-5% | 1-5% | 10-25% |
| Silene antirrhina L. | <1% | <1% | <1% | <1% | <1% |
| Sonchus asper (L.) Hill | <1% | | | | <1% |
| Sphaeralcea spp. | 1-5% | | | | |
| Sporobolus spp. | | <1% | | <1% | <1% |
| Stylocline micropoides Gray | | | | | <1% |
| Tamarix ramosissima Ledeb. | 5-10% | 10-25% | 10-25% | 1-5% | 25-50% |
| Tidestromia lanuginosa (Nutt.) Standl. | <1% | | | | |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------------------------|---------------|-------------|-------------|
| 5 Bromus rubens L. | 2 | | |
| 15 Tamarix ramosissima Ledeb. | 3 | | |
| 25 Tamarix ramosissima Ledeb. | 9 | | |
| 35 Tamarix ramosissima Ledeb. | 10 | | |
| 45 Artemisia ludoviciana Nutt. | 1 | | |
| 45 Tamarix ramosissima Ledeb. | 20 | 1 | |

Vegetation Structure Data - New

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 2

Transect Type: Tamarisk Area

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|----|-----------|----|-----------|----|---------|----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 0 | | 0 | | 0 | | 0.00 | |
| 15 | 0.02 | | 0.01 | | 0 | | 0.01 | |
| 25 | 0.05 | | 0.02 | | 0.03 | | 0.03 | |
| 25 | 0.1 | | 0.07 | | 0.09 | | 0.09 | |
| 35 | 0.05 | | 0.05 | | 0.07 | | 0.06 | |
| 45 | 0.08 | | 0.08 | | 0.06 | | 0.07 | |
| 45 | 0.2 | | 0.13 | | 0.14 | | 0.16 | |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 2

Transect Type: Tamarisk Area

Date: 5/19/2006 Revisit? Post-tamarisk removal

Recorder: Pamela Walls Reader: Lori Makarick

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

Weather: Sunny and warm, 1% clouds, 73 F, calm and still with a very light breeze.

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--|----------------|
| Bedrock | 27 | Aristida purpurea Nutt. | 1 |
| Cobble | 7 | Bebbia juncea (Benth.) Greene var. aspera Greene | 1 |
| Gravel | 12 | Bromus rubens L. | 5 |
| Litter (duff) | 28 | Cynodon dactylon (L.) Pers. | 21 |
| Sand | 22 | Isocoma acradenia (Greene) Greene | 6 |
| Stone | 4 | Juncus torreyi Coville | 1 |
| | | Oenothera caespitosa Nutt. | 1 |
| | | Polypogon monspeliensis (L.) Desf. | 2 |
| | | Sonchus asper (L.) Hill | 2 |
| | | Sporobolus contractus A.S. Hitchc. | 3 |
| | | Sporobolus flexuosus (Thurb. ex Vasey) Rydb. | 1 |
| | | Tamarix ramosissima Ledeb. | 1 |
| | | Water | 1 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|---------------------|-----------|------------|------------|------------|------------|
| Stone | 8 | 12 | 8 | 7 | 20 |
| Cobble | 8 | 12 | 8 | 17 | 9 |
| Sand | 18 | 5 | 3 | 17 | 9 |
| Litter (duff) | 8 | 12 | 3 | 3 | 43 |
| Coarse woody debris | 0 | 2 | 0 | 0 | 3 |
| Gravel | 38 | 27 | 8 | 36 | 9 |
| Bedrock | 18 | 27 | 69 | 17 | 0 |
| Boulder | 3 | 2 | 0 | 3 | 9 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | <1% | S | <1% | S | <0% | | 1-5% | S+P | <0% | |
| Algae spp | | | | | | | | | <1% | |
| Allionia incarnata L. | <0% | | <0% | | <0% | | <1% | | <0% | |
| Aristida arizonica Vasey | <0% | | <1% | | <0% | | <1% | | <1% | |
| Aristida purpurea Nutt. | 1-5% | | <1% | | <0% | | <0% | | <1% | |
| Artemisia ludoviciana Nutt. | <0% | | <0% | | <1% | | <0% | | <1% | |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | <0% | | 1-5% | | <0% | | <1% | | <1% | |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 2

Transect Type: Tamarisk Area

| | | | | | | | | | |
|---|--------|--------|-----|--------|---|-------|---|--------|-----|
| Bebbia juncea (Benth.) Greene var. aspera Greene | 1-5% | | | | | | | | |
| Bromus rubens L. | 10-25% | <1% | | 1-5% | | 1-5% | | <1% | |
| Bromus tectorum L. | <0% | <0% | | <0% | | <1% | | <0% | |
| Camissonia walkeri (A. Nels.) Raven | <1% | <1% | | <0% | | <1% | | <0% | |
| Cryptantha spp. | 1-5% | <0% | | <0% | | <1% | | <0% | |
| Cynodon dactylon (L.) Pers. | <0% | 10-25% | | 5-10% | | 1-5% | | 25-50% | |
| Encelia farinosa Gray ex Torr. | 1-5% | <1% | | <0% | | <0% | | <0% | |
| Erigeron divergens Torr. & Gray | <0% | <0% | | <1% | | <0% | | <0% | |
| Funastrum cynanchoides (Dcne.) Schlechter | <1% | | | | | | | | |
| Gutierrezia spp. | 1-5% | <0% | | | | | | | |
| Isocoma acradenia (Greene) Greene | 1-5% | 1-5% | | <1% | | 5-10% | | 25-50% | |
| Juncus torreyi Coville | <0% | <1% | | | | | | 1-5% | |
| Lepidium lasiocarpum Nutt. var. lasiocarpum | <1% | <1% | | | | | | | |
| Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm. | 1-5% | | | | | | | | |
| Muhlenbergia porteri Scribn. ex Beal | <1% | | | | | | | | |
| Oenothera caespitosa Nutt. | 1-5% | 1-5% | | <0% | | <1% | | <0% | |
| Parietaria hespera Hinton | <1% | <1% | | | | | | | |
| Perityle emoryi | <0% | <1% | | <0% | | | | | |
| Polypogon monspeliensis (L.) Desf. | <1% | 1-5% | | <1% | | <1% | | 5-10% | |
| Sonchus asper (L.) Hill | <1% | <1% | | <0% | | <1% | | 1-5% | |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | 1-5% | | | | | | | | |
| Sporobolus contractus A.S. Hitchc. | <1% | <0% | | <0% | | <1% | | 1-5% | |
| Tamarix ramosissima Ledeb. | <0% | 1-5% | S+P | <1% | S | <1% | S | 5-10% | S+P |
| Tidestromia lanuginosa (Nutt.) Standl. | 1-5% | | | | | | | | |
| Typha domingensis Pers. | | | | <1% | | | | | |
| Water | <0% | <0% | | 10-25% | | <0% | | 1-5% | |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|---------------------------------------|---------------|-------------|-------------|
| 15 Polypogon monspeliensis (L.) Desf. | 3 | | |

Vegetation Structure Data - New

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|---------------------------------------|---------------|-------------|-------------|
| 5 Bromus rubens L. | 2 | | |
| 15 Cynodon dactylon (L.) Pers. | 2 | | |
| 15 Isocoma acradenia (Greene) Greene | 2 | | |
| 15 Polypogon monspeliensis (L.) Desf. | 4 | | |
| 15 Vacant Space | 6 | | |

Canyon/Park Area: Trail Canyon

River mile: 219 R

Project (Phase): Phase IIa

Transect Name: Trail Canyon 2

Transect Type: Tamarisk Area

| | | |
|----|-----------------------------|---|
| 45 | Cynodon dactylon (L.) Pers. | 1 |
|----|-----------------------------|---|

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|------|-----------|------|-----------|------|---------|------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 7.56 | 961 | 8.07 | 971 | 8.08 | 953 | 7.90 | 962 |
| 15 | 8.9 | 506 | 9.2 | 487 | 9.9 | 524 | 9.33 | 506 |
| 25 | 8.99 | 2898 | 8.99 | 2962 | 9.04 | 2951 | 9.01 | 2937 |
| 35 | 8.89 | 807 | 8.89 | 816 | 8.85 | 800 | 8.88 | 808 |
| 45 | 8.06 | 3999 | 9 | 3999 | 9.09 | 3999 | 8.72 | 3999 |

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 1

Transect Type: Tamarisk Area

| | Start point | | End point |
|---------------------------|--|---------------------|------------------|
| Easting: | 419370 | Easting: | 419400 |
| Northing: | 3994870 | Northing: | 3994832 |
| GPS accuracy (m): | 3.1 | GPS accuracy (m): | 2.3 |
| Elevation (m): | 1001 | Elevation (m): | 1001 |
| Bearing: | 128 | | |
| Aspect (0-360): | 146 | Slope (degrees): | 10 |
| Transect description: | Transect start is .5m from the base of a 4.5m mesquite with an open canopy on creek left side of the drainage about 4m from the edge of the creek bank. Just below the mesquite in the creek channel is a patch of cattail. Transect end is located on the creek left side of the drainage where it makes a dramatic turn to the north. End is at the base of the first Hakatai ledge, 2m from the creek bed in a Baccharis sapling. | | |
| Additional Info:: | | | |
| Geological layer: | Hakatai | | |
| Habitat type: | Riparian | GB desert scrub | |
| Dominant species: | Baccharis salicifolia (Ruiz & Pavón) Pers., Encelia farinosa Gray ex Torr., Isocoma acradenia (Greene) Greene, Prosopis glandulosa Torr., Salix exigua Nutt., Tamarix ramosissima Ledeb. | | |
| Associated species: | Aristida purpurea Nutt., Baccharis emoryi Gray, Bromus rubens L., Carex hystericina Muhl. ex Willd., Encelia frutescens (Gray) Gray, Eriogonum inflatum Torr. & Frém., Erodium cicutarium (L.) L'Hér. ex Ait., Isocoma acradenia (Greene) Greene, Pluchea sericea (Nutt.) Coville, Sonchus asper (L.) Hill, Sphaeralcea ambigua Gray, Stanleya pinnata (Pursh) Britt. | | |
| Surface water within 25m? | <input checked="" type="checkbox"/> | Surface water type: | stream |
| Landform: | Drainage channel | Surface rocks: | sandstone |
| Soil type: | sandy loam | Topo position: | Interfluve |
| Light exposure: | open | Soil moisture: | dry |
| | partial-shade | | |

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 1

Transect Type: Tamarisk Area

Date: 10/8/2004 Revisit? Pre-tamarisk removal

Recorder: Reader: Suzanne Rhodes

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

Weather: Clear, warm, some clouds

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|---|----------------|
| Bare Soil | 26 | Baccharis emoryi Gray | 4 |
| Cobble | 7 | Encelia farinosa Gray ex Torr. | 10 |
| Litter (duff) | 65 | Eriogonum inflatum Torr. & Frém. | 1 |
| Woody debris structure | 23 | Isocoma acradenia (Greene) Greene | 16 |
| | | Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 4 |
| | | Pluchea sericea (Nutt.) Coville | 4 |
| | | Prosopis glandulosa Torr. | 15 |
| | | Salix exigua Nutt. | 23 |
| | | Tamarix ramosissima Ledeb. | 8 |

Daubenmire Scale Cover Data

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Baccharis emoryi Gray | | | | | | | | | 5-10% | |
| Bromus rubens L. | | | | | | | <1% | | 1-5% | |
| Carex hystericina Muhl. ex Willd. | 1-5% | | | | | | | | | |
| Encelia farinosa Gray ex Torr. | | | 1-5% | | 5-10% | | 1-5% | | 1-5% | |
| Encelia frutescens (Gray) Gray | | | | | <1% | | | | | |
| Eriogonum inflatum Torr. & Frém. | | | | | 1-5% | | | | | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | | | | 1-5% | | | | | |
| Isocoma acradenia (Greene) Greene | | | | | | | 5-10% | | 10-25% | |
| Prosopis glandulosa Torr. | 1-5% | | 50-75% | | <1% | | | | | |
| Salix exigua Nutt. | | | 10-25% | | 5-10% | | 50-75% | | 25-50% | |
| Sphaeralcea ambigua Gray | | | | | | | <1% | | | |
| Tamarix ramosissima Ledeb. | 1-5% | | | | 1-5% | | | | 5-10% | |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|--------------------------------|---------------|-------------|-------------|
| 5 | Tamarix ramosissima Ledeb. | 2 | 1 | 3 |
| 15 | Prosopis glandulosa Torr. | 4 | 4 | 3 |
| 25 | Encelia farinosa Gray ex Torr. | 2 | | |
| 35 | Encelia farinosa Gray ex Torr. | 2 | | |
| 35 | Salix exigua Nutt. | | 1 | 6 |

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 1

Transect Type: Tamarisk Area

| | | |
|----|-----------------------------------|---|
| 45 | Baccharis emoryi Gray | 1 |
| 45 | Isocoma acradenia (Greene) Greene | 3 |

Vegetation Structure Data - New

Soil Data

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 1

Transect Type: Tamarisk Area

Date: 5/9/2007 Revisit? Post-tamarisk removal

Recorder: Melissa McMaster Reader: Lisa Hahn

Wind Speed: Air Temp (F): Cloud Cover: 0

Weather: Clear, sunny, 75F slight breeze

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--|----------------|
| Boulder | 1 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 11 |
| Coarse woody debris | 2 | Bromus rubens L. | 1 |
| Cobble | 6 | Encelia farinosa Gray ex Torr. | 6 |
| Gravel | 22 | Erodium cicutarium (L.) L'Hér. ex Ait. | 1 |
| Litter (duff) | 43 | Isocoma acradenia (Greene) Greene | 18 |
| Sand | 24 | Oenothera elata Kunth ssp. hookeri (Torr. & Gray) W. Dietr. & W.L. Wagner | 1 |
| Stone | 2 | Pluchea sericea (Nutt.) Coville | 7 |
| | | Prosopis glandulosa Torr. | 9 |
| | | Salix exigua Nutt. | 7 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Lichen | 0 | 0 | 0 | 0 | 0 |
| Sand | 30 | 34 | 15 | 21 | 17 |
| Crypto | 0 | 0 | 0 | 0 | 1 |
| Gravel | 2 | 32 | 56 | 21 | 22 |
| Stone | 2 | 1 | 2 | 11 | 10 |
| Coarse woody debris | 25 | 0 | 1 | 1 | 1 |
| Woody debris structure | 0 | 0 | 0 | 1 | 1 |
| Moss (ground) | 0 | 0 | 0 | 0 | 1 |
| Bedrock | 0 | 0 | 0 | 0 | 0 |
| Bare Soil | 0 | 0 | 0 | 0 | 0 |
| Litter (duff) | 39 | 30 | 10 | 28 | 21 |
| Cobble | 1 | 1 | 15 | 10 | 21 |
| Boulder | 0 | 0 | 0 | 5 | 3 |
| Water | 0 | 0 | 0 | 0 | 0 |
| Basal Veg | 1 | 2 | 1 | 2 | 2 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Artemisia ludoviciana Nutt. | 1-5% | | <0% | | <0% | | <0% | | 1-5% | |
| Astragalus lentiginosus Dougl. ex Hook. | <1% | | <0% | | <0% | | <0% | | 1-5% | |
| Atriplex canescens (Pursh) Nutt. | | | | | | | <1% | | | |

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 1

Transect Type: Tamarisk Area

| | | | | | |
|---|--------|-------|--------|--------|--------------|
| Baccharis salicifolia (Ruiz & Pavón) Pers. | 1-5% | <0% | <0% | 10-25% | 25-50% |
| Baccharis sergiloides Gray | | | 1-5% | | <1% |
| Bothriochloa barbinodis (Lag.) Herter | | | | 1-5% | |
| Bromus rubens L. | <1% | <1% | <1% | <1% | 1-5% |
| Cirsium spp. | <1% | <0% | <0% | <0% | 1-5% |
| Cryptantha spp. | <0% | <1% | | | |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | <0% | <1% | <1% | | |
| Encelia farinosa Gray ex Torr. | <0% | 5-10% | 1-5% | 1-5% | <0% |
| Encelia resinifera C. Clark ssp. tenuifolia C. Clark | | | | <1% | |
| Eriogonum deflexum Torr. | <0% | <1% | <1% | | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <0% | <1% | <1% | <1% | <1% |
| Isocoma acradenia (Greene) Greene | <1% | 1-5% | 1-5% | 10-25% | 10-25% |
| Lepidium lasiocarpum Nutt. var. lasiocarpum | <1% | <0% | <1% | <0% | <0% |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | | | | <1% | <1% |
| Muhlenbergia porteri Scribn. ex Beal | | | | | <1% |
| Oenothera elata Kunth ssp. hookeri (Torr. & Gray) W. Dietr. & W.L. Wagner | <1% | <0% | <0% | <0% | 1-5% |
| Pluchea sericea (Nutt.) Coville | 5-10% | | | | |
| Prosopis glandulosa Torr. | 10-25% | M | 5-10% | M | 1-5% S+P <0% |
| Salix exigua Nutt. | <0% | | 25-50% | <1% | <0% |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | | | | 1-5% | |
| Sporobolus contractus A.S. Hitchc. | | | | | <1% |
| Tamarix ramosissima Ledeb. | | | | | <1% S |
| Tiquilia latior (I.M. Johnston) A. Richards. | | | | <1% | |
| Tridens muticus (Torr.) Nash | | | | | <1% |
| Typha domingensis Pers. | | <1% | | | |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|---|---------------|-------------|-------------|
| 15 Salix exigua Nutt. | | 5 | |
| 35 Baccharis salicifolia (Ruiz & Pavón) Pers. | 10 | 2 | |
| 45 Isocoma acradenia (Greene) Greene | 13 | | |

Vegetation Structure Data - New

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|-----------------------------------|---------------|-------------|-------------|
| 15 Encelia farinosa Gray ex Torr. | 1 | | |
| 15 Salix exigua Nutt. | | 4 | 1 |

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 1

Transect Type: Tamarisk Area

| | | | |
|----|---|---|---|
| 25 | Erodium cicutarium (L.) L'Hér. ex Ait. | 1 | |
| 35 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 6 | 1 |
| 45 | Baccharis salicifolia (Ruiz & Pavón) Pers. | | 3 |
| 45 | Isocoma acradenia (Greene) Greene | 9 | |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|-----|-----------|-----|-----------|-----|---------|-----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 9.08 | 430 | 8.79 | 305 | 8.66 | 311 | 8.84 | 349 |
| 15 | 9.07 | 41 | 8.95 | 45 | 9.11 | 41 | 9.04 | 42 |
| 25 | 9.12 | 35 | 9.26 | 31 | 9.29 | 33 | 9.22 | 33 |
| 35 | 9.05 | 66 | 8.99 | 82 | 8.99 | 82 | 9.01 | 77 |
| 45 | 8.67 | 173 | 8.67 | 143 | 8.64 | 181 | 8.66 | 166 |

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 1

Transect Type: Tamarisk Area

Date: 10/8/2004 Revisit? Pre-tamarisk removal

Recorder: Reader: Suzanne Rhodes

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

Weather: Clear, warm, some clouds

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|---|----------------|
| Bare Soil | 26 | Baccharis emoryi Gray | 4 |
| Cobble | 7 | Encelia farinosa Gray ex Torr. | 10 |
| Litter (duff) | 65 | Eriogonum inflatum Torr. & Frém. | 1 |
| Woody debris structure | 23 | Isocoma acradenia (Greene) Greene | 16 |
| | | Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 4 |
| | | Pluchea sericea (Nutt.) Coville | 4 |
| | | Prosopis glandulosa Torr. | 15 |
| | | Salix exigua Nutt. | 23 |
| | | Tamarix ramosissima Ledeb. | 8 |

Daubenmire Scale Cover Data

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Baccharis emoryi Gray | | | | | | | | | 5-10% | |
| Bromus rubens L. | | | | | | | <1% | | 1-5% | |
| Carex hystericina Muhl. ex Willd. | 1-5% | | | | | | | | | |
| Encelia farinosa Gray ex Torr. | | | 1-5% | | 5-10% | | 1-5% | | 1-5% | |
| Encelia frutescens (Gray) Gray | | | | | <1% | | | | | |
| Eriogonum inflatum Torr. & Frém. | | | | | 1-5% | | | | | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | | | | 1-5% | | | | | |
| Isocoma acradenia (Greene) Greene | | | | | | | 5-10% | | 10-25% | |
| Prosopis glandulosa Torr. | 1-5% | | 50-75% | | <1% | | | | | |
| Salix exigua Nutt. | | | 10-25% | | 5-10% | | 50-75% | | 25-50% | |
| Sphaeralcea ambigua Gray | | | | | | | <1% | | | |
| Tamarix ramosissima Ledeb. | 1-5% | | | | 1-5% | | | | 5-10% | |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|--------------------------------|---------------|-------------|-------------|
| 5 | Tamarix ramosissima Ledeb. | 2 | 1 | 3 |
| 15 | Prosopis glandulosa Torr. | 4 | 4 | 3 |
| 25 | Encelia farinosa Gray ex Torr. | 2 | | |
| 35 | Encelia farinosa Gray ex Torr. | 2 | | |
| 35 | Salix exigua Nutt. | | 1 | 6 |

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 1

Transect Type: Tamarisk Area

| | | |
|----|-----------------------------------|---|
| 45 | Baccharis emoryi Gray | 1 |
| 45 | Isocoma acradenia (Greene) Greene | 3 |

Vegetation Structure Data - New

Soil Data

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 1

Transect Type: Tamarisk Area

Date: 5/9/2007 Revisit? Post-tamarisk removal

Recorder: Melissa McMaster Reader: Lisa Hahn

Wind Speed: Air Temp (F): Cloud Cover: 0

Weather: Clear, sunny, 75F slight breeze

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--|----------------|
| Boulder | 1 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 11 |
| Coarse woody debris | 2 | Bromus rubens L. | 1 |
| Cobble | 6 | Encelia farinosa Gray ex Torr. | 6 |
| Gravel | 22 | Erodium cicutarium (L.) L'Hér. ex Ait. | 1 |
| Litter (duff) | 43 | Isocoma acradenia (Greene) Greene | 18 |
| Sand | 24 | Oenothera elata Kunth ssp. hookeri (Torr. & Gray) W. Dietr. & W.L. Wagner | 1 |
| Stone | 2 | Pluchea sericea (Nutt.) Coville | 7 |
| | | Prosopis glandulosa Torr. | 9 |
| | | Salix exigua Nutt. | 7 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Lichen | 0 | 0 | 0 | 0 | 0 |
| Sand | 30 | 34 | 15 | 21 | 17 |
| Crypto | 0 | 0 | 0 | 0 | 1 |
| Gravel | 2 | 32 | 56 | 21 | 22 |
| Stone | 2 | 1 | 2 | 11 | 10 |
| Coarse woody debris | 25 | 0 | 1 | 1 | 1 |
| Woody debris structure | 0 | 0 | 0 | 1 | 1 |
| Moss (ground) | 0 | 0 | 0 | 0 | 1 |
| Bedrock | 0 | 0 | 0 | 0 | 0 |
| Bare Soil | 0 | 0 | 0 | 0 | 0 |
| Litter (duff) | 39 | 30 | 10 | 28 | 21 |
| Cobble | 1 | 1 | 15 | 10 | 21 |
| Boulder | 0 | 0 | 0 | 5 | 3 |
| Water | 0 | 0 | 0 | 0 | 0 |
| Basal Veg | 1 | 2 | 1 | 2 | 2 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | | | | | | | | | <1% | |
| Artemisia ludoviciana Nutt. | 1-5% | | <0% | | <0% | | <0% | | 1-5% | |
| Astragalus lentiginosus Dougl. ex Hook. | <1% | | <0% | | <0% | | <0% | | 1-5% | |
| Atriplex canescens (Pursh) Nutt. | | | | | | | <1% | | | |

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 1

Transect Type: Tamarisk Area

| | | | | | |
|---|--------|-------|--------|--------|--------------|
| Baccharis salicifolia (Ruiz & Pavón) Pers. | 1-5% | <0% | <0% | 10-25% | 25-50% |
| Baccharis sergiloides Gray | | | 1-5% | | <1% |
| Bothriochloa barbinodis (Lag.) Herter | | | | 1-5% | |
| Bromus rubens L. | <1% | <1% | <1% | <1% | 1-5% |
| Cirsium spp. | <1% | <0% | <0% | <0% | 1-5% |
| Cryptantha spp. | <0% | <1% | | | |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | <0% | <1% | <1% | | |
| Encelia farinosa Gray ex Torr. | <0% | 5-10% | 1-5% | 1-5% | <0% |
| Encelia resinifera C. Clark ssp. tenuifolia C. Clark | | | | <1% | |
| Eriogonum deflexum Torr. | <0% | <1% | <1% | | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <0% | <1% | <1% | <1% | <1% |
| Isocoma acradenia (Greene) Greene | <1% | 1-5% | 1-5% | 10-25% | 10-25% |
| Lepidium lasiocarpum Nutt. var. lasiocarpum | <1% | <0% | <1% | <0% | <0% |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | | | | <1% | <1% |
| Muhlenbergia porteri Scribn. ex Beal | | | | | <1% |
| Oenothera elata Kunth ssp. hookeri (Torr. & Gray) W. Dietr. & W.L. Wagner | <1% | <0% | <0% | <0% | 1-5% |
| Pluchea sericea (Nutt.) Coville | 5-10% | | | | |
| Prosopis glandulosa Torr. | 10-25% | M | 5-10% | M | 1-5% S+P <0% |
| Salix exigua Nutt. | <0% | | 25-50% | | <1% <0% |
| Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. | | | | 1-5% | |
| Sporobolus contractus A.S. Hitchc. | | | | | <1% |
| Tamarix ramosissima Ledeb. | | | | | <1% S |
| Tiquilia latior (I.M. Johnston) A. Richards. | | | | <1% | |
| Tridens muticus (Torr.) Nash | | | | | <1% |
| Typha domingensis Pers. | | <1% | | | |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|---|---------------|-------------|-------------|
| 15 Salix exigua Nutt. | | 5 | |
| 35 Baccharis salicifolia (Ruiz & Pavón) Pers. | 10 | 2 | |
| 45 Isocoma acradenia (Greene) Greene | 13 | | |

Vegetation Structure Data - New

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|-----------------------------------|---------------|-------------|-------------|
| 15 Encelia farinosa Gray ex Torr. | 1 | | |
| 15 Salix exigua Nutt. | | 4 | 1 |

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 1

Transect Type: Tamarisk Area

| | | | |
|----|---|---|---|
| 25 | Erodium cicutarium (L.) L'Hér. ex Ait. | 1 | |
| 35 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 6 | 1 |
| 45 | Baccharis salicifolia (Ruiz & Pavón) Pers. | | 3 |
| 45 | Isocoma acradenia (Greene) Greene | 9 | |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|-----|-----------|-----|-----------|-----|---------|-----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 9.08 | 430 | 8.79 | 305 | 8.66 | 311 | 8.84 | 349 |
| 15 | 9.07 | 41 | 8.95 | 45 | 9.11 | 41 | 9.04 | 42 |
| 25 | 9.12 | 35 | 9.26 | 31 | 9.29 | 33 | 9.22 | 33 |
| 35 | 9.05 | 66 | 8.99 | 82 | 8.99 | 82 | 9.01 | 77 |
| 45 | 8.67 | 173 | 8.67 | 143 | 8.64 | 181 | 8.66 | 166 |

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 1

Transect Type: Tamarisk Control

| | Start point | | End point |
|---------------------------|--|---------------------|------------------|
| Easting: | 419351 | Easting: | 419397 |
| Northing: | 3994844 | Northing: | 3994823 |
| GPS accuracy (m): | 1.9 | GPS accuracy (m): | 1.9 |
| Elevation (m): | 1006 | Elevation (m): | 1004 |
| Bearing: | 122 | | |
| Aspect (0-360): | 122 | Slope (degrees): | 6 |
| Transect description: | Transect start is located at the creek right side of the drainage on a slope with SALEXI and PHRAUS. Start is .5m downcreek of a 5cm diameter SALEXI. A 1mx.5m limestone boulder is upslope of transect at the 4m mark. Transect end is located in the creek bottom about .75m away from the base of the Dox wall that turns to the north as you walk up the creek. Just above the transect end, CLACAL is growing in a seep. End is downslope of T1A end. | | |
| Additional Info:: | | | |
| Geological layer: | Dox Sandstone | | |
| | Dox Sandstone | | |
| | Dox Sandstone | | |
| Habitat type: | Riparian GB desert scrub | | |
| Dominant species: | Baccharis emoryi Gray, Baccharis salicifolia (Ruiz & Pavón) Pers., Cladium californicum (S. Wats.) O'Neill, Isocoma acradenia (Greene) Greene, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Polypogon viridis (Gouan) Breistr., Prosopis glandulosa Torr., Salix exigua Nutt. | | |
| Associated species: | Artemisia ludoviciana Nutt., Carex hystericina Muhl. ex Willd., Cladium californicum (S. Wats.) O'Neill, Grass spp, Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Phragmites australis (Cav.) Trin. ex Steud. | | |
| Surface water within 25m? | <input checked="" type="checkbox"/> | Surface water type: | stream |
| Landform: | Drainage channel | Surface rocks: | sandstone |
| Soil type: | sandy loam sand | Topo position: | Interfluve |
| Light exposure: | open partial-shade | Soil moisture: | dry moist |

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 1

Transect Type: Tamarisk Control

Date: 10/8/2004 Revisit? Pre-tamarisk removal

Recorder: Reader: Suzanne Rhodes

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

Weather: Clear, warm, some clouds

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|---|----------------|
| Bare Soil | 63 | Baccharis emoryi Gray | 6 |
| Cobble | 28 | Cladium californicum (S. Wats.) O'Neill | 6 |
| Litter (duff) | 14 | Isocoma acradenia (Greene) Greene | 1 |
| | | Phragmites australis (Cav.) Trin. ex Steud. | 1 |
| | | Salix exigua Nutt. | 19 |

Daubenmire Scale Cover Data

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Baccharis emoryi Gray | 1-5% | | 5-10% | | 5-10% | | 5-10% | | <1% | |
| Carex hystericina Muhl. ex Willd. | <1% | | | | | | | | | |
| Cladium californicum (S. Wats.) O'Neill | | | | | | | 25-50% | | | |
| Isocoma acradenia (Greene) Greene | <1% | | 1-5% | | 1-5% | | | | <1% | |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 1-5% | | | | <1% | | | | | |
| Phragmites australis (Cav.) Trin. ex Steud. | 1-5% | | | | | | | | | |
| Prosopis glandulosa Torr. | | | <1% | | | | | | | |
| Salix exigua Nutt. | <1% | | 5-10% | | 5-10% | | 25-50% | | 5-10% | |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--|---------------|-------------|-------------|
| 15 Baccharis emoryi Gray | 2 | | |
| 15 Salix exigua Nutt. | 2 | 2 | |
| 35 Cladium californicum (S. Wats.) O'Neill | 9 | 1 | |

Vegetation Structure Data - New

Soil Data

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 1

Transect Type: Tamarisk Control

Date: 5/9/2007 Revisit? Post-tamarisk removal
 Recorder: Steve Till Reader: Lori Makarick
 Wind Speed: Air Temp (F): Cloud Cover: 0
 Weather: 75F Sunny and no clouds

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|---|----------------|
| Coarse woody debris | 1 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 17 |
| Cobble | 4 | Cladium californicum (S. Wats.) O'Neill | 4 |
| Gravel | 39 | Iva acerosa (Nutt.) R.C. Jackson | 1 |
| Litter (duff) | 34 | Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 4 |
| Sand | 19 | Polypogon viridis (Gouan) Breistr. | 1 |
| Stone | 3 | Salix exigua Nutt. | 32 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Boulder | 3 | 7 | 9 | 2 | 0 |
| Bedrock | 0 | 0 | 0 | 0 | 0 |
| Basal Veg | 1 | 2 | 1 | 3 | 1 |
| Sand | 6 | 9 | 6 | 3 | 10 |
| Coarse woody debris | 5 | 3 | 1 | 2 | 1 |
| Lichen | 0 | 0 | 0 | 0 | 0 |
| Water | 0 | 7 | 3 | 0 | 1 |
| Woody debris structure | 4 | 0 | 0 | 1 | 0 |
| Litter (duff) | 46 | 35 | 18 | 35 | 11 |
| Stone | 2 | 9 | 9 | 6 | 4 |
| Gravel | 27 | 17 | 39 | 40 | 47 |
| Crypto | 0 | 1 | 1 | 0 | 0 |
| Bare Soil | 0 | 0 | 0 | 0 | 0 |
| Cobble | 6 | 10 | 10 | 7 | 25 |
| Moss (ground) | 0 | 1 | 3 | 1 | 0 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Astragalus lentiginosus Dougl. ex Hook. | 1-5% | | <0% | | <1% | | | | | |
| Astragalus nuttallianus DC. | | | | | | | | | <1% | |
| Atriplex canescens (Pursh) Nutt. | 1-5% | | | | | | | | | |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | 5-10% | | 10-25% | | 5-10% | | 5-10% | | 1-5% | |
| Bromus rubens L. | 5-10% | | <0% | | <1% | | <1% | | <1% | |
| Cladium californicum (S. Wats.) O'Neill | | | | | | | 10-25% | | | |
| Eriogonum deflexum Torr. | <1% | | | | | | | | <1% | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <1% | | | | | | | | <1% | |

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 1

Transect Type: Tamarisk Control

| | | | | | |
|--|--------|--------|-------|--------|--------|
| Isocoma acradenia (Greene) Greene | <1% | <1% | 5-10% | <1% | <0% |
| Iva acerosa (Nutt.) R.C. Jackson | 5-10% | | | | |
| Lepidium alyssoides var. junceum Rollins | <1% | | | | <1% |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 10-25% | <1% | 1-5% | 1-5% | <0% |
| Oenothera elata Kunth | <1% | | <1% | <1% | |
| Phacelia crenulata Torr. ex S. Wats. | <1% | | | | |
| Phragmites australis (Cav.) Trin. ex Steud. | 1-5% | | | | |
| Polypogon viridis (Gouan) Breistr. | | | 1-5% | 1-5% | <1% |
| Salix exigua Nutt. | 1-5% | 25-50% | 5-10% | 10-25% | 25-50% |
| Tamarix ramosissima Ledeb. | | | | <1% | S |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--|---------------|-------------|-------------|
| 5 Baccharis salicifolia (Ruiz & Pavón) Pers. | 8 | | |
| 5 Iva acerosa (Nutt.) R.C. Jackson | 6 | | |
| 15 Baccharis salicifolia (Ruiz & Pavón) Pers. | 3 | | |
| 15 Salix exigua Nutt. | 1 | | |
| 35 Baccharis salicifolia (Ruiz & Pavón) Pers. | 1 | | |
| 35 Cladium californicum (S. Wats.) O'Neill | 6 | 2 | |
| 35 Salix exigua Nutt. | | | 1 |

Vegetation Structure Data - New

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--|---------------|-------------|-------------|
| 5 Baccharis salicifolia (Ruiz & Pavón) Pers. | | 2 | |
| 5 Iva acerosa (Nutt.) R.C. Jackson | 6 | | |
| 5 Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 2 | | |
| 15 Baccharis salicifolia (Ruiz & Pavón) Pers. | 6 | | |
| 15 Salix exigua Nutt. | 3 | 1 | |
| 25 Baccharis salicifolia (Ruiz & Pavón) Pers. | 2 | | |
| 35 Baccharis salicifolia (Ruiz & Pavón) Pers. | 3 | | |
| 35 Cladium californicum (S. Wats.) O'Neill | 10 | 4 | |
| 35 Salix exigua Nutt. | | 1 | 5 |

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 1

Transect Type: Tamarisk Control

| | | |
|----|---|---|
| 45 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 1 |
| 45 | Bromus rubens L. | 2 |
| 45 | Salix exigua Nutt. | 2 |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|------|-----------|------|-----------|------|---------|------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 6.58 | 1502 | 7.33 | 1335 | 7.61 | 1438 | 7.17 | 1425 |
| 15 | 8.86 | 782 | 9.03 | 849 | 9.16 | 842 | 9.02 | 824 |
| 25 | 9.17 | 508 | 9.1 | 498 | 9.04 | 459 | 9.10 | 488 |
| 35 | 9.12 | 1421 | 9.22 | 1404 | 9.18 | 1390 | 9.17 | 1405 |
| 45 | 9.33 | 401 | 9.15 | 406 | 9.06 | 386 | 9.18 | 398 |

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 1

Transect Type: Tamarisk Control

Date: 10/8/2004 Revisit? Pre-tamarisk removal

Recorder: Reader: Suzanne Rhodes

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

Weather: Clear, warm, some clouds

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|---|----------------|
| Bare Soil | 63 | Baccharis emoryi Gray | 6 |
| Cobble | 28 | Cladium californicum (S. Wats.) O'Neill | 6 |
| Litter (duff) | 14 | Isocoma acradenia (Greene) Greene | 1 |
| | | Phragmites australis (Cav.) Trin. ex Steud. | 1 |
| | | Salix exigua Nutt. | 19 |

Daubenmire Scale Cover Data

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Baccharis emoryi Gray | 1-5% | | 5-10% | | 5-10% | | 5-10% | | <1% | |
| Carex hystericina Muhl. ex Willd. | <1% | | | | | | | | | |
| Cladium californicum (S. Wats.) O'Neill | | | | | | | 25-50% | | | |
| Isocoma acradenia (Greene) Greene | <1% | | 1-5% | | 1-5% | | | | <1% | |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 1-5% | | | | <1% | | | | | |
| Phragmites australis (Cav.) Trin. ex Steud. | 1-5% | | | | | | | | | |
| Prosopis glandulosa Torr. | | | <1% | | | | | | | |
| Salix exigua Nutt. | <1% | | 5-10% | | 5-10% | | 25-50% | | 5-10% | |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--|---------------|-------------|-------------|
| 15 Baccharis emoryi Gray | 2 | | |
| 15 Salix exigua Nutt. | 2 | 2 | |
| 35 Cladium californicum (S. Wats.) O'Neill | 9 | 1 | |

Vegetation Structure Data - New

Soil Data

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 1

Transect Type: Tamarisk Control

Date: 5/9/2007 Revisit? Post-tamarisk removal
 Recorder: Steve Till Reader: Lori Makarick
 Wind Speed: Air Temp (F): Cloud Cover: 0
 Weather: 75F Sunny and no clouds

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|---|----------------|
| Coarse woody debris | 1 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 17 |
| Cobble | 4 | Cladium californicum (S. Wats.) O'Neill | 4 |
| Gravel | 39 | Iva acerosa (Nutt.) R.C. Jackson | 1 |
| Litter (duff) | 34 | Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 4 |
| Sand | 19 | Polypogon viridis (Gouan) Breistr. | 1 |
| Stone | 3 | Salix exigua Nutt. | 32 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Boulder | 3 | 7 | 9 | 2 | 0 |
| Bedrock | 0 | 0 | 0 | 0 | 0 |
| Basal Veg | 1 | 2 | 1 | 3 | 1 |
| Sand | 6 | 9 | 6 | 3 | 10 |
| Coarse woody debris | 5 | 3 | 1 | 2 | 1 |
| Lichen | 0 | 0 | 0 | 0 | 0 |
| Water | 0 | 7 | 3 | 0 | 1 |
| Woody debris structure | 4 | 0 | 0 | 1 | 0 |
| Litter (duff) | 46 | 35 | 18 | 35 | 11 |
| Stone | 2 | 9 | 9 | 6 | 4 |
| Gravel | 27 | 17 | 39 | 40 | 47 |
| Crypto | 0 | 1 | 1 | 0 | 0 |
| Bare Soil | 0 | 0 | 0 | 0 | 0 |
| Cobble | 6 | 10 | 10 | 7 | 25 |
| Moss (ground) | 0 | 1 | 3 | 1 | 0 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Astragalus lentiginosus Dougl. ex Hook. | 1-5% | | <0% | | <1% | | | | | |
| Astragalus nuttallianus DC. | | | | | | | | | <1% | |
| Atriplex canescens (Pursh) Nutt. | 1-5% | | | | | | | | | |
| Baccharis salicifolia (Ruiz & Pavón) Pers. | 5-10% | | 10-25% | | 5-10% | | 5-10% | | 1-5% | |
| Bromus rubens L. | 5-10% | | <0% | | <1% | | <1% | | <1% | |
| Cladium californicum (S. Wats.) O'Neill | | | | | | | 10-25% | | | |
| Eriogonum deflexum Torr. | <1% | | | | | | | | <1% | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <1% | | | | | | | | <1% | |

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 1

Transect Type: Tamarisk Control

| | | | | | |
|--|--------|--------|-------|--------|--------|
| Isocoma acradenia (Greene) Greene | <1% | <1% | 5-10% | <1% | <0% |
| Iva acerosa (Nutt.) R.C. Jackson | 5-10% | | | | |
| Lepidium alyssoides var. junceum Rollins | <1% | | | | <1% |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 10-25% | <1% | 1-5% | 1-5% | <0% |
| Oenothera elata Kunth | <1% | | <1% | <1% | |
| Phacelia crenulata Torr. ex S. Wats. | <1% | | | | |
| Phragmites australis (Cav.) Trin. ex Steud. | 1-5% | | | | |
| Polypogon viridis (Gouan) Breistr. | | | 1-5% | 1-5% | <1% |
| Salix exigua Nutt. | 1-5% | 25-50% | 5-10% | 10-25% | 25-50% |
| Tamarix ramosissima Ledeb. | | | | <1% | S |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--|---------------|-------------|-------------|
| 5 Baccharis salicifolia (Ruiz & Pavón) Pers. | 8 | | |
| 5 Iva acerosa (Nutt.) R.C. Jackson | 6 | | |
| 15 Baccharis salicifolia (Ruiz & Pavón) Pers. | 3 | | |
| 15 Salix exigua Nutt. | 1 | | |
| 35 Baccharis salicifolia (Ruiz & Pavón) Pers. | 1 | | |
| 35 Cladium californicum (S. Wats.) O'Neill | 6 | 2 | |
| 35 Salix exigua Nutt. | | | 1 |

Vegetation Structure Data - New

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--|---------------|-------------|-------------|
| 5 Baccharis salicifolia (Ruiz & Pavón) Pers. | | 2 | |
| 5 Iva acerosa (Nutt.) R.C. Jackson | 6 | | |
| 5 Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 2 | | |
| 15 Baccharis salicifolia (Ruiz & Pavón) Pers. | 6 | | |
| 15 Salix exigua Nutt. | 3 | 1 | |
| 25 Baccharis salicifolia (Ruiz & Pavón) Pers. | 2 | | |
| 35 Baccharis salicifolia (Ruiz & Pavón) Pers. | 3 | | |
| 35 Cladium californicum (S. Wats.) O'Neill | 10 | 4 | |
| 35 Salix exigua Nutt. | | 1 | 5 |

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 1

Transect Type: Tamarisk Control

| | | |
|----|---|---|
| 45 | Baccharis salicifolia (Ruiz & Pavón) Pers. | 1 |
| 45 | Bromus rubens L. | 2 |
| 45 | Salix exigua Nutt. | 2 |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|------|-----------|------|-----------|------|---------|------|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 6.58 | 1502 | 7.33 | 1335 | 7.61 | 1438 | 7.17 | 1425 |
| 15 | 8.86 | 782 | 9.03 | 849 | 9.16 | 842 | 9.02 | 824 |
| 25 | 9.17 | 508 | 9.1 | 498 | 9.04 | 459 | 9.10 | 488 |
| 35 | 9.12 | 1421 | 9.22 | 1404 | 9.18 | 1390 | 9.17 | 1405 |
| 45 | 9.33 | 401 | 9.15 | 406 | 9.06 | 386 | 9.18 | 398 |

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 2

Transect Type: Tamarisk Area

| | Start point | | End point |
|---------------------------|---|---------------------|------------------|
| Easting: | 418974 | Easting: | 419010 |
| Northing: | 3994814 | Northing: | 3994783 |
| GPS accuracy (m): | 4.7 | GPS accuracy (m): | 2.6 |
| Elevation (m): | 1025 | Elevation (m): | 1025 |
| Bearing: | 131 | | |
| Aspect (0-360): | 131 | Slope (degrees): | 2 |
| Transect description: | Transect start is 3m downstream of a mature acacia on a gravel island in the middle of the drainage. Start point rock is a .5x.5m orange boulder between ISOACR and ENCFAR shrubs. Transect runs downstream. End point is located in the upstream branch of a proglia (5x2.5m) that is at the upstream end of a Hakatai ledge. | | |
| Additional Info:: | Unkar T2B runs parallel on creek left side of drainage. | | |
| Geological layer: | Dox | | |
| Habitat type: | Riparian | GB desert scrub | |
| Dominant species: | Acacia greggii Gray, Brickellia longifolia S. Wats., Eriogonum deflexum Torr., Prosopis glandulosa Torr., Tamarix ramosissima Ledeb. | | |
| Associated species: | Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth, Artemisia ludoviciana Nutt., Datura wrightii Regel, Encelia resinifera C. Clark ssp. tenuifolia C. Clark, Eriogonum deflexum Torr., Isocoma acradenia (Greene) Greene | | |
| Surface water within 25m? | <input type="checkbox"/> | Surface water type: | |
| Landform: | Drainage channel | Surface rocks: | sandstone |
| Soil type: | sandy loam loamy sand | Topo position: | Low Level |
| Light exposure: | open partial-shade | Soil moisture: | dry |

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 2

Transect Type: Tamarisk Area

Date: 10/8/2004 Revisit? Pre-tamarisk removal

Recorder: Michelle Zuro Reader: Suzanne Rhodes

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

Weather: Clear, warm, some clouds

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|-----------------------------------|----------------|
| Bare Soil | 61 | Isocoma acradenia (Greene) Greene | 4 |
| Cobble | 39 | Prosopis glandulosa Torr. | 1 |
| Litter (duff) | 8 | Tamarix ramosissima Ledeb. | 20 |

Daubenmire Scale Cover Data

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|-----------------------------------|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | | | | | 1-5% | | | | | |
| Datura wrightii Regel | 1-5% | | | | | | | | | |
| Eriogonum deflexum Torr. | 1-5% | | | | | | | | | |
| Isocoma acradenia (Greene) Greene | 5-10% | | | | | | | | | |
| Prosopis glandulosa Torr. | | | | | | | | | 10-25% | |
| Tamarix ramosissima Ledeb. | | | | | | | 50-75% | | 10-25% | |

Vegetation Structure Data - Old

Vegetation Structure Data - New

Soil Data

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 2

Transect Type: Tamarisk Area

Date: 5/7/2007 Revisit? Post-tamarisk removal
 Recorder: Steve Till Reader: Lori Makarick
 Wind Speed: Air Temp (F): Cloud Cover: 0
 Weather: 74 F. Sunny with no clouds.

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--------------------------------|----------------|
| Boulder | 2 | Acacia greggii Gray | 4 |
| Coarse woody debris | 2 | Brickellia longifolia S. Wats. | 1 |
| Cobble | 9 | Encelia farinosa Gray ex Torr. | 2 |
| Gravel | 43 | Ephedra fasciculata A. Nels. | 1 |
| Litter (duff) | 16 | Eriogonum deflexum Torr. | 3 |
| Sand | 17 | Moss spp. | 3 |
| Stone | 10 | Prosopis glandulosa Torr. | 1 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Crypto | 0 | 0 | 0 | 0 | 0 |
| Litter (duff) | 13 | 1 | 11 | 35 | 18 |
| Stone | 16 | 18 | 5 | 3 | 11 |
| Gravel | 20 | 30 | 36 | 23 | 24 |
| Moss (ground) | 1 | 0 | 0 | 0 | 0 |
| Boulder | 10 | 10 | 3 | 0 | 0 |
| Coarse woody debris | 2 | 9 | 1 | 2 | 1 |
| Cobble | 21 | 30 | 23 | 13 | 15 |
| Bare Soil | 0 | 0 | 0 | 0 | 0 |
| Basal Veg | 1 | 1 | 1 | 1 | 1 |
| Woody debris structure | 0 | 0 | 0 | 0 | 0 |
| Sand | 16 | 10 | 2 | 20 | 30 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | | | | | 10-25% | M | | | | |
| Astragalus nuttallianus DC. | <1% | | <1% | | <1% | | <1% | | | |
| Bothriochloa barbinodis (Lag.) Herter | | | | | | | <1% | | 5-10% | |
| Brickellia longifolia S. Wats. | | | <1% | | <1% | | 1-5% | | 1-5% | |
| Bromus rubens L. | | | <1% | | | | 1-5% | | <1% | |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | | | | | | | | | <1% | |
| Datura wrightii Regel | 1-5% | | | | | | | | | |
| Encelia farinosa Gray ex Torr. | 1-5% | | | | | | | | | |
| Ephedra fasciculata A. Nels. | 1-5% | | | | 1-5% | | | | | |

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 2

Transect Type: Tamarisk Area

| | | | | | |
|--|-------|------|------|------|------|
| Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird | | | | <1% | <1% |
| Eriogonum deflexum Torr. | <1% | 1-5% | 1-5% | 1-5% | 1-5% |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <1% | <1% | | <1% | <1% |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | <1% | | <1% | | |
| Isocoma acradenia (Greene) Greene | 5-10% | | <1% | | |
| Lepidium lasiocarpum Nutt. var. lasiocarpum | | | | <1% | <1% |
| Phacelia crenulata Torr. ex S. Wats. | | <1% | | | <1% |
| Sporobolus contractus A.S. Hitchc. | | | | | <1% |
| Sporobolus cryptandrus (Torr.) Gray | | | <0% | <1% | |
| Stanleya pinnata (Pursh) Britt. | | | | | <1% |
| Stephanomeria pauciflora (Torr.) A. Nels. | <1% | | | | |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|-----------------------------|---------------|-------------|-------------|
| 45 Eriogonum deflexum Torr. | 0 | | |

Vegetation Structure Data - New

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|-----------------------------|---------------|-------------|-------------|
| 45 Eriogonum deflexum Torr. | 1 | | |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|-----|-----------|-----|-----------|-----|---------|-----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 8.09 | 364 | 8.21 | 366 | 8.25 | 359 | 8.18 | 363 |
| 15 | 8.53 | 127 | 8.52 | 133 | 8.54 | 131 | 8.53 | 130 |
| 25 | 8.56 | 92 | 8.5 | 89 | 8.53 | 97 | 8.53 | 93 |
| 35 | 7.76 | 579 | 7.75 | 623 | 7.74 | 614 | 7.75 | 605 |
| 45 | 8.48 | 117 | 8.57 | 112 | 8.56 | 124 | 8.54 | 118 |

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 2

Transect Type: Tamarisk Area

Date: 10/8/2004 Revisit? Pre-tamarisk removal

Recorder: Michelle Zuro Reader: Suzanne Rhodes

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

Weather: Clear, warm, some clouds

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|-----------------------------------|----------------|
| Bare Soil | 61 | Isocoma acradenia (Greene) Greene | 4 |
| Cobble | 39 | Prosopis glandulosa Torr. | 1 |
| Litter (duff) | 8 | Tamarix ramosissima Ledeb. | 20 |

Daubenmire Scale Cover Data

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|-----------------------------------|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | | | | | 1-5% | | | | | |
| Datura wrightii Regel | 1-5% | | | | | | | | | |
| Eriogonum deflexum Torr. | 1-5% | | | | | | | | | |
| Isocoma acradenia (Greene) Greene | 5-10% | | | | | | | | | |
| Prosopis glandulosa Torr. | | | | | | | | | 10-25% | |
| Tamarix ramosissima Ledeb. | | | | | | | 50-75% | | 10-25% | |

Vegetation Structure Data - Old

Vegetation Structure Data - New

Soil Data

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 2

Transect Type: Tamarisk Area

Date: 5/7/2007 Revisit? Post-tamarisk removal
 Recorder: Steve Till Reader: Lori Makarick
 Wind Speed: Air Temp (F): Cloud Cover: 0
 Weather: 74 F. Sunny with no clouds.

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--------------------------------|----------------|
| Boulder | 2 | Acacia greggii Gray | 4 |
| Coarse woody debris | 2 | Brickellia longifolia S. Wats. | 1 |
| Cobble | 9 | Encelia farinosa Gray ex Torr. | 2 |
| Gravel | 43 | Ephedra fasciculata A. Nels. | 1 |
| Litter (duff) | 16 | Eriogonum deflexum Torr. | 3 |
| Sand | 17 | Moss spp. | 3 |
| Stone | 10 | Prosopis glandulosa Torr. | 1 |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Crypto | 0 | 0 | 0 | 0 | 0 |
| Litter (duff) | 13 | 1 | 11 | 35 | 18 |
| Stone | 16 | 18 | 5 | 3 | 11 |
| Gravel | 20 | 30 | 36 | 23 | 24 |
| Moss (ground) | 1 | 0 | 0 | 0 | 0 |
| Boulder | 10 | 10 | 3 | 0 | 0 |
| Coarse woody debris | 2 | 9 | 1 | 2 | 1 |
| Cobble | 21 | 30 | 23 | 13 | 15 |
| Bare Soil | 0 | 0 | 0 | 0 | 0 |
| Basal Veg | 1 | 1 | 1 | 1 | 1 |
| Woody debris structure | 0 | 0 | 0 | 0 | 0 |
| Sand | 16 | 10 | 2 | 20 | 30 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | | | | | 10-25% | M | | | | |
| Astragalus nuttallianus DC. | <1% | | <1% | | <1% | | <1% | | | |
| Bothriochloa barbinodis (Lag.) Herter | | | | | | | <1% | | 5-10% | |
| Brickellia longifolia S. Wats. | | | <1% | | <1% | | 1-5% | | 1-5% | |
| Bromus rubens L. | | | <1% | | | | 1-5% | | <1% | |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | | | | | | | | | <1% | |
| Datura wrightii Regel | 1-5% | | | | | | | | | |
| Encelia farinosa Gray ex Torr. | 1-5% | | | | | | | | | |
| Ephedra fasciculata A. Nels. | 1-5% | | | | 1-5% | | | | | |

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 2

Transect Type: Tamarisk Area

| | | | | | |
|--|-------|------|------|------|------|
| Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird | | | | <1% | <1% |
| Eriogonum deflexum Torr. | <1% | 1-5% | 1-5% | 1-5% | 1-5% |
| Erodium cicutarium (L.) L'Hér. ex Ait. | <1% | <1% | | <1% | <1% |
| Gutierrezia sarothrae (Pursh) Britt. & Rusby | <1% | | <1% | | |
| Isocoma acradenia (Greene) Greene | 5-10% | | <1% | | |
| Lepidium lasiocarpum Nutt. var. lasiocarpum | | | | <1% | <1% |
| Phacelia crenulata Torr. ex S. Wats. | | <1% | | | <1% |
| Sporobolus contractus A.S. Hitchc. | | | | | <1% |
| Sporobolus cryptandrus (Torr.) Gray | | | <0% | <1% | |
| Stanleya pinnata (Pursh) Britt. | | | | | <1% |
| Stephanomeria pauciflora (Torr.) A. Nels. | <1% | | | | |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|-----------------------------|---------------|-------------|-------------|
| 45 Eriogonum deflexum Torr. | 0 | | |

Vegetation Structure Data - New

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|-----------------------------|---------------|-------------|-------------|
| 45 Eriogonum deflexum Torr. | 1 | | |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|-----|-----------|-----|-----------|-----|---------|-----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 8.09 | 364 | 8.21 | 366 | 8.25 | 359 | 8.18 | 363 |
| 15 | 8.53 | 127 | 8.52 | 133 | 8.54 | 131 | 8.53 | 130 |
| 25 | 8.56 | 92 | 8.5 | 89 | 8.53 | 97 | 8.53 | 93 |
| 35 | 7.76 | 579 | 7.75 | 623 | 7.74 | 614 | 7.75 | 605 |
| 45 | 8.48 | 117 | 8.57 | 112 | 8.56 | 124 | 8.54 | 118 |

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 2

Transect Type: Tamarisk Control

| | Start point | | End point |
|---------------------------|---|---------------------|------------------|
| Easting: | 418996 | Easting: | 419035 |
| Northing: | 3994812 | Northing: | 3994783 |
| GPS accuracy (m): | 4.6 | GPS accuracy (m): | 5 |
| Elevation (m): | 1027 | Elevation (m): | 1022 |
| Bearing: | 130 | | |
| Aspect (0-360): | 126 | Slope (degrees): | 3 |
| Transect description: | Transect start is nestled beneath a mature acacia at the upstream end of a Hakatai ledge on creek left side of the drainage. The transect end is in the middle of the drainage equidistant from a giant PROGLA patch about 15m long on creek left. The Hakatai ledge on creek right. There is no distinctive boulder for end point. | | |
| Additional Info:: | No surface water here, no TAMRAM in transect, native vegetation only. | | |
| Geological layer: | Dox | | |
| Habitat type: | Riparian | GB desert scrub | |
| Dominant species: | Acacia greggii Gray, Encelia farinosa Gray ex Torr., Eriogonum deflexum Torr., Prosopis glandulosa Torr. | | |
| Associated species: | Camissonia walkeri (A. Nels.) Raven, Dasyochloa pulchella (Kunth) Willd. ex Rydb., Datura wrightii Regel, Echinocereus engelmannii (Parry ex Engelm.) Lem., Ephedra nevadensis S. Wats., Erodium cicutarium (L.) L'Hér. ex Ait., Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Pleuraphis rigida Thurb. | | |
| Surface water within 25m? | <input type="checkbox"/> | Surface water type: | |
| Landform: | Drainage channel | Surface rocks: | sandstone |
| Soil type: | sand | Topo position: | Interfluve |
| Light exposure: | open | Soil moisture: | dry |

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 2

Transect Type: Tamarisk Control

Date: 10/8/2004 Revisit? Pre-tamarisk removal

Recorder: Kari Malen Reader: Suzanne Rhodes

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

Weather: Clear, warm, some clouds

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|-----------------------------|----------------|
| Bare Soil | 42 | Acacia greggii Gray | 3 |
| Cobble | 60 | Ephedra nevadensis S. Wats. | 3 |
| Litter (duff) | 3 | Prosopis glandulosa Torr. | 16 |
| Woody debris structure | 1 | | |

Daubenmire Scale Cover Data

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | 10-25% | | | | | | | | | |
| Encelia farinosa Gray ex Torr. | 1-5% | | 1-5% | | | | 1-5% | | | |
| Ephedra nevadensis S. Wats. | 1-5% | | | | | | | | | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | | <1% | | | | | | | |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 1-5% | | | | | | | | | |
| Pleuraphis rigida Thurb. | | | 1-5% | | | | | | | |
| Prosopis glandulosa Torr. | | | 10-25% | | 25-50% | | 25-50% | | 25-50% | |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|-----------------------|---------------|-------------|-------------|
| 5 Acacia greggii Gray | | 3 | |

Vegetation Structure Data - New

Soil Data

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 2

Transect Type: Tamarisk Control

Date: 5/9/2007 Revisit? Post-tamarisk removal

Recorder: Lisa Hahn Reader: Melissa McMaster

Wind Speed: Air Temp (F): Cloud Cover: 0

Weather: clear blue sky, very light breeze, high 80's, feels very hot!

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--------------------------------------|----------------|
| Bedrock | 4 | Acacia greggii Gray | 6 |
| Cobble | 27 | Ephedra torreyana S. Wats. | 2 |
| Gravel | 26 | Eriogonum deflexum Torr. | 1 |
| Litter (duff) | 5 | Phacelia crenulata Torr. ex S. Wats. | 1 |
| Sand | 38 | Prosopis glandulosa Torr. | 6 |
| Stone | 2 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Cobble | 6 | 12 | 35 | 35 | 40 |
| Gravel | 38 | 57 | 40 | 39 | 40 |
| Coarse woody debris | 1 | 1 | 0 | 0 | 0 |
| Woody debris structure | 0 | 0 | 0 | 0 | 0 |
| Litter (duff) | 8 | 7 | 3 | 1 | 1 |
| Sand | 13 | 16 | 19 | 20 | 6 |
| Bedrock | 30 | 1 | 0 | 0 | 0 |
| Boulder | 0 | 2 | 0 | 0 | 5 |
| Crypto | 1 | 1 | 0 | 0 | 0 |
| Lichen | 0 | 0 | 0 | 0 | 0 |
| Basal Veg | 1 | 1 | 1 | 1 | 1 |
| Bare Soil | 0 | 0 | 0 | 0 | 0 |
| Stone | 1 | 1 | 2 | 4 | 7 |
| Water | 0 | 0 | 0 | 0 | 0 |
| Moss (ground) | 1 | 1 | 0 | 0 | 0 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | <1% | | | | | | | | | |
| Acacia greggii Gray | 1-5% | M | | | | | | | | |
| Astragalus nuttallianus DC. | | | <1% | | <1% | | | | | |
| Atriplex canescens (Pursh) Nutt. | 1-5% | | | | | | | | | |
| Bromus rubens L. | | | | | <1% | | | | | |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | | | <1% | | | | | | | |
| Encelia farinosa Gray ex Torr. | 1-5% | | <1% | | | | | | | |
| Ephedra torreyana S. Wats. | 5-10% | | | | | | | | | |

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 2

Transect Type: Tamarisk Control

| | | | | | | | | | |
|---|-----|---|-------|---|-------|---|------|--|-----|
| Eriogonum deflexum Torr. | <1% | | 1-5% | | 1-5% | | 1-5% | | <1% |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | | <1% | | <1% | | <1% | | |
| forb spp | | | | | | | | | <1% |
| Lepidium lasiocarpum Nutt. var. lasiocarpum | | | | | <1% | | | | <1% |
| Machaeranthera pinnatifida (Hook.) Shinnery | | | | | <1% | | | | |
| Mammillaria grahamii Engelm. var. grahamii | <1% | | | | | | | | |
| Phacelia crenulata Torr. ex S. Wats. | | | <1% | | <1% | | <1% | | <0% |
| Pleuraphis jamesii Torr. | | | 1-5% | | | | | | |
| Prosopis glandulosa Torr. | <1% | M | 5-10% | M | 5-10% | M | | | |
| Stanleya pinnata (Pursh) Britt. | | | | | <1% | | | | |
| Tridens muticus (Torr.) Nash | | | | | <1% | | | | |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|---------------------|---------------|-------------|-------------|
| 5 | Acacia greggii Gray | 2 | 1 | |

Vegetation Structure Data - New

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|---------------------|---------------|-------------|-------------|
| 5 | Acacia greggii Gray | 2 | 4 | |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|----|-----------|----|-----------|----|---------|----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 9.05 | 88 | 8.8693 | 9 | 93 | 15 | 36.97 | 37 |
| 15 | 8.92 | 57 | 9 | 54 | 8.96 | 57 | 8.96 | 56 |
| 25 | 8.86 | 82 | 8.75 | 82 | 8.82 | 84 | 8.81 | 83 |
| 35 | 8.85 | 61 | 8.91 | 54 | 8.87 | 61 | 8.88 | 59 |
| 45 | 8.84 | 54 | 8.79 | 60 | 8.79 | 49 | 8.81 | 54 |

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 2

Transect Type: Tamarisk Control

Date: 10/8/2004 Revisit? Pre-tamarisk removal

Recorder: Kari Malen Reader: Suzanne Rhodes

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

Weather: Clear, warm, some clouds

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|------------------------|----------------|-----------------------------|----------------|
| Bare Soil | 42 | Acacia greggii Gray | 3 |
| Cobble | 60 | Ephedra nevadensis S. Wats. | 3 |
| Litter (duff) | 3 | Prosopis glandulosa Torr. | 16 |
| Woody debris structure | 1 | | |

Daubenmire Scale Cover Data

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Acacia greggii Gray | 10-25% | | | | | | | | | |
| Encelia farinosa Gray ex Torr. | 1-5% | | 1-5% | | | | 1-5% | | | |
| Ephedra nevadensis S. Wats. | 1-5% | | | | | | | | | |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | | <1% | | | | | | | |
| Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi | 1-5% | | | | | | | | | |
| Pleuraphis rigida Thurb. | | | 1-5% | | | | | | | |
| Prosopis glandulosa Torr. | | | 10-25% | | 25-50% | | 25-50% | | 25-50% | |

Vegetation Structure Data - Old

| <u>Point Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|-----------------------|---------------|-------------|-------------|
| 5 Acacia greggii Gray | | 3 | |

Vegetation Structure Data - New

Soil Data

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 2

Transect Type: Tamarisk Control

Date: 5/9/2007 Revisit? Post-tamarisk removal

Recorder: Lisa Hahn Reader: Melissa McMaster

Wind Speed: Air Temp (F): Cloud Cover: 0

Weather: clear blue sky, very light breeze, high 80's, feels very hot!

Point Intercept Transect (50m)

| <u>Ground Cover</u> | <u>% Cover</u> | <u>Species</u> | <u>% Cover</u> |
|---------------------|----------------|--------------------------------------|----------------|
| Bedrock | 4 | Acacia greggii Gray | 6 |
| Cobble | 27 | Ephedra torreyana S. Wats. | 2 |
| Gravel | 26 | Eriogonum deflexum Torr. | 1 |
| Litter (duff) | 5 | Phacelia crenulata Torr. ex S. Wats. | 1 |
| Sand | 38 | Prosopis glandulosa Torr. | 6 |
| Stone | 2 | | |

Daubenmire Scale Cover Data

| <u>Ground Cover</u> | <u>5m</u> | <u>15m</u> | <u>25m</u> | <u>35m</u> | <u>45m</u> |
|------------------------|-----------|------------|------------|------------|------------|
| Cobble | 6 | 12 | 35 | 35 | 40 |
| Gravel | 38 | 57 | 40 | 39 | 40 |
| Coarse woody debris | 1 | 1 | 0 | 0 | 0 |
| Woody debris structure | 0 | 0 | 0 | 0 | 0 |
| Litter (duff) | 8 | 7 | 3 | 1 | 1 |
| Sand | 13 | 16 | 19 | 20 | 6 |
| Bedrock | 30 | 1 | 0 | 0 | 0 |
| Boulder | 0 | 2 | 0 | 0 | 5 |
| Crypto | 1 | 1 | 0 | 0 | 0 |
| Lichen | 0 | 0 | 0 | 0 | 0 |
| Basal Veg | 1 | 1 | 1 | 1 | 1 |
| Bare Soil | 0 | 0 | 0 | 0 | 0 |
| Stone | 1 | 1 | 2 | 4 | 7 |
| Water | 0 | 0 | 0 | 0 | 0 |
| Moss (ground) | 1 | 1 | 0 | 0 | 0 |

| <u>Species</u> | <u>5m</u> | <u>Age</u> | <u>15m</u> | <u>Age</u> | <u>25m</u> | <u>Age</u> | <u>35m</u> | <u>Age</u> | <u>45m</u> | <u>Age</u> |
|--|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | <1% | | | | | | | | | |
| Acacia greggii Gray | 1-5% | M | | | | | | | | |
| Astragalus nuttallianus DC. | | | <1% | | <1% | | | | | |
| Atriplex canescens (Pursh) Nutt. | 1-5% | | | | | | | | | |
| Bromus rubens L. | | | | | <1% | | | | | |
| Dasyochloa pulchella (Kunth) Willd. ex Rydb. | | | <1% | | | | | | | |
| Encelia farinosa Gray ex Torr. | 1-5% | | <1% | | | | | | | |
| Ephedra torreyana S. Wats. | 5-10% | | | | | | | | | |

Canyon/Park Area: Unkar Creek

River mile: 72.5 R

Project (Phase): Phase IIa

Transect Name: Unkar Creek 2

Transect Type: Tamarisk Control

| | | | | | | | | | |
|---|-----|---|-------|---|-------|---|------|--|-----|
| Eriogonum deflexum Torr. | <1% | | 1-5% | | 1-5% | | 1-5% | | <1% |
| Erodium cicutarium (L.) L'Hér. ex Ait. | | | <1% | | <1% | | <1% | | |
| forb spp | | | | | | | | | <1% |
| Lepidium lasiocarpum Nutt. var. lasiocarpum | | | | | <1% | | | | <1% |
| Machaeranthera pinnatifida (Hook.) Shinnery | | | | | <1% | | | | |
| Mammillaria grahamii Engelm. var. grahamii | <1% | | | | | | | | |
| Phacelia crenulata Torr. ex S. Wats. | | | <1% | | <1% | | <1% | | <0% |
| Pleuraphis jamesii Torr. | | | 1-5% | | | | | | |
| Prosopis glandulosa Torr. | <1% | M | 5-10% | M | 5-10% | M | | | |
| Stanleya pinnata (Pursh) Britt. | | | | | <1% | | | | |
| Tridens muticus (Torr.) Nash | | | | | <1% | | | | |

Vegetation Structure Data - Old

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|---------------------|---------------|-------------|-------------|
| 5 | Acacia greggii Gray | 2 | 1 | |

Vegetation Structure Data - New

| <u>Point</u> | <u>Species</u> | <u><1m</u> | <u>1-2m</u> | <u>2-3m</u> |
|--------------|---------------------|---------------|-------------|-------------|
| 5 | Acacia greggii Gray | 2 | 4 | |

Soil Data

| Point | Reading 1 | | Reading 2 | | Reading 3 | | Average | |
|-------|-----------|----|-----------|----|-----------|----|---------|----|
| | pH | EC | pH | EC | pH | EC | pH | EC |
| 5 | 9.05 | 88 | 8.8693 | 9 | 93 | 15 | 36.97 | 37 |
| 15 | 8.92 | 57 | 9 | 54 | 8.96 | 57 | 8.96 | 56 |
| 25 | 8.86 | 82 | 8.75 | 82 | 8.82 | 84 | 8.81 | 83 |
| 35 | 8.85 | 61 | 8.91 | 54 | 8.87 | 61 | 8.88 | 59 |
| 45 | 8.84 | 54 | 8.79 | 60 | 8.79 | 49 | 8.81 | 54 |

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 (m²): (From Map) _____ Area Cover: _____ * See table below for SWEMP codes
 Infested Area (m²): _____ % 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 (m²): (From Map) _____ Area Cover: _____ * See table below for SWEMP codes
 Infested Area (m²): _____ % 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 jointed and exfoliating 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

Interfluvium: 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:

- 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.
 - If the soil does not remain in a ball, circle "**sand**"
- 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.
 - If no ribbon is formed, record "**loamy sand**"
- If ribbon forms but breaks before it is 2.5 cm, rub the soil between fingers.
 - If very gritty, record "**sandy loam**"
 - If very smooth, record "**silt loam**"
 - If neither gritty or smooth, record "**loam**"
- If ribbon breaks between 2.5 and 5 cm, rub the soil between fingers.
 - If very gritty, record "**sandy clay loam**"
 - If very smooth, record "**silty clay loam**"
 - If neither gritty or smooth, record "**clay loam**"
- If ribbon breaks when it is >5 cm, rub the soil between fingers.
 - If very gritty, record "**sandy clay**"
 - If very smooth, record "**clay**"
 - 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 (<i>Bouteloua/Pleuraphis</i>), mixed shrub |
| Interior wetlands | Cattail, rushes, sedges, willows |
| Riparian | cottonwood-willow, mixed deciduous broadleaf |

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), microbotic 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 trees 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 greater 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!

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: _____° |
| 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 TIC)

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: Ponderosa Pine Forest GB Mountain Scrub GB Conifer Woodland GB Desertscrub Mojave Desertscrub Interior Wetlands Riparian Other _____ | Land form: Rockpile Drainage Channel Valley Bottom Fill Ridge Slickrock Terrace Mesa Butte Cliff Talus Sand Dune Plateau Other _____ | Topographic Position: High level High Slope Mid Slope Low Slope Backslope Step in Slope Toe Slope Low Level Interfluve | |
| Surface rocks: Basalt Conglomerate Limestone Mudstone Sandstone Shale Schist Other _____ | Soil type: sand loamy sand sandy loam silt loam loam sandy clay loam silty clay loam clay loam sandy clay clay silty clay | Light exposure: open full-shade partial-shade | Soil moisture: 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

Interfluv: 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:

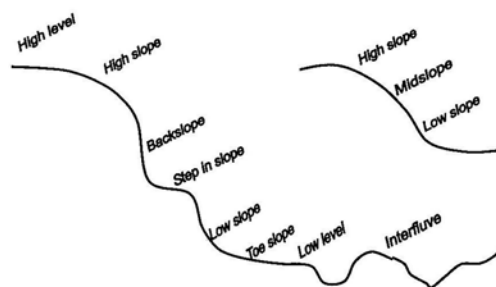
1. Place soil in hand, remove pebbles, and add water very slowly, until it has the potential to have the consistency of putty. Add more soil or water as needed.
 - a. If the soil does not remain in a ball, circle "**sand**"
2. If the soil remains in a ball, squeeze the ball between your thumb and forefinger, 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 (<i>Bouteloua/Pleuraphis</i>), 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



| 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 |

COMPLETE PHOTODOCUMENTATION FORMS FOR EACH TRANSECT (Include view from Start and End Points and multiple photos of how to locate transect start)

DRAW MAP AND INCLUDE ANY ADDITIONAL INFORMATION THAT WOULD HELP RELOCATE TRANSECT

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 ☺ / 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 \odot / 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 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 (<i>Bouteloua/Pleuraphis</i>), 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 jointed and exfoliating 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
Interfluvium: 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:

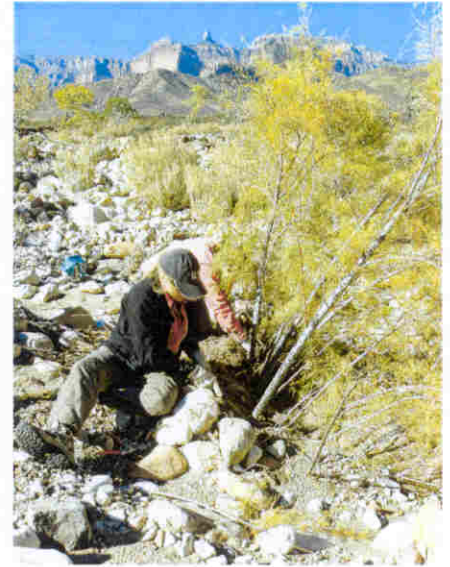
- Place soil in hand, remove pebbles, and add water very slowly, until it has the potential to have the consistency of putty. Add more soil or water as needed.
 - If the soil does not remain in a ball, circle "**sand**"
- If the soil remains in a ball, squeeze the ball between your thumb and forefinger, attempting to make a ribbon of uniform thickness and width pushing up and over your forefinger until it breaks from its own weight.
 - If no ribbon is formed, record "**loamy sand**"
- If ribbon forms but breaks before it is 2.5 cm, rub the soil between fingers.
 - If very gritty, record "**sandy loam**"
 - If very smooth, record "**silt loam**"
 - If neither gritty or smooth, record "**loam**"
- If ribbon breaks between 2.5 and 5 cm, rub the soil between fingers.
 - If very gritty, record "**sandy clay loam**"
 - If very smooth, record "**silty clay loam**"
 - If neither gritty or smooth, record "**clay loam**"
- If ribbon breaks when it is >5 cm, rub the soil between fingers.
 - If very gritty, record "**sandy clay**"
 - If very smooth, record "**clay**"
 - If neither gritty or smooth, record "**silty clay**"

THE GRAND CANYON NEEDS YOUR HELP!

Tamarisk Backpacking Project

Grand Canyon National Park is looking for motivated, enthusiastic individuals to work as short-term volunteers with the Park's Backcountry Vegetation Program!

One of the most significant threats to global biodiversity is the invasion of exotic plants. Tamarisk (*Tamarix ramosissima*), commonly known as salt cedar, is an invasive exotic tree that grows in dense stands along rivers and streams in the western United States. Tamarisk, introduced to the U.S. in the 19th century as an erosion control agent, rapidly spread and established throughout the West and caused major changes to natural environments. These prolific non-native trees displace native vegetation, create conditions that are inhospitable for the germination of native plant seeds, impact wildlife abundance, and increase fire frequency.



The spread of tamarisk has gone beyond the river corridor of the Grand Canyon and poses a significant threat to tributaries and springs that remain as some of the last examples of pristine riparian habitat in the desert southwest. This encroachment not only threatens native vegetation communities but also wildlife that depends upon these sources of water. Luckily, you can help!

September 2006 marks the beginning our 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 hand saws in action. Does this sound like fun to you? At this point in the project, we are reaching remote areas via backpacking on 4-8 day trips. The work is hard and the days are long, but the sense of community and accomplishment are great.

Volunteer Requirements:

Ability to...

- live in remote areas with few amenities where inclement weather is possible.
- work extended schedules with long work days.
- maintain a positive attitude in a group setting for extended periods of time.
- backpack with a load of 50 pounds or more over rough terrain.



For more information or to sign up for a trip contact Terra Crampton at: terra@gcnpf.org (928) 774-1760 or visit our website: www.gcvolunteers.com

Volunteers sought for tamarisk removal

In Grand Canyon National Park, the number of invasive plant species increased from only nine reported species in 1930 to over 170 exotic plant species known to be in the park today.

Officials prepared a comprehensive management plan to target plants that pose a significant threat to native ecosystems, and tamarisk (*tamari ramosissima*) rose to the top of the list. Tamarisk spreads quickly in riparian areas often developing monoculture stands, and altering water tables. Tamarisk crowds

out native vegetation, damages wildlife habitat, and negatively affects the hydrology of precious riparian areas. In the Southwest, riparian areas are biologically diverse and productive ecosystems, as over 65 percent of the region's wildlife depend on them. However riparian areas account for less than 2 percent of the land and are rapidly decreasing.

Volunteers are pivotal to the success of the effort to remove tamarisk from seeps, springs and tributaries of the Colorado River. To date, over 175,000 trees have

been removed from over five acres with more than 15,000 hours of volunteers time donated to the project.

Find out how to sign up for backcountry trips on our Web site at www.gcvolunteers.org.

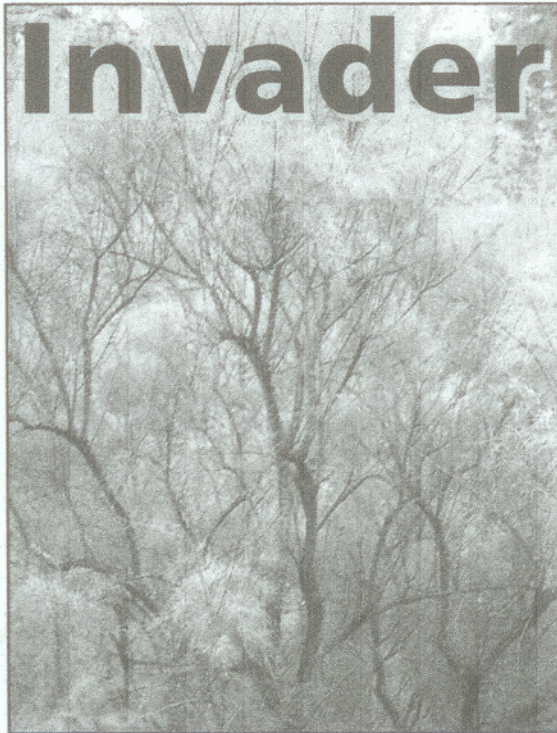
Contact Kelly Williams or Melissa McMaster for more information at 928-226-0158.

The GCPBA Newswire is a service to the boating community provided by Grand Canyon Private Boaters Association. Visit them at www.gcpba.org.

Park News

Controlling an

Invader



Spring 2005 GRCA Publication "The Guide"

As you travel throughout the Southwest, you will likely see a small, many-branched tree with tiny, feathery, drooping leaves called a tamarisk (*Tamarix ramosissima*) or salt cedar. Introduced in the 19th century as an erosion-control agent and for ornamental purposes, the highly invasive tamarisk spread throughout the West, causing major changes to natural environments. Tamarisk reached the Grand Canyon area in the 1930s. It became a dominant species along the Colorado River following completion of Glen Canyon Dam in 1963.

Although some wildlife species use this plant for shelter or nesting, tamarisk threatens the park's native ecosystems. A mature tree can produce more than 250 million seeds, which are dispersed by wind and water. Tamarisk roots can reach depths of more than 100 feet (30 m), taking over the water needed by many native species. As tamarisk invades the beaches and canyons of the park, native vegetation is crowded out, wildlife is displaced, water is usurped, and fire frequency may increase.

National Park Service policies call for managing exotic (or 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 side canyons and tributaries of the Colorado River meets these criteria. Formed to address the tamarisk problem in Grand Canyon, the Tamarisk Management and Tributary Restoration project seeks to 1) prevent further loss or degradation of the

existing native flora and fauna and 2) restore more natural conditions thereby protecting the park's riparian areas. The project uses environmentally sensitive techniques approved through a public review process, including mechanical (hand-pulling or cutting) and chemical control of tamarisk in side canyons, tributaries, developed areas, and springs.

The tamarisk management project is extremely labor intensive, but enormous progress has been made over the past two years largely due to the hard work and dedication of volunteers. The National Park Service thanks all of the volunteers and welcomes new folks to the team. If you are interested in this or other Inner Canyon Vegetation Management projects visit www.volunteer.gov/gov. Find the volunteer description and apply online.

For more detailed project information, refer to the compliance documents and project reports posted on the park's website www.nps.gov/grca.



Controlling an Invader

became dominant along the Colorado River following completion of Glen Canyon Dam in 1963.

Although people and wildlife species use this plant for shelter, food, or nesting habitat, tamarisk threatens the park's native ecosystems. An average tree produces about 600,000 seeds (a mature tree may develop more than 250 million seeds), which wind and water disperse widely. Tamarisk roots can reach depths of more than 100 feet (30 m), outcompeting many native species. As tamarisk invades the beaches and side canyons of the park, it crowds out native vegetation, displaces wildlife, usurps valuable water, and leads to ecosystem-level changes.

National Park Service policies call for managing exotic (or nonnative) 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." The Tamarisk Management and Tributary Restoration project seeks to prevent further loss or degradation of the existing

native flora and fauna and restore more natural conditions to protect the park's riparian areas.

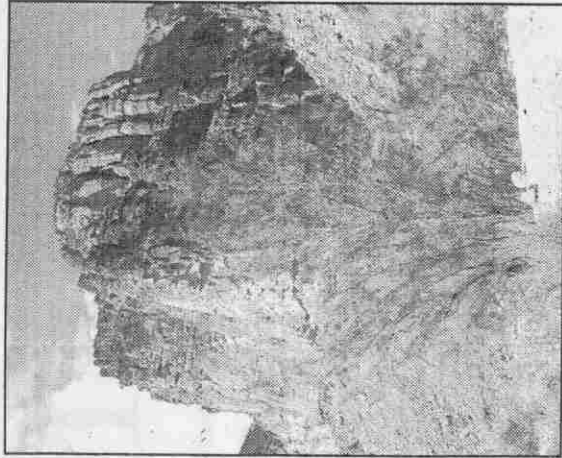
Through a public review process, the park evaluated the beneficial and adverse impacts of a tamarisk management project to natural, cultural, and wilderness resources.

Environmentally acceptable actions include mechanical (hand-pulling or cutting) and chemical control of tamarisk in side canyons, tributaries, developed areas, and springs.

Control efforts began in 2002 with support from 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. To date, crews have completed work in nearly 100 project areas, removing in excess of 180,000 tamarisk trees from more than 5,000 acres. Only seven percent of the initially controlled trees required follow-up treatment. This ongoing project has resulted in a 99 percent reduction of tamarisk in treated areas. Native plants are returning and thriving.

Enormous progress has been made over the past three years with the hard work and dedication of volunteers. The National Park Service thanks all of the volunteers and welcomes new folks to the team. If you are interested in volunteering at Grand Canyon National Park visit www.volunteer.gov/gov or www.gcvolunteers.org. Find the volunteer description and apply online.

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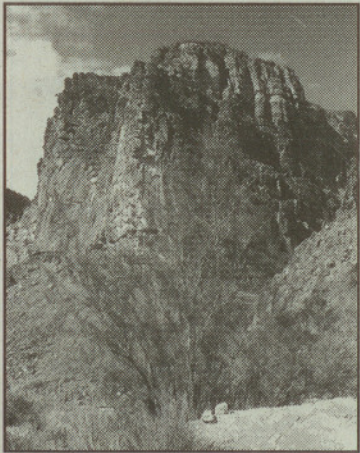


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Controlling an Invader

GRCA Publication "The Guide" Summer 2006



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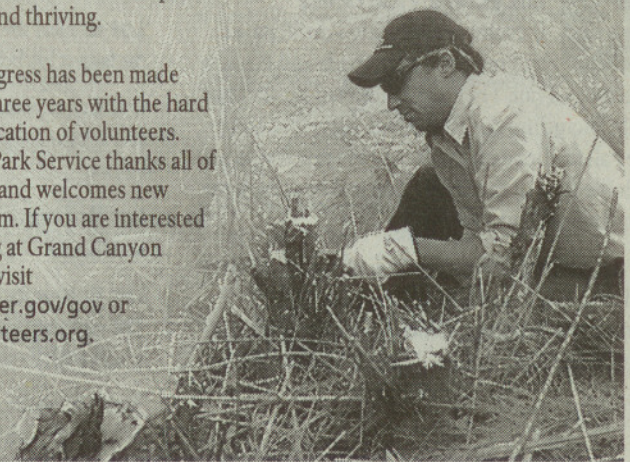
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GCA lecture series back on the road

The Canyon Country Lecture Series, sponsored by Grand Canyon Association, resumes in Prescott and Flagstaff this month.

Upcoming lectures:

Wednesday, Sept. 14, 7-8:30 p.m., in Flagstaff: "Astronomy of the Ancient Southwest" by archaeo-astronomer Bryan Bates, who highlights the centuries-old traditions of several Colorado Plateau tribes of "reading" celestial objects to determine the timing for such critical societal functions as planting, harvesting, and ceremonial gatherings.

Sunday, Sept. 18, 1-3 p.m., in Prescott: "Grand Canyon's Over the Edge Veg Program" by NPS vegetation experts Lori Makarick and Kate Waters who describe ongoing habitat restoration projects, including a number of recent floral discoveries.

Sunday, Oct. 16, 1-3 p.m., Prescott: "Life Zones to Living Crust: Natural History Stories from the Plateau," by Stewart Aitchison. Using C. Hart Merriam's groundbreaking theory of life zones as a backdrop, author and naturalist Aitchison shares his extensive knowledge of the diverse plant and animal communities on the Colorado Plateau.

Wednesday, Oct. 26, 7-8:30 p.m., Flagstaff: "Life through Time in Grand Canyon" by Larry Stevens, PhD, biologist

and former GCNP ecologist, will trace the history of life at Grand Canyon—from the single-cell organisms of our primordial past to the slightly more evolved river runners of today.

Wednesday, Nov. 16, 7-8:30 p.m. in Flagstaff and Sunday, Nov. 20, 1-3 p.m. in Prescott: "The Painted Desert: A Lost Landscape" by writer Scott Thybony. Thybony will present stories and images from northern Arizona's intriguing Painted Desert.

Sunday, Dec. 18, 1-3 p.m., Prescott: "Historical Mining at Grand Canyon" presented by Jack Pennington. From uranium to bat guano, Grand Canyon has witnessed a number of mining boom and bust cycles. Geologist and Grand Canyon Field Institute instructor Jack Pennington brings to life the stories.

Flagstaff lectures are at Cline Library, intersection of Knoles Drive and McCreary Road on the NAU campus. Parking is available to the west of the library (Lot P13 on Riordan Ranch Road). Prescott lectures are at Sharlot Hall Museum, 415 W. Gurley (two blocks west of Courthouse Plaza). Space at the Prescott lecture series is limited; call 928-445-3122 to inquire about seating. All lectures are free and open to the public.

For more information, call GCA at 638-2481 or visit www.grandcanyon.org.

----- Forwarded by Linda Jalbert/GRCA/NPS on 12/15/2005 10:48 AM -----



"Riverwire"
<riverwire@rrfw.org>
12/14/2005 07:45 PM
MST
Please respond to
Riverwire

To: riverwire@rrfw.org
cc: (bcc: Linda Jalbert/GRCA/NPS)
Subject: RRFW Riverwire - TAMMIES TARGETED IN DROUGHT MITIGATION
EFFORTS

RRFW Riverwire – TAMMIES TARGETED IN DROUGHT MITIGATION EFFORTS

December 14, 2005

Tamarisk, that bane of southwestern rivers, is being targeted by river managers, volunteers and a nonprofit group in an effort to recoup the loss of precious river flows, particularly in the current drought. The tamarisk tree, native to the Middle East, was introduced early last century to stabilize bank erosion, but quickly naturalized, crowding out native species and sucking as much as 500,000 acre-feet a year of scarce desert water by some estimates.

Prior to the construction of Glen Canyon Dam, tamarisk growth was limited to higher elevation terraces and tributaries in Grand Canyon National Park (GCNP), but stable flow regimes in most years encouraged their spread. The high flow of 1983, over 100,000 cfs, killed one third of the tamarisks below the 60,000 cfs water mark. In 1996 the short-duration "spike flows" of 45,000 cfs and lower failed to remove any tamarisks. Flows in 2000, with short, low peaks below 33,000 cfs, followed by steady flows, caused an increase in the already widespread germination of tamarisks.

Tamarisk control was initiated in Grand Canyon National Park in 1998. To date, 134,808 trees have been removed from 4,496 acres in 63 tributaries of the river. An average of 12% of the removed trees required follow up treatment in order to fully eradicate. Volunteers donated 8,000 volunteer hours valued at \$137,500.

Tamarisk removal is particularly critical in GCNP, as this World Heritage Site contains 1737 different plant species and has more floral diversity than, and the most plant species of, any national park. 42% of Arizona's native flora is represented in the park.

Colorado's Horsethief Canyon and Dinosaur National Monument are among the sites selected for the release of the tamarisk's only known predator, the salt cedar leaf beetle. The beetle is currently chewing away at 3 sites and could be released in Dinosaur National Monument soon, after completion of a required Environmental Assessment. There will be pre- and post-monitoring at each site for five years with data being collected every two weeks. Because the beetle cannot reproduce in areas with fewer than 14 ½ hours of sunlight per day, release is confined to areas above 38 degrees north. Once a tree has been defoliated by the beetles, the leafless tree is then manually eradicated.

The San Miguel River, a tributary of the Dolores River in the Upper Colorado River Basin, remains one of the few naturally functioning riparian ecosystems in the Western United States. The Tamarisk Eradication Project is preserving and protecting the biological health of the riparian areas throughout the San Miguel River Watershed by removing non-native invasive trees in order to establish the San Miguel as the only naturally functioning—and free of non-native trees—river in the Upper Colorado River Basin by 2006.

Nancy Seamons, Environmental Coordinator for River Runners for Wilderness, attended the Tamarisk Symposium in Grand Junction, Colorado, co-hosted by The Tamarisk Coalition and the Colorado State University (CSU) Cooperative Extension biennially. This year's symposium, held on October 12 -14, 2005, was well attended by nearly 250 national and international researchers, on-the-ground program managers, environmental representatives and federal/state/local agencies. Participants heard presentations and discussed topics including current research, control projects, restoration, mapping and funding, legislation and planning, economics and biological control.

Throughout the summer of 2005, the Tamarisk Coalition mapped tamarisk and Russian olive (another non-native tree wreaking havoc) along the riparian corridors of the Arkansas and Colorado Rivers and their tributaries. Accessing the rivers by roads and the river channel itself, field technicians are "ground truthing," or verifying the presence and characteristics of tamarisk and Russian olive stands in comparison to satellite and aerial photos.

The Tamarisk Coalition is a 501(c)3 non-profit whose mission is to provide education, technical assistance, and coordinating support for the restoration of riparian lands and is working with Congress to provide \$80 million over five years for tamarisk control and revegetation for large scale projects, critical research, long term management and funding options. To learn more about tamarisk and invasive plants, visit the Tamarisk Coalition web site at www.tamariskcoalition.org.

RIVERWIRE is a free service to the community of river lovers from River Runners for Wilderness. Membership is FREE! Send your e-mail address to riverwire@rrfw.org and we'll add you to the RRFW RIVERWIRE e-mail list. To join, visit our website at www.rrfw.org and click on the "membership" link. Donate at RRFW Store. RRFW is a project of Living Rivers.

Canyon fossil a new life form

Resembling an early sea worm from 500 million years ago, the discovery was a shock to the boating party that found it and to scientists, too.

By ANNE MINARD

Special to the Sun

What's 500 million years old and looks like a 6-inch-long squiggly line?

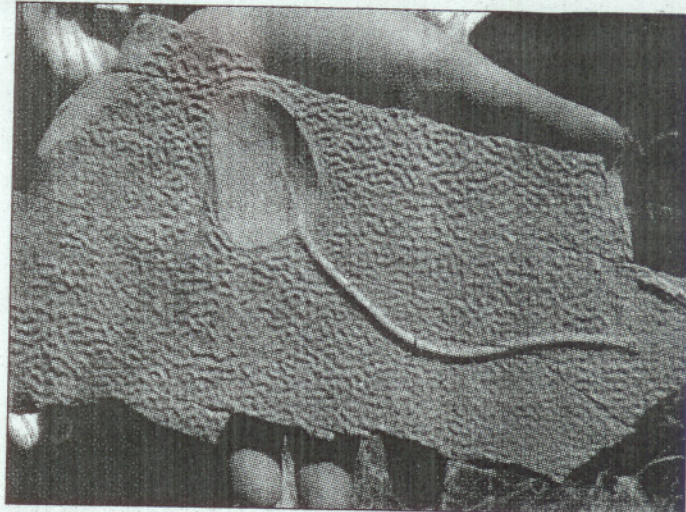
Geologists are calling it an eocrinoid, and it's a life form probably new to science. It was discovered by happy accident last year in a remote stretch of the Grand Canyon.

'It was deposited during time when ... the ancestors of all the modern groups of animals were appearing.'

**CHRISTA
SADLER**

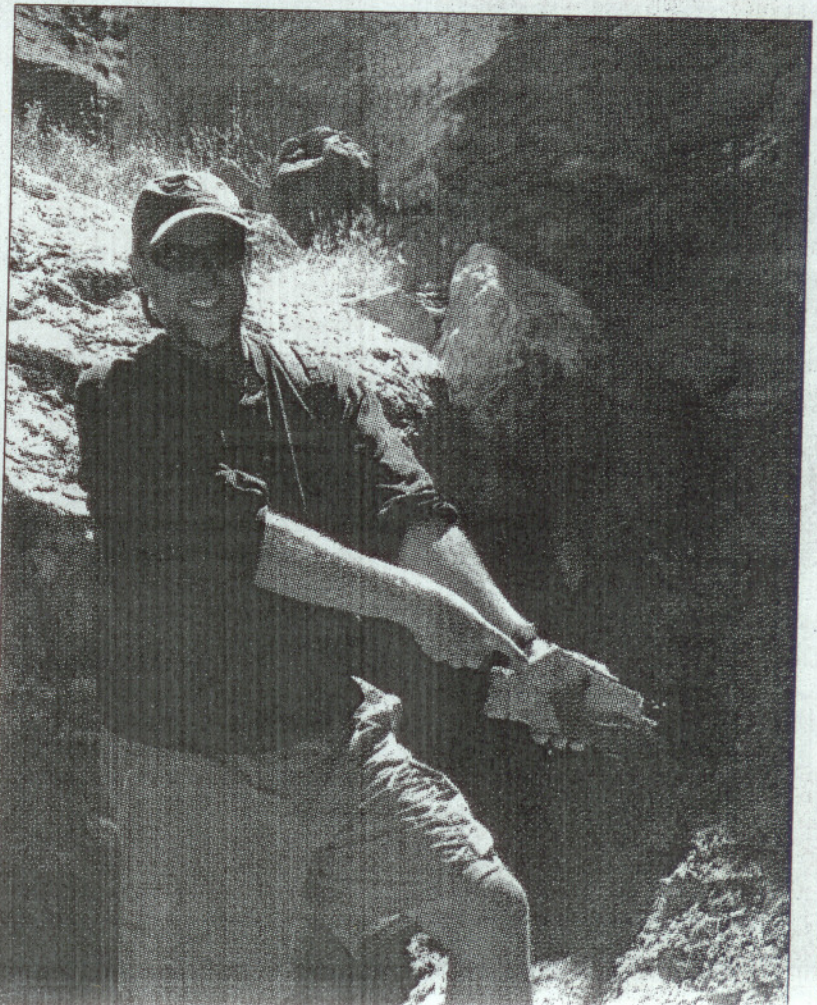
Geologist

"Frankly," Hays added, "I was jumping out of my skin waiting for the rest of the group to catch up so I could show them what the canyon had shared with us. We joked



Courtesy photos

FRANK HAYS, PACIFIC AREA director for the National Park Service, below, points to the fossil he discovered while on a boat trip through the Grand Canyon. Above, the fossilized remains of the six-inch-long, tadpole-like creature are clearly visible above in a piece of Bright Angel Shale.



FOSSIL

from Page A1

that it was some new species that would be named after me.”

The knot of people stood around looking at the hand-sized rock and its well-preserved fossil, about six inches from head to tail.

“The alarming thing about it was that it looked like a huge sperm cell,” Hall said. “We were just like, ‘Man, that’s a big sperm cell.’” Sensing it was an interesting find, they snapped a few digital photos and put the rock back down a little higher in the drainage, where it was less likely to get washed away in a flash flood.

Even then, there was some discussion about taking the fossil or leaving it behind, Hall said. It’s a discussion he and other boatmen know by heart, from urging passengers to respect rocks — and anything else they find in the Canyon — by leaving them there.

“The Park Service philosophy is to leave the resource in place. We didn’t know that this might be an unknown species, but we did think it was a unique find. It’s a neat part of the natural resource. And we thought it should stay in the park,” he said.

And they went on with their tamarisk trip.

The Bright Angel Shale isn’t the Grand Canyon’s oldest rock — the canyon contains layers believed to be up to 1.8 billion years old. Still, laid down about 500 million years ago, it’s old. At that time, the Colorado Plateau hosted a primitive marine environment with lots of worms and trilobites — simple, shelled creatures whose closest modern relative is the horseshoe crab.

Christa Sadler, a Flagstaff geologist, river guide and author of the geology book, “Life in Stone: Fossils of the Colorado Plateau,” said the Bright Angel Shale represents an exciting time in history.

“It was deposited during a time when, really, the ancestors of all the modern groups of animals were appearing and flourishing and diversifying,” she said. “Thirty million years before that, up until right around that time, life had been pretty basic. All of a sudden, in the world’s oceans, we find this massive explosion.”

Finding fossil evidence of the explosion is rare and exciting, she said; the Bright Angel Shale doesn’t keep as good a record as some of the Canyon’s younger rock layers. And this particular record piqued the interest of every scientist who saw it.

First, the photos went to Lori Makarick, Grand Canyon’s inner Canyon vegetation program manager and



To get this photo, go to photos.azdailysun.com

Jake Bacon/Arizona Daily Sun

KATE WATTERS STANDS WITH her husband Dan Hall in front of their Flagstaff home. Hall was a boatman on a scientific trip down the Colorado river when Frank Hays discovered a fossil. Kate was the person who retrieved the fossil from the canyon on a later trip when scientists confirmed that the fossilized organism was a new species.

the director of the tamarisk program.

“I sent the pictures to a couple of people in the park. Everyone who saw it was like, ‘God, that looks like something new,’” Makarick said. One of those people was John Rihs, the Park’s Earth Science Program director.

“I had no idea what it was, and I thought I’d seen most fossil things out there,” he said.

The scientists decided to retrieve the fossil. Hall was headed downriver on an unrelated river trip, so they sent him with a special padded case and specific instructions. But he couldn’t get a GPS reading in the remote canyon that day. He spent an hour looking and gave up.

It wasn’t until last fall that Kate Watters, Hall’s wife and a fellow boatman, was heading downstream on another tamarisk trip. The scientists gave her the same mission, the GPS worked that time, and she brought the rock out of the Canyon. Even then, it was a controversial move, Watters said: “I guess while we were down there, there were e-mails flying all around about it.”

Rihs sent photos of the fossil to geologists at the Flagstaff U.S. Geological survey, Northern Arizona University and the USGS in Menlo Park, Calif., where they’re still being scrutinized. The fossil itself

remains at Grand Canyon’s museum.

Most of the geologists are leaning toward calling the giant spermatozoa an eocrinoid. Eo means dawn. Crinoids, which presumably came later, are related to modern sea urchins and sea stars. Common 250 million to 400 million years ago, crinoids looked like flowers but were animals on stalks, with tentacles to push food into their maws.

Finding a new fossil, especially in the Bright Angel Shale, is rare. But Watters, who is also a botanist, said the tamarisk trips have yielded other discoveries. On the same May trip when Hays discovered the eocrinoid, other volunteers made 15 new plant records.

“They’re not new species to science like they think this fossil is, but they’re new plants that we didn’t know occurred in the Grand Canyon,” she said.

Watters said such discoveries — they’re most common in botany and archeology — are a natural consequence of the kind of backcountry explorations she and others do for the tamarisk project. But they almost always never happen on purpose, she said.

“It’s kind of like anything; you can go back the next day and be like ‘Oh yeah, there they are.’ You’re going to the bathroom and you see it.”



Maureen Oltrogge
02/25/2005 10:22 AM
MST

To:
cc: (bcc: Lori Makarick/GRCA/NPS)
Subject: News Release - GCNP Protects Native Species Through Invasive Plant Management Program



2.25.05 Invasive Weeds Awareness Week.doc



Slimey Tick pool 11-03.jpg
Example of native riparian vegetation

Grand Canyon News Release

Release date: Immediate

Contact(s): Maureen Oltrogge
Phone number: 928-638-7779
Date: February 25, 2005

GRAND CANYON NATIONAL PARK PROTECTS NATIVE SPECIES THROUGH INVASIVE PLANT MANAGEMENT PROGRAM

Park highlights program during National Invasive Weeds Awareness Week

Grand Canyon, AZ - The Sixth Annual National Invasive Weeds Awareness Week occurs February 27th through March 5th. Invasive plants and weeds infest more than 2.6 million acres within the national park system, threatening the complex native ecosystems for which the National Park Service (NPS) serves as guardian and steward. In a coordinated response to the threats that invasive (exotic) plant species pose to biodiversity, the NPS now deploys 17 Exotic Plant Management Teams (EPMT's) throughout the country to assist parks in the inventory, control and monitoring of invasive plants. Many individual parks, particularly the larger ones like Grand Canyon, also have invasive plant management programs.

Grand Canyon National Park began a very active invasive plant management program in 1993, when park biologists noted an increasing number of new plants in the Park. Some species were found far outside of the Park's developed areas and primary trail corridors, the usual areas for invasion. While there were only 116 known invasive plant species in the Park in 1993, there are at least 170 today, comprising about 10% of the total flora.

Grand Canyon National Park's vegetation program focuses control efforts on the highest priority species, including those demonstrating the greatest threats to the Park's native ecosystems and the species for which containment or eradication is feasible. Park staff plan to devote more effort toward prevention with special focus on 1) identifying areas with rich native species diversity, 2) slowing the spread of invasive species into the backcountry of the park, and 3) increasing educational outreach. One of Grand Canyon National Park's most successful invasive species control efforts is the Tamarisk Management and Tributary Restoration Program, which focuses on protecting riparian areas, seeps and springs in the Park. These areas contain extremely valuable habitat for wildlife and plant species, and are among some of the most rare and threatened ecosystems in the Southwest.

Tamarisk (*Tamarix ramosissima*), or salt cedar, is well-known to everyone who has spent any time along rivers in the desert areas of the Southwest. Introduced to the United States in the 19th century as an erosion control agent and

ornamental plant, the highly invasive tamarisk rapidly spread and caused major changes to natural environments as it formed dense monocultures. Tamarisk reached the Grand Canyon area in the 1930s, where it occupied some pre-dam terraces and tributaries. It became a dominant species along the Colorado River following completion of Glen Canyon Dam in 1963.

Although some animals use tamarisk, and humans have used it for erosion control and shade, the impact that tamarisk exerts on native ecosystems are well-documented and present challenges for ecologists trying to preserve and restore riparian habitats. A typical mature tamarisk produces about 600,000 seeds, and a large tamarisk may produce up to 250 million seeds. Tamarisk roots can reach depths of more than 100 feet, exploiting water resources that had once been used by native cottonwoods and willows. Tamarisk often forms dense stands and a thick layer of salty leaf litter, both of which impede the growth of native plant species. As tamarisk invades the beaches, side canyons, and springs in Grand Canyon, native vegetation is crowded out, wildlife is sometimes displaced, and fragile natural and cultural resources become vulnerable from increased fire hazard.

Prior to initiating a tamarisk control effort, park management evaluated the beneficial and adverse impacts of a tamarisk management project to natural, cultural and wilderness resources through a public review process (an Environmental Assessment/ Assessment of Effect). The approved action (the environmentally preferred alternative) includes manual treatment (i.e. hand-pulling) and targeted chemical control of tamarisk in side canyons, tributaries, developed areas, and springs. At this time, the project does not include control of tamarisk along the main river corridor due to the extent of its distribution, the difficulty of control along the 277 miles of the Colorado River within the Park, and the amount of funding required for such an extensive effort.

Grand Canyon's tamarisk control project, which began in fall 2002, has been supported by the Arizona Water Protection Fund, the Colorado River Fund, the Grand Canyon National Park Foundation, the Grand Canyon Wildlands Council, the NPS, and many thousands of hours of volunteer labor. To date, crews have completed work in 70 project areas. In just over two years, crews have removed more than 124,000 tamarisk plants that infested over 4500 acres, with only 12% of the initially controlled plants requiring follow-up treatment. Prior to project implementation, biologists installed a long-term monitoring system that includes 22 transects and 376 fixed photo points to track changes in vegetation. The vegetation transects have allowed biologists to document a 99% reduction of tamarisk cover in treated areas, and an increase in native plants. In many areas where tamarisk trees once formed dense thickets, native species of wildflowers, shrubs and trees now thrive. Park biologists will continue to monitor these project areas for 5-10 years.

For more detailed project information, refer to the Environmental Assessment/Assessment of Effect and project reports posted on the park's webpage (www.nps.gov/grca). If you would like additional information about this project, please contact the park's Inner Canyon Vegetation Program Manager, Lori Makarick at 928-226-0165 or Lori_Makarick@nps.gov. The tamarisk management project is labor-intensive, but a great deal of progress has been made over the past two years largely due to the hard work and dedication of volunteers. The NPS thanks all of the volunteers and welcomes new volunteers to the team. Those interested in this or other Inner Canyon Vegetation Management projects, should visit www.volunteer.gov/gov and look for the volunteer description and apply online.

-NPS-

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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 areas 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 2006-07 (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 250,000 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 2006 through March 2007, crews will be working in side canyons along the Colorado River. Crews will be spending several weeks at Phantom Ranch and Cottonwood Campground to complete tamarisk removal along Bright Angel Creek. They will also be conducting backpacking trips into more remote tributaries.

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 Backcountry Vegetation Program Manager and Project Coordinator at:
Lori_Makarick@nps.gov

If you would like to volunteer to help with this effort, please contact Terra Crampton at the Grand Canyon National Park Foundation, (928)774-1760, or terra@gcnpf.org

Or visit www.gcvolunteers.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 than 30,000 hours of their time to this project.

We thank all of the individual volunteers for making this project a success!



NOTICE

Tamarisk control work takes place between September and 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.

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.

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.



One acre of living saltcedar trees consumes 977,553 gallons of water per year.



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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Volunteers

Volunteering is Grand!

By Joe Jonakin, Restoration Department Volunteer

Opportunities to volunteer abound at Byron Forest Preserve. There are inside activities such as woodworking, or the Tuesday morning work sessions at the Jarrett Center, or helping to maintain the buildings. There are also outside activities such as monitoring bluebird houses (in season) and prairie/savannah restoration (all year). One of the great advantages of

volunteering is that the work hours are extremely adjustable. There is no problem in asking the boss for vacation time; it's always there for the taking.

There are also opportunities to perform similar volunteer work for the National Park Service. A program is in place to assist our national parks called VIP (Volunteers-In-Parks). It is a huge program. In fiscal year 2005, 137,000 volunteers donated 5.2 million hours to our national parks. The VIP website (www.nps.gov/volunteer/) led me to an exciting possibility of working in one of our greatest national parks. I spend a lot of time here at the Forest Preserve working with the prairie and savannah restoration crew, where much of our effort is spent removing woody invasive species. Since I've become such an "expert" at brush removal, when I stumbled across an opportunity to apply my skills in a different setting, I jumped at the chance. Last November, I took some "vacation" from the Forest Preserve and participated in a grand adventure in the Grand Canyon.

The Grand Canyon National Park Foundation sponsors weeklong backpacking trips into the Canyon, Spring and Fall, to control a woody Eurasian invasive, *Tamarix ramosissima* (common name, tamarisk or salt cedar). Tamarisk is a highly invasive tree along waterways in the American Southwest, including the Grand Canyon. While these waterways represent a tiny fraction of the desert landscape, they provide breeding habitat for more than half of southwestern bird species, and are used by almost two-thirds of all vertebrate species during some phase of life. Tamarisk is widespread along the Colorado River corridor and side canyons, displacing native plants and the animals that depend upon them. While it can probably never be eradicated, it can be controlled by volunteers like us.

Qualifications required for these trips: 1) Ability and willingness to haul heavy packs (60 lbs. or so) up and down steep canyon trails. 2) Ability to share work, camp duties, and play with a diverse bunch of fellow crew members (one or two leaders and five or six other volunteers, typically). The Foundation provides the food and tools, volunteers provide the sweat. 3) Ability to thrive in wilderness conditions (with plenty of help from other crew members).

Rewards: 1) Provide a valuable service to the GCNP. According to the GCNP Foundation, to date, over 200,000 tamarisk trees have been removed from over 100 side canyons in the five years the volunteer program has been in place. Volunteers have donated over 20,000 hours toward this end.

2) Develop new friendships. Intense working and living conditions force you to become well acquainted and dependent upon your fellow workers. You will go into the Canyon as an assemblage of individuals, and come out as a closely-knit team.

3) Be privileged to walk through some of the most beautiful and awe-inspiring country in the world. The vast majority of people who visit the Grand Canyon see it from the rims. A few make day trips down and up the more popular and accessible trails. Fewer still make one or two day backpacking trips into the Canyon. As a volunteer, you spend seven or eight days in the Canyon, hike off-trail, and see parts of the Canyon only a handful of people get to see.

If you would like more information you can visit the Grand Canyon volunteers web site at www.gcvolunteers.org, or contact Todd Tucker or me at 1-815-234-8535 ext. 222.



Cleaning out at Tamarisk Patch in Horn Creek Canyon.

"...over 200,000 tamarisk trees have been removed from over 100 side canyons in the five years the volunteer program has been in place"



The November crew after eight days in the Canyon.

Canoe & Kayak
July 2006

Botanical Warfare

A diligent crew of volunteers is battling invasive tamarisk trees on the Colorado.

> **THE RAFTS ARE UNLOADED**, camp is set up, and a group of river-runners walk up one of the Grand Canyon's spectacular side canyons. This isn't just another crew going for a hike, however. These are tamarisk hunters, and they are bent on eliminating *Tamarisk ramosissima*—the dreaded invader of western desert rivers.

Tamarisk trees were introduced to America from the Mediterranean in the mid-1800s. The species flourished in its new home, and now river corridors throughout the Southwest are choked with the invasive trees. Tamarisk trees increase ground salinity, inhibit the growth of native species, displace wildlife, and siphon precious springs. In short, the tamarisk is a nightmare.

Fortunately, the tamarisk is on its way out. Twice a year, the National Park Service rallies several volunteers for a raft trip in The Ditch. The participants raft between

camps, then hike to previously identified tamarisk groves and attack the trees with hatchet, ax, and saw. Before signing up, one should know that these trips are no paid vacations. They are done mostly in winter, and long, cold river days are followed with brutal physical work. Tamarisk trunks must first be dug out from beneath compacted flood debris, and then cut with handsaws. The exposed stumps are painted with herbicide to inhibit regrowth.

The NPS chose Garlon as an effective but low-impact herbicide. It is absorbed by the stumps and kills tamarisk roots, but goes no farther. Without the herbicide treatment, the resilient trees resprout rapidly, and all the saw work is for naught.

So far, native plants have recolonized treated areas, and springs that were nearly sucked dry by tamarisks are returning to historical flows. —Tyler Williams

PHOTO BY TYLER WILLIAMS



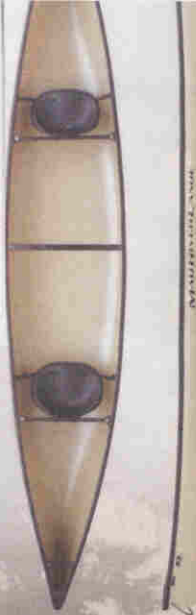
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HORIZO



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 Gairdi

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)* | 11% |
| 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.

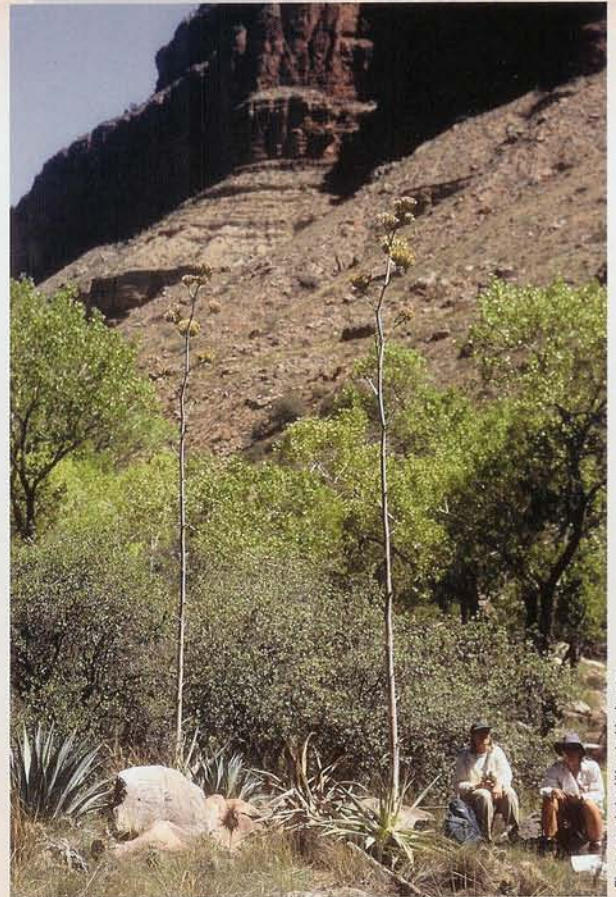
The Canyon's geology is diverse as well, with numerous formations and soil types represented, providing varied ecological niches. The main river system, the Colorado, also acts as a corridor for plant (and gene) dispersal. In addition, nearly 60 other perennial water sources, and numerous seeps and springs 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



Agave phillipsiana, a new species recently named by Wendy from the Grand Canyon.

Photograph by Wendy Hodgson



Proceeding towards Confucius and Mencius temples.

Photograph by Dave Gianci

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 Platform¹ 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

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

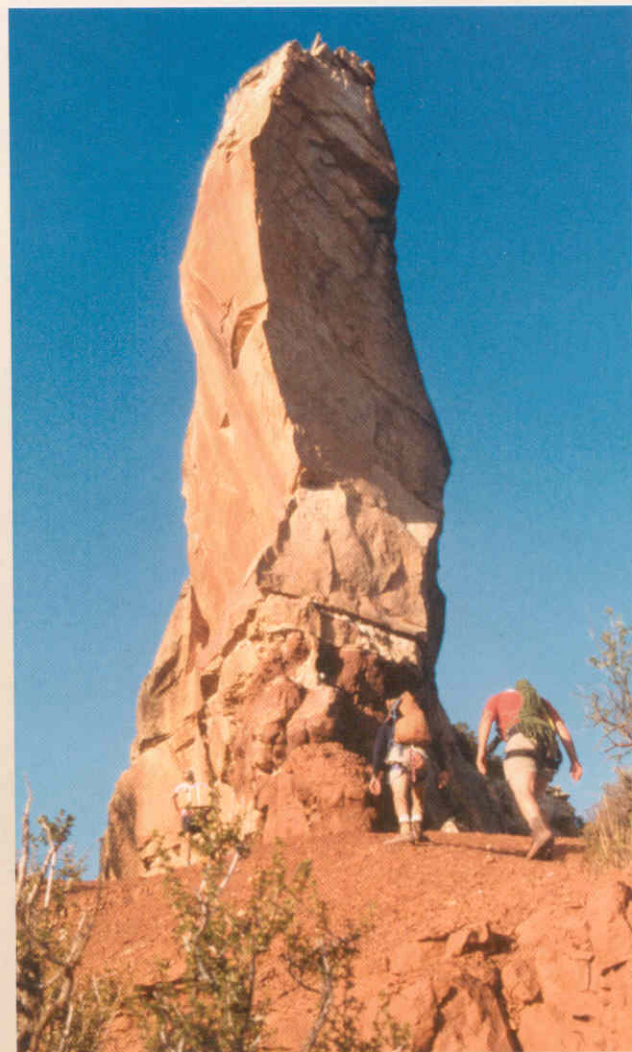


Photograph by Wendy Hodgson

First-ever documented hybrid involving dry-fruit yucca (*Yucca angustissima*) and fleshy-fruited yucca (*Yucca baccata*) in the Grand Canyon.

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 Dave Garcia

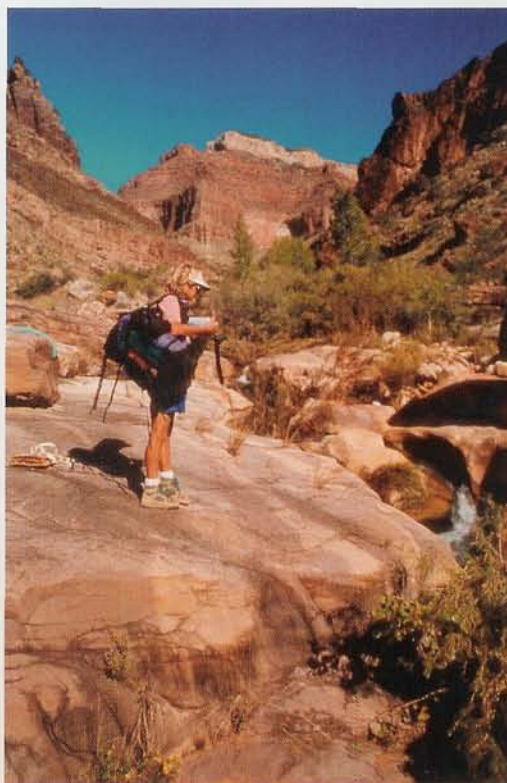
Rock formation before reaching Buddha Temple.

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 abyssii*, 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.

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 list-



Photograph by Dave Ganci

Wendy collecting plants and recording information.

ed 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, *Phacelia 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. ✨

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Verde River Whitewater • Plaza Blanca Badlands • Mancos, CO

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!

FREE!

ORDEALS OF CHOICE

Down The Green River With
WILLIAM LEE MANLY
20 Years Before
JOHN WESLEY POWELL

HUT CAT- & SKIING

We've got 'em
both covered

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



A warrior's tools

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.

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)



The goal: to find and destroy all tamarisk, effectively setting back the invasion into the park by 50 years.



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.gvolunteers.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.



THE SIX LEAST WANTED!

These invasive plants may have interesting traits, but they severely threaten Grand Canyon's native species. Here are a few of the park's most troublesome invaders:



Tamarisk (*Tamarix ramosissima*), a Eurasian tree also known as salt cedar, quickly crowds out native plants, such as willow and cottonwood trees. Once established, tamarisk trees make it tough for native plants to grow—by adding salt to the soil and producing a very thick layer of duff below the trees.



Camelthorn (*Albaga maurorum*), a Eurasian shrub, has roots that can reach a depth of 45 feet, stealing precious ground water from native plants and taking over limited beaches along the Colorado River corridor.



Growing in early spring, the Eurasian plant **Sahara mustard** (*Brassica tournefortii*) can quickly reach a height of more than three feet, out competing native wildflowers. It is rapidly spreading along the Colorado River.



Ravenna grass, (*Saccharum ravennae*), a Eurasian grass found along the river in the park, forms clumps that can grow to ten feet tall and six feet wide. It is highly competitive and provides little habitat for native wildlife.



Cheatgrass (*Bromus tectorum*) and **red brome** (*Bromus rubens*), are Eurasian grasses now widespread in Grand Canyon. They can increase fire frequency and disrupt the growth of native grasses and forbs. Red brome is shown below.

Which invaders are successful?

Not all non-native species are a problem. Of the 170 exotic plant species found at Grand Canyon, 60 are “target” species because of the threats they pose to native plants and animals. The characteristics of a successful invader include:

Habitat generalists can survive in a variety of environmental conditions, such as wide temperature ranges.

Rapid reproducers have abundant seed production or can spread across a large area via their stems or roots.

Habitat modifiers may alter their environments, such as soil conditions, making habitats inhospitable for native plants.



Can we stop the invasion?

With exotic species comprising about 10 percent of Grand Canyon's total vegetation, the National Park Service (NPS) is getting tough with invaders. In addition to focusing on “target” species, resource managers are working hard at protecting areas rich in native species and backcountry regions where controlling the invaders is still possible.

A success!

The Tamarisk Management and Tributary Restoration Program is one example of the park's aggressive efforts to control invaders. Tamarisk, established along the Colorado River and up tributary canyons, is succumbing to efforts aimed at controlling its spread in the park's side canyons. Program managers have accomplished an almost complete elimination of tamarisk in treated areas and native plants are returning. This successful program was made possible with the help of dedicated volunteers and NPS partners, including the Grand Canyon National Park Foundation, the Grand Canyon Wildlands Council and the Arizona Water Protection Fund.



Cover: invasive tamarisk and native cottonwoods along a Colorado River tributary; photo: Dave Edwards; tamarisk, red bromo; Dave Edwards; camelthorn; Glenn Rink; sahara mustard; Craig Dreemann; Design: Mary Beath

National Park Service
U.S. Department of the Interior

Grand Canyon National Park
Arizona



Fight the Invasion!

Controlling invasive plant species at Grand Canyon National Park

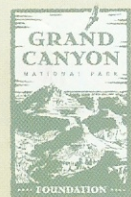
Join in the fight.

Become a volunteer with Grand Canyon's Vegetation Program; go to www.volunteer.gov/gov or www.gcnpf.org for more information.

Give native vegetation a break. Stay on trails and do not disturb the soil.

Learn to recognize invasive species where you live and what you can do to help control their spread.

We all have an integral role to play in protecting our public lands and preserving our world's biodiversity.



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.

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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.

Non-native species, also known as exotic species, are plants and animals that expand their traditional ranges and begin to invade foreign landscapes. Human activities, such as recreation, agriculture and transportation, often assist in their spread. Not all exotic species pose a threat to native ecosystems. But others, known as invasive species, are a global problem that threatens native plants and animals, even in the protected national park lands we all enjoy. Invaders disrupt native ecosystems through the elimination of native species, the alteration of natural processes, and the degradation of habitats.



Invasive Plant Species Observation

Y*ou 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.

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.



Top: mature plant; bottom: flowers.

PHOTOS: GLENN RINK



Mature plant.

PHOTO: NPS

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.



Top: mature plants; bottom: leaves.

PHOTO: ©BARRY RICE/THE NATURE CONSERVANCY PHOTO: NPS

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.

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 volunteers 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!



Top: Ravenna grass with seedhead;
bottom: pampus grass seedhead.



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 (*Shepherdia 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!



Russian olive flowers and leaves.



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.

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.



Tumble mustard.



London rocket.



Perennial sowthistle flower/seedhead.



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!



Spiny sowthistle.



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.

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



PHOTO: M.S.

PHOTO: RIMES H. MILLER

Top: mature plant; bottom: leaves.

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



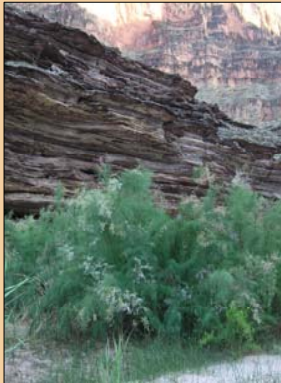
The Arizona Water Protection Fund Commission has funded a portion of this brochure. The views presented are the Grantees' and do not necessarily represent those of the Commission, the State, or the Arizona Department of Water Resources.



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.



Tamarisk monoculture

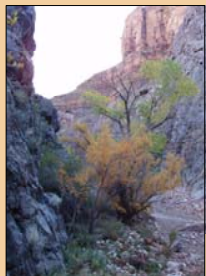


Native riparian habitats are threatened by tamarisk

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

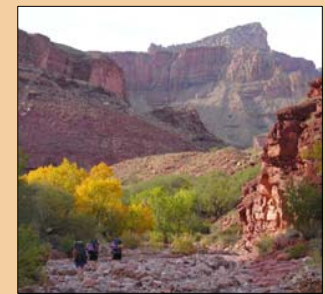
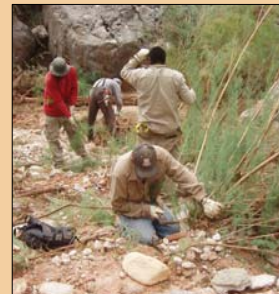


Native plant regrowth

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

Appendix I. Plant Collections and Observations (Made by Wendy Hodgson)

| Plant Species Latin Name | Collection Number | Comments |
|---|-------------------|--|
| Badger Canyon | | |
| <i>Abronia elliptica</i> | 19465 | |
| <i>Achnatherum hymenoides</i> | 20890 | |
| <i>Artemisia ludoviciana</i> ssp. | | |
| <i>Astragalus preussii</i> var. <i>preussii</i> | 19442, 20891 | |
| <i>Astragalus amphioxys</i> var. <i>modestus</i> | 20892 | |
| <i>Astragalus nuttallianus</i> var. <i>imperfectus</i> | 19456 | |
| <i>Astragalus sabulonum</i> | 19455 | documented from 3 sites in Grand Canyon (AZ herbaria) |
| <i>Atriplex garrettii</i> | 21808, 21809 | rare, Coconino Co., southern Utah |
| <i>Brickellia longifolia</i> var. <i>longifolia</i> | | |
| <i>Bromus catharticus</i> | 19469 | |
| <i>Bromus rubens</i> | | |
| <i>Camissonia walkeri</i> ssp. <i>walkeri</i> | 19445 | |
| <i>Chaenactis stevioides</i> | 19451 | |
| <i>Cryptantha</i> spp. | 19458 | |
| <i>Cryptantha angustifolia</i> | 19443 | documented from 4 sites in Park (AZ herbaria) |
| <i>Cryptantha barbigera</i> | 21820 | |
| <i>Cryptantha crassisepala</i> var. <i>elachantha</i> | 19470 | documented from 2 site in Grand Canyon |
| <i>Cryptantha micrantha</i> var. <i>micrantha</i> | 21821 | documented from 3 sites in Grand Canyon (AZ herbaria) |
| <i>Datura wrightii</i> | | documented from 20 sites in Grand Canyon, of which 9 were from near Bright Angel campground by Robert Bye for study (Canyon plants may be new taxon) |
| <i>Dimorphocarpa wislizeni</i> | 19440 | documented from 1 site in Grand Canyon (AZ herbaria) |
| <i>Encelia resinifera</i> ssp. <i>resinifera</i> | 19447 | |
| <i>Ephedra torreyana</i> var. <i>torreyana</i> | 21812 | |
| <i>Ericameria nauseosa</i> ssp. <i>consimilis</i> var. <i>juncea</i> | | |
| <i>Ericameria nauseosa</i> ssp. <i>consimilis</i> var. <i>mohavense</i> | 20958 | otherwise known only from s Nev and s Calif; need verification |
| <i>Eriogonum inflatum</i> | | |
| <i>Euphorbia aaron-rossii</i> | 19453 | rare, endemic |
| <i>Fallugia paradoxa</i> | 19462 | |
| <i>Gilia scopulorum</i> | 21817 | |
| <i>Gilia sinuata</i> | 19446 | |
| <i>Gutierrezia sarothrae</i> | | |
| <i>Ipomopsis polycladon</i> | 19449 | |
| <i>Isocoma acradenia</i> var. <i>eremophila</i> | | |
| <i>Lepidium montanum</i> | 19454 | species not well documented in Az, varieties under study |
| <i>Lepidium lasiocarpum</i> var. <i>lasiocarpum</i> | 19450 | |
| <i>Lupinus brevicaulis</i> | 20956 | documented from 8 sites in Grand Canyon (AZ herbaria) |
| <i>Lycium andersonii</i> var. <i>andersonii</i> | 19436, 21822 | |
| <i>Machaeranthera pinnatifida</i> ssp. <i>pinnatifida</i> | | |

| Plant Species Latin Name | Collection Number | Comments |
|--|-------------------|--|
| <i>Malacothrix glabrata</i> | 19444 | |
| <i>Malacothrix sonchoides</i> | 19467 | documented from one site in Grand Canyon (AZ herbaria) |
| <i>Malcolmia africana</i> | 20893B, 21816 | |
| <i>Nicotiana obtusifolia</i> var. <i>obtusifolia</i> | | |
| <i>Oenothera pallida</i> ssp. <i>pallida</i> | 19468 | |
| <i>Opuntia basilaris</i> var. <i>longiareolata</i> | 19461 | |
| <i>Pectocarya heterocarpa</i> | 19457 | documented from 4 sites in Grand Canyon (AZ herbaria) |
| <i>Phacelia crenulata</i> var. <i>corrugata/angustifolia</i> | 19441, 21814 | |
| <i>Plagiobothrys jonesii</i> | 19459 | documented from 4 sites in Grand Canyon (AZ herbaria) |
| <i>Plantago patagonica</i> | 19464, 21819 | |
| <i>Prenanthes exigu</i> | 21815 | documented from 7 sites in Grand Canyon (AZ herbaria) |
| <i>Salsola</i> spp. | | |
| <i>Schismus arabicus</i> | 19439 | |
| <i>Sphaeralcea parvifolia</i> | 21810 | |
| <i>Sphaeralcea grossulariifolia</i> ssp. | 19463, 21811 | documented from 7 sites in Grand Canyon(AZ herbaria) |
| <i>Sphaeralcea leptophylla</i> | 19460 | New to Park |
| <i>Sphaeralcea rusbyi</i> ssp. <i>rusbyi</i> | 19437 | documented from 7 sites Grand Canyon (AZ herbaria) |
| <i>Stanleya pinnata</i> var. <i>pinnata</i> | 19452 | |
| <i>Stephanomeria pauciflora</i> | | |
| <i>Streptanthella longirostris</i> | 19438, 19466 | |
| <i>Tamarix ramosissima</i> | | |
| <i>Thelysperma subnudum</i> var. <i>subnudum</i> | 19448 | documented from 1 site in Grand Canyon (AZ herbaria) |
| <i>Thymophylla pentachaeta</i> var. <i>belenidium</i> | | |
| <i>Tiquilia latior</i> | 21813 | |
| | | |
| 36.5 Mile | | |
| <i>Acacia greggii</i> var. <i>greggii</i> | | |
| <i>Baccharis salicifolius</i> | | |
| <i>Bromus rubens</i> | | |
| <i>Camissonia walkeri</i> ssp. <i>walkeri</i> | | |
| <i>Cercis orbiculata</i> | | |
| <i>Cryptantha barbiger</i> | 21823 | |
| <i>Datura wrightii</i> | | |
| <i>Juncus tenuis</i> | 21828 | |
| <i>Lepidium lasiocarpum</i> var. <i>lasiocarpum</i> | 21824 | |
| <i>Melilotus officinalis</i> | | |
| <i>Nasturtium officinale</i> | 21827 | documented from 7 sites in Grand Canyon (AZ herbaria) |
| <i>Nicotiana obtusifolia</i> var. <i>obtusifolia</i> | | |
| <i>Oenothera caespitosa</i> var. | | |
| <i>Phacelia rotundifolia</i> | 21825 | |
| <i>Pseudognaphalium</i> | | |

| Plant Species Latin Name | Collection Number | Comments |
|--|-------------------|--|
| <i>Veronica anagallis-aquatica</i> | 21826 | |
| Saddle Canyon | | |
| <i>Acacia greggii</i> var. <i>greggii</i> | | |
| <i>Acer negundo</i> var. <i>interius</i> | | |
| <i>Acourtia wrightii</i> | | |
| <i>Adiantum capillus-veneris</i> | | |
| <i>Aquilegia chrysantha</i> | 20908 | |
| <i>Aquilegia chrysantha</i> X <i>A. desertorum</i> | 19533, 20909 | new to Park, under study by Noel Holmgren |
| <i>Atriplex canescens</i> var. <i>canescens</i> | | |
| <i>Berberis fremontii</i> | 19534 | documented from 5 sites in Grand Canyon (AZ herbaria) |
| <i>Brickellia atractyloides</i> | 20913 | |
| <i>Brickellia longifolia</i> var. <i>longifolia</i> | | |
| <i>Bromus tectorum</i> | | |
| <i>Celtis laevigata</i> var. <i>reticulata</i> | | |
| <i>Cercis orbiculata</i> | | |
| <i>Cirsium</i> cf. <i>rydbergii</i> | 20907 | strong affinities with <i>C. rydbergii</i> |
| <i>Cryptantha racemosa</i> | 20911 | |
| <i>Datura wrightii</i> | | |
| <i>Echinocereus engelmannii</i> | 20915 | |
| <i>Encelia farinosa</i> | | |
| <i>Ephedra</i> spp. | | |
| <i>Erigeron concinnus</i> var. <i>concinnus</i> | 19535 | |
| <i>Lepidium lasiocarpum</i> | | |
| <i>Lepidium eastwoodiae</i> Al-Shebaz | 18357, 18359 | Unusual, other collections from Park, need further study, per Andrew Salywon |
| <i>Lycium andersonii</i> var. <i>andersonii</i> | | |
| <i>Malcolmia africana</i> | 19536 | |
| <i>Maurandella antirrhiniflora</i> | | |
| <i>Mimulus cardinalis</i> | | |
| <i>Mirabilis multiflora</i> var. <i>multiflora</i> | 20910 | |
| <i>Opuntia basilaris</i> var. <i>longiareolata</i> | | |
| <i>Opuntia engelmannii</i> var. <i>engelmannii</i> | 19532, 20906 | |
| <i>Opuntia polyacantha</i> var. <i>erinacea</i> | | |
| <i>Parietaria hespera</i> var. <i>hespera</i> | | |
| <i>Prosopis glandulosa</i> var. <i>glandulosa</i> | 20916 | |
| <i>Ptelea trifoliata</i> var. | | |
| <i>Schedonorus phoenix</i> (Scop.) Holub (syn., <i>Lolium arundinaceum</i> [Schreb.] S. Darbyshire) | 18358 | |
| <i>Sisymbrium irio</i> | 19537 | documented from 8 sites in Grand Canyon (AZ herbaria) |
| <i>Sphaeralcea ambigua</i> ssp. <i>ambigua</i> | | documented from 8 sites in Grand Canyon (AZ herbaria) |

| Plant Species Latin Name | Collection Number | Comments |
|---|-------------------|--|
| <i>Stanleya pinnata</i> var. <i>pinnata</i> | | |
| <i>Thymophylla pentachaeta</i> var. <i>belenidium</i> | | |
| <i>Veronica anagallis-aquatica</i> | | |
| <i>Xylorhiza tortifolia</i> var. | 20914 | |
| | | |
| Nankoweap Creek | | |
| <i>Abronia elliptica</i> | | |
| <i>Acacia greggii</i> var. <i>greggii</i> | | |
| <i>Achnatherum hymenoides</i> | 21856 | |
| <i>Achnatherum speciosa</i> | 21837 | |
| <i>Acourtia wrightii</i> | | |
| <i>Adiantum capillus-veneris</i> | | |
| <i>Agave utahensis</i> ssp. <i>kaibabensis</i> | | |
| <i>Allionia incarnata</i> | | |
| <i>Amelanchier utahensis</i> var. <i>utahensis</i> | 21843 | |
| <i>Anulocaulis leisolenus</i> var. <i>leisolenus</i> | 21857 | state-level rare plant, documented from 8 sites in Grand Canyon (DES and GCNP) |
| <i>Apocynum cannabinum</i> | 21871 | documented from 7 sites in Grand Canyon (AZ herbaria) |
| <i>Aristida adscensionis</i> | | |
| <i>Aristida purpurea</i> var. | | |
| <i>Artemisia tridentata</i> var. | 21876 | |
| <i>Artemisia ludoviciana</i> var. | | |
| <i>Astragalus nuttallianus</i> var. <i>imperfectus</i> | 21841, 21862 | often difficult to distinguish from <i>A. emoryanus</i> |
| <i>Astragalus amphioxys</i> var. <i>vespertinus</i> | 21849 | |
| <i>Astragalus lentiginosus</i> var. <i>palans</i> | 21853 | |
| <i>Baccharis salicifolia</i> | | |
| <i>Bothriochloa barbinodis</i> | | |
| <i>Bouteloua curtipendula</i> var. <i>curtipendula</i> | | documented from 9 sites in Grand Canyon (AZ herbaria) |
| <i>Brickellia longifolia</i> var. <i>longifolia</i> | | |
| <i>Bromus rubens</i> | 21851 | |
| <i>Calycoseris parryi</i> | 21867 | |
| <i>Camissonia walkeri</i> ssp. <i>walkeri</i> | | |
| <i>Cercis orbiculata</i> | 21834 | |
| <i>Chaenactis stevioides</i> | | |
| <i>Cirsium neomexicanum</i> | 21865 | |
| <i>Cladium californicum</i> | | |
| <i>Clematis ligusticifolia</i> var. <i>ligusticifolia</i> | 21860 | |
| <i>Cryptantha</i> spp. | | |
| <i>Cryptantha flava</i> | 21846 | sometimes difficult to distinguish from <i>C. confertiflora</i> |
| <i>Cryptantha confertiflora</i> /capitata | | |
| <i>Echinocactus horizonthalonius</i> var. <i>xeranthemoides</i> | | |

| Plant Species Latin Name | Collection Number | Comments |
|--|-------------------|---|
| <i>Echinocereus engelmannii</i> | 21847 | |
| <i>Elymus elymoides</i> | 21854 | |
| <i>Encelia farinosa</i> | | |
| <i>Encelia resinifera</i> ssp. <i>resinifera</i> | 21831 | |
| <i>Ephedra aspera</i> | 21839 | |
| <i>Ephedra torreyana</i> var. <i>torreyana</i> | 21840 | |
| <i>Equisetum</i> spp. | | |
| <i>Ericameria nauseosa</i> ssp. <i>consimilis</i> var. <i>juncea</i> | | |
| <i>Erigeron divergens</i> | | |
| <i>Erigeron utahensis</i> var. <i>sparsifolius</i> | 21838 | rare |
| <i>Eriogonum corymbosum</i> var. | | |
| <i>Eriogonum</i> cf. <i>polycladon</i> | 21868 | documented at 0 sites in Grand Canyon (AZ herbaria) |
| <i>Eriogonum heermannii</i> Durand & Hilgard var. <i>argense</i> Munz (syn., <i>E. h.</i> var. <i>subracemosum</i> [Stokes] Reveal) | | |
| <i>Eriogonum inflatum</i> | 21844 | |
| <i>Eurybia glauca</i> | | |
| <i>Fallugia paradoxa</i> | 21859 | |
| <i>Galium stellatum</i> | | |
| <i>Gutierrezia sarothrae</i> | | |
| <i>Hesperodoria salicina</i> | | rare, endemic to Grand Canyon |
| <i>Hesperostipa comata</i> | 21842 | |
| <i>Juniperus osteosperma</i> | 21873 | |
| <i>Lepidium lasiocarpum</i> | 21861 | |
| <i>Lupinus brevicaulis</i> | | |
| <i>Machaeranthera pinnatifida</i> ssp. <i>pinnatifida</i> | 21835 | |
| <i>Maurandella antirrhiniflora</i> | 21875 | |
| <i>Mentzelia cronquistii</i> | | new to Park, see Christy (1999) |
| <i>Mirabilis multiflora</i> var. <i>multiflora</i> | 21830 | |
| <i>Muhlenbergia asperifolia</i> | 21836 | |
| <i>Nicotiana obtusifolia</i> var. <i>obtusifolia</i> | 21855 | |
| <i>Oenothera elata</i> var. <i>hirsutissima</i> | | |
| <i>Oenothera caespitosum</i> var. <i>marginatum</i> | 21869 | |
| <i>Opuntia basilaris</i> var. <i>longiareolata</i> | 22122 | |
| <i>Opuntia</i> cf. <i>engelmannii</i> X <i>O. phaeacantha</i> | 22120 | |
| <i>Opuntia phaeacantha</i> | 22124 | |
| <i>Opuntia polyacantha erinacea</i> | 22121 | |
| <i>Opuntia</i> cf. <i>polyacantha</i> var. <i>erinacea</i> X <i>O. phaeacantha</i> | 22123 | |
| <i>Oxytenia acerosa</i> | | |
| <i>Penstemon palmeri</i> var. <i>palmeri</i> | | |
| <i>Perityle congesta</i> | | near endemic to Arizona and Grand Canyon, barely extending into extreme southern UT |

| Plant Species Latin Name | Collection Number | Comments |
|---|-------------------|--|
| <i>Phacelia crenulata</i> var. <i>crenulata</i> | 21874 | |
| <i>Phacelia crenulata</i> var. <i>corrugata</i> | 21866 | |
| <i>Plantago patagonica</i> | | |
| <i>Pleuraphis jamesii</i> | 21872 | |
| <i>Pluchea sericea</i> | | |
| <i>Polypogon monspeliensis</i> | 21877 | |
| <i>Populus fremontii</i> | | |
| <i>Prosopis glandulosa</i> var. <i>glandulosa</i> | | |
| <i>Psilostrophe sparsiflora</i> | 21832 | |
| <i>Psoralidium lanceolatum</i> | 21870 | documented from 2 sites in Grand Canyon (AZ herbaria) |
| <i>Ptelea trifoliata</i> var. | | |
| <i>Purshia stansburiana</i> | 21833, 21845 | |
| <i>Quercus turbinella</i> | | |
| <i>Rhus trilobata</i> var. <i>simplicifolia</i> | | |
| <i>Robinia neomexicana</i> var. <i>neomexicana</i> | | |
| <i>Saccharum ravennae</i> | | observed and pulled 2004 |
| <i>Salix exigua</i> | 21863 | |
| <i>Salvia dorrii</i> ssp. <i>dorrii</i> var. | 21858 | |
| <i>Solidago velutina</i> | | |
| <i>Sphaeralcea ambigua</i> ssp. <i>ambigua</i> | 21829 | |
| <i>Sphaeralcea grossulariifolia</i> ssp. | | |
| <i>Stephanomeria pauciflora</i> | | |
| <i>Stanleya pinnata</i> var. <i>pinnata</i> | 21852 | |
| <i>Thamnosma montanum</i> | | |
| <i>Thymophylla pentachaeta</i> var. <i>belenidium</i> | | |
| <i>Tiquilia latior</i> | 21848 | |
| <i>Typha domingensis</i> | 21850 | need leaf bases to compare with <i>T. angustifolia</i> |
| <i>Vitis arizonica</i> | 21864 | |
| <i>Xylorhiza tortifolia</i> var. | | |
| <i>Yucca baccata</i> | | |
| | | |
| Kwagunt Creek | | |
| <i>Anulocaulis leisolenus</i> var. <i>leisolenus</i> | 18222 | state-level rare plant |
| <i>Aquilegia desertorum</i> | 21878 | rare, may be new species |
| <i>Mentzelia cronquistii</i> | 18221 | often misidentified |
| <i>Robinia neomexicana</i> var. <i>neomexicana</i> | | |
| <i>Salvia columbariae</i> | | extensive range disjunct, new to Coconino Co. and Grand Canyon; not collected, may have been carried by indigenous peoples |
| <i>Sporobolus giganteus</i> | 18360 | |
| <i>Tiquilia latior</i> | 18220 | |
| | | |

| Plant Species Latin Name | Collection Number | Comments |
|--|-------------------|--|
| Carbon Creek | | |
| <i>Acacia greggii</i> var. <i>greggii</i> | | |
| <i>Achnatherum speciosum</i> | 19568 | |
| <i>Adenophylla porophylloides</i> | 20953 | |
| <i>Amsinckia menziesii</i> var. <i>intermedia</i> | 19559 | |
| <i>Amsonia tomentosa</i> var. <i>stenophylla</i> | 20949 | rare, documented from 4 sites in Grand Canyon (AZ herbaria) |
| <i>Amsonia tomentosa</i> var. <i>tomentosa</i> | 20950 | rare, documented from 5 sites in Grand Canyon (AZ herbaria) |
| <i>Anulocaulis leisolenus</i> var. <i>leisolenus</i> | 19601 | rare |
| <i>Aristida adscensionis</i> | | |
| <i>Aristida purpurea</i> var. <i>nealleyi</i> | 19567, 20904 | |
| <i>Artemisia ludoviciana</i> var. | | |
| <i>Astragalus amphioxys</i> var. <i>vespertinus</i> | 19572 | |
| <i>Astragalus amphioxys</i> var. <i>modestus</i> | 20920 | |
| <i>Astragalus calycosus</i> var. | | |
| <i>Astragalus emoryanus</i> | 19573 | documented from 3 sites in Grand Canyon sometimes difficult to distinguish from <i>A. nuttallianus</i> |
| <i>Astragalus nuttallianus</i> var. | 20927 | |
| <i>Atriplex canescens</i> var. <i>canescens</i> | 19583 | |
| <i>Atriplex confertifolia</i> | 19594 | |
| <i>Baccharis brachyphylla</i> | 19579, 20935 | documented from 4 sites in Grand Canyon (AZ herbaria) |
| <i>Baccharis sergiloides</i> | | |
| <i>Brickellia atractyloides</i> | 20936 | |
| <i>Brickellia longifolia</i> var. <i>longifolia</i> | | |
| <i>Brickellia microphylla</i> var. <i>scabra</i> | | documented from 7 sites in Grand Canyon (AZ herbaria) |
| <i>Bromus rubens</i> | | |
| <i>Bromus tectorum</i> | | |
| <i>Calochortus ambiguus</i> | | |
| <i>Calycoseris parryi</i> | 19555 | |
| <i>Camissonia chamaenerioides</i> | 19563 | |
| <i>Camissonia walkeri</i> ssp. <i>walkeri</i> | 20947 | |
| <i>Chaenactis stevioides</i> | 20932 | |
| <i>Chorizanthe brevicornu</i> var. <i>brevicornu</i> | 20921 | documented from 5 sites in Grand Canyon (AZ herbaria) |
| <i>Cirsium neomexicanum</i> | 19569, 20946 | |
| <i>Cryptantha angustifolia</i> | 19586 | |
| <i>Cryptantha barbiger</i> | 20944 | |
| <i>Cryptantha</i> cf. <i>capitata</i> | 20949 | rare |
| <i>Cryptantha flava</i> | | |
| <i>Cryptantha maritima</i> | | |
| <i>Cryptantha pterocarya</i> | | |
| <i>Cryptantha racemosa</i> | | |
| <i>Dasyochloa pulchella</i> | | |

| Plant Species Latin Name | Collection Number | Comments |
|--|-------------------|---|
| <i>Descurainia pinnata</i> | 19560 | |
| <i>Draba cuneifolia</i> var. <i>cuneifolia</i> | | |
| <i>Echinocactus polycephalus</i> var. <i>xeranthemoides</i> | 20929, 20952 | |
| <i>Echinocereus engelmannii</i> | 20933 | |
| <i>Encelia farinosa</i> | | |
| <i>Encelia resinifera</i> ssp. <i>resinifera</i> | 19590, 20924 | |
| <i>Ephedra</i> spp. | | |
| <i>Ericameria nauseosa</i> ssp. <i>consimilis</i> var. <i>juncea</i> | | |
| <i>Eriogonum inflatum</i> | 19565, 20938 | |
| <i>Eriogonum trichopes</i> | | |
| <i>Erodium cicutarium</i> | 20928 | |
| <i>Gilia sinuata</i> | 19582, 19564A | |
| <i>Gilia stellata</i> | 19564B, 20942 | reported only from lower Marble Canyon (Phillips, et al. 1987), documented from 5 sites |
| <i>Gutierrezia sarothrae</i> | | |
| <i>Ipomopsis polycladon</i> | 19588 | documented from 8 sites in Grand Canyon (AZ herbaria) |
| <i>Isocoma acradenia</i> var. <i>eremophila</i> | | |
| <i>Langloisia setosissima</i> var. <i>setosissima</i> | 19587 | |
| <i>Layia glandulosa</i> | 10578 | |
| <i>Lepidium lasiocarpum</i> var. <i>lasiocarpum</i> | 19574 | |
| <i>Lycium andersonii</i> | 19571 | |
| <i>Machaeranthera pinnatifida</i> | 20931 | |
| <i>Malacothrix glabrata</i> | 20923 | |
| <i>Mentzelia albicaulis</i> | 19595 | |
| <i>Mentzelia cronquistii</i> | 19581 | |
| <i>Mirabilis laevis</i> (Benth.) Curran var. <i>villosa</i> (Kell.) Spell. (syn., <i>M. bigelovii</i> Gray) | 19585 | |
| <i>Mirabilis multiflora</i> var. <i>multiflora</i> | | |
| <i>Muhlenbergia</i> | | |
| <i>Nicotiana obtusifolia</i> var. <i>obtusifolia</i> | 19589 | |
| <i>Oenothera cavernae</i> | | rare, restricted to nw AZ, se NV, extreme s. UT; documented from 11 sites in Grand Canyon (AZ herbaria) |
| <i>Opuntia basilaris longiareolata</i> | | |
| <i>Opuntia engelmannii</i> var. <i>engelmannii</i> | 20945 | |
| <i>Opuntia phaeacantha</i> | 19598 | |
| <i>Opuntia polyacantha</i> var. <i>erinacea</i> | 20951 | |
| <i>Oxytenia acerosa</i> | 19597 | |
| <i>Phacelia crenulata</i> var. <i>crenulata</i> | 20925 | |
| <i>Phacelia crenulata</i> var. <i>corrugata</i> | 19561, 19596 | |
| <i>Phragmites australis</i> | 19576 | |
| <i>Plantago ovata</i> | 19584 | |

| Plant Species Latin Name | Collection Number | Comments |
|--|---------------------|---|
| <i>Pleuraphis jamesii</i> | 19566, 20937 | |
| <i>Pluchea sericea</i> | 19600 | |
| <i>Populus fremontii</i> | 20941 | |
| <i>Porophyllum gracile</i> | 20948 | |
| <i>Prenanthera exigua</i> | 19558 | |
| <i>Prosopis glandulosa</i> var. <i>torreyana</i> | 19592, 20934, 20939 | |
| <i>Pseudognaphalium</i> | | |
| <i>Psilostrophe sparsiflora</i> | 19557 | |
| <i>Psoralea fremontii</i> var. <i>fremontii</i> | 19575, 20926 | |
| <i>Schismus arabicus</i> | | |
| <i>Schoenoplectus maritimus</i> | 20917 | |
| <i>Senecio flaccidus</i> var. <i>monoensis</i> | 19593 | |
| <i>Silene antirrhina</i> | | |
| <i>Sphaeralcea ambigua</i> var. <i>ambigua</i> | | |
| <i>Sphaeralcea coccinea</i> | 19562 | only collection from Park (AZ herbaria), specimen missing |
| <i>Stanleya pinnata</i> var. <i>pinnata</i> | 20919 | |
| <i>Stephanomeria pauciflora</i> | 20930 | |
| <i>Streptanthella longirostris</i> | 20922 | |
| <i>Stylocline micropoides</i> | 19570 | |
| <i>Suaeda moquinii</i> | 18577, 20918 | |
| <i>Tamarix ramosissima</i> | | |
| <i>Thymophylla pentachaeta</i> var. <i>belenidium</i> | | |
| <i>Tiquilia latior</i> | | |
| <i>Yucca baccata</i> | | |
| <i>Yucca</i> cf. <i>elata</i> | 19599 | |
| | | |
| Unkar Creek | | |
| <i>Acacia greggii</i> var. <i>greggii</i> | | |
| <i>Agave utahensis</i> ssp. <i>kaibabensis</i> | 21914 | |
| <i>Alhagi maurorum</i> | 18363 | |
| <i>Amsinckia menziesii</i> var. <i>intermedia</i> | 21891 | |
| <i>Argemone</i> spp. | 21911 | does not key well, approaches <i>A. arizonica</i> |
| <i>Aristida adscensionis</i> | | |
| <i>Artemisia ludoviciana</i> var. | | |
| <i>Astragalus nuttallianus</i> var. <i>imperfectus</i> | 21883 | |
| <i>Astragalus praelongus</i> var. <i>praelongus</i> | 21904 | |
| <i>Baccharis brachyphylla</i> | 21885 | |
| <i>Brickellia longifolia</i> var. <i>longifolia</i> | | |
| <i>Camissonia walkeri</i> ssp. <i>walkeri</i> | 21899 | |
| <i>Camissonia chamaenerioides</i> | 21923 | |
| <i>Cercis orbiculata</i> | 21907 | |

| Plant Species Latin Name | Collection Number | Comments |
|---|-------------------|---|
| <i>Chaenactis stevioides</i> | 21919 | |
| <i>Chaenactis macrantha</i> | 21886 | |
| <i>Cryptantha barbigera</i> | 21892 | |
| <i>Cryptantha angustifolia</i> | 21897 | |
| <i>Datura wrightii</i> | 21902 | |
| <i>Echinocereus engelmannii</i> | | |
| <i>Elymus elymoides</i> | 21905 | |
| <i>Encelia resinifera</i> ssp. <i>resinifera</i> | 21903 | |
| <i>Encelia resinifera</i> ssp. <i>tenuifolia</i> | 21908 | rare, endemic to Grand Canyon |
| <i>Eriogonum deflexum</i> | 21918 | |
| <i>Eschscholzia minutiflora</i> ssp. <i>minutiflora</i> | 21924 | documented from 4 sites in Grand Canyon (AZ herbaria) |
| <i>Fallugia paradoxa</i> | 21910 | |
| <i>Gutierrezia sarothrae</i> | | |
| <i>Isocoma acradenia</i> var. <i>eremophila</i> | 18362 | |
| <i>Juniperus osteosperma</i> | | |
| <i>Langloisia setosissima</i> ssp. <i>setosissima</i> | 21920 | |
| <i>Lepidium lasiocarpum</i> | 21882 | |
| <i>Mentzelia albicaulis</i> | 21922 | |
| <i>Mimulus guttatus</i> | 21894 | |
| <i>Muhlenbergia asperifolia</i> | 21901 | |
| <i>Muhlenbergia porteri</i> | | documented from 8 sites in Grand Canyon (AZ herbaria) |
| <i>Nicotiana obtusifolia</i> var. <i>obtusifolia</i> | | |
| <i>Opuntia phaeacantha</i> | 21915 | |
| <i>Opuntia polyacantha</i> var. <i>erinacea</i> | 21912 | |
| <i>Parietaria hespera</i> var. <i>hespera</i> | 21913 | |
| <i>Penstemon palmeri</i> var. <i>palmeri</i> | 21906 | |
| <i>Perityle emoryi</i> | 18227 | |
| <i>Phacelia crenulata</i> var. <i>crenulata</i> | 21893, 21890A | |
| <i>Phacelia crenulata</i> var. <i>ambigua</i> | 18226, 21890B | |
| <i>Phacelia rotundifolia</i> | 21921 | |
| Unk . <i>Poaceae</i> | 21888 | send to Dixie Damrel |
| <i>Polypogon viridis</i> (Gouan) Breistr. (syn., <i>P. semiverticillatus</i> [Forsk.] Hyl. | 21896 | |
| <i>Populus fremontii</i> | | |
| <i>Psilostrophe sparsiflora</i> | 21909 | |
| <i>Rhus trilobata</i> var. <i>simplicifolia</i> | 21900 | |
| <i>Salix exigua</i> | 21895 | |
| <i>Silene antirrhina</i> | 21889 | |
| <i>Sphaeralcea rusbyi</i> ssp. <i>rusbyi</i> | 21884 | |
| <i>Stanleya pinnata</i> var. <i>pinnata</i> | 21887 | |
| <i>Typha domingensis</i> | 21898, 21917 | |

| Plant Species Latin Name | Collection Number | Comments |
|--|-------------------|---|
| <i>Yucca baccata</i> | 21916 | |
| Red Canyon | | |
| <i>Abronia elliptica</i> | 20879 | |
| <i>Acacia greggii</i> var. <i>greggii</i> | | |
| <i>Achnatherum hymenoides</i> | | |
| <i>Agave utahensis</i> ssp. <i>kaibabensis</i> | | |
| <i>Aloysia wrightii</i> | 21329 | |
| <i>Amsonia tomentosa</i> var. <i>stenophylla</i> | 9741 | |
| <i>Artemisia ludoviciana</i> var. | | |
| <i>Astragalus calycosum</i> var. | | |
| <i>Atriplex canescens</i> var. <i>canescens</i> | 21333 | |
| <i>Baccharis brachyphylla</i> | 21353 | |
| <i>Baccharis emoryi</i> | 21331 | |
| <i>Bebbia juncea</i> var. <i>aspera</i> | 21341 | |
| <i>Bouteloua curtipendula</i> var. <i>curtipendula</i> | | |
| <i>Brickellia atractyloides</i> | | |
| <i>Brickellia longifolia</i> var. <i>longifolia</i> | | |
| <i>Camissonia walkeri</i> ssp. <i>walkeri</i> | | |
| <i>Cercis orbiculata</i> | | |
| <i>Cheilanthes fendleri</i> | 21324B | new to Park, documented from 2 sites in Grand Canyon |
| <i>Chloracantha spinosa</i> | 21327 | |
| <i>Cryptantha racemosa</i> | 21339 | |
| <i>Dasyochloa pulchella</i> | | |
| <i>Datura wrightii</i> | | |
| <i>Dicoria canescens</i> ssp. <i>brandegei</i> | 21334 | |
| <i>Echinocactus polycephalus</i> var. <i>xeranthemoides</i> | | |
| <i>Encelia farinosa</i> | | |
| <i>Encelia resinifera</i> ssp. <i>resinifera</i> | | |
| <i>Ericameria nauseosa</i> ssp. <i>consimilis</i> var. <i>juncea</i> | | |
| <i>Eschscholzia minutiflora</i> | 9734 | |
| <i>Galium stellatum</i> var. <i>eremicum</i> | | |
| <i>Gutierrezia microcephala</i> | 21355 | |
| <i>Gutierrezia sarothrae</i> | | |
| <i>Isocoma acradenia</i> var. <i>eremophila</i> | 21330 | |
| <i>Lycium andersonii</i> | | |
| <i>Mammillaria grahamii</i> | | documented from 3 sites in Grand Canyon (AZ herbaria) |
| <i>Mammillaria tetrancistra</i> | | documented from 4 sites in Grand Canyon (AZ herbaria) |
| <i>Oenothera elata</i> ssp. <i>hirsutissima</i> | | |
| <i>Oenothera pallida</i> ssp. <i>pallida</i> | 20878 | |
| <i>Opuntia basilaris</i> var. <i>longiareolata</i> | | |

| Plant Species Latin Name | Collection Number | Comments |
|---|---------------------|--|
| <i>Opuntia engelmannii</i> var. <i>engelmannii</i> | | |
| <i>Parthenium incanum</i> | | disjunct Canyon populations, Chihuahuan Desert |
| <i>Phragmites australis</i> | 21326 | |
| <i>Physalis crassifolia</i> var. <i>crassifolia</i> | 21354 | |
| <i>Pleuchea sericea</i> | | |
| <i>Sporobolus contractus</i> | 21335 | |
| <i>Porophyllum gracile</i> | | |
| <i>Prosopis glandulosa</i> var. <i>torreyana</i> | | |
| <i>Purshia stansburiana</i> | | |
| <i>Rhus trilobata</i> var. <i>simplicifolia</i> | | |
| <i>Salsola tragus</i> | 21328 | |
| <i>Solidago velutina</i> | | |
| <i>Sphaeralcea</i> spp. | | |
| <i>Stanleya pinnata</i> var. <i>pinnata</i> | | |
| <i>Tamarix ramosissima</i> | | |
| <i>Thamnosma montana</i> | | |
| <i>Thymophylla pentachaeta</i> var. <i>belenidium</i> | 21332 | |
| <i>Yucca</i> cf. <i>elata</i> | 21321-21324A | |
| | | |
| Hance Creek | | |
| <i>Acacia greggii</i> var. <i>greggii</i> | | |
| <i>Adiantum capillus-veneris</i> | 21722A | |
| <i>Amelanchier utahensis</i> var. <i>covillei</i> | 21686 | |
| <i>Aristida purpurea</i> var. | 21692 | |
| <i>Artemisia ludoviciana</i> | | |
| <i>Astragalus nuttallianus</i> var. <i>imperfectus</i> | 21689, 21694 | |
| <i>Astragalus amphioxys</i> var. <i>vespertinus</i> | 20885 | |
| <i>Astrolepis cochisensis</i> | 21727 | |
| <i>Brickellia longifolia</i> var. <i>longifolia</i> | | |
| <i>Bromus rubens</i> | 21693 | |
| <i>Castilleja angustifolia</i> (Nutt.) G. Don var. <i>dubia</i> A. Nels. (syn., <i>C. chromosa</i> A. Nels.) | 21680, 21708 | |
| <i>Ceanothus greggii</i> var. <i>greggii</i> | 21700 | |
| <i>Cercis orbiculata</i> | 20888, 21696, 21710 | |
| <i>Cheilanthes feei</i> | 21721 | |
| <i>Cladium californicum</i> | 21712 | |
| <i>Claytonia perfoliata</i> | 21726 | |
| <i>Cryptantha capitata</i> | 21695, 21717 | rare |
| <i>Echinocactus polycephalus</i> var. <i>xeranthemoides</i> | 21704 | |
| <i>Echinocereus coccineus</i> | 21711 | |
| <i>Encelia resinifera</i> ssp. <i>resinifera</i> | | |

| Plant Species Latin Name | Collection Number | Comments |
|---|---------------------|---|
| <i>Ephedra torreyana</i> var. <i>torreyana</i> | 21684, 21685 | |
| <i>Eriogonum corymbosum</i> var. | | |
| <i>Eriogonum heermannii</i> var. <i>argense</i> | 21719 | |
| <i>Eriogonum inflatum</i> | | |
| <i>Erodium cicutarium</i> | 21699 | |
| <i>Eschscholzia minutiflora</i> ssp. <i>minutiflora</i> | | |
| <i>Eurybia glauca</i> | | |
| <i>Fendlera rupicola</i> | 21713 | |
| <i>Fraxinus anomala</i> var. <i>lowellii</i> | 21683 | |
| <i>Garrya flavescens</i> var. <i>flavescens</i> | 21724 | documented from 8 sites in Grand Canyon (AZ herbaria) |
| <i>Gutierrezia sarothae</i> | | |
| <i>Hesperodoria salicina</i> | 21722B | |
| <i>Juniperus osteosperma</i> | 21682 | |
| <i>Lathyrus brachycalyx</i> ssp. <i>zionis</i> | 20886, 21690, 21707 | sw UT, extreme nw NM, n AZ; "AZ plants may be new species" (Kearney & Peebles 1964) |
| <i>Mammillaria tetrancistra</i> | 21729 | northernmost extension |
| <i>Microseris lindleyi</i> | 21703, 21709 | |
| <i>Oenothera elata</i> ssp. <i>hirsutissima</i> | 21682 | |
| <i>Opuntia basilaris</i> var. <i>longiareolata</i> | 21730 | |
| <i>Opuntia engelmannii</i> var. <i>engelmannii</i> | | |
| <i>Opuntia polyacantha</i> var. <i>erinacea</i> | 20886 | |
| <i>Penstemon eatonii</i> var. <i>undosus</i> | 21702 | |
| <i>Penstemon palmeri</i> var. <i>palmeri</i> | 21718 | |
| <i>Penstemon utahensis</i> | 21716 | |
| <i>Petrophyton caespitosum</i> | 21720 | |
| <i>Phlox austromontana</i> | 21688, 21714 | |
| <i>Phlox amabilis</i> | 21697, 21723 | near-endemic to AZ, also in sc UT |
| <i>Plantago patagonica</i> | 21698 | |
| <i>Poa fendleriana</i> | 21679, 21687 | |
| <i>Bromus marginatus</i> | 21725 | |
| <i>Populus fremontii</i> | | |
| <i>Psilostrophe sparsiflora</i> | 21725 | |
| <i>Ptelea trifoliata</i> ssp. <i>pallida</i> | 21681 | |
| <i>Purshia stansburiana</i> | 20887 | |
| <i>Rhus trilobata</i> var. <i>simplicifolia</i> | 21701 | |
| <i>Salvia dorrii</i> ssp. <i>dorrii</i> | 21731 | |
| <i>Solidago velutina</i> | | |
| <i>Stanleya pinnata</i> var. <i>pinnata</i> | | |
| <i>Tamarix ramosissima</i> | 21691 | 3-5 large plants, 36d 0.415°N, 111d 57.470°W |
| <i>Thamnosma montana</i> | 21715 | |
| <i>Yucca</i> cf. <i>elata</i> | | |

| Plant Species Latin Name | Collection Number | Comments |
|--|----------------------|---|
| Cottonwood Creek | | |
| <i>Acacia greggii</i> var. <i>greggii</i> | | |
| <i>Acourtia wrightii</i> | 21758 | |
| <i>Agave utahensis</i> ssp. <i>kaibabensis</i> | | |
| <i>Amelanchier utahensis</i> var. <i>covillei</i> | 21771, 21796 | |
| <i>Androsace occidentalis</i> | 21792 | |
| <i>Androstephium brevifolium</i> | 21794 | |
| <i>Anemone tuberosa</i> | 21775 | |
| <i>Artemisia ludoviciana</i> var. | | |
| <i>Astragalus nuttallianus</i> | 21753, 21776B, 21787 | |
| <i>Astragalus newberryi</i> var. <i>blyae</i> | 21788 | if id stands, new to Park |
| <i>Astrolepis cochisensis</i> | 21760 | |
| <i>Baccharis emoryi</i> | | |
| <i>Bernardia myricifolia</i> (Scheele) S. Wats. (syn., <i>B. incana</i> Morton) | 21772 | |
| <i>Boechera fendleri</i> (S. Wats.) W. Weber var. <i>fendleri</i> (syn., <i>Arabis fendleri</i> [Wats.] Greene) | 21750 | |
| <i>Castilleja angustifolia</i> var. <i>dubia</i> | 21784 | |
| <i>Celtis laevigata</i> var. <i>reticulata</i> | 21801 | |
| <i>Chamaesyce albomarginata</i> | 21744 | documented from 0 sites in Grand Canyon (AZ herbaria) |
| <i>Chamaesyce arizonica</i> | 21754 | documented from 6 sites in Grand Canyon (AZ herbaria) |
| <i>Cheilanthes feei</i> | 21757 | |
| <i>Cryptantha capitata</i> | 21772 | |
| <i>Echinocactus polycephalus</i> var. <i>xeranthemoides</i> | 21805 | |
| <i>Echinocereus coccineus</i> | 21806 | |
| <i>Ephedra viridis</i> | 21799, 21800 | does not key well with Ikert-Bond (2003), aff. <i>nevadense</i> |
| <i>Erigeron flagellaris</i> | 21773 | |
| <i>Eriogonum corymbosum</i> var. | | |
| <i>Frangula betulifolia</i> var. <i>obovata</i> | 21780 | |
| <i>Fraxinus anomala</i> var. <i>lowellii</i> | 21798, 21785 | |
| <i>Galium stellatum</i> var. <i>eremicum</i> | 21746 | |
| <i>Galium</i> (annual, need fruit) | 21802 | |
| <i>Garrya wrightii</i> | 21786 | documented from 4 sites in Grand Canyon (AZ herbaria) |
| <i>Gutierrezia sarothrae</i> | | |
| <i>Hedeoma nana</i> ssp. <i>nana</i> | 21751, 21773 | |
| <i>Hesperodoria salicina</i> | 21749 | |
| <i>Imperata breviflora</i> | 21747 | rare in AZ, elsewhere, except CA where it is considered a noxious weed |
| <i>Juniperus osteosperma</i> | | |
| <i>Lappula occidentalis</i> var. <i>occidentalis</i> | 21804 | |

| Plant Species Latin Name | Collection Number | Comments |
|--|-------------------|---|
| <i>Lathyrus brachycalyx</i> ssp. <i>zionis</i> | 21777 | |
| <i>Lepidium densiflorum</i> | 21752 | |
| <i>Muhlenbergia appressa</i> | 21748 | near AZ endemic, rare in San Bernardino Co, CA, new to Park with only 3 collections |
| <i>Opuntia polyacantha</i> var. <i>erinacea</i> | | |
| <i>Oxytenia acerosa</i> | 21776 | |
| <i>Penstemon utahensis</i> | 21778 | |
| <i>Phacelia cryptantha</i> | 21755 | |
| <i>Phlox amabilis</i> | 21774 | |
| <i>Phragmites australis</i> | 21793 | |
| <i>Pholistoma auritum</i> var. <i>arizonicum</i> | 21756 | near AZ endemic, rare in San Bernardino Co, CA; documented from 7 sites in Grand Canyon (AZ herbaria) |
| <i>Pinus edulis</i> | 21779 | |
| <i>Poa fendleriana</i> ssp. | 21783, 21790 | |
| <i>Poa bigelovii</i> | 21791 | |
| <i>Populus fremontii</i> | | |
| <i>Prunus fasciculata</i> var. <i>fasciculata</i> | 21761 | |
| <i>Psilostrophe sparsiflora</i> | | |
| <i>Ptelea trifoliata</i> ssp. <i>pallida</i> | 21797 | |
| <i>Purshia stansburiana</i> | | |
| <i>Rhus trilobata</i> var. <i>simplicifolia</i> | 21782 | |
| <i>Salix laevigata</i> (male) | 21781 | |
| <i>Salix laevigata</i> (female) | 21787 | |
| <i>Solidago velutina</i> | | |
| <i>Sonchus oleraceus</i> | 21759 | |
| <i>Streptanthus carinatus</i> ssp. <i>arizonicus</i> | 21789 | rare in AZ; documented from 0 sites in Grand Canyon (AZ herbaria) |
| <i>Tetranneuris acaulis</i> var. <i>arizonica</i> | 21795 | |
| <i>Yabea microcarpa</i> | 21803 | |
| <i>Yucca</i> cf. <i>elata</i> | | |
| | | |
| Boucher Creek and tributary | | |
| <i>Acacia greggii</i> var. <i>greggii</i> | | |
| <i>Adenophyllum porophylloides</i> | | |
| <i>Adiantum capillus-veneris</i> | 21930 | |
| <i>Agave utahensis</i> ssp. <i>kaibabensis</i> | | |
| <i>Allionia incarnata</i> | | |
| <i>Aquilegia chrysantha</i> | 21934 | |
| <i>Aristida purpurea</i> | | |
| <i>Baccharis sarothroides</i> | | |
| <i>Baccharis sergiloides</i> | | |
| <i>Bebbia juncea</i> var. <i>aspera</i> | | |

| Plant Species Latin Name | Collection Number | Comments |
|---|-------------------|---|
| <i>Berberis haematocarpa</i> | 21942 | |
| <i>Bernardia myricifolia</i> | | |
| <i>Bothriochloa barbinodis/intermedius</i> | | |
| <i>Brickellia atractyloides</i> | | |
| <i>Brickellia coulteri</i> | | near AZ endemic, in sw NM |
| <i>Brickellia longifolia</i> var. <i>longifolia</i> | | |
| <i>Carex curatorum</i> (female) | 21931A | rare in AZ, in s UT |
| <i>Carex curatorum</i> (male) | 21931B | rare in AZ, in s UT |
| <i>Cercis orbiculata</i> | 21927 | |
| <i>Cladium californicum</i> | | |
| <i>Dichanthelium acuminatum</i> var. <i>fasciculatum</i> | 21945 | documented from 3 sites in Grand Canyon |
| <i>Echinocereus engelmannii</i> | | |
| <i>Encelia farinosa</i> | | |
| <i>Encelia resinifera</i> ssp. <i>resinifera</i> | | |
| <i>Ephedra aspera</i> Engelm. ex S. Wats. (syn., <i>E. fasciculata</i> A. Nels.) | 21949 | |
| <i>Epipactis gigantea</i> | 21933 | |
| <i>Erigeron lobatus</i> | 21932 | rare in AZ, common in Grand Canyon |
| <i>Eriogonum inflatum</i> | | |
| <i>Fraxinus anomala</i> var. <i>lowellii</i> | 21935 | |
| <i>Galium stellatum</i> var. <i>eremicum</i> | | |
| <i>Gutierrezia sarothrae</i> | | |
| <i>Hedeoma nana</i> ssp. <i>nana</i> | 21937 | |
| <i>Hesperodoria salicina</i> | | |
| <i>Hesperostipa neomexicana</i> | | |
| <i>Isocoma acradenia</i> var. <i>eremophila</i> | | |
| <i>Physaria purpurea</i> (syn., <i>Lesquerella purpurea</i> [Gray] S. Wats.) | 21938 | |
| <i>Mammillaria tetrancistra</i> | 21928 | |
| <i>Mimulus cardinalis</i> | 21936 | |
| <i>Mirabilis pumila</i> | 21939 | |
| <i>Muhlenbergia asperifolia</i> | | |
| <i>Muhlenbergia porteri</i> | | |
| <i>Nicotiana obtusifolia</i> var. <i>obtusifolia</i> | | |
| <i>Nolina</i> cf. <i>microcarpa</i> | | may represent a new variety or species |
| <i>Opuntia basilaris</i> var. <i>longiareolata</i> | | |
| <i>Opuntia chlorotica</i> | | |
| <i>Parietaria hespera</i> var. <i>hespera</i> | 21946 | |
| <i>Perityle congesta</i> | 21944 | |
| <i>Petrophyton caespitosa</i> | 21929 | |
| <i>Phacelia crenulata</i> | | |

| Plant Species Latin Name | Collection Number | Comments |
|---|--------------------------|--|
| <i>Phacelia crenulata</i> var. <i>ambigua</i> | 21940 | |
| <i>Phacelia filiformis</i> | 21941 | endemic to AZ |
| <i>Physalis crassifolia</i> var. <i>crassifolia</i> | 21939 | |
| <i>Polypogon viridis</i> | 21943 | |
| <i>Populus fremontii</i> | | |
| <i>Psilostrophe sparsiflora</i> | 21947 | |
| <i>Ptelea trifoliata</i> ssp. <i>pallida</i> | 21948 | |
| <i>Rhus trilobata</i> var. <i>simplicifolia</i> | | |
| <i>Salvia dorrii</i> ssp. <i>dorrii</i> | | |
| <i>Stephanomeria pauciflora</i> | | |
| <i>Thymophylla pentachaeta</i> var. <i>belenidium</i> | | |
| <i>Tiquilia canescens</i> var. <i>canescens</i> | | |
| <i>Trixis californica</i> | | |
| <i>Typha domingensis</i> | | |
| <i>Yucca elata</i> | | |
| | | |
| Trail Canyon | | |
| <i>Acacia greggii</i> var. <i>greggii</i> | 19793 | |
| <i>Allionia incarnata</i> | 19772, 19799 | |
| <i>Argythamnia</i> cf. <i>neomexicana</i> | 19761 | |
| <i>Aristida adscensionis</i> | 19749 | |
| <i>Aristida purpurea</i> var. <i>nealleyi</i> | 19736, 19753 | |
| <i>Astragalus nuttallianus</i> | | |
| <i>Baccharis salicifolia</i> | | |
| <i>Baccharis sarothroides</i> | | |
| <i>Baileya multiradiata</i> | 19791 | |
| <i>Bebbia juncea</i> var. <i>aspera</i> | | |
| <i>Brickellia coulteri</i> | 19751 | |
| <i>Brickellia longifolia</i> var. <i>longifolia</i> | | |
| <i>Bromus rubens</i> | | |
| <i>Bromus tectorum</i> | | |
| <i>Camissonia brevipes</i> | 19770 | documented from 6 sites in Grand Canyon (AZ herbaria) |
| <i>Camissonia</i> cf. <i>multijuga</i> | 19743 | |
| <i>Camissonia refracta</i> | 19755, 19794 | represents an upriver extension; documented from 6 sites in Grand Canyon (AZ herbaria) |
| <i>Camissonia walkeri</i> ssp. <i>walkeri</i> | | |
| <i>Cheilanthes feei</i> | 19733, 19758 | |
| <i>Cirsium neomexicanum</i> | 19734 | |
| <i>Cryptantha barbigera</i> | | |
| <i>Cryptantha maritima</i> var. | 19744 | |
| <i>Cryptantha racemosa</i> | 19774 | |

| Plant Species Latin Name | Collection Number | Comments |
|---|-------------------|---|
| <i>Cylindropuntia acanthocarpa</i> var. <i>coloradensis</i> | 21221 | |
| <i>Dasyochloa pulchella</i> | 19737 | |
| <i>Datura wrightii</i> | 19760 | |
| <i>Descurainia pinnata</i> | | |
| <i>Draba cuneifolia</i> var. <i>cuneifolia</i> | | |
| <i>Encelia farinosa</i> | | |
| <i>Ephedra</i> spp. | | |
| <i>Eriastrum diffusum</i> | 19797 | |
| <i>Erigeron divergens</i> | | |
| <i>Erigeron lobatus</i> | 19738 | |
| <i>Eriogonum corymbosum</i> var. | | |
| <i>Eriogonum fasciculatum</i> var. <i>polifolium</i> | 19765 | |
| <i>Eriogonum nidularium</i> | 19781 | pending identification, new to Park |
| <i>Erodium cicutarium</i> | | |
| <i>Eucnide urens</i> | 19731 | |
| <i>Ferocactus cylindraceus</i> var. | 19748 | probably a new variety of <i>F. cylindraceus</i> ; documented from 11 sites in Grand Canyon (AZ herbaria) |
| <i>Funastrum cynanchoides</i> var. | | |
| <i>Galium proliferum</i> | 19741 | documented from 1 other site in Grand Canyon |
| <i>Galium stellatum</i> ssp. <i>eremicum</i> | | |
| <i>Gilia flavocincta</i> var. <i>australis</i> | 19735, 19784 | |
| <i>Glandularia gooddingii</i> | 19789 | |
| <i>Gutierrezia sarothrae</i> | | |
| <i>Hedeoma nana</i> ssp. <i>nana</i> | 19778, 19801 | |
| <i>Hibiscus denudatus</i> | 19762 | documented from 2 sites in Grand Canyon |
| <i>Isocoma acradenia</i> var. <i>eremophila</i> | | |
| <i>Juncus torreyi</i> | 19746 | |
| <i>Langloisia setosissima</i> ssp. <i>setosissima</i> | 19785 | |
| <i>Lappula occidentalis</i> var. <i>occidentalis</i> | 19773 | |
| <i>Larrea tridentata</i> var. <i>tridentata</i> | 19796 | |
| <i>Lepidium lasiocarpum</i> | | |
| <i>Lepidium montanum</i> | 19767 | |
| <i>Linanthus bigelovii</i> | 19732 | |
| <i>Linum lewisii</i> | 19783 | |
| <i>Machaeranthera pinnatifida</i> ssp. <i>pinnatifida</i> | | |
| <i>Mammillaria grahamii</i> | | |
| <i>Maurandella antirrhiniflora</i> | 19775 | |
| <i>Melampodium leucanthum</i> | 19790 | known from two other sites in Grand Canyon |
| <i>Mimulus guttatus</i> | 19786, 19795 | |
| <i>Mirabilis laevis</i> var. | | |
| <i>Mortonia scabrella</i> | 19763 | disjunct from s AZ, n MX, se NM |

| Plant Species Latin Name | Collection Number | Comments |
|--|-------------------|---|
| <i>Muhlenbergia microsperma</i> | | |
| <i>Nemacladus glanduliferus</i> var. <i>orientalis</i> | 19739, 19756 | |
| <i>Nicotiana obtusifolia</i> var. <i>obtusifolia</i> | 19742 | |
| <i>Oenothera caespitosa</i> var. <i>navajoensis</i> | 19769 | new to Park |
| <i>Opuntia basilaris</i> var. <i>basilaris</i> | | |
| <i>Opuntia engelmannii</i> var. <i>engelmannii</i> | | |
| <i>Opuntia engelmannii/phaeacantha</i> | | |
| <i>Orobanche ludoviciana</i> ssp. <i>ludoviciana</i> | 19802 | documented from 3 other sites in Grand Canyon |
| <i>Parietaria hespera</i> var. <i>hespera</i> | | |
| <i>Penstemon palmeri</i> var. <i>palmeri</i> | 19752 | |
| <i>Perityle emoryi</i> | 19788 | |
| <i>Peucephyllum schottii</i> | 19759 | |
| <i>Phacelia crenulata</i> var. <i>ambigua</i> | | |
| <i>Phacelia glechomifolia</i> | 19757, 19776 | endemic to Arizona, rare |
| <i>Phacelia pedicellata</i> | | |
| <i>Phoradendron californicum</i> | | |
| <i>Pleurocoronis pluriseta</i> | 19766 | |
| <i>Pluchea sericea</i> | 19754 | |
| <i>Poa bigelovii</i> | | |
| <i>Polypogon monspeliensis</i> | 19800 | |
| <i>Porophyllum gracile</i> | | |
| <i>Prosopis glandulosus</i> var. <i>torreyana</i> | | |
| <i>Schismus arabicus</i> | | |
| <i>Senecio lemmonii</i> | | new to Park but not collected |
| <i>Senna covesii</i> | | |
| <i>Setaria macrostachya</i> | 19730 | |
| <i>Silene antirrhina</i> | 19771 | |
| <i>Sonchus oleraceus</i> | | |
| <i>Sphaeralcea ambigua</i> ssp. <i>ambigua</i> | 19782 | |
| <i>Sphaeralcea grossulariifolia</i> ssp. | 19740 | |
| <i>Sporobolus contractus</i> | 19764, 19779 | |
| <i>Sporobolus flexuosus</i> | 19768, 19780 | |
| <i>Tamarix ramosissima</i> | | |
| <i>Thymophylla pentachaeta</i> var. <i>belenidium</i> | 19798 | |
| <i>Tiquilia canescens</i> | 19777 | |
| <i>Tridens muticus</i> var. <i>muticus</i> | 19792 | |
| <i>Trixis californica</i> | 19750 | |
| <i>Typha domingensis</i> | 19747 | |
| <i>Viguiera parishii</i> | 19745 | |
| <i>Vulpia octoflora</i> var. | | |
| | | |

| Plant Species Latin Name | Collection Number | Comments |
|--|-------------------|--|
| 225 Mile Canyon | | |
| <i>Abutilon incanum</i> | 19821 | documented from 4 sites in Grand Canyon (AZ herbaria) |
| <i>Acacia greggii</i> var. | | |
| <i>Adenophyllum porophylloides</i> | | |
| <i>Aristida adscensionis</i> | 19810 | |
| <i>Aristida purpurea</i> var. <i>nealleyi</i> | 19812 | |
| <i>Bebbia juncea</i> var. <i>aspera</i> | | |
| <i>Bernardia myricifolia</i> | 19831 | |
| <i>Bromus rubens</i> | | |
| <i>Camissonia multijuga</i> | | |
| <i>Camissonia walkeri</i> ssp. <i>walkeri</i> | 19819 | |
| <i>Chorizanthe brevicornu</i> var. <i>brevicornu</i> | 19824 | documented from 5 sites in Grand Canyon (AZ herbaria) |
| <i>Cryptantha racemosa</i> | 19806, 19822 | |
| <i>Cryptantha</i> spp. | | |
| <i>Cylindropuntia acanthocarpa</i> | | |
| <i>Cylindropuntia bigelovii</i> | | |
| <i>Dasyochloa pulchella</i> | 19823 | |
| <i>Encelia farinosa</i> | | |
| <i>Ephedra aspera</i> | | |
| <i>Eriogonum fasciculatum</i> var. <i>polifolium</i> | 19814 | |
| <i>Ferocactus cylindraceus</i> var. | 19805 | |
| <i>Fouquieria splendens</i> | | |
| <i>Funastrum cynanchoides</i> var. | | |
| <i>Galium proliferum</i> | 19741 | documented from 2 sites in Grand Canyon (AZ herbaria) |
| <i>Galium stellatum</i> var. <i>eremicum</i> | 19828 | |
| <i>Hesperoyucca newberryi</i> | 19807 | endemic to AZ, Grand Canyon; documented from 7 sites in Grand Canyon (AZ herbaria) |
| <i>Hibiscus denudatus</i> | 19815 | documented from 4 sites in Grand Canyon (AZ herbaria) |
| <i>Isocoma acradenia</i> var. <i>eremophila</i> | | |
| <i>Larrea tridentata</i> var. <i>tridentata</i> | | |
| <i>Lepidium lasiocarpum</i> var. <i>lasiocarpum</i> | 19826 | |
| <i>Lepidium montanum</i> | 19820 | |
| <i>Lycium</i> spp. | | |
| <i>Machaeranthera pinnatifida</i> var. <i>gooddingii</i> | 19813 | |
| <i>Mammillaria grahamii</i> | | |
| <i>Maurandella antirrhiniflora</i> | | |
| <i>Muhlenbergia porteri</i> | 19829 | |
| <i>Nicotiana obtusifolia</i> var. <i>obtusifolia</i> | 19804 | |
| <i>Opuntia basilaris</i> var. <i>basilaris</i> | 19803 | |
| <i>Opuntia chlorotica</i> | | |
| <i>Parietaria pensylvanica</i> | 19830 | |

| Plant Species Latin Name | Collection Number | Comments |
|--|--------------------------|---|
| <i>Penstemon palmeri</i> var. <i>palmeri</i> | | |
| <i>Perityle emoryi</i> | 19818 | |
| <i>Peucephyllum schottii</i> | | |
| <i>Phacelia crenulata</i> var. <i>ambigua</i> | | |
| <i>Phacelia pedicellata</i> | | documented from 8 sites in Grand Canyon (AZ herbaria) |
| <i>Physalis hederifolia</i> | 19817 | |
| <i>Pleurocoronis pluriseta</i> | 19816 | |
| <i>Polypogon monspeliensis</i> | | |
| <i>Porophyllum gracile</i> | | |
| <i>Prosopis glandulosa</i> var. <i>torreyana</i> | | |
| <i>Schismus arabicus</i> | 19827 | |
| <i>Silene antirrhina</i> | | |
| <i>Sonchus oleraceus</i> | | |
| <i>Sphaeralcea</i> spp. | | |
| <i>Sporobolus flexuosus</i> | 19811 | |
| <i>Tiquilia canescens</i> var. <i>canescens</i> | 19809 | documented from 7 sites in Grand Canyon (AZ herbaria) |
| <i>Trixis californica</i> | | |
| <i>Typha domingensis</i> | | |
| <i>Viguiera parishii</i> | 19825 | |

Appendix J - Rare Plant Monitoring Data

Canyon/Park Area: 70.2 Mile Cardenas Hillside Spring

River mile: 70.2 L

Location description: ANULEI 3

Project (Phase): Phase IIa

Easting: 423158 Northing: 3993572 GPS Accuracy (m): 40 Elevation (m):

Site description: From Cardenas Camp take the Escalante Trail upriver and look for the hillside spring with sawgrass and phragmites. Take the dry wash bottom downstream of hillside spring up to the spring.

Dominant species:

Associated species: *Acacia greggii* Gray, *Atriplex canescens* (Pursh) Nutt., *Cladium californicum* (S. Wats.) O'Neill, *Iva acerosa* (Nutt.) R.C. Jackson, *Phragmites australis* (Cav.) Trin. ex Steud., *Sporobolus airoides* (Torr.) Torr., *Suaeda suffrutescens* S. Wats., *Tamarix ramosissima* Ledeb.

Species: *Anulocaulis leiosolenus* (Torr.) Standl.

Date: 5/10/2005

VEGETATION STRUCTURE WITHIN POPULATION

Cover Estimate

Phenology

| | | | |
|--------------------|------|-------------|------|
| Tree Cover: | <1% | Flowering: | % |
| Shrub Cover: | 0% | Fruiting: | % |
| Forb Cover: | <1% | Vegetative: | 100% |
| Graminoid Cover: | 1-5% | | |
| Moss Cover: | 0% | | |
| Lichen Cover: | 0% | | |
| Bare Ground Cover: | >75% | | |
| Soil Crust Cover: | 0% | | |

POPULATION SIZE

Est Num of Individuals: 1 Num of Sub Populations: 0 Size of Area (sq meters): 0

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: Flooding could take this plant out

OTHER COMMENTS

Evidence of Reproductive Success: None seen - only 1 basal rosette seen in the dry wash.

Evidence of Symbiotic or Parasitic Relationship: no

Evidence of Disease Predation or Injury: no

Comments: This was seen on a quick visit to the spring to collect CLACAL, SPOAIR, IVAACE.

Canyon/Park Area: Cardenas Creek

River mile: 71 L

Location description: ANULEI 5

Project (Phase): Phase IIa

Easting: 422318 Northing: 3992872 GPS Accuracy (m): 6 Elevation (m): 901

Site description:

Dominant species: *Bebbia juncea* (Benth.) Greene var. *aspera* Greene, *Eriogonum inflatum* Torr. & Frém., *Phacelia crenulata* Torr. ex S. Wats.

Associated species: *Encelia farinosa* Gray ex Torr.

Species: *Anulocaulis leiosolenus* (Torr.) Standl.

Date: 5/10/2007

VEGETATION STRUCTURE WITHIN POPULATION

| Cover Estimate | Phenology |
|-------------------------|------------------|
| Tree Cover: 0% | Flowering: 100 % |
| Shrub Cover: <1% | Fruiting: % |
| Forb Cover: 1-5% | Vegetative: % |
| Graminoid Cover: 0% | |
| Moss Cover: 0% | |
| Lichen Cover: 0% | |
| Bare Ground Cover: >75% | |
| Soil Crust Cover: 0% | |

POPULATION SIZE

Est Num of Individuals: 7 Num of Sub Populations: 0 Size of Area (sq meters): 250

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: Many flowers seen, should be a good seed production.

Evidence of Symbiotic or Parasitic Relationship:

Evidence of Disease Predation or Injury:

Comments: 2 photos of habitat - also took a few of the plant itself before that. Lisa Hahn also took plant photos.

Canyon/Park Area: Clear Creek

River mile: 84.1 R

Canyon/Park Area: Clear Creek

River mile: 84.1 R

Location description: CARCUR 1

Project (Phase): Phase IIa

Easting: 411695 Northing: 3997647 GPS Accuracy (m): 11 Elevation (m): 1440

Site description: Go up East arm of Clear Creek until almost through Tapeats, turn left in north tributary, 1 km turn left up small side drainage.

Dominant species: Iva acerosa (Nutt.) R.C. Jackson, Phragmites australis (Cav.) Trin. ex Steud.

Associated species: Adiantum capillus-veneris L., Andropogon glomeratus (Walt.) B.S.P., Aquilegia L., Dichanthelium acuminatum (Sw.) Gould & C.A. Clark var. fasciculatum (Torr.) Freckmann, Lobelia cardinalis L., Solidago velutina DC.

Species: *Carex curatorum* Stacey

Date: 9/9/2005

VEGETATION STRUCTURE WITHIN POPULATION

| Cover Estimate | | <u>Phenology</u> | |
|-----------------------|--------|-------------------------|------|
| Tree Cover: | 0% | Flowering: | 0% |
| Shrub Cover: | 0% | Fruiting: | 0% |
| Forb Cover: | 10-25% | Vegetative: | 100% |
| Graminoid Cover: | 10-25% | | |
| Moss Cover: | 1-5% | | |
| Lichen Cover: | 0% | | |
| Bare Ground Cover: | 25-50% | | |
| Soil Crust Cover: | 0% | | |

POPULATION SIZE

Est Num of Individuals: 100 Num of Sub Populations: Size of Area (sq meters): 5

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 Relationship:

Evidence of Disease Predation or Injury:

Comments:

Canyon/Park Area: Clear Creek

River mile: 84.1 R

Location description: CARCUR 2

Project (Phase): Phase IIa

Easting: 409448 Northing: 4000307 GPS Accuracy (m): 12 Elevation (m): 1300

Site description: Up Clear Creek, turn left in canyon above OBI, following most water, stay left in Ariel Canyon well into Muav limestone.

Dominant species: Baccharis emoryi Gray, Cercis occidentalis Torr. ex Gray

Associated species: Cercis occidentalis Torr. ex Gray, Cirsium arizonicum (Gray) Petrak, Clematis spp., Lobelia cardinalis L., Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi, Oenothera elata Kunth ssp. hookeri (Torr. & Gray) W. Dietr. & W.L. Wagner, Phragmites australis (Cav.) Trin. ex Steud., Populus fremontii S. Wats., Quercus turbinella Greene, Schizachyrium scoparium (Michx.) Nash, Solidago velutina DC.

Species: Carex curatorum Stacey

Date: 9/10/2005

VEGETATION STRUCTURE WITHIN POPULATION

| Cover Estimate | Phenology |
|---------------------------|-------------------|
| Tree Cover: 5-10% | Flowering: 0 % |
| Shrub Cover: 5-10% | Fruiting: 0 % |
| Forb Cover: 10-25% | Vegetative: 100 % |
| Graminoid Cover: 25-50% | |
| Moss Cover: <1% | |
| Lichen Cover: <1% | |
| Bare Ground Cover: 10-25% | |
| Soil Crust Cover: 0% | |

POPULATION SIZE

Est Num of Individuals: 500 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:

OTHER COMMENTS

Evidence of Reproductive Success: none

Evidence of Symbiotic or Parasitic Relationship: none

Evidence of Disease Predation or Injury: none

Comments:

Canyon/Park Area: Clear Creek

River mile: 84.1 R

Location description: FRACUS 1

Project (Phase): Phase IIa

Easting: 413062 Northing: 4002375 GPS Accuracy (m): 10 Elevation (m): 1676

Site description: This is 1 mile downstream of Cheyava Falls.

Dominant species: Juniperus osteosperma (Torr.) Little, Ostrya knowltonii Coville, Quercus turbinella Greene

Associated species: Acer negundo L. var. californicum (Torr. & Gray) Sarg., Agave utahensis Engelm., Cercis occidentalis Torr. ex Gray, Cercocarpus intricatus S. Wats., Ephedra spp., Yucca baccata Torr.

Species: *Fraxinus cuspidata* Torr.

Date: 9/11/2005

VEGETATION STRUCTURE WITHIN POPULATION

| Cover Estimate | | <u>Phenology</u> | |
|-----------------------|--------|-------------------------|------|
| Tree Cover: | 1-5% | Flowering: | % |
| Shrub Cover: | 25-50% | Fruiting: | 90 % |
| Forb Cover: | 1-5% | Vegetative: | 10 % |
| Graminoid Cover: | 1-5% | | |
| Moss Cover: | <1% | | |
| Lichen Cover: | <1% | | |
| Bare Ground Cover: | 10-25% | | |
| Soil Crust Cover: | 0% | | |

POPULATION SIZE

Est Num of Individuals: 100 Num of Sub Populations: Size of Area (sq meters): 5E+0

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

Evidence of Symbiotic or Parasitic Relationship: no

Evidence of Disease Predation or Injury: no

Comments:

Canyon/Park Area: Clear Creek

River mile: 84.1 R

Location description: OSTKNO 1

Project (Phase): Phase IIa

Easting: 412600 Northing: 4000650 GPS Accuracy (m): Elevation (m): 1768

Site description: Go to Cheyava Falls

Dominant species: , Acer negundo L. var. californicum (Torr. & Gray) Sarg., Cercis occidentalis Torr. ex Gray, Ostrya knowltonii Coville

Associated species: Adiantum capillus-veneris L., Apocynum cannabinum L., Aquilegia L., Berberis repens Lindl., Cirsium arizonicum (Gray) Petrak, Mimulus cardinalis Dougl. ex Benth.

Species: *Ostrya knowltonii Coville*

Date: 9/11/2005

VEGETATION STRUCTURE WITHIN POPULATION

Cover Estimate

Phenology

| | | | |
|--------------------|--------|-------------|------|
| Tree Cover: | 50-75% | Flowering: | 0 % |
| Shrub Cover: | 1-5% | Fruiting: | 10 % |
| Forb Cover: | 5-10% | Vegetative: | 90 % |
| Graminoid Cover: | 1-5% | | |
| Moss Cover: | <1% | | |
| Lichen Cover: | 0% | | |
| Bare Ground Cover: | 10-25% | | |
| Soil Crust Cover: | <1% | | |

POPULATION SIZE

Est Num of Individuals: 1000 Num of Sub Populations: 1 Size of Area (sq meters): 1E+0

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: Many young trees

Evidence of Symbiotic or Parasitic Relationship: no

Evidence of Disease Predation or Injury: no

Comments:

Canyon/Park Area: Clear Creek

River mile: 84.1 R

Location description: OSTKNO 2

Project (Phase): Phase IIa

Easting: 413062 Northing: 4002375 GPS Accuracy (m): 10 Elevation (m): 1676

Site description: 1 mile downstream of Cheyava Falls

Dominant species: Fraxinus cuspidata Torr., Juniperus osteosperma (Torr.) Little, Ostrya knowltonii Coville, Quercus turbinella Greene

Associated species: Acer negundo L. var. californicum (Torr. & Gray) Sarg., Agave utahensis Engelm., Cercis occidentalis Torr. ex Gray, Cercocarpus intricatus S. Wats., Ephedra spp., Yucca baccata Torr.

Species: *Ostrya knowltonii Coville*

Date: 9/11/2005

VEGETATION STRUCTURE WITHIN POPULATION

| Cover Estimate | | <u>Phenology</u> | |
|-----------------------|--------|-------------------------|---|
| Tree Cover: | 1-5% | Flowering: | % |
| Shrub Cover: | 25-50% | Fruiting: | % |
| Forb Cover: | 1-5% | Vegetative: | % |
| Graminoid Cover: | 1-5% | | |
| Moss Cover: | <1% | | |
| Lichen Cover: | <1% | | |
| Bare Ground Cover: | 10-25% | | |
| Soil Crust Cover: | 0% | | |

POPULATION SIZE

Est Num of Individuals: 400 Num of Sub Populations: Size of Area (sq meters): 3E+0

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: no

Evidence of Symbiotic or Parasitic Relationship: no

Evidence of Disease Predation or Injury: no

Comments:

Canyon/Park Area: Clear Creek

River mile: 84.1 R

Location description: OSTKNO 2

Project (Phase): Phase IIa

Easting: 413062 Northing: 4002375 GPS Accuracy (m): 10 Elevation (m): 1676

Site description: 1 mile downstream of Cheyava Falls

Dominant species: Fraxinus cuspidata Torr., Juniperus osteosperma (Torr.) Little, Ostrya knowltonii Coville, Quercus turbinella Greene

Associated species: Acer negundo L. var. californicum (Torr. & Gray) Sarg., Agave utahensis Engelm., Cercis occidentalis Torr. ex Gray, Cercocarpus intricatus S. Wats., Ephedra spp., Yucca baccata Torr.

Species: *Fraxinus cuspidata Torr.*

Date: 9/11/2005

VEGETATION STRUCTURE WITHIN POPULATION

| Cover Estimate | <u>Phenology</u> |
|---------------------------|-------------------------|
| Tree Cover: 1-5% | Flowering: 0% |
| Shrub Cover: 25-50% | Fruiting: 90% |
| Forb Cover: 1-5% | Vegetative: 10% |
| Graminoid Cover: 1-5% | |
| Moss Cover: <1% | |
| Lichen Cover: <1% | |
| Bare Ground Cover: 10-25% | |
| Soil Crust Cover: 0% | |

POPULATION SIZE

Est Num of Individuals: 100 Num of Sub Populations: Size of Area (sq meters): 5E+0

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: no

Evidence of Symbiotic or Parasitic Relationship: no

Evidence of Disease Predation or Injury: no

Comments: THIS SHOULD BE DELETED OUT OF THE DATABASE BECAUSE IT HAS BEEN MOVED TO FRAC

Canyon/Park Area: Clear Creek

River mile: 84.1 R

Location description: PTEPET 1

Project (Phase): Phase IIa

Easting: 412076 Northing: 3997892 GPS Accuracy (m): 12 Elevation (m): 1440

Site description: Go up east arm of Clear Creek almost thru Tapeats, turn left up North tributary, go 1-1.5 km

Dominant species: Quercus turbinella Greene, Rhus trilobata Nutt.

Associated species: Achnatherum speciosum (Trin. & Rupr.) Barkworth, Artemisia ludoviciana Nutt., Bothriochloa barbinodis (Lag.) Herter, Brickellia longifolia S. Wats., Datura wrightii Regel, Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird, Fallugia paradoxa (D. Don) Endl. ex Torr., Heterotheca villosa (Pursh) Shimmers, Purshia stansburiana (Torr.) Henrickson, Thamnosma montana Torr. & Frém., Yucca baccata Torr.

Species: Pteryxia petraea (M.E. Jones) Coult. & Rose

Date: 9/9/2005

VEGETATION STRUCTURE WITHIN POPULATION

| Cover Estimate | Phenology |
|-------------------------|------------------|
| Tree Cover: 0% | Flowering: 0% |
| Shrub Cover: 1-5% | Fruiting: 0% |
| Forb Cover: 1-5% | Vegetative: 100% |
| Graminoid Cover: <1% | |
| Moss Cover: 0% | |
| Lichen Cover: 0% | |
| Bare Ground Cover: >75% | |
| Soil Crust Cover: 0% | |

POPULATION SIZE

Est Num of Individuals: 1 Num of Sub Populations: 1 Size of Area (sq meters): 1

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: in wash

OTHER COMMENTS

Evidence of Reproductive Success: no

Evidence of Symbiotic or Parasitic Relationship: no

Evidence of Disease Predation or Injury: no

Comments: Subpop = 1 more individual about .5 km upstream.

Canyon/Park Area: Clear Creek

River mile: 84.1 R

Location description: PTEPET 2

Project (Phase): Phase IIa

Easting: 412820 Northing: 4001770 GPS Accuracy (m): Elevation (m): 1615

Site description: Main arm of Clear Creek, 1.1 km past Cheyava falls.

Dominant species: Acer negundo L. var. californicum (Torr. & Gray) Sarg., Fallugia paradoxa (D. Don) Endl. ex Torr., Quercus turbinella Greene

Associated species: Apocynum cannabinum L., Brickellia californica (Torr. & Gray) Gray, Bromus tectorum L., Heterotheca villosa (Pursh) Shinnars, Poa fendleriana (Steud.) Vasey

Species: Pteryxia petraea (M.E. Jones) Coult. & Rose

Date: 9/11/2005

VEGETATION STRUCTURE WITHIN POPULATION

Cover Estimate

Phenology

| | | | |
|--------------------|--------|-------------|-------|
| Tree Cover: | 5-10% | Flowering: | 0 % |
| Shrub Cover: | 5-10% | Fruiting: | 0 % |
| Forb Cover: | 1-5% | Vegetative: | 100 % |
| Graminoid Cover: | 1-5% | | |
| Moss Cover: | 0% | | |
| Lichen Cover: | 0% | | |
| Bare Ground Cover: | 50-75% | | |
| Soil Crust Cover: | 0% | | |

POPULATION SIZE

Est Num of Individuals: 2 Num of Sub Populations: Size of Area (sq meters): 4

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: in wash 1st terrace.

OTHER COMMENTS

Evidence of Reproductive Success: no

Evidence of Symbiotic or Parasitic Relationship: no

Evidence of Disease Predation or Injury: no

Comments: Many populations found in clear creek main arm above Tapeats.

Canyon/Park Area: Clear Creek

River mile: 84.1 R

Location description: PTEPET 3

Project (Phase): Phase IIa

Easting: 412419 Northing: 4000806 GPS Accuracy (m): 9 Elevation (m): 1737

Site description: Go to Muav slope west of Cheyava Falls (the wet one) perennial.

Dominant species: Achnatherum speciosum (Trin. & Rupr.) Barkworth, Eriogonum corymbosum Benth., Quercus gambelii Nutt., Rhus trilobata Nutt.

Associated species: , , Erigeron utahensis Gray, Erigeron utahensis Gray var. sparsifolius (Eastw.) Cronq., Phlox austromontana Coville

Species: Pteryxia petraea (M.E. Jones) Coult. & Rose

Date: 9/11/2005

VEGETATION STRUCTURE WITHIN POPULATION

| Cover Estimate | | <u>Phenology</u> | |
|-----------------------|------|-------------------------|-------|
| Tree Cover: | 0% | Flowering: | 0 % |
| Shrub Cover: | 1-5% | Fruiting: | 0 % |
| Forb Cover: | 1-5% | Vegetative: | 100 % |
| Graminoid Cover: | 1-5% | | |
| Moss Cover: | 0% | | |
| Lichen Cover: | 0% | | |
| Bare Ground Cover: | >75% | | |
| Soil Crust Cover: | 0% | | |

POPULATION SIZE

Est Num of Individuals: 1 Num of Sub Populations: Size of Area (sq meters): 1

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: no

Evidence of Symbiotic or Parasitic Relationship: no

Evidence of Disease Predation or Injury: no

Comments: Many populations found in Clear Creek.

Canyon/Park Area: Clear Creek

River mile: 84.1 R

Location description: PTEPET 4

Project (Phase): Phase IIa

Easting: 412283 Northing: 4000830 GPS Accuracy (m): 13 Elevation (m): 1590

Site description: Slopes (lower Muav) below Cheyava Falls

Dominant species: *Ostrya knowltonii* Coville, *Quercus turbinella* Greene

Associated species: , *Fallugia paradoxa* (D. Don) Endl. ex Torr., *Juniperus osteosperma* (Torr.) Little, *Penstemon* spp., *Philadelphus microphyllus* Gray, *Phlox austromontana* Coville, *Pinus ponderosa* P.& C. Lawson, *Poa fendleriana* (Steud.) Vasey

Species: *Pteryxia petraea* (M.E. Jones) Coult. & Rose

Date: 9/11/2005

VEGETATION STRUCTURE WITHIN POPULATION

| Cover Estimate | Phenology |
|---------------------------|------------------|
| Tree Cover: 10-25% | Flowering: 0% |
| Shrub Cover: 25-50% | Fruiting: 40% |
| Forb Cover: <1% | Vegetative: 60% |
| Graminoid Cover: 10-25% | |
| Moss Cover: <1% | |
| Lichen Cover: 0% | |
| Bare Ground Cover: 25-50% | |
| Soil Crust Cover: 0% | |

POPULATION SIZE

Est Num of Individuals: 50 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:

OTHER COMMENTS

Evidence of Reproductive Success: yes, vegetative and some young, isolated plants

Evidence of Symbiotic or Parasitic Relationship: no

Evidence of Disease Predation or Injury: no

Comments: Other group of 50 m downslope

Canyon/Park Area: Cottonwood Creek

River mile: 80.6 L

Canyon/Park Area: Cottonwood Creek

River mile: 80.6 L

Location description: IMPBRE 1

Project (Phase): Phase IIa

Easting: 410922 Northing: 3988951 GPS Accuracy (m): 13 Elevation (m): 1117

Site description: Grandview trail to Cottonwood, Cottonwood to lower gorge.

Dominant species: Cercis occidentalis Torr. ex Gray, Solidago spp.

Associated species: Bromus rubens L., Bromus tectorum L., Hesperodoria salicina (Blake) Nesom, Isocoma acradenia (Greene) Greene, Oenothera elata Kunth ssp. hookeri (Torr. & Gray) W. Dietr. & W.L. Wagner, Salix exigua Nutt., Sonchus spp.

Species: Imperata brevifolia Vasey

Date: 6/9/2005

VEGETATION STRUCTURE WITHIN POPULATION

Cover Estimate

Phenology

| | | | |
|--------------------|------|-------------|------|
| Tree Cover: | 1-5% | Flowering: | 9 % |
| Shrub Cover: | 1-5% | Fruiting: | 5 % |
| Forb Cover: | 1-5% | Vegetative: | 86 % |
| Graminoid Cover: | 1-5% | | |
| Moss Cover: | <1% | | |
| Lichen Cover: | <1% | | |
| Bare Ground Cover: | >75% | | |
| Soil Crust Cover: | 0% | | |

POPULATION SIZE

Est Num of Individuals: Num of Sub Populations: Size of Area (sq meters): 3

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: no

Evidence of Symbiotic or Parasitic Relationship: no

Evidence of Disease Predation or Injury: no

Comments: Several small clumps less than 1 m.

Canyon/Park Area: Grapevine Creek

River mile: 81.5 L

Canyon/Park Area: Grapevine Creek

River mile: 81.5 L

Location description: CARCUR 3

Project (Phase): Phase IIa

Easting: 407825 Northing: 3988682 GPS Accuracy (m): 16 Elevation (m): 1070

Site description: West arm of Grapevine 1/4 mile below Tonto Trail at Tapeats pouroff.

Dominant species: Populus fremontii S. Wats.

Associated species: Adiantum capillus-veneris L., Andropogon glomeratus (Walt.) B.S.P., Heterotheca villosa (Pursh) Shinners, Iva acerosa (Nutt.) R.C. Jackson, Melilotus officinalis (L.) Lam., Oenothera elata Kunth ssp. hookeri (Torr. & Gray) W. Dietr. & W.L. Wagner, Solidago spp.

Species: Carex curatorum Stacey

Date: 6/10/2005

VEGETATION STRUCTURE WITHIN POPULATION

Cover Estimate

Phenology

| | | | |
|--------------------|------|-------------|------|
| Tree Cover: | <1% | Flowering: | 25 % |
| Shrub Cover: | <1% | Fruiting: | 25 % |
| Forb Cover: | <1% | Vegetative: | 50 % |
| Graminoid Cover: | <1% | | |
| Moss Cover: | <1% | | |
| Lichen Cover: | <1% | | |
| Bare Ground Cover: | >75% | | |
| Soil Crust Cover: | <1% | | |

POPULATION SIZE

Est Num of Individuals: 75 Num of Sub Populations: 1 Size of Area (sq meters): 10

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: some not flowering, presumed immature.

Evidence of Symbiotic or Parasitic Relationship: no

Evidence of Disease Predation or Injury: no

Comments:

Canyon/Park Area: Grapevine Creek

River mile: 81.5 L

Location description: OSTKNO 3

Project (Phase): Phase IIa

Easting: 411000 Northing: 3984626 GPS Accuracy (m): 12 Elevation (m): 1830

Site description: Hop off Grandview Trail at head of Grapevine canyon and go downhill 300 m.

Dominant species: Amelanchier utahensis Koehne, Ostrya knowltonii Coville

Associated species: Phlox austromontana Coville, Pinus edulis Engelm., Pseudotsuga menziesii (Mirbel) Franco

Species: *Ostrya knowltonii Coville*

Date: 6/11/2005

VEGETATION STRUCTURE WITHIN POPULATION

| Cover Estimate | <u>Phenology</u> |
|---------------------------|-------------------------|
| Tree Cover: 25-50% | Flowering: 0 % |
| Shrub Cover: 10-25% | Fruiting: 10 % |
| Forb Cover: 1-5% | Vegetative: 90 % |
| Graminoid Cover: <1% | |
| Moss Cover: <1% | |
| Lichen Cover: <1% | |
| Bare Ground Cover: 25-50% | |
| Soil Crust Cover: 0% | |

POPULATION SIZE

Est Num of Individuals: 200 Num of Sub Populations: Size of Area (sq meters): 1E+0

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: Grandview landslide, alot of momentum just above here

OTHER COMMENTS

Evidence of Reproductive Success: no

Evidence of Symbiotic or Parasitic Relationship: no

Evidence of Disease Predation or Injury: no

Comments:

Canyon/Park Area: Grapevine Creek

River mile: 81.5 L

Location description: SILREC 1

Project (Phase): Phase IIa

Easting: 411379 Northing: 3984404 GPS Accuracy (m): 9 Elevation (m): 1951

Site description: Down Grandview to near base of Coconino.

Dominant species: Fraxinus anomala Torr. ex S. Wats., Philadelphus microphyllus Gray, Symphoricarpos oreophilus Gray

Associated species: , Cercocarpus montanus Raf., Chrysothamnus spp., Delphinium nuttallianum Pritz. ex Walp., Ephedra spp., Galium spp., Garrya spp., Hedeoma spp., Juncus spp., Linum lewisii Pursh, Phlox austromontana Coville, Poa fendleriana (Steud.) Vasey

Species: *Silene rectiramea* B.L. Robins.

Date: 6/8/2005

VEGETATION STRUCTURE WITHIN POPULATION

| Cover Estimate | Phenology |
|---------------------------|------------------|
| Tree Cover: 10-25% | Flowering: 90 % |
| Shrub Cover: 25-50% | Fruiting: 0 % |
| Forb Cover: 5-10% | Vegetative: 10 % |
| Graminoid Cover: 10-25% | |
| Moss Cover: <1% | |
| Lichen Cover: <1% | |
| Bare Ground Cover: 10-25% | |
| Soil Crust Cover: <1% | |

POPULATION SIZE

Est Num of Individuals: 10 Num of Sub Populations: Size of Area (sq meters): 1000

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: about 10% young plants.

Evidence of Symbiotic or Parasitic Relationship: no

Evidence of Disease Predation or Injury: no

Comments:

Canyon/Park Area: Grapevine Creek

River mile: 81.5 L

Location description: SILREC 2

Project (Phase): Phase IIa

Easting: 411200 Northing: 3984770 GPS Accuracy (m): Elevation (m): 2012

Site description: Drop off Grandview Trail into head of Grapevine Canyon about 100 m.

Dominant species: *Abies concolor* (Gord. & Glend.) Lindl. ex Hildebr., *Heuchera parvifolia* Nutt. ex Torr. & Gray, *Mahonia repens* (Lindl.) G. Don, *Quercus gambelii* Nutt., *Symphoricarpos oreophilus* Gray, *Thalictrum fendleri* Engelm. ex Gray

Associated species:

Species: *Silene rectiramea* B.L. Robins.

Date: 6/11/2005

VEGETATION STRUCTURE WITHIN POPULATION

| Cover Estimate | Phenology |
|-------------------------|------------------|
| Tree Cover: 5-10% | Flowering: 100 % |
| Shrub Cover: 1-5% | Fruiting: 0 % |
| Forb Cover: 5-10% | Vegetative: 0 % |
| Graminoid Cover: <1% | |
| Moss Cover: <1% | |
| Lichen Cover: <1% | |
| Bare Ground Cover: >75% | |
| Soil Crust Cover: 0% | |

POPULATION SIZE

Est Num of Individuals: Num of Sub Populations: Size of Area (sq meters): 1000

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: Grandview landslide probably took out a good many.

OTHER COMMENTS

Evidence of Reproductive Success:

Evidence of Symbiotic or Parasitic Relationship:

Evidence of Disease Predation or Injury:

Comments:

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Location description: ANULEI 6

Project (Phase): Phase IIa

Easting: 421237 Northing: 4017009 GPS Accuracy (m): 7 Elevation (m):

Site description: About 2km up the Nankoweap drainage from the Colorado River. This is near transect 2A.

Dominant species: Brickellia longifolia S. Wats., Datura wrightii Regel, Populus fremontii S. Wats., Stephanomeria pauciflora (Torr.) A. Nels.

Associated species:

Species: *Anulocaulis leiosolenus* (Torr.) Standl.

Date: 10/4/2004

VEGETATION STRUCTURE WITHIN POPULATION

| Cover Estimate | | <u>Phenology</u> | |
|-----------------------|--------|-------------------------|-------|
| Tree Cover: | <1% | Flowering: | 100 % |
| Shrub Cover: | <1% | Fruiting: | % |
| Forb Cover: | <1% | Vegetative: | % |
| Graminoid Cover: | <1% | | |
| Moss Cover: | 0% | | |
| Lichen Cover: | 0% | | |
| Bare Ground Cover: | 25-50% | | |
| Soil Crust Cover: | 0% | | |

POPULATION SIZE

Est Num of Individuals: 7 Num of Sub Populations: 2 Size of Area (sq meters): 1

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

Evidence of Symbiotic or Parasitic Relationship: no

Evidence of Disease Predation or Injury: some plants had recent flood water effects but were not buried or uprooting.

Comments: Not previously noted from this side of the canyon.

Canyon/Park Area: Nankoweap Creek

River mile: 52.1 R

Location description: ERIHEE 1

Project (Phase): Phase IIa

Easting: 420972 Northing: 4016925 GPS Accuracy (m): 6 Elevation (m): 948

Site description: 2 miles up Nankoweap drainage in Muav limestone, sandy soil - 5 m from drainage creek

Dominant species: Baccharis emoryi Gray, Bromus rubens L.

Associated species: Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth, Artemisia ludoviciana Nutt., Purshia mexicana (D. Don) Henrickson

Species: *Eriogonum heermannii* Dur. & Hilg. var. *subracemosum* (S. Stokes) Rev Date: 10/22/2005

VEGETATION STRUCTURE WITHIN POPULATION

| Cover Estimate | Phenology |
|--------------------------|------------------|
| Tree Cover: 0% | Flowering: 100 % |
| Shrub Cover: 5-10% | Fruiting: 0 % |
| Forb Cover: 0% | Vegetative: 0 % |
| Graminoid Cover: <1% | |
| Moss Cover: 0% | |
| Lichen Cover: 0% | |
| Bare Ground Cover: 5-10% | |
| Soil Crust Cover: 0% | |

POPULATION SIZE

Est Num of Individuals: 1 Num of Sub Populations: Size of Area (sq meters): 2

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: Slope movement

OTHER COMMENTS

Evidence of Reproductive Success: none

Evidence of Symbiotic or Parasitic Relationship: none

Evidence of Disease Predation or Injury: none

Comments: First time that I saw this plant growing in an area that was no a limestone outcropping.

Canyon/Park Area: Phantom Canyon

River mile: 0

Canyon/Park Area: Phantom Canyon

River mile: 0

Location description: AGAPHI 2

Project (Phase): Phase IIa

Easting: 399139 Northing: 4000706 GPS Accuracy (m): Elevation (m):

Site description: UTM's taken off map. At the confluence of Phantom and Haunted Creeks.

Dominant species: Agave utahensis Engelm. var. kaibabensis (McKelvey) Breitung, Baccharis emoryi Gray, Imperata brevifolia Vasey, Nolina microcarpa S. Wats., Populus fremontii S. Wats., Quercus turbinella Greene, Salix exigua Nutt., Yucca baccata Torr.

Associated species:

Species: Agave phillipsiana W.C. Hodgson

Date: 1/18/2007

VEGETATION STRUCTURE WITHIN POPULATION

| Cover Estimate | Phenology |
|-----------------------|------------------|
| Tree Cover: 0% | Flowering: 0% |
| Shrub Cover: 0% | Fruiting: 0% |
| Forb Cover: 0% | Vegetative: 100% |
| Graminoid Cover: 0% | |
| Moss Cover: 0% | |
| Lichen Cover: 0% | |
| Bare Ground Cover: 0% | |
| Soil Crust Cover: 0% | |

POPULATION SIZE

Est Num of Individuals: 8 Num of Sub Populations: Size of Area (sq meters): 7

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: It was getting late but could not find any seeds. There were 3 plants down on the ground with the obvious paniculate inflorescence. One looked like it was from this year; the other 2 possible from the year before. However, the seed pods (and hence, any seeds) had all completely fallen off.

Evidence of Symbiotic or Parasitic Relationship: None

Evidence of Disease Predation or Injury: None

Comments: The downed plants were from natural causes. The remaining plants all looked healthy and happy. Nothing co

Canyon/Park Area: Roaring Springs Canyon

River mile: 0

Canyon/Park Area: Roaring Springs Canyon

River mile: 0

Location description: ARGARI 1

Project (Phase): Phase IIa

Easting: 405858 Northing: 4007528 GPS Accuracy (m): 14.9 Elevation (m): 1934

Site description: From N. Kaibab Trail below tunnel - drainage that continues to bridge. This is below the Supai tunnel.

Dominant species: Brickellia grandiflora (Hook.) Nutt., Bromus tectorum L., Clematis ligusticifolia Nutt., Solidago spp.

Associated species: , Acer negundo L. var. californicum (Torr. & Gray) Sarg., Acer saccharinum L., Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth, Agave utahensis Engelm., Cercis orbiculata Greene, Eurybia glauca (Nutt.) Nesom, Garrya flavescens S. Wats., Garrya spp., Gutierrezia sarothrae (Pursh) Britt. & Rusby, Heterotheca villosa (Pursh) Shinners, Oenothera elata Kunth, Opuntia phaeacantha Engelm., Populus fremontii S. Wats., Robinia neomexicana Gray

Species: *Argemone arizonica* G.B. Ownbey

Date: 10/5/2005

VEGETATION STRUCTURE WITHIN POPULATION

| Cover Estimate | | <u>Phenology</u> | |
|-----------------------|--------|-------------------------|------|
| Tree Cover: | 1-5% | Flowering: | 0 % |
| Shrub Cover: | 50-75% | Fruiting: | 85 % |
| Forb Cover: | 5-10% | Vegetative: | 15 % |
| Graminoid Cover: | 1-5% | | |
| Moss Cover: | 0% | | |
| Lichen Cover: | 0% | | |
| Bare Ground Cover: | 5-10% | | |
| Soil Crust Cover: | 0% | | |

POPULATION SIZE

Est Num of Individuals: 102 Num of Sub Populations: 1 Size of Area (sq meters): 8000

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: Slope Movement

OTHER COMMENTS

Evidence of Reproductive Success: Yes

Evidence of Symbiotic or Parasitic Relationship: None

Evidence of Disease Predation or Injury: None

Comments: Subpopulation: up side seep 80 m from main pop. Drainage channel extremely difficult to survey with precipi

Canyon/Park Area: South Canyon

River mile: 31.9 R

Canyon/Park Area: South Canyon

River mile: 31.9 R

Location description: ERIHEE 3

Project (Phase): Phase IIa

Easting: 423236 Northing: 4039864 GPS Accuracy (m): 7.1 Elevation (m):

Site description: UTM's in NAD27. Lower South Canyon beach at the base of the Redwall limestone cliffs - growing on rocks.

Dominant species: Brickellia longifolia S. Wats., Salix exigua Nutt.

Associated species: Dasyochloa pulchella (Kunth) Willd. ex Rydb., Datura wrightii Regel, Echinocactus polycephalus Engelm. & Bigelow, Ephedra spp., Opuntia basilaris Engelm. & Bigelow var. longiareolata (Clover & Jotter) L. Benson

Species: *Eriogonum heermannii* Dur. & Hilg. var. *subracemosum* (S. Stokes) Rev Date: 9/1/2004

VEGETATION STRUCTURE WITHIN POPULATION

| Cover Estimate | | <u>Phenology</u> | |
|-----------------------|-----|-------------------------|-------|
| Tree Cover: | <1% | Flowering: | 100 % |
| Shrub Cover: | <1% | Fruiting: | % |
| Forb Cover: | <1% | Vegetative: | % |
| Graminoid Cover: | <1% | | |
| Moss Cover: | 0% | | |
| Lichen Cover: | 0% | | |
| Bare Ground Cover: | 0% | | |
| Soil Crust Cover: | 0% | | |

POPULATION SIZE

Est Num of Individuals: 9 Num of Sub Populations: Size of Area (sq meters): 600

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: Slope water runoff, one plant is adjacent to camp area.

OTHER COMMENTS

Evidence of Reproductive Success:

Evidence of Symbiotic or Parasitic Relationship:

Evidence of Disease Predation or Injury: One entire plant was knocked off cliff, possibly by rock fall.

Comments:

