DATA RESULTS REPORT

for

Forest Canyons Baseline Project: A Water Quality Analysis of Main St. Canyon, Coldwater Creek, Leach Canyon, and Lion Spring

July 2007 to June 2008

Prepared By

Inland Empire **WATERKEEPER®**

3741 Merced Drive, Unit F2, Riverside, CA 92503
(951) 689-6842 ■ www.IEWaterkeeper.org

August 31, 2008

TABLE OF CONTENTS

Executive Summary

Samples were collected from Coldwater Creek, Leach Canyon, Lion Spring and Upper Rd. Detention Basin once a month for 12 months starting in July, 2007 through June, 2008 by staff and volunteers of Inland Empire Waterkeeper. The purpose of the project is to provide baseline water quality data for regulators and agencies to measure impacts to the forest watersheds if future development projects are constructed in the Santa Ana Mountains.

Each month, we collected field observations and field measurements on each creek. Field measurements included air temperature, water temperature, dissolved oxygen, electrical conductivity, pH and flow rate. Field observations were of negligible importance to this report so they are not reported herein, but available upon request. Samples of the creek water were taken back to the Waterkeeper lab for analysis of nutrients (ammonia, nitrate, phosphate), turbidity and bacteria (E.Coli, Total Coliforms and Enterococcus). Twice during the 12-month period we collected additional water samples for analysis by a contract lab for TPH, PAH, TSS and total metals for an understanding of potentially toxic, man-made chemicals.

Findings suggest 3 of the 4 creeks maintain some flow throughout the year, which is critical to surrounding habitat in our desert-like environment. Flow was never observed in Main St. Canyon, even during a rain storm. In terms of aquatic life criteria the quality of water for flowing creeks is relatively high; however, we do no recommend human consumption without some filtering and treatment. We found no detectable amounts of total petroleum hydrocarbons (TPH) or poly-aromatic hydrocarbons (PAH) at any site. The detention basin exceeded the total suspended solids (TSS) action level. Phosphate levels were often exceeding the standard; dissolved oxygen levels were low for the site with most stagnant flow, and conductivity was high where total copper concentrations were high. We also measured one spike of mercury and two spikes of total nickel that exceed threshold. Bacteria concentrations spiked sporadically except for the detention basin that exceeded thresholds for enterococcus, total coliform and E. Coli (fecal coliform) after the rainy season. That same basin had the highest measured levels of ammonia; otherwise, we observed only one spike of ammonia in the creeks, which is likely from an illegal farm upstream.

A biological assessment was performed on Coldwater Creek by Coastkeeper and Waterkeeper staff in April, 2008. After collecting specimens and ranking their importance using the California Streamside Biosurvey method, we assigned the creek a water quality rating of "excellent". The creek contained several "sensitive" species, such as mayflies, stoneflies, and caddisflies (without netspinners); several "intermediate" and "tolerant" species were also identified. An assessment was not appropriate for the other sites because one is a stagnant detention basin (flowing water is required), and the other two are springs with flow that disappears underground within the required length of 300 feet.

<insert map>

Background

The Santa Ana Mountains make up the Trabuco Ranger District of the Cleveland National Forest, which celebrates its Centennial this year. It is also one of the few remaining places of wild, open space in the Inland Empire; however, the integrity of this critical mountain range is threatened by three substantial projects. First, the Lake Elsinore Advanced Pump Storage project (LEAPS), Irvine-Corona Expressway tunnel (ICE) and the 241 Toll Road Extension project. With support from Resources Legacy Fund Foundation, Inland Empire Waterkeeper and Orange County Coastkeeper took on studying the water quality of important creeks that could be affected by these projects.

Inland Empire Waterkeeper focused on the LEAPS and ICE projects on the Riverside County (east) side of the mountains.[1] We began by locating all the named canyons between Corona and Lake Elsinore, followed with site reconnaissance of each to determine the degree of accessibility and other sampling constraints. We then prepared a Quality Assurance Project Plan (QAPP) and put together a Technical Advisory Committee made up of one representative from the U.S. Forest Service, University of California Riverside Department of Environmental Sciences, City of Lake Elsinore and Elsinore Valley Municipal Water District. With their help, we located four viable sampling locations from a list of 10-15 sites:

- Main Street Canyon, Corona
- Coldwater Creek, Corona
- Leach Canyon, Lake Elsinore
- Morrell Canyon (Lion Spring), Lake Elsinore

The purpose of this project is to gather baseline water quality data on native streams that, (1) have no pre-existing data available on them, and (2) could be used in the future to compare to post-construction water quality.

Sampling was performed by teams of volunteers under the guidance of Waterkeeper staff in the morning of the third Saturday of each month. We found that the creek in Main Street Canyon did not flow even during a rainstorm so sampling was moved to the detention basin located downstream at Upper Road. The basin receives flow from both the natural canyon and some residential runoff. Notably, the basin infiltrates at an extremely slow rate (complete drain down far greater than 72 hours) and clearly presented not only a vector source but a failed BMP. The City of Corona Dept. of Water and Power was contacted and they are working with Riverside County Flood Control to improve the infiltration rate of the basin. Also, an agreement could not be reached with the property owner at the mouth of Bedford Canyon, which is where the tunnel is proposed at Cajalco Road. We hope to gain access there sometime in the future. We are thankful for access to Lion Spring by the U.S. Forest Service, Upper Rd. Detention Basin by the Riverside County Flood Control District, Coldwater Creek by the Emissaries of Divine Light, and Leach Canyon by Elsinore Valley Municipal Water District.

[1] The findings of Orange County Coastkeeper on Christianos Creek and San Mateo Creek are available on their Web site, www.coastkeeper.org.

Test Methods

Sampling events included field observations, field measurements and lab analysis. Field work consisted of measuring water and air temperature, dissolved oxygen , pH, and electrical conductivity concentrations and flow rate. Lab analysis consisted of testing for nitrate-nitrogen, phosphate, turbidity and ammonia-nitrogen with a hand-held colorimeter. In addition, we tested for total coliforms, E. Coli, and enterococcus bacteria using the IDEXX Quanti-Tray 2000 procedure with Enterolert and Colilert-18 reagents. Lab space and equipment was provided as an in-kind donation towards theproject by Hydrophix®, located in Riverside.

Sampling teams photographed as often as possible, recorded the date, arrival time, departure time and the following physical observations of the site:

Habitat (dry, wadeable stream, etc.)
Precipitation
Sky (clear, cloudy, etc.)
Wind direction
Wind speed
Water color
Water clarity
Water odor
Sediment color
Sediment composition
Sediment odor
Latitude/Longitude
Elevation
Sample season
Air temperature

Equipment
The following professional-grade meters were purchased and used for this project:

- Dissolved Oxygen and temperature: Extech® heavy duty dissolved oxygen meter
- Electrical Conductivity and temperature: Eutech/Oakton® ECTestr11+ meter
- pH and temperature: Eutech/Oakton® pHTestr 30 meter
- Magellan Explorist 500LE handheld GPS
- CHEMets® Kit for dissolved oxygen (No. K-7512)

Each sampling team was provided a portable cooler with ice in a Ziploc bag (to avoid sample contamination) and 4 sample jars. One 100 mL amber glass jar for nutrient tests, two 100 mL sealed, IDEXX jars pre-filled with sodium thiosulfate (to control for any chlorine residuals), and one sealed 100 mL specimen cup as backup. Funds were not available to purchase one set of meters for each sampling team, so the team going to the creek with the most amount of flow would take the meters, while the other teams would fill the sample cup to bring back to the central hub for measurement with the meters. Since dissolved oxygen meters are not accurate if the water is not flowing, the teams without the meter used a CHEMets Kit (No. K-7512) that gives an approximate concentration in the field.

Since the creeks were found to be consistently small in size, the volume and velocity was measured using the bucket-fill approach (except for the basin, which was stagnant and photographed to estimate volume). This approach is performed by measuring the time required to fill a known volume at a central discharge point of the creek. The bucket was filled five times for an average value. It is a conservative estimate of overall flow, so we multiplied by an adjustment factor of 1.5.

Calibration
The meters were calibrated as dictated by the QAPP within 24 hours of use at the Waterkeeper office using a 3-point standard for pH, 1-point standard for EC and percent O_2 in air for the dissolved oxygen meter. Calibration standards were kept in the dark at room temperature (less than 25°C). The first pH meter became problematic and was replaced free-of-charge by Cole-Parmer in November, 2007.

In-House Lab Analysis
Samples were kept on ice and carried to the lab for analysis as soon as possible after collection (usually within 1-2 hours). Upon arrival, the samples to be tested for nitrate, phosphate, and ammonia were brought to room temperature. Each sample was read by the colorimeter 3 times to get an average value, including one blank per test per site. No duplicates were performed. The samples to be tested for bacteria were kept at 4°C until analysis that occurred within 5 hours of collection. Bacteria testing was performed using the IDEXX Quanti-Tray 2000 method that estimates the mean probable number of bacteria present per 100 mL of sample. The Colilert-18 and Enterolert reagents were added directly to sample and/or dilution of sample and incubated for 18-22 hours or 24-28 hours at 35°C and 41°C, respectively. Dilution was rarely needed but initially done at 1:100 and 1:10; reagents were added to the dilution water before adding the sample to buffer the shock of distilled water on the bacteria.

Contract Lab Analysis
Additional samples were collected in February to determine whether man-made chemicals and metals were present in detectable amounts, and if concentrations exceed human health and/or aquatic life thresholds. Samples for only total metals analysis was also collected in March. Using prepared sampling containers from Microbac laboratory (formerly Centrum Analytical labs), we collected samples for total suspended solids (TSS), total petroleum hydrocarbons[2] (TPH), total metals and polycyclic aromatic hydrocarbons[3] (PAH). Metals can occur naturally, especially at the mouth of a creek coming from a mountain range known to be rich with minerals and metals. Significant mining operations existed on both sides of the range in the early 20th century. However, TPH (gasoline, diesel, oil) and PAH (semi-volatile organic compounds, e.g., pyrene, anthracene, naphthalene, etc.,) concentrations would be extremely rare in a natural creek with a protected watershed. If these chemicals appeared in significant concentrations, we would know that it was not naturally occurring and some investigation upstream would be warranted. Likewise, TSS concentrations are expected to be low for most of the year in natural mountain creeks because it is a measure of the solids suspended in solution that can be filtered out.

[2] 3 sets of carbon chains by GCMS and GC/FID (C_6-C_{12}, C_{12}-C_{22}, C_{22}-C_{40})
[3] 17 different compounds by EPA method 8270C

Results Tables and Discussion.

It is important to understand the thresholds by which we gage success or failure when reading data results. Therefore, we begin with a brief discussion on the thresholds applied to the results of each creek. Thresholds will vary slightly between creeks because they have different beneficial uses assigned to them by the local Regional Water Quality Control Board as shown below:

- Coldwater Creek: **MUN**, **REC1, WARM**, AGR, GWR, , REC2, WILD
- Leach Canyon: Does not have its own uses, but since it would drain into Lake Elsinore, it would need to meet the lake's thresholds, which are **REC1**, **WARM**, REC2, WILD
- Lion Spring: Does not have its own uses, but since it would drain into Morrell Canyon, it would need to meet the Canyon's thresholds, which are **REC1**, **WARM**, **COLD,** AGR, IND, REC2, WILD[4]
- Main Street Canyon: Does not have its own uses, but since it would drain into Reach 1 of Temescal Creek, it would need to meet the Creek's thresholds, which are **REC1**, **WARM**, REC2, WILD

In our case, the uses that apply to determining thresholds are "MUN", "WARM", "COLD", and "REC1". MUN waters may be used for drinking water supply; WARM waters support warm water ecosystems; COLD waters support the more sensitive coldwater ecosystems; and REC1 waters support body contact recreational activities (factors into bacteria limits).

- Obviously, there is no threshold for the air temperature but the water temperature can have a dramatic effect on aquatic organisms due to changes in oxygen concentrations and pH. According to the Basin Plan, COLD streams should not increase by more than 5°F from controllable factors and WARM streams shall not exceed 90°F (32.2°C) from June-October or above 78°F (25.6°C) for rest of year from controllable factors.
- According to the Basin Plan, dissolved oxygen concentrations should not drop below 5 mg/L for WARM waters, or below 6 mg/L for COLD.
- According to (Harter, 2003), electrical conductivity thresholds can be estimated from the TDS (total dissolved solids) objective found in the Basin Plan: [TDS (mg/L) ≈0.65 EC (µS/cm)]. If a TDS value has not been established, a standard of 1000 µS/cm is appropriate.
- According to the Basin Plan, the pH can not drop below 6.5 or exceed 8.5 as a result of controllable factors.

[4] Sample location is within the boundary of the San Diego Regional Board.

- As stated in the Basin Plan, we will use the primary drinking water standard for nitrate (as nitrogen), which is 10 mg/L.

- There is no local standard for phosphate concentrations but EPA recommends a standard of 0.1 mg/L for natural waters. There are limits for chemicals containing phosphate, like fertilizers.

- Turbidity is the clarity of the water and a rough estimate of the suspended and dissolved solids present in the water. The Basin Plan dictates that turbidity shall not increase to negatively impact surface waters, but it provides some guidance that the clearest waters can not increase by more than 20%, moderate waters can not increase by more than 10 units, and the most turbid waters can not increase by 10%. We are unable to compare our results with the Basin Plan numbers because our turbidity units are in FAU units (Basin Plan uses NTU units). After 12 months of observation, we feel that turbidity was raised enough to impact waters in only one location (Upper Rd. Basin in Corona).

- According to the Basin Plan, we will use an ammonia (as nitrogen) threshold for chronic exposure of 0.098 mg/L that includes a 50% safety factor. This was developed for the Santa Ana River system that includes Temescal Creek.

- Flow rate is expressed as gallons per minute (gpm) using the conservative bucket-fill method with a correction factor of 1.5.

- The enterococcus limit is the single-sample maximum of 104 organisms per 100 mL of sample, from California AB 411 (1999).

- Likewise, the total coliform number is the single-sample maximum of 10,000 organisms per 100 mL of sample from California AB 411 (1999).

- Resolution No. R8-2005-0001 by the Santa Ana Regional Water Quality Control Board specifies fecal coliform (or E. Coli) concentrations in a single sample not to exceed 235 organisms per 100 mL of sample.

Each Creek was sampled for Total Metals, PAH, TPH and TSS. The thresholds by which we measure these constituents are in the California Toxics Rule (CTR) that was published in the *Federal Register* on May 18, 2000 (40 CFR 131). There is a small discrepancy between our metals results and the metals thresholds. Our metals results are shown as the total concentration of metals (dissolved plus filterable), whereas the CTR shows thresholds as only dissolved. We wanted to analyze the total concentration of metals so the numbers shown are highly conservative in terms of actual threat to aquatic health.

Coldwater Creek, above Glen Ivy Hot Springs Spa in Corona [33°45' 13.14", -117° 29' 44.76"]													
Sampling Date	**7/28/07**	**8/19/07**	**9/15/07**	**10/20/07**	**11/17/07**	**12/15/07**	**1/19/08**	**2/23/08**	**3/15/08**	**4/19/08**	**5/17/08**	**6/21/08**	***Thresholds***
Air temp (°C)	23	-	18.3°C	-	-	11°C	15.6°C	-	13.9°C		-	27.8°C	-
Water temp (°C)	19.8	22.8	16.9	15	12	9.2	9	9.7	11.2		14.7	18.8	*32.2°C / 25.6°C*
Dissolved oxygen (mg/L)	7.53	7.2	8.2	9.1	7	9.3	10.8	9.9	9		9.6	8	*Less than 6 mg/L*
Conductivity (µS)	**540**	**503**	**494**	**455**	**483**	**486.3**	**507.3**	**389.7**	380		**444**	**461.7**	*384.6 µS*
pH	7.7	7.7	7.9	7.5	7.5	8.3	8.4	8.4	8.5		8.23	8.2	*< 6.5 and > 8.5*
Nitrate-nitrogen (mg/L)	0.63	0.73	1.2	0.5	1.4	1.2	0.7	0.1	1		0.1	0.6	*10 mg/L*
Phosphate (mg/L)	**0.18**	**0.26**	0.05	0.07	**0.11**	0.05	0.06	0.09	0.08	Test failure	**0.11**	**0.12**	*0.1 mg/L*
Turbidity (FAU)	13	0	0	0	1	0	0	0	3		0	0	*Significant visual increase*
Ammonia-nitrogen (mg/L)	0.01	**0.12**	0.02	0 (LIMIT)[a]	0.04	0.00	0.00	0.00	0.01		0.00	0.02	*0.098 mg/L*
Flow rate (gpm)	50	24	56	20	60	115	198	-	-		-	26	-
Enterococcus (mpn)[b]	**117.4 (1:1)**	23.3 (1:1)	12.1 (1:1)	5.1 (1:1)	3.1 (1:1)	11 (1:1)	5.2 (1:1)	1.0 (1:1)	17.5 (1:1)		13.1 (1:1)	**148 (1:10)**	*104 mpn/100mL*
Total coliform (mpn)[b]	3076 (1:10)	1299.7 (1:1)	3654 (1:10)	-	579.4 (1:1)	260.2 (1:1)	435.2 (1:1)	206.3 (1:1)	-		410.6 (1:1)	1553.1 (1:1)	*10,000 mpn/100mL*
E. Coli (mpn)[b]	63 (1:10)	17.1 (1:1)	5.2 (1:1)	-	60.2 (1:1)	1.0 (1:1)	1.0 (1:1)	20.1 (1:1)	-		4.1 (1:1)	27.5 (1:1)	*235 mpn/100mL*

[a] The reading was below the minimum detection limit of the colorimeter.
[b] Results reported are the least diluted that did not exceed maximum measurable concentration. Dilution factor shown in parenthesis.
*Results that exceed threshold are in **bold** and highlighted yellow.*

Beginning with Coldwater Creek, which consistently had the most flow of all the creeks, we find dissolved oxygen concentrations are high but that is to be expected from a flowing creek with many small rapids. Phosphate appeared a little high in the beginning of winter but has dropped to acceptable levels.

Samples from our February visit to Coldwater Creek were also tested for total suspended solids (TSS), total petroleum hydrocarbons (TPH), total metals and polycyclic aromatic hydrocarbons (PAH). March samples were just tested for total metals. Samples were tested by a certified contract laboratory and results compared to the California Toxics Rule. Since the results are shown as the total concentration present, they are highly protective. Results from the total metals tests are shown below:

Coldwater Creek

		Total Metals by ICP (EPA Method 6010B)	
Contaminant	**Thresholds [d]**	**Result 2/23/08 (µg/L)**	**Result 3/15/08 (µg/L)**
Antimony	14 µg/L [a]	ND	ND
Arsenic	CMC: 340 µg/L CCC: 150 µg/L [b]	10*	ND
Barium	2000 µg/L [c]	**54**	**12**
Beryllium	4 µg/L [c]	ND	ND
Cadmium	CMC: 4.3 µg/L CCC: 2.2 µg/L [b]	ND	ND
Total chromium (III and VI)	100 µg/L [c]	**12**	ND
Cobalt	-	ND	ND
Copper	CMC: 13 µg/L CCC: 9.0 µg/L [b]	**71**	**17***
Lead	CMC: 65 µg/L CCC: 2.5 µg/L [b]	ND	ND
Mercury (by EPA Method 7470A)	0.05 µg/L [a]	ND	ND
Molybdenum	-	10*	9*
Nickel	CMC: 470 µg/L CCC: 52 µg/L [b]	**29**	**108**
Selenium	CCC: 5 µg/L [b]	ND	ND
Silver	CMC: 3.4 µg/L [b]	ND	ND
Thallium	1.7 µg/L [a]	ND	ND
Vanadium	-	ND	ND
Zinc	CMC: 120 µg/L CCC: 120 µg/L [b]	94*	113*

[a] California Toxics Rule (CTR) Human Health Criteria for dissolved metals.
[b] CTR Aquatic Life Criteria. Criterion Maximum Concentration and Criterion Continuous Concentration both apply.
[c] EPA National Primary Drinking Water Standards
[d] Thresholds are given as the dissolved fraction of metals (that concentration that remains after filtering)
Asterisk * indicates result greater than minimum detection limit of test, but less than the reporting limit.
Bold numbers indicate a result greater than the reporting limit.
ND means "non-detect" or was not found at or above the reporting limit.

Samples taken on February 23rd were "non-detect" for PAHs, TPHs and TSS. These findings suggest that harmful anthropogenic chemicals have not been introduced into the creek. Since TSS is non-detect, and turbidity was negligible we feel that the results (in the form of "total metals") and the thresholds (in the form of "dissolved metals") are comparable. For both sample events, total copper concentrations exceed both acute and continuous aquatic life criteria, but it may not be all bio-available. Notably, the primary drinking water "action level" is 1300 µg/L so we feel copper concentrations do not threaten human health. In March, the total concentration of nickel exceeded the continuous aquatic life criteria; but it may not be all bio-available. It does not however, exceed the human health criteria of 610 µg/L so we again do not suspect a threat to human health.

Main Street Canyon is a large drainage that we found to never carry runoff, at least at the mouth of the watershed where it emptied into the valley. We were unable to walk further up into the canyon due to private property and dog issues. Even visiting the site in the middle of a hard rain storm we could not find flow in the creek bed. Notably, the site is a popular site for illegal dumping and we hope the City of Corona will respond accordingly. The canyon drains into a large detention basin just above Upper Road before it becomes a concrete-lined box channel. We obtained a key and access approval from Riverside County Flood Control District to enter the basin. Samples were collected by a clean bucket on a rope.

It is important to note this basin did not drain down in the 72-hour period after a storm that is a typical guideline of basin design. It took weeks to drain down several feet of water and therefore contained high levels of bacteria at first, which decreased with time. We suspect it was either compacted during construction, or has sealed due to inadequate maintenance. Not only is this a vector concern but a safety concern in the event of a large storm, the basin would not have adequate capacity resulting in overflow and downstream flooding.

Main Street Canyon and Upper Rd. Detention Basin

	Main Street Canyon, Corona [33° 49' 22.80", -117° 34' 37.44"]							**Upper Rd. Basin** [33°49' 59.94", -117° 34' 10.86"]					***Thresholds***
	7/21/07	**8/19/07**	**9/15/07**	**10/20/07**	**11/17/07**	**12/15/07**	**1/19/08**	**2/23/08**	**3/15/08**	**4/19/08**	**5/17/08**	**6/21/08**	
Air temp (°C)	-	-	-	61°F	-	-	-	61°F	-	-			-
Water temp (°C)								-	-	15.9			*32.2°C / 25.6°C*
Dissolved oxygen (mg/L)								6	6	-			*Less than 5 mg/L*
Conductivity (µS)								376.3	-	-			*1000 uS/cm*
pH								8.1	-	**8.8**			*< 6.5 or > 8.5*
Nitrate-nitrogen (mg/L)								5.3	4	4.6			*10 mg/L*
Phosphate (mg/L)								**1.95**	**1.11**	**0.92**	No Water	No water	*0.10 mg/L*
Turbidity (FAU)	No water	No water	No water	No water	No water	No water	No water	**154**	**98**	**94**			*Significant visual increase*
Ammonia-nitrogen (mg/L)								**0.34**	**0.12**	**0.13**			*0.098 mg/L*
Average flow rate (gpm)								0	0	0			-
Enterococcus (mpn)								**2,014** (1:10)	13.2	8.6 (1:1)			*104 mpn/100mL*
Total coliform (mpn)								**27,550** (1:100)	-	214.2 (1:1)			*10,000 mpn/100mL*
E. coli (mpn)								**410.6** (1:1)	-	4.1 (1:1)			*235 mpn/100mL*

*Results that exceed threshold are in **bold** and highlighted yellow.*

Since very little is contributed to Main Street wash/creek from the forest and canyon area, we can measure how much is contributed from discharges below the canyon but above Upper Road from development and agriculture. The ammonia concentrations were likely a result of human introduction, and high turbidity a result of significant upstream soil erosion. Samples from our February visit to the Upper Road Detention Basin were also tested for total suspended solids (TSS), total petroleum hydrocarbons (TPH), total metals and polycyclic aromatic hydrocarbons (PAH) to further develop the baseline data. Results from the total metals tests are shown below:

Upper Road Detention Basin

		Total Metals by ICP (EPA Method 6010B)	
Contaminant	**Thresholds** [d]	**Results 2/23/08 (µg/L)**	**Result 3/15/08 (µg/L)**
Antimony	14 µg/L [a]	ND	ND
Arsenic	CMC: 340 µg/L CCC: 150 µg/L [b]	ND	ND
Barium	2000 µg/L [c]	**52**	**61**
Beryllium	4 µg/L [c]	ND	ND
Cadmium	CMC: 4.3 µg/L CCC: 2.2 µg/L [b]	ND	ND
Total chromium (III and VI)	100 µg/L [c]	ND	ND
Cobalt	-	ND	ND
Copper	CMC: 13 µg/L CCC: 9.0 µg/L [b]	**21**	14*
Lead	CMC: 65 µg/L CCC: 2.5 µg/L [b]	ND	ND
Mercury (by EPA Method 7470A)	0.05 µg/L [a]	ND	ND
Molybdenum	-	ND	ND
Nickel	CMC: 470 µg/L CCC: 52 µg/L [b]	ND	**27**
Selenium	CCC: 5 µg/L [b]	ND	ND
Silver	CMC: 3.4 µg/L [b]	ND	ND
Thallium	1.7 µg/L [a]	ND	ND
Vanadium	-	ND	ND
Zinc	CMC: 120 µg/L CCC: 120 µg/L [b]	37*	63*

[a] California Toxics Rule (CTR) Human Health Criteria
[b] CTR Aquatic Life Criteria. Criterion Maximum Concentration and Criterion Continuous Concentration both apply.
[c] EPA National Primary Drinking Water Standards
[d] Thresholds are given as the dissolved fraction of metals (that concentration that remains after filtering)
Asterisk * indicates result greater than minimum detection limit of test, but less than the reporting limit.
Bold numbers indicate a result greater than the reporting limit.
ND means "non-detect" or was not found at or above the reporting limit.

Copper concentrations exceed acute and continuous aquatic life criteria, but no other metals appear to exist in levels that could damage aquatic life. All results were "non-detect" for PAHs and TPHs. TSS was above the project action limit of 70 mg/L at 77 mg/L. This is clearly evident by the dark color of the basin water and high turbidity levels.

Leach Canyon, Lake Elsinore [33° 40'35.10", -117° 25' 14.58"]												
	8/19/07	**9/15/07**	**10/20/07**	**11/17/07**	**12/15/07**	**1/19/08**	**2/23/08**	**3/15/08**	**4/19/08**	**5/17/08**	**6/21/08**	***Threshold***
Air temp (°C)	-	-	-		-	-	-					-
Water temp (°C)	Puddled water, but no flowing water. Too little to sample	No water	-	14	-	-	-	-	13.7	16.9	18.2	*32.2°C / 25.6°C*
Dissolved oxygen (mg/L)			-	-	5	7	6.5	6.5	8	6	6	*Less than 5 mg/L*
Conductivity (µS)			908	916	1066	1456	936	870	854	923	935	*3077 µS*
pH			7	-	7.7	7.7	8	7.95	7.9	7.8	7.8	*< 6.5 or > 8.5*
Nitrate-nitrogen (mg/L)			1.3	0.8	1.43	0.6	1.1	0.3	0.3	0.83	0.5	*10 mg/L*
Phosphate (mg/L)			**1.03**	**1.09**	**0.36**	0.08	**0.26**	**0.11**	**0.12**	**0.11**	**0.13**	*0.10 mg/L*
Turbidity (FAU)			85	49	15	2	0	0	0	3	0	*Significant visual increase*
Ammonia-nitrogen (mg/L)			0.04	0.08	0.02	0.00	0.01	0	0	0.02	0	*0.098 mg/L*
Average flow rate (gpm)			0 (puddle 4"deep)	0 (puddle 5"-6" deep)	0 (trickle)	2.6	25	17.3	465	323	< 1	-
Enterococcus (mpn)			-	16.1 (1:1)	8.4 (1:1)	10 (1:10)	7.4 (1:1)	5.2 (1:1)	6.3 (1:1)	33.2 (1:1)	**387.3 (1:1)**	*104 mpn/100mL*
Total coliform (mpn)			2851 (1:10)	2419.6 (1:1)	1956 (1:10)	770.1 (1:1)	365.4 (1:1)	-	1553.1 (1:1)	2909 (1:10)	7270 (1:10)	*10,000 mpn/100mL*
E. coli (mpn)			41.9 (1:1)	17.5 (1:1)	20 (1:10)	8.4 (1:1)	9.7 (1:1)	-	6.3 (1:1)	14.6 (1:1)	22.8 (1:1)	*235 mpn/100mL*

*Results that exceed threshold are in **bold** and highlighted yellow.*

Phosphate levels are consistently high in Leach Canyon, the causes of which are unknown. It could be from natural processes or an illegal farm located up the canyon and fertilizers are being used.

Samples from our February visit to Leach Canyon were also tested for total suspended solids (TSS), total petroleum hydrocarbons (TPH), total metals and polycyclic aromatic hydrocarbons (PAH) to further develop the baseline data. We found all results were "non-detect" for PAH, TPH and TSS. In March, samples were again tested for total metals. Results from the total metals tests are shown below:

Leach Canyon

		Total Metals by ICP (EPA Method 6010B)	
Contaminant	**Thresholds** [d]	**Results 2/23/08 (µg/L)**	**Results 3/15/08 (µg/L)**
Antimony	14 µg/L [a]	ND	ND
Arsenic	CMC: 340 µg/L CCC: 150 µg/L [b]	ND	ND
Barium	2000 µg/L [c]	**23**	**22**
Beryllium	4 µg/L [c]	ND	ND
Cadmium	CMC: 4.3 µg/L CCC: 2.2 µg/L [b]	ND	ND
Total chromium (III and VI)	100 µg/L [c]	ND	ND
Cobalt	-	ND	ND
Copper	CMC: 13 µg/L CCC: 9.0 µg/L [b]	ND	ND
Lead	CMC: 65 µg/L CCC: 2.5 µg/L [b]	ND	ND
Mercury (by EPA Method 7470A)	0.05 µg/L [a]	0.3*	ND
Molybdenum	-	ND	ND
Nickel	CMC: 470 µg/L CCC: 52 µg/L [b]	**28**	**41**
Selenium	CCC: 5 µg/L [b]	ND	ND
Silver	CMC: 3.4 µg/L [b]	ND	ND
Thallium	1.7 µg/L [a]	ND	ND
Vanadium	-	ND	ND
Zinc	CMC: 120 µg/L CCC: 120 µg/L [b]	46*	70*

[a] California Toxics Rule (CTR) Human Health Criteria
[b] CTR Aquatic Life Criteria. Criterion Maximum Concentration (acute) and Criterion Continuous Concentration both apply.
[c] EPA National Primary Drinking Water Standards
[d] Thresholds are given as the dissolved fraction of metals (that concentration that remains after filtering)
Asterisk * indicates result greater than minimum detection limit of test, but less than the reporting limit.
Bold numbers indicate a result greater than the reporting limit.
ND means "non-detect" or was not found at or above the reporting limit.

Total mercury concentration in February was found to be higher than the minimum detection limit but slightly less than the reporting limit of 0.4 µg/L; it is also higher than the human health criteria. The cause of which is unknown. Otherwise, no metals exceed standards.

Lion Spring, Morrell Canyon, Cleveland National Forest [33° 37'53.70", -117° 22; 45.96"]									
	11/17/07	**12/15/07**	**1/19/08**	**2/23/08**	**3/15/08**	**4/19/08**	**5/17/08**	**6/21/08**	***Thresholds***
Air temp (°C)	No water	No water	-	18.9	-	-	19		-
Water temp (°C)			-	-	9.4	11.2	13.9	18.5	*> 5°F change from controllable factors*[5]
Dissolved oxygen (mg/L)			6	**5.5**	10	**5.6**	**2.5**	**3.5**	*Less than 6 mg/L*
Conductivity (µS)			**1148**	738.3	-	671	710	**810**	*769.2 µS*[6]
pH			7.6	7.7	-	7.6	7.4	7.66	*< 6.5 or > 8.5*
Nitrate-nitrogen (mg/L)			1.0	0.23	0.8	0.2	0.1	0.7	*10 mg/L*
Phosphate (mg/L)			**0.21**	**0.21**	**0.24**	**0.17**	**0.23**	**0.36**	*0.10 mg/L*
Turbidity (FAU)			1	0	0	0	0	3	*Significant visual increase*
Ammonia-nitrogen (mg/L)			0.03	0.00	0.00	0.00	0.01	0.01	*0.098 mg/L*
Average flow rate (gpm)			0 (trickle)	67	Small trickle	Small trickle	Small trickle	Puddles	-
Enterococcus (mpn)			25.9 (1:1)	3 (1:1)	< 1 (1:1)	2.0 (1:1)	3.0 (1:1)	**410.6 (1:1)**	*104 mpn/100mL*
Total coliform (mpn)			579.4 (1:1)	127.4 (1:1)	-	344.8 (1:1)	1413.6 (1:1)	24,192 (1:10)	*10,000 mpn/100mL*
E. coli (mpn)			1.0 (1:1)	< 1.0 (1:1)	-	31.3 (1:1)	1.0 (1:1)	58.3 (1:1)	*235 mpn/100mL*

*Results that exceed threshold are in **bold** and highlighted yellow.*

[5] Since we are establishing the baseline data, we are unable to determine what a 5 degree change from the norm would be.
[6] Based on TDS standard for San Mateo Canyon, of which Morrell Canyon and subsequently Lion Spring are tributary.

Lion Spring has unexpectedly high phosphate levels that are likely due to internal, natural sources. Also the sudden jump in bacteria concentrations that occurred in June is likely due to the stagnant water and input from natural sources.

Samples from our February expedition to Lion Spring were also tested for total suspended solids (TSS), total petroleum hydrocarbons (TPH), total metals and polycyclic aromatic hydrocarbons (PAH) to further develop the baseline data. Results were "non-detect" for PAH and TPH. TSS was 2 mg/L, far below the action limit of 70 mg/L. Samples in March were also tested for just total metals. Results from the total metals tests are shown below:

Lion Spring

		Total Metals by ICP (EPA Method 6010B)	
Contaminant	**Thresholds** [d]	**Results 2/23/08 (ug/L)**	**Results 3/15/08 (ug/L)**
Antimony	14 µg/L [a]	ND	ND
Arsenic	CMC: 340 µg/L CCC: 150 µg/L [b]	ND	ND
Barium	2000 µg/L [c]	**61**	**64**
Beryllium	4 µg/L [c]	ND	ND
Cadmium	CMC: 4.3 µg/L CCC: 2.2 µg/L [b]	ND	ND
Total chromium (III and VI)	100 µg/L [c]	ND	ND
Cobalt	-	ND	ND
Copper	CMC: 13 µg/L CCC: 9.0 µg/L [b]	17*	ND
Lead	CMC: 65 µg/L CCC: 2.5 µg/L [b]	ND	ND
Mercury (by EPA Method 7470A)	0.05 µg/L [a]	ND	ND
Molybdenum	-	ND	ND
Nickel	CMC: 470 µg/L CCC: 52 µg/L [b]	**28**	**58**
Selenium	CCC: 5 µg/L [b]	ND	ND
Silver	CMC: 3.4 µg/L [b]	ND	ND
Thallium	1.7 µg/L [a]	ND	ND
Vanadium	-	ND	ND
Zinc	CMC: 120 µg/L CCC: 120 µg/L [b]	ND	60*

[a] California Toxics Rule (CTR) Human Health Criteria
[b] CTR Aquatic Life Criteria. Criterion Maximum Concentration and Criterion Continuous Concentration both apply.
[c] EPA National Primary Drinking Water Standards
[d] Thresholds are given as the dissolved fraction of metals (that concentration that remains after filtering)
Asterisk * indicates result greater than minimum detection limit of test, but less than the reporting limit.
Bold numbers indicate a result greater than the reporting limit.
ND means "non-detect" or was not found at or above the reporting limit.

In February, the total copper concentration temporarily exceeded acute and continuous aquatic life criteria, and in March, total nickel concentrations temporarily exceeded the continuous aquatic life criteria.

Biological Assessment Results

On April 15, 2008, I.E. Waterkeeper Programs Director Autumn DeWoody and O.C. Coastkeeper Field Manager, Zehava Purim-Adimor performed a biological assessment on Coldwater Creek. Method was taken from the California Streamside Biosurvey (Sept. 2001). Coldwater Creek was the only creek chosen of the four because of its consistent and steady flow over the minimum required length of 300 linear feet. We began by collecting the macro-invertebrate samples at 3 randomly selected points over a 300-foot span of creek. At each point, we visually divided the creek into 3 and dislodged the samples from each by kicking and rubbing the rocks. Samples floated into a net, we then transferred them to a screen-bottom bucket for sorting into an ice cube tray with tweezers.[7]

Once sorted, we used the invertebrate picture key to identify species and count total numbers. The specimens were returned alive to the creek once identified and counted. The table below shows the types and number of species found at each transect. Using the California Streamside Biosurvey Data Worksheet, we then estimated the biological index of water quality, which is 40 that corresponds to a water quality rating of "Excellent."

	Transect 1	**Transect 2**	**Transect 3**	**Total**
Beetles	2	0	1	3
Caddisflies	1	4	1	6
Crane flies	2	0	0	2
Dragon and/or damselflies	1	4	4	9
*Egg sacks *not counted**	*0*	*0*	*3*	*3*
Flatworm	0	0	1	1
Mayflies	0	4	0	4
Midges	11	2	5	18
Segmented worm	3	0	5	8
Snail	1	0	0	1
Stoneflies	2	1	4	7
Total	**23**	**15**	**24**	**62**

After performing the bioassessment we made other field observations of the creek, from weather to habitat features that all suggest a healthy, natural creek emanating from a preserved watershed. Scat of a large mammal was found next to the site, and the flow rate was estimated using the velocity-area method (using bobber) at 14.2 cubic feet per second (or 6,373 gallons per minute).

[7] Performed under the authority of OC Coastkeeper's Scientific Collection Permit from California Dept. of Fish and Game. IE Waterkeeper has since obtained their own Scientific Collection Permit.

Conclusion

As expected, the quality of habitat and water in the four creeks is relatively high with periodic exceptions (does not include Upper Rd. basin). We found Coldwater Creek to flow year-round, while Main Street canyon never carried measurable flow. Lion Spring and Leach Canyon provide spring water nearly year-round, which is critical to the plants and animals in our desert-like environment. The Upper Rd. detention basin requires considerable work to begin functioning as intended. This basin provides no aesthetic or groundwater benefits, resulting in marginal flood control benefit. It also presents a significant vector control problem and likely discharges flow with high TSS, bacteria and ammonia (as N).

Phosphate concentrations exceeded the limit of 0.10 mg/L at least once for all sites; notably, the two springs exceeded the threshold nearly every month. Coastkeeper also found high phosphate levels, which we believe to be indicative of a natural condition of the mountains. Conductivity (a measure of the "saltiness" or ability to transmit electricity) was almost always higher than the estimated threshold for Coldwater Creek, which is likely evidence of the high total copper concentration, since copper has an excellent ability to conduct electricity. Ammonia (as nitrogen) is toxic to aquatic organisms even in very small concentrations, so the spike observed in August, 2007 at Coldwater Creek may have been a result of upstream fertilizer use on a marijuana farm that was removed by authorities sometime in late August/early September, 2007. Dissolved oxygen concentrations were often low for Lion Spring, which is expected for a small spring that contains algae, and is almost totally stagnant. Bacteria concentrations, turbidity and ammonia (as N) were highest in the detention basin below Main Street Canyon after a rainstorm. Bacteria steadily decreased over the following months; however the exceedance of TSS demonstrates the considerable erosion that occurred and ammonia maintained high levels due to an unknown source. For other sites, bacteria concentrations only sporadically jump up, likely caused by animal scat and/or warm, stagnant water that encourages growth. Total Copper and total nickel concentrations most often exceeded state thresholds. Samples were taken in the rainy season so we believe this is naturally occurring as a result of upstream erosion. In February at Leach Canyon, a sample tested for mercury was higher than the state standard by an order of magnitude, which we can not explain.

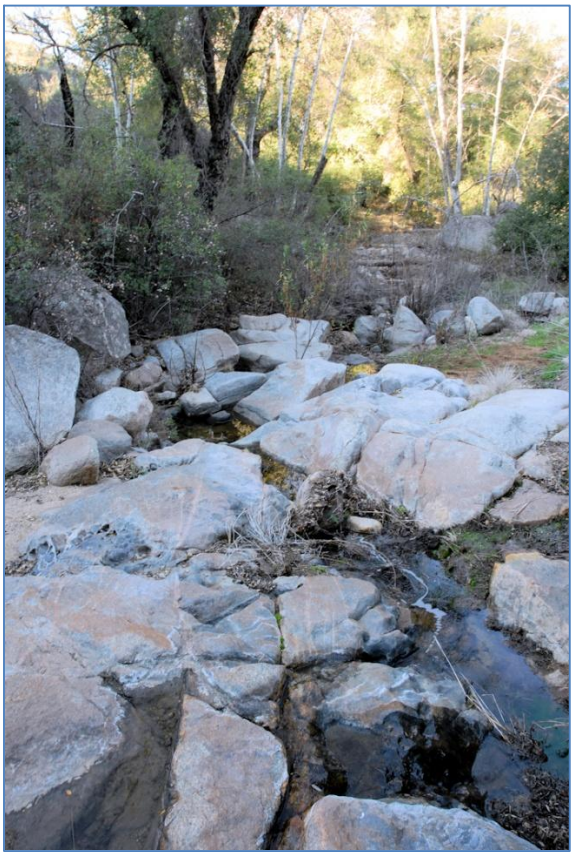
The biological assessment confirmed our belief that Coldwater Creek has an excellent habitat for aquatic macro-invertebrates. Although we did not collect the required 100 specimens, 62 were found including Mayflies, Stoneflies, and Caddisflies. The method we used for the assessment does not apply to stagnant waterbodies (i.e., the Upper Rd. detention basin) or spring-like waters (i.e., Lion Spring and Leach Canyon) so we were unable to determine biological health there. However, we feel the springs maintain a whole host of specimens including mammals, birds and reptiles throughout the hot summer and moderately wet winters.

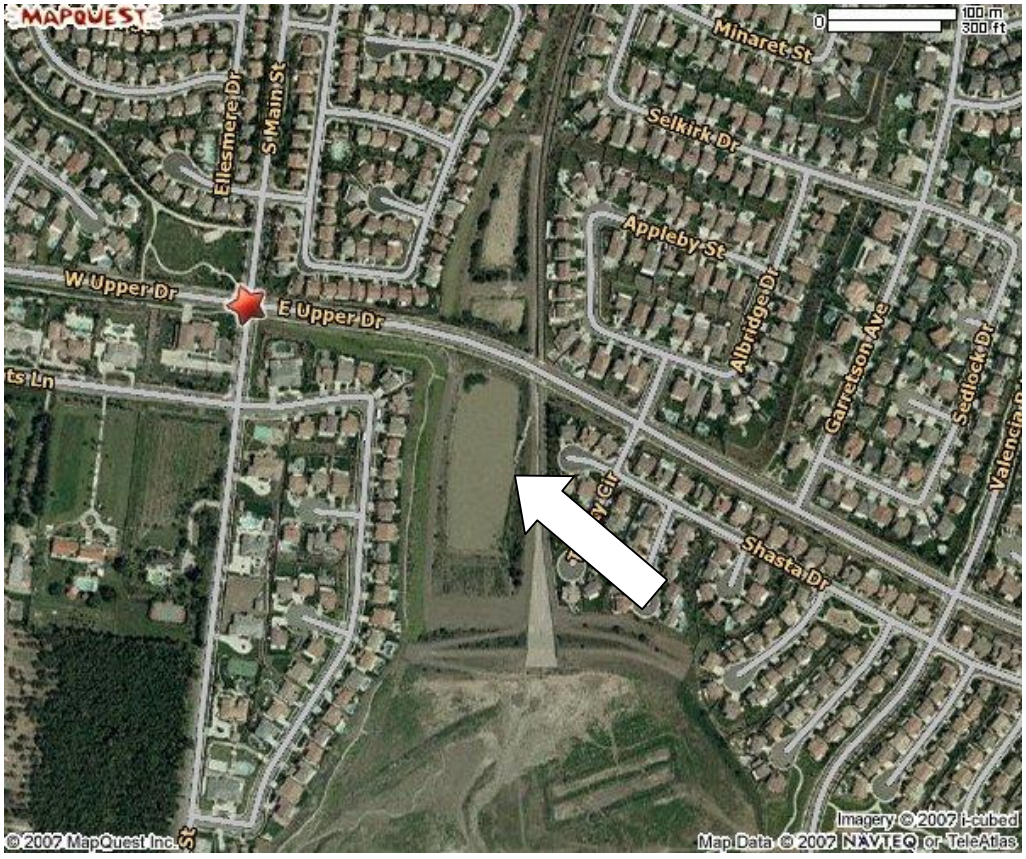
Photos

1) Coldwater Creek (above Glen Ivy Hot Springs Spa in Corona)

2) Leach Canyon (top of Amorose Road in Lake Elsinore)

3) Lion Spring (Morrell Canyon off W. Main Divide Road in Cleveland National Forest – enter via Morgan Trailhead)





4) Upper Road Detention Basin

From Mapquest©. Arrow shows sampling location