Codornices Creek Restoration Project

2012 Monitoring Report

Phase 1, 2 and 3 Geomorphic Monitoring
Phase 3 Vegetation Monitoring
Phase 1, 2 and 3 BMI Monitoring
Photo Monitoring

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Codornices Creek Monitoring 2012

1. Overview

This Monitoring Report presents the 2012 monitoring results for Phase 1, 2 and Phase 3 of the Codornices Creek Restoration Project and follows the December 2011 Supplemental Report that summarized the previous year's monitoring of Lower Codornices Creek.

To date three phases of Codornices Creek restoration have been completed. Phase 1 was completed in 2005, Phase 2 in 2006 and Phase 3 in 2010. In 2012 geomorphic monitoring, BMI surveys and the fish habitat assessment was conducted in all three phases. For 2012 Vegetation monitoring occurred only in Phase 3.

The following is a calendar of scheduled monitoring activities for the three phases of the Codornices Creek Restoration Project for 2012.

Table 1: Monitoring Calendar

Calendar Year 2012					
Phase	*Geomorphic Survey*	*Vegetation Survey*	*BMI Survey*	*Fish Survey*	*Report*
I	January (Yr. 8)	None (Yr. 8)	Spring 2012	Spring 2012	
II	January 2012 (Yr. 5)*	None (Yr. 6)	Spring 2012	Spring 2012	Report
III	Spring 2012 (Yr. 2)	Spring 2012 (Yr. 2)	Spring 2012	Spring 2012	

2. Vegetation Monitoring Results (Phase III Only)

Year 2 / July 2012

2.1. METHODS:

The project monitoring was performed in accordance with the elements of the Monitoring and Mitigation Plan (MMP) prepared by FarWest Restoration Engineering (FRE) dated April 16, 2006. The MMP describes the project goals, monitoring questions, performance criteria and monitoring protocols required to evaluate the success of the restoration project towards achieving project objectives. The vegetation monitoring was broken down into four separate tasks. Monitoring for each task was conducted separately using distinct methods:

MMP Task 2.1: Task 2.1 monitors the soil bioengineering components of the project. For year 2, all poles with sprouts over 2-ft tall are counted.

Table 2: Soil Bioengineering Success Criteria

Year	Criteria
Year 1: 2011	Sprouts
Year 2: 2012	**2-feet tall**
Year 3: 2013	4-feet tall
Year 4: 2014	6-feet tall
Year 5: 2015	Evaluate entire canopy for percent cover
Year 10: 2020	Evaluate entire canopy for percent cover

MMP Task 2.2: This task evaluates the success of the live staking outside the active channel bank. For year 2, all stakes with sprouts are counted.

Table 3: Dogwood Stake Success Criteria

Year	Criteria
Year 1: 2011	Survival
Year 2: 2012	**Survival**
Year 3: 2013	1-foot tall
Year 4: 2014	2-feet tall
Year 5: 2015	Evaluate entire canopy for percent cover
Year 10: 2020	Evaluate entire canopy for percent cover

MMP Task 2.3: Container plants are monitored under this task. The entire site was surveyed and all living plants from the planting plan and additional plants installed by volunteers since the project completion were tallied and compiled on a per species basis. Dead plants were noted but not compiled.

MMP Task 2.4: The final task measures percent cover of native and nonnative plants in 10 randomly sampled 3 foot by 3 foot plots using the Daubenmire method as detailed in the USFS Technical Reference: Sampling Vegetation Attributes, 1996.

2.2. RESULTS

2.2.1. MMP Tasks 2.1 and 2.2: Soil Bioengineering and Live Stakes

Soil Bioengineering and live stakes are performing well. The brush mattress on river right at the upstream and of the project is dense with growth. 202 live willow stakes were counted within the project limits. There were 7 dead cuttings, all from stakes planted by volunteers in May 2012. Over 375 additional willow stakes were planted in December 2012 to augment the willow poles on-site per the request of the Water Board. Dogwood staking also performed well between 2011 and 2012. 72 individuals (91%) survived through 2012. The Codornices Creek Watershed Council (CCWC) has continued to plant additional dogwood as well.

2.2.2. MMP Task 2.3: Container Planting

Table 4: Phase III Container Planting Results

		2011 as-built		2012	
Species	**Specified**	#	*% survival from previous period*		*% survival from previous period*
Acer macrophyllum	6	6	*100%*	7	*117%*
Acer negundo	3	3	*100%*	3	*100%*
Aesculus californica	18	17	*94%*	16	*94%*
Alnus rhombifolia	40	37	*93%*	37	*100%*
Heteromeles arbutifolia	18	15	*83%*	17	*113%*
Mimulus aurantiacus	15	1	*7%*	3	*300%*
Populus fremontii	20	18	*90%*	19	*106%*
Quercus agrifolia	23	28	*122%*	29	*104%*
Rhamnus californica	14	13	*93%*	22	*169%*
Ribes sanguineum	8	8	*100%*	8	*100%*
Rosa californica	11	8	*73%*	15	*188%*
Sambucus mexicana	11	13	*NA*	14	*108%*
TOTAL # OF INDIV.	**187**	**167**	*89%*	**190**	*114%*

2.2.3. MMP Task 2.4: Percent Cover

Native plant establishment on the Phase 3 floodplain is better than the previous two phases. Leymus triticoides has successfully established and accounts for the majority of the native cover on the floodplain. Ongoing maintenance by the City of Albany and volunteer groups has been successful at limiting the colonization of many of the invasive species typical of urban restoration areas.

Table 5: Percent Cover Results

2012		Species Native		Species Exotic Forbs		Species Exotic Grasses		Species Bare Soil	
Cover Class	Mid-point	Number	Product	Number	Product	Number	Product	Number	Product
1-5%	2.5	0	0	1	2.5	1	2.5	3	7.5
5-25%	15	0	0	4	60	7	105	5	75
26-50%	37.5	1	37.5	5	187.5	2	75	1	37.5
51-75%	62.5	1	62.5	0	0	0	0	0	0
76-95%	85	8	680	0	0	0	0	0	0
96-100%	97.5	0	0	0	0	0	0	0	0
Total Canopy			780		250		182.5		120
Number of Samples			10		10		10		10
% Canopy Cover			78%		25%		18%		12%
Species Composition			**59%**		**19%**		**14%**		**9%**
Frequency			100%		100%		100%		90%

2.3. DISCUSSION

2.3.1. MMP Task 2.1 and 2.2: Soil Bioengineering and Live Stakes

The willow used for soil bioengineering is healthy and growing. The arroyo willow is not as robust as the red willow on-site but there are similar survival rates between species. There continue to be many volunteer willow plants sprouting along the channel. With the addition of the most recent planting in December of 2012, the entire channel corridor will likely see near 100% cover of willow.

2.3.2. MMP Task 2.3: Container Planting

More plants were observed in 2012 than in 2011. This is due to a greater success rate of detecting plants than in previous years. Additionally some species are beginning to self-colonize and other plants may have been recently planted by the CCWC. Overall the container plants are meeting the 60% survival threshold.

2.3.3. MMP Task 2.4: Percent Cover

The goal for the second year of monitoring is to have less than 30% exotic species cover. There is currently 33% cover non-native species detected in the random selected sample plots. There was very few aggressive exotic species detected within the reach. Nasturtium and avena are found throughout the site and are continuing to be addressed through ongoing maintenance.   Additional effort should continue with removing fennel, Algerian ivy, and bristly ox-tongue.

2.4. General Notes

Overall the vegetation in Phase 3 is performing well. Site soil preparation and compaction mitigation was improved over techniques employed during the prior to phases, and the maintenance and irrigation programs have also been more consistent. The additional effort and plant material installed by volunteers has also played a significant role in getting native species to colonize this urban site.

2.5. Maintenance Recommendations

2.5.1. Remove Algerian ivy. Small patches are present and should be removed immediately upon detection.
2.5.2. Bindweed should be removed immediately. None was detected during the survey period.
2.5.3. Locate and remove Himalayan blackberry and nasturtium
2.5.4. Empty trash cans on-site more frequently.

3. Geomorphic Survey

Phase 1 – Year 8
Phase 2 – Year 5
Phase 3 – Year 2

3.1. Methods

Profile and cross section surveys were repeated in 2012 in all three phases. Cross sections are from established and monumented locations.

3.2. Results

3.2.1. Channel Profile Phase I and II

Bed features have continued to evolve in Phase 1 and 2. Pools have become deeper in many locations and riffles have built up. Willow roots compose the primary riffle structure in Phase 1. Gravels compose Phase 2 riffles. The profile shows aggradation at the upstream end of Phase 2. This aggraded material is primarily medium and fine gravels. This aggradation has propagated through the 6^{th} street culvert and has influenced the channel morphology of Phase 3.

3.2.2. Cross Section Phase I and II

Phase 1 and 2 have remained stable. No noticeable trends can be detected. Some cross sections appear to be narrowing over time and the floodplain in many cross sections appears to be aggrading. The past year saw approximately 4 events that over topped the floodplain. It is typical to see fine silt deposition on the floodplain after such events.

Cross section 14, at the upstream end of Phase 2 shows considerable deposition on both the floodplain and the channel.

3.2.3. Channel Profile Phase III

Winter 2011/2012 saw less adjustment and change than the first winter (2010/2011) in Phase 3. Much of the bed has maintained a consistent elevation. Downstream aggradation continued. The upstream step pools have remained stable.

Riffle and pool morphology have begun to develop within the channel with the exception of areas scoured to hardpan. The hardpan is hampering sediment deposition in these areas and limiting development of depositional feature such as point bars. Emergent vegetation was thick during the summer and led to minor sedimentation within the active channel. The first storms in the fall of 2012 removed the emergent vegetation from the channel.

3.2.4. Cross Sections Phase III

The two riffle cross sections were resurveyed in 2012. Cross section #1 is in the lower portion of the creek and is influenced by the culvert backwater. Cross section #2 is upstream in the location adjacent to the hardpan bed. Cross section 1 shows continued adjustment of the channel above the 6th street culvert. Cross section 2 has developed an inner depositional bench, but otherwise remains similar to the 2011 survey.

3.3. Discussion

All three phases are performing well and do not need any adaptive management at this time. Phases 1 and 2 have seen some deposition of the floodplain and further development of geomorphic features. Overall the bed and banks remain stable.

Phase 3 continues to see some adjustment at the downstream end of the project. 2011 saw rapid deposition at the culvert entrance. There were two primary drivers for this change. The first is the backwater caused by the culvert during large storm events. This backwater flooded the floodplain and lowered discharge velocities causing sediment deposition in the channel. This mechanism was compounded by aggradation downstream of the 6th street culvert in Phase 2 that has propagated upstream. This aggradation lowered the channel profile slope and further reduced the competency of the channel to pass sediment. There are indications that the deposition at the downstream end is working towards an equilibrium condition. The deposition has elevated the floodplain in this area and a low flow channel has recently reformed. No intervention is required at this time.

The exposed hardpan upstream continues to persist. This hardpan substrate excludes any opportunity for hyporheic flow and does not provide ideal habitat for benthos. This condition exists upstream of the project site as well, just below 9th street. Adding larger channel cobbles that would persist during large flows and begin to provide structure to capture sediment and build the channel on top of the hardpan clay can be considered as a tool for adaptive management. Proper design and sizing of the cobble mixture is essential. It is acceptable to delay this work as the channel may begin to build and aggrade as roots of the riparian vegetation begin to encroach on the channel. Adding cobbles may be worth considering if the hardpan persists in the channel after 5 years.

3.4. Maintenance Recommendations

3.4.1. Continue to monitor the deposition at the downstream portion of the project site. If it appears 6th street culvert has limited capacity, treatments can be considered to improve sediment competency through the reach. This would include modifying the upstream end of the Phase 2 channel and/or removing material from the Phase 3 channel and placing it on the floodplain to increase the depth of the channel adjacent to the culvert. It should be noted that these are two items that are likely to occur on their own, so it is not recommended pursuing these options unless there is immediate concern over the culvert capacity.

4. BMI Survey

4.1. Methods

RDG collected benthic macro invertebrates following the California Stream Bioassessment Procedure in October 2012 prior to the first rains of the season. This protocol is consistent with past sampling conducted by Kier Associates in 2006. Each of the three phases of restoration were sampled separately and were composed of three randomly selected riffle locations for a total of nine (9) collection sites. Each of the three samples was evaluated in the laboratory by Tom King of BioAssessment Services, Folsom, Ca.

4.2. Results

The three samples contained a total of 22 discrete taxa. Phase 1 and 2 each had a taxonomic richness of 17, while Phase 3 had a taxonomic richness of 16. EPT[1] composed 14% of the sample in Phase 1, and only 1.3% in Phase 2 and 2.0% in Phase 3. The California Tolerance Value was 5.5, 6.2 and 5.8 for Phase 1-3 respectively.

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[1] (Ephemeroptera, Plecoptera, Trichoptera) sensitive taxa that decrease in richness in the presence of pollution

Table 6: BMI Survey Results

Biological metric values for sites sampled from Codornices Creek, Alameda County, October 2012.
Metrics based on SAFIT level I standard taxonomic effort except chironomids identified to subfamily/ tribe[2].

Metrics	Codornices Creek Phase I	Codornices Creek Phase II	Codornices Creek Phase III	Phase I 2006	Phase III[3] 2006
Richness:					
Taxonomic	17	17	16	13	14
EPT	2	1	2	2	2
Composition:					
EPT Index (%)	14	1.3	2.0	6	9
Sensitive EPT Index (%)	14	1.3	0.7	0	0
Shannon Diversity	2.3	2.0	2.2	.92	.89
Dominant Taxon (%)	23	24	29	66	77
Non-Insect Taxa (%)	47	59	50		
Tolerance:					
Tolerance Value	5.5	6.2	5.8	5.43	5.6
Intolerant Organisms (%)	14	1.3	0.7		
Intolerant Taxa (%)	12	5.9	6.3		
Tolerant Organisms (%)	28	24	21		
Tolerant Taxa (%)	29	29	31		
Functional Feeding Groups:					
Collector-Gatherers (%)	46	46	64		
Collector-Filterers (%)	1.3	2.2	1.4		
Scrapers (%)	25	23	11		
Predators (%)	15	27	22		
Shredders (%)	14	1.3	0.7		
Other (%)	0.0	0.0	1.4		

4.3. Discussion

The results continue to show a general impairment of Codornices Creek in each of the three phases of restoration; however, each phase saw a rise in the sensitive EPT index compared to 2006 results. Shannon's diversity Index also improved across all three sites compared to the 2006 results.

A subtle difference between the three phases can also be detected. Phase II has the lowest scores, which is not expected, however, the relatively high scores for Phase 1 are encouraging to see and may be an initial indication of improved ecological health of the creek through the restoration area. If future monitoring shows this trend continuing than this will provide more certain results.

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[2] Standard taxonomic effort source: Southwest Association of Freshwater Invertebrate Taxonomists (http://www.waterboards.ca.gov/swamp/docs/safit/ste_list.pdf).

[3] 2006 survey occurred in the Phase III reach prior to construction.