Appendix: Monitoring Efforts at Coyote Creek South

A compilation of monitoring reports, updates, and graphics for the Coyote Creek South Wet Prairie and Vernal Pool Restoration Project

Prepared by Amanda Reinholtz of the Long Tom Watershed Council

12/22/2019

This document is associated with OWEB grant 2018-70000-16571, "Telling the Story – Coyote Creek South: Wet Prairie-Vernal Pool Restoration Phases 1 and 2. It meant to complement the 'Coyote Creek South Restoration Results' handout and provides additional data and documentation on restoration methods and results.

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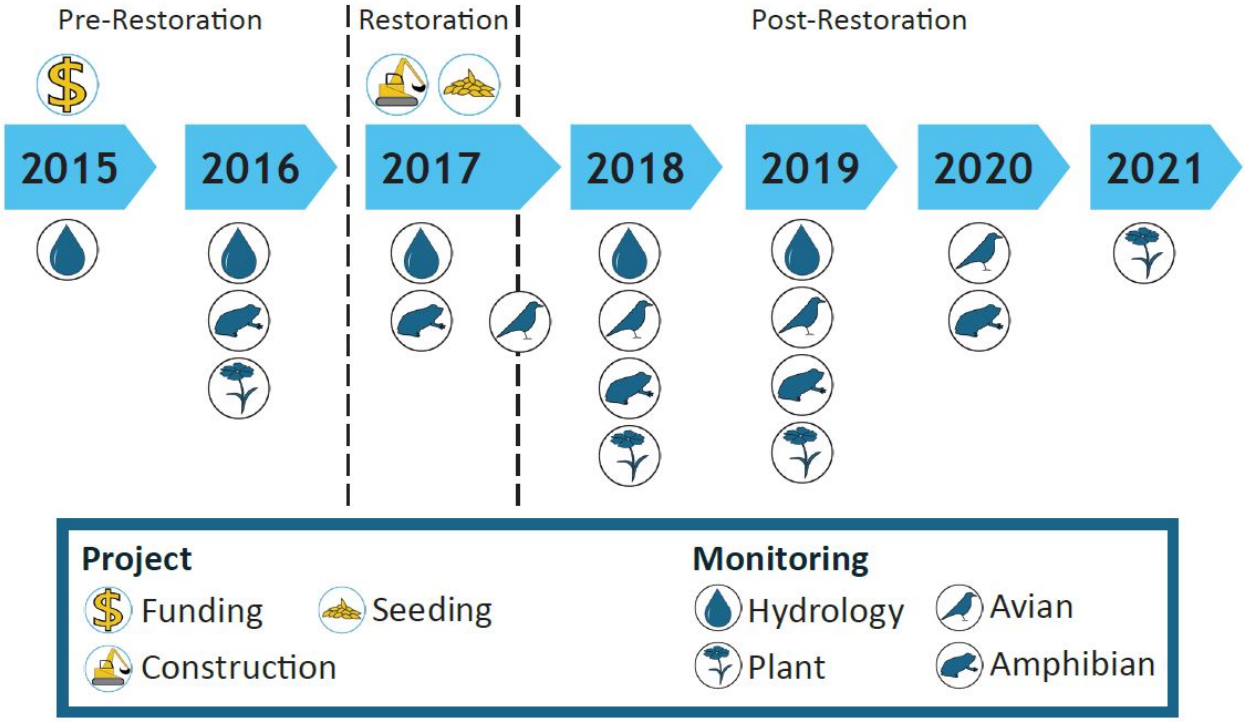
Coyote Creek South: PROJECT TIMELINES

Project Actions and Monitoring Timeline



Site Preparation and Maintenance Timeline

	2014	2015	2016	2017	2018 - 2019
Spring			Herbicide application: glyphosate 116 acres	Herbicide application: glyphosate 116 acres	Herbicide application: - grass specific - broad leaf in grass zones - invasive spot spray entire site
Summer	**Last seed/hay crop**	Mow 80 acres (fescue)	Mow 116 acres	**Earthwork**	
Fall	Herbicide application: glyphosate 37 acres			**Seed drill** Herbicide application: glyphosate post-seed	Herbicide application: - grass specific - broad leaf in grass zones - invasive spot spray entire site

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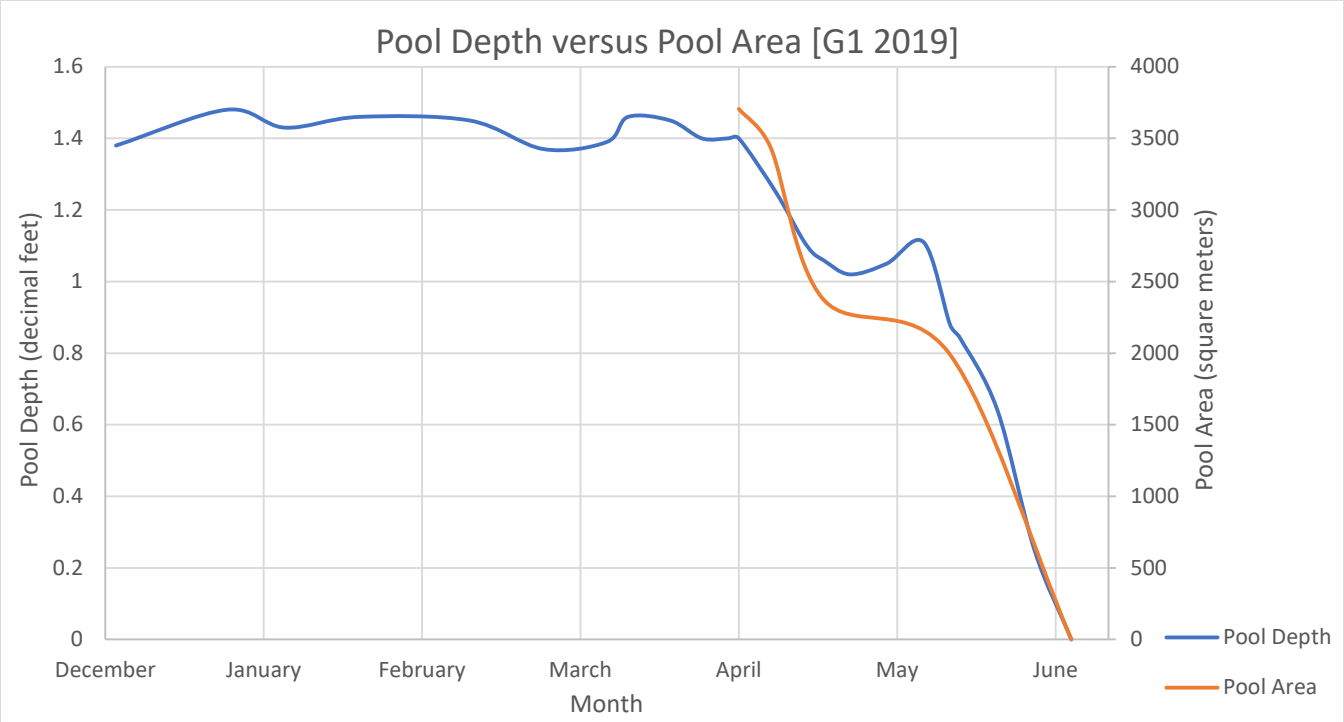
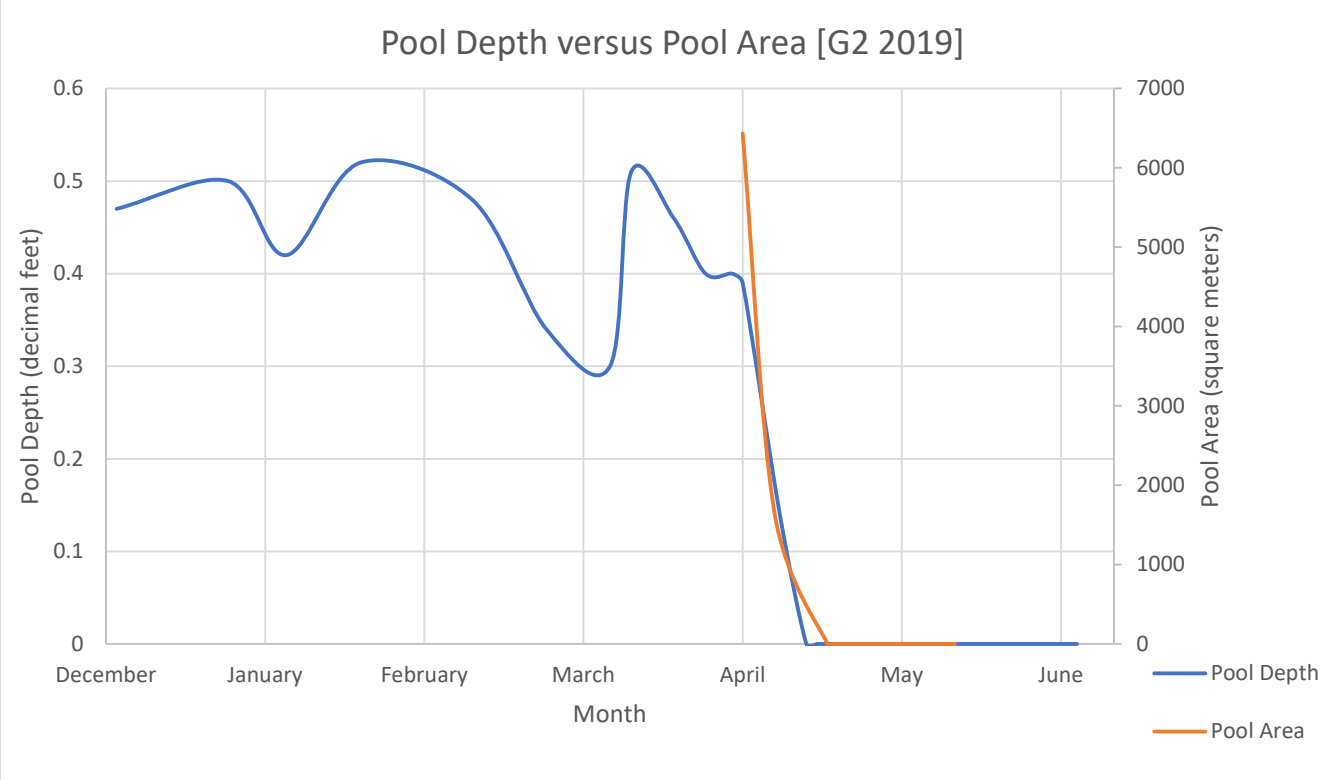
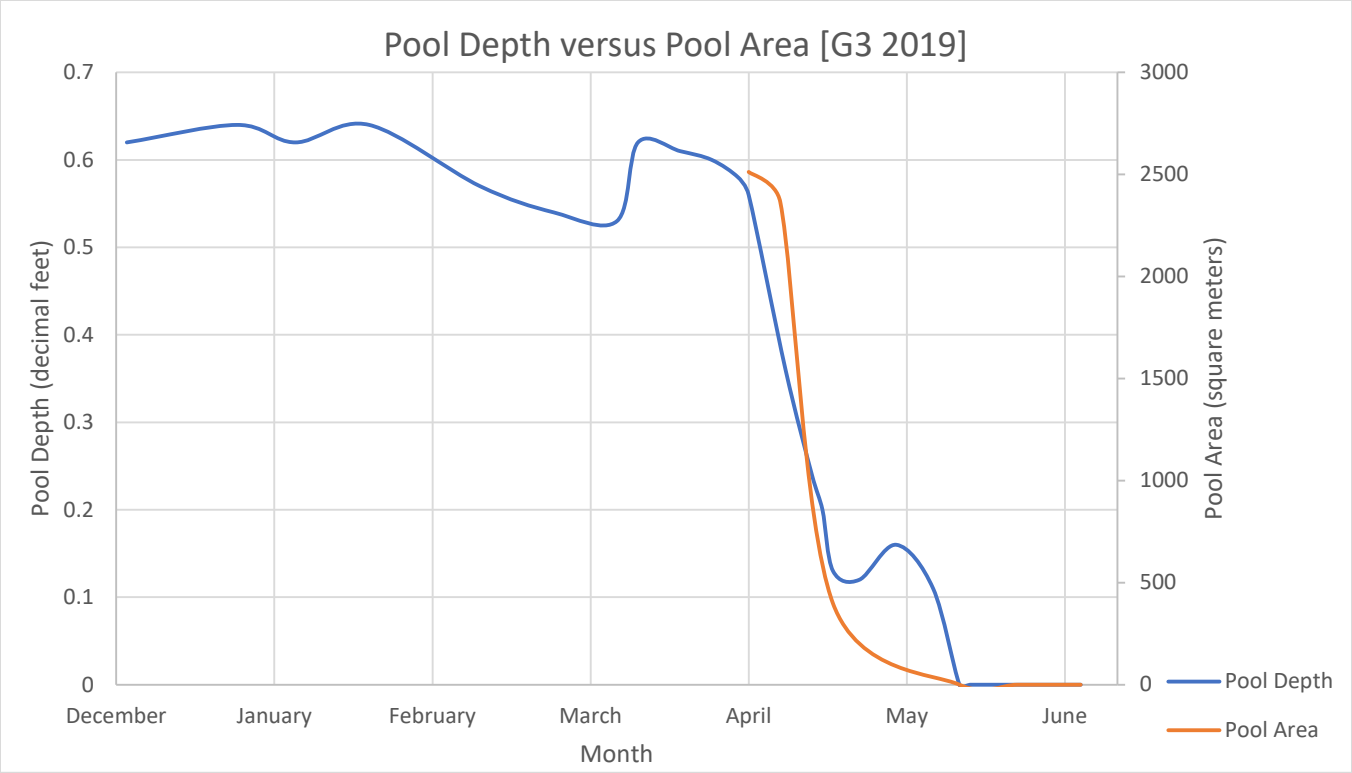
Pool Monitoring Data – Pool Depth and Area Graphs

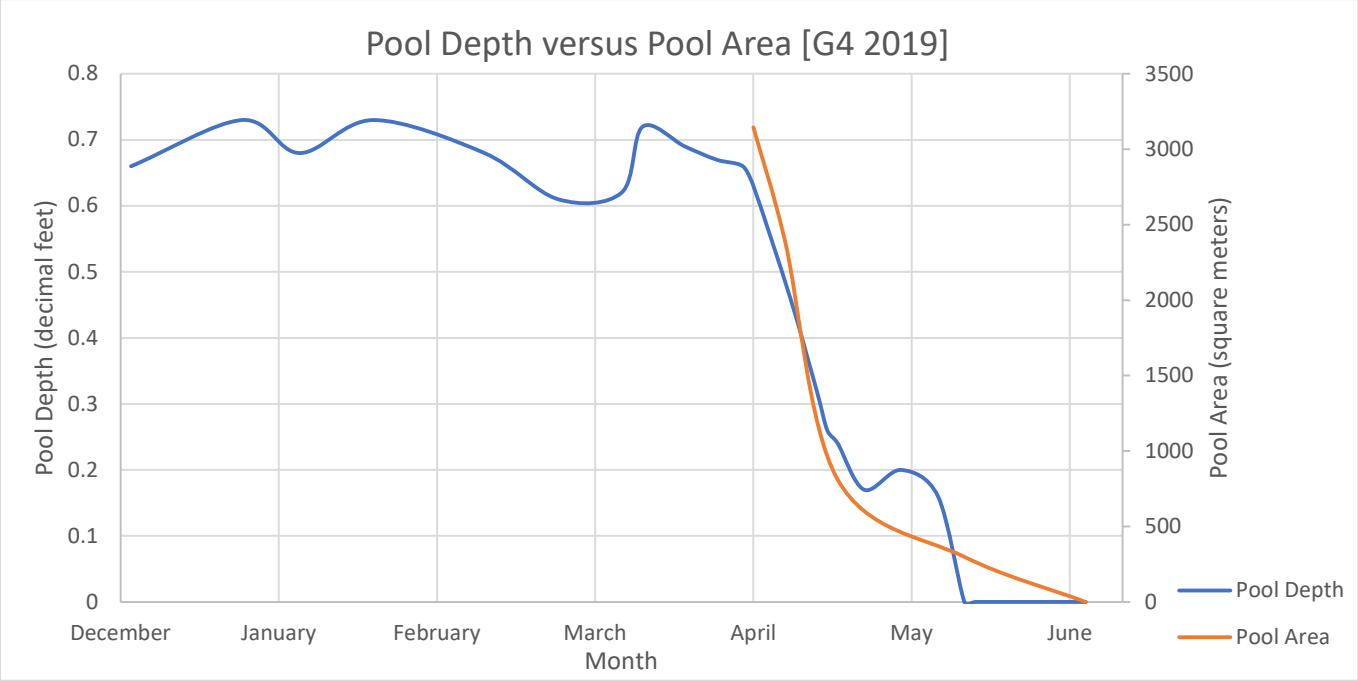
Complete set of graphs showing pool depth through time and pool area through time for all gauged pools at Coyote Creek South

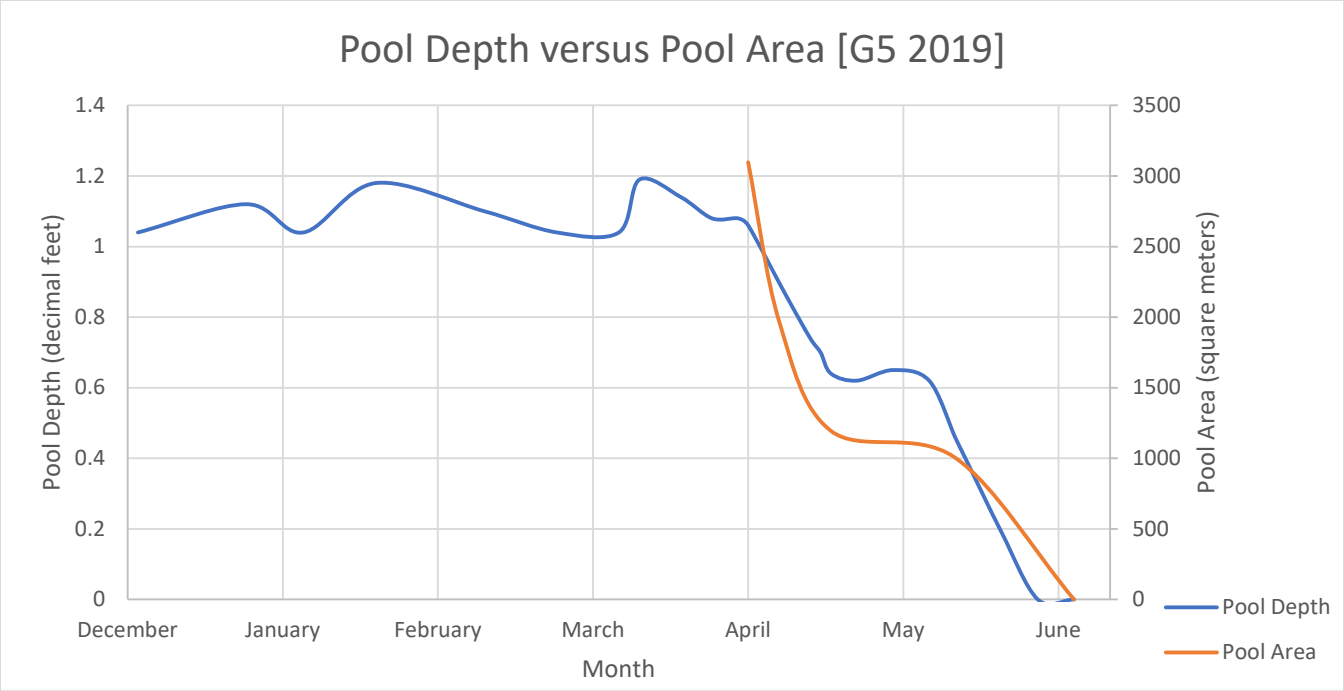
Prepared by Sarah Stahl, LTWC intern
8/1/2019

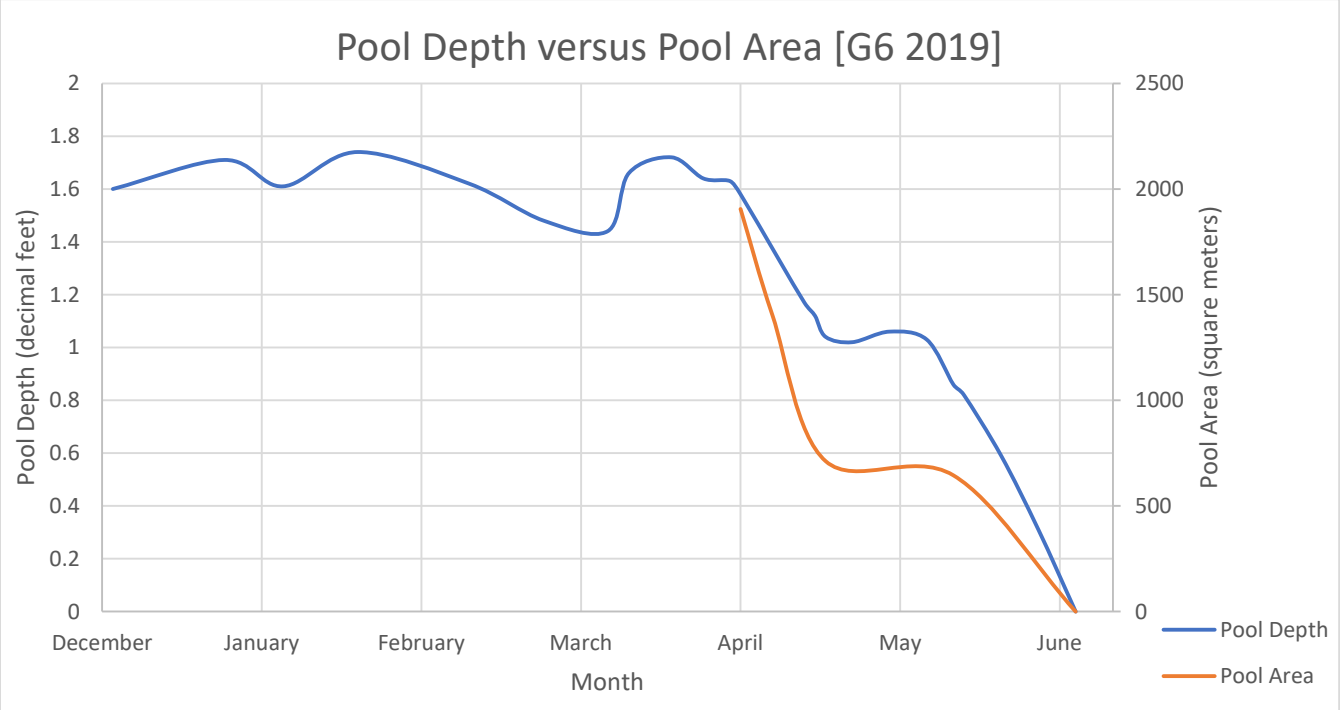

Pool Depth versus Pool Area [G1 2019]
Pool Depth (decimal feet)
Pool Area (square meters)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
4000
3500
3000
2500
2000
1500
1000
500
0
December
January
February
March
April
May
June
Month
Pool Depth
Pool Area

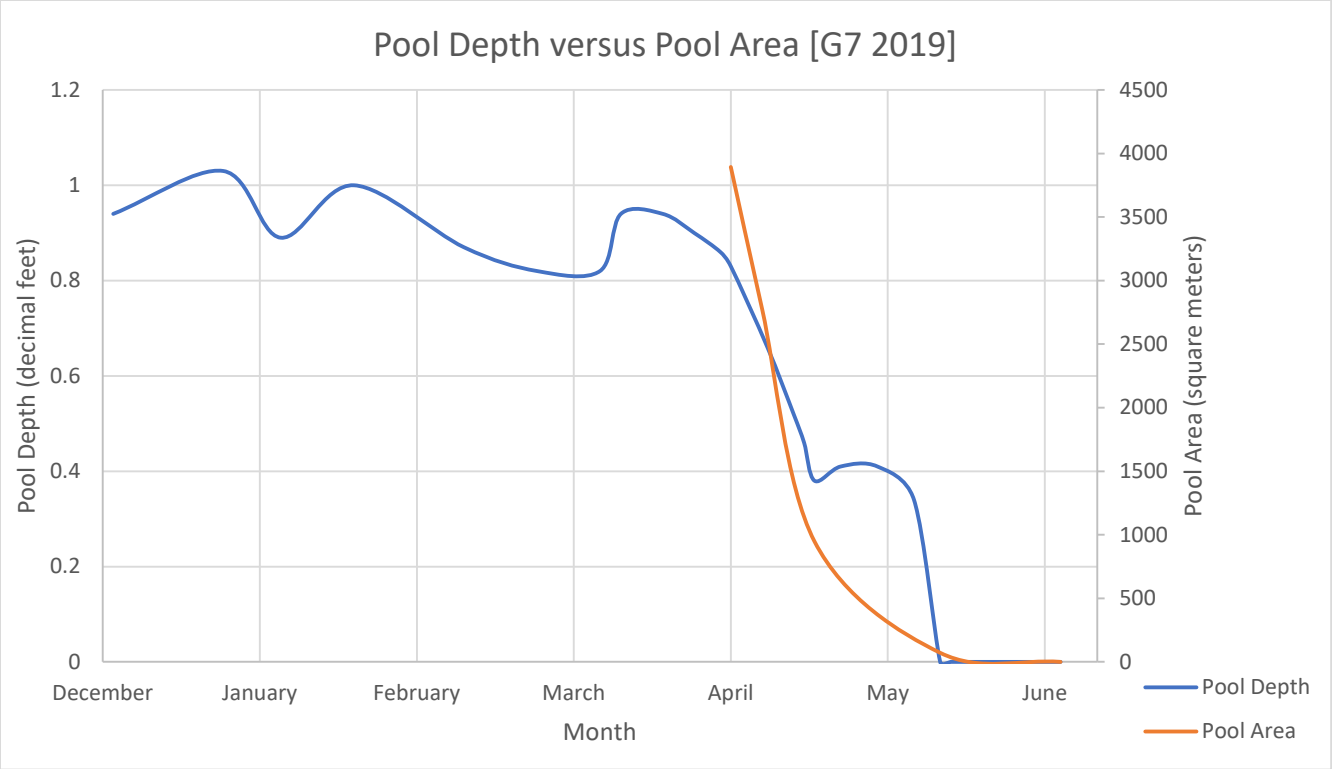

Pool Depth versus Pool Area [G2 2019]
Pool Depth (decimal feet)
Pool Area (square meters)
0.6
0.5
0.4
0.3
0.2
0.1
0
7000
6000
5000
4000
3000
2000
1000
0
December
January
February
March
April
May
June
Month
Pool Depth
Pool Area


Pool Depth versus Pool Area [G3 2019]
Pool Depth (decimal feet)
Pool Area (square meters)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
3000
2500
2000
1500
1000
500
0
December
January
February
March
April
May
June
Month
Pool Depth
Pool Area


Pool Depth versus Pool Area [G4 2019]
Pool Depth (decimal feet)
Pool Area (square meters)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
3500
3000
2500
2000
1500
1000
500
0
December
January
February
March
April
May
June
Month
Pool Depth
Pool Area


Pool Depth versus Pool Area [G5 2019]
Pool Depth (decimal feet)
Pool Area (square meters)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
3500
3000
2500
2000
1500
1000
500
0
December
January
February
March
April
May
June
Month
Pool Depth
Pool Area


Pool Depth versus Pool Area [G6 2019]
Pool Depth (decimal feet)
Pool Area (square meters)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2500
2000
1500
1000
500
0
December
January
February
March
April
May
June
Month
Pool Depth
Pool Area


Pool Depth versus Pool Area [G7 2019]
Pool Depth (decimal feet)
1.2
1
0.8
0.6
0.4
0.2
0
Pool Area (square meters)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
December
January
February
March
April
May
June
Month
Pool Depth
Pool Area

Seed Mixes for Coyote Creek South

62 species total

Wet Prairie - All Heights	
Achillea millefolium	Yarrow
Allium amplectens	Slim-leaf onion
Ascelpias speciosa	Showy milkweed
Camassia quamash	Camas
Carex densa	Dense sedge
Carex pachystachya	Thick-headed sedge
Carex scoparia	Pointed broom sedge
Carex stipata	Sawbeak sedge
Carex unilateralis	One-sided sedge
Epilobium densiflorum	Close-flowerd Boisduvalia
Eriophyllum lanatum	Oregon sunshine
Grindelia integrifolia	Willamette Valley gumweed
Juncus ensifolius	Dagger-leaf rush
Juncus tenuis	Poverty rush
Lomatium nudicaule	Bare-stem lomatium
Lotus unifoliolatus (L. purshianus)	Spanish clover
Luzula comosa	Field woodrush
Madia elegans	Showy tarweed
Madia glomerata	Cluster tarweed
Microsteris gracilis	Slender phlox
Mimulus guttatus	Large monkey flower
Perideridia oregana	Oregon yampah
Plagiobothrys figuratus	Fragrant popcorn flower
Plectritis congesta	Rosy plectritis
Potentilla gracilis	Graceful cinquefoil
Prunella vulgaris var lanceolata	Self-heal
Ranunculus occidentalis	Western buttercup
Rumex salicifolius	Willow dock
Sanguisorba annua (occidentalis)	Annual burnet
Saxifraga oregana	Oregon saxifrage
Sidalcea cusickii	Cusick's sidalcea
Sisyrinchium idahoense	Western blue-eyed grass
Symphyotrichum (Aster) hallii	Hall's aster
Wyethia angustifolia	Narrow-leaf Mule's Ears
Zigadenus venenosus	Death camas

Vernal Pool - Amphibian	
Alisma trivale	American water plantain
Downingia elegans	Showy downingia
Eleocharis obtusa	Blunt spikerush
Eleocharis palustris	Creeping spikerush
Plagiobothrys figuratus	Fragrant popcorn flower
Schoenoplectus tabernaemontani	Soft-stem bulrush
Scirpus microcarpus	Small-fruited bulrush

Upland Prairie	
Achillea millefolium	Yarrow
Ascelpias speciosa	Showy milkweed
Carex tumulicola	Foothill sedge
Clarkia amoena	Farewell to spring
Clarkia purpurea ssp quadrivulnera	Small-flowered godetia
Collinsia grandiflora	Large-flowered blue-eyed mary
Collomia grandiflora	Large-flowered collomia
Eriophyllum lanatum	Oregon sunshine
Geum macrophyllum	Large-leaved avens
Lomatium nudicaule	Bare-stem lomatium
Lomatium triternatum	Nine-leaf lomatium
Madia elegans	Showy tarweed
Microseris laciniata	Cut-leaf microseris
Perideridia oregana	Oregon yampah
Plectritis congesta	Rosy plectritis
Potentilla glandulosa	Sticky cinquefoil
Potentilla gracilis	Graceful cinquefoil
Prunella vulgaris var lanceolata	Self-heal
Ranunculus occidentalis	Western buttercup
Rumex salicifolius	Willow dock
Saxifraga oregana	Oregon saxifrage
Sidalcea malviflora ssp. virgata	Harsh checkermallow
Wyethia angustifolia	Narrow-leaf Mule's Ears

Sparse Prairie	
Achillea millefolium	Yarrow
Eriophyllum lanatum	Oregon sunshine
Plagiobothrys figuratus	Fragrant popcorn flower
Potentilla gracilis	Graceful cinquefoil
Prunella vulgaris var lanceolata	Self-heal
Ranunculus occidentalis	Western buttercup
Ranunculus orthorhyncus	Straight-beak buttercup
Rumex salicifolius	Willow dock
Saxifraga oregana	Oregon saxifrage
Symphyotrichum (Aster) hallii	Hall's aster

Vernal Pool - Sparse & Dense *	
Downingia elegans	Showy downingia
Microsteris (Phlox) gracilis	Slender phlox
Mimulus guttatus	Large monkey flower
Plagiobothrys figuratus	Fragrant popcorn flower
Ranunculus orthorhyncus	Western buttercup
Veronica peregrina	Purslane speedwell

* seeding rates differ

Competitive Prairie	
Allium amplectens	Slim-leaf onion
Ascelpias speciosa	Showy milkweed
Camassia quamash	Camas
Carex densa	Dense sedge
Carex pachystachya	Thick-headed sedge
Carex scoparia	Pointed broom sedge
Carex stipata	Sawbeak sedge
Carex unilateralis	One-sided sedge
Clarkia purpurea ssp quadrivulnera	Small-flowered godetia
Collinsia grandiflora	Large-flowered blue-eyed mary
Collomia grandiflora	Large-flowered collomia
Epilobium densiflorum	Close-flowered Boisduvalia
Juncus ensifolius	Dagger-leaf rush
Juncus tenuis	Poverty rush
Lomatium nudicaule	Bare-stem lomatium
Lomatium triternatum	Nine-leaf lomatium
Microsteris gracilis	Microsteris
Mimulus guttatus	Large monkey flower
Perideridia oregana	Oregon yampah
Plagiobothrys figuratus	Fragrant popcorn flower
Potentilla gracilis	Graceful cinquefoil
Prunella vulgaris var lanceolata	Self-heal
Ranunculus occidentalis	Western buttercup
Ranunculus orthorhyncus	Straight-beak buttercup
Rumex salicifolius	Willow dock
Sanguisorba annua (occidentalis)	Annual burnet
Saxifraga oregana	Oregon saxifrage
Sidalcea cusickii	Cusick's sidalcea
Sisyrinchium idahoense	Western blue-eyed grass

Border Grass Mix	
Agrostis exerata	Spike bentgrass
Beckmannia syzigachne	American slough grass
Deschampsia cespitosa	Tufted hairgrass
Elymus glaucus	Blue wild rye
Hordeum brachyantherum	Meadow barley

Vernal Pool - Competitive	
Carex densa	Dense sedge
Carex unilateralis	One-sided sedge
Downingia elegans	Showy downingia
Epilobium densiflorum	Close-flowered Boisduvalia
Microsteris (Phlox) gracilis	Slender phlox
Mimulus guttatus	Large monkey flower
Plagiobothrys figuratus	Fragrant popcorn flower
Ranunculus orthorhyncus	Western buttercup
Rorripa curvisiliqua	Curve-pod yellowcress
Veronica peregrina	Purselane speedwell

Long Tom Watershed Council

Seeding Summary – Coyote Creek South

Seeding summary as prepared by RTF consulting for Coyote Creek South (not intended as a stand-alone report)

Planting Highlights Coyote Prairie South, Fields #1 and #2

Overview

The site was planted on 10/9, 10/10, and 10/16 with a customized version of a no-till drill set up for the unique characteristics of high diversity seed mixes and Willamette valley site conditions. Fall precipitation was less than ideal for a final response from the remnant seed bank, but planting conditions were good for the first 2 days, and ideal on the third. Precipitation received prior to planting puddled in the lowest areas and provided a response of annual ryegrass where the upper profile was saturated. More significant precipitation occurred prior to the final day of planting (10/16) but still struggled to get adequate saturation for germination. Soaking precipitation finally arrived late the week of 10/16 to saturate the upper soil profile and support consistent germination.

The whole site received a final glysophate treatment on 10/16 as weather/scheduling allowed, but prior the germination of desirable species. This treatment targeted some of annual ryegrass that germinated with the initial precipitation and some seedlings from the second precipitation event. Most of the areas planted with the wet prairie mix (38.1 ac.) on 10/16 were re-treated with glysophate on 10/30, just prior to germination of the planted seed mix. Overall this was not the ideal situation for the sprout/plant/spray philosophy, but it was the best we could do with the weather pattern and the wet prairie areas has almost ideal timing which will be apparent as we move forward. With multiple years of site prep, and the ability to selectively control annual ryegrass in most planting areas, I anticipate the less than perfect timing to have limited adverse effects.

Seeding

Overall seeding was carried out for each habitat (map attached) as accurately as possible, with variations highlighted below. As built conditions varied slightly from mapped habitats which could have also caused some slight deviations. Based on each seed mix, and ideal depths for planting, mixes were either straight drilled on 7” rows, dropped on surface through small seed attachment on 7” rows, or a combination of both as noted below. Drill depth was set for ½” deep for the grass only areas, and shallowed up to ¼” inch for all other mixes. Drill depths were set up as not to exceed depths, so areas with no soil disturbance planted at ¼” were similar to dropped seed on surface. Inevitably some of the dropped seed falls into the drill rows to provide diverse planting depths and allow each species to prosper in its ideal location. Overall, seed will be slightly deeper in the areas that were disked as the loose soil had yet to firm up with precipitation.

Grass only areas:

Total acres planted: 18 ac. @~14 lbs/ac. This mix was planted for 2 passes (28’) around the entire site, on the berms, powerline ROW, and in a few locations where the berm was close to

the perimeter these areas were filled in with grass mix. Drill depth was set for ½" deep for the grass only areas.

Amphibian pools:

Total acres planted: 6.3 ac. @~2 lbs/ac. Chris specifically showed us the areas for this mix, so it should be very accurate. This mix was planted through the small seed attachment with every other row drilled @1/4" depth, and the in between rows dropped on the surface. Mix was blended with pellets on volume @ ~50/50.

Showy mix:

Total acres planted: 1.2 ac. @~3.3 lbs/ac. Chris specifically showed us the areas for this mix, so it should be very accurate. This mix was planted through the small seed attachment with every other row drilled @1/4" depth, and the in between rows dropped on the surface. Mix was not blended with pellets, and some off the amphibian mix was still in the drill which may provide additional diversity.

Sparse vernal pool:

Total acres planted: 2 ac. @~1 lbs/ac. Chris specifically showed us the areas for this mix, so it should be very accurate. This mix was planted through the small seed attachment with every other row drilled @1/4" depth, and the in between rows dropped on the surface. Mix was not blended with pellets.

Dense vernal pool:

Total acres planted: 26.8 ac. @~2lbs/ac. This mix was planted through the small seed attachment with every other row drilled @1/4" depth, and the in between rows dropped on the surface. Mix was not blended with pellets.

Competitive:

Total acres planted: 12 ac. @~4lbs/ac. This mix was planted through the large seed attachment drilled @1/4" depth on 7" rows (note: Areas with no soil disturbance were planted on surface). Mix was blended with enough pellets to bulk it up. This mix was planted back and forth starting at the property boundary in SE corner. Started drilling on S edge of eastern most amphibian pool, and contoured until we tied in with powerline grass only mix. It was planted back and forth so should be consistent. The 2 small polygons by the road were not planted with this mix as delineated on the map and instead were planted with WP mix on 10/16 since we were low on seed after SE corner.

Upland/Wet prairie:

Total acres planted: 10.6 ac. @~4lbs/ac. This mix was planted through the large seed attachment drilled @1/4" depth on 7" rows (note: Areas with no soil disturbance were planted on surface). Mix was blended with enough pellets to bulk it up. This mix was planted as indicated on map, except the small areas in between polygons mapped as WP were also planted with this mix since they were so small they were likely to get forgotten about especially with rain forecast prior to completion. It appeared the areas mapped for WP, were associated with historic AG ditches, so those areas were over planted with WP mix to ensure something would take hold in that moisture regime.

Sparse wet prairie(low):

Total acres planted: 14 ac. @~1 lbs/ac. This mix was planted through the small seed attachment with every other row drilled @1/4" depth, and the in between rows dropped on the surface. Mix was blended with enough pellets to bulk it up. We had a hard time defining this polygon. I made 2 passes around the entire polygon before Chris got us back on course. After that we focused on seeding the core sparse areas as directed, and ended up planting 14 ac as directed. With rain coming, we decided to plant the remaining 4.4 ac from our initial 2 rounds after we redirected with WP mix (all heights) at similar seeding rate to keep with the low seeding rate focus for this area.

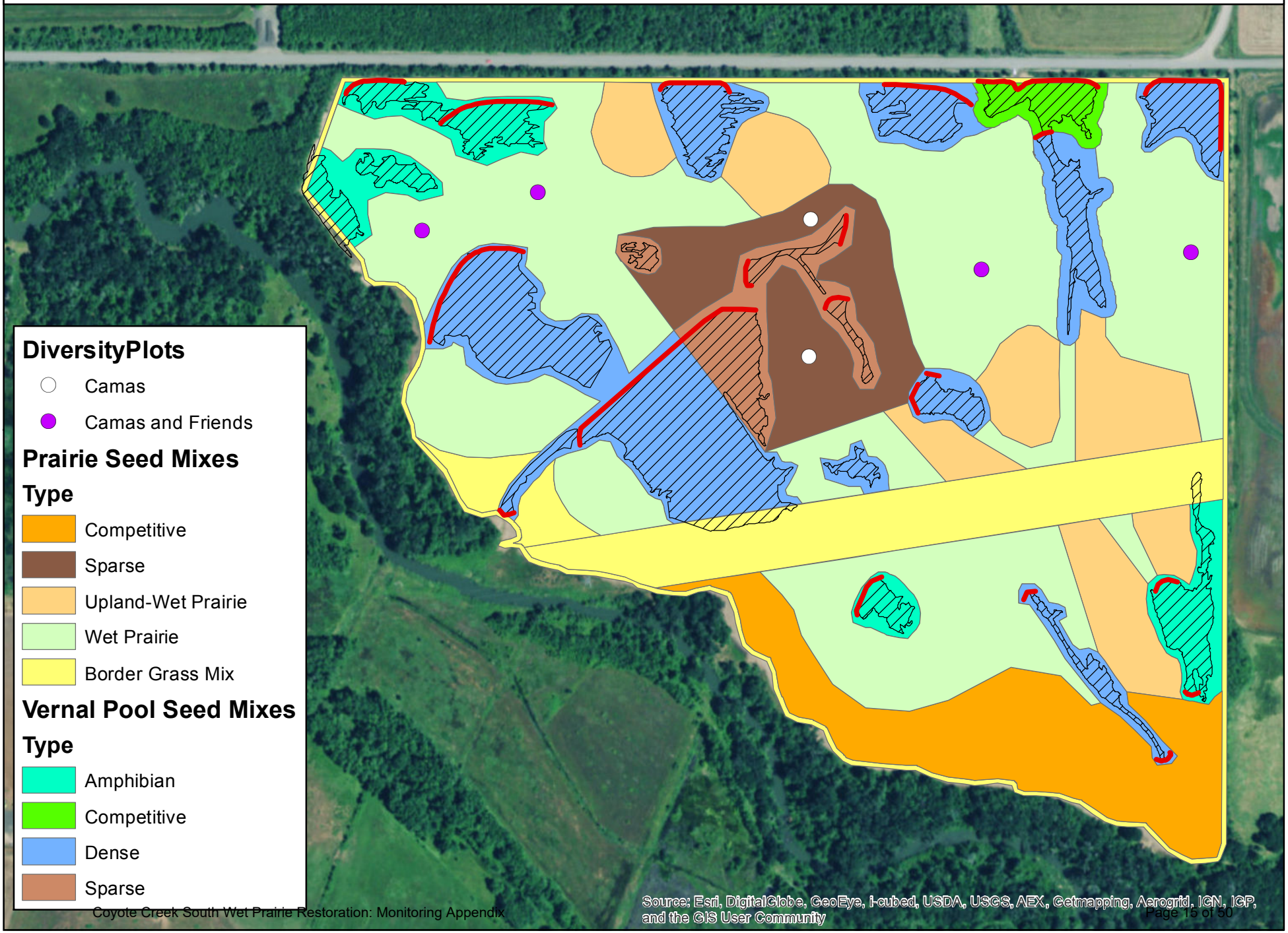
Sparse wet prairie (All heights):

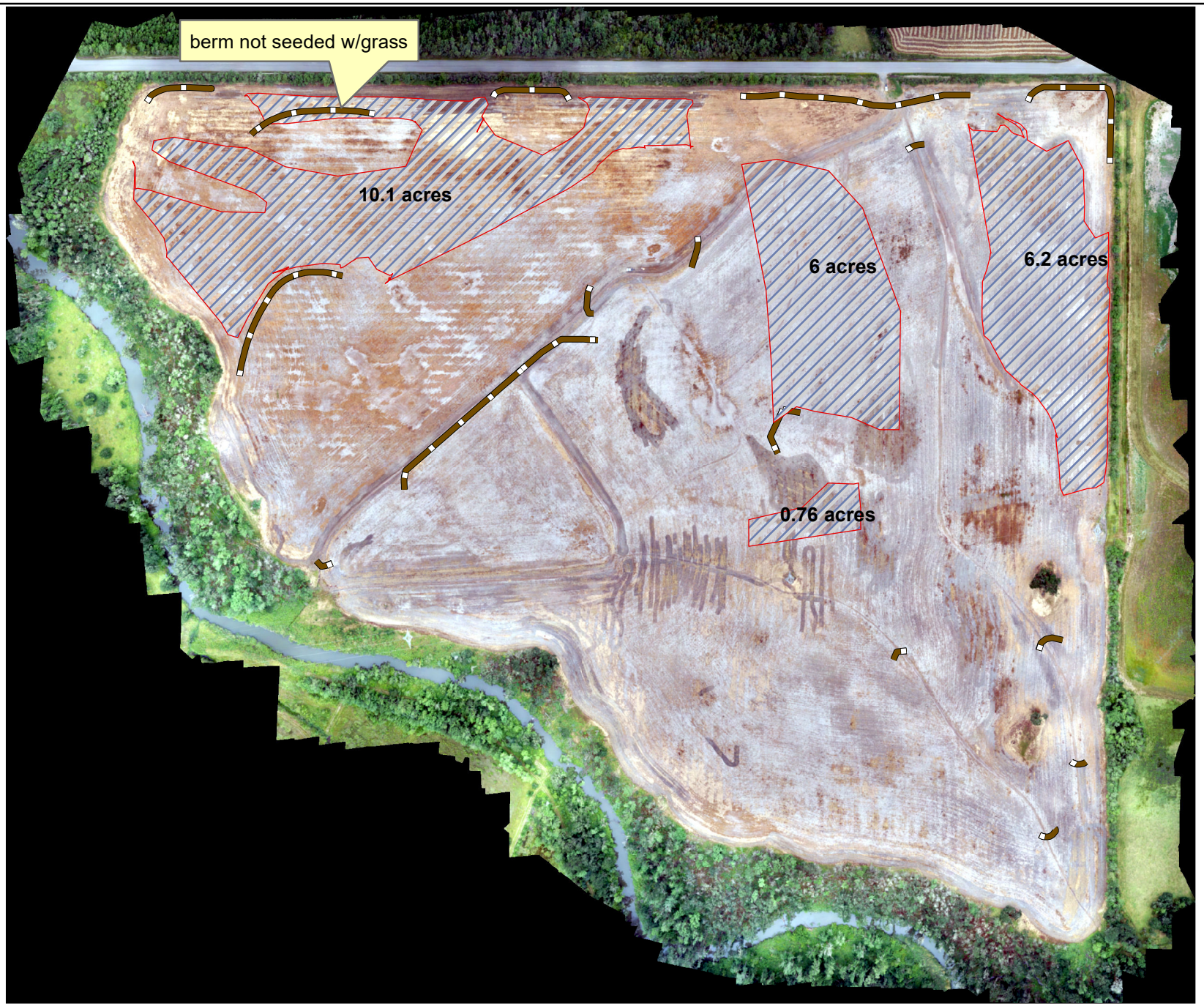
Total acres planted: 38.1 ac. @~2.8lbs/ac. See note above where this mix was used to fill in sparse wet prairie area (additional 4.4 ac.). This mix was planted through the large seed attachment drilled @1/4" depth on 7" rows (note: Areas with no soil disturbance were planted on surface). Mix was blended with pellets on volume @ ~50/50. This was the last mix planted and utilized in areas not previously planted, so there were likely some overlaps, but we were most concerned about having unplanted areas. 2/3 of the way through we realized we had more acres left that anticipated. Chris was able to jump in and blend up 2 batches with remaining seed to ensure we had enough to finish. The final 2 bags of seed were utilized in the 6 ac and 6.2 acre polygons on the GPS not-planted map (attached). I only mention this extra seed as we may see differences in dominant spp etc.

Conclusion

Overall the seeding went extremely well other than a few points highlighted in summary. Although the areas of the previous fescue crop were rough to plant, I think that area will have the most micro topography and really aid in establishment of high diversity plant assemblages. The wet prairie areas that received a final herbicide application on 10/30 are worth noting for educational purposes, as our planted species will have a competitive edge in those areas. I would expect Annual ryegrass to be abundant in areas with soils disturbance, but should be manageable with proper timing of treatments. It's always a pleasure planting high diversity seed mixes and look forward to seeing the site mature and keeping non-native species at low levels through full establishment.

Coyote Creek South Draft Seeding Map - March 2017





Coyote Creek South - North Restoration (Fields 1 &2)
Areas flagged/not planted 10/11/17

N

0 170 340 680 1,020 Feet

Vegetation, Avian, and Amphibian Monitoring at Coyote Creek South

Monitoring Reports and Summaries through 2019

Compiled by Amanda Reinholtz, LTWC

11/8/2019

2019 Vegetation Monitoring Summary

Coyote Creek South

Eugene, OR

November 1, 2019

Summary prepared by Diane Steeck
City of Eugene Parks and Open Space
for the
Long Tom Watershed Council
Eugene, OR

Introduction

Vegetation monitoring at the Coyote Creek South Phase 1 and 2 restorations (OWEB grant # 215-3057-11736) focused on assessments of plant establishment from seed mixes and volunteer colonization in 2018. In 2019, the first year of quantitative vegetation sampling was conducted. Quantitative vegetation sampling provides data that can be used to plan future seeding, to identify non-native invasive plant species that should be controlled, and to assess success in achieving habitat goals for plant and animal species and communities. These initial monitoring results provide a baseline against which future species composition and diversity can be compared to identify trajectories of the developing plant community.

The standard quantitative vegetation monitoring method for this site is the point-intercept method, used to assess plant cover by species. A complete species list for the site was also developed from meandering surveys across the site in May and July 2019. The complete species list within the restoration area is provided at the end of this report.

On June 17, 18, and 20, 2019, staff conducted point-intercept monitoring at the Coyote Creek South location. Vegetation in the acre surrounding two streaked horned lark nests was monitored only after the larks had left the nests, on July 3, 2019. Monitoring methods are described elsewhere, in the vegetation protocol, with methods specific to 2019 described further below.

Site-wide vegetation monitoring

Because this was the first year of quantitative vegetation monitoring (the second year of plant growth since first seeding), staff monitored relatively intensely, taking 8 points (samples) per acre, for a total of 886 sample points over the entire 116-acre Phase 1 and 2 restoration site. Two acres, one around each of the two active streaked horned lark nests, were avoided during the June monitoring to ensure monitoring activity did not disturb the nesting larks.

The monitoring method used a systematic sampling with random starts to assess vegetation cover. Monitoring was conducted along transects starting in the NE corner of the site. Up to 48 points were taken along each transect, running from north to south and south to north. After completing the first transect, moving north to south, monitoring staff at the south end of the site moved to the next transect and collected points along that transect moving north. As transects were completed staff moved from the east side of the site to the west. The monitoring area included only the area seeded, which was typically delineated by the native grass swath that borders the site, buffering it from adjacent nonnative plant populations.

Transects start points and monitoring location were aligned using a handheld computer with a GPS 1-acre grid overlaid on an site map or aerial photo. Pacing was also employed, after calibrating paces against a meter measuring tape. Starting at the northeasternmost site corner, the northern line of grid intersections and transects were flagged running east to west. From

these grid intersections, transects were started at 19 and 40 meters to the east, in each 1-acre grid square, giving two N-S transects running through each 1-acre square.

Points along a transect were taken at 13-meter intervals except for the first point of a 1-acre square. Locating the first point in a 1-acre square required using a randomly generated number between 1 and 5 to represent the number of meters that would be added on to the first pace of 13 meters. For instance, if the random number was 2, and the monitoring staff were heading south, then from the grid line, the first point would be taken after pacing 15 meters south; the subsequent 3 points would be taken 13 meters apart. After taking the 4th sample along the transect in the grid-square, staff would move forward to the line representing the next grid square, using the GPS map on the handheld computer to maintain their alignment along the transect.

Vegetation monitoring around streaked horned lark nests

By early July, bird monitoring staff concluded that the nests in the monitoring area were no longer active, so on July 3 vegetation monitoring staff conducted point-intercept monitoring in the 1-acre area around each nest that had been skipped earlier. Staff also assessed the vegetation in the 1 meter directly around the nest. For the 1-acre point-intercept monitoring, staff collected data at 25 sample points, which were located along 5 transects (5 points each), spaced 10 m apart starting from the NE corner. Points along the transects were taken at 10 m intervals, except the first point, which used the same random start method (between 1 and 5) described earlier. Point-intercept monitoring methods were the same as the broader vegetation monitoring, except that the maximum height of vegetation in the 4-inch radius area around the steel pin was recorded at each point.

Results

Site-wide vegetation monitoring

Summaries of the site-wide vegetation results are shown in Tables 1 and 2.

Table 1. Results from the 2019 site-wide point intercept monitoring of vegetation. Species are ordered from highest to lowest Percent Cover and grouped by native and non-native origin. Bolded quantities under “Percent Cover” are those native species with at least 1% cover.

Origin	Species	Code	Percent Cover	Forbs	Annual
Native	*Juncus bufonius*	JUNBUF	**11.6**		1
Native	*Alopecurus geniculatus*	ALOGEN	**10.7**		
Native	*Plagiobothrys figuratus*	PLAFIG	**9.5**	1	1
Native	*Gnaphalium palustre*	GNAPAL	**9.4**	1	1

Origin	Species	Code	Percent Cover	Forbs	Annual
Native	*Plagiobothrys scouleri*	PLASCO	**8.5**	1	1
Native	*Deschampsia cespitosa*	DESCES	**7.4**		
Native	*Rorippa curvisiliqua*	RORCUR	**5.4**	1	1
Native	*Grindelia integrifolia x nana*	GRIINT	**4.9**	1	
Native	*Agrostis exarata*	AGREXA	**4.1**		
Native	*Hordeum brachyantherum*	HORBRA	**3.4**		
Native	*Epilobium densiflorum*	EPIDEN	**2.6**	1	1
Native	*Prunella vulgaris var. lanceolata*	PRUVULL	**2.4**	1	
Native	*Clarkia purpurea*	CLAPUR	**2.3**	1	1
Native	*Deschampsia elongata*	DESELO	**2.1**		
Native	*Epilobium brachycarpum*	EPIBRA	**1.9**	1	1
Native	*Gratiola ebracteata*	GRAEBR	**1.5**	1	1
Native	*Veronica peregrina*	VERPER	**1.2**	1	1
Native	*Epilobium ciliatum*	EPICIL	**1.0**	1	1
Native	*Eriophyllum lanatum var lanatum*	ERILANL	**1.0**	1	
Native	*Erythranthe guttata*	ERYGUT	**1.0**	1	1
Native	*Panicum capillare*	PANCAP	**1.0**		1
Native	*Madia elegans*	MADELE	0.9	1	1
Native	*Juncus occidentalis*	JUNOCC	0.8		
Native	*Beckmannia syzigachne*	BECSYZ	0.7		1*
Native	*Carex sp (all Carex encountered were native)*	CAR sp	0.6		
Native	*Carex unilateralis*	CARUNI	0.6		
Native	*Acmispon americana*	ACMAME	0.5	1	1
Native	*Eleocharis obtusa*	ELEOBT	0.5		1
Native	*Glyceria occidentalis*	GLYOCC	0.5		
Native	*Collomia grandiflora*	COLGRA	0.2	1	1
Native	*Madia sativa*	MADSAT	0.2	1	1
Native	*Achillea millefolium*	ACHMIL	0.1	1	
Native	*Bidens frondosa*	BIDFRO	0.1	1	1
Native	*Clarkia amoena*	CLAAMO	0.1	1	1

Origin	Species	Code	Percent Cover	Forbs	Annual
Native	*Collinsia grandiflora*	COLGRA	0.1	1	1
Native	*Eleocharis palustris*	ELEPAL	0.1		
Native	*Madia glomerata*	MADGLO	0.1	1	1
Native	*Pseudognaphalium stramineum*	PSESTR	0.1	1	1*
Non-native / Introduced	*Lythrum hyssopifolium*	LYTHYS	17.7	1	1
Non-native / Introduced	*Lythrum portula*	LYTPOR	7.9	1	1
Non-native / Introduced	*Panicum dichotomiflorum*	PANDIC	1.5		
Non-native / Introduced	*Vulpia myuros*	VULMYU	1.5		1
Non-native / Introduced	*Poa annua*	POAANN	1.2		1
Non-native / Introduced	*Poa pratensis*	POAPRA	0.6		
Non-native / Introduced	*Aira elegans*	AIRELE	0.5		1
Non-native / Introduced	*Briza minor*	BRIMIN	0.3		1
Non-native / Introduced	*Echinochloa crus-galii*	ECHCRU	0.3		1
Non-native / Introduced	*Lolium multiflorum*	LOLMUL	0.3		1
Non-native / Introduced	*Cerastium glomeratum*	CERGLO	0.2	1	1
Non-native / Introduced	*Geranium dissectum*	GERDIS	0.2	1	1
Non-native / Introduced	*Myosotis discolor*	MYODIS	0.2	1	1
Non-native / Introduced	*Agrostis stolonifera/capillaris*	AGRSTO/CAP	0.1		
Non-native / Introduced	*Anthriscus caucalis*	ANTCAU	0.1	1	1
Non-native / Introduced	*Bromus commutatus*	BROCOM	0.1		1
Non-native / Introduced	*Galium divaricatum*	GALDIV	0.1	1	1
Non-native / Introduced	*Hypochaeris radicata*	HYPRAD	0.1	1	
Non-native / Introduced	*Persicaria maculosa*	POLPER	0.1	1	1*

Table 2. 2019 summarized results from the monitoring results shown in Table 1.

Vegetation Summary	
Number of native species encountered by Pt-Intercept method	38
Native species cover (absolute)	99%
Native species cover (relative to all vegetation cover)	75%
Number of non-native species encountered by monitoring method	19
Non-native species cover (absolute)	33%
Non-native species cover (relative to all vegetation cover)	25%
Percent of native species that are annual	58%
Number of native forbs with > 1% cover (over 1 acre of cover on site)	14
Number of native graminoids with >1% cover	7
Bareground, litter, or moss	**9.6%**

Of note, 38 native species were encountered ("hit" by the pin) during the monitoring. Of these, 21 had at least 1% cover over the site, meaning they had established sufficiently to each provide 1.1 or more acres of cover across the 116 acre site. Based on the monitoring data, just under 10% of the site is unvegetated (recorded as either bare, litter, or moss), providing habitat for species that prefer open ground, such as breeding streaked horned larks.

Non-native species provided about a quarter of the vegetation cover on the site, with the two small annual *Lythrum* species (*Lythrum hysoppifolia* and *L. portula*), making up over ¾ of this total. If more perennial native vegetation becomes established on the site, the *Lythrum* species are likely to diminish in cover, based on results at the adjacent Coyote Prairie site, managed by the City of Eugene. If the site is managed with annual disturbance (scraping, tilling, etc) or an emphasis on maintaining a community dominated by smaller annual plants (for instance, to keep vegetation sparse for nesting streaked horned larks) then *Lythrum* may not diminish in future years. This year, of the native species recorded during monitoring, 58% are annual species. It is common for wet prairie restorations in the southern Willamette Valley to be dominated by annual vegetation in the first few years, which typically transitions to a more perennially dominated community after 5 or more years.

The site in 2019 has a forb-rich vegetation community with forbs making up 67% of those native species that had greater than 1% cover. During monitoring, native bees and honeybees

were observed feeding on native flowering species and Sphinx moth larvae were abundant, consuming native members of the Onagraceae (primrose family) in the northeast region of the site. Observers noted western meadowlarks on an adjacent property feeding their young large caterpillars that appeared to be sphinx moth larvae.

The point-intercept method is known to miss uncommon species, since only the species "hit" by the tip of the monitoring pin are recorded. Site-wide meandering surveys identified an additional 33 species of plants that occur in small populations or as few individuals. These include 19 native species and 14 non-native species (Table 5, end of report).

Seeded Species Occurrence

About 59 native plant species were seeded onto the Coyote Creek Restoration Phases in fall 2017. Of these, 27 were found to have at least 0.1% cover as recorded during point-intercept monitoring in 2019. An additional 13 seeded native species were not "hit" during point-intercept monitoring, but were recorded during meandering walking surveys, for a total of 40 native seeded species having been found growing on the site in 2019. Species that were seeded, but not found during the 2019 growing season should not be considered to have completely failed to establish. Some wet prairie natives take years to reach reproductive size and so may have been missed during walking surveys due to small initial population sizes and inconspicuous growth habit over the large, 116-acre site (e.g. *Wyethia angustifolia*, *Cammasia quamash*, *Perideridia oregana*, *Allium amplectens*). Four or five years after first fall seeding is a more reasonable time to conclude which seeded species completely failed to establish populations in the restoration.

In addition to native species that were seeded and not found, there were also 11 native plant species that were not seeded, but were recorded during point intercept sampling. These likely emerged from an existing soil seedbank and a few of them with wind-dispersed seeds, such as *Epilobium brachycarpum* and *E. ciliatum*, may have colonized the site from surrounding lands. Even the two most abundant native species on the site, as recorded by point-intercept monitoring - *Juncus bufonius* and *Alopecurus geniculatus* – were not seeded. These graminoids have emerged abundantly from the soil seedbank at the adjacent Coyote Prairie restoration phases as well. Similarly, all of the 11 unseeded natives that were encountered during point-intercept monitoring have emerged in other restorations in the West Eugene Wetlands and represent tenacious natives that are frequently able to persist in wetlands cropped with ryegrass.

Streaked horned lark vegetation monitoring

The point-intercept monitoring of the 1-acre areas surrounding each of the inactive nests showed an average maximum vegetation height of less than 1.5 feet. This is relatively short, and vegetation would likely have been even shorter earlier in the season when the larks chose the nest locations. Many prairie plants are growing rapidly during the warming months of May

and June, and the monitoring date was on July 3 after fledging had occurred or the nest had failed.

Table 3. Plant height and bareground recorded in the two 1-acre areas surrounding streaked horned lark nests.

NE Nest	25 pts sampled	
Vegetation avg max height (in.)		12.1
Median max height (in.)		8
Bareground		20%

SW Nest	25 pts sampled	
Vegetation avg max height (in.)		17.6
Median max height (in.)		12.5
Bareground		0

Bareground in the 1-acre area surrounding nests was estimated at 20% around the NE nest and 0% (every point hit a plant) around the SW nest location. Within the 1-meter square area directly around the nest, bareground was estimated to be the most common "cover" in one of the immediate nest locations (quadrats; 51-75% cover class) and was recorded as 20% in the other nest location. Using the median value in the 51-75% cover class of 63%, the two bareground values around nests are very high at 20% and 63%.

Both values are substantially greater than the site-wide bareground value of 9.6% recorded during site-wide monitoring, which may indicate that the larks are nesting in the site's least vegetated locations. The 3 plant species with the highest cover directly around the nest differed between the two nest locations, so the 6 species that had a cover value higher than 5% (all were less than 50%) are listed below

.

Table 4. The three plant species with the greatest cover values in the 1-m area around each of two streaked horned lark nests.

Species	**Habit**	**Typical height**
Plagiobothrys scouleri (scoulers popcorn flower)	Annual forb	under 12"
Vulpia myuros / bromoides (rat-tail fescue)	Annual grass	under 12"
Rorippa curvisiliqua (curve-pod rorippa)	Annual forb	under 12"
Lythrum hyssopifolium (hyssop loosestrife)	Annual forb	under 12"
Grindelia integrifolia x nana (Willamette Valley gumplant)	Bienniel forb	under 12" as rosette (first yr plants); greater than 12" when flowering (second-year plants)
Erythranthe guttata (common monkey flower)	Annual forb	under 12"

Species List

Table 5. This list of species was recorded at the Coyote Creek South (CCS) prairie and vernal pool restoration in Eugene, OR, in spring and summer of 2019. Species were encountered

during quantitative monitoring and during meandering surveys in May and July within the restoration area, which was generally delineated by the native grass swath that surrounds the site and acts as a buffer against the establishment of non-native species from adjacent areas. On this list under Origin, N refers to Native and I to introduced (non-native).

Scientific Name	**Common Name**	**Origin**	**CCS**
Achillea millefolium	yarrow	N	X
Acmispon americanus (syn. Lotus unifoliolatus)	Spanish clover	N	X
Agrostis exarata	spike bentgrass	N	X
Agrostis stolonifera/capillaris	creeping bentgrass	I	X
Aira elegans (syn A. caryophyllea)	silver hairgrass	I	X
Alisma trivale	northern waterplantain	N	X
Alopecurus geniculatus	water foxtail	N	X
Alopecurus pratensis	meadow foxtail	I	X
Anagallis arvensis	scarlet pimpernel	I	X
Anthemis cotula	mayweed chamomile	I	X
Anthriscus caucalis	bur chervil	I	X
Beckmannia syzigachne	American sloughgrass	N	X
Bidens frondosa	leafy beggars-tick	N	X
Briza minor	little quaking-grass	I	X
Bromus commutatus	hairy brome	I	X
Camassia leichtlinii ssp. *suksdorfii*	great camas	N	
Camassia quamash ssp. *maxima*	common camas	N	
Carex densa	dense sedge	N	X
Carex obnupta	slough sedge	N	
Carex unilateralis	one-sided sedge	N	X

Centaurium erythraeae	common centaury	I	X
Cerastium glomeratum	sticky chickweed	I	X
Chamerion angustifolium var. *canescens*	perennial fireweed	N	X
Claria amoena	farewell-to-spring	N	X
Clarkia purpurea ssp. *quadrivulnera*	winecup clarkia	N	X
Collinsia grandiflora	large flowered collinsia	N	X
Collomia grandiflora	large-flowered collomia	N	X
Daucus carota	Queen Anne's lace	I	X
Deschampsia cespitosa	tufted hairgrass	N	X
Deschampsia elongata	slender hairgrass	N	X
Downingia elegans	showy downingia	N	X
Downingia yina	Willamette downingia	N	X
Drymocallis glandulosa var. glandulosa (re-chk var. in 2020)	Sticky cinqefoil	N	X
Echinochloa crus-galli	large barnyard-grass	I	X
Eleocharis obtusa	blunt spike-rush	N	X
Eleocharis palustris	creeping spikerush	N	X
Elymus glaucus ssp. *glaucus*	blue wildrye	N	X
Epilobium brachycarpum	autumn willowherb	N	X
Epilobium ciliatum	hairy willowherb	N	X
Epilobium densiflorum	dense spike-primrose	N	X
Eriophyllum lanatum var. *lanatum*	wooly sunflower	N	X
Eryngium petiolatum	Oregon coyote thistle	N	X
*Erythranthe guttata (*syn. *Mimulus guttatus)*	common monkeyflower	N	X
Fraxinus latifolia	Oregon ash	N	X

Galium divaricatum	wall bedstraw	I	X
Geranium dissectum	cut-leaved geranium	I	X
Geum macrophyllum	large-leaf avens	N	X
Glyceria occidentalis	western mannagrass	N	X
Gnaphalium palustre	lowland cudweed	N	X
Gratiola ebracteata	bractless hedge-hyssop	N	X
Grindelia integrifolia × *Grindelia nana* var. *nana*	Willamette V. gumweed	N	X
Holcus lanatus	velvet grass	I	X
Hordeum brachyantherum	meadow barley	N	X
Hypericum perforatum	St. John's-wort	I	X
Hypochaeris radicata	false dandelion	I	X
Juncus bufonius	toad rush	N	X
Juncus occidentalis	slender rush	N	X
Lolium multiflorum	Italian ryegrass	N	X
Lythrum hyssopifolium	hyssop loosestrife	I	X
Lythrum portula	water-purslane	I	X
Madia elegans	showy tarweed	N	X
Madia glomerata	cluster tarweed	N	X
Madia sativa	coast tarweed	N	X
Mentha pulegium	pennyroyal	I	X
Microseris laciniata ssp. *laciniata*	cut-leaved microseris	N	X
Microsteris gracilis	pink microsteris	N	X
Montia linearis	narrow-leaved montia	N	X
Montia fontana	annual water minerslettuce	N	X
Myosotis discolor	yellow and blue forget-me-not	N	X

Panicum capillare ssp. *capillare*	common witchgrass	N	X
Panicum dichotomiflorum	fall witchgrass	I	X
Persicaria maculosa	spotted ladysthumb	I	X
Plagiobothrys figuratus var. *figuratus*	fragrant popcorn-flower	N	X
Plagiobothrys scouleri	Scouler's popcorn-flower	N	X
Plantago lanceolata	English plantain	I	X
Plectritis congesta	rosy plectritis	N	X
Poa annua	annual bluegrass	I	X
Poa pratensis	Kentucky blugrass	I	X
Potentilla gracilis var. *gracilis*	slender cinquefoil	N	X
Prunella vulgaris var. *lanceolata*	native heal all	N	X
Pseudognaphalium stramineum	cottonbatting plant	N	X
Ranunculus occidentalis	western buttercup	N	X
Ranunculus orthorhynchus	straight beaked buttercup	N	X
Rorippa curvisiliqua	western yellowcress	N	X
Rumex acetocella	sheep sorrel	I	X
Rumex crispus	curly dock	I	X
Rumex salicifolius var. *salicifolius*	willow dock	N	X
Senecio jacobea	tansy ragwort	I	X
Sidalcea malviflora ssp. *virgata*	dwarf checker-mallow	N	X
Solanum dulcamara	bitter nightshade	I	X
Torilis arvensis	spreading hedgeparsley	I	X
Veronica peregrina var. *xalapensis*	purslane speedwell	N	X
Vulpia myuros	rat-tail fescue	I	X

Streaked Horned Lark Surveys at Coyote Creek South, Summer 2017

Photo: Bob Altman

Prepared by Bob Altman

Avifauna Northwest

October, 2017

Introduction
The 309-acre Coyote Creek South property, owned by the Oregon Department of Fish and Wildlife, is undergoing habitat restoration in cooperation with the Long Tom Watershed Council. The habitat restoration includes conversion of 116 acres of former grass seed fields to a mosaic of 104 acres of wet prairie and 12 acres of vernal pool habitat, incorporating habitat requirements for Streaked Horned Lark and Red-legged Frog.

Objective
The project objective was to conduct breeding and post-breeding season surveys to document the occurrence, abundance, and nesting status of Streaked Horned Lark (hereafter larks) and other priority bird species to assess project effectiveness and provide a baseline on populations for ongoing and future habitat management.

Methods
Survey methodology was an area search technique in which the observer moves freely through a defined area emphasizing time spent in locations where birds are occurring (Ralph et al. 1995). Area searches facilitate the detection of uncommon/rare species due to freedom of movement and complete coverage of an area.

Each area search survey occurred during the early morning and lasted approximately 1.5 hours, being completed before 9 AM. Visits were at least one week apart, and only were conducted during favorable weather conditions. Most visits were conducted by one individual (Bob Altman), with one visit (July 7) including one other person (Niles Brinton), and other visit (June 27) including three others (Niles Brinton, Katie MacKendrick, and Scott Nelson). Rope-dragging to locate nests was conducted on June 27.

Results
Nine area search surveys were conducted from June 17 to September 28 (Table 1). At least one lark was detected on all surveys except the last one. It is likely that 3-5 pairs of larks nested on the property, with 4-5 males being detected on all visits during the breeding season (i.e., through July).

No nests were located, but one dependent fledgling (incapable of flight) was observed on July 7, and as many as four independent fledglings (fully capable of flight) were observed on August 4. Additionally, female larks were observed carrying food on two visits.

Table 1. Daily results of Streaked Horned Lark area search surveys, summer, 2017.

	Adults			Fledglings [1]		
Date	Male	Female	Unk	Independent	Dependent	Comments
4/28	*2*	*2*	*0*	*0*	*0*	*Seen by Chris Vogel*
6/17	5	1	0	0	0	
6/27	4	2	0	1	0	One meadowlark along east property edge
7/7	5	2	0	1	1	One meadowlark pair on east edge of property
7/17	4	1	0	3	0	Female carrying food
7/24	5	3	0	0	0	
8/4	1	1	1	4	0	Unknown was flying bird; female carrying food
8/20	0	0	1	0	0	Unknown was flying bird
9/10	0	0	1	0	0	Unknown was flying bird
9/28	0	0	0	0	0	13 meadowlarks and 12 pipits

[1] Independent/dependent refers to flight capability.

Discussion

The surveys were initiated in the latter half of 2017 breeding season, thus, do not provide a complete picture of breeding season site use by larks. Although no nests were located, the regular presence of several pairs, along with observations of recently fledged young indicate that some nesting did occur on the site.

The fewer number of female detections on all visits during the breeding season is due to either being undetected on nests or an unbalanced gender ratio. If the latter, then the number of nesting pairs was likely three, the maximum number of females detected on any visit. However, territorial behavior among the 4-5 males detected on all breeding season visits was often noteworthy, suggesting paired status.

The observation of a maximum number of four fledglings with a minimum number of three pairs suggests the potential for low nest success or low survivorship of recently fledged young. A full nesting season of surveys, including nest monitoring and color-banding of nestlings, will provide a better assessment of nesting productivity and post-fledging survivorship.

The drop in numbers of larks in August was probably a combination of post-breeding dispersal and displacement due to mowing operations which began on July 28, and earth-moving for vernal pool creation which began on August 7. The latter resulted in large areas completely devoid of vegetation, which may have reduced the insect prey base for foraging birds.

The other primary potential nesting disturbance factor was field spraying on June 6. This occurred prior to the surveys, so it is unknown if there was any displacement of birds or nest destruction resulting from this activity.

The presence of a Western Meadowlark pair on July 7 indicates the potential for nesting on the site. However, they do nest immediately adjacent to the east on Coyote Prairie, and could just be foraging on Coyote Creek South.

Literature Cited

Ralph, C.J., G.R. Geupel, P. Pyle, T.E. Martin, D.F. DeSante. 1995. Handbook of field methods for monitoring landbirds. USDA For. Serv. Gen. Tech. Rept. PSW-GTR-144. 41 pp.

Streaked Horned Lark Surveys at Coyote Creek South, Breeding Season, 2018

Photos: Bob Altman

Prepared by Bob Altman

Avifauna Northwest

October, 2018

Introduction
The 309-acre Coyote Creek South property, owned by the Oregon Department of Fish and Wildlife, is undergoing habitat restoration in cooperation with the Long Tom Watershed Council. The habitat restoration includes conversion of 116 acres of former grass seed fields to a mosaic of 104 acres of wet prairie and 12 acres of vernal pool habitat, incorporating habitat requirements for Streaked Horned Lark.

Objective
The objective was to conduct breeding season surveys to document the occurrence, abundance, and nesting status of Streaked Horned Lark (hereafter larks) and other priority bird species (e.g., Western Meadowlark, Grasshopper Sparrow) to assess project effectiveness and provide a baseline on populations for ongoing and future habitat management.

Methods
Lark survey methodology was an area search technique in which the observer moves freely through a defined area emphasizing time spent in locations where birds are occurring (Ralph et al. 1995). Area searches facilitate the detection of uncommon/rare species due to freedom of movement and complete coverage of an area.

Thirteen area search surveys were conducted from March 19 to August 22. Visits were at least one week apart, and only were conducted during favorable weather conditions. Each survey occurred during the morning before 10:00 am, and lasted 1-1.5 hours. Most visits were conducted by one individual (Bob Altman), with two visits including one other person (Niles Brinton or Monica Lapinski), and two visits with two other people (Niles Brinton and Monica Lapinski). Rope-dragging to locate nests was conducted on two visits (5/29 and 6/7).

Avian community surveys were conducted using a point count protocol (Ralph et al. 1995). Three previously established point count stations were surveyed during three relatively equally spaced visits on May 20, June 6, and June 18. Each survey was completed before 10:00 am during favorable weather conditions. All species and individuals detected within the area of the prairie restoration were recorded during a 5-minute listening period at each station. The distance to each detection was estimated. Relative abundance was calculated as the number of detections/point count survey.

Results
Larks were detected on all thirteen area search surveys (Table 1). It is likely that 4-5 pairs of larks nested on the property. No nests were located, but independent fledglings (fully capable of flight) were observed on all visits after 6/18, including 12 on 8/4. Additionally, a female lark was observed carrying food on one visit, and nesting material on another visit.

Table 1. Results of Streaked Horned Lark breeding season area search surveys at Coyote Creek South, 2018.

	Adults				
Date	Male	Female	Unknown	Hatch-Year	Comments
3/19	2				
4/4	1				
4/9	4	3	1		Unknown likely female based on flying with male
4/25	5	3			
5/8	3	2	3		
5/20	5	3			

5/29	5	3			
6/7	4	3			
6/18	4	1			
6/27	4	2	1	2	Female seen carrying nest material
7/7	4	3		5	Female seen carrying food
7/20	5	3		5	
8/4	3	1	1	12	
8/22	1		3	6	

There were 13 bird species detected during point count surveys (Table 2). This included eight detections of larks. The highest relative abundance was for Savannah Sparrow (2.11 birds/point count), except for a flock of 78 Canada Geese on 5/20. Other detections of note on the property included five Great Egrets on May 20, one Western Kingbird on June 18, and one Western Meadowlark on June 18. Additionally, Purple Martins were detected as flyovers on two visits, June 6 and June 17.

Table 2. Point count survey results from Coyote Creek South, May-June, 2018.

	Relative Abundance[1]	Dates	Comments
American Goldfinch	0.11	6/6	
American Robin	0.22	5/20	
Barn Swallow	0.22	6/6, 6/18	
Canada Goose	*	5/20	Flock of 78 birds on 5/20
Great Egret	0.56	5/20	
Great-blue Heron	0.11	5/20	
Streaked Horned Lark	0.89	5/20, 6/6, 6/18	
Killdeer	0.56	5/20	
Savannah Sparrow	2.11	5/20, 6/6, 6/18	
Song Sparrow	0.33	6/6, 6/18	
Tree Swallow	0.22	5/20	
Western Kingbird	0.11	6/18	
Western Meadowlark	0.11	6/18	

[1] Number of detections/point count survey.

‘* Relative abundance not calculated due to singular large flock.

Discussion

Although no lark nests were located, the regular presence of several pairs, along with many observations of recently fledged young indicate that nesting did occur on the site. Further, the observation of a maximum number of 12 fledglings on one visit suggests good nest success. This potentially resulted from less field disturbance in 2018 than the previous year when earth moving was still occurring along with mowing and spraying. Additionally, in 2018 the spraying was spot-spraying rather than broadcast spraying (less disturbance to nesting birds), and conversations with the spray crew enhanced their awareness and concern for nesting birds.

Potentially increased nesting success in 2018 also may be a factor of improved habitat conditions in the prairie restoration, and a dry spring which made vernal pools available for nesting sooner. As a result, the majority of the site was suitable for lark nesting the entire breeding season. In 2017, there were larger areas of completely exposed bare ground (unsuitable nesting habitat) due to the recent and ongoing earth moving.

In 2018 there also was a much better mosaic of vegetated and sparsely-vegetated areas including smaller areas of denser and/or taller vegetation for hiding cover (see cover photos). Typically at prairie restoration sites, the habitat will become more vegetated over time and move out of lark suitability. However, the presence of several vernal pools, should be able to maintain some suitable lark breeding habitat for some of the breeding season.

The fewer number of female detections on all visits during the breeding season is not unexpected. Female detectability is less than males due to not singing and being on nests during part of the breeding season. It is also possible there is an unbalanced gender ratio. However, territorial behavior among the 4-5 males detected on all breeding season visits was often noteworthy, suggesting paired status.

It is noteworthy that there were no detections of larks when point count surveys were conducted at the same stations in 2015 and 2016. This was prior to the initiation of prairie restoration when the field was still in agricultural production. Point count surveys were not conducted in 2017 after restoration had been initiated, but there was a similar population to 2018 (i.e., 4-5 breeding pairs).

The presence of a singing Western Meadowlark on June 18 is likely from the nesting pair on the adjacent Coyote prairie. It was detected near the boundary, but there was no meadowlark nesting on Coyote South.

Savannah Sparrow is the only species likely nesting on the prairie restoration outside of larks. However, American Goldfinch, American Robin, and Song Sparrow likely nest in the adjacent shrubby areas and do some foraging on the prairie.

Literature Cited

Ralph, C.J., G.R. Geupel, P. Pyle, T.E. Martin, D.F. DeSante. 1995. Handbook of field methods for monitoring landbirds. USDA For. Serv. Gen. Tech. Rept. PSW-GTR-144. 41 pp.

Coyote Creek South Breeding Birds and Streaked Horned Larks, 2019

Photo: Bob Altman

Prepared by Bob Altman

Avifauna Northwest

October, 2019

Introduction

The 309-acre Coyote Creek South property, owned by the Oregon Department of Fish and Wildlife (ODFW), is undergoing habitat restoration in cooperation with the Long Tom Watershed Council (LTWC). The habitat restoration includes two sites of conversion of grass seed fields to wet prairie and vernal pool habitat. Phase 1 is 112 acres of wet prairie and 12 acres of vernal pools on the northern part of the property along Cantrell Road. Phase 2 is 53 acres of wet prairie on the southern part of the property at the end of Halderson Road. Both areas have provided suitable habitat for the Federally Threatened Streaked Horned Lark since the initiation of restoration activities.

Objectives

The primary objective was to conduct breeding season surveys and monitoring to document the occurrence, abundance, and nesting status of Streaked Horned Lark (hereafter larks) and other priority bird species (e.g., Western Meadowlark, Grasshopper Sparrow) to assess project effectiveness for ODFW Strategy Species, and provide a baseline on populations for ongoing and future habitat management. A secondary objective was to provide real-time updates of lark nest locations to assist ODFW and LTWC staff in planning restoration and other activities on the site.

Methods

Avian community surveys were conducted at the Phase 1 site using a point count protocol (Ralph et al. 1995). Three previously established point count stations were surveyed during three visits on May 16, June 8, and June 27. Each survey was completed before 9:30 am during favorable weather conditions. All species and individuals detected within the area of the prairie restoration were documented during a 5-minute listening period at each station. The distance to each detection was estimated. Relative abundance was calculated as the number of detections/point count survey.

Lark survey methodology was an area search technique in which the observer moves freely through a defined area emphasizing time spent in locations where birds are occurring (Ralph et al. 1995). Thirty-one area search surveys were conducted from April 24 to August 24 at the Phase 1 site, and 24 surveys at the Phase 2 site from May 3 to August 24. There were two visits in April (pre-breeding) and two visits in August (post-breeding). During the breeding season (May-July), there were at least two visits/week. Surveys were conducted during favorable weather conditions. Each survey occurred during the morning before 11:00 am, and lasted 1-2 hours/site (i.e., Phase 1 site and Phase 2 site). Most visits were conducted by one individual (Lara Jones), with occasional assistance from 1-2 other individuals (Bob Altman, Niles Brinton). Four individuals (Bob Altman, Niles Brinton, Abby Colehour, Lara Jones) conducting rope-dragging to try to locate nests on one visit (5/16).

In addition to area search population counts, most of the time was spent trying to locate lark nests. Nests were located by using systematic and behavioral approaches (Martin and Conway 1994), and opportunistically when walking through an area and flushing a bird off a nest. Nests were marked by placing colored flags 3-4 meters in two opposite directions from the nest, and revisited in a manner to minimize predator attraction and investigator-induced predation (Martin and Conway 1994). To determine nest outcome, nests were checked every 1-4 days until either the young fledged or the nest failed. A nest fledging at least one young was considered successful. If nest contents (eggs or nestlings) were removed more than two days before the projected fledging date, and the parents could not be found feeding fledglings or behaving in a protective manner, the nest was considered depredated. Causes of nest failure were surmised based on examinations of the nests and the surrounding area (Patterson and Best 1996). At 5-6 days of age, each nestling was uniquely color-banded with two bands on each leg, a USFWS aluminum band and color band on one leg and two color bands on the other leg.

Results

Larks were detected on all surveys at both the Phase 1 and Phase 2 sites (Tables 1 and 2). There were 5-6 pairs of larks nesting on the property. This included three pairs on the Phase 1 site, and 2-3 pairs on the Phase 2 site. The third male on the Phase 2 site was only occasionally detected and there was never a detection of a third female. There were two observations of a lark flying high from the Phase 1 site in the direction of the Phase 2 site; thus, the extra male detected at the Phase 2 site may have been a visitor from the Phase 1 site. High counts for fledglings seen on one visit was six in the Phase 1 site and seven in the Phase 2 site.

Table 1. Streaked Horned Lark breeding season area search surveys at Coyote Creek South Phase 1 wet prairie restoration, 2019.

Date	Adults			Hatch-Year	Comments
	Male	Female	Unknown		
4/24	3	3	1	0	
4/28	3	3	1	0	
5/3	3	2	0	0	
5/8	2	1	1	0	Workers present. Unknown likely female.
5/10	1	1	0	0	1 pair flew south of tree line.
5/16	3	2	0	0	Rope dragged, found no nests.
5/19	2	1	0	0	
5/23	2	2	0	0	Male displaying to female.
5/28	3	1	0	0	Males chasing/fighting.
5/30	3	1	0	0	
6/2	3	1	0	0	Nest.01 nest has chicks (2 days old).
6/4	3	1	0	0	Nest.01 with 3 chicks. New Nest.02 with 3 chicks.
6/6	2	0	0	0	Nest.01 too young to band. Nest.02 banded.
6/8	2	1	0	0	Nest.01 banded. Nest.02 1 chick left, parents with food.
6/10	2	2	0	0	Nest.01 fledged? Nest.02 1 chick still in nest.
6/13	4	2	0	2	Nest.01 female with nest material. Nest.02 pair feeding banded fledgling. Found much older fledgling near Nest.02.
6/17	3	1	1	1	Female feeding flrdgling near Nest.02, males fighting.
6/20	3	1	1	1	Female feeding fledgling near Nest.02. Found dead nestling with bands (lb/o) at Nest.02.
6/24	3	0	1	3	Collected dead nestling.
6/27	3	1	0	1	
7/1	3	1	2	0	
7/5	2	1	2	0	
7/8	3	1	1	0	Found Nest.03
7/15	2	1	3	1	
7/18	2	1	0	4	
7/21	2	1	5	2	
7/24	3	0	1	6	Unknown probably female with male. Banded adult female.
7/25	1	0	3	6	
7/29	1	1	1	1	
8/1	0	0	0	1	Unbanded fledgling.
8/24	0	0	2	0	

Table 2. Streaked Horned Lark breeding season area search surveys at Coyote Creek South Phase 2 wet prairie restoration, 2019.

Date	Adults			Hatch-Year	Comments
	Male	Female	Unknown		
5/3	0	0	5	0	First visit, 5-6 birds total.
5/16	1	1	1	0	Pair foraging in northwest corner.
5/23	2	0	1	0	
5/28	1	0	1	0	
5/30	2	1	0	0	
6/2	2	1	0	0	Males picking up material. Likely nest in center of field.
6/4	3	1	0	0	Found Nest.01 with 3 eggs.
6/6	2	2	0	0	Nest.01 hatched. 3 nestlings.
6/8	3	1	0	0	Nest.01 with 3 nestlings, parents near.
6/10	2	2	0	1	Nest.01 banded. 1 pair feeding fledglings.
6/13	2	2	0	1	Nest.01 pair feeding fledglings. Second pair with food.
6/17	1	0	1	0	
6/20	3	1	0	2	Males fighting, feeding fledglings.
6/24	1	1	0	1	
6/27	2	1	1	2	Found Nest.02, female not leaving area.
7/1	3	1	0	2	
7/5	2	2	1	1	
7/8	2	2	0	0	
7/15	1	1	0	0	
7/18	2	2	0	1	
7/21	2	2	0	0	
7/29	2	0	2	4	
8/1	2	0	4	2	Recently fledged young with adult male.
8/24	0	0	0	7	

Photos: Lara Jones

Five lark nests were located and monitored (Table 3). Three nests were in the Phase 1 site, and two in the Phase 2 site (Appendices A and B). The first two nests in Phase 1 were of different pairs. It is unknown if the two nests in Phase 2 were of the same or different pairs. Four of the five nests were successful fledging 11 young. The one unsuccessful nest was in the Phase 1 site. Predation was the likely cause of nest failure. There were other successful nests based on sightings of several unbanded dependent fledglings at both sites.

Table 3. Streaked Horned Lark nest monitoring at Coyote Creek South, 2019.

Site	Date	Contents	Outcome	Comments
Phase 1.01	5/30	3 eggs	Fail	3 nestlings banded but nest empty prior to fledge date
Phase 1.02	6/4	3 nestlings	Success	3 nestlings banded but only one fledged
Phase 1.03	7/8	1 nestling	Success	1 nestling banded and fledged
Phase 2.01	6/4	3 eggs	Success	3 nestlings banded and fledged
Phase 2.02	6/27	4 eggs	Success	4 nestlings banded and fledged

Phase 1.01 44.04010, -123.25289
Phase 1.02 44.03954, -123.25472
Phase 1.03 44.03966, -123.25495
Phase 2.01 44.03020, -123.25340
Phase 2.02 44.03161, -123.25542

Fourteen nestlings were uniquely color-banded. This included seven from the three nests at the Phase 1 site, and seven from two nests at the Phase 2 site (Table 4). One additional adult female was captured with a mist-net and color-banded at the Phase 1 site on July 24. There was one resight of a color-banded bird – a fledgling from the Phase 1 site on June 13, just a few days after fledging.

Photos: Bob Altman

Table 4. Streaked Horned Lark color-banding at Coyote Creek South, 2019.

Site	Date	Band Number	Right Top	Right Bottom	Left Top	Left Bottom	Nest
Phase 1	6/6	2771-19693	Red	Light Blue	Purple	Aluminum	Phase1.01
Phase 1	6/6	2771-19694	Red	Orange	Purple	Aluminum	Phase1.01
Phase 1	6/6	2771-19695	Red	Yellow	Purple	Aluminum	Phase1.01
Phase 1	6/6	2771-19690	Light Blue	Red	Purple	Aluminum	Phase1.02
Phase 1	6/6	2771-19691	Purple	Aluminum	Light Blue	Orange	Phase1.02
Phase 1	6/6	2771-19692	Purple	Aluminum	Light Blue	Yellow	Phase1.02
Phase 2	6/10	1291-33143	Orange	Light Blue	Purple	Aluminum	Phase2.01
Phase 2	6/10	1291-33144	Orange	Red	Purple	Aluminum	Phase2.01
Phase 2	6/10	1291-33145	Orange	Yellow	Purple	Aluminum	Phase2.01
Phase 2	7/6	2821-72604	Red	Dark Green	Purple	Aluminum	Phase2.02
Phase 2	7/6	2821-72605	Red	Black	Purple	Aluminum	Phase2.02
Phase 2	7/6	2821-72606	Orange	Dark Green	Purple	Aluminum	Phase2.02
Phase 2	7/6	2821-72607	Light Blue	Black	Purple	Aluminum	Phase2.02
Phase 1	7/9	2821-72608	Light Blue	Dark Green	Purple	Aluminum	Phase1.03
Phase 1	7/24	2821-72616	Red	Yellow	Yellow	Aluminum	Adult female

There were 14 bird species detected during point count surveys (Table 5). This included seven detections of larks. The highest relative abundance was for Savannah Sparrow (1.89 birds/point count).

Table 5. Point count survey results from Coyote Creek South, Phase 1 site, May-June, 2019.

Species	Relative Abundance[1]	Dates	Comments
American Goldfinch	0.22	6/8	
American Robin	0.33	5/16, 6/8	
Barn Swallow	0.22	6/8	
Canada Goose	1.00	5/16, 6/8	
European Starling	0.90	5/16, 6/27	
Great-blue Heron	0.33	5/16, 6/8	
Streaked Horned Lark	0.78	5/16, 6/8, 6/27	
Killdeer	0.33	5/16	
Mallard	0.44	5/16, 6/8	
Savannah Sparrow	1.89	5/16, 6/8, 6/27	
Song Sparrow	0.33	6/6, 6/18	
Tree Swallow	0.44	5/16, 6/27	
Western Kingbird	0.33	6/8, 6/27	Nesting in powerline tower
Western Meadowlark	0.11	6/27	

[1] Number of detections/point count survey.

Discussion

Larks first appeared at Coyote Creek South Phase 1 site in 2017 after the initiation of prairie restoration from a former agricultural grass seed field. This colonization by larks is often seen after ground disturbance that results in significant bare and sparsely vegetated ground. However, larks have high breeding site fidelity, and movement to a new site is usually dependent on the presence of a population nearby that is displaced and seeking suitable nesting habitat. This displacement can be a result of vegetation succession moving a site out of suitability, or disturbance during the nesting season from

equipment operations in the fields where they are nesting. It is likely that the settlement of larks at Coyote Creek South is from birds at the private Estergaard property to the north, which is maintained annually as production grass seed fields.

During the breeding seasons of 2017 and 2018, there were 4-5 pairs of larks at the Phase 1 site. The additional pair of larks on the property in 2019 (5-6 pairs) may have been due to an apparent good productivity year in 2018 (Altman 2018). In 2019, it is likely that the 2-3 pairs in the Phase 2 site were birds that moved from the Phase 1 site, as suitable lark habitat there has been reduced from vegetation growth after the initial restoration clearing. At the same time, suitable lark habitat in the Phase 2 site was created with the initial restoration of habitat from spray-outs in spring and fall 2018. The Phase 2 site was not surveyed in 2018, so it is uncertain if larks were present after the initial spray-out in spring.

The reduction in nesting pairs of larks on the Phase 1 site in 2019 is not unexpected. As prairie vegetation becomes more established over the first 2-3 years post-initiation of restoration, the habitat typically becomes less suitable for larks and the population declines. When larks first colonized the Phase 1 site in 2017, there were large areas of completely exposed bare ground (unsuitable nesting habitat) at the beginning of the nesting season due to the recent earth moving and absence of a full growing season for vegetation. However, by June most of the site was suitable for lark nesting the remainder of the 2017 breeding season. In 2018, there was a much better mosaic of vegetated and sparsely-vegetated conditions including smaller areas of denser and/or taller vegetation for hiding cover. In 2019, the site was mostly suitable habitat in the beginning of the breeding season, but by mid-June vegetation growth resulted in large parts of the site becoming unsuitable habitat. Most of the remaining suitable habitat was in the vernal pools.

The wet prairie at Coyote Creek South Phase 1 site was designed and created with several vernal pools. These are intended to hold water longer in the spring and dry-out at variable rates depending on water depths and other factors. They provide a diversity of habitat conditions in the prairie landscape and potential suitable habitat for several wildlife species including larks, which use the sparsely-vegetated dry-out areas for nesting and foraging. As the prairie becomes less suitable for larks with vegetation development, the vernal pools should provide some annual suitable habitat for nesting larks. However, this is dependent annually on the timing of the draw-down of the water (e.g., wet winter/spring versus dry winter/spring), and the degree of sedimentation and seed sources within the vernal pools (which change over time), which will affect the type and rapidity of the vegetation development within the vernal pool.

In the long-term, it is likely that 2-4 nesting pairs is the potential lark population that could be maintained at the Phase 1 site, and 0-2 pairs at the Phase 2 site. The reason for the potential absence of larks at the Phase 2 site is because there will be no vernal pools to provide potential habitat once the prairie vegetation is fully developed. However, there are some natural swales and depressions that could function as vernal pools and provide some of the sparsely vegetated habitat conditions required by larks.

The small population of larks at Coyote Creek South has a tenuous existence, and independent of habitat conditions can be extirpated with 1-2 years of poor reproduction and/or survivorship. Larks have evolved as a landscape-dependent species that is often forced to move locations when their early successional habitat moves in and out of suitability, both between and within breeding seasons. Thus, the availability of multiple suitable sites within a landscape, at different stages in suitability, is likely important in maintaining a population. Although the current lark population in the landscape south of and excluding the Eugene Airport is relatively small, potential habitat to maintain a “meta-population” has been increased with the two new Coyote Creek South sites in last 2-3 years, along with some lark

habitat at the adjacent City of Eugene's Coyote Creek Prairie site and Greenhill Road Prairie site, the private Estergaard property, the future prairie at the ODFW's Coyote Creek Northeast property, and at a few locations in the Fern Ridge Wildlife Area.

Coyote Creek South is the southernmost known nesting of larks within their range. Small and edge of range populations are inherently at a greater risk of extirpation due to potential issues of genetic variability and related problems of inbreeding and genetic drift, reduced ability to handle natural and anthropogenic fluctuations in birth and death rates, and reduced ability to handle major stochastic events (Shaffer 1981). The nearest lark population of some size is the Eugene Airport, approximately 5.5 miles north. Between these two sites there are a few birds seen annually in the breeding season at Fern Ridge Wildlife Area, at the Greenhill Road City of Eugene prairie, and at the Estergaard property less than one mile north of Coyote Creek South.

It is noteworthy that there were no detections of larks when point count surveys were conducted in 2015 and 2016. This was prior to the initiation of prairie restoration. Point count surveys were not conducted in 2017 after restoration had been initiated, but area search surveys indicated there was a lark population of 4-5 pairs, the same as in 2018 when point count surveys were conducted.

Among other birds, the most notable species detected were Western Meadowlark and Grasshopper Sparrow, two ODFW Strategy Species. Western Meadowlarks were seen on three visits at the Phase 1 site, although nesting was never suspected. They are known to nest on the adjacent Coyote Creek Prairie, and occasionally forage on Coyote Creek South. Two singing Grasshopper Sparrows were detected on July 24. These likely represent post-breeding dispersal birds since they were not detected during the breeding season. However, Grasshopper Sparrows have been known to nest nearby along Cantrell Road, and the singing suggests some degree of territorial activity.

In late April and early May when lark surveys started, there was good use of the vernal pools by several shorebird species including Yellowlegs, Dunlin, and Western Sandpipers. Bald Eagles and Canada Geese were also regularly seen during that time period.

Savannah Sparrow is the only species likely nesting on the prairie restoration outside of larks. However, Western Kingbirds nested in a powerline tower and regularly foraged in the prairie. Additionally, American Goldfinch, American Robin, and Song Sparrow likely nested in the adjacent shrubby habitat and did some foraging in the prairie.

Photos: Bob Altman

Recommendations

Continue Streaked Horned Lark monitoring on the property. Restoration activities and habitat monitoring are ongoing, especially at the Phase 2 site. Thus, efforts to minimize potential negative consequences to lark reproduction will be important in maintaining and potentially expanding this population at the southern edge of their range.

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Appendix A. Coyote South Phase 1 Streaked Horned Lark nest locations, 2019.

Appendix B. Coyote South Phase 2 Streaked Horned Lark nest locations, 2019.

Photos: Bob Altman

Amphibian Monitoring at Coyote Creek South

A compilation of monitoring updates from Wildlife Biologist Christopher Pearl

Summarized by Amanda Reinholtz, LTWC

11/8/2019

Important Note: The following is not an official report, but rather a compilation of annual updates from 2017-2019 from herpetologist Christopher Pearl

Pre-construction

Chris Pearl carried out several different tasks in 2017. He conducted egg mass surveys for the second year in constructed marshes on the west side of Coyote Creek. This was to provide additional species inventory for the area and to better understand this habitat as a potential source for amphibian colonists for pool construction planned for the project area on the northeast side of Coyote Creek. The southwestern marshes provide breeding habitat for 5 native species. They host appreciable numbers of the project's focal species, northern red-legged frogs (Rana aurora).

In the project area, Chris measured water depths in 24 water bodies over the spring 2017. This was to better understand the duration of flooding, a fundamental driver for amphibians and many wetland biota. Similar measurements were made in the warmer, drier spring of 2016. Water bodies included ditches, pools perched on the formerly cultivated terrace and relatively isolated from other surface waters, and pools along margins of the cultivated terrace and influenced by peripheral ditches during high water. Early spring 2017 had prolonged wet cool weather, so we have some pool depth information on habitat conditions in contrasting spring conditions on the site. Life stages indicating breeding was detected for at least 1 native amphibian in 7 water bodies in 2017. Most sites with amphibian breeding in 2017 were around the periphery of the pasture complex. Pacific chorus frogs (Pseudacris regilla) were the most commonly detected amphibian larvae (7 water bodies) and long-toed salamander larvae were detected in 1. Several adult long-toed salamanders were found beneath cover objects during opportunistic inspections. One adult red-legged frog was found in forest adjacent to the field complex. Adult rough skin newts (Taricha granulosa) were found in one pool complex in 2017 but evidence of newt breeding was not detected. We detected 2 nonnative species that have potential to affect native amphibians. Multiple adult and sub-adult bullfrogs were detected in the ditch on the northern boundary of the site, and 1-3 juvenile bullfrogs were observed in 3 different pools around the edge of the field complex. Evidence of Red swamp crayfish (burrows, chelae) was infrequently found in the main ditch system that bisects the northern portion of the site and drains into Coyote Creek. Fish were not observed in any of the pools or ditches.

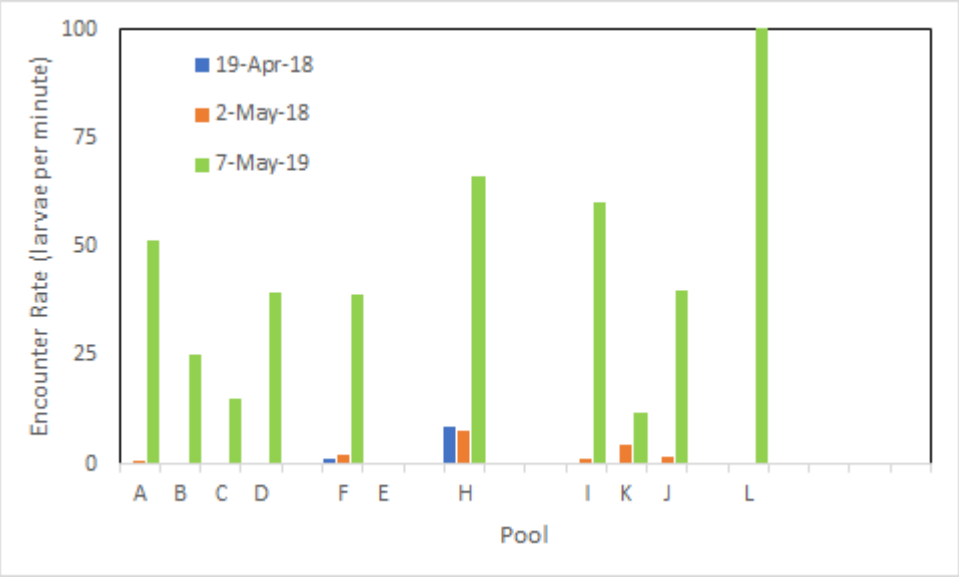
In fall of 2017, a series of vernal pools was constructed at Coyote Prairie on the floodplain of Coyote Creek near Eugene, Oregon.

Post-construction

Field activities in 2018 focused on surveys of amphibians and habitat in the reconfigured pools south of Cantrell Road and east of Coyote Creek. Construction work was completed in fall 2017 so this was the first spring that new pools were available to breeding amphibians. Precipitation in the area was low in the first part of winter and closer to average in latter part of winter, including some heavy rains. Pools appeared relatively full in April 2018. Water levels dropped relatively steadily in May. We detected a total of 3 native amphibian species in 17 pools. Pacific chorus frog (*Pseudacris regilla*) larvae were detected in 8 pools. Long toed salamander larvae (*Ambystoma macrodactylum*) and Rough skin newt adults (*Taricha granulosa*) were found in 2 pools and 1 pool, respectively. Chorus frog larvae were relatively abundant in 3 pools. Larval newts were not detected but at least 1 adult female was gravid so may have laid eggs later. Similar to our pre-construction surveys, the pools close to the western riparian forest hosted

more amphibian species and higher numbers of individuals than pools further away. Long toed salamander larvae and Rough skin newt adults were only found in the pools near the forested edge. No non-native predators were observed in the pools during the spring surveys although American bullfrogs (*Lithobates catesbeianus*) inhabit the ditch along Cantrell Road.

Spring of 2019 represented the second year that these habitats were available to native amphibians. Sampling in May revealed a marked increase in the most common amphibian on the site, Pacific Chorus frog (*Pseudacris regilla*). Chorus frog larvae were found in 100% (10 of 10) of the focal pools that had water in May, a small increase over the 8/10 pools with larvae in 2018. However, Chorus frog encounter rates (number of larvae observed per minute) were about an order of magnitude higher in these focal pools than in the first year after construction. Multiple factors may contribute to this increase. It is likely that Chorus frogs in our area can breed after 1 year, so high numbers in 2019 may reflect local recruitment from these pools and those on property to the east in 2018. The length of time that constructed pools held water into late spring in 2019 was generally similar to their duration in 2018. April 2019 included consecutive large rains and flooding of Coyote Creek that fully inundated the area with the constructed pools. This high water likely explains the finding of 3 common carp (*Cyprinus carpio*) carcasses among the constructed pools in May. The high water may also have facilitated red swamp crayfish (*Procambarus clarkii*) access to at least 2 of the pools. As in 2018, Bullfrogs (*Lithobates catesbeianus*) were present in the ditch along Cantrell Road but the short hydroperiod should limit their use of the vernal pools. These 3 nonnative species are found in Coyote Creek and other wetlands in the area but are unlikely to have large effects unless they become locally abundant. Similar to 2018, other native amphibians seen on the site included rough skin newt (*Taricha granulosa*) and long toed salamander (*Ambystoma macrodactylum*).



The above bar graph shows the encounter rate of Pacific chorus frogs on two dates in 2018 (April 19 and May 2) and one in 2019 (May 7). The encounter rates in 2019 were an order of magnitude higher than those in 2018.