

Petroglyph Energy, Inc.
Well Pad Final Reclamation Evaluation

Well Name: Lively 35-09

Evaluation Date: July 16, 2015

Evaluated by: Robin Bay; Senior Environmental Scientist; Habitat Management, Inc.

Current Condition

The Lively 35-09 pad has several patches of well-established grasses at the south end, but overall desirable species are extremely sparse. Heavy cover of tall tumbled mustard (*Sisymbrium altissimum*), Scotch thistle (*Onopordum acanthium*), and diffuse knapweed (*Centaurea diffusa*) dominate the northern portion of the site. Large patches of cheatgrass (*Bromus tectorum*) and field bindweed (*Convolvulus arvensis*) are also present on the north side. The access road is highly compacted and has a heavy cover of stork's bill (*Erodium cicutarium*).

Three vegetation transects were collected on the Lively 35-09 pad to determine the status of the reclamation as compared to transects collected on the surrounding area (i.e. reference area). The total vegetation cover was 37.3%, but the perennial non-noxious vegetation cover was only 17.3%. The perennial non-noxious vegetation cover on the reference area was 48%, 80% of this reference value is 38.4% (48×0.8). These data indicate that the pad is not currently ready for bond release and action is necessary to transition to a sustainable perennial plant community. Transect data are provided in the table below. Transect locations are shown on the attached map. Photographs of current conditions and vegetation transects are provided below.

Recommended Actions

The north portion of this well pad will require extensive management to control the weed population and establish a native community. It will be necessary to mow or disk this area to clear away the standing dead tumbled mustard, Scotch thistle, and diffuse knapweed so pre-emergent and selective broadleaf herbicides can effectively contact establishing weeds and the ground's surface. Cheatgrass should be treated with a pre-emergent herbicide this fall. In the spring after these species have germinated, the entire area should be treated heavily with an appropriate non-selective herbicide (i.e., Round-up). This area may need more than one herbicide treatment and it may be necessary to let it lie left fallow for a year before re-seeding is performed. When effective weed control has been achieved, this area should be re-seeded using a no-till drill or harrow and broadcast method. The approved seed mix should be used at the approved target rate. Seeding can occur any time from late fall to early spring, as ground conditions allow.

The access road will need to be decompacted by cross-ripping to a depth of approximately 12" with a small bulldozer. The access road should then be harrowed and seeded with the approved seed mix.

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Field bindweed and stork's bill could be treated on the access road and the south portion of the pad with spot-application of an appropriate broadleaf selective herbicide to minimize their spread on the pad. However, these C-list species are not targeted by Heurfano County and it is anticipated that establishment of desirable vegetation on the site will provide competition to minimize the presence of this species over time. Other management recommendations should be prioritized before management of field bindweed and stork's bill.

After management activities are completed the site should be checked periodically to verify germination of newly seeded areas, check for infestations of other noxious weeds, and check for other issues that may arise and impact the reclamation area.

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Table 1: Lively 35-09 Vegetation Transect Data

			Hits				Average Absolute	Average Relative	Frequency
Genus	Species	Common Name	1	2	3	Total	Cover (%)	Cover (%)	(%)
Grass & Grass-Like: Annual Undesirable									
Bromus	arvensis	field brome			p	0	0.00	0.00	33.33
Bromus	tectorum	cheatgrass	p	1	3	4	2.67	7.14	100.00
Subtotal				1	3	4	2.67	7.14	
Grass & Grass-Like: Perennial Desirable									
Achnatherum	hymenoides	Indian ricegrass		p	1	1	0.67	1.79	66.67
Aristida	purpurea	purple threeawn	1			1	0.67	1.79	33.33
Bouteloua	curtipendula	sideoats grama	p			0	0.00	0.00	33.33
Bouteloua	gracilis	blue grama		p	p	0	0.00	0.00	66.67
Elymus	elymoides	squirreltail		p	p	0	0.00	0.00	66.67
Hespirostipa	comata	needle and thread	1	2	p	3	2.00	5.36	100.00
Pascopyrum	smithii	western wheatgrass	1	6	3	10	6.67	17.86	100.00
Pseudoroegneria	spicata	bluebunch wheatgrass		1		1	0.67	1.79	33.33
Schedonnardus	paniculatus	tumblegrass	p	p		0	0.00	0.00	66.67
Sporobolus	cryptandrus	sand dropseed	3	p		3	2.00	5.36	66.67
Subtotal			6	9	4	19	12.67	33.93	
Total Graminoid Cover			6	10	7	23	15.33	41.07	100.00
Total Perennial Graminoid Cover			6	9	4	19	12.67	33.93	100.00
Forbs: Annual Desirable									
Chamaesyce	missurica	prairie sandmat	p			0	0.00	0.00	33.33
Dyssodia	papposa	fetid marigold	p			0	0.00	0.00	33.33
Descurainia	pinnata	western tansymustard		p		0	0.00	0.00	33.33
Helianthus	annuus	common sunflower		2		2	1.33	3.57	33.33
Unknown	Boraginaceae		0	p		0	0.00	0.00	33.33
Subtotal				2		2	1.33	3.57	
Forbs: Annual Undesirable									
Alyssum	desertorum	desert madwort	p			0	0.00	0.00	33.33
Erodium	cicutarium	redstem filaree	p	2		2	1.33	3.57	66.67
Lactuca	seriola	prickly lettuce		p	p	0	0.00	0.00	66.67
Sisymbrium	altissimum	tall tumbled mustard		1	20	21	14.00	37.50	66.67
Tragopogon	dubius	yellow salsify	p			0	0.00	0.00	33.33
Subtotal				3	20	23	15.33	41.07	
Forbs: Biennial Undesirable									
Centaurea	diffusa	diffuse knapweed			1	1	0.67	1.79	33.33
Onopordum	acanthium	Scotch thistle			p	0	0.00	0.00	33.33
Subtotal					1	1	0.67	1.79	
Forbs: Perennial Desirable									
Artemisia	carruthii	Carruth's sagewort			1	1	0.67	1.79	33.33
Artemisia	frigida	prairie sage	p	p		0	0.00	0.00	66.67
Heterotheca	villosa	false hairy golden aster		1		1	0.67	1.79	33.33
Linum	lewisii	blue flax	p	1		1	0.67	1.79	66.67
Ratibida	columnifera	prairie coneflower		p	1	1	0.67	1.79	66.67
Solanum	elaeagnifolium	silverleaf nightshade			p	0	0.00	0.00	33.33
Sphaeralcea	coccinea	scarlet globemallow	p	p		0	0.00	0.00	66.67
Thelesperma	filifolium	stiff green thread	p	p		0	0.00	0.00	66.67
Verbena	bracteata	bigbract verbena	2			2	1.33	3.57	33.33
Subtotal			2	2	2	6	4.00	10.71	
Forbs: Perennial Undesirable									
Marrubium	vulgare	horehound	p			0	0.00	0.00	33.33
Taraxacum	officianale	common dandelion		p		0	0.00	0.00	33.33
Subtotal						0	0.00	0.00	
Total Forb Cover			2	7	23	32	21.33	57.14	100.00
Total Perennial Forb Cover			2	2	2	6	4.00	10.71	100.00
Woody Species: Perennial Desirable									
Gutierrezia	sarothrae	broom snakeweed		1		1	0.67	1.79	33.33
Krascheninnikovia	lanata	winterfat		p		0	0.00	0.00	33.33
Psoralidium	tenuiflorum	slimstem scurfpea	p			0	0.00	0.00	33.33
Subtotal				1		1	0.67	1.79	
Total Shrub Cover			0	1	0	1	0.67	1.79	33.33
Total Vegetation Cover			8	18	30	56	37.33	100.00	100.00
Total Perennial Vegetation Cover			8	12	6	26	17.33	46.43	100.00
Total Ground Cover			38	46	39	123	82.00		100.00
Rock			2			2	1.33		33.33
Litter			28	28	9	65	43.33		100.00
Bare Ground			12	4	11	27	18.00		100.00
Total Hits			50	50	50	150	100.00		
Total Species			19	24	14				38.00
Total Perennial Species			14	19	8				24.00

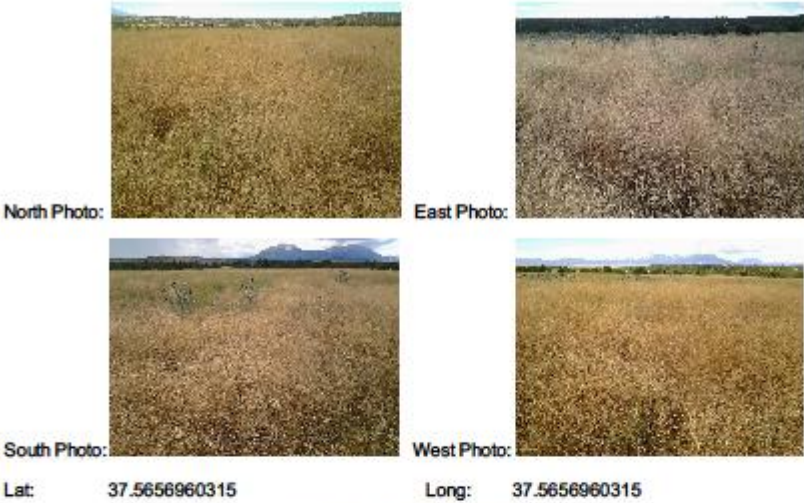
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Table 2: Reference Area Vegetation Transect Data

Genus	Species	Common Name	Hits					Average Absolute	Average Relative	Frequency (%)	
			1	2	3	4	5				Total
Grass & Grass-Like: Annual Desirable											
Vulpia	octoflora	sixweeks fescue	1	p	p	p	p	1	0.40	0.76	100.00
Subtotal			1					1	0.40	0.76	
Grass & Grass-Like: Annual Undesirable											
Bromus	arvensis	field brome			2			2	0.80	1.52	20.00
Bromus	tectorum	cheatgrass		p	1	p		1	0.40	0.76	60.00
Subtotal					3			3	1.20	2.27	
Grass & Grass-Like: Perennial Desirable											
Aristida	purpurea	purple threeawn	p		1	p	5	6	2.40	4.55	80.00
Bouteloua	gracilis	blue grama	17	22	19	15	17	90	36.00	68.18	100.00
Elymus	canadensis	Canada wildrye	p	p			p	0	0.00	0.00	60.00
Elymus	elymoides	squirreltail	p	p	p		p	0	0.00	0.00	80.00
Hespirostipa	comata	needle and thread	p	p			p	0	0.00	0.00	60.00
Muhlenbergia	torreyi	ring muhly		1		p		1	0.40	0.76	40.00
Pascopyrum	smithii	western wheatgrass				p	1	1	0.40	0.76	40.00
Schedonnardus	paniculatus	tumblegrass		p	1		p	1	0.40	0.76	60.00
Sporobolus	cryptandrus	sand dropseed	1	1	p	p	2	4	1.60	3.03	100.00
Subtotal			18	24	21	15	25	103	41.20	78.03	
Total Graminoid Cover			19	24	24	15	25	107	42.80	81.06	100.00
Total Perennial Graminoid Cover			18	24	21	15	25	103	41.20	78.03	100.00
Forbs: Annual Desirable											
Conyza	canedensis	Canadian horseweed				1		1	0.40	0.76	20.00
Cryptantha	minima	little cryptantha		p				0	0.00	0.00	20.00
Descurainia	pinnata	western tansymustard		p		p		0	0.00	0.00	40.00
Dysphania	graveolens	fetid goosefoot				p		0	0.00	0.00	20.00
Helianthus	annuus	common sunflower		p		p	p	0	0.00	0.00	60.00
Oenothera	albicaulis	whitest evening primrose					p	0	0.00	0.00	20.00
Plantago	patagonica	woolly plantain	p	1	p	p	p	1	0.40	0.76	100.00
Subtotal				1		1		2	0.80	1.52	
Forbs: Annual Undesirable											
Alyssum	desertorum	desert madwort			5			5	2.00	3.79	20.00
Chenopodium	sp.	goosefoot		p		p	p	0	0.00	0.00	60.00
Lactuca	seriola	prickly lettuce			p			0	0.00	0.00	20.00
Sisymbrium	altissimum	tall tumblemustard				1	p	1	0.40	0.76	40.00
Tragopogon	dubius	yellow salsify		p	p			0	0.00	0.00	40.00
Subtotal					5	1		6	2.40	4.55	
Forbs: Biennial Desirable											
Grindelia	squarrosa	curlycup gumweed				p		0	0.00	0.00	20.00
Subtotal								0	0.00	0.00	
Forbs: Perennial Desirable											
Allium	textile	onion	p					0	0.00	0.00	20.00
Artemisia	campestris	field sage				p		0	0.00	0.00	20.00
Artemisia	carruthii	Carruth's sagewort			p	1		1	0.40	0.76	40.00
Dalea	candida	white prairie clover	p					0	0.00	0.00	20.00
Eriogonum	effusum	spreading buckwheat	p					0	0.00	0.00	20.00
Erigeron	pumilis	shaggy fleabane	p	2	p	1	p	3	1.20	2.27	100.00
Heterotheca	villosa	false hairy golden aster	p		3	p		3	1.20	2.27	60.00
Lupinus	sp.	lupine	p					0	0.00	0.00	20.00
Lygodesmia	juncea	rush skeletonplant					p	0	0.00	0.00	20.00
Sphaeralcea	coccinea	scarlet globemallow	p	p		p	p	0	0.00	0.00	80.00
Thelesperma	filifolium	stiff greenthread	p	p			p	0	0.00	0.00	60.00
Tragopogon	dubius		p					0	0.00	0.00	20.00
Subtotal				2	3	2		7	2.80	5.30	
Total Forb Cover			0	3	8	4	0	15	6.00	11.36	60.00
Total Perennial Forb Cover			0	2	3	2	0	7	2.80	5.30	60.00
Woody Species: Perennial Desirable											
Chrysothamnus	greenei	Greene's rabbitbrush	1	1			p	2	0.80	1.52	60.00
Echinocereus	coccineus	scarlet hedgehog cactus		p			p	0	0.00	0.00	40.00
Gutierrezia	sarothrae	broom snakeweed	2	5		p	1	8	3.20	6.06	80.00
Krascheninnikovia	lanata	winterfat					p	0	0.00	0.00	20.00
Opuntia	phaeacantha	tulip pricklypear	p	p	p		p	0	0.00	0.00	80.00
Opuntia	polyacantha	plains pricklypear	p					0	0.00	0.00	20.00
Psoralidium	tenuiflorum	slimstem scurfpea			p			0	0.00	0.00	20.00
Subtotal			3	6			1	10	4.00	7.58	
Total Woody Cover			3	6	0	0	1	10	4.00	7.58	60.00
Total Vegetation Cover			22	33	32	19	26	132	52.80	100.00	100.00
Total Perennial Vegetation Cover			21	32	24	17	26	120	48.00	90.91	100.00
Total Ground Cover			37	39	43	44	40	203	81.20		100.00
Rock					1			1	0.40		20.00
Litter			15	6	10	25	14	70	28.00		100.00
Bare Ground			13	11	7	6	10	47	18.80		100.00
Total Hits			50	50	50	50	50	250	100.00		
Total Species			21	22	17	21	23				44.00
Total Perennial Species			21	19	12	18	21				28.00

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