

Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 25 Herbaceous Production Data

Sample	Herbaceous Production (g/m2)			
	Annual Species	Perennial Species	Total	Allowable
1	99.6	3.5	103.1	36.4
2	105.8	0	105.8	39.1
3	35.2	77.2	112.4	45.7
4	173.1	0.5	173.6	106.9
5	260.8	0.2	261	194.3
6	78.7	11.7	90.4	23.7
7	66.7	4.2	70.9	4.2
8	69.9	26.2	96.1	29.4
9	34.1	60.1	94.2	27.5
10	81.6	13.6	95.2	28.5
11	83	8	91	24.3
12	1.1	147.2	148.3	81.6
13	7.3	284.8	292.1	225.4
14	21.4	37.8	59.2	0.0
15	68.4	4.2	72.6	5.9
Average	79.1	45.3	124.4	58.2

Excess Annual Production	66.7
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If average annual production is greater than 10%, subtract the average excess

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Reclamation Area 32 Herbaceous Production Data

Sample	Herbaceous Production (g/m2)			
	Annual Species	Perennial Species	Total	Allowable
1	0	93.3	93.3	72.1
2	0	51.3	51.3	30.1
3	16.7	81.8	98.5	77.3
4	1.6	70.8	72.4	51.2
5	5.8	60.5	66.3	45.1
6	41.6	54.2	95.8	74.6
7	55.2	14.6	69.8	48.6
8	27	15.4	42.4	21.2
9	29.6	56.3	85.9	64.7
10	43.1	30.3	73.4	52.2
11	177.9	12.7	190.6	169.4
12	0	88.4	88.4	67.2
13	30.4	40.1	70.5	49.3
14	11.4	21.6	33	11.8
15	0	86.5	86.5	65.3
Average	29.4	51.9	81.2	60.0

Excess Annual Production	21.2
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If average annual production is greater than 10%, subtract the average excess

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Reclamation Area 33 Herbaceous Production Data

Sample	Herbaceous Production (g/m ²)			
	Annual Species	Perennial Species	Total	Allowable
1	0	156.8	156.8	150.0
2	0	70.7	70.7	63.9
3	64.3	40.4	104.7	97.9
4	0	56.1	56.1	49.3
5	0	175.6	175.6	168.8
6	76.6	0	76.6	69.8
7	0	94.4	94.4	87.6
8	2.7	102.1	104.8	98.0
9	0	62.5	62.5	55.7
10	65.8	43.6	109.4	102.6
11	1.5	69.3	70.8	64.0
12	0.3	82.3	82.6	75.8
13	20.3	70.5	90.8	84.0
14	12.7	63.5	76.2	69.4
15	0	95.3	95.3	88.5
Average	16.3	78.9	95.2	88.4

Excess Annual Production	6.8
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If average annual production is greater than 10%, subtract the average excess

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Reclamation Area 34 Herbaceous Production Data

Sample	Herbaceous Production (g/m2)			
	Annual Species	Perennial Species	Total	Allowable
1	2.9	127.4	130.3	115.1
2	21.1	102.2	123.3	108.1
3	47.3	10.9	58.2	43.0
4	65.9	12.2	78.1	62.9
5	18.5	15.8	34.3	19.1
6	0.9	88.3	89.2	74.0
7	35.5	8	43.5	28.3
8	30.3	18.4	48.7	33.5
9	4.1	5.6	9.7	0.0
10	5.7	28.8	34.5	19.3
11	0.4	82.2	82.6	67.4
12	20.5	15.1	35.6	20.4
13	41.3	67.4	108.7	93.5
14	17.1	67.3	84.4	69.2
15	16.7	25.4	42.1	26.9
Average	21.9	45.0	66.9	52.1

Excess Annual Production	15.2
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If average annual production is greater than 10%, subtract the average excess

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Appendix D: Complete Species List

Keenesburg Mine Reclamation Species List 2023

Scientific Name	Common Name	Area 25	Area 32	Area 33	Area 34	Area 35	Area 36	Area 37	Area 38	Area 42	Area 43	Area 44
Grass: Annual Native												
Cenchrus longispinus	mat sandbur	6.7		10	6.7	13.3	73.3	46.7	40	53.3	20	20
Munroa squarrosa	false buffalograss	76.7	100	20	90	93.3	80	100	73.3	73.3		46.7
Panicum capillare	witchgrass	46.7	90	100	10	53.3	66.7	46.7	6.7	20	53.3	93.3
Vulpia octoflora	sixweeks fescue	20		10								
Grass: Annual Introduced												
Bromus arvensis	field brome						6.7					
Bromus tectorum	cheatgrass	53.3	100	100	13.3	46.7	73.3	80	66.7	86.7	86.7	86.7
Echinochloa crus-galli	barnyardgrass											
Eragrostis ciliaris	stinkgrass	6.7	40	50	3.3	53.3	53.3	13.3		20		40
Eragrostis minor	little lovegrass						40	33.3		20		33.3
Setaria viridis	green bristlegrass											
Triticum aestivum	common wheat						13.3	6.7				
Grass: Perennial Desirable (Cool)												
Achnatherum hymenoides	Indian ricegrass	16.7		20	46.7	100	93.3	100	100	60	20	86.7
Agropyron cristatum	crested wheatgrass			40	3.3							
Bromus inermis	smooth brome	3.3			10							
Cyperus schweinitzii	Schweinitz's flatsedge				33.3	33.3	6.7	20			33.3	13.3
Elymus trachycaulus	slender wheatgrass	6.7	10				6.7	40	20			46.7
Leymus cinereus	basin wildrye		10									
Pascopyrum smithii	western wheatgrass	6.7	10		10		13.3	26.7	6.7	6.7	13.3	13.3
Thinopyrum intermedium	intermediate wheatgrass		10		6.7							
Grass: Perennial Desirable (Warm)												
Andropogon hallii	sand bluestem	36.7	20	70	26.7			20	46.7		13.3	13.3
Aristida purpurea	purple threeawn	3.3										
Bouteloua curtipendula	sideoats grama		60	30	26.7	13.3	6.7	6.7		6.7		13.3
Bouteloua gracilis	blue grama	16.7	100	100	50	13.3	6.7	26.7		6.7		33.3
Calamovilfa longifolia	prairie sandreed	63.3	100	100	70	20	20	40	73.3	20	20	
Panicum virgatum	switchgrass	16.7	60	90	16.7		6.7	20	46.7		13.3	
Schizachyrium scoparium	little bluestem			10	30			13.3			13.3	
Sorghastrum nutans	Indiangrass		90	10				6.7	26.7	46.7	100	86.7
Sporobolus cryptandrus	sand dropseed	90		100	100	100	86.7	86.7	46.7	46.7		

Keenesburg Mine Reclamation Species List 2023 (continued)

Scientific Name	Common Name	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	
Forbs: Annual & Biennial Native		25	32	33	34	35	36	37	38	42	43	44					
Amaranthus retroflexus	redroot amaranth	93.3	100	40	50	66.7	73.3	93.3	26.7	46.7	40	93.3					
Ambrosia acanthicarpa	flatspine bur ragweed	6.7			40	13.3	13.3	13.3		13.3	6.7	13.3					
Argemone polyanthemus	crested pricklypoppy	63.3	20		6.7	6.7	6.7	6.7		13.3		6.7					
Chamaesyce glyptosperma	ribseed sandmat	3.3	20		30	20	6.7	53.3		13.3	60	40					
Chenopodium berlandieri	pitseed goosefoot								6.7	6.7							
Chenopodium desiccatum	aridland goosefoot	20	10		20		33.3	13.3									
Chenopodium leptophyllum	narrowleaf goosefoot	10	30				26.7	13.3		33.3	40	6.7					
Cleome serrulata	Rocky Mountain beeplant	3.3		10			6.7			6.7		6.7					
Conyza canadensis	Canadian horsetweed	33.3	90	60		40	40	20		20	20	20					
Croton texensis	Texas croton	30	10	50	63.3	6.7	13.3	26.7	26.7	13.3	33.3	20					
Erigeron bellidiastrium	western daisy fleabane	46.7	20		13.3	6.7	6.7	6.7			13.3						
Eriogonum annuum	annual buckwheat						6.7				33.3						
Helianthus annuus	common sunflower	100	100	100	100	100	100	100	100	100	100	93.3					
Machaeranthera bigelovii	Bigelow's tansyaster	3.3			33.3		6.7	13.3	6.7		40	13.3					
Oenothera pallida	pale evening primrose			20					13.3	6.7	26.7	13.3					
Plantago patagonica	woolly plantain																
Polygonum ramosissimum	bushy knotweed		20				33.3	13.3		6.7							
Solanum triflorum	cutleaf nightshade	10															
Forbs: Annual & Biennial Introduced																	
Alyssum sp.	madwort						13.3	6.7	20	6.7							
Amaranthus blitoides	mat amaranth		20	20	16.7												
Ambrosia artemisiifolia	annual ragweed	26.7						13.3		6.7	80	6.7					
Bassia scoparia	burningbush	13.3	10	20	3.3	20	73.3	33.3		13.3	6.7	20					
Chenopodium album	lambsquarters			10					6.7								
Cirsium flodmanii	Flodman's thistle				33.3												
Cuscuta indecora	bigseed alfalfa dodder					86.7	33.3	53.3		6.7	13.3	13.3					
Dysphania botrys	Jerusalem oak goosefoot	86.7	40	20	86.7	100	46.7	73.3	73.3	33.3	26.7	53.3					
Lactuca serriola	prickly lettuce	86.7	80	60		53.3	73.3	26.7	20	26.7	13.3	20					
Melilotus officinalis	sweetclover	3.3	10	20	10		13.3	6.7	6.7	13.3		20					
Polygonum aviculare	prostrate knotweed	16.7		10		46.7	80	66.7	46.7	26.7		46.7					
Salsola collina	slender Russian thistle	10			3.3	93.3	13.3	26.7	13.3		13.3	33.3					

Keenesburg Mine Reclamation Species List 2023 (continued)

Scientific Name	Common Name	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area
Forbs: Annual & Biennial Introduced																	
Salsola tragus	prickly Russian thistle	100	100	50	96.7	100	100	100	100	100	100	100	100	100	100	100	100
Sisymbrium altissimum	tall tumbled mustard	10		10		33.3	26.7										
Tragopogon dubius	yellow salsify	13.3	20	10	6.7												
Forbs: Perennial Native																	
Ambrosia psilostachya	Cuman ragweed	30	20		20		26.7	20	6.7								13.3
Asclepias stenophylla	slimleaf milkweed				3.3												
Cuscuta indecora	bigseed alfalfa dodder					86.7	33.3	53.3	6.7								13.3
Epilobium ciliatum	fringed willowherb																
Evolvulus nuttallianus	shaggy dwarf morning-glory			10	10												
Heterotheca villosa	hairy false goldenaster																
Mentzelia nuda	bractless blazingstar		10						6.7							13.3	
Physalis hispida	prairie groundcherry								6.7							26.7	
Psoraleidum lanceolatum	lemon scurfpea								6.7							6.7	
Ratibida columnifera	upright prairie coneflower																
Symphotrichum falcatum	white prairie aster	3.3					20	13.3									20
Tradescantia occidentalis	prairie spiderwort			10													
Forbs: Perennial Introduced																	
Convolvulus arvensis	field bindweed	3.3															
Subshrubs/Shrubs/Succulents: Perennial Native																	
Artemisia filifolia	sand sagebrush	6.7															
Cylindropuntia whipplei	Whipple cholla																
Opuntia polyacantha	hairspine pricklypear	20		10	6.7											13.3	
Yucca glauca	soapweed yucca															26.7	

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Appendix E: Precipitation Data 1993 – 2024

Kearnsburg Mine 2023 Vegetation Monitoring Report

Kearnsburg Mine Precipitation Data 1993-2023

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Sept-Jul	% from Avg Yr	% from Avg Sept-Jul
1993	1	0.05	0.05	2.37	1.2	3	0.38	0.2	1.9	1.2	0.8	0	12.15			
1994	0.4	0.21	0.17	1.24	0.59	0.45	1.01	1.49	0.99	1.7	0.6	0.33	9.18	7.97	-32%	-34%
1995	0.13	0.3	0.57	2.49	4.53	4.55	0.58	0.47	1.07	0.3	0.21	0.04	15.24	16.77	13%	39%
1996	0.32	0.29	0.77	0.2	2.44	2.4	2.25	0.52	2.22	0.67	0.35	0	12.43	10.29	-8%	-15%
1997	0.7	0.58	0.46	1.18	1.17	1.32	1.06	3.51	0.68	1.17	0.84	0.39	13.06	9.71	-3%	-20%
1998	0.14	0.2	0.67	1.34	2.33	2.53	1.09	2.03	0.08	1.95	0.44	0.51	13.31	11.38	-1%	-6%
1999	0.49	0	0.12	4.62	4.21	1.29	2.02	3.16	2.12	0.13	0.4	0.06	18.62	15.73	38%	30%
2000	0.05	0	1.35	0.55	2.64	0.78	1.62	0.9	1.42	0.21	1.1	0.31	10.93	9.7	-19%	-20%
2001	0.61	0.45	0.73	2.41	4.12	1.4	2.92	0.83	0.84	0.51	0.76	0.07	15.65	15.68	16%	30%
2002	0.55	0	0.68	0.3	1.04	1.22	0.49	1.15	0.91	1	0.38	0.05	7.77	6.46	-42%	-47%
2003	0	0.5	2.77	1.93	3.12	1.57	0.35	1.18	0	0.1	0.3	0.45	12.27	12.58	-9%	4%
2004	0.5	0.41	0.04	1.69	1.25	1.55	0.56	0.89	1.31	0.96	0.73	0	9.89	6.85	-26%	-43%
2005	0.23	0.1	0.46	2.25	1.45	2.78	0.51	1.12	0.2	3.01	0.72	0.31	13.14	10.78	-2%	-11%
2006	0.07	0	0.67	0.52	0.21	0.16	2.12	0.95	0.45	1.6	0.45	3.42	10.62	7.99	-21%	-34%
2007	0.79	0.07	0.4	1.58	4.48	0.3	1.44	3.68	0.57	0.53	0.3	1.08	15.22	14.98	13%	24%
2008	0	0.16	0.43	1.03	1.74	1.66	0.56	6.3	1.06	0.63	0.19	0.61	14.37	8.06	7%	-33%
2009	0.07	0.02	0.62	3.51	1.81	2.02	3.17	0.65	1.07	1.92	0.75	0.89	16.5	13.71	23%	14%
2010	0.1	0.34	0.89	2.62	2.28	2.13	1.52	0.75	0.04	0.75	0.12	0.24	11.78	14.51	-12%	20%
2011	0.18	0.51	0	1.43	6.31	1.34	2.45	1.11	0.78	2.86	0.5	0.66	18.13	13.37	35%	11%
2012	0	0.56	0	1.3	1.87	0.63	0.73	0.14	1.56	1.22	0.47	0.22	8.7	9.89	-35%	-18%
2013	0.11	0.62	0.95	1.39	1.67	0.6	1.04	1.55	3.69	1.08	0.19	0.09	12.98	9.85	-4%	-18%
2014	1.24	0.26	0.83	0.48	4.9	2.67	2.03	1.61	1.96	0.45	0.41	0.45	17.29	17.46	29%	45%
2015	0.31	0.34	0.36	2.45	6.79	2.03	1.11	0.42	0.16	1.56	0.83	0.82	17.18	16.66	28%	38%
2016	0.28	0.74	0.64	3.57	2.81	1.99	3.04	0.69	0.45	0.37	0	0	14.58	16.44	8%	36%
2017	0.53	0.08	0.95	1.51	4.5	1.13	0.72	2.62	1.1	1.19	0.15	0.05	14.53	10.63	8%	-12%
2018	0.21	0.29	1	0.65	3.01	4.77	2.13	0.83	0.33	0.56	0.1	0	13.88	14.55	3%	21%
2019	0.48	0.42	2.36	1.22	2.62	2.03	1.36	1.42	0.72	0.67	0.84	0.31	14.45	11.48	7%	-5%
2020	0.05	0.57	2.44	0.78	1.24	1	1.21	0.47	0.61*	0.36*	0.21*	0.42*	9.35	7.29	9.83	-31%
2021	0.19*	0.22	1.06	1.15	2.84	0.95	0.89	1.29	0.47	0.24	0.01	0.05	9.36	8.89	-30%	-26%
2022	0.62	0.31	1.28	0.36	2.08	0.4	0.76	0.29	0.88	0.38	0.29	1.15	0.88	6.58	-33%	-45%
2023	0.73	0.14	0.5	1.74	5.37	4.75	2.73	0.45	0.32	0.59			17.32	18.66	31%	57%
Mean (1993-2021)	0.34	0.29	0.77	1.65	2.73	1.73	1.39	1.45	0.99	1.00	0.46	0.42	13.21	11.86		

*CCCRHS (2021) data substituted for onsite data

Keenesburg Mine 2023 Vegetation Monitoring Report

Appendix F: Cover Transect Photographs

Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 25

Transect 1



Transect 2



Transect 3



Transect 4



Transect 5



Transect 6



Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 25

Transect 7



Transect 8



Transect 9



Transect 10



Transect 11



Transect 12



Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 25

Transect 13



Transect 14



Transect 15



Transect 16



Transect 17



Transect 18



Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 25

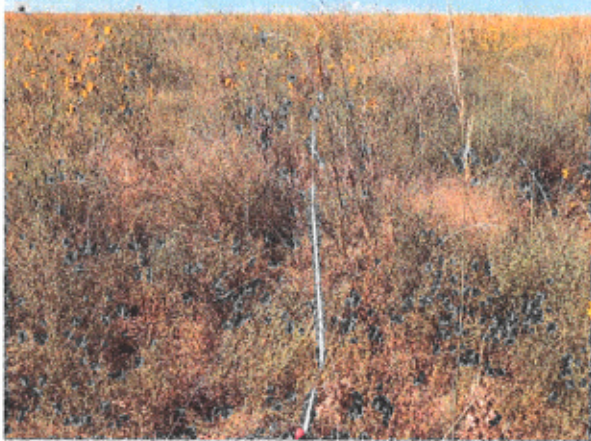
Transect 19



Transect 20



Transect 21



Transect 22



Transect 23



Transect 24



Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 25

Transect 25



Transect 26



Transect 27



Transect 28



Transect 29



Transect 30



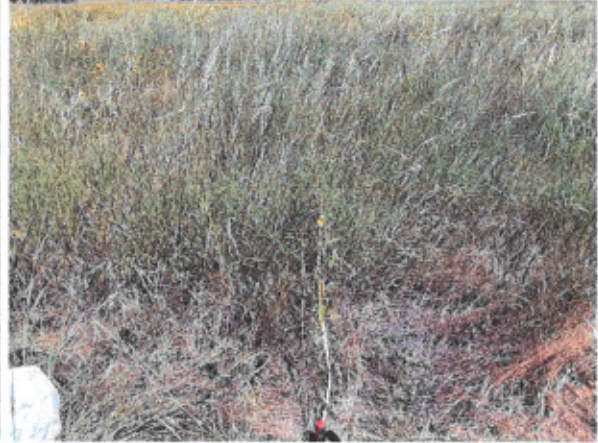
Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 32

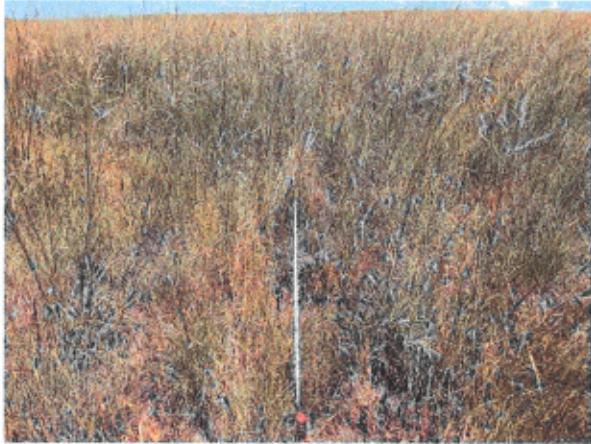
Transect 1



Transect 2



Transect 3



Transect 4



Transect 5



Transect 6



Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 32

Transect 7



Transect 8



Transect 9



Transect 10



Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 33

Transect 1



Transect 2



Transect 3



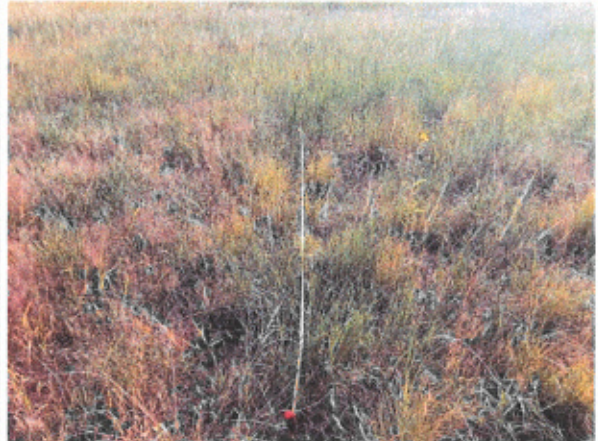
Transect 4



Transect 5



Transect 6



Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 33

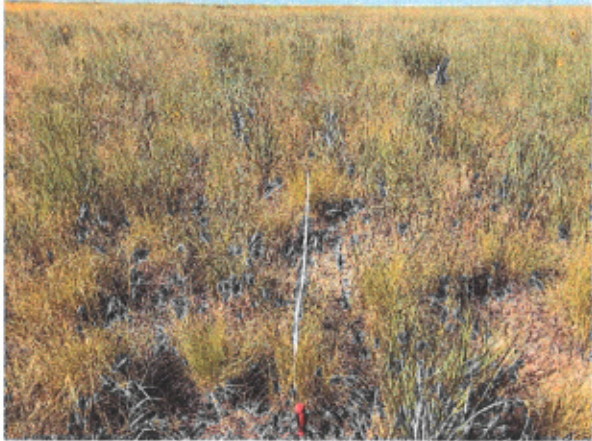
Transect 7



Transect 8



Transect 9



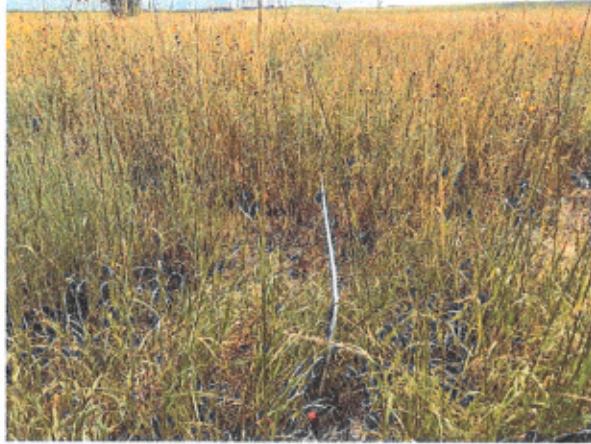
Transect 10



Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 34

Transect 1



Transect 2



Transect 3



Transect 4



Transect 5



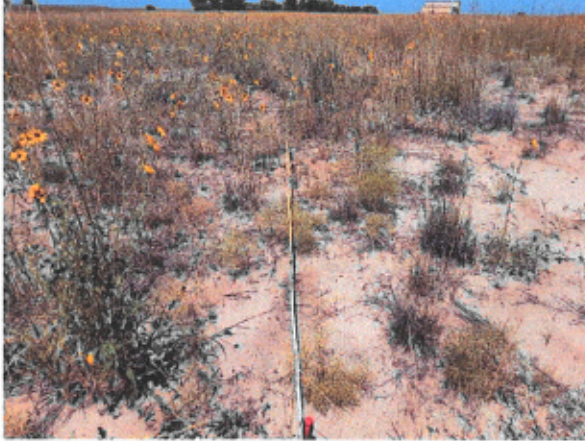
Transect 6



Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 34

Transect 7



Transect 8



Transect 9



Transect 10



Transect 11



Transect 12



Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 34

Transect 13



Transect 14



Transect 15



Transect 16



Transect 17



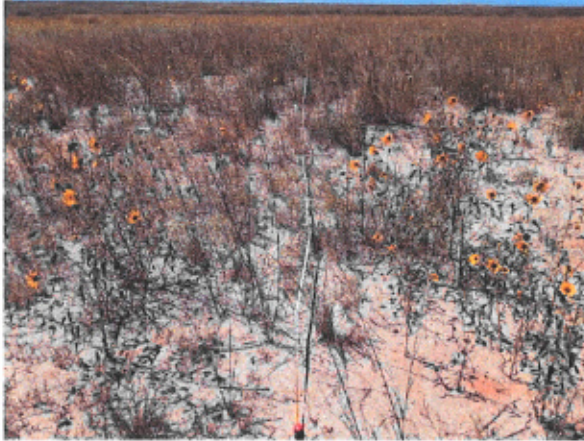
Transect 18



Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 34

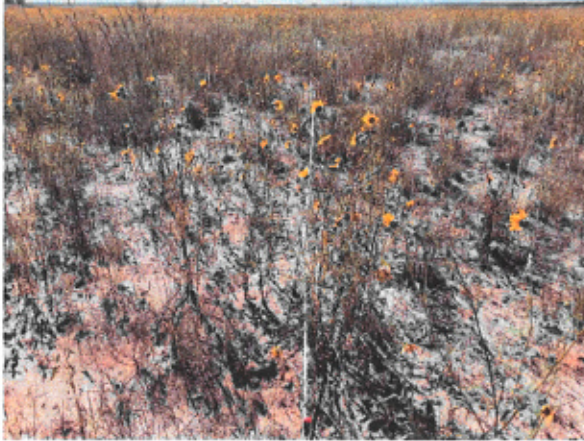
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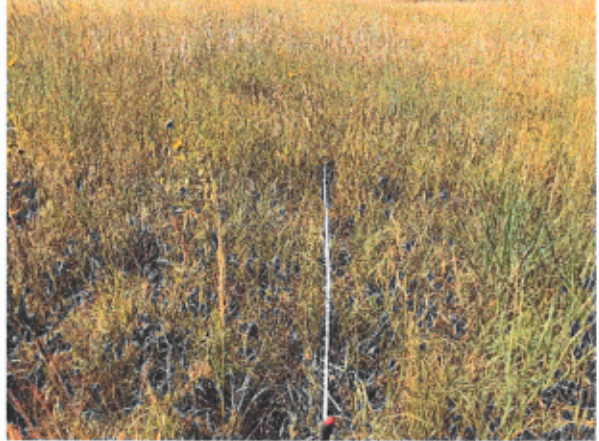
Transect 20



Transect 21



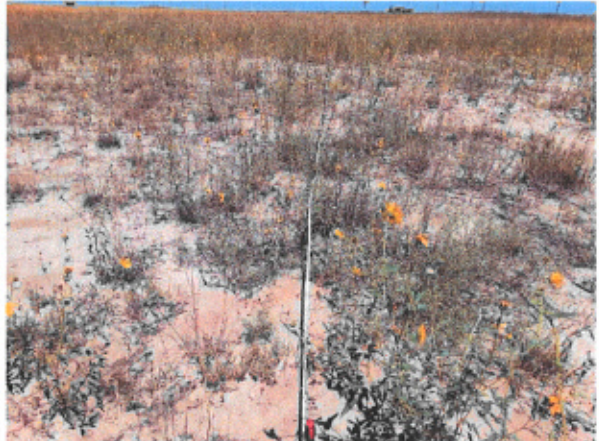
Transect 22



Transect 23



Transect 24



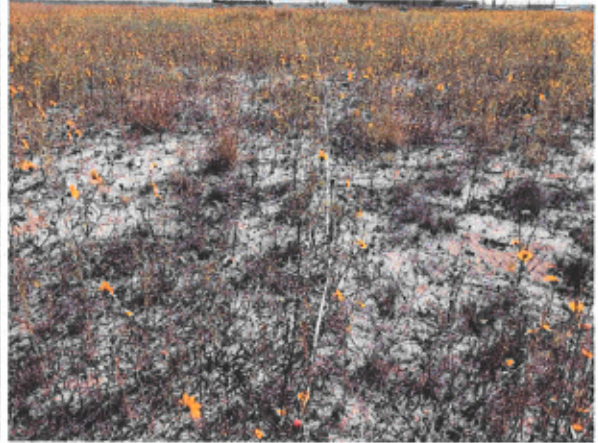
Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 34

Transect 25



Transect 26



Transect 27



Transect 28



Transect 29



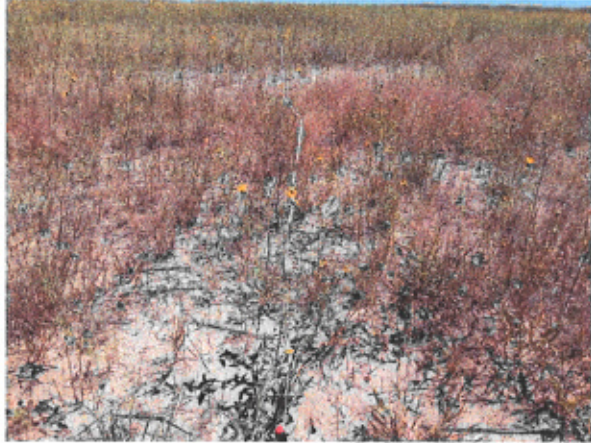
Transect 30



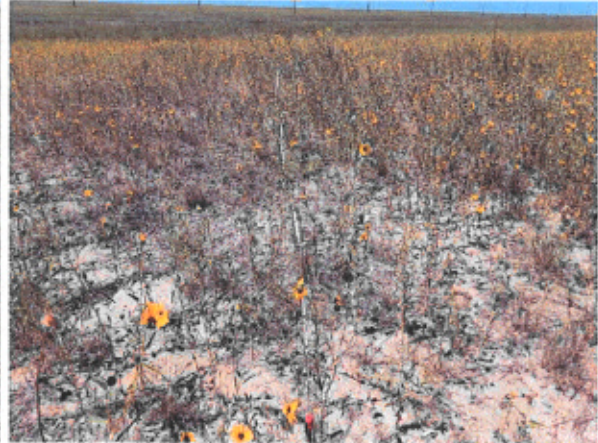
Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 35

Transect 1



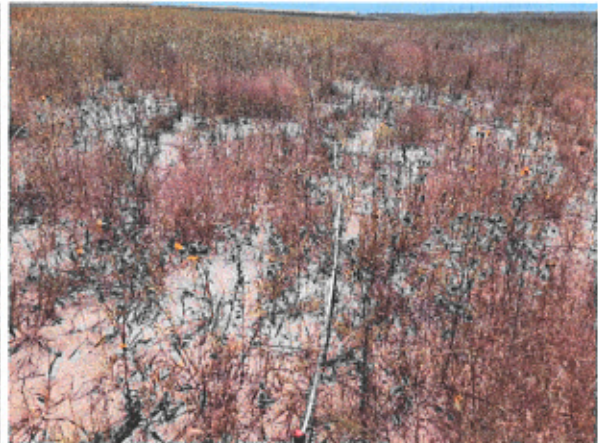
Transect 2



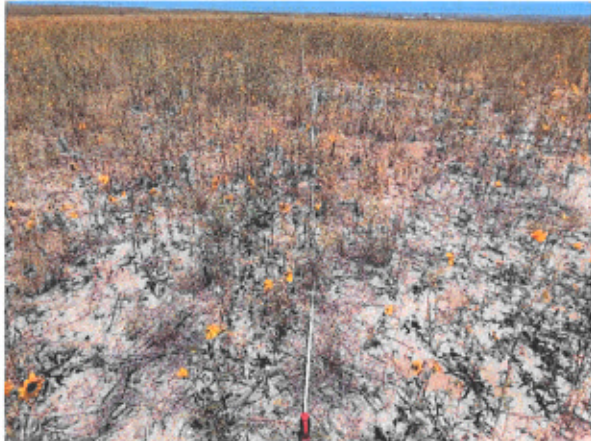
Transect 3



Transect 4



Transect 5



Transect 6



Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 35

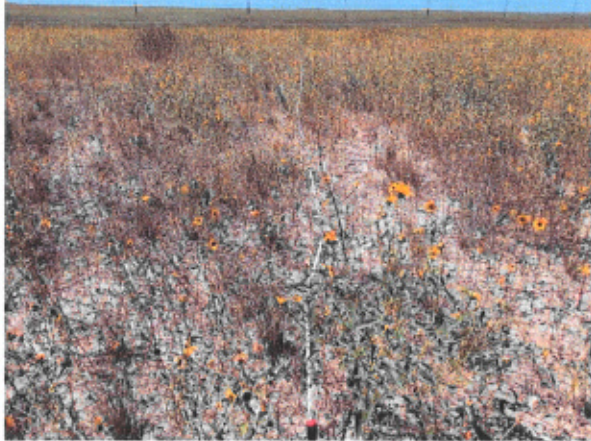
Transect 7



Transect 8



Transect 9



Transect 10



Transect 11



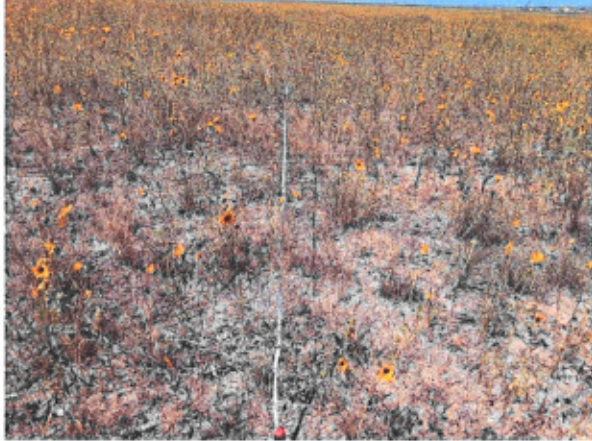
Transect 12



Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 35

Transect 13



Transect 14



Transect 15



Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 36

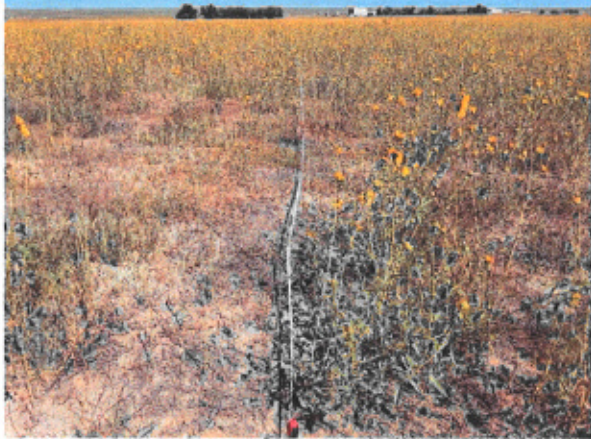
Transect 1



Transect 2



Transect 3



Transect 4



Transect 5



Transect 6



Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 36

Transect 7



Transect 8



Transect 9



Transect 10



Transect 11



Transect 12



Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 36

Transect 13



Transect 14



Transect 15



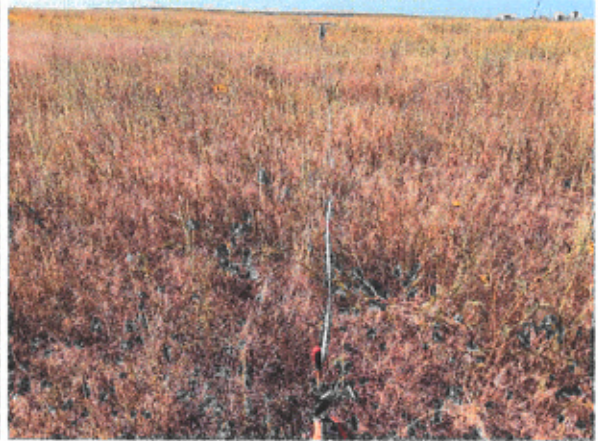
Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 37

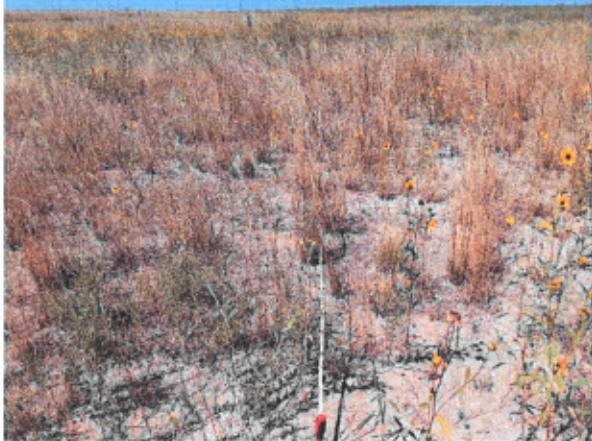
Transect 1



Transect 2



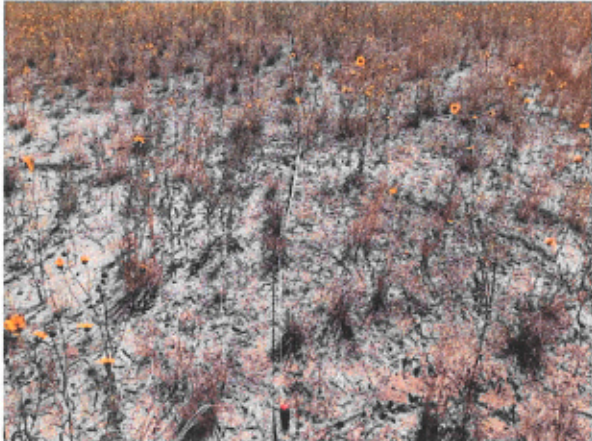
Transect 3



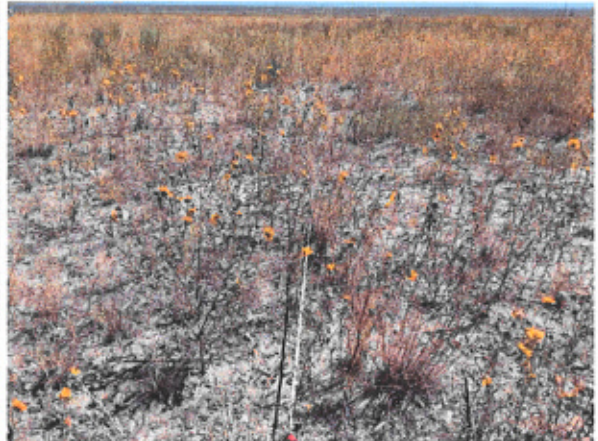
Transect 4



Transect 5



Transect 6



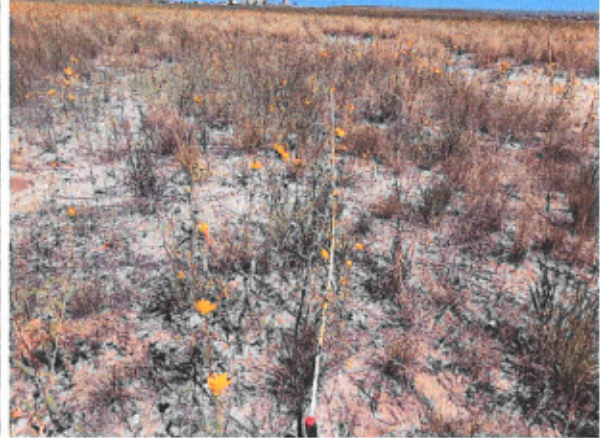
Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 37

Transect 7



Transect 8



Transect 9



Transect 10



Transect 11



Transect 12



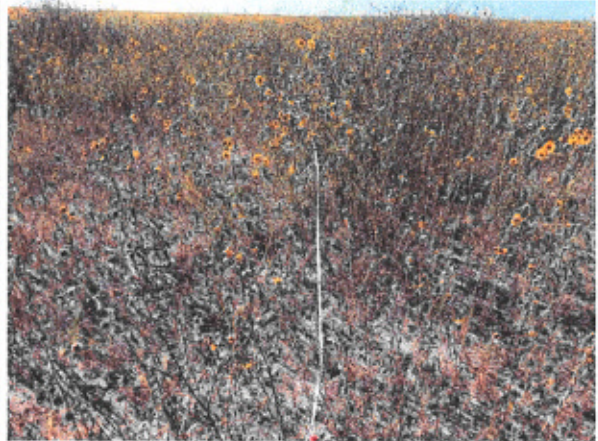
Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 37

Transect 13



Transect 14



Transect 15



Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 38

Transect 1



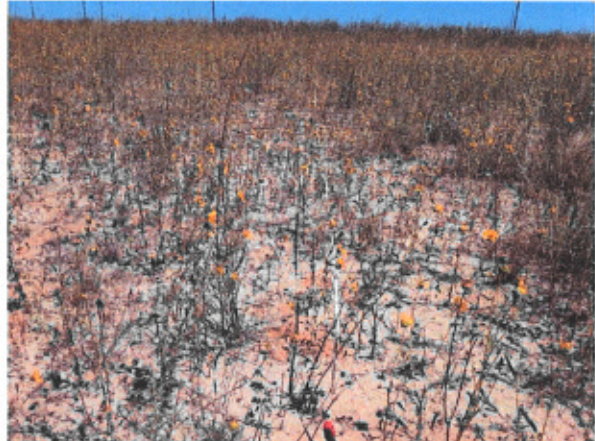
Transect 2



Transect 3



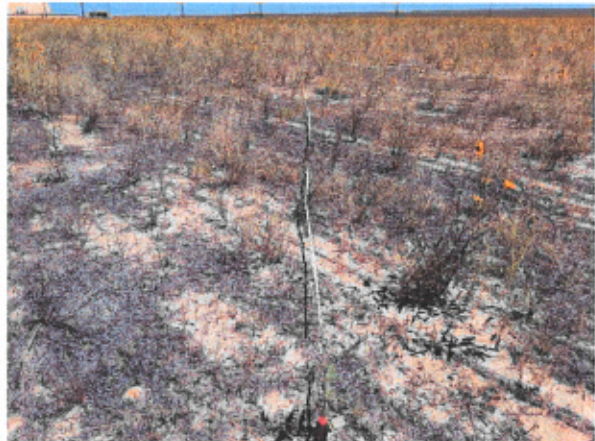
Transect 4



Transect 5



Transect 6



Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 38

Transect 7



Transect 8



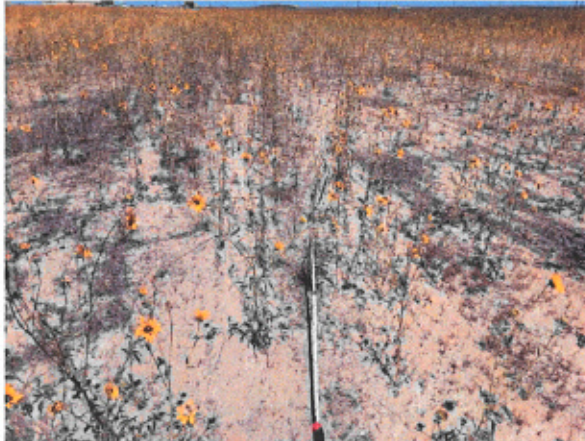
Transect 9



Transect 10



Transect 11



Transect 12



Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 38

Transect 13



Transect 14



Transect 15



Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 42

Transect 1



Transect 2



Transect 3



Transect 4



Transect 5



Transect 6



Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 42

Transect 7



Transect 8



Transect 9



Transect 10



Transect 11



Transect 12



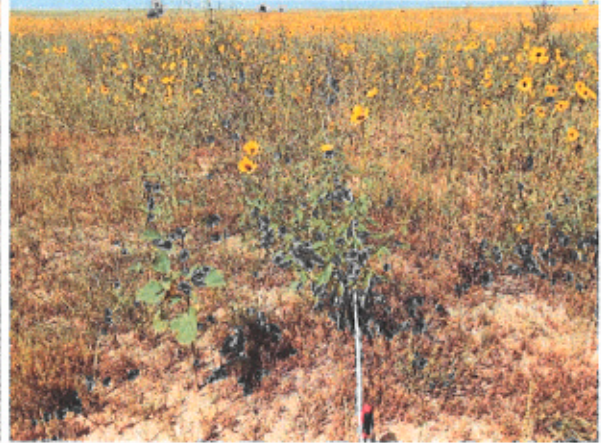
Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 42

Transect 13



Transect 14



Transect 15



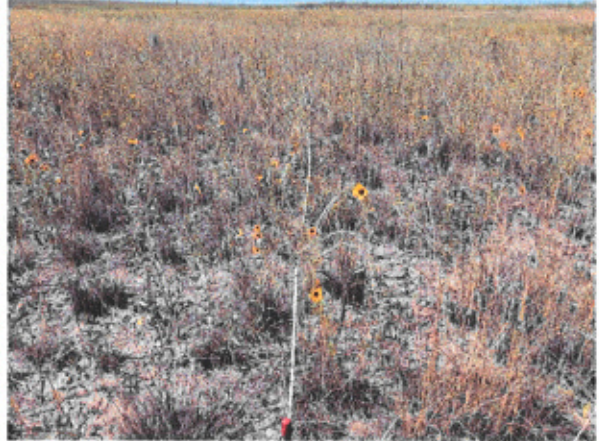
Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 43

Transect 1



Transect 2



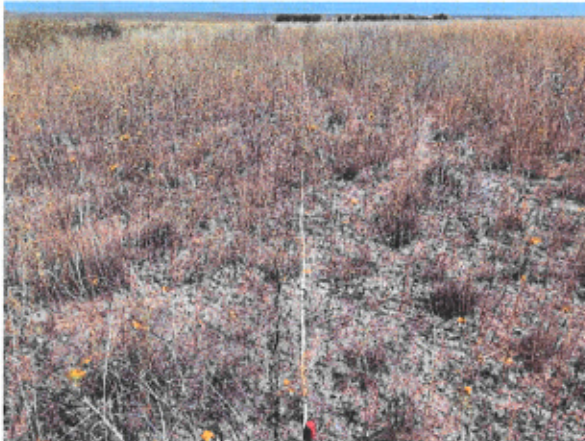
Transect 3



Transect 4



Transect 5



Transect 6



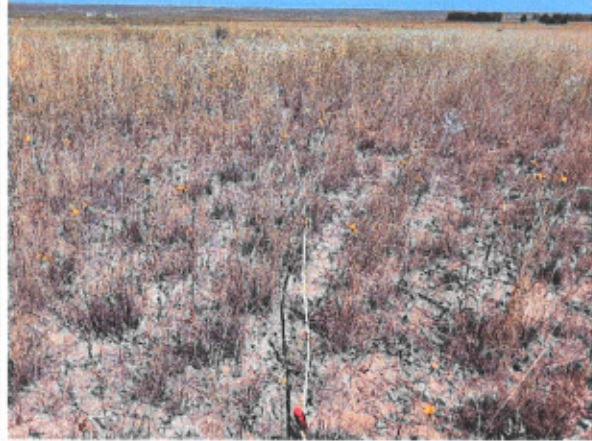
Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 43

Transect 7



Transect 8



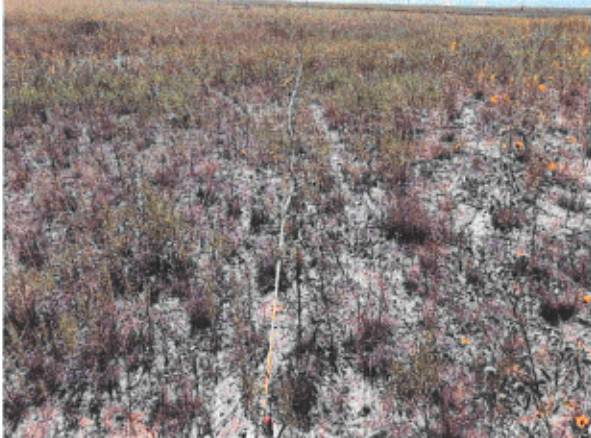
Transect 9



Transect 10



Transect 11



Transect 12



Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 43

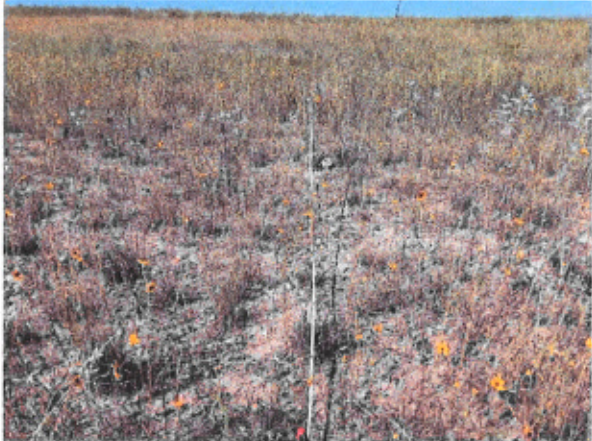
Transect 13



Transect 14



Transect 15



Keenesburg Mine 2023 Vegetation Monitoring Report

Reclamation Area 44

Transect 1



Transect 2



Transect 3



Transect 4



Transect 5



Transect 6

