

Contaminant of Concern	Concentrations	Republican WC Road 29 & U Sample #1 Line Leak 04-22-16	Republican WC Road 29 & U Background
Organic Compounds in Soil			
Inorganics in Soils			
Electrical Conductivity (EC)	<4 mmhos/cm or 2x background	7.19	0.39
Sodium Adsorption Ratio (SAR)	<12 _s	83.4	0.2
pH	6-9	8.6	7.6

SOIL ANALYSIS REPORT

CLIENT:
18250
AUGUSTUS ENERGY RESOURCES
LLC
36695 HWY 385
PO BOX 250
WRAY, CO 80758



1816 E. Wyatt Earp
PO Box 1397
Dodge City, KS 67801
800.557.7509
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LAB NO: 88849 - 88850
INVOICE NO: 210642
DATE RECEIVED: 04/27/2016
DATE REPORTED: 04/29/2016

SOIL ANALYSIS RESULTS FOR: FIELD IDENTIFICATION: REPUBLICAN WC RD 29 & U LINE

METHOD USED:		1:1 Water-Soil	1:1 Water-Soil					Ammonium Acetate	Ammonium Acetate								
Lab Number	Sample ID	Sample Depth	Soil pH	Buffer pH	Sol. Salts mmho/cm	Excess Lime	% Organic Matter	Phosphorus ppm P	Potassium ppm K	Calcium ppm Ca	Magnesium ppm Mg	Sodium ppm Na	Zinc ppm Zn	Iron ppm Fe	Manganese ppm Mn	Copper ppm Cu	Boron ppm B
88849	LEAK	0 - 6	9.2		1.41	Lo			101	1153	60	1250					
88850	BACKGROUND	0 - 6	7.8		0.09	Lo			135	1734	77	12					

METHOD USED:		Sat. Paste															Cation:Anion	
Lab Number	Sample ID	Sample Depth	Saturation % Sat	Soil pH	Electrical Conductivity mmho/cm	Potassium mg/L K	Sulfur mg/L S	Calcium mg/L Ca	Magnesium mg/L Mg	Sodium mg/L Na	Carbonate mg/L CO3	Bicarbonate mg/L HCO3	Chloride mg/L Cl	Boron mg/L B	Sodium Adsorption Ratio			
88849	LEAK	0 - 6	33	8.6	7.19	15	13	20	5.0	1610	<10	470	2280	5.61	83.4	71.8 / 74.3		
88850	BACKGROUND	0 - 6	33	7.6	0.39	18	2	64	6.2	6	<10	240	7	0.08	0.2	4.4 / 4.3		

FERTILIZER RECOMMENDATIONS:		POUNDS ACTUAL NUTRIENT PER ACRE															Cation Exchange Capacity						
Lab Number	Sample ID	Crop To Be Grown	Yield Goal	Lime, ECC Tons/A to raise pH to:			N	P ₂ O ₅	K ₂ O	Zn	S	Mn	Cu	MgO	B	Ca	Cl	CEC	%H	%K	%Ca	%Mg	%Na
				6.0	6.5	7.0																	
88849	LEAK																	12	0	2	48	4	45
88850	BACKGROUND																	10	0	4	89	7	1

SPECIAL COMMENTS AND SUGGESTIONS:

Lab Number(s): 88849
WARNING: Soil sodium (% Na) is very high. Typical symptoms of a sodic soil are surface crusting, soil sealing, and poor water penetration. Additional soil analysis can determine the proper rate of gypsum or other soil amendment. If irrigated, water analysis can help identify the sodium source. Contact the laboratory for more information.

Lab Number(s): 88849, 88850
 Servi-Tech Laboratory fertilizer recommendations were not requested.



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Lab No.: 88849		SOIL ANALYSIS RESULTS		Date Reported: 04/29/2016	
Send To: 18250		AUGUSTUS ENERGY RESOURCES LLC 36695 HWY 385 PO BOX 250 WRAY, CO 80758		 Steve Harrold Laboratory Manager	
Results For:		Invoice No.: 210642		Date Received: 04/27/2016	
Sample Identification: LEAK		Field ID		REPUBLICAN WC RD 29 & U LI	
Sample Depth: 0-6"					
Exchangable:					
	<u>ppm</u>	<u>%</u>			
Calcium, Ca	1153	48	Cation Exchange Capacity, CEC meq/100g		12
Magnesium, Mg	60	4	Soil pH - 1:1		9.2
Potassium, K	101	2	Soil pH - Saturated Paste		8.6
Sodium, Na	1250	45	Soluble Salts, mmho/cm		1.41
Excess Lime Rating		LOW	Exchangable Sodium Percent, ESP		45
Extractable (from saturated paste, based on 33% water saturation):					
		<u>mg/L</u>		<u>meq/L</u>	
Calcium (Ca)		20		1.0	
Magnesium (Mg)		5.0		0.4	
Sodium (Na)		1610		70.0	
Chloride (Cl)		2280		64.3	
Sulfur (S)		13		0.8	
Boron (B)		5.61			
Potassium (K)		15		0.4	
Bicarbonate (HCO ₃)		470		7.7	
Carbonate (CO ₃)		<10		<0.3	
Sodium Adsorption Ratio (SAR)		83.4			
Electrical Conductivity (ECe), mmho/cm		7.19			
Cation:Anion		71.8 / 74.3			
Calculated Gypsum Recommendation (from ESP and CEC)					
Soil Texture			Gypsum Rec. T/A		
COARSE	(sands, loamy sands, sandy loams)		7.5	To	8.0
MEDIUM	(loams, silt loams, clay loams)		8.8	To	9.3
FINE	(silty clay, clay loams, clays)		9.5	To	10.1
This soil is considered: SALINE/SODIC					
GYPSUM SUGGESTIONS: If soil has good internal drainage, full gypsum rate can be used to reclaim the affected area, but keep applications below 2 to 3 tons in a single year. Reclamation may not be feasible if a high water table is present, but applying 1/2 to 1 ton of gypsum every one to two years may help prevent crusting and surface "sealing".					



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Sample Identification: LEAK		Date Received: 04/27/2016		Field ID: REPUBLICAN WC RD 29 & U LI	
Sample Depth: 0-6"		Field ID: REPUBLICAN WC RD 29 & U LI			
SOIL PERMEABILITY HAZARD (based on ESP and SAR):					
Soil texture		Potential hazard			
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COARSE (sands, loamy sands, sandy loams)		CAUTION			
MEDIUM (loams, silt loams, clay loams)		HIGH			
FINE (silty clay loams, clays)		HIGH			
SOIL SALINITY: Saline soils can be managed by choosing tolerant crops, keeping the seedbed moist until crop establishment, and/or irrigating with relatively good quality irrigation water. Good internal soil drainage is needed to reclaim saline areas, so lowering water tables may be necessary. Test soil (and water) annually to monitor changes in salinity levels.					
SOIL SALINITY HAZARD (based on extractable salts, ECe):					
Crop type		Potential hazard			
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SALT SENSITIVE (onions, carrots, many ornamentals, many fruit crops, etc.)		HIGH			
MODERATELY SENSITIVE (seedling alfalfa, corn, soybeans, many vegetables, etc.)		HIGH			
MODERATELY TOLERANT (wheat, wheatgrass, sudangrass, sorghum, fescue, oats, bromegrass, etc.)		CAUTION			
SALT TOLERANT (barley, bermudagrass, sugarbeets, cotton, etc.)		LOW			
CHLORIDE: Excess soil chloride may cause toxicity symptoms in sensitive plants. Toxicity should be verified by plant tissue analysis. High chloride soils can be managed by choosing tolerant crops, keeping the seed bed moist until crop establishment, and/or by irrigating with relatively good quality irrigation water.					
EXTRACTABLE CHLORIDE HAZARD (based on soil extractable chloride, Cl):					
HIGH for chloride sensitive crops (includes berries, fruit trees, grapes, citrus, etc.)					
HIGH for moderately tolerant crops (includes alfalfa, beans, rice, sorghum, etc.)					
HIGH for chloride tolerant crops (includes wheat, flax, tomato, cotton, barley, corn, beets, etc.)					
BORON: Excess soil boron may cause toxicity symptoms in sensitive plants. Toxicity should be verified by plant tissue analysis. If toxicity is a problem, choose boron tolerant crops and/or irrigate with relatively good quality irrigation water.					



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Results For: Sample Identification: LEAK Sample Depth: 0-6"	Invoice No.: 210642 Date Received: 04/27/2016 Field ID REPUBLICAN WC RD 29 & U LI
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EXTRACTABLE BORON HAZARD (based on soil extractable boron, B):

Crop type	Potential hazard

BORON SENSITIVE (such as sunflower, barley, onions, citrus, fruit trees, grapes, etc.)	HIGH
MODERATELY SENSITIVE (such as potatoes, peppers, peas, radishes, etc.)	HIGH
MODERATELY TOLERANT (such as wheat, corn, oats, clover, lettuce, turnips, celery, etc.) . .	HIGH
BORON TOLERANT (such as alfalfa, beets, cotton, grain sorghum, tomatoes, vetch, etc.)	CAUTION



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Results For:		Invoice No.: 210642		Date Received: 04/27/2016	
Sample Identification: BACKGROUND		Field ID		REPUBLICAN WC RD 29 & U LI	
Sample Depth: 0-6"					
Exchangable:					
	<u>ppm</u>	<u>%</u>			
Calcium, Ca	1734	89	Cation Exchange Capacity, CEC meq/100g		10
Magnesium, Mg	77	7	Soil pH - 1:1		7.8
Potassium, K	135	4	Soil pH - Saturated Paste		7.6
Sodium, Na	12	1	Soluble Salts, mmho/cm		0.09
Excess Lime Rating		LOW	Exchangable Sodium Percent, ESP		1
Extractable (from saturated paste, based on 33% water saturation):					
		<u>mg/L</u>		<u>meq/L</u>	
Calcium (Ca)		64		3.2	
Magnesium (Mg)		6.2		0.5	
Sodium (Na)		6		0.3	
Chloride (Cl)		7		0.2	
Sulfur (S)		2		0.1	
Boron (B)		0.08			
Potassium (K)		18		0.5	
Bicarbonate (HCO ₃)		240		3.9	
Carbonate (CO ₃)		<10		<0.3	
Sodium Adsorption Ratio (SAR) 0.2					
Electrical Conductivity (ECe), mmho/cm 0.39					
Cation:Anion 4.4 / 4.3					
Calculated Gypsum Recommendation (from ESP and CEC)					
Soil Texture			Gypsum Rec. T/A		
COARSE	(sands, loamy sands, sandy loams)		0.0	To	0.0
MEDIUM	(loams, silt loams, clay loams)		0.0	To	0.0
FINE	(silty clay, clay loams, clays)		0.0	To	0.0
This soil is considered: NON-SALINE/NON-SODIC					
SOIL PERMEABILITY HAZARD (based on ESP and SAR):					
Soil texture		Potential hazard			
-----		-----			
COARSE (sands, loamy sands, sandy loams)		LOW			
MEDIUM (loams, silt loams, clay loams)		LOW			
FINE (silty clay loams, clays)		LOW			



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Results For: Sample Identification: Sample Depth:	BACKGROUND 0-6"	Invoice No.: 210642 Date Received: 04/27/2016 Field ID REPUBLICAN WC RD 29 & U LI
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SOIL SALINITY HAZARD (based on extractable salts, ECe):

Crop type	Potential hazard
SALT SENSITIVE (onions, carrots, many ornamentals, many fruit crops, etc.)	LOW
MODERATELY SENSITIVE (seedling alfalfa, corn, soybeans, many vegetables, etc.)	LOW
MODERATELY TOLERANT (wheat, wheatgrass, sudangrass, sorghum, fescue, oats, bromegrass, etc.)	LOW
SALT TOLERANT (barley, bermudagrass, sugarbeets, cotton, etc.)	LOW

EXTRACTABLE CHLORIDE HAZARD (based on soil extractable chloride, Cl):

- LOW for chloride sensitive crops (includes berries, fruit trees, grapes, citrus, etc.)
- LOW for moderately tolerant crops (includes alfalfa, beans, rice, sorghum, etc.)
- LOW for chloride tolerant crops (includes wheat, flax, tomato, cotton, barley, corn, beets, etc.)

EXTRACTABLE BORON HAZARD (based on soil extractable boron, B):

Crop type	Potential hazard
BORON SENSITIVE (such as sunflower, barley, onions, citrus, fruit trees, grapes, etc.)	LOW
MODERATELY SENSITIVE (such as potatoes, peppers, peas, radishes, etc.)	LOW
MODERATELY TOLERANT (such as wheat, corn, oats, clover, lettuce, turnips, celery, etc.)	LOW
BORON TOLERANT (such as alfalfa, beets, cotton, grain sorghum, tomatoes, vetch, etc.)	LOW