

Contaminant of Concern	Concentrations	D. Brophy 41-21 Sample #1 Line Leak 01-13-16	D. Brophy 41-21 Sample #2 Line Leak 01-13-16	D. Brophy 41-21 Background 01-13-16
Organic Compounds in Soil				
Inorganics in Soils				
Electrical Conductivity (EC)	<4 mmhos/cm or 2x background	9.12	0.33	0.32
Sodium Adsorption Ratio (SAR)	<12 _s	110	0.2	0.2
pH	6-9	8.3	7.7	7.8

SOIL ANALYSIS REPORT

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



1816 E. Wyatt Earp
 PO Box 1397
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LAB NO: 53132 - 53134
INVOICE NO: 207223
DATE RECEIVED: 01/18/2016
DATE REPORTED: 01/22/2016

SOIL ANALYSIS RESULTS FOR: FIELD IDENTIFICATION: D BROPHY 41-21

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
53132	1	0 - 6	8.9		1.97	No			85	272	42	1324					
53133	2	0 - 6	8.1		0.07	No			94	1128	30	6					
53134	BACKGROUND	0 - 6	8.2		0.10	Lo			120	2884	61	9					

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				
53132	1	0 - 6	28	8.3	9.12	20	9	19	6.3	2160	<10	290	2310	7.56	110	95.9 / 72.5			
53133	2	0 - 6	28	7.7	0.33	18	2	65	3.1	6	<10	180	8	0.11	0.2	4.2 / 3.3			
53134	BACKGROUND	0 - 6	31	7.8	0.32	12	1	62	3.6	6	<10	220	8	0.08	0.2	4.0 / 3.9			

FERTILIZER RECOMMENDATIONS:				POUNDS ACTUAL NUTRIENT PER ACRE													
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
				6.0	6.5	7.0											
53132	1																
53133	2																
53134	BACKGROUND																

Cation Exchange Capacity					
CEC	%H	%K	%Ca	%Mg	%Na
8	0	3	18	5	75
6	0	4	92	4	0
15	0	2	94	3	0

SPECIAL COMMENTS AND SUGGESTIONS:

Lab Number(s): 53132
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): 53132, 53133, 53134
 Servi-Tech Laboratory fertilizer recommendations were not requested.



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Lab No.: 53132		SOIL ANALYSIS RESULTS		Date Reported: 01/22/2016	
Send To: 18250		AUGUSTUS ENERGY RESOURCES LLC 36695 HWY 385 PO BOX 250 WRAY, CO 80758		 Steve Harrold Laboratory Manager	
Results For:		Invoice No.: 207223		Date Received: 01/18/2016	
Sample Identification: 1		Field ID		D BROPHY 41-21	
Sample Depth: 0-6"					
Exchangable:					
	<u>ppm</u>	<u>%</u>			
Calcium, Ca	272	18	Cation Exchange Capacity, CEC meq/100g		8
Magnesium, Mg	42	5	Soil pH - 1:1		8.9
Potassium, K	85	3	Soil pH - Saturated Paste		8.3
Sodium, Na	1324	75	Soluble Salts, mmho/cm		1.97
Excess Lime Rating		NO	Exchangable Sodium Percent, ESP		75
Extractable (from saturated paste, based on 28% water saturation):					
		<u>mg/L</u>		<u>meq/L</u>	
Calcium (Ca)		19		0.9	
Magnesium (Mg)		6.3		0.5	
Sodium (Na)		2160		93.9	
Chloride (Cl)		2310		65.2	
Sulfur (S)		9		0.6	
Boron (B)		7.56			
Potassium (K)		20		0.5	
Bicarbonate (HCO ₃)		290		4.8	
Carbonate (CO ₃)		<10		<0.3	
Sodium Adsorption Ratio (SAR) 110					
Electrical Conductivity (ECe), mmho/cm 9.12					
Cation:Anion 95.9 / 72.5					
Calculated Gypsum Recommendation (from ESP and CEC)					
Soil Texture			Gypsum Rec. T/A		
COARSE	(sands, loamy sands, sandy loams)		10.1	To	10.5
MEDIUM	(loams, silt loams, clay loams)		11.0	To	11.4
FINE	(silty clay, clay loams, clays)		11.5	To	11.9
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: 1		Date Received: 01/18/2016		Field ID: D BROPHY 41-21	
Sample Depth: 0-6"		Field ID: D BROPHY 41-21			
SOIL PERMEABILITY HAZARD (based on ESP and SAR):					
Soil texture		Potential hazard			
-----		-----			
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			
-----		-----			
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.)		HIGH			
SALT TOLERANT (barley, bermudagrass, sugarbeets, cotton, etc.)		CAUTION			
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:		Invoice No.: 207223
Sample Identification: 1		Date Received: 01/18/2016
Sample Depth: 0-6"		Field ID: D BROPHY 41-21

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.: 207223		Date Received: 01/18/2016	
Sample Identification: 2		Field ID		D BROPHY 41-21	
Sample Depth: 0-6"					
Exchangable:					
	<u>ppm</u>	<u>%</u>			
Calcium, Ca	1128	92	Cation Exchange Capacity, CEC meq/100g		6
Magnesium, Mg	30	4	Soil pH - 1:1		8.1
Potassium, K	94	4	Soil pH - Saturated Paste		7.7
Sodium, Na	6	0	Soluble Salts, mmho/cm		0.07
Excess Lime Rating		NO	Exchangable Sodium Percent, ESP		0
Extractable (from saturated paste, based on 28% water saturation):					
		<u>mg/L</u>		<u>meq/L</u>	
Calcium (Ca)		65		3.2	
Magnesium (Mg)		3.1		0.3	
Sodium (Na)		6		0.3	
Chloride (Cl)		8		0.2	
Sulfur (S)		2		0.1	
Boron (B)		0.11			
Potassium (K)		18		0.5	
Bicarbonate (HCO ₃)		180		2.9	
Carbonate (CO ₃)		<10		<0.3	
Sodium Adsorption Ratio (SAR) 0.2					
Electrical Conductivity (ECe), mmho/cm 0.33					
Cation:Anion 4.2 / 3.3					
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:	Invoice No.: 207223	Date Received: 01/18/2016
Sample Identification: 2	Date Received: 01/18/2016	Field ID: D BROPHY 41-21
Sample Depth: 0-6"		

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



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Results For:		Invoice No.: 207223		Date Received: 01/18/2016	
Sample Identification: BACKGROUND		Field ID		D BROPHY 41-21	
Sample Depth: 0-6"					
Exchangable:					
	<u>ppm</u>	<u>%</u>			
Calcium, Ca	2884	94	Cation Exchange Capacity, CEC meq/100g		15
Magnesium, Mg	61	3	Soil pH - 1:1		8.2
Potassium, K	120	2	Soil pH - Saturated Paste		7.8
Sodium, Na	9	0	Soluble Salts, mmho/cm		0.10
Excess Lime Rating		LOW	Exchangable Sodium Percent, ESP		0
Extractable (from saturated paste, based on 31% water saturation):					
		<u>mg/L</u>		<u>meq/L</u>	
Calcium (Ca)		62		3.1	
Magnesium (Mg)		3.6		0.3	
Sodium (Na)		6		0.3	
Chloride (Cl)		8		0.2	
Sulfur (S)		1		<0.1	
Boron (B)		0.08			
Potassium (K)		12		0.3	
Bicarbonate (HCO ₃)		220		3.6	
Carbonate (CO ₃)		<10		<0.3	
Sodium Adsorption Ratio (SAR) 0.2					
Electrical Conductivity (ECe), mmho/cm 0.32					
Cation:Anion 4.0 / 3.9					
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: BACKGROUND Sample Depth: 0-6"	Invoice No.: 207223 Date Received: 01/18/2016 Field ID: D BROPHY 41-21
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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