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Remediation Work Plan (Off-Location)

Cotton Draw #181 SWD Battery
|30-015-41649|2RP-3990|

Prepared For:

Devon Energy Production
6488 Seven Rivers Hwy
Artesia, New Mexico 88210

Prepared By:

TALON/LPE
408 W. Texas Avenue
Artesia, New Mexico 88210

March 23, 2017

Mr. Brett Fulks
Devon Energy Corporation
6488 Seven Rivers Hwy.
Artesia, New Mexico 88210

Subject: **Soil Assessment and Remediation Work Plan**
Cotton Draw #181 SWD Battery Pasture Area
|30-015-41649| 2RP-3990|

Dear Mr. Fulks,

Devon Energy Corporation (Devon) has contracted Talon/LPE (Talon) to perform soil assessment and remediation services at the above referenced location. The results of our soil assessment and proposed remediation activities consist of the following.

Site Information

The Cotton Draw #181 SWD is located approximately forty (40) miles southeast of Carlsbad, New Mexico. The legal location for this release is Unit Letter H, Section 36, Township 24 South and Range 31 East in Eddy County, New Mexico. More specifically the latitude and longitude for the release are 32.1767349 North and -103.7268524 West. A site plan is presented in [Appendix I](#).

According to the soil survey provided by the United States Department of Agriculture Natural Resources Conservation Service, the soil in this area is made up of Pajarito loamy fine sand with 0 to 3 percent slopes. Drainage courses in this area are normally dry.

Ground Water and Site Ranking

The New Mexico Office of the State Engineer (NMOSE) Water Rights Reporting System indicates that groundwater in the project vicinity is 450-feet below ground surface (BGS). According to the NMOSE GIS web app there are several wells in the project vicinity. However none of these wells have recorded groundwater depth. See [Appendix II](#) for the referenced groundwater data.

Therefore the ranking for this site is a **0** based on the following:

Depth to ground water	>100'
Wellhead Protection Area	>1000'
Distance to surface water body	>1000'

Based upon the site ranking of **0**, NMOCD Recommended Remedial Action Levels (RRAL) are 50 mg/kg for BTEX, 10 mg/kg for Benzene, 5,000 mg/kg for TPH and the recommended guideline for Total Chlorides is 1,000 mg/kg.

Incident Description and Initial Remedial Actions

On November 3, 2016, the Cotton Draw #181 SWD Battery was struck by lightning resulting in a release of 2,450 barrels of produced water. Vacuum trucks were immediately dispatched to the location and recovered 960 barrels of fluid. The battery was immediately shut-in. A site plan is presented in [Appendix I](#) which illustrates the impacted area.

On November 4, 2016, Talon mobilized personnel to begin the site assessment and soil sampling activities for the construction of a work plan. Grab soil samples were collected in the ROW and in the pasture behind the battery utilizing a hand auger to a depth of 4-feet BGS.

Laboratory Results

See [Appendix V](#) for complete report of laboratory results.

Sample ID	Depth (feet)	BTEX (mg/kg)	Chlorides (mg/kg)	TPH (mg/kg) GRO	TPH (mg/kg) DRO
S-1	0'	<0.300	1440	<10	11.9
	1'	<0.300	2160	<10	<10
	2'	<0.300	2960	<10	<10
	3'	<0.300	5360	<10	<10
	4'	<0.300	7330	<10	<10
S-2	0'	<0.300	2560	13	675
	1'	<0.300	3480	<10	14.6
	2'	<0.300	4880	<10	15.2
	3'	--	8930	--	--
	4'	--	320	--	--
S-3	0'	<0.300	32	<10	<10
	1'	--	48	--	--
	2'	--	32	--	--
	3'	--	32	--	--
	4'	--	32	--	--
S-4	0'	<0.300	3280	<10	<10
	1'	--	48	--	--
	2'	--	160	--	--
	3'	--	48	--	--
	4'	--	64	--	--
S-5	0'	<0.300	4000	<10	73.6
	1'	<0.300	6000	--	--
	2'	--	7200	--	--
	3'	--	6930	--	--
	4'	--	3280	--	--

Sample ID	Depth (feet)	BTEX (mg/kg)	Chlorides (mg/kg)	TPH (mg/kg) GRO	TPH (mg/kg) DRO
S-6	0'	<0.300	1840	<10	<10
	1'	<0.300	5460	<10	<10
	2'	--	8800	--	--
	3'	--	7330	--	--
	4'	--	1870	--	--
S-7	0'	<0.300	48	<10	<10
	1'	<0.300	48	<10	<10

--Analyte Not Tested

On January 26, 2017 Talon personnel returned to the location to obtain additional samples at greater depths utilizing an air rotary drill rig as directed by the NMOCD.

Sample ID	Depth (feet)	BTEX (mg/kg)	Chlorides (mg/kg)	TPH (mg/kg) GRO	TPH (mg/kg) DRO
B-1	1'	--	3600	--	--
	2'	--	560	--	--
	3'	--	144	--	--
	4'	--	160	--	--
	6'	--	208	--	--
	10'	--	224	--	--
B-2	1'	--	560	--	--
	2'	--	48	--	--
	3'	--	48	--	--
	4'	--	48	--	--
	5'	--	48	--	--
B-3	5'	--	2560	--	--
	10'	--	4400	--	--
	15'	--	1680	--	--
	20'	--	448	--	--

--Analyte Not Tested

Objective

The objective of this proposed remediation process is to flush target solutes (sodium and chloride) to a depth of 4-feet BGS. This depth should be sufficient to allow for the revegetation of local plant species. Based on the information provided by the United Nations Food and Agriculture Organization (FAO) the maximum capillary rise for a coarse textured soil is 50cm (19.7 inches). This proposed depth will prevent salt toxicity from the referenced solutes ascending through the soil profile back into the rhizosphere of species contained within BLM LPC seed mixture. The species contained within the LPC seed mixture with the deepest minimum rooting depth are Sand Dropseed (*Sporobolus cryptandrus*) and Big Bluestem (*Andropogon gerardii*). See [Appendix IV](#) for published data.

Proposed Remedial Actions

- Earthen berms will be constructed in the pasture to encompass the impacted area.
- Gypsum (CaSO_4) will be worked into the top 0.5-feet of soil at a rate of 22 tons/acre (maximum recommended application rate) within the impacted area in order to replace sodium on the soil cation exchange complex.
- Following gypsum incorporation, the impacted area will be flooded with fresh water in order to solubilize the gypsum and incorporate it further into the soil profile.
- The treated soil will then be left in-situ to allow for natural percolation of solutes to occur following natural precipitation events.
- The impacted area will be contoured and left in a “rough” condition to approximate natural surface deviations, control erosion, promote revegetation and to hold water.
- The site will be monitored per the “monitoring regime” detailed below.

Monitoring Regime

- During the first 12 months of in-situ remediation quarterly soil samples will be collected in 1-foot intervals from the areas in the vicinity of sample locations S-1, S-2, S-4, S-5, and S-6 to a depth of 4-feet BGS in order to document the vertical movement of solutes. Samples will be analyzed for total chlorides, pH, Sodium Absorption Ratio (SAR), and Electrical Conductivity (EC). Vegetation growth will also be monitored.

- Should our stated goals be achieved during the initial 12 month period monitoring will continue on a biannual basis for 24 months in order to track the ongoing progress of this remediation.
- Once analytical results indicate that the solutes have been successfully flushed to the proposed depth. Soil borings will be advanced at sample locations S-1, S-5, and S-6 to define the total vertical depths of chloride impacts >250 mg/kg.
- Should the remediation goals not be achieved during the initial 12 month period based on quarterly sample results the work area will again be flooded with freshwater. The site will again be monitored on a quarterly basis for 12 months. If success is achieved as outlined per the objective section above. Sampling will then be moved to a semiannual basis for the following 24 months.

Revegetation Plan


- Once soil analytical data indicates that the seeding will be beneficial i.e. Sodium Absorption Ratio (SAR) <13 and Electrical Conductivity (EC) <4 dS/m. The site will be seeded with BLM LPC seed mixture per the manufacturers prescribed application rate utilizing a Culti-Pack seed drill.
- The site will be periodically monitored for revegetation to insure that revegetation matching or exceeding natural potential plant cover and diversity levels are achieved.
- The site will also be monitored for noxious weeds development, specifically African Rue. Should noxious weed issues occur or revegetation is slow to occur (accounting for precipitation levels) NMSLO will be consulted on the best course of action to reconcile the issue.

Should you have any questions or if further information is required, please do not hesitate to contact our office at (575)-746-8768

Respectfully submitted,

TALON/LPE


Sheldon L. Hitchcock
Project Manager


David J. Adkins
District Manager

Attachments

Appendix I Site Plan
Appendix II Groundwater Data
Appendix III Initial C-141
Appendix IV Rooting Depth Data
Appendix V Laboratory Results

APPENDIX I

SITE PLAN

Cotton Draw Unit 181

Devon Energy

Legend

- Bore Hole
- Burried Line
- DCP Burried Line
- Devon Burried Line
- Impacted Area
- Sample Location

S-4 S-5 S-3 S-2 S-1 S-6 S-7

Bore Hole #3 Bore Hole #2 Bore Hole #1

Google Earth

© 2016 Google

500 ft

N

APPENDIX II

GROUNDWATER DATA



New Mexico Office of the State Engineer

Water Column/Average Depth to Water

(A CLW##### in the POD suffix indicates the POD has been replaced & no longer serves a water right file.)

(R=POD has been replaced, O=orphaned, C=the file is closed)

(quarters are 1=NW 2=NE 3=SW 4=SE)

(quarters are smallest to largest) (NAD83 UTM in meters)

(In feet)

POD Number	POD Sub-Code	basin	County	Q 64	Q 16	Q 4	Sec	Tws	Rng	X	Y	Distance	Depth Well	Depth Water	Water Column
C 02572			ED	4	2	2	02	25S	31E	618695	3559294*	1996	852		
C 02568			ED	4	3	1	01	25S	31E	619103	3558892*	2037	1025		
C 02573			ED	1	4	2	02	25S	31E	618499	3559091*	2278			
C 02569			ED	4	4	2	02	25S	31E	618699	3558891*	2280	1016		
C 02571			ED	4	1	2	02	25S	31E	618292	3559294*	2315	860		
C 02574			ED	1	1	2	02	25S	31E	618092	3559494*	2382			
C 02570			ED	4	2	4	02	25S	31E	618704	3558489*	2594	895		
C 03830 POD1		CUB	ED	4	2	4	02	25S	31E	618632	3558432	2681	450		

Average Depth to Water: --

Minimum Depth: --

Maximum Depth: --

Record Count: 8

Basin/County Search:

County: Eddy

UTMNAD83 Radius Search (in meters):

Easting (X): 620196

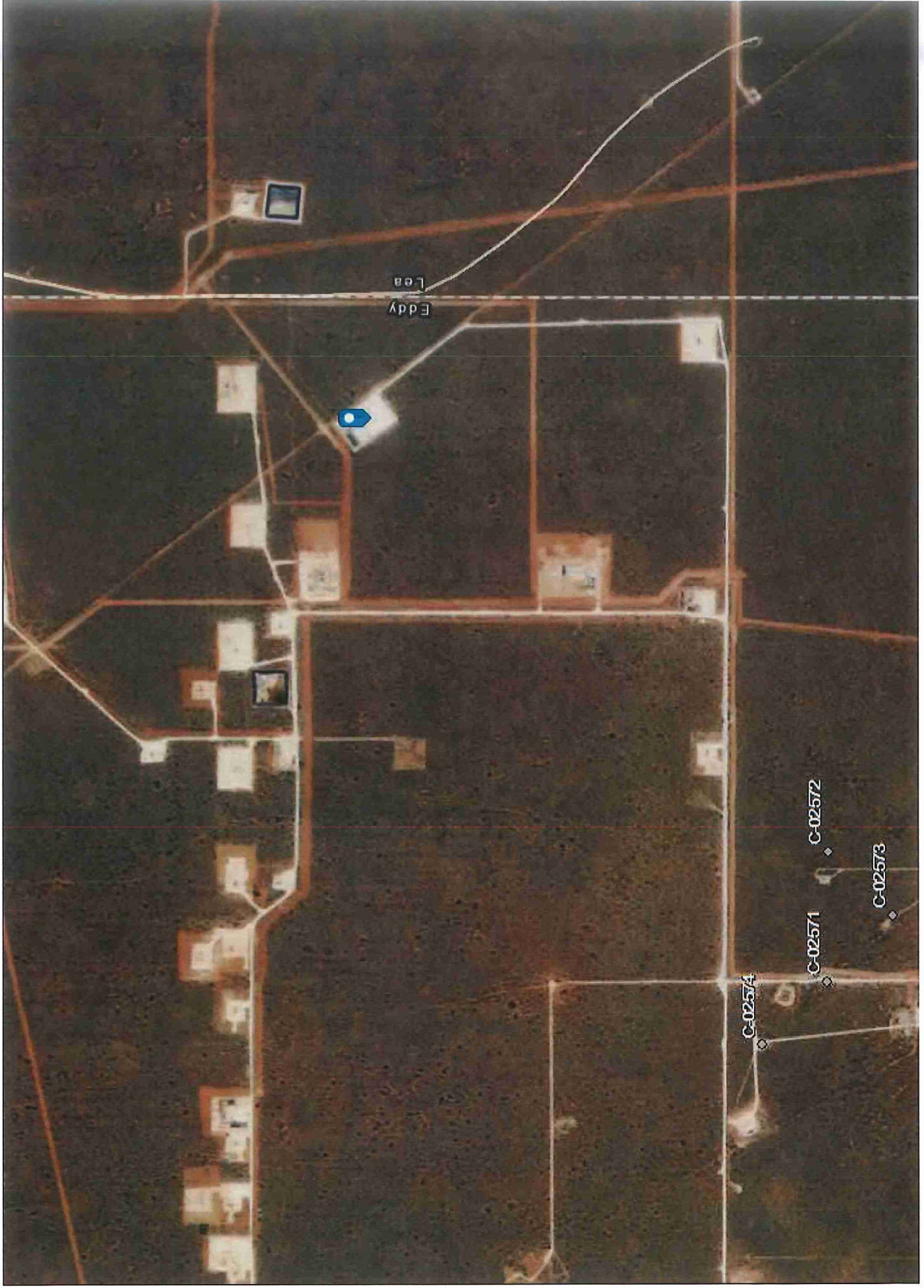
Northing (Y): 3560611

Radius: 5000

*UTM location was derived from PLSS - see Help

The data is furnished by the NMOSE/ISC and is accepted by the recipient with the expressed understanding that the OSE/ISC make no warranties, expressed or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the data.

OSE Well Locations



APPENDIX III

INITIAL C-141

District I
1625 N. French Dr., Hobbs, NM 88240
District II
811 S. First St., Artesia, NM 88210
District III
1000 Rio Brazos Road, Aztec, NM 87410
District IV
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy Minerals and Natural Resources
Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

NM OIL CONSERVATION

ARTESIA DISTRICT

Form C-141
Revised August 8, 2011

NOV 10 2016

Submit 1 Copy to appropriate District Office in
accordance with 19.15.29 NMAC.

RECEIVED

Release Notification and Corrective Action

NAB1631451165

OPERATOR		<input checked="" type="checkbox"/> Initial Report	<input type="checkbox"/> Final Report
Name of Company Devon Energy Production Company 6137		Contact Jake Harrington, Production Foreman	
Address 6488 Seven Rivers Hwy Artesia, NM 88210		Telephone No. 432-214-5175	
Facility Name Cotton Draw Unit SWD 181		Facility Type Salt Water Disposal	
Surface Owner State		Mineral Owner State	API No 30-015-41649

LOCATION OF RELEASE

Unit Letter	Section	Township	Range	Feet from the	North/South Line	Feet from the	East/West Line	County
H	36	24S	31E	1568	North	1189	East	Eddy

Latitude: 32.1767349

Longitude: -103.7268524

NATURE OF RELEASE

Type of Release Produced water	Volume of Release 2450 BBLS Produced Water	Volume Recovered 960 BBLS Produced Water
Source of Release Produced Water tanks	Date and Hour of Occurrence 11/3/2016 @ 11:45pm	Date and Hour of Discovery 11/3/2016 @ 11:45pm
Was Immediate Notice Given? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not Required	If YES, To Whom? Mike Bratcher, OCD	
By Whom? Jake Harrington, Production Foreman	Date and Hour November 3, 2016 @ 9:50 AM *	
Was a Watercourse Reached? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	If YES, Volume Impacting the Watercourse N/A	
If a Watercourse was Impacted, Describe Fully.* N/A		
Describe Cause of Problem and Remedial Action Taken.* The SWD was struck by lightning resulting in a release of 2450 BBLS produced water and a fire. The power lines to the facility were immediately turned off to prevent further release. The local Fire Department was called to ensure safety and to extinguish the fire. The facility did have lightning protection on it.		
Describe Area Affected and Cleanup Action Taken.* 2450 BBLS of produced water were released when lightning struck the SWD, causing the water tanks to rupture and start a fire. The liner was checked for holes and there were holes found due to the fire. Vacuum trucks recovered 960 BBLS of produced water. Environmental agency will be contacted for remediation.		
I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to NMOCD rules and regulations all operators are required to report and/or file certain release notifications and perform corrective actions for releases which may endanger public health or the environment. The acceptance of a C-141 report by the NMOCD marked as "Final Report" does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to ground water, surface water, human health or the environment. In addition, NMOCD acceptance of a C-141 report does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations.		

Signature: Sarah Gallegos-Troublefield		OIL CONSERVATION DIVISION	
Printed Name: Sarah Gallegos-Troublefield		Approved by Environmental Specialist: <i>[Signature]</i>	
Title: Field Admin Support		Approval Date: 11/14/16	Expiration Date: N/A
E-mail Address: Sarah.Gallegos-Troublefield@dmv.com		Conditions of Approval:	
Date: 11/10/2016 Phone: 575.748.1864		Attached <input checked="" type="checkbox"/>	

* Attach Additional Sheets If Necessary

2RP-3990

APPENDIX IV

ROOTING DEPTH DATA


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Characteristics

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[PLANTS Characteristics species list](#)

Conservation Plant Characteristics

***Sporobolus cryptandrus* (Torr.) A. Gray**
sand dropseed
SPCR

Morphology/Physiology

Active Growth Period	Spring
After Harvest Regrowth Rate	Slow
Bloat	None
C:N Ratio	High
Coppice Potential	No
Fall Conspicuous	No
Fire Resistant	No
Flower Color	Yellow
Flower Conspicuous	No
Foliage Color	Green
Foliage Porosity Summer	Porous
Foliage Porosity Winter	Porous
Foliage Texture	Fine
Fruit/Seed Color	Brown
Fruit/Seed Conspicuous	No
Growth Form	Bunch
Growth Rate	Moderate
Height at 20 Years, Maximum (feet)	
Height, Mature (feet)	3.0
Known Allelopath	No
Leaf Retention	No
Lifespan	Short
Low Growing Grass	No
Nitrogen Fixation	None

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Sporobolus cryptandrus
Scientific Name

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- NRCS State Plants Lists

Related Tools

- Crop Nutrient Tool
- Ecological Site Information System
- PLANTS Identification Keys
- Plant Materials Web Site
- Plant Materials Publications
- USDA Plant Hardiness Map

Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None

Growth Requirements

Adapted to Coarse Textured Soils	Yes
Adapted to Fine Textured Soils	No
Adapted to Medium Textured Soils	Yes
Anaerobic Tolerance	None
CaCO3 Tolerance	Medium
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	Low
Fire Tolerance	Medium
Frost Free Days, Minimum	150
Hedge Tolerance	None
Moisture Use	Low
pH, Minimum	6.6
pH, Maximum	8.0
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	8
Precipitation, Maximum	16
Root Depth, Minimum (inches)	18
Salinity Tolerance	Medium
Shade Tolerance	Intolerant
Temperature, Minimum (°F)	-38

Reproduction

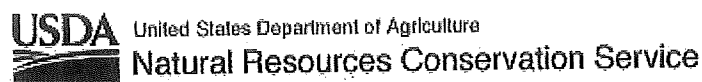
Bloom Period	Late Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	High
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Fall
Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No

Propagated by Tubers	No
Seed per Pound	5600080
Seed Spread Rate	Rapid
Seedling Vigor	Low
Small Grain	No
Vegetative Spread Rate	None

Suitability/Use

Berry/Nut/Seed Product	No
Christmas Tree Product	No
Fodder Product	No
Fuelwood Product	
Lumber Product	No
Naval Store Product	No
Nursery Stock Product	No
Palatable Browse Animal	Medium
Palatable Graze Animal	Low
Palatable Human	No
Post Product	No
Protein Potential	Low
Pulpwood Product	No
Veneer Product	No

Time Generated: 03/06/2017



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Characteristics

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Conservation Plant Characteristics

***Andropogon hallii* Hack.**
sand bluestem
ANHA

Morphology/Physiology

Active Growth Period	Summer
After Harvest Regrowth Rate	Moderate
Bloat	None
C:N Ratio	Medium
Coppice Potential	No
Fall Conspicuous	No
Fire Resistant	No
Flower Color	Yellow
Flower Conspicuous	No
Foliage Color	Green
Foliage Porosity Summer	Moderate
Foliage Porosity Winter	Porous
Foliage Texture	Coarse
Fruit/Seed Color	Brown
Fruit/Seed Conspicuous	No
Growth Form	Bunch
Growth Rate	Moderate
Height at 20 Years, Maximum (feet)	
Height, Mature (feet)	6.1
Known Allelopath	No
Leaf Retention	No
Lifespan	Moderate
Low Growing Grass	No
Nitrogen Fixation	None

Search	
Name Search	
Andropogon hallii Hack	
Scientific Name	<input type="button" value="Go"/>
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Related Tools	
<ul style="list-style-type: none"> Crop Nutrient Tool Ecological Site Information System PLANTS Identification Keys Plant Materials Web Site Plant Materials Publications USDA Plant Hardiness Map 	

Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None

Growth Requirements

Adapted to Coarse Textured Soils	Yes
Adapted to Fine Textured Soils	No
Adapted to Medium Textured Soils	No
Anaerobic Tolerance	Medium
CaCO3 Tolerance	High
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	High
Fire Tolerance	Low
Frost Free Days, Minimum	120
Hedge Tolerance	None
Moisture Use	Medium
pH, Minimum	5.6
pH, Maximum	8.4
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	10
Precipitation, Maximum	32
Root Depth, Minimum (inches)	20
Salinity Tolerance	Low
Shade Tolerance	Intolerant
Temperature, Minimum (°F)	-38

Reproduction

Bloom Period	Mid Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	Medium
Fruit/Seed Period Begin	Fall
Fruit/Seed Period End	Fall
Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No

Propagated by Tubers	No
Seed per Pound	96640
Seed Spread Rate	Slow
Seedling Vigor	Medium
Small Grain	No
Vegetative Spread Rate	Slow

Suitability/Use

Berry/Nut/Seed Product	No
Christmas Tree Product	No
Fodder Product	Yes
Fuelwood Product	
Lumber Product	No
Naval Store Product	No
Nursery Stock Product	No
Palatable Browse Animal	Medium
Palatable Graze Animal	High
Palatable Human	No
Post Product	No
Protein Potential	Medium
Pulpwood Product	No
Veneer Product	No

Andropogon hallii* Hack.*sand bluestem****ANHA****Cultivar: Cherry**

Morphology/Physiology

Active Growth Period	Summer
After Harvest Regrowth Rate	Moderate
Bloat	None
C:N Ratio	Medium
Coppice Potential	No
Fall Conspicuous	No
Fire Resistant	No
Flower Color	Yellow
Flower Conspicuous	No
Foliage Color	Green
Foliage Porosity Summer	Moderate
Foliage Porosity Winter	Porous
Foliage Texture	Coarse
Fruit/Seed Color	Brown

Fruit/Seed Conspicuous	No
Growth Form	Rhizomatous
Growth Rate	Moderate
Height at 20 Years, Maximum (feet)	
Height, Mature (feet)	6.1
Known Allelopath	No
Leaf Retention	No
Lifespan	Moderate
Low Growing Grass	No
Nitrogen Fixation	None
Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None

Growth Requirements

Adapted to Coarse Textured Soils	Yes
Adapted to Fine Textured Soils	No
Adapted to Medium Textured Soils	No
Anaerobic Tolerance	Medium
CaCO3 Tolerance	Low
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	High
Fire Tolerance	High
Frost Free Days, Minimum	120
Hedge Tolerance	None
Moisture Use	Low
pH, Minimum	5.6
pH, Maximum	8.4
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	10
Precipitation, Maximum	30
Root Depth, Minimum (inches)	20
Salinity Tolerance	Low
Shade Tolerance	Intolerant
Temperature, Minimum (°F)	-23

Reproduction

Bloom Period	Mid Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	High
Fruit/Seed Period Begin	Summer

Fruit/Seed Period End	Fall
Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No
Propagated by Tubers	No
Seed per Pound	96640
Seed Spread Rate	Slow
Seedling Vigor	Medium
Small Grain	No
Vegetative Spread Rate	Rapid

Suitability/Use

Berry/Nut/Seed Product	No
Christmas Tree Product	No
Fodder Product	Yes
Fuelwood Product	
Lumber Product	No
Naval Store Product	No
Nursery Stock Product	No
Palatable Browse Animal	Medium
Palatable Graze Animal	High
Palatable Human	No
Post Product	No
Protein Potential	Medium
Pulpwood Product	No
Veneer Product	No

Andropogon hallii* Hack.*sand bluestem****ANHA****Cultivar: Elida**

Morphology/Physiology

Active Growth Period	Summer
After Harvest Regrowth Rate	Moderate
Bloat	None
C:N Ratio	Medium

Coppice Potential	No
Fall Conspicuous	No
Fire Resistant	No
Flower Color	Yellow
Flower Conspicuous	No
Foliage Color	Green
Foliage Porosity Summer	Moderate
Foliage Porosity Winter	Porous
Foliage Texture	Coarse
Fruit/Seed Color	Brown
Fruit/Seed Conspicuous	No
Growth Form	Rhizomatous
Growth Rate	Moderate
Height at 20 Years, Maximum (feet)	
Height, Mature (feet)	6.1
Known Allelopath	No
Leaf Retention	No
Lifespan	Moderate
Low Growing Grass	No
Nitrogen Fixation	None
Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None

Growth Requirements

Adapted to Coarse Textured Soils	Yes
Adapted to Fine Textured Soils	No
Adapted to Medium Textured Soils	No
Anaerobic Tolerance	Medium
CaCO ₃ Tolerance	Low
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	High
Fire Tolerance	High
Frost Free Days, Minimum	120
Hedge Tolerance	None
Moisture Use	Low
pH, Minimum	5.6
pH, Maximum	8.4
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	10

Precipitation, Maximum	30
Root Depth, Minimum (inches)	20
Salinity Tolerance	Low
Shade Tolerance	Intolerant
Temperature, Minimum (°F)	-23

Reproduction

Bloom Period	Mid Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	High
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Fall
Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No
Propagated by Tubers	No
Seed per Pound	96640
Seed Spread Rate	Slow
Seedling Vigor	Medium
Small Grain	No
Vegetative Spread Rate	Rapid

Suitability/Use

Berry/Nut/Seed Product	No
Christmas Tree Product	No
Fodder Product	Yes
Fuelwood Product	
Lumber Product	No
Naval Store Product	No
Nursery Stock Product	No
Palatable Browse Animal	Medium
Palatable Graze Animal	High
Palatable Human	No
Post Product	No
Protein Potential	Medium
Pulpwood Product	No
Veneer Product	No

***Andropogon hallii* Hack.**
sand bluestem
ANHA
Cultivar: Garden

Morphology/Physiology

Active Growth Period	Summer
After Harvest Regrowth Rate	Moderate
Bloat	None
C:N Ratio	Medium
Coppice Potential	No
Fall Conspicuous	No
Fire Resistant	No
Flower Color	Yellow
Flower Conspicuous	No
Foliage Color	Green
Foliage Porosity Summer	Moderate
Foliage Porosity Winter	Porous
Foliage Texture	Coarse
Fruit/Seed Color	Brown
Fruit/Seed Conspicuous	No
Growth Form	Rhizomatous
Growth Rate	Moderate
Height at 20 Years, Maximum (feet)	
Height, Mature (feet)	6.2
Known Allelopath	No
Leaf Retention	No
Lifespan	Moderate
Low Growing Grass	No
Nitrogen Fixation	None
Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None

Growth Requirements

Adapted to Coarse Textured Soils	Yes
Adapted to Fine Textured Soils	No
Adapted to Medium Textured Soils	No
Anaerobic Tolerance	Medium
CaCO ₃ Tolerance	Low
Cold Stratification Required	No
Drought Tolerance	High

Fertility Requirement	High
Fire Tolerance	High
Frost Free Days, Minimum	120
Hedge Tolerance	None
Moisture Use	Low
pH, Minimum	5.6
pH, Maximum	8.4
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	10
Precipitation, Maximum	30
Root Depth, Minimum (inches)	20
Salinity Tolerance	Low
Shade Tolerance	Intolerant
Temperature, Minimum (°F)	-38

Reproduction

Bloom Period	Mid Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	High
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Fall
Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No
Propagated by Tubers	No
Seed per Pound	96640
Seed Spread Rate	Slow
Seedling Vigor	Medium
Small Grain	No
Vegetative Spread Rate	Rapid

Suitability/Use

Berry/Nut/Seed Product	No
Christmas Tree Product	No
Fodder Product	Yes
Fuelwood Product	

Lumber Product	No
Naval Store Product	No
Nursery Stock Product	No
Palatable Browse Animal	Medium
Palatable Graze Animal	High
Palatable Human	No
Post Product	No
Protein Potential	Medium
Pulpwood Product	No
Veneer Product	No

Andropogon hallii* Hack.*sand bluestem****ANHA****Cultivar: Goldstrike**

Morphology/Physiology

Active Growth Period	Summer
After Harvest Regrowth Rate	Moderate
Bloat	None
C:N Ratio	Medium
Coppice Potential	No
Fall Conspicuous	No
Fire Resistant	No
Flower Color	Yellow
Flower Conspicuous	No
Foliage Color	Green
Foliage Porosity Summer	Moderate
Foliage Porosity Winter	Porous
Foliage Texture	Coarse
Fruit/Seed Color	Brown
Fruit/Seed Conspicuous	No
Growth Form	Rhizomatous
Growth Rate	Moderate
Height at 20 Years, Maximum (feet)	
Height, Mature (feet)	6.2
Known Allelopath	No
Leaf Retention	No
Lifespan	Moderate
Low Growing Grass	No
Nitrogen Fixation	None
Resprout Ability	No

Shape and Orientation	Erect
Toxicity	None

Growth Requirements

Adapted to Coarse Textured Soils	Yes
Adapted to Fine Textured Soils	No
Adapted to Medium Textured Soils	No
Anaerobic Tolerance	Medium
CaCO3 Tolerance	Low
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	High
Fire Tolerance	High
Frost Free Days, Minimum	120
Hedge Tolerance	None
Moisture Use	Low
pH, Minimum	5.6
pH, Maximum	8.4
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	10
Precipitation, Maximum	30
Root Depth, Minimum (inches)	20
Salinity Tolerance	Low
Shade Tolerance	Intolerant
Temperature, Minimum (°F)	-38

Reproduction

Bloom Period	Mid Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	High
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Fall
Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No
Propagated by Tubers	No

Seed per Pound	96640
Seed Spread Rate	Slow
Seedling Vigor	Medium
Small Grain	No
Vegetative Spread Rate	Rapid

Suitability/Use

Berry/Nut/Seed Product	No
Christmas Tree Product	No
Fodder Product	Yes
Fuelwood Product	
Lumber Product	No
Naval Store Product	No
Nursery Stock Product	No
Palatable Browse Animal	Medium
Palatable Graze Animal	High
Palatable Human	No
Post Product	No
Protein Potential	Medium
Pulpwood Product	No
Veneer Product	No

Andropogon hallii* Hack.*sand bluestem****ANHA****Cultivar: Woodward**

Morphology/Physiology

Active Growth Period	Summer
After Harvest Regrowth Rate	Moderate
Bloat	None
C:N Ratio	Medium
Coppice Potential	No
Fall Conspicuous	No
Fire Resistant	No
Flower Color	Yellow
Flower Conspicuous	No
Foliage Color	Green
Foliage Porosity Summer	Moderate
Foliage Porosity Winter	Porous
Foliage Texture	Coarse
Fruit/Seed Color	Brown
Fruit/Seed Conspicuous	No

Growth Form	Rhizomatous
Growth Rate	Moderate
Height at 20 Years, Maximum (feet)	
Height, Mature (feet)	6.4
Known Allelopath	No
Leaf Retention	No
Lifespan	Moderate
Low Growing Grass	No
Nitrogen Fixation	None
Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None

Growth Requirements

Adapted to Coarse Textured Soils	Yes
Adapted to Fine Textured Soils	No
Adapted to Medium Textured Soils	No
Anaerobic Tolerance	Medium
CaCO3 Tolerance	Low
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	High
Fire Tolerance	High
Frost Free Days, Minimum	150
Hedge Tolerance	None
Moisture Use	Low
pH, Minimum	5.6
pH, Maximum	8.4
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	10
Precipitation, Maximum	30
Root Depth, Minimum (inches)	20
Salinity Tolerance	Low
Shade Tolerance	Intolerant
Temperature, Minimum (°F)	-13

Reproduction

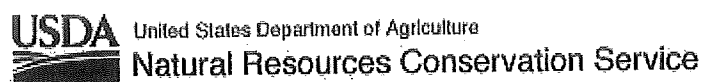
Bloom Period	Mid Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	High
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Fall

Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No
Propagated by Tubers	No
Seed per Pound	96640
Seed Spread Rate	Slow
Seedling Vigor	Medium
Small Grain	No
Vegetative Spread Rate	Rapid

Suitability/Use

Berry/Nut/Seed Product	No
Christmas Tree Product	No
Fodder Product	Yes
Fuelwood Product	
Lumber Product	No
Naval Store Product	No
Nursery Stock Product	No
Palatable Browse Animal	Medium
Palatable Graze Animal	High
Palatable Human	No
Post Product	No
Protein Potential	Medium
Pulpwood Product	No
Veneer Product	No

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Conservation Plant Characteristics

***Schizachyrium scoparium* (Michx.) Nash**
little bluestem
SCSC

Morphology/Physiology

Active Growth Period	Summer and Fall
After Harvest Regrowth Rate	Moderate
Bloat	None
C:N Ratio	Medium
Coppice Potential	No
Fall Conspicuous	No
Fire Resistant	No
Flower Color	Yellow
Flower Conspicuous	No
Foliage Color	Gray-Green
Foliage Porosity Summer	Dense
Foliage Porosity Winter	Porous
Foliage Texture	Medium
Fruit/Seed Color	Brown
Fruit/Seed Conspicuous	No
Growth Form	Bunch
Growth Rate	Moderate
Height at 20 Years, Maximum (feet)	
Height, Mature (feet)	3.0
Known Allelopath	No
Leaf Retention	No
Lifespan	Long
Low Growing Grass	No
Nitrogen Fixation	None

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little bluestem

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Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None
Growth Requirements	
Adapted to Coarse Textured Soils	Yes
Adapted to Fine Textured Soils	Yes
Adapted to Medium Textured Soils	Yes
Anaerobic Tolerance	None
CaCO3 Tolerance	High
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	Low
Fire Tolerance	Medium
Frost Free Days, Minimum	100
Hedge Tolerance	None
Moisture Use	Low
pH, Minimum	5.0
pH, Maximum	8.4
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	12
Precipitation, Maximum	45
Root Depth, Minimum (inches)	14
Salinity Tolerance	None
Shade Tolerance	Intolerant
Temperature, Minimum (°F)	-38
Reproduction	
Bloom Period	Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	Medium
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Fall
Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No

Propagated by Tubers	No
Seed per Pound	240670
Seed Spread Rate	Moderate
Seedling Vigor	Low
Small Grain	No
Vegetative Spread Rate	None

Suitability/Use

Berry/Nut/Seed Product	No
Christmas Tree Product	No
Fodder Product	Yes
Fuelwood Product	
Lumber Product	No
Naval Store Product	No
Nursery Stock Product	No
Palatable Browse Animal	Medium
Palatable Graze Animal	High
Palatable Human	No
Post Product	No
Protein Potential	Medium
Pulpwood Product	No
Veneer Product	No

Schizachyrium scoparium* (Michx.) Nash*little bluestem****SCSC****Cultivar: Aldous**

Morphology/Physiology

Active Growth Period	Summer and Fall
After Harvest Regrowth Rate	Moderate
Bloat	None
C:N Ratio	Medium
Coppice Potential	No
Fall Conspicuous	No
Fire Resistant	No
Flower Color	Yellow
Flower Conspicuous	No
Foliage Color	Gray-Green
Foliage Porosity Summer	Dense
Foliage Porosity Winter	Porous
Foliage Texture	Medium
Fruit/Seed Color	Brown

Fruit/Seed Conspicuous	No
Growth Form	Bunch
Growth Rate	Moderate
Height at 20 Years, Maximum (feet)	
Height, Mature (feet)	3.0
Known Allelopath	No
Leaf Retention	No
Lifespan	Long
Low Growing Grass	No
Nitrogen Fixation	None
Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None

Growth Requirements

Adapted to Coarse Textured Soils	Yes
Adapted to Fine Textured Soils	Yes
Adapted to Medium Textured Soils	Yes
Anaerobic Tolerance	None
CaCO ₃ Tolerance	High
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	Low
Fire Tolerance	Medium
Frost Free Days, Minimum	110
Hedge Tolerance	None
Moisture Use	Low
pH, Minimum	5.5
pH, Maximum	8.4
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	16
Precipitation, Maximum	45
Root Depth, Minimum (inches)	14
Salinity Tolerance	None
Shade Tolerance	Intolerant
Temperature, Minimum (°F)	-33

Reproduction

Bloom Period	Late Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	Medium
Fruit/Seed Period Begin	Summer

Fruit/Seed Period End	Fall
Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No
Propagated by Tubers	No
Seed per Pound	240670
Seed Spread Rate	Moderate
Seedling Vigor	Low
Small Grain	No
Vegetative Spread Rate	None

Suitability/Use

Berry/Nut/Seed Product	No
Christmas Tree Product	No
Fodder Product	Yes
Fuelwood Product	
Lumber Product	No
Naval Store Product	No
Nursery Stock Product	No
Palatable Browse Animal	Medium
Palatable Graze Animal	High
Palatable Human	No
Post Product	No
Protein Potential	Medium
Pulpwood Product	No
Veneer Product	No

Schizachyrium scoparium* (Michx.) Nash*little bluestem****SCSC****Cultivar: Badlands**

Morphology/Physiology

Active Growth Period	Spring and Summer
After Harvest Regrowth Rate	Moderate
Bloat	None
C:N Ratio	Medium

Coppice Potential	No
Fall Conspicuous	No
Fire Resistant	No
Flower Color	Yellow
Flower Conspicuous	No
Foliage Color	Gray-Green
Foliage Porosity Summer	Moderate
Foliage Porosity Winter	Porous
Foliage Texture	Medium
Fruit/Seed Color	Brown
Fruit/Seed Conspicuous	No
Growth Form	Bunch
Growth Rate	Moderate
Height at 20 Years, Maximum (feet)	
Height, Mature (feet)	3.0
Known Allelopath	No
Leaf Retention	No
Lifespan	Long
Low Growing Grass	No
Nitrogen Fixation	None
Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None

Growth Requirements

Adapted to Coarse Textured Soils	Yes
Adapted to Fine Textured Soils	Yes
Adapted to Medium Textured Soils	Yes
Anaerobic Tolerance	None
CaCO ₃ Tolerance	High
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	Low
Fire Tolerance	Medium
Frost Free Days, Minimum	95
Hedge Tolerance	None
Moisture Use	Low
pH, Minimum	5.0
pH, Maximum	8.4
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	16

Precipitation, Maximum	30
Root Depth, Minimum (inches)	12
Salinity Tolerance	None
Shade Tolerance	Intolerant
Temperature, Minimum (°F)	-38

Reproduction

Bloom Period	Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	Medium
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Fall
Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No
Propagated by Tubers	No
Seed per Pound	240670
Seed Spread Rate	Moderate
Seedling Vigor	Low
Small Grain	No
Vegetative Spread Rate	None

Suitability/Use

Berry/Nut/Seed Product	No
Christmas Tree Product	No
Fodder Product	Yes
Fuelwood Product	
Lumber Product	No
Naval Store Product	No
Nursery Stock Product	No
Palatable Browse Animal	Medium
Palatable Graze Animal	High
Palatable Human	No
Post Product	No
Protein Potential	Medium
Pulpwood Product	No
Veneer Product	No

***Schizachyrium scoparium* (Michx.) Nash**
little bluestem
SCSC
Cultivar: Blaze

Morphology/Physiology

Active Growth Period	Summer and Fall
After Harvest Regrowth Rate	Moderate
Bloat	None
C:N Ratio	Medium
Coppice Potential	No
Fall Conspicuous	No
Fire Resistant	No
Flower Color	Yellow
Flower Conspicuous	No
Foliage Color	Green
Foliage Porosity Summer	Dense
Foliage Porosity Winter	Porous
Foliage Texture	Medium
Fruit/Seed Color	Brown
Fruit/Seed Conspicuous	No
Growth Form	Bunch
Growth Rate	Moderate
Height at 20 Years, Maximum (feet)	
Height, Mature (feet)	3.0
Known Allelopath	No
Leaf Retention	No
Lifespan	Long
Low Growing Grass	No
Nitrogen Fixation	None
Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None

Growth Requirements

Adapted to Coarse Textured Soils	Yes
Adapted to Fine Textured Soils	Yes
Adapted to Medium Textured Soils	Yes
Anaerobic Tolerance	None
CaCO ₃ Tolerance	High
Cold Stratification Required	No
Drought Tolerance	High

Fertility Requirement	Low
Fire Tolerance	Medium
Frost Free Days, Minimum	110
Hedge Tolerance	None
Moisture Use	Low
pH, Minimum	5.5
pH, Maximum	8.4
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	16
Precipitation, Maximum	45
Root Depth, Minimum (inches)	14
Salinity Tolerance	None
Shade Tolerance	Intolerant
Temperature, Minimum (°F)	-33

Reproduction

Bloom Period	Late Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	Medium
Fruit/Seed Period Begin	Fall
Fruit/Seed Period End	Fall
Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No
Propagated by Tubers	No
Seed per Pound	240670
Seed Spread Rate	Moderate
Seedling Vigor	Medium
Small Grain	No
Vegetative Spread Rate	Moderate

Suitability/Use

Berry/Nut/Seed Product	No
Christmas Tree Product	No
Fodder Product	Yes
Fuelwood Product	

Lumber Product	No
Naval Store Product	No
Nursery Stock Product	No
Palatable Browse Animal	Medium
Palatable Graze Animal	High
Palatable Human	No
Post Product	No
Protein Potential	Medium
Pulpwood Product	No
Veneer Product	No

***Schizachyrium scoparium* (Michx.) Nash**
little bluestem
SCSC
Cultivar: Camper

Morphology/Physiology

Active Growth Period	Summer and Fall
After Harvest Regrowth Rate	Moderate
Bloat	None
C:N Ratio	Medium
Coppice Potential	No
Fall Conspicuous	No
Fire Resistant	No
Flower Color	Yellow
Flower Conspicuous	No
Foliage Color	Gray-Green
Foliage Porosity Summer	Dense
Foliage Porosity Winter	Porous
Foliage Texture	Medium
Fruit/Seed Color	Brown
Fruit/Seed Conspicuous	No
Growth Form	Bunch
Growth Rate	Moderate
Height at 20 Years, Maximum (feet)	
Height, Mature (feet)	3.0
Known Allelopath	No
Leaf Retention	No
Lifespan	Long
Low Growing Grass	No
Nitrogen Fixation	None
Resprout Ability	No

Shape and Orientation	Erect
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Toxicity	None
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Growth Requirements

Adapted to Coarse Textured Soils	Yes
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Adapted to Fine Textured Soils	Yes
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Adapted to Medium Textured Soils	Yes
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Anaerobic Tolerance	None
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CaCO3 Tolerance	High
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Cold Stratification Required	No
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Drought Tolerance	High
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Fertility Requirement	Low
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Fire Tolerance	Medium
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Frost Free Days, Minimum	100
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Hedge Tolerance	None
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Moisture Use	Low
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pH, Minimum	5.2
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pH, Maximum	8.4
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Planting Density per Acre, Minimum	
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Planting Density per Acre, Maximum	
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Precipitation, Minimum	18
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Precipitation, Maximum	45
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Root Depth, Minimum (inches)	14
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Salinity Tolerance	None
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Shade Tolerance	Intolerant
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Temperature, Minimum (°F)	-38
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Reproduction

Bloom Period	Fall
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Commercial Availability	Routinely Available
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Fruit/Seed Abundance	Medium
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Fruit/Seed Period Begin	Fall
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Fruit/Seed Period End	Fall
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Fruit/Seed Persistence	No
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Propagated by Bare Root	No
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Propagated by Bulb	No
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Propagated by Container	No
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Propagated by Corm	No
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Propagated by Cuttings	No
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Propagated by Seed	Yes
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Propagated by Sod	No
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Propagated by Sprigs	No
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Propagated by Tubers	No
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Seed per Pound	240670
Seed Spread Rate	Moderate
Seedling Vigor	Low
Small Grain	No
Vegetative Spread Rate	None

Suitability/Use

Berry/Nut/Seed Product	No
Christmas Tree Product	No
Fodder Product	Yes
Fuelwood Product	
Lumber Product	No
Naval Store Product	No
Nursery Stock Product	No
Palatable Browse Animal	Medium
Palatable Graze Animal	High
Palatable Human	No
Post Product	No
Protein Potential	Medium
Pulpwood Product	No
Veneer Product	No

Schizachyrium scoparium* (Michx.) Nash*little bluestem****SCSC****Cultivar: Cimarron**

Morphology/Physiology

Active Growth Period	Summer and Fall
After Harvest Regrowth Rate	Moderate
Bloat	None
C:N Ratio	Medium
Coppice Potential	No
Fall Conspicuous	No
Fire Resistant	No
Flower Color	White
Flower Conspicuous	No
Foliage Color	Gray-Green
Foliage Porosity Summer	Dense
Foliage Porosity Winter	Porous
Foliage Texture	Medium
Fruit/Seed Color	Brown
Fruit/Seed Conspicuous	No

Growth Form	Bunch
Growth Rate	Moderate
Height at 20 Years, Maximum (feet)	
Height, Mature (feet)	3.5
Known Allelopath	No
Leaf Retention	No
Lifespan	Long
Low Growing Grass	No
Nitrogen Fixation	None
Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None

Growth Requirements

Adapted to Coarse Textured Soils	Yes
Adapted to Fine Textured Soils	Yes
Adapted to Medium Textured Soils	Yes
Anaerobic Tolerance	None
CaCO ₃ Tolerance	High
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	Low
Fire Tolerance	Medium
Frost Free Days, Minimum	150
Hedge Tolerance	None
Moisture Use	Low
pH, Minimum	5.6
pH, Maximum	8.4
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	12
Precipitation, Maximum	40
Root Depth, Minimum (inches)	14
Salinity Tolerance	None
Shade Tolerance	Intolerant
Temperature, Minimum (°F)	-23

Reproduction

Bloom Period	Late Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	High
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Fall

Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No
Propagated by Tubers	No
Seed per Pound	255000
Seed Spread Rate	Slow
Seedling Vigor	Low
Small Grain	No
Vegetative Spread Rate	None

Suitability/Use

Berry/Nut/Seed Product	No
Christmas Tree Product	No
Fodder Product	Yes
Fuelwood Product	
Lumber Product	No
Naval Store Product	No
Nursery Stock Product	No
Palatable Browse Animal	Medium
Palatable Graze Animal	High
Palatable Human	No
Post Product	No
Protein Potential	Medium
Pulpwood Product	No
Veneer Product	No

Schizachyrium scoparium* (Michx.) Nash*little bluestem****SCSC****Cultivar: Pastura**

Morphology/Physiology

Active Growth Period	Summer and Fall
After Harvest Regrowth Rate	Moderate
Bloat	None
C:N Ratio	Medium
Coppice Potential	No

Fall Conspicuous	No
Fire Resistant	No
Flower Color	White
Flower Conspicuous	No
Foliage Color	Green
Foliage Porosity Summer	Dense
Foliage Porosity Winter	Porous
Foliage Texture	Medium
Fruit/Seed Color	Brown
Fruit/Seed Conspicuous	No
Growth Form	Bunch
Growth Rate	Moderate
Height at 20 Years, Maximum (feet)	
Height, Mature (feet)	3.5
Known Allelopath	No
Leaf Retention	No
Lifespan	Long
Low Growing Grass	No
Nitrogen Fixation	None
Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None

Growth Requirements

Adapted to Coarse Textured Soils	Yes
Adapted to Fine Textured Soils	Yes
Adapted to Medium Textured Soils	Yes
Anaerobic Tolerance	None
CaCO ₃ Tolerance	High
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	Low
Fire Tolerance	Medium
Frost Free Days, Minimum	120
Hedge Tolerance	None
Moisture Use	Low
pH, Minimum	5.6
pH, Maximum	8.4
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	12
Precipitation, Maximum	40

Root Depth, Minimum (inches)	14
Salinity Tolerance	None
Shade Tolerance	Intolerant
Temperature, Minimum (°F)	-33

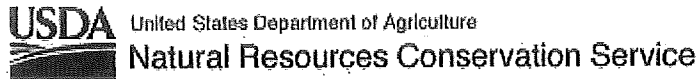
Reproduction

Bloom Period	Late Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	High
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Fall
Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No
Propagated by Tubers	No
Seed per Pound	240670
Seed Spread Rate	Slow
Seedling Vigor	High
Small Grain	No
Vegetative Spread Rate	None

Suitability/Use

Berry/Nut/Seed Product	No
Christmas Tree Product	No
Fodder Product	Yes
Fuelwood Product	
Lumber Product	No
Naval Store Product	No
Nursery Stock Product	No
Palatable Browse Animal	Medium
Palatable Graze Animal	High
Palatable Human	No
Post Product	No
Protein Potential	Medium
Pulpwood Product	No
Veneer Product	No

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Conservation Plant Characteristics

***Coreopsis tinctoria* Nutt.**
golden tickseed
COTI3

Morphology/Physiology

Active Growth Period	Spring and Summer
After Harvest Regrowth Rate	Slow
Bloat	None
C:N Ratio	Medium
Coppice Potential	No
Fall Conspicuous	No
Fire Resistant	No
Flower Color	Yellow
Flower Conspicuous	Yes
Foliage Color	Green
Foliage Porosity Summer	Porous
Foliage Porosity Winter	Porous
Foliage Texture	Medium
Fruit/Seed Color	Brown
Fruit/Seed Conspicuous	No
Growth Form	Single Crown
Growth Rate	Rapid
Height at 20 Years, Maximum (feet)	
Height, Mature (feet)	3.0
Known Allelopath	No
Leaf Retention	No
Lifespan	Short
Low Growing Grass	No
Nitrogen Fixation	None

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Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None
Growth Requirements	
Adapted to Coarse Textured Soils	No
Adapted to Fine Textured Soils	Yes
Adapted to Medium Textured Soils	Yes
Anaerobic Tolerance	Medium
CaCO3 Tolerance	Medium
Cold Stratification Required	No
Drought Tolerance	Low
Fertility Requirement	Medium
Fire Tolerance	Low
Frost Free Days, Minimum	90
Hedge Tolerance	None
Moisture Use	High
pH, Minimum	5.2
pH, Maximum	7.8
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	20
Precipitation, Maximum	55
Root Depth, Minimum (inches)	8
Salinity Tolerance	None
Shade Tolerance	Intermediate
Temperature, Minimum (°F)	52
Reproduction	
Bloom Period	Late Spring
Commercial Availability	Routinely Available
Fruit/Seed Abundance	High
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Summer
Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No

Propagated by Tubers	No
Seed per Pound	3222222
Seed Spread Rate	Moderate
Seedling Vigor	High
Small Grain	No
Vegetative Spread Rate	None

Suitability/Use

Berry/Nut/Seed Product	No
Christmas Tree Product	No
Fodder Product	No
Fuelwood Product	
Lumber Product	No
Naval Store Product	No
Nursery Stock Product	Yes
Palatable Browse Animal	
Palatable Graze Animal	
Palatable Human	No
Post Product	No
Protein Potential	
Pulpwood Product	No
Veneer Product	No

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Conservation Plant Characteristics

***Setaria vulpiseta* (Lam.) Roem. & Schult.**
plains bristlegrass
SEVU2

Morphology/Physiology

Active Growth Period	Spring and Summer
After Harvest Regrowth Rate	Moderate
Bloat	None
C:N Ratio	Medium
Coppice Potential	No
Fall Conspicuous	No
Fire Resistant	No
Flower Color	Yellow
Flower Conspicuous	No
Foliage Color	Green
Foliage Porosity Summer	Dense
Foliage Porosity Winter	Porous
Foliage Texture	Medium
Fruit/Seed Color	Brown
Fruit/Seed Conspicuous	No
Growth Form	Bunch
Growth Rate	Moderate
Height at 20 Years, Maximum (feet)	
Height, Mature (feet)	3.0
Known Allelopath	No
Leaf Retention	No
Lifespan	Moderate
Low Growing Grass	No
Nitrogen Fixation	None

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Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None

Growth Requirements

Adapted to Coarse Textured Soils	No
Adapted to Fine Textured Soils	No
Adapted to Medium Textured Soils	Yes
Anaerobic Tolerance	None
CaCO3 Tolerance	Medium
Cold Stratification Required	No
Drought Tolerance	Medium
Fertility Requirement	Medium
Fire Tolerance	Medium
Frost Free Days, Minimum	180
Hedge Tolerance	None
Moisture Use	Medium
pH, Minimum	6.0
pH, Maximum	8.0
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	12
Precipitation, Maximum	24
Root Depth, Minimum (inches)	18
Salinity Tolerance	None
Shade Tolerance	Intermediate
Temperature, Minimum (°F)	-13

Reproduction

Bloom Period	Early Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	Medium
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Fall
Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No

Propagated by Tubers	No
Seed per Pound	290000
Seed Spread Rate	Moderate
Seedling Vigor	High
Small Grain	No
Vegetative Spread Rate	None

Suitability/Use

Berry/Nut/Seed Product	No
Christmas Tree Product	No
Fodder Product	Yes
Fuelwood Product	
Lumber Product	No
Naval Store Product	No
Nursery Stock Product	No
Palatable Browse Animal	Medium
Palatable Graze Animal	High
Palatable Human	No
Post Product	No
Protein Potential	Medium
Pulpwood Product	No
Veneer Product	No

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Conservation Plant Characteristics

***Andropogon gerardii* Vitman**
big bluestem
ANGE

Morphology/Physiology

Active Growth Period	Summer
After Harvest Regrowth Rate	Moderate
Bloat	Low
C:N Ratio	Medium
Coppice Potential	No
Fall Conspicuous	No
Fire Resistant	No
Flower Color	Yellow
Flower Conspicuous	No
Foliage Color	Green
Foliage Porosity Summer	Dense
Foliage Porosity Winter	Porous
Foliage Texture	Medium
Fruit/Seed Color	Brown
Fruit/Seed Conspicuous	No
Growth Form	Bunch
Growth Rate	Moderate
Height at 20 Years, Maximum (feet)	
Height, Mature (feet)	6.0
Known Allelopath	No
Leaf Retention	No
Lifespan	Long
Low Growing Grass	No
Nitrogen Fixation	None

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Plant Materials Web Site

Plant Materials Publications

USDA Plant Hardiness Map

Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None
Growth Requirements	
Adapted to Coarse Textured Soils	Yes
Adapted to Fine Textured Soils	Yes
Adapted to Medium Textured Soils	Yes
Anaerobic Tolerance	Medium
CaCO3 Tolerance	High
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	Low
Fire Tolerance	High
Frost Free Days, Minimum	155
Hedge Tolerance	None
Moisture Use	Low
pH, Minimum	6.0
pH, Maximum	7.5
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	12
Precipitation, Maximum	55
Root Depth, Minimum (inches)	20
Salinity Tolerance	Medium
Shade Tolerance	Intolerant
Temperature, Minimum (°F)	-46
Reproduction	
Bloom Period	Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	Medium
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Fall
Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No

Propagated by Tubers	No
Seed per Pound	144240
Seed Spread Rate	Slow
Seedling Vigor	Low
Small Grain	No
Vegetative Spread Rate	Slow

Suitability/Use

Berry/Nut/Seed Product	No
Christmas Tree Product	No
Fodder Product	Yes
Fuelwood Product	
Lumber Product	No
Naval Store Product	No
Nursery Stock Product	No
Palatable Browse Animal	Medium
Palatable Graze Animal	High
Palatable Human	No
Post Product	No
Protein Potential	Medium
Pulpwood Product	No
Veneer Product	No

Andropogon gerardii* Vitman*big bluestem****ANGE****Cultivar: Bison**

Morphology/Physiology

Active Growth Period	Summer
After Harvest Regrowth Rate	Moderate
Bloat	Low
C:N Ratio	Medium
Coppice Potential	No
Fall Conspicuous	No
Fire Resistant	No
Flower Color	Yellow
Flower Conspicuous	No
Foliage Color	Green
Foliage Porosity Summer	Dense
Foliage Porosity Winter	Porous
Foliage Texture	Medium
Fruit/Seed Color	Brown

Fruit/Seed Conspicuous	No
Growth Form	Bunch
Growth Rate	Moderate
Height at 20 Years, Maximum (feet)	
Height, Mature (feet)	6.0
Known Allelopath	No
Leaf Retention	No
Lifespan	Long
Low Growing Grass	No
Nitrogen Fixation	None
Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None

Growth Requirements

Adapted to Coarse Textured Soils	Yes
Adapted to Fine Textured Soils	Yes
Adapted to Medium Textured Soils	Yes
Anaerobic Tolerance	Medium
CaCO ₃ Tolerance	High
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	Low
Fire Tolerance	High
Frost Free Days, Minimum	155
Hedge Tolerance	None
Moisture Use	High
pH, Minimum	6.0
pH, Maximum	7.5
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	12
Precipitation, Maximum	55
Root Depth, Minimum (inches)	20
Salinity Tolerance	Medium
Shade Tolerance	Intolerant
Temperature, Minimum (°F)	-43

Reproduction

Bloom Period	Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	Low
Fruit/Seed Period Begin	Summer

Fruit/Seed Period End	Fall
Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No
Propagated by Tubers	No
Seed per Pound	144240
Seed Spread Rate	Slow
Seedling Vigor	Low
Small Grain	No
Vegetative Spread Rate	Slow

Suitability/Use

Berry/Nut/Seed Product	No
Christmas Tree Product	No
Fodder Product	Yes
Fuelwood Product	
Lumber Product	No
Naval Store Product	No
Nursery Stock Product	No
Palatable Browse Animal	High
Palatable Graze Animal	High
Palatable Human	No
Post Product	No
Protein Potential	Medium
Pulpwood Product	No
Veneer Product	No

Andropogon gerardii* Vitman*big bluestem****ANGE****Cultivar: Bonilla**

Morphology/Physiology

Active Growth Period	Summer
After Harvest Regrowth Rate	Moderate
Bloat	None
C:N Ratio	Medium

Coppice Potential	No
Fall Conspicuous	No
Fire Resistant	No
Flower Color	Yellow
Flower Conspicuous	No
Foliage Color	Green
Foliage Porosity Summer	Dense
Foliage Porosity Winter	Porous
Foliage Texture	Medium
Fruit/Seed Color	Brown
Fruit/Seed Conspicuous	No
Growth Form	Bunch
Growth Rate	Moderate
Height at 20 Years, Maximum (feet)	
Height, Mature (feet)	6.5
Known Allelopath	No
Leaf Retention	No
Lifespan	Long
Low Growing Grass	No
Nitrogen Fixation	None
Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None

Growth Requirements

Adapted to Coarse Textured Soils	Yes
Adapted to Fine Textured Soils	Yes
Adapted to Medium Textured Soils	Yes
Anaerobic Tolerance	Medium
CaCO ₃ Tolerance	High
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	Medium
Fire Tolerance	High
Frost Free Days, Minimum	120
Hedge Tolerance	None
Moisture Use	Medium
pH, Minimum	6.5
pH, Maximum	7.5
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	12

Precipitation, Maximum	30
Root Depth, Minimum (inches)	20
Salinity Tolerance	Medium
Shade Tolerance	Intolerant
Temperature, Minimum (°F)	-39

Reproduction

Bloom Period	Mid Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	High
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Fall
Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No
Propagated by Tubers	No
Seed per Pound	144240
Seed Spread Rate	Slow
Seedling Vigor	Medium
Small Grain	No
Vegetative Spread Rate	Slow

Suitability/Use

Berry/Nut/Seed Product	No
Christmas Tree Product	No
Fodder Product	Yes
Fuelwood Product	
Lumber Product	No
Naval Store Product	No
Nursery Stock Product	No
Palatable Browse Animal	High
Palatable Graze Animal	High
Palatable Human	No
Post Product	No
Protein Potential	Medium
Pulpwood Product	No
Veneer Product	No

***Andropogon gerardii* Vitman**
big bluestem
ANGE
Cultivar: Champ

Morphology/Physiology

Active Growth Period	Summer
After Harvest Regrowth Rate	Moderate
Bloat	Low
C:N Ratio	Medium
Coppice Potential	No
Fall Conspicuous	No
Fire Resistant	No
Flower Color	Yellow
Flower Conspicuous	No
Foliage Color	Green
Foliage Porosity Summer	Dense
Foliage Porosity Winter	Porous
Foliage Texture	Medium
Fruit/Seed Color	Brown
Fruit/Seed Conspicuous	No
Growth Form	Bunch
Growth Rate	Moderate
Height at 20 Years, Maximum (feet)	
Height, Mature (feet)	6.5
Known Allelopath	No
Leaf Retention	No
Lifespan	Long
Low Growing Grass	No
Nitrogen Fixation	None
Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None

Growth Requirements

Adapted to Coarse Textured Soils	No
Adapted to Fine Textured Soils	Yes
Adapted to Medium Textured Soils	Yes
Anaerobic Tolerance	Medium
CaCO ₃ Tolerance	High
Cold Stratification Required	No
Drought Tolerance	High

Fertility Requirement	Medium
Fire Tolerance	High
Frost Free Days, Minimum	180
Hedge Tolerance	None
Moisture Use	Medium
pH, Minimum	6.0
pH, Maximum	7.5
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	12
Precipitation, Maximum	35
Root Depth, Minimum (inches)	20
Salinity Tolerance	Medium
Shade Tolerance	Intolerant
Temperature, Minimum (°F)	-30

Reproduction

Bloom Period	Late Spring
Commercial Availability	Routinely Available
Fruit/Seed Abundance	High
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Fall
Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No
Propagated by Tubers	No
Seed per Pound	144240
Seed Spread Rate	Slow
Seedling Vigor	Medium
Small Grain	No
Vegetative Spread Rate	Slow

Suitability/Use

Berry/Nut/Seed Product	No
Christmas Tree Product	No
Fodder Product	Yes
Fuelwood Product	

Lumber Product	No
Naval Store Product	No
Nursery Stock Product	No
Palatable Browse Animal	Medium
Palatable Graze Animal	High
Palatable Human	No
Post Product	No
Protein Potential	Medium
Pulpwood Product	No
Veneer Product	No

Andropogon gerardii* Vitman*big bluestem****ANGE****Cultivar: Kaw**

Morphology/Physiology

Active Growth Period	Summer
After Harvest Regrowth Rate	Moderate
Bloat	Low
C:N Ratio	Medium
Coppice Potential	No
Fall Conspicuous	No
Fire Resistant	No
Flower Color	Yellow
Flower Conspicuous	No
Foliage Color	Green
Foliage Porosity Summer	Dense
Foliage Porosity Winter	Porous
Foliage Texture	Medium
Fruit/Seed Color	Brown
Fruit/Seed Conspicuous	No
Growth Form	Bunch
Growth Rate	Moderate
Height at 20 Years, Maximum (feet)	
Height, Mature (feet)	6.9
Known Allelopath	No
Leaf Retention	No
Lifespan	Long
Low Growing Grass	No
Nitrogen Fixation	None
Resprout Ability	No

Shape and Orientation	Erect
Toxicity	None

Growth Requirements

Adapted to Coarse Textured Soils	Yes
Adapted to Fine Textured Soils	Yes
Adapted to Medium Textured Soils	Yes
Anaerobic Tolerance	Medium
CaCO ₃ Tolerance	High
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	Low
Fire Tolerance	High
Frost Free Days, Minimum	180
Hedge Tolerance	None
Moisture Use	Low
pH, Minimum	6.0
pH, Maximum	8.0
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	13
Precipitation, Maximum	45
Root Depth, Minimum (inches)	20
Salinity Tolerance	Medium
Shade Tolerance	Intolerant
Temperature, Minimum (°F)	-28

Reproduction

Bloom Period	Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	Medium
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Fall
Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No
Propagated by Tubers	No

Seed per Pound	144240
Seed Spread Rate	Slow
Seedling Vigor	Low
Small Grain	No
Vegetative Spread Rate	Slow

Suitability/Use

Berry/Nut/Seed Product	No
Christmas Tree Product	No
Fodder Product	Yes
Fuelwood Product	
Lumber Product	No
Naval Store Product	No
Nursery Stock Product	No
Palatable Browse Animal	Medium
Palatable Graze Animal	High
Palatable Human	No
Post Product	No
Protein Potential	Medium
Pulpwood Product	No
Veneer Product	No

Andropogon gerardii* Vitman*big bluestem****ANGE****Cultivar: Niagara**

Morphology/Physiology

Active Growth Period	Summer
After Harvest Regrowth Rate	Moderate
Bloat	None
C:N Ratio	Medium
Coppice Potential	No
Fall Conspicuous	No
Fire Resistant	No
Flower Color	Yellow
Flower Conspicuous	No
Foliage Color	Green
Foliage Porosity Summer	Dense
Foliage Porosity Winter	Porous
Foliage Texture	Medium
Fruit/Seed Color	Brown
Fruit/Seed Conspicuous	No

Growth Form	Bunch
Growth Rate	Moderate
Height at 20 Years, Maximum (feet)	
Height, Mature (feet) ^	6.3
Known Allelopath	No
Leaf Retention	No
Lifespan	Long
Low Growing Grass	No
Nitrogen Fixation	None
Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None

Growth Requirements

Adapted to Coarse Textured Soils	Yes
Adapted to Fine Textured Soils	Yes
Adapted to Medium Textured Soils	Yes
Anaerobic Tolerance	Medium
CaCO3 Tolerance	High
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	Medium
Fire Tolerance	High
Frost Free Days, Minimum	120
Hedge Tolerance	None
Moisture Use	Low
pH, Minimum	5.0
pH, Maximum	7.0
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	12
Precipitation, Maximum	45
Root Depth, Minimum (inches)	20
Salinity Tolerance	Medium
Shade Tolerance	Intolerant
Temperature, Minimum (°F)	-23

Reproduction

Bloom Period	Early Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	Medium
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Fall

Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No
Propagated by Tubers	No
Seed per Pound	144240
Seed Spread Rate	Slow
Seedling Vigor	Medium
Small Grain	No
Vegetative Spread Rate	Slow

Suitability/Use

Berry/Nut/Seed Product	No
Christmas Tree Product	No
Fodder Product	Yes
Fuelwood Product	
Lumber Product	No
Naval Store Product	No
Nursery Stock Product	No
Palatable Browse Animal	Medium
Palatable Graze Animal	High
Palatable Human	No
Post Product	No
Protein Potential	Medium
Pulpwood Product	No
Veneer Product	No

Andropogon gerardii* Vitman*big bluestem****ANGE****Cultivar: Pawnee**

Morphology/Physiology

Active Growth Period	Summer
After Harvest Regrowth Rate	Moderate
Bloat	Low
C:N Ratio	Medium
Coppice Potential	No

Fall Conspicuous	No
Fire Resistant	No
Flower Color	Yellow
Flower Conspicuous	No
Foliage Color	Green
Foliage Porosity Summer	Dense
Foliage Porosity Winter	Porous
Foliage Texture	Medium
Fruit/Seed Color	Brown
Fruit/Seed Conspicuous	No
Growth Form	Bunch
Growth Rate	Moderate
Height at 20 Years, Maximum (feet)	
Height, Mature (feet)	7.0
Known Allelopath	No
Leaf Retention	No
Lifespan	Long
Low Growing Grass	No
Nitrogen Fixation	None
Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None

Growth Requirements

Adapted to Coarse Textured Soils	No
Adapted to Fine Textured Soils	Yes
Adapted to Medium Textured Soils	Yes
Anaerobic Tolerance	Medium
CaCO ₃ Tolerance	High
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	Medium
Fire Tolerance	High
Frost Free Days, Minimum	180
Hedge Tolerance	None
Moisture Use	Low
pH, Minimum	5.5
pH, Maximum	8.0
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	12
Precipitation, Maximum	35

Root Depth, Minimum (inches)	20
Salinity Tolerance	Medium
Shade Tolerance	Intolerant
Temperature, Minimum (°F)	-38

Reproduction

Bloom Period	Late Spring
Commercial Availability	Routinely Available
Fruit/Seed Abundance	Medium
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Fall
Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No
Propagated by Tubers	No
Seed per Pound	144240
Seed Spread Rate	Slow
Seedling Vigor	Medium
Small Grain	No
Vegetative Spread Rate	Slow

Suitability/Use

Berry/Nut/Seed Product	No
Christmas Tree Product	No
Fodder Product	Yes
Fuelwood Product	
Lumber Product	No
Naval Store Product	No
Nursery Stock Product	No
Palatable Browse Animal	Medium
Palatable Graze Animal	High
Palatable Human	No
Post Product	No
Protein Potential	Medium
Pulpwood Product	No
Veneer Product	No

***Andropogon gerardii* Vitman**
big bluestem
ANGE
Cultivar: Rountree

Morphology/Physiology

Active Growth Period	Summer
After Harvest Regrowth Rate	Moderate
Bloat	Low
C:N Ratio	Medium
Coppice Potential	No
Fall Conspicuous	No
Fire Resistant	No
Flower Color	Yellow
Flower Conspicuous	No
Foliage Color	Green
Foliage Porosity Summer	Dense
Foliage Porosity Winter	Porous
Foliage Texture	Medium
Fruit/Seed Color	Brown
Fruit/Seed Conspicuous	No
Growth Form	Bunch
Growth Rate	Moderate
Height at 20 Years, Maximum (feet)	
Height, Mature (feet)	6.5
Known Allelopath	No
Leaf Retention	No
Lifespan	Long
Low Growing Grass	No
Nitrogen Fixation	None
Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None

Growth Requirements

Adapted to Coarse Textured Soils	No
Adapted to Fine Textured Soils	Yes
Adapted to Medium Textured Soils	Yes
Anaerobic Tolerance	Medium
CaCO3 Tolerance	High
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	Medium

Fire Tolerance	High
Frost Free Days, Minimum	180
Hedge Tolerance	None
Moisture Use	Low
pH, Minimum	5.5
pH, Maximum	8.5
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	20
Precipitation, Maximum	35
Root Depth, Minimum (inches)	20
Salinity Tolerance	Medium
Shade Tolerance	Intolerant
Temperature, Minimum (°F)	-28

Reproduction

Bloom Period	Late Spring
Commercial Availability	Routinely Available
Fruit/Seed Abundance	Medium
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Fall
Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No
Propagated by Tubers	No
Seed per Pound	144240
Seed Spread Rate	Slow
Seedling Vigor	Low
Small Grain	No
Vegetative Spread Rate	Slow

Suitability/Use

Berry/Nut/Seed Product	No
Christmas Tree Product	No
Fodder Product	Yes
Fuelwood Product	
Lumber Product	No

Naval Store Product	No
Nursery Stock Product	No
Palatable Browse Animal	Medium
Palatable Graze Animal	High
Palatable Human	No
Post Product	No
Protein Potential	Medium
Pulpwood Product	No
Veneer Product	No

***Andropogon gerardii* Vitman**
big bluestem
ANGE
Cultivar: Sunnyview

Morphology/Physiology

Active Growth Period	Spring and Summer
After Harvest Regrowth Rate	Moderate
Bloat	Low
C:N Ratio	Medium
Coppice Potential	No
Fall Conspicuous	No
Fire Resistant	No
Flower Color	Yellow
Flower Conspicuous	No
Foliage Color	Green
Foliage Porosity Summer	Dense
Foliage Porosity Winter	Porous
Foliage Texture	Medium
Fruit/Seed Color	Brown
Fruit/Seed Conspicuous	No
Growth Form	Bunch
Growth Rate	Moderate
Height at 20 Years, Maximum (feet)	
Height, Mature (feet)	6.0
Known Allelopath	No
Leaf Retention	No
Lifespan	Long
Low Growing Grass	No
Nitrogen Fixation	None
Resprout Ability	No
Shape and Orientation	Erect

Toxicity	None
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Growth Requirements

Adapted to Coarse Textured Soils	No
Adapted to Fine Textured Soils	Yes
Adapted to Medium Textured Soils	Yes
Anaerobic Tolerance	Medium
CaCO ₃ Tolerance	High
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	Medium
Fire Tolerance	High
Frost Free Days, Minimum	120
Hedge Tolerance	None
Moisture Use	Low
pH, Minimum	5.5
pH, Maximum	8.0
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	12
Precipitation, Maximum	30
Root Depth, Minimum (inches)	18
Salinity Tolerance	Medium
Shade Tolerance	Intolerant
Temperature, Minimum (°F)	-36

Reproduction

Bloom Period	Mid Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	Medium
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Fall
Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No
Propagated by Tubers	No
Seed per Pound	144240

Seed Spread Rate	Slow
Seedling Vigor	Low
Small Grain	No
Vegetative Spread Rate	Slow

Suitability/Use

Berry/Nut/Seed Product	No
Christmas Tree Product	No
Fodder Product	Yes
Fuelwood Product	
Lumber Product	No
Naval Store Product	No
Nursery Stock Product	No
Palatable Browse Animal	Medium
Palatable Graze Animal	High
Palatable Human	No
Post Product	No
Protein Potential	Medium
Pulpwood Product	No
Veneer Product	No

Andropogon gerardii* Vitman*big bluestem****ANGE****Cultivar: T-1947**

Morphology/Physiology

Active Growth Period	Summer
After Harvest Regrowth Rate	Moderate
Bloat	Low
C:N Ratio	Medium
Coppice Potential	No
Fall Conspicuous	No
Fire Resistant	No
Flower Color	Yellow
Flower Conspicuous	No
Foliage Color	Green
Foliage Porosity Summer	Dense
Foliage Porosity Winter	Porous
Foliage Texture	Medium
Fruit/Seed Color	Brown
Fruit/Seed Conspicuous	No
Growth Form	Bunch

Growth Rate	Moderate
Height at 20 Years, Maximum (feet)	
Height, Mature (feet)	7.0
Known Allelopath	No
Leaf Retention	No
Lifespan	Long
Low Growing Grass	No
Nitrogen Fixation	None
Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None

Growth Requirements

Adapted to Coarse Textured Soils	Yes
Adapted to Fine Textured Soils	Yes
Adapted to Medium Textured Soils	Yes
Anaerobic Tolerance	Medium
CaCO ₃ Tolerance	High
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	Low
Fire Tolerance	High
Frost Free Days, Minimum	190
Hedge Tolerance	None
Moisture Use	Low
pH, Minimum	5.5
pH, Maximum	7.5
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	12
Precipitation, Maximum	33
Root Depth, Minimum (inches)	20
Salinity Tolerance	Low
Shade Tolerance	Intolerant
Temperature, Minimum (°F)	-9

Reproduction

Bloom Period	Mid Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	Medium
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Fall
Fruit/Seed Persistence	No

Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No
Propagated by Tubers	No
Seed per Pound	144240
Seed Spread Rate	Slow
Seedling Vigor	Low
Small Grain	No
Vegetative Spread Rate	Slow

Suitability/Use

Berry/Nut/Seed Product	No
Christmas Tree Product	No
Fodder Product	Yes
Fuelwood Product	
Lumber Product	No
Naval Store Product	No
Nursery Stock Product	No
Palatable Browse Animal	Medium
Palatable Graze Animal	High
Palatable Human	No
Post Product	No
Protein Potential	Medium
Pulpwood Product	No
Veneer Product	No

Time Generated: 03/08/2017

APPENDIX V

LABORATORY RESULTS



PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

November 08, 2016

KIMBERLY WILSON

TALON LPE

408 W. TEXAS AVE.

ARTESIA, NM 88210

RE: COTTON DRAW #181 BATTERY

Enclosed are the results of analyses for samples received by the laboratory on 11/07/16 13:45.

Cardinal Laboratories is accredited through Texas NELAP under certificate number T104704398-16-8. Accreditation applies to drinking water, non-potable water and solid and chemical materials. All accredited analytes are denoted by an asterisk (*). For a complete list of accredited analytes and matrices visit the TCEQ website at www.tceq.texas.gov/field/qa/lab_accred_certif.html.

Cardinal Laboratories is accredited through the State of Colorado Department of Public Health and Environment for:

Method EPA 552.2	Haloacetic Acids (HAA-5)
Method EPA 524.2	Total Trihalomethanes (TTHM)
Method EPA 524.4	Regulated VOCs (V1, V2, V3)

Accreditation applies to public drinking water matrices.

This report meets NELAP requirements and is made up of a cover page, analytical results, and a copy of the original chain-of-custody. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Celey D. Keene

Lab Director/Quality Manager

Analytical Results For:

TALON LPE
KIMBERLY WILSON
408 W. TEXAS AVE.
ARTESIA NM, 88210
Fax To: (575) 745-8905

Received: 11/07/2016
Reported: 11/08/2016
Project Name: COTTON DRAW #181 BATTERY
Project Number: 700794.205.01
Project Location: EDDY COUNTY, NM

Sampling Date: 11/03/2016
Sampling Type: Soil
Sampling Condition: Cool & Intact
Sample Received By: Jodi Henson

Sample ID: S-1 0 (H602507-01)

BTEX 8021B		mg/kg		Analyzed By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/07/2016	ND	2.25	113	2.00	0.355	
Toluene*	<0.050	0.050	11/07/2016	ND	2.28	114	2.00	1.03	
Ethylbenzene*	<0.050	0.050	11/07/2016	ND	2.18	109	2.00	1.00	
Total Xylenes*	<0.150	0.150	11/07/2016	ND	6.63	110	6.00	0.532	
Total BTEX	<0.300	0.300	11/07/2016	ND					

Surrogate: 4-Bromofluorobenzene (PIC) 111 % 73.6-140

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	1440	16.0	11/08/2016	ND	400	100	400	0.00	

TPH 8015M		mg/kg		Analyzed By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/07/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	11.9	10.0	11/07/2016	ND	190	95.2	200	2.96	

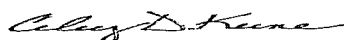
Surrogate: 1-Chlorooctane 104 % 35-147

Surrogate: 1-Chlorooctadecane 99.4 % 28-171

Cardinal Laboratories

*=Accredited Analyte

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Celey D. Keene, Lab Director/Quality Manager

Analytical Results For:

TALON LPE
KIMBERLY WILSON
408 W. TEXAS AVE.
ARTESIA NM, 88210
Fax To: (575) 745-8905

Received: 11/07/2016
Reported: 11/08/2016
Project Name: COTTON DRAW #181 BATTERY
Project Number: 700794.205.01
Project Location: EDDY COUNTY, NM

Sampling Date: 11/03/2016
Sampling Type: Soil
Sampling Condition: Cool & Intact
Sample Received By: Jodi Henson

Sample ID: S-1 1 (H602507-02)

BTEX 8021B		mg/kg	Analyzed By: MS						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/07/2016	ND	2.25	113	2.00	0.355	
Toluene*	<0.050	0.050	11/07/2016	ND	2.28	114	2.00	1.03	
Ethylbenzene*	<0.050	0.050	11/07/2016	ND	2.18	109	2.00	1.00	
Total Xylenes*	<0.150	0.150	11/07/2016	ND	6.63	110	6.00	0.532	
Total BTEX	<0.300	0.300	11/07/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID) 111 % 73.6-140

Chloride, SM4500Cl-B		mg/kg	Analyzed By: AC						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	2160	16.0	11/08/2016	ND	400	100	400	0.00	

TPH 8015M		mg/kg	Analyzed By: MS						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/07/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	<10.0	10.0	11/07/2016	ND	190	95.2	200	2.96	

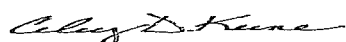
Surrogate: 1-Chlorooctane 99.5 % 35-147

Surrogate: 1-Chlorooctadecane 97.2 % 28-171

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*=Accredited Analyte

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Celey D. Keene, Lab Director/Quality Manager

Analytical Results For:

TALON LPE
KIMBERLY WILSON
408 W. TEXAS AVE.
ARTESIA NM, 88210
Fax To: (575) 745-8905

Received: 11/07/2016
Reported: 11/08/2016
Project Name: COTTON DRAW #181 BATTERY
Project Number: 700794.205.01
Project Location: EDDY COUNTY, NM

Sampling Date: 11/03/2016
Sampling Type: Soil
Sampling Condition: Cool & Intact
Sample Received By: Jodi Henson

Sample ID: S-1 2 (H602507-03)

BTEX 8021B		mg/kg		Analyzed By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/07/2016	ND	2.25	113	2.00	0.355	
Toluene*	<0.050	0.050	11/07/2016	ND	2.28	114	2.00	1.03	
Ethylbenzene*	<0.050	0.050	11/07/2016	ND	2.18	109	2.00	1.00	
Total Xylenes*	<0.150	0.150	11/07/2016	ND	6.63	110	6.00	0.532	
Total BTEX	<0.300	0.300	11/07/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID) 111 % 73.6-140

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	2960	16.0	11/08/2016	ND	400	100	400	0.00	

TPH 8015M		mg/kg		Analyzed By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/07/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	<10.0	10.0	11/07/2016	ND	190	95.2	200	2.96	

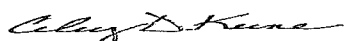
Surrogate: 1-Chlorooctane 88.3 % 35-147

Surrogate: 1-Chlorooctadecane 90.9 % 28-171

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*=Accredited Analyte

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Celey D. Keene, Lab Director/Quality Manager

Analytical Results For:

TALON LPE
KIMBERLY WILSON
408 W. TEXAS AVE.
ARTESIA NM, 88210
Fax To: (575) 745-8905

Received: 11/07/2016
Reported: 11/08/2016
Project Name: COTTON DRAW #181 BATTERY
Project Number: 700794.205.01
Project Location: EDDY COUNTY, NM

Sampling Date: 11/03/2016
Sampling Type: Soil
Sampling Condition: Cool & Intact
Sample Received By: Jodi Henson

Sample ID: S-1 3 (H602507-04)

BTEX 8021B		mg/kg		Analyzed By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/07/2016	ND	2.25	113	2.00	0.355	
Toluene*	<0.050	0.050	11/07/2016	ND	2.28	114	2.00	1.03	
Ethylbenzene*	<0.050	0.050	11/07/2016	ND	2.18	109	2.00	1.00	
Total Xylenes*	<0.150	0.150	11/07/2016	ND	6.63	110	6.00	0.532	
Total BTEX	<0.300	0.300	11/07/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID) 112 % 73.6-140

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	5360	16.0	11/08/2016	ND	400	100	400	0.00	

TPH 8015M		mg/kg		Analyzed By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/07/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	<10.0	10.0	11/07/2016	ND	190	95.2	200	2.96	

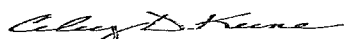
Surrogate: 1-Chlorooctane 89.5 % 35-147

Surrogate: 1-Chlorooctadecane 89.3 % 28-171

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*=Accredited Analyte

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Celey D. Keene, Lab Director/Quality Manager

Analytical Results For:

TALON LPE
KIMBERLY WILSON
408 W. TEXAS AVE.
ARTESIA NM, 88210
Fax To: (575) 745-8905

Received:	11/07/2016	Sampling Date:	11/03/2016
Reported:	11/08/2016	Sampling Type:	Soil
Project Name:	COTTON DRAW #181 BATTERY	Sampling Condition:	Cool & Intact
Project Number:	700794.205.01	Sample Received By:	Jodi Henson
Project Location:	EDDY COUNTY, NM		

Sample ID: S-1 4 (H602507-05)

BTEX 8021B		mg/kg		Analyzed By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/07/2016	ND	2.25	113	2.00	0.355	
Toluene*	<0.050	0.050	11/07/2016	ND	2.28	114	2.00	1.03	
Ethylbenzene*	<0.050	0.050	11/07/2016	ND	2.18	109	2.00	1.00	
Total Xylenes*	<0.150	0.150	11/07/2016	ND	6.63	110	6.00	0.532	
Total BTEX	<0.300	0.300	11/07/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID) 110 % 73.6-140

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	7330	16.0	11/08/2016	ND	400	100	400	0.00	

TPH 8015M		mg/kg		Analyzed By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/07/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	<10.0	10.0	11/07/2016	ND	190	95.2	200	2.96	

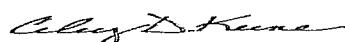
Surrogate: 1-Chlorooctane 98.0 % 35-147

Surrogate: 1-Chlorooctadecane 102 % 28-171

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Celey D. Keene, Lab Director/Quality Manager

Analytical Results For:

 TALON LPE
 KIMBERLY WILSON
 408 W. TEXAS AVE.
 ARTESIA NM, 88210
 Fax To: (575) 745-8905

 Received: 11/07/2016
 Reported: 11/08/2016
 Project Name: COTTON DRAW #181 BATTERY
 Project Number: 700794.205.01
 Project Location: EDDY COUNTY, NM

 Sampling Date: 11/03/2016
 Sampling Type: Soil
 Sampling Condition: Cool & Intact
 Sample Received By: Jodi Henson

Sample ID: S-2 0 (H602507-06)

BTEX 8021B		mg/kg	Analyzed By: MS						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/07/2016	ND	2.25	113	2.00	0.355	
Toluene*	<0.050	0.050	11/07/2016	ND	2.28	114	2.00	1.03	
Ethylbenzene*	<0.050	0.050	11/07/2016	ND	2.18	109	2.00	1.00	
Total Xylenes*	<0.150	0.150	11/07/2016	ND	6.63	110	6.00	0.532	
Total BTEX	<0.300	0.300	11/07/2016	ND					

Surrogate: 4-Bromofluorobenzene (PIE) 112 % 73.6-140

Chloride, SM4500Cl-B		mg/kg	Analyzed By: AC						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	2560	16.0	11/08/2016	ND	400	100	400	0.00	

TPH 8015M		mg/kg	Analyzed By: MS						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	13.0	10.0	11/07/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	675	10.0	11/07/2016	ND	190	95.2	200	2.96	

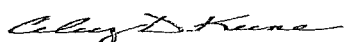
Surrogate: 1-Chlorooctane 88.7 % 35-147

Surrogate: 1-Chlorooctadecane 100 % 28-171

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Celey D. Keene, Lab Director/Quality Manager

Analytical Results For:

 TALON LPE
 KIMBERLY WILSON
 408 W. TEXAS AVE.
 ARTESIA NM, 88210
 Fax To: (575) 745-8905

 Received: 11/07/2016
 Reported: 11/08/2016
 Project Name: COTTON DRAW #181 BATTERY
 Project Number: 700794.205.01
 Project Location: EDDY COUNTY, NM

 Sampling Date: 11/03/2016
 Sampling Type: Soil
 Sampling Condition: Cool & Intact
 Sample Received By: Jodi Henson

Sample ID: S-2 1 (H602507-07)

BTEX 8021B		mg/kg		Analyzed By: MS						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier	
Benzene*	<0.050	0.050	11/08/2016	ND	2.25	113	2.00	0.355		
Toluene*	<0.050	0.050	11/08/2016	ND	2.28	114	2.00	1.03		
Ethylbenzene*	<0.050	0.050	11/08/2016	ND	2.18	109	2.00	1.00		
Total Xylenes*	<0.150	0.150	11/08/2016	ND	6.63	110	6.00	0.532		
Total BTEX	<0.300	0.300	11/08/2016	ND						

Surrogate: 4-Bromofluorobenzene (PIE) 111 % 73.6-140

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	3480	16.0	11/08/2016	ND	400	100	400	0.00	

TPH 8015M		mg/kg		Analyzed By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/07/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	14.6	10.0	11/07/2016	ND	190	95.2	200	2.96	

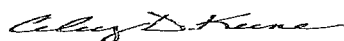
Surrogate: 1-Chlorooctane 85.4 % 35-147

Surrogate: 1-Chlorooctadecane 96.8 % 28-171

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Celest D. Keene, Lab Director/Quality Manager

Analytical Results For:

TALON LPE
KIMBERLY WILSON
408 W. TEXAS AVE.
ARTESIA NM, 88210
Fax To: (575) 745-8905

Received: 11/07/2016
Reported: 11/08/2016
Project Name: COTTON DRAW #181 BATTERY
Project Number: 700794.205.01
Project Location: EDDY COUNTY, NM

Sampling Date: 11/03/2016
Sampling Type: Soil
Sampling Condition: Cool & Intact
Sample Received By: Jodi Henson

Sample ID: S-2 2 (H602507-08)

BTEX 8021B		mg/kg		Analyzed By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/08/2016	ND	2.25	113	2.00	0.355	
Toluene*	<0.050	0.050	11/08/2016	ND	2.28	114	2.00	1.03	
Ethylbenzene*	<0.050	0.050	11/08/2016	ND	2.18	109	2.00	1.00	
Total Xylenes*	<0.150	0.150	11/08/2016	ND	6.63	110	6.00	0.532	
Total BTEX	<0.300	0.300	11/08/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID) 111 % 73.6-140

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	4880	16.0	11/08/2016	ND	400	100	400	0.00	

TPH 8015M		mg/kg		Analyzed By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/07/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	15.2	10.0	11/07/2016	ND	190	95.2	200	2.96	

Surrogate: 1-Chlorooctane 91.4 % 35-147

Surrogate: 1-Chlorooctadecane 105 % 28-171

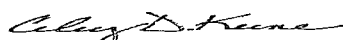
Sample ID: S-2 3 (H602507-09)

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	8930	16.0	11/08/2016	ND	400	100	400	0.00	QM-07

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Celey D. Keene, Lab Director/Quality Manager

Analytical Results For:

TALON LPE
KIMBERLY WILSON
408 W. TEXAS AVE.
ARTESIA NM, 88210
Fax To: (575) 745-8905

Received: 11/07/2016
Reported: 11/08/2016
Project Name: COTTON DRAW #181 BATTERY
Project Number: 700794.205.01
Project Location: EDDY COUNTY, NM

Sampling Date: 11/03/2016
Sampling Type: Soil
Sampling Condition: Cool & Intact
Sample Received By: Jodi Henson

Sample ID: S-2 4 (H602507-10)

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	320	16.0	11/08/2016	ND	400	100	400	0.00	

Sample ID: S-3 0 (H602507-11)

BTEX 8021B		mg/kg		Analyzed By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/08/2016	ND	2.25	113	2.00	0.355	
Toluene*	<0.050	0.050	11/08/2016	ND	2.28	114	2.00	1.03	
Ethylbenzene*	<0.050	0.050	11/08/2016	ND	2.18	109	2.00	1.00	
Total Xylenes*	<0.150	0.150	11/08/2016	ND	6.63	110	6.00	0.532	
Total BTEX	<0.300	0.300	11/08/2016	ND					

Surrogate: 4-Bromofluorobenzene (PIB) 110 % 73.6-140

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	32.0	16.0	11/08/2016	ND	400	100	400	0.00	

TPH 8015M		mg/kg		Analyzed By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/07/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	<10.0	10.0	11/07/2016	ND	190	95.2	200	2.96	

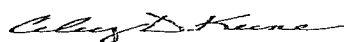
Surrogate: 1-Chlorooctane 95.0 % 35-147

Surrogate: 1-Chlorooctadecane 87.6 % 28-171

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Celey D. Keene, Lab Director/Quality Manager

Analytical Results For:

 TALON LPE
 KIMBERLY WILSON
 408 W. TEXAS AVE.
 ARTESIA NM, 88210
 Fax To: (575) 745-8905

 Received: 11/07/2016
 Reported: 11/08/2016
 Project Name: COTTON DRAW #181 BATTERY
 Project Number: 700794.205.01
 Project Location: EDDY COUNTY, NM

 Sampling Date: 11/03/2016
 Sampling Type: Soil
 Sampling Condition: Cool & Intact
 Sample Received By: Jodi Henson

Sample ID: S-3 1' (H602507-12)

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	48.0	16.0	11/08/2016	ND	400	100	400	0.00	

Sample ID: S-3 2 (H602507-13)

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	32.0	16.0	11/08/2016	ND	400	100	400	0.00	

Sample ID: S-3 3 (H602507-14)

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	32.0	16.0	11/08/2016	ND	400	100	400	0.00	

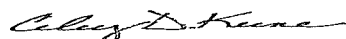
Sample ID: S-3 4 (H602507-15)

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	32.0	16.0	11/08/2016	ND	400	100	400	0.00	

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Celest D. Keene, Lab Director/Quality Manager

Analytical Results For:

 TALON LPE
 KIMBERLY WILSON
 408 W. TEXAS AVE.
 ARTESIA NM, 88210
 Fax To: (575) 745-8905

 Received: 11/07/2016
 Reported: 11/08/2016
 Project Name: COTTON DRAW #181 BATTERY
 Project Number: 700794.205.01
 Project Location: EDDY COUNTY, NM

 Sampling Date: 11/03/2016
 Sampling Type: Soil
 Sampling Condition: Cool & Intact
 Sample Received By: Jodi Henson

Sample ID: S-4 0 (H602507-16)

BTEX 8021B		mg/kg		Analyzed By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/08/2016	ND	2.25	113	2.00	0.355	
Toluene*	<0.050	0.050	11/08/2016	ND	2.28	114	2.00	1.03	
Ethylbenzene*	<0.050	0.050	11/08/2016	ND	2.18	109	2.00	1.00	
Total Xylenes*	<0.150	0.150	11/08/2016	ND	6.63	110	6.00	0.532	
Total BTEX	<0.300	0.300	11/08/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID) 111 % 73.6-140

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	3280	16.0	11/08/2016	ND	400	100	400	0.00	

TPH 8015M		mg/kg		Analyzed By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/08/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	<10.0	10.0	11/08/2016	ND	190	95.2	200	2.96	

Surrogate: 1-Chlorooctane 83.2 % 35-147

Surrogate: 1-Chlorooctadecane 90.9 % 28-171

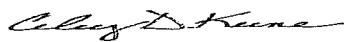
Sample ID: S-4 1 (H602507-17)

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	48.0	16.0	11/08/2016	ND	400	100	400	0.00	

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Celest D. Keene, Lab Director/Quality Manager

Analytical Results For:

 TALON LPE
 KIMBERLY WILSON
 408 W. TEXAS AVE.
 ARTESIA NM, 88210
 Fax To: (575) 745-8905

 Received: 11/07/2016
 Reported: 11/08/2016
 Project Name: COTTON DRAW #181 BATTERY
 Project Number: 700794.205.01
 Project Location: EDDY COUNTY, NM

 Sampling Date: 11/03/2016
 Sampling Type: Soil
 Sampling Condition: Cool & Intact
 Sample Received By: Jodi Henson

Sample ID: S-4 2 (H602507-18)

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	160	16.0	11/08/2016	ND	400	100	400	0.00	

Sample ID: S-4 3 (H602507-19)

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	48.0	16.0	11/08/2016	ND	400	100	400	0.00	

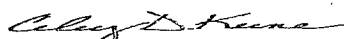
Sample ID: S-4 4 (H602507-20)

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	64.0	16.0	11/08/2016	ND	400	100	400	0.00	

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Celey D. Keene, Lab Director/Quality Manager

Analytical Results For:

 TALON LPE
 KIMBERLY WILSON
 408 W. TEXAS AVE.
 ARTESIA NM, 88210
 Fax To: (575) 745-8905

 Received: 11/07/2016
 Reported: 11/08/2016
 Project Name: COTTON DRAW #181 BATTERY
 Project Number: 700794.205.01
 Project Location: EDDY COUNTY, NM

 Sampling Date: 11/03/2016
 Sampling Type: Soil
 Sampling Condition: Cool & Intact
 Sample Received By: Jodi Henson

Sample ID: S-5 0 (H602507-21)

BTX 8021B		mg/kg		Analyzed By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/08/2016	ND	2.25	113	2.00	0.355	
Toluene*	<0.050	0.050	11/08/2016	ND	2.28	114	2.00	1.03	
Ethylbenzene*	<0.050	0.050	11/08/2016	ND	2.18	109	2.00	1.00	
Total Xylenes*	<0.150	0.150	11/08/2016	ND	6.63	110	6.00	0.532	
Total BTX	<0.300	0.300	11/08/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID) 111 % 73.6-140

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	4000	16.0	11/08/2016	ND	400	100	400	0.00	

TPH 8015M		mg/kg		Analyzed By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/08/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	73.6	10.0	11/08/2016	ND	190	95.2	200	2.96	

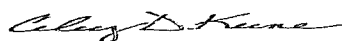
Surrogate: 1-Chlorooctane 105 % 35-147

Surrogate: 1-Chlorooctadecane 113 % 28-171

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Celest D. Keene, Lab Director/Quality Manager

Analytical Results For:

TALON LPE
KIMBERLY WILSON
408 W. TEXAS AVE.
ARTESIA NM, 88210
Fax To: (575) 745-8905

Received:	11/07/2016	Sampling Date:	11/03/2016
Reported:	11/08/2016	Sampling Type:	Soil
Project Name:	COTTON DRAW #181 BATTERY	Sampling Condition:	Cool & Intact
Project Number:	700794.205.01	Sample Received By:	Jodi Henson
Project Location:	EDDY COUNTY, NM		

Sample ID: S-5 1 (H602507-22)

BTEX 8021B		mg/kg	Analyzed By: MS						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/08/2016	ND	2.25	113	2.00	0.355	
Toluene*	<0.050	0.050	11/08/2016	ND	2.28	114	2.00	1.03	
Ethylbenzene*	<0.050	0.050	11/08/2016	ND	2.18	109	2.00	1.00	
Total Xylenes*	<0.150	0.150	11/08/2016	ND	6.63	110	6.00	0.532	
Total BTEX	<0.300	0.300	11/08/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID) 112 % 73.6-140

Chloride, SM4500Cl-B		mg/kg	Analyzed By: AC						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	6000	16.0	11/08/2016	ND	400	100	400	0.00	

TPH 8015M		mg/kg	Analyzed By: MS						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/08/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	<10.0	10.0	11/08/2016	ND	190	95.2	200	2.96	

Surrogate: 1-Chlorooctane 99.4 % 35-147

Surrogate: 1-Chlorooctadecane 105 % 28-171

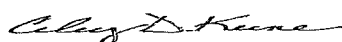
Sample ID: S-5 2 (H602507-23)

Chloride, SM4500Cl-B		mg/kg	Analyzed By: AC						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	7200	16.0	11/08/2016	ND	400	100	400	0.00	

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Celey D. Keene, Lab Director/Quality Manager

Analytical Results For:

TALON LPE
KIMBERLY WILSON
408 W. TEXAS AVE.
ARTESIA NM, 88210
Fax To: (575) 745-8905

Received: 11/07/2016
Reported: 11/08/2016
Project Name: COTTON DRAW #181 BATTERY
Project Number: 700794.205.01
Project Location: EDDY COUNTY, NM

Sampling Date: 11/03/2016
Sampling Type: Soil
Sampling Condition: Cool & Intact
Sample Received By: Jodi Henson

Sample ID: S-5 3 (H602507-24)

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier	
Chloride	6930	16.0	11/08/2016	ND	400	100	400	0.00		

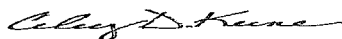
Sample ID: S-5 4 (H602507-25)

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier	
Chloride	3280	16.0	11/08/2016	ND	400	100	400	0.00		

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Analytical Results For:

TALON LPE
KIMBERLY WILSON
408 W. TEXAS AVE.
ARTESIA NM, 88210
Fax To: (575) 745-8905

Received: 11/07/2016
Reported: 11/08/2016
Project Name: COTTON DRAW #181 BATTERY
Project Number: 700794.205.01
Project Location: EDDY COUNTY, NM

Sampling Date: 11/03/2016
Sampling Type: Soil
Sampling Condition: Cool & Intact
Sample Received By: Jodi Henson

Sample ID: S-6 0 (H602507-26)

BTEX 8021B		mg/kg		Analyzed By: MS						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier	
Benzene*	<0.050	0.050	11/08/2016	ND	2.25	113	2.00	0.355		
Toluene*	<0.050	0.050	11/08/2016	ND	2.28	114	2.00	1.03		
Ethylbenzene*	<0.050	0.050	11/08/2016	ND	2.18	109	2.00	1.00		
Total Xylenes*	<0.150	0.150	11/08/2016	ND	6.63	110	6.00	0.532		
Total BTEX	<0.300	0.300	11/08/2016	ND						

Surrogate: 4-Bromofluorobenzene (PID) 111 % 73.6-140

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	1840	16.0	11/08/2016	ND	400	100	400	0.00	

TPH 8015M		mg/kg		Analyzed By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/08/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	<10.0	10.0	11/08/2016	ND	190	95.2	200	2.96	

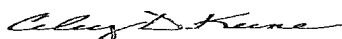
Surrogate: 1-Chlorooctane 97.4 % 35-147

Surrogate: 1-Chlorooctadecane 91.3 % 28-171

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Celey D. Keene, Lab Director/Quality Manager

Analytical Results For:

TALON LPE
KIMBERLY WILSON
408 W. TEXAS AVE.
ARTESIA NM, 88210
Fax To: (575) 745-8905

Received:	11/07/2016	Sampling Date:	11/03/2016
Reported:	11/08/2016	Sampling Type:	Soil
Project Name:	COTTON DRAW #181 BATTERY	Sampling Condition:	Cool & Intact
Project Number:	700794.205.01	Sample Received By:	Jodi Henson
Project Location:	EDDY COUNTY, NM		

Sample ID: S-6 1 (H602507-27)

BTEX 8021B		mg/kg		Analyzed By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/08/2016	ND	2.25	113	2.00	0.355	
Toluene*	<0.050	0.050	11/08/2016	ND	2.28	114	2.00	1.03	
Ethylbenzene*	<0.050	0.050	11/08/2016	ND	2.18	109	2.00	1.00	
Total Xylenes*	<0.150	0.150	11/08/2016	ND	6.63	110	6.00	0.532	
Total BTEX	<0.300	0.300	11/08/2016	ND					

Surrogate: 4-Bromofluorobenzene (PIE) 112 % 73.6-140

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	5460	16.0	11/08/2016	ND	400	100	400	0.00	

TPH 8015M		mg/kg		Analyzed By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/08/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	<10.0	10.0	11/08/2016	ND	190	95.2	200	2.96	

Surrogate: 1-Chlorooctane 97.4 % 35-147

Surrogate: 1-Chlorooctadecane 85.5 % 28-171

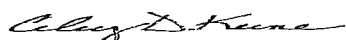
Sample ID: S-6 2 (H602507-28)

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	8800	16.0	11/08/2016	ND	400	100	400	0.00	

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Celey D. Keene, Lab Director/Quality Manager

Analytical Results For:

TALON LPE
KIMBERLY WILSON
408 W. TEXAS AVE.
ARTESIA NM, 88210
Fax To: (575) 745-8905

Received:	11/07/2016	Sampling Date:	11/03/2016
Reported:	11/08/2016	Sampling Type:	Soil
Project Name:	COTTON DRAW #181 BATTERY	Sampling Condition:	Cool & Intact
Project Number:	700794.205.01	Sample Received By:	Jodi Henson
Project Location:	EDDY COUNTY, NM		

Sample ID: S-6 3 (H602507-29)

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	7330	16.0	11/08/2016	ND	432	108	400	0.00	QM-07

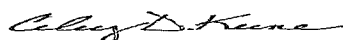
Sample ID: S-6 4 (H602507-30)

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	1870	16.0	11/08/2016	ND	432	108	400	0.00	

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Celey D. Keene, Lab Director/Quality Manager

Analytical Results For:

TALON LPE
KIMBERLY WILSON
408 W. TEXAS AVE.
ARTESIA NM, 88210
Fax To: (575) 745-8905

Received: 11/07/2016
Reported: 11/08/2016
Project Name: COTTON DRAW #181 BATTERY
Project Number: 700794.205.01
Project Location: EDDY COUNTY, NM

Sampling Date: 11/03/2016
Sampling Type: Soil
Sampling Condition: Cool & Intact
Sample Received By: Jodi Henson

Sample ID: S-7 0' (H602507-31)

BTEX 8021B		mg/kg		Analyzed By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/08/2016	ND	2.25	113	2.00	0.355	
Toluene*	<0.050	0.050	11/08/2016	ND	2.28	114	2.00	1.03	
Ethylbenzene*	<0.050	0.050	11/08/2016	ND	2.18	109	2.00	1.00	
Total Xylenes*	<0.150	0.150	11/08/2016	ND	6.63	110	6.00	0.532	
Total BTEX	<0.300	0.300	11/08/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID) 111 % 73.6-140

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	48.0	16.0	11/08/2016	ND	432	108	400	0.00	

TPH 8015M		mg/kg		Analyzed By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/08/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	<10.0	10.0	11/08/2016	ND	190	95.2	200	2.96	

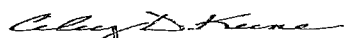
Surrogate: 1-Chlorooctane 91.8 % 35-147

Surrogate: 1-Chlorooctadecane 94.8 % 28-171

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Celey D. Keene, Lab Director/Quality Manager

Analytical Results For:

TALON LPE
KIMBERLY WILSON
408 W. TEXAS AVE.
ARTESIA NM, 88210
Fax To: (575) 745-8905

Received: 11/07/2016
Reported: 11/08/2016
Project Name: COTTON DRAW #181 BATTERY
Project Number: 700794.205.01
Project Location: EDDY COUNTY, NM

Sampling Date: 11/03/2016
Sampling Type: Soil
Sampling Condition: Cool & Intact
Sample Received By: Jodi Henson

Sample ID: S-7 1' (H602507-32)

BTEX 8021B		mg/kg		Analyzed By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/08/2016	ND	2.25	113	2.00	0.355	
Toluene*	<0.050	0.050	11/08/2016	ND	2.28	114	2.00	1.03	
Ethylbenzene*	<0.050	0.050	11/08/2016	ND	2.18	109	2.00	1.00	
Total Xylenes*	<0.150	0.150	11/08/2016	ND	6.63	110	6.00	0.532	
Total BTEX	<0.300	0.300	11/08/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID) 110 % 73.6-140

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	48.0	16.0	11/08/2016	ND	432	108	400	0.00	

TPH 8015M		mg/kg		Analyzed By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/08/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	<10.0	10.0	11/08/2016	ND	190	95.2	200	2.96	

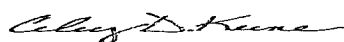
Surrogate: 1-Chlorooctane 98.2 % 35-147

Surrogate: 1-Chlorooctadecane 106 % 28-171

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Celey D. Keene, Lab Director/Quality Manager

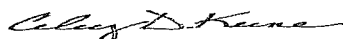
Notes and Definitions

QM-07	The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.
ND	Analyte NOT DETECTED at or above the reporting limit
RPD	Relative Percent Difference
**	Samples not received at proper temperature of 6°C or below.
***	Insufficient time to reach temperature.
-	Chloride by SM4500Cl-B does not require samples be received at or below 6°C
	Samples reported on an as received basis (wet) unless otherwise noted on report

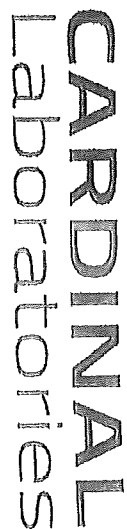
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Celey D. Keene, Lab Director/Quality Manager



CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

ANALYSIS REQUEST

SAVING	
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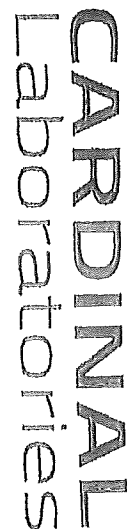
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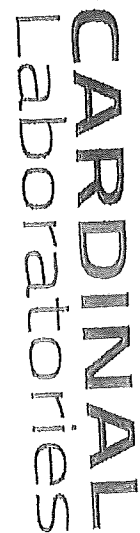
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CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

Page 2 of 4

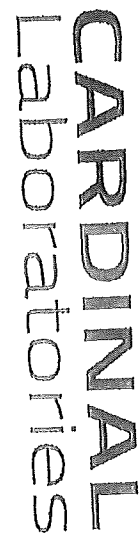
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ANALYSIS REQUEST

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CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

Page 4 of 14

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PHONE (575) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

February 02, 2017

KIMBERLY WILSON

TALON LPE

408 W. TEXAS AVE.

ARTESIA, NM 88210

RE: COTTON DRAW #181 BATTERY

Enclosed are the results of analyses for samples received by the laboratory on 02/01/17 12:00.

Cardinal Laboratories is accredited through Texas NELAP under certificate number T104704398-16-8. Accreditation applies to drinking water, non-potable water and solid and chemical materials. All accredited analytes are denoted by an asterisk (*). For a complete list of accredited analytes and matrices visit the TCEQ website at www.tceq.texas.gov/field/qa/lab_accred_certif.html.

Cardinal Laboratories is accredited through the State of Colorado Department of Public Health and Environment for:

Method EPA 552.2	Haloacetic Acids (HAA-5)
Method EPA 524.2	Total Trihalomethanes (TTHM)
Method EPA 524.4	Regulated VOCs (V1, V2, V3)

Accreditation applies to public drinking water matrices.

This report meets NELAP requirements and is made up of a cover page, analytical results, and a copy of the original chain-of-custody. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Celey D. Keene

Lab Director/Quality Manager

Analytical Results For:

TALON LPE
KIMBERLY WILSON
408 W. TEXAS AVE.
ARTESIA NM, 88210
Fax To: (575) 745-8905

Received:	02/01/2017	Sampling Date:	01/26/2017
Reported:	02/02/2017	Sampling Type:	Soil
Project Name:	COTTON DRAW #181 BATTERY	Sampling Condition:	** (See Notes)
Project Number:	700794.205.01	Sample Received By:	Angela Cabrera
Project Location:	EDDY COUNTY, NM		

Sample ID: B-1 1' (H700244-01)

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier	
Chloride	3600	16.0	02/02/2017	ND	432	108	400	0.00		

Sample ID: B-1 2' (H700244-02)

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	560	16.0	02/02/2017	ND	432	108	400	0.00	

Sample ID: B-1 3' (H700244-03)

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	144	16.0	02/02/2017	ND	432	108	400	0.00	

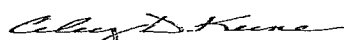
Sample ID: B-1 4' (H700244-04)

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	160	16.0	02/02/2017	ND	432	108	400	0.00	

Cardinal Laboratories

*=Accredited Analyte

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Celey D. Keene, Lab Director/Quality Manager

Analytical Results For:

TALON LPE
KIMBERLY WILSON
408 W. TEXAS AVE.
ARTESIA NM, 88210
Fax To: (575) 745-8905

Received: 02/01/2017
Reported: 02/02/2017
Project Name: COTTON DRAW #181 BATTERY
Project Number: 700794.205.01
Project Location: EDDY COUNTY, NM

Sampling Date: 01/26/2017
Sampling Type: Soil
Sampling Condition: ** (See Notes)
Sample Received By: Angela Cabrera

Sample ID: B-1 6' (H700244-05)

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	208	16.0	02/02/2017	ND	432	108	400	0.00	

Sample ID: B-1 10' (H700244-06)

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	224	16.0	02/02/2017	ND	432	108	400	0.00	

Sample ID: B-2 1' (H700244-07)

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	560	16.0	02/02/2017	ND	432	108	400	0.00	

Sample ID: B-2 2' (H700244-08)

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	48.0	16.0	02/02/2017	ND	432	108	400	0.00	

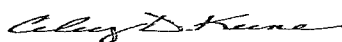
Sample ID: B-2 3' (H700244-09)

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	48.0	16.0	02/02/2017	ND	432	108	400	0.00	

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*=Accredited Analyte

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Celey D. Keene, Lab Director/Quality Manager

Analytical Results For:

TALON LPE
KIMBERLY WILSON
408 W. TEXAS AVE.
ARTESIA NM, 88210
Fax To: (575) 745-8905

Received:	02/01/2017	Sampling Date:	01/26/2017
Reported:	02/02/2017	Sampling Type:	Soil
Project Name:	COTTON DRAW #181 BATTERY	Sampling Condition:	** (See Notes)
Project Number:	700794.205.01	Sample Received By:	Angela Cabrera
Project Location:	EDDY COUNTY, NM		

Sample ID: B-2 4' (H700244-10)

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier	
Chloride	48.0	16.0	02/02/2017	ND	432	108	400	0.00		

Sample ID: B-2 5' (H700244-11)

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier	
Chloride	48.0	16.0	02/02/2017	ND	432	108	400	0.00		

Sample ID: B-3 5' (H700244-12)

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	2560	16.0	02/02/2017	ND	432	108	400	0.00	

Sample ID: B-3 10' (H700244-13)

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	4400	16.0	02/02/2017	ND	432	108	400	0.00	

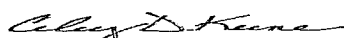
Sample ID: B-3 15' (H700244-14)

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	1680	16.0	02/02/2017	ND	432	108	400	0.00	

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*=Accredited Analyte

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Celey D. Keene, Lab Director/Quality Manager

Analytical Results For:

TALON LPE
KIMBERLY WILSON
408 W. TEXAS AVE.
ARTESIA NM, 88210
Fax To: (575) 745-8905

Received: 02/01/2017
Reported: 02/02/2017
Project Name: COTTON DRAW #181 BATTERY
Project Number: 700794.205.01
Project Location: EDDY COUNTY, NM

Sampling Date: 01/27/2017
Sampling Type: Soil
Sampling Condition: ** (See Notes)
Sample Received By: Angela Cabrera

Sample ID: B-3 20' (H700244-15)

Chloride, SM4500Cl-B

mg/kg

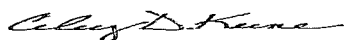
Analyzed By: AC

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	448	16.0	02/02/2017	ND	432	108	400	0.00	

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* = Accredited Analyte

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Celey D. Keene, Lab Director/Quality Manager

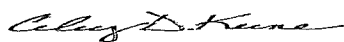
Notes and Definitions

ND	Analyte NOT DETECTED at or above the reporting limit
RPD	Relative Percent Difference
**	Samples not received at proper temperature of 6°C or below.
***	Insufficient time to reach temperature.
-	Chloride by SM4500Cl-B does not require samples be received at or below 6°C Samples reported on an as received basis (wet) unless otherwise noted on report

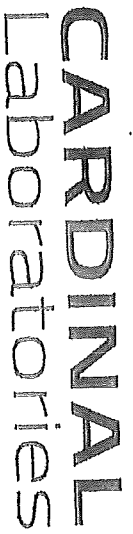
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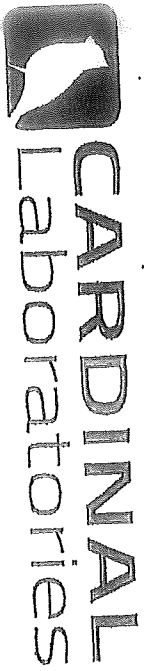
Celey D. Keene, Lab Director/Quality Manager



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ANALYSIS REQUEST

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CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

Page 2 of 2

101 East Marland, Hobbs, NM 88240
(575) 393-2326 FAX (575) 393-2476

ANALYSIS REQUEST

Company Name: Talon/LPE		P.O. #:												
Project Manager: Kimberly Wilson		Company: Talon/LPE												
Address: 408 W. Texas Ave.		Attn:												
City: Artesia		Address:												
State: NM Zip: 88210		City:												
Phone #: 575-746-8768 Fax #: 575-746-8905		State: Zip:												
Project #: 700794.205.01 Project Owner: Nelson		Phone #:												
Project Name: Cotton Draw #181 Battery		Fax #:												
Project Location: Eddy City		PRESERV												
Sampler Name: Kim Wilson		SAMPLING												
FOR LAB USE ONLY														
Lab ID.	Sample L.D.	(G)RAB OR (C)OMP.	# CONTAINERS	GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER:	ACID/BASE:	ICE / COOL	OTHER:	DATE	TIME
H700244														
11 B-2	5'												1/26/17	4:20
12 B-3	5'												1/27/17	10:00
13 B-3	10'												10:11	
14 B-3	15'												10:19	
15 B-3	20'												11:00	

Chlorides

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Requisitioned By: Kimberly Wilson Date: 2/1/17 Received By: Shalee Coburn

Requisitioned By: Kimberly Wilson Date: 2:00 Received By: Shalee Coburn

Delivered By: (Circle One) #75 17:44 Sample Condition: Cool Intact ☒ Yes ☐ No

Sampler - UPS - Bus - Other: #75 17:44 Sample Condition: Cool Intact ☒ Yes ☐ No

CHECKED BY: [Signature]

REMARKS: Rush !!