

## **APPENDIX I**

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### **SOIL HORIZON ASSESSMENT**

# MEMORANDUM

Job **SATES Phase IA Part 2 Initial Test Plot Characterization Test Pit Soil Horizon Description**  
 Client **Teck American Incorporated**  
 To **Dave Enos and Denise Mills**  
 From **Amy Kephart**  
 Copy to **Kris McCaig, Teck American Incorporated; Cristy Kessel, Teck American Incorporated; Mike Arnold, Ramboll; Rosalind Schoof, Ramboll**

## 1. Introduction

In accordance with the *Final Work Plan for the Soil Amendment Technology Evaluation Study (SATES), Phase I: Test Plot Characterization and Initial Amendment Alternatives Evaluation* (Work Plan; Ramboll 2017a), test plot characterization was conducted as part of the evaluation process for test plots and sub-plots that will be carried forward for use in the pilot testing of amendment options. As summarized in the draft Work Plan Addendum (Ramboll 2017b), submitted on September 29, 2017, the four test plots selected for further analysis in the test plot characterization phase, include test plots 401-1, 401-2, 441-1, and 258-3. Each of these four test plots were sub-divided into four 50-foot by 50-foot sub-plots.

As part of the test plot characterization, a total of sixteen test pits were completed: four test pits per test plot. One test pit was excavated within each of the sixteen sub-plots based on the location with the highest lead concentration in soil identified within each sub-plot during the initial test plot screening. For the soil profile exposed in each test pit, soil conditions, including soil types and horizons, were described by an experienced soil scientist, Jason James from the University of Washington, on October 13, 2017. Soil horizon development and soil structure was characterized based on parameters described in Schoeneberger et al. (2012) including: location, horizon, horizon depth, horizon boundary, color, redoximorphic features, texture, structure, and consistence.

A summary of the findings by Mr. James, including an overall summary and descriptions by depth, are included as an attachment to this memo.

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## 2. **References**

Ramboll Environ U.S. Corporation (Ramboll). 2017a. FINAL Work Plan for the Soil Amendment Technology Evaluation Study Phase I: Test Plot Characterization and Initial Amendment Alternatives Evaluation. Prepared for Teck American Incorporated. Seattle, WA.

Ramboll Environ U.S. Corporation (Ramboll). 2017b. Addendum - Soil Amendment Technology Evaluation Study (SATES) Final Work Plan for the Soil Amendment Technology Evaluation Study, Phase I: Test Plot Characterization and Initial Amendment Alternatives Evaluation. Prepared for Teck American Incorporated. Seattle, WA. September 29.

**ATTACHMENT: SOIL HORIZON DESCRIPTION**

### **SATES Soil Profile Classifications**

By: Jason James, University of Washington  
November 30, 2017

For 258-3 A-D, I classified the soil as Typic Xeropsamments. These are Entisols since they lack B horizon development. The "psamm" part of the name basically means sandy - they have a texture class of loamy fine sand or coarser throughout and less than 35% rock fragments. The "Xero" part means the area has a xeric moisture regime (which seems to be the case based on previous examination of the climate of the area, and this is also what the NRCS soil maps use as the moisture regime). In theory these could be Quartzipsamments, but I assumed that less than 90% was resistant minerals (e.g. quartz). I classified it as Typic because it did not hit a lithic contact (bedrock) within 50 cm of the surface, there was no sign of durinodes or redox features, any clay lamellae or translocation in the profile. There were two other possible Great Groups that were possible - Vitrandic and Dystric. Given that these require lab chemical analysis, I assumed they were not present. I didn't see evidence of much volcanic glass/ash, but to be Vitrandic, it only needs to be 5%. As for Dystric, this assumes base saturation less than 60%, which I can't know in the field. Without chemical data, it's best to assume that the soil does not meet this criterion and to go with Typic.

401-1 A and C were both classified as Typic Haploxerepts. These were both at one end of the plot and had cambic horizon development (Bw horizon), whereas subplots B and D lacked a B horizon. The cambic horizon is diagnostic for the Inceptisol soil order. Xerept means an Inceptisol with a xeric moisture regime. The "Haplo" basically means it had no other distinguishing features like deep, dark A horizons, duripans or durinodes, and calcium carbonate horizons. I again assumed it wasn't "Dystro" because I did not have data to backup this definition.

401-1 B and D were classified as Typic Xerorthents. This means they are Entisols (lack B horizon), and have rock fragments greater than 35% by volume, which I approximated based on field observations. I decided they weren't Fluvents despite being floodplain soils because there's no evidence of irregular decreases in organic matter with depth (e.g. repeated flooding covering the old soil surface). "Xer" again means xeric moisture regime. The main other Great Group possibilities for the soil were Vitrandic and Dystric, as discussed above. Since I didn't have observations or data to suggest either of these, I classified as Typic.

At 401-2 A and B, the profiles closely resembled 401-1 B and D. Consequently, they were classified the same way - Typic Xerorthents.

At 401-2 C and D, the rock fragments were just under 35% by volume, which means they fall into the Psamments suborder. Because the moisture regime is xeric, the soil is in the Xeropsamments great group. This again assumes that the soil is <90% resistant minerals (quartz). Finally, these are Typic because there are no other diagnostic features of note. This once again assumes that the chemical criteria to meet Dystric and Vitrandic are not met.

441-1 A was classified as a Typic Haploxerept. This is an Inceptisol because of the cambic horizon (Bw). I had initially thought it might be a Humic Dystroxerept or even a Humixerept,

but both of these require knowledge of base saturation. This soil compared to the rest of 441-1 had a much deeper and darker A horizon, but without lab data, it should be regarded as a more typical xeric Inceptisol. The coarse textural class means you need a minimum thickness of 25 cm of A to have a mollic or umbric epipedon, so even if we had OM% and base saturation, it'd be too thin.

441-1 B and C were classified as Typic Xeropsamments. While these were substantially more gravelly than 258-3 A-D, they still contained <35% by volume gravel, and so fall into the Psamment suborder.

441-1 D was classified as Typic Xerorthents, which is discussed above (in 401-1 B and D).

The soils at all of the sites are at the very early stages of development with only barely formed B horizons in some places. All were well drained and had a coarse texture (loamy sand to sand) with gravel and/or cobbles, most of which were quite rounded suggesting outwash as the parent material. The one exception was site 258-3, which seemed to lack the larger particles but was mostly loose, non-pedogenically altered fine sand in the subsoil. Organic matter is already the main contributor to soil structure in these soils, so the addition of different types of OM could make a large impact on structure, especially near the surface.

Subplot	Marker	Date	Description by:					
DU 258-3 Subplot A	P01	8/13/2017	Jason James					
Parent Material	Landform	Slope	Surface Stone/Rock					
Outwash	Floodplain	0%	0%					
Horizon	Depth (inches)	Boundary (lower)	Texture*	Structure	Consistence	% Rock	Roots	Redoximorphic Features
Oi	0.5 - 0	abrupt, wavy					Common fine roots	
A	0 - 6	gradual, smooth	Loamy fine sand	weak, coarse granular	soft; weakly coherent, easily crushed to single grain	0% gravel	Many fine, common medium roots	None
AC	6 - 11	gradual, wavy	Loamy fine sand	weak, coarse subangular blocky	soft; weakly coherent, easily crushed to single grain	0% gravel	Many fine, common medium roots	None
C	11 - 20+		Loamy fine sand	weak, medium subangular blocky	soft; weakly coherent, easily crushed to single grain	5% gravel	Common fine, few coarse roots	None
<b>Notes:</b> Oi - some needles but also some understory leaves, twigs, and other litter Surface A held together by many fine roots Krotovina (filled-in animal burrow) - evident in face from 5-7 inches depth (filled in with C horizon material) Fine sandy texture throughout profile * Texture measured by feel test; more precise measurement to be provided by subsequent lab analysis <b>Soil Classification:</b> Typic Xeropsamments								

Subplot	Marker	Date	Description by:					
DU 258-3 Subplot B		8/13/2017	Jason James					
Parent Material	Landform	Slope	Surface Stone/Rock					
Outwash	Floodplain	0%	0%					
Horizon	Depth (inches)	Boundary (lower)	Texture*	Structure	Consistence	% Rock	Roots	Redoximorphic Features
Oi	0.5 - 0	abrupt, smooth				0% gravel		
A	0 - 5	gradual, smooth	Loamy fine sand	weak, coarse subangular blocky structure breaking to weak, coarse granular	soft; weakly coherent, easily crushed to single grain	0% gravel	Many fine, common medium roots	None
C	5 - 18+		Loamy fine sand	weak, coarse angular blocky structure	Loose, noncoherent with some peds being soft; weakly coherent, easily crushed to single grain	10% gravel	Common fine roots	None
<b>Notes:</b> Oi - mostly grass litter with some needles and twigs C horizon is hard/dense, but crumbles readily when removed from profile A horizon holds together with large, weak peds (fist sized) Bioturbation is evident nearby with molehills in many places across the plot * Texture measured by feel test; more precise measurement to be provided by subsequent lab analysis <b>Soil Classification:</b> Typic Xeropsamments								

Subplot	Marker	Date	Description by:					
DU 258-3 Subplot C	G02	8/13/2017	Jason James					
Parent Material	Landform	Slope	Surface Stone/Rock					
Outwash	Floodplain	0%	0%					
Horizon	Depth (inches)	Boundary (lower)	Texture*	Structure	Consistence	% Rock	Roots	Redoximorphic Features
Oi	1 - 0	abrupt, smooth						
A	0 - 8	abrupt, smooth	Loamy fine sand	weak, medium granular	soft; weakly coherent, easily crushed to single grain	0% gravel	Many fine, common medium, common coarse	None
AC	8-13	clear, wavy	Loamy fine sand	weak, medium subangular blocky	soft; weakly coherent, easily crushed to single grain	0% gravel	Common fine, few medium	None
C	13 - 18+		Loamy fine sand	weak, coarse subangular blocky	soft; weakly coherent, easily crushed to single grain	5% gravel	Common fine	None
<b>Notes:</b> Oi - mixture of needles, leaves, twigs, and dead grass Soil is fine sandy throughout Krotovina - animal burrow in C horizon filled in by A horizon material at 15-17 inches * Texture measured by feel test; more precise measurement to be provided by subsequent lab analysis <b>Soil Classification:</b> Typic Xeropsamments								

Subplot	Marker	Date	Description by:					
DU 258-3 Subplot D	I09	8/13/2017	Jason James					
Parent Material	Landform	Slope	Surface Stone/Rock					
Outwash	Floodplain	0%	0%					
Horizon	Depth (inches)	Boundary (lower)	Texture*	Structure	Consistence	% Rock	Roots	Redoximorphic Features
Oi	2.5 - 0	abrupt, wavy					Many fine roots	
A	0 - 7	gradual, smooth	Loamy fine sand	weak, coarse granular	soft; weakly coherent, easily crushed to single grain	0% gravel	Many fine, common medium roots	None
AC	7 - 12	diffuse, smooth	Loamy fine sand	weak, medium subangular blocky	soft; weakly coherent, easily crushed to single grain	5% gravel	Many fine, few medium, common coarse roots	None
C	12 - 20+		Loamy fine sand	Structureless	loose; non-coherent	5% gravel	Common fine	None
<b>Notes:</b> Oi - mixture of leaves, needles, and twigs on top of patchy moss Texture is fine sandy throughout; little evident pore structure below surface but coarse texture will provide fast infiltration * Texture measured by feel test; more precise measurement to be provided by subsequent lab analysis <b>Soil Classification:</b> Typic Xeropsamments								



Subplot	Marker	Date	Description by:					
DU 401-1 Subplot A	B02	8/13/2017	Jason James					
Parent Material	Landform	Slope	Surface Stone/Rock					
Outwash	Floodplain	0%	0%					
Horizon	Depth (inches)	Boundary (lower)	Texture*	Structure	Consistence	% Rock	Roots	Redoximorphic Features
Oi	2 - 0	abrupt, wavy					Few medium roots	
A	0 - 3	diffuse, smooth	Loamy sand	moderately strong, medium subangular blocky structure breaking to weak, coarse granular	slightly hard; easily broken between thumb and forefinger	5% gravel	Few fine, many medium, and few coarse roots	None
Bw	3 - 14	clear, smooth	Loamy sand	moderately strong, coarse subangular blocky	slightly hard; easily broken between thumb and forefinger	10% gravel	Common fine and medium roots	None
C	14 - 18+		Sand	very weak grading to non-coherent, fine subangular blocky	Loose, non-coherent	10% gravel	Common fine, many medium, and many coarse roots	None
<b>Notes:</b> Oi - undecomposed needles & cones with some twigs and branches Soil is fine sandy throughout - less gravel than other pits in DU 401 Bw development is noticeable by coloration Structure in A & Bw is distinct, sticks to roots - stronger than other profiles in 401 Large root extends through profile at 14-16 inches * Texture measured by feel test; more precise measurement to be provided by subsequent lab analysis <b>Soil Classification:</b> Typic Haploxerepts								

Subplot	Marker	Date	Description by:					
DU 401-1 Subplot B	D09	8/13/2017	Jason James					
Parent Material	Landform	Slope	Surface Stone/Rock					
Outwash	Floodplain	0%	0%					
Horizon	Depth (inches)	Boundary (lower)	Texture*	Structure	Consistence	% Rock	Roots	Redoximorphic Features
Oi	2 - 0	abrupt, wavy					Few fine roots	
A	0 - 6	clear, wavy	Sand	weak, coarse granular	slightly hard; easily broken between thumb and forefinger	30% gravel	Many fine, common medium roots	None
C	6 - 18+		Sand	very weak grading to non-coherent, fine subangular blocky	Loose, non-coherent	45% gravel	Many fine, many medium, and few coarse roots	None
<b>Notes:</b> Oi - undecomposed needles grading to small, recognizable pieces Gravelly sand texture throughout Wavy A horizon lower boundary suggests some preferential flow paths in soil * Texture measured by feel test; more precise measurement to be provided by subsequent lab analysis <b>Soil Classification:</b> Typic Xerorthents								

Subplot	Marker	Date	Description by:					
DU 401-1 Subplot C	F03	8/13/2017	Jason James					
Parent Material	Landform	Slope	Surface Stone/Rock					
Outwash	Floodplain	0%	0%					
Horizon	Depth (inches)	Boundary (lower)	Texture*	Structure	Consistence	% Rock	Roots	Redoximorphic Features
Oi	1 - 0	abrupt, wavy					Few fine roots	
A	0 - 5	clear, wavy	Sand	moderately strong, medium subangular blocky structure breaking to moderately strong, coarse granular	slightly hard; easily broken between thumb and forefinger	10% gravel	Many fine, common medium roots	None
Bw	5 - 10	diffuse, smooth	Sand	weak, medium subangular blocky	soft; weakly coherent, easily crushed to single grain	20% gravel	Many fine and medium roots	None
C	10 - 18+		Sand	weak, medium subangular blocky	Loose, noncoherent with some peds being soft; weakly coherent, easily crushed to single grain	30% gravel	Few fine, common medium roots	None
<b>Notes:</b> Oi - fresh needles on top of moss, thinner O horizon than other profiles in 401-1 Sandy soil throughout; some wavy boundaries & preferential flow pathways Extensive fine rooting in surface A & Bw horizons * Texture measured by feel test; more precise measurement to be provided by subsequent lab analysis <b>Soil Classification:</b> Typic Haploxerepts								

Subplot	Marker	Date	Description by:					
DU 401-1 Subplot D	G10	8/13/2017	Jason James					
Parent Material	Landform	Slope	Surface Stone/Rock					
Outwash	Floodplain	0%	0%					
Horizon	Depth (inches)	Boundary (lower)	Texture*	Structure	Consistence	% Rock	Roots	Redoximorphic Features
Oi	3 - 0	abrupt, wavy					Common medium roots	
A	0 - 8	clear, wavy	Loamy sand	moderately strong, very coarse subangular blocky structure breaking to weak, coarse granular	slightly hard; easily broken between thumb and forefinger	5% gravel	Many fine, common medium, and common coarse roots	None
C1	8 - 15	diffuse, smooth	Sand	weak, medium subangular blocky	soft; weakly coherent, easily crushed to single grain	20% gravel	Common fine, many medium, and common coarse roots	None
C2	15 - 20+		Sand	very weak grading to non-coherent, medium subangular blocky	Loose, noncoherent with some peds being soft; weakly coherent, easily crushed to single grain	25% gravel	Common fine, few medium roots	None
<b>Notes:</b> Oi - undecomposed ponderosa pine needles grading to small needle/twig pieces Much more distinct structure in A horizon than horizons below Wavy boundary in A horizon suggest some preferential flow into subsoil * Texture measured by feel test; more precise measurement to be provided by subsequent lab analysis <b>Soil Classification:</b> Typic Xerorthents								

Subplot	Marker	Date	Description by:					
DU 401-2 Subplot A	C03	8/13/2017	Jason James					
Parent Material	Landform	Slope	Surface Stone/Rock					
Outwash	Floodplain	0%	0%					
Horizon	Depth (inches)	Boundary (lower)	Texture*	Structure	Consistence	% Rock	Roots	Redoximorphic Features
Oi	3.5 - 0	abrupt, wavy					None	
A	0 - 4	clear, smooth	Loamy sand	weak, coarse granular	soft; weakly coherent, easily crushed to single grain	10% gravel	Common fine, many medium roots	None
A/Bw	4 - 8	abrupt, irregular	Loamy sand	moderately strong, coarse subangular blocky	slightly hard; easily broken between thumb and forefinger	10% gravel	Few fine, common medium, few coarse roots	None
C	8 - 18+		Sand	weak, fine subangular blocky	soft; weakly coherent, easily crushed to single grain	40% gravel	Common fine, medium, and coarse roots	None

**Notes:**  
 Oi - grades from thick mat of undecomposed needles to recognizable, small fragments of needles & bark  
 A/Bw - interfingering of weakly altered B horizon with A horizon. This suggests some preferential flow of organic material into the subsoil  
 Bw not a distinct horizon below the interfingering layer  
 \* Texture measured by feel test; more precise measurement to be provided by subsequent lab analysis  
**Soil Classification:**  
 Typic Xerorthents

Subplot	Marker	Date	Description by:					
DU 401-2 Subplot B	D06	8/13/2017	Jason James					
Parent Material	Landform	Slope	Surface Stone/Rock					
Outwash	Floodplain	0%	0%					
Horizon	Depth (inches)	Boundary (lower)	Texture*	Structure	Consistence	% Rock	Roots	Redoximorphic Features
Oi	2.5 - 0	abrupt, wavy					Common medium, few coarse roots	
A	0 - 5	gradual, smooth	Loamy sand	weak, coarse subangular blocky breaking to weak, very coarse granular	soft; weakly coherent, easily crushed to single grain	10% gravel	Common fine, many medium roots	None
AC	5 - 12	clear, smooth	Loamy sand	moderately strong, coarse subangular blocky	slightly hard; easily broken between thumb and forefinger	25% gravel	Common fine, common medium, few coarse roots	None
C	12 - 18+		Sand	weak, medium subangular blocky	Loose, noncoherent with some peds being soft; weakly coherent, easily crushed to single grain	35% gravel	Common fine, few medium roots	None

**Notes:**  
 Oi - some harvesting slash, as well as twigs, bark, and needles of ponderosa pine; grades to smaller, more decomposed pieces with depth  
 Soil is gravelly sand throughout, densest in AC horizon  
 Pores evident throughout profile, particularly around margins of large particles  
 \* Texture measured by feel test; more precise measurement to be provided by subsequent lab analysis  
**Soil Classification:**  
 Typic Xerorthents

Subplot	Marker	Date	Description by:					
DU 401-2 Subplot C	F04	8/13/2017	Jason James					
Parent Material	Landform	Slope	Surface Stone/Rock					
Outwash	Floodplain	0%	0%					
Horizon	Depth (inches)	Boundary (lower)	Texture*	Structure	Consistence	% Rock	Roots	Redoximorphic Features
Oi	1 - 0	abrupt, smooth					None	
A	0 - 9	clear, wavy	Loamy sand	moderately strong, medium subangular blocky	slightly hard; easily broken between thumb and forefinger	15% gravel	few fine, many medium, common coarse roots	None
C	9 - 20+		Sand	very weak grading to non-coherent, medium, subangular blocky	Loose, noncoherent with some peds being soft; weakly coherent, easily crushed to single grain	25% gravel	Common fine and medium roots	None

**Notes:**  
 Oi - undecomposed ponderosa pine needles & bark; grades to fine, slightly decomposed but still identifiable needles near mineral soil  
 Gravelly sand / loamy sand texture throughout profile with predominant macropores  
 \* Texture measured by feel test; more precise measurement to be provided by subsequent lab analysis  
**Soil Classification:**  
 Typic Xeropsamments

Subplot	Marker	Date	Description by:					
DU 401-2 Subplot D	J08	8/13/2017	Jason James					
Parent Material	Landform	Slope	Surface Stone/Rock					
Outwash	Floodplain	0%	0%					
Horizon	Depth (inches)	Boundary (lower)	Texture*	Structure	Consistence	% Rock	Roots	Redoximorphic Features
Oi	1.5 - 0	abrupt, wavy					Many fine, few medium roots	
A	0 - 6	gradual, smooth	Loamy sand	moderately strong, very coarse platy structure breaking to weak, very coarse granular	slightly hard; easily broken between thumb and forefinger	5% gravel	Many fine, common medium roots	None
C1	6 - 13	gradual, smooth	Loamy sand	weak, coarse subangular blocky	soft; weakly coherent, easily crushed to single grain	10% gravel	Many fine, common medium, few coarse roots	None
C2	13 - 20+		Sand	weak, medium subangular blocky	soft; weakly coherent, easily crushed to single grain	30% gravel	Common fine and medium roots	None

**Notes:**  
 Oi - some dead grasses & ponderosa pine needles, bark, and twigs  
 Gravelly sand / loamy sand texture throughout profile with pores clearly evident  
 Some rutting at topsoil and dense peds suggest some compaction has occurred in this location  
 \* Texture measured by feel test; more precise measurement to be provided by subsequent lab analysis  
**Soil Classification:** Typic Xeropsamments

Subplot	Marker	Date	Description by:					
DU 441-1 Subplot A	A01	8/13/2017	Jason James					
Parent Material	Landform	Slope	Surface Stone/Rock					
Outwash / till	Sideslope / toeslope	4%, concave, 100 ft long, south facing	5% cobbles, 10% stones					
Horizon	Depth (inches)	Boundary (lower)	Texture*	Structure	Consistence	% Rock	Roots	Redoximorphic Features
Oi	1.5 - 0	abrupt, smooth				5% cobbles	Common fine roots	
A	0 - 8	clear, wavy	Sand	moderately strong, coarse granular	slightly hard; easily broken between thumb and forefinger	5% gravel, 20% cobbles	Many fine, common medium, few coarse roots	None
Bw	8 - 15	gradual, smooth	Sand	weak, medium subangular blocky	soft; weakly coherent, easily crushed to single grain	15% gravel, 10% cobbles	Common fine and medium roots	None
C	15 - 20+		Sand	weak, medium subangular blocky	soft; weakly coherent, easily crushed to single grain	25% gravel, 10% cobbles	Few fine, common medium, few coarse roots	None
<b>Notes:</b> Oi - mostly needles & leaves, some dead understory vegetation Cobbly & gravelly sand texture throughout Dark A horizon color * Texture measured by feel test; more precise measurement to be provided by subsequent lab analysis <b>Soil Classification:</b> Typic Haploxerept								

Subplot	Marker	Date	Description by:					
DU 441-1 Subplot B	B06	8/13/2017	Jason James					
Parent Material	Landform	Slope	Surface Stone/Rock					
Outwash	Toe slope	2%, concave, 100 ft long, south facing	5% cobbles, 10% stones					
Horizon	Depth (inches)	Boundary (lower)	Texture*	Structure	Consistence	% Rock	Roots	Redoximorphic Features
Oi	1 - 0	abrupt, wavy				5% cobbles	Common fine roots	
A	0 - 4	clear, smooth	Loamy sand	weak, very coarse granular	soft; weakly coherent, easily crushed to single grain	20% gravel	Many fine, few medium roots	None
AC	4 - 12	clear, smooth	Sand	weak, coarse subangular blocky	soft; weakly coherent, easily crushed to single grain	20% gravel, 5% cobbles	Many fine and medium roots	None
C	12 - 20+		Sand	Structureless	Loose; non-coherent	15% gravel	Few fine, common medium, and few coarse roots	None
<b>Notes:</b> Oi - mix of needles, leaves & understory litter (salal, oregon grape) Moderately dark A, but not deep Very weak to non-existent structure in C horizon * Texture measured by feel test; more precise measurement to be provided by subsequent lab analysis <b>Soil Classification:</b> Typic Xeropsamments								

Subplot	Marker	Date	Description by:					
DU 441-1 Subplot C		8/13/2017	Jason James					
Parent Material	Landform	Slope	Surface Stone/Rock					
Outwash	Toe slope	1%, concave, 100 ft long, south facing	5% cobbles, 10% stones					
Horizon	Depth (inches)	Boundary (lower)	Texture*	Structure	Consistence	% Rock	Roots	Redoximorphic Features
Oi	1 - 0	abrupt, wavy					Few fine roots	
A	0 - 5	gradual, smooth	Loamy sand	moderately strong, coarse subangular blocky structure breaking to weak, coarse granular	soft; weakly coherent, easily crushed to single grain	10% gravel	Many fine, common medium roots	None
C1	5 - 15	clear, smooth	Sand	weak, coarse subangular blocky	soft; weakly coherent, easily crushed to single grain	5% gravel, 20% cobbles	Many fine, common medium, few coarse roots	None
C2	15 - 20+		Sand	Structureless	Loose; non-coherent	20% gravel, 15% cobbles	Few fine and medium roots	None
<b>Notes:</b> Oi - mostly needles, some leaves and twigs; grading to recognizable OM near mineral soil C1 horizon - not enough color to be Bw Evidence of burrowing nearby - molehills/mounds of soil * Texture measured by feel test; more precise measurement to be provided by subsequent lab analysis <b>Soil Classification:</b> Typic Xeropsamments								

Subplot	Marker	Date	Description by:					
DU 441-1 Subplot D	F09	8/13/2017	Jason James					
Parent Material	Landform	Slope	Surface Stone/Rock					
Outwash	Valley bottom	0%	10% cobbles, 20% stones					
Horizon	Depth (inches)	Boundary (lower)	Texture*	Structure	Consistence	% Rock	Roots	Redoximorphic Features
Oi	1 - 0	abrupt, wavy					Common medium roots	
A	0 - 4	clear, wavy	Loamy sand	moderately strong, coarse subangular blocky structure breaking to weak, coarse granular	slightly hard; easily broken between thumb and forefinger	5% gravel, 10% cobbles	Many fine, common medium, common coarse roots	None
C1	4 - 17	gradual, smooth	Sand	weak, coarse subangular blocky	soft; weakly coherent, easily crushed to single grain	5% gravel, 10% cobbles, 40% stones	Common fine, common medium, many coarse roots	None
C2	17 - 20+		Sand	Structureless	Loose; non-coherent	10% gravel, 20% cobbles	Many fine, few medium roots	None
<b>Notes:</b> Oi - mostly needles, some understory leaves, pinecones, & twigs Large stone from 7-15 inches in profile Evidence of burrowing/molehills nearby * Texture measured by feel test; more precise measurement to be provided by subsequent lab analysis <b>Soil Classification:</b> Typic Xerorthents								