



3910 NE 10<sup>th</sup> Avenue  
Portland, Oregon 97212

November 1, 2012  
Project No. 899-1

Mr. Brian Wegener  
Tualatin Riverkeepers  
11675 SW Hazelbrook Road  
Tualatin, Oregon 97062

**RESULTS OF GEOTECHNICAL LABORATORY TESTING  
ON ENGINEERED SOIL  
THPRD SUNSET SWIM CENTER PERVIOUS PAVEMENT  
BEAVERTON, OREGON**

Dear Mr. Brian:

Attached are the results of geotechnical laboratory tests performed on a sample of “structural soil” proposed for supporting pervious concrete pavement adjacent to new tree wells in the Sunset Swim Center parking lot. The tests were performed to evaluate the strength of the crushed gravel and soil mixture. Based on these test results, recommendations are presented for substituting 24 inches of structural soil in place of the 10-inch thick storage aggregate layer.

Structural soil is crushed gravel and sand mixed with soil. The crushed gravel provides strength for supporting pavement loads. The soil supports tree growth by allowing roots to penetrate the mixture. The test sample was provided by Sunmark Environmental in Troutdale, Oregon. Sunmark refers to the mixture as Earthlite™ BioStructure Soil Mix.

**TEST RESULTS**

The following laboratory tests were performed on the sample:

- **Grain size sieve analysis** - determines how much gravel, sand, and fines (silt and clay are in the sample)
- **Organic content** - determines how much organic material is in the sample
- **Laboratory compaction**-determines the density of the soil when compacted and provides an estimate of porosity
- **California Bearing Ratio** – determines the strength of the soil for supporting pavement traffic loads

Test results are attached in Appendix A.



The results indicate that the sample is composed (by weight) of 75 percent gravel-size particles, 12 percent sand-size particles, and 10 percent silt and clay particles. Approximately 2.3 percent of the sample by weight consists of organic matter.

Testing measured a California Bearing Ratio (CBR) of 21% when the sample was compacted to 95 percent of the maximum dry density as determined by the modified Proctor compaction test. This CBR strength provides approximately one-half the supporting strength of conventional crushed gravel base rock.

#### **PAVEMENT RECOMMENDATIONS**

Based on the test results, 24 inches of Sunmark structural soil can be used to replace 10 inches of storage aggregate specified in the GeoDesign geotechnical report for the project dated January 15, 2010 and Addendum No. 2 dated January 13, 2012. The structural soils should be compacted to an average of dry density of at least 113 pcf. This density is approximately 95 percent of the maximum dry density determined in accordance with ASTM Test Method D 1557 and reported in Appendix A. Structural soil compacted to this density has a porosity of about 28 percent and provides approximately 6½ inches of water storage capacity.

I hope this information meets your needs at this time. Please contact me if you have questions.

Sincerely,

**ALDER GEOTECHNICAL SERVICES, LLC**

John Cunningham, P.E., G.E.  
Oregon Registered Geotechnical Engineer No. 13,507

- (1) Addressee
- (1) Green Girl Land Development Solutions
- (1) 3J Consulting, Inc.



**APPENDIX A**  
**Laboratory Test Results**



Professional Service Industries, Inc.  
 6032 N. Cutter Circle, Suite 480  
 Portland, OR 97217  
 CCB No. 176269  
 Phone: (503) 289-1778  
 Fax: (503) 289-1918

# Aggregate/Soil Test Report

**Report No: MAT:07021022-1-S1**  
**Issue No: 2**

**Client:** ALDER GEOTECHNICAL SERVICES  
 3610 NE 10TH AVE  
 PORTLAND, OR 97212

**CC:** JOHN CUNNINGHAM

**Project:** ALDER GEOTECHNICAL LAB TESTING  
 BEAVERTON, OR

These test results apply only to the specific locations and materials noted and may not represent any other locations or elevations. This report may not be reproduced, except in full, without written permission by Professional Service Industries, Inc. If a non-compliance appears on this report, to the extent that the reported non-compliance impacts the project, the resolution is outside the PSI scope of engagement.

*John Eakman*

Approved Signatory: John Eakman (Project Manager)  
 Date of Issue: 10/29/2012

**Sample Details**

**Sample ID:** 07021022-1-S1 **Lift:**

**Client Sample ID:**

**Date Sampled:** 10/03/12

**Sampled By:** Client

**Specification:** Information Only

**Supplier:** Client Supplied

**Source:** Facility

**Material:** 3/4"-0 and Organic Mix

**Sampling Method:** Stockpile/Trans - ASTM D 75 - 5.3.3

**General Location:** Tualatin Hills Parks and Recreation

**Location:** Sunset Swim Center

**Particle Size Distribution**

**Method:** ASTM C 136 - 06, ASTM C 117 - 04

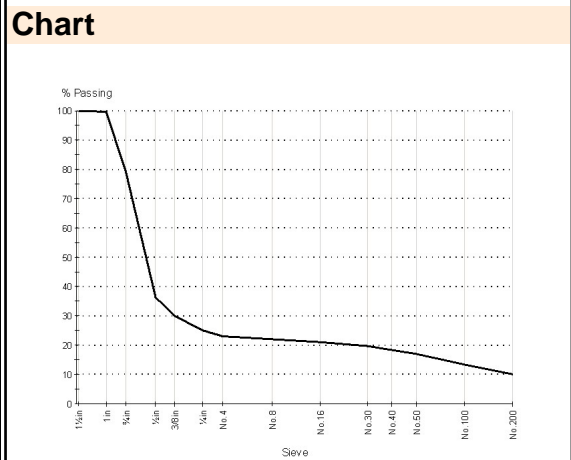
**Drying by:** Oven

**Date Tested:** 10/15/2012

**Other Test Results**

Description	Method	Result	Limits
Maximum Dry Density (lb/ft <sup>3</sup> )	ASTM D 1557 - 07	110.1	
Corrected Maximum Dry Density (lb/ft <sup>3</sup> )		118.9	
Optimum Moisture Content (%)		14.4	
Corrected Optimum Moisture Content (%)		11.6	
Method		C	
Preparation Method		Moist	
Specific Gravity (Fines)		2.65	
Retained Sieve 3/8" (9.5mm) (%)		67	
Retained Sieve 3/4" (19mm) (%)		21	
Specific Gravity (Oversize)	ASTM D 1557 - 07	2.69	
Date Tested		10/12/2012	
Ash Content (%)	ASTM D 2974 - 07	97.7	
Organic Content (%)		2.3	
Furnace Temperature (°C)		440	
Moisture Content (%)		9.0	
Moisture contents are proportioned by	oven-dried mass		
Moisture Content Method (A or B)		A	
Ash Content Method (C or D)		C	
Date Tested		10/12/2012	

Sieve Size	% Passing	Limits
1 1/2 in (37.5mm)	100	
1 in (25.0mm)	100	
3/4 in (19.0mm)	79	
1/2 in (12.5mm)	36	
3/8 in (9.5mm)	30	
1/4 in (6.3mm)	25	
No.4 (4.75mm)	23	
No.8 (2.36mm)	22	
No.16 (1.18mm)	21	
No.30 (600µm)	20	
No.40 (425µm)	18	
No.50 (300µm)	17	
No.100 (150µm)	13	
No.200 (75µm)	10	
Finer No.200 (75µm)	9.3	



**Comments**

N/A



Professional Service Industries, Inc.  
 6032 N. Cutter Circle, Suite 480  
 Portland, OR 97217  
 CCB No. 176269  
 Phone: (503) 289-1778  
 Fax: (503) 289-1918

# Proctor Test Report

Report No: PTR:07021022-1-S1

Issue No: 2

Client: ALDER GEOTECHNICAL SERVICES  
 3610 NE 10TH AVE  
 PORTLAND, OR 97212

CC: JOHN CUNNINGHAM

These test results apply only to the specific locations and materials noted and may not represent any other locations or elevations. This report may not be reproduced, except in full, without written permission by Professional Service Industries, Inc. If a non-compliance appears on this report, to the extent that the reported non-compliance impacts the project, the resolution is outside the PSI scope of engagement.

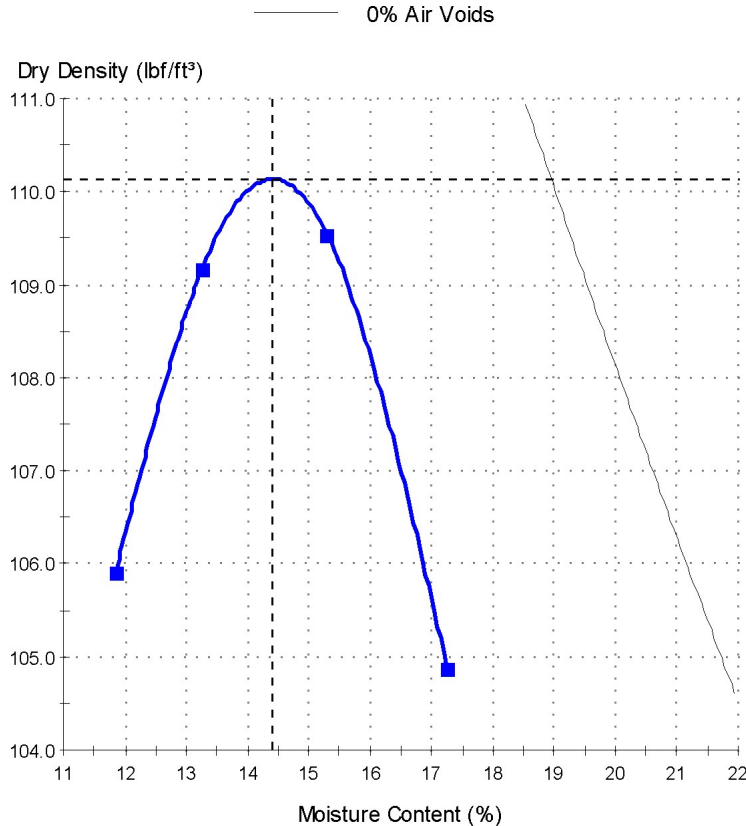
Project: ALDER GEOTECHNICAL LAB TESTING  
 BEAVERTON, OR

Approved Signatory: John Eakman (Project Manager)  
 Date of Issue: 10/29/2012

## Sample Details

Sample ID:	07021022-1-S1	Date Sampled:	10/3/2012
Date Received:	10/3/2012	Sampled By:	Client
Specification:	Information Only	Supplier:	Client Supplied
Source:	Facility	Material:	3/4"-0 and Organic Mix
Sampling Method:	Stockpile/Trans - ASTM D 75 - 5.3.3	General Location:	Tualatin Hills Parks and Recreation
Location:	Sunset Swim Center	Tested By:	Robin Goff
Date Tested:	10/12/2012		

## Dry Density - Moisture Content Relationship



## Test Results

ASTM D 1557 - 07

Maximum Dry Density (lb/ft³):	110.1
Corrected Maximum Dry Density (lb/ft³):	118.9
Optimum Moisture Content (%):	14.4
Corrected Optimum Moisture Content (%):	11.6
Method:	C
Preparation Method:	Moist
Specific Gravity (Fines):	2.65
Retained Sieve 3/8" (9.5mm) (%):	67
Retained Sieve 3/4" (19mm) (%):	21
Passing Sieve 3/8" (9.5mm) (%):	33
Passing Sieve 3/4" (19mm) (%):	79
Specific Gravity (Oversize):	2.69

## Comments



Professional Service Industries, Inc.  
 6032 N. Cutter Circle, Suite 480  
 Portland, OR 97217  
 CCB No. 176269  
 Phone: (503) 289-1778  
 Fax: (503) 289-1918

# California Bearing Ratio Report

Report No: CBR:07021022-1-S1  
 Issue No: 1

Client: ALDER GEOTECHNICAL SERVICES  
 3610 NE 10TH AVE  
 PORTLAND, OR 97212

CC: JOHN CUNNINGHAM

Project: ALDER GEOTECHNICAL LAB TESTING  
 BEAVERTON, OR

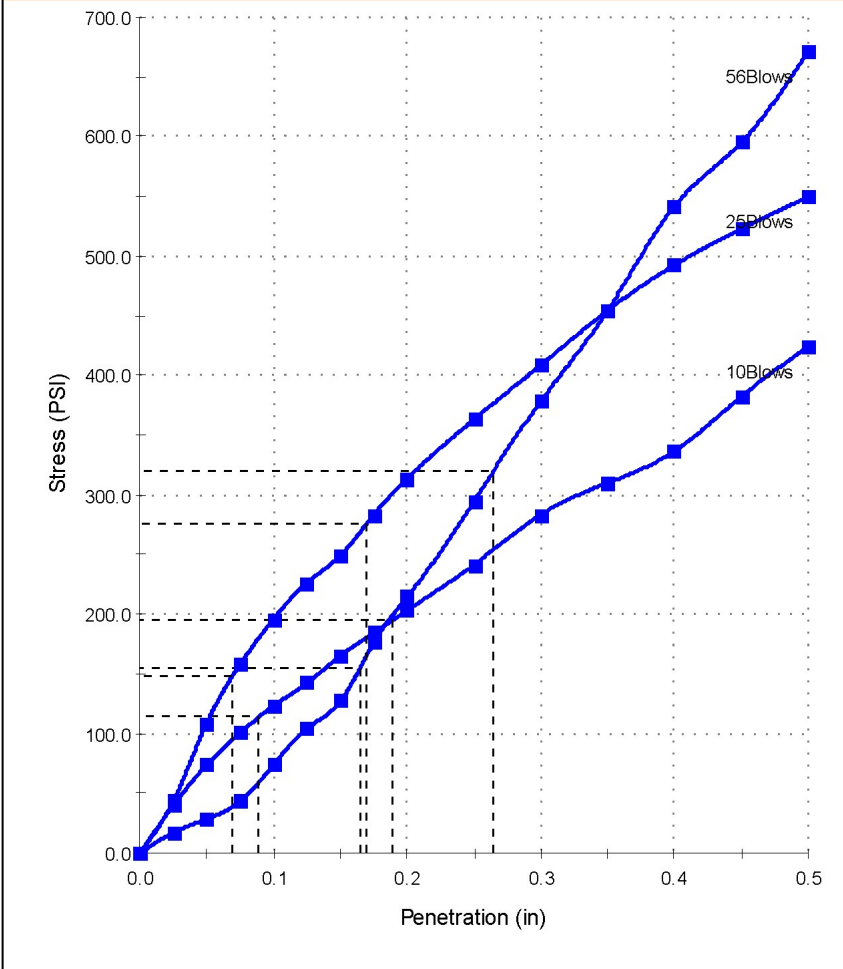
These test results apply only to the specific locations and materials noted and may not represent any other locations or elevations. This report may not be reproduced, except in full, without written permission by Professional Service Industries, Inc. If a non-compliance appears on this report, to the extent that the reported non-compliance impacts the project, the resolution is outside the PSI scope of engagement.

Approved Signatory: John Eakman (Project Manager)  
 Date of Issue: 10/29/2012

## Sample Details

Sample ID: 07021022-1-S1 Date Sampled: 10/3/2012  
 Sampling Method: Stockpile/Trans - ASTM D 75 - 5.3.3 Source: Facility  
 Material: 3/4"-0 and Organic Mix Specification: Information Only  
 Location: Sunset Swim Center Tested By: Michael Rinne  
 Date Tested: 10/22/2012

## Stress vs Penetration



## Overall Results

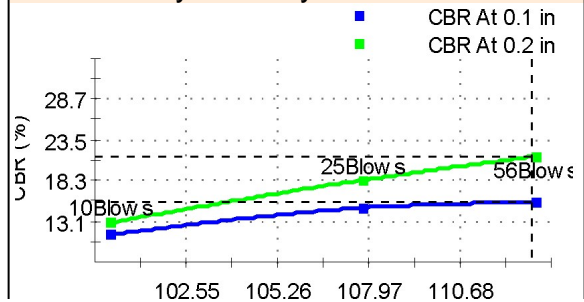
ASTM D 1883 - 07

CBR At 0.1in (%): 16  
 CBR At 0.2in (%): 21  
 At Dry Density (lb/ft³): 112.8

## Test Results

Blows	56	10	25
Comp. Eff.	ASTM D 1557	ASTM D 1557	ASTM D 1557
Initial MC (%)	10.8	10.8	10.8
MC of Top 1in (%)	16.3	15.9	17.9
MC After (%)	16.0	19.3	18.7
DD Before (lb/ft³)	112.89	100.34	107.82
DD After (lb/ft³)	113.36	101.17	108.01
CBR (%)	21.3	13.0	18.4
% MDD	102.5	91.1	97.9
Sample Condition	soaked	soaked	soaked
Surcharge (lb)	10.00	10.00	10.00
Swell (%)	-0.02	0.04	0.07
Oversize (%)	21.2	21.2	21.2

## CBR Vs Dry Density



## Comments