FSBPA Beach Preservation Technology Conference
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A New Test for Determining Sediment Quality

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Objective:

Develop tests and criteria to better discern beach fill **QUALITY**

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- Similar color and grain size
- Not prone to cementation
- < 5% gravel (#4 Sieve)
- < 5% fines (#200 or #230 Sieve)
- Mean grain size

BEACH COMPATIBLE FILL

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- Similar color and grain size
- Not prone to cementation
- < 5% gravel (#4 Sieve)
- < 2.5% fines (#200 or #230 Sieve)
- Mean grain size ≥ 0.27 mm

*Require method of moments

Sieve	Required % Passing (Finer Than)
3/4"	> 99.5%
#4	> 95%
#10	> 85%
#35	45 - 97%
#50	15 - 75%
#80	≤ 25%
#140	≤ 10%
#200	≤ 2.5%

BEACH COMPATIBLE FILL

(Brevard County)

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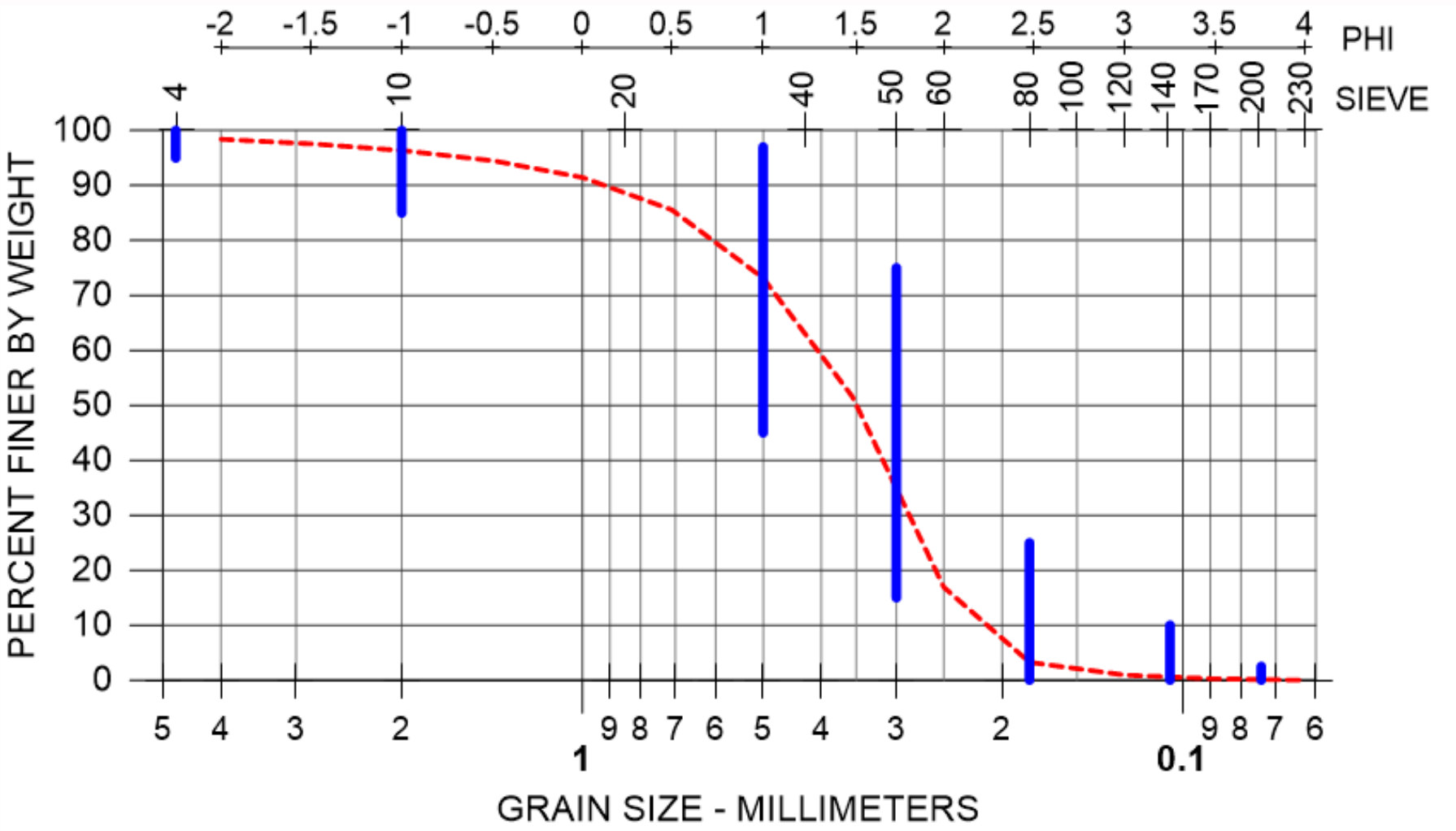
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
3
3.5
4
PHI
4
10
20
40
50
60
80
100
120
140
170
200
230
SIEVE
PERCENT FINER BY WEIGHT
100
90
80
70
60
50
40
30
20
10
0
5
4
3
2
1
9
8
7
6
5
4
3
2
0.1
9
8
7
6
GRAIN SIZE - MILLIMETERS

the toaster oven test

TEST FOR CEMENTATION

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the toaster oven test

Saturate a sediment sample with water, shape into a ball, heat at 450 deg F with cracked-open door for about 45-60 minutes. Let sample cool, and then poke with a pencil. Samples with no proclivity for cementation will collapse immediately (score=0); samples with high proclivity for cementation will not break or cleave (score=5).

Score sample for breakage (tendency to cement) between 0 and 5. This is similar to geologists' scale for mineral hardness (which is graded 1 to 10).

TEST FOR CEMENTATION

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Reveals critical information regarding grains, including whether the sediment was manufactured by crushing stone.

LOUPE EXAMINATION

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Similar color and grain size

Not prone to cementation

< 5% gravel (#4 Sieve)

< 2.5% fines (#200 or #230 Sieve)

Mean grain size

Grain size specification


User satisfaction

BEACH COMPATIBLE FILL

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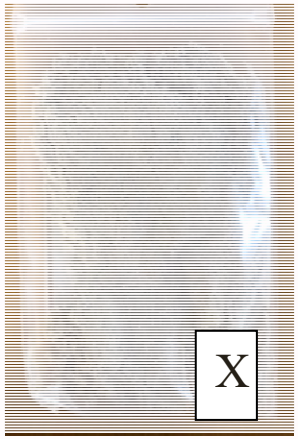
UPLAND SAND SOURCES



NATIVE DUNE

Offshore Sand Sources:

CANAVERAL SHOALS II

OCEAN CAY

BEACH SAMPLES (tested in this investigation)

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1. Wet vs. Dry Sieve Analysis
2. Carbonate Content (< 2 mm grain size)
3. Hydrometer: clay versus silt content
4. Turbidity Test

TESTS

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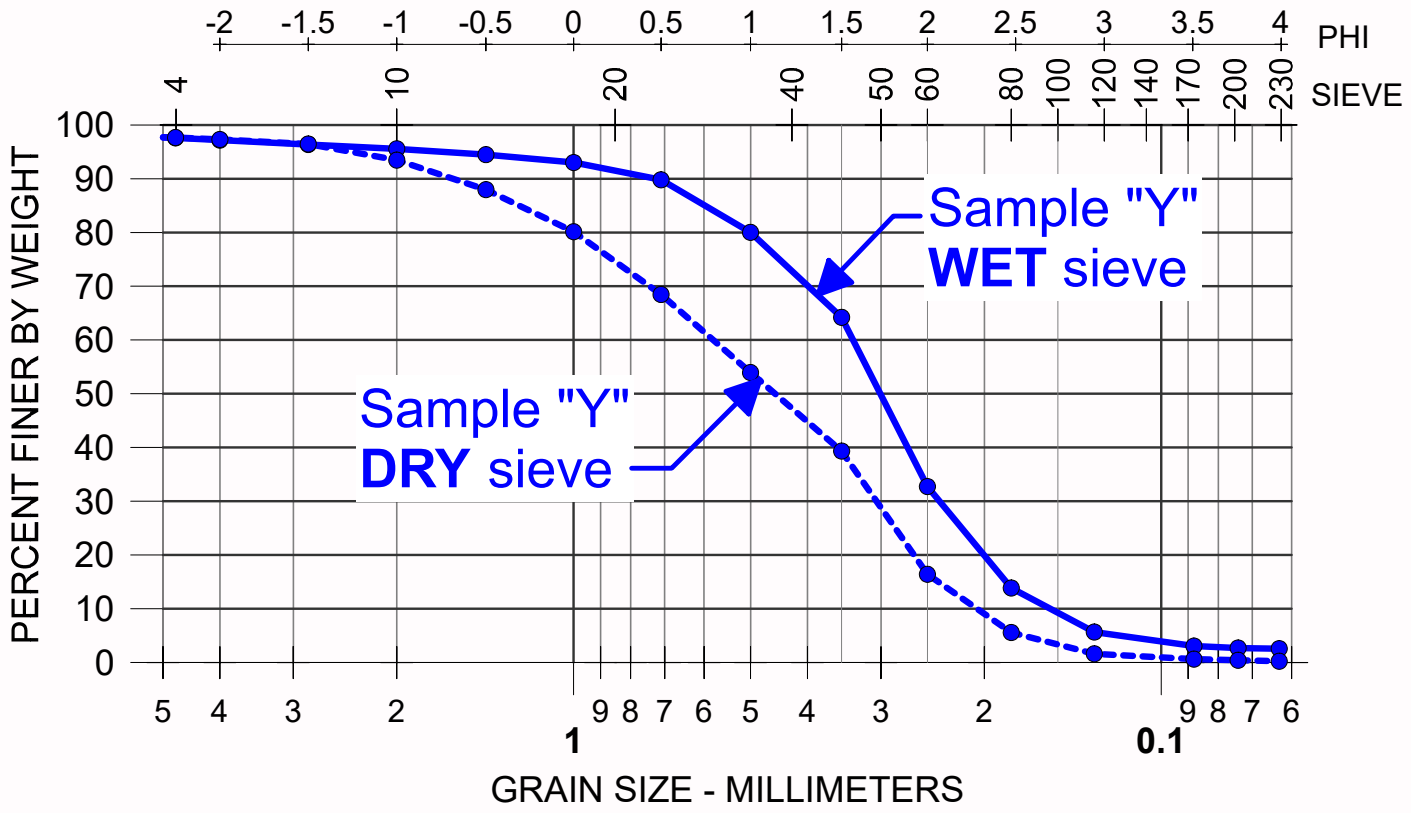
DRY sieve vs. WET sieve



SIEVE ANALYSIS METHODS

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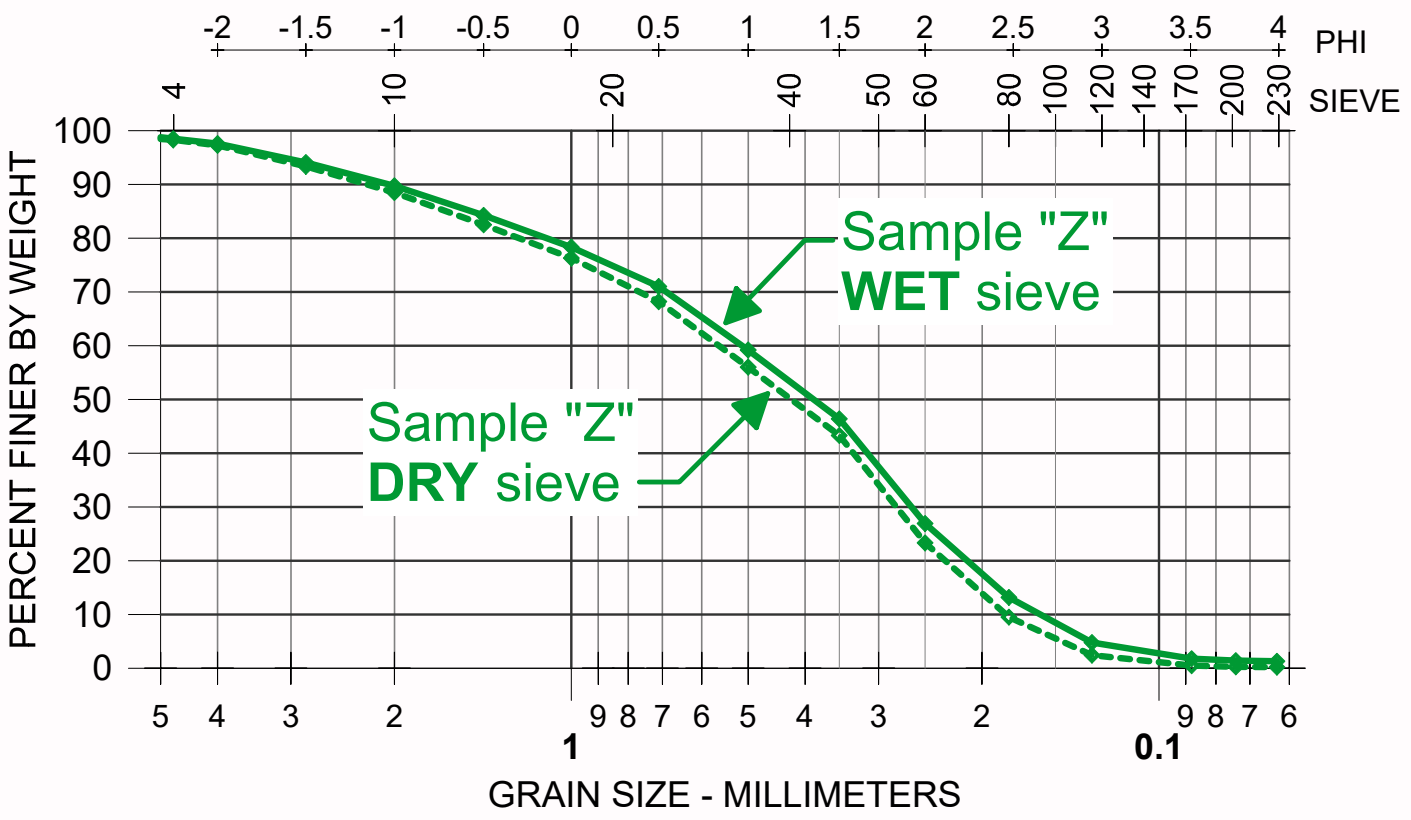

SIEVE ANALYSIS METHODS

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Sand Sample	% Fines (Passing #230 Sieve)		
	DRY	WET	*Difference*
Native	0.57 %	1.75 %	*1.18 %*
X	0.13 %	0.61 %	*0.48 %*
Y	0.28 %	2.61 %	*2.33 %*
Z	0.23 %	1.33 %	*1.10 %*

SIEVE ANALYSIS METHODS

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No Significant Difference

Native = 5%

Poor Sand = 6%

CARBONATE Content (Sediment < 2 mm)

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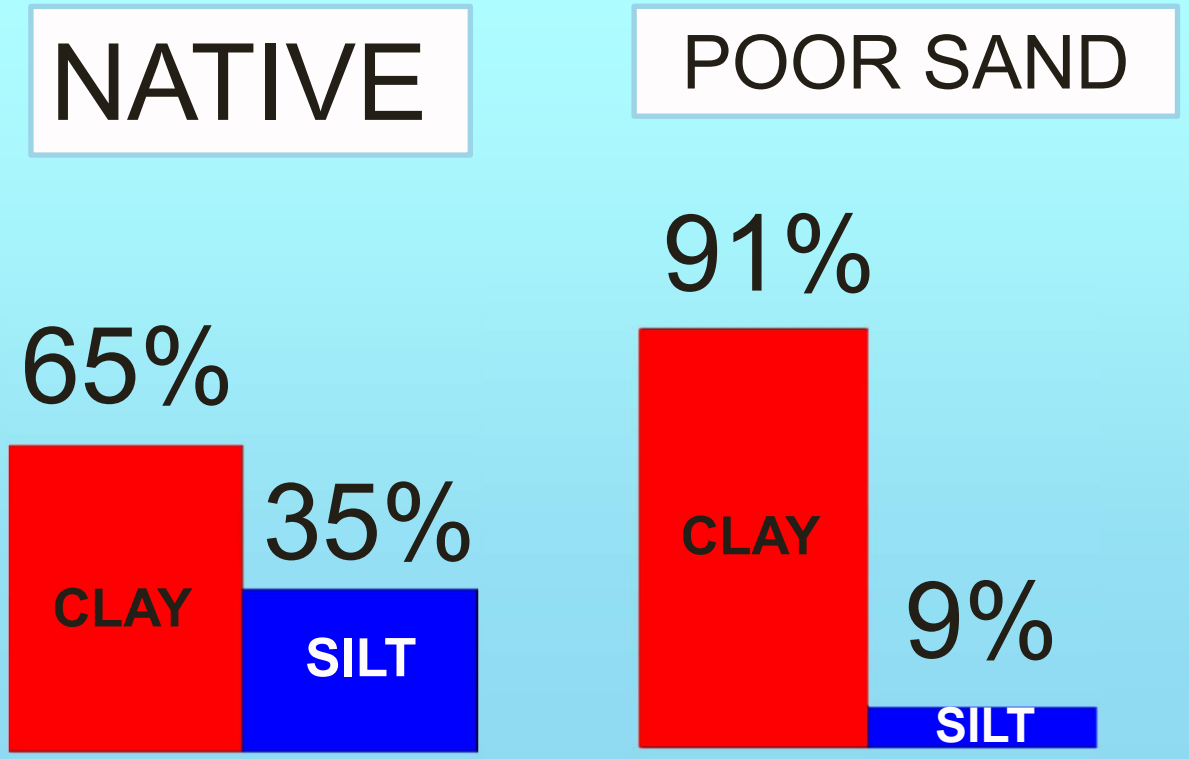

HYDROMETER (CLAY vs. SILT)

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HYPOTHESIS:

Quality material
is not turbid &
particles settle quickly

TURBIDITY TEST

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Measure 150 mL
distilled water

TURBIDITY TEST

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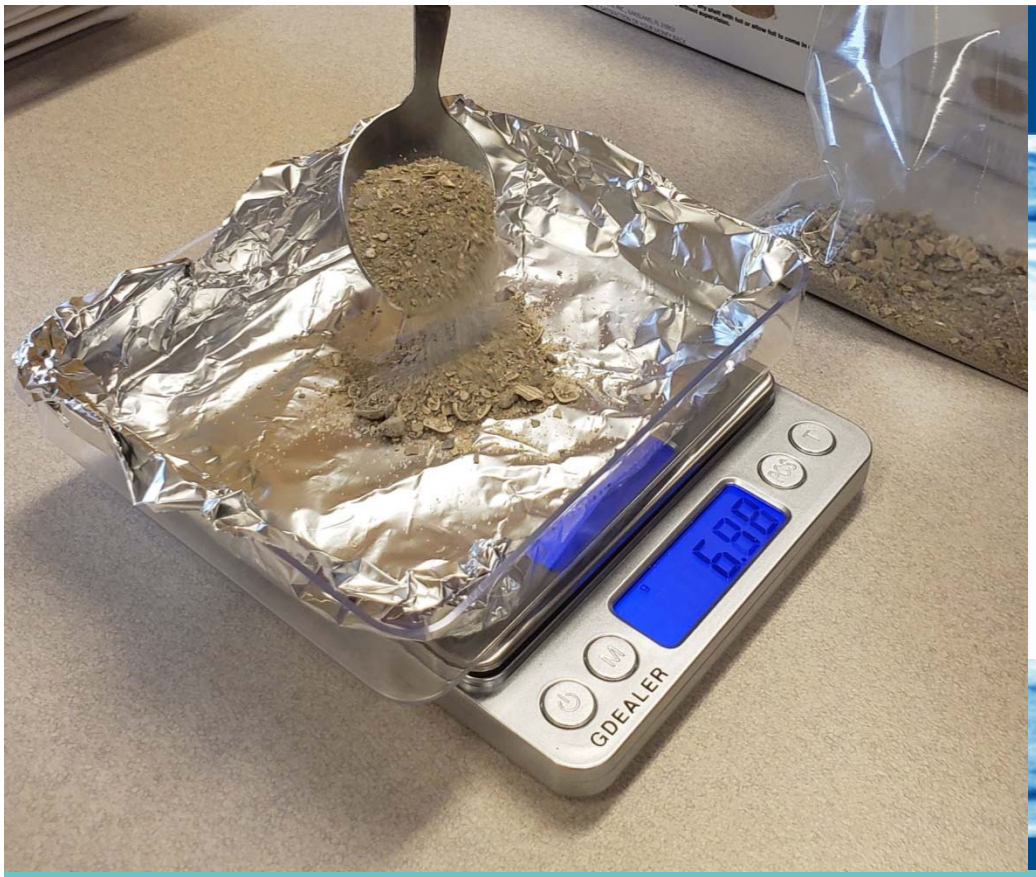

Measure

10 g sand

TURBIDITY TEST

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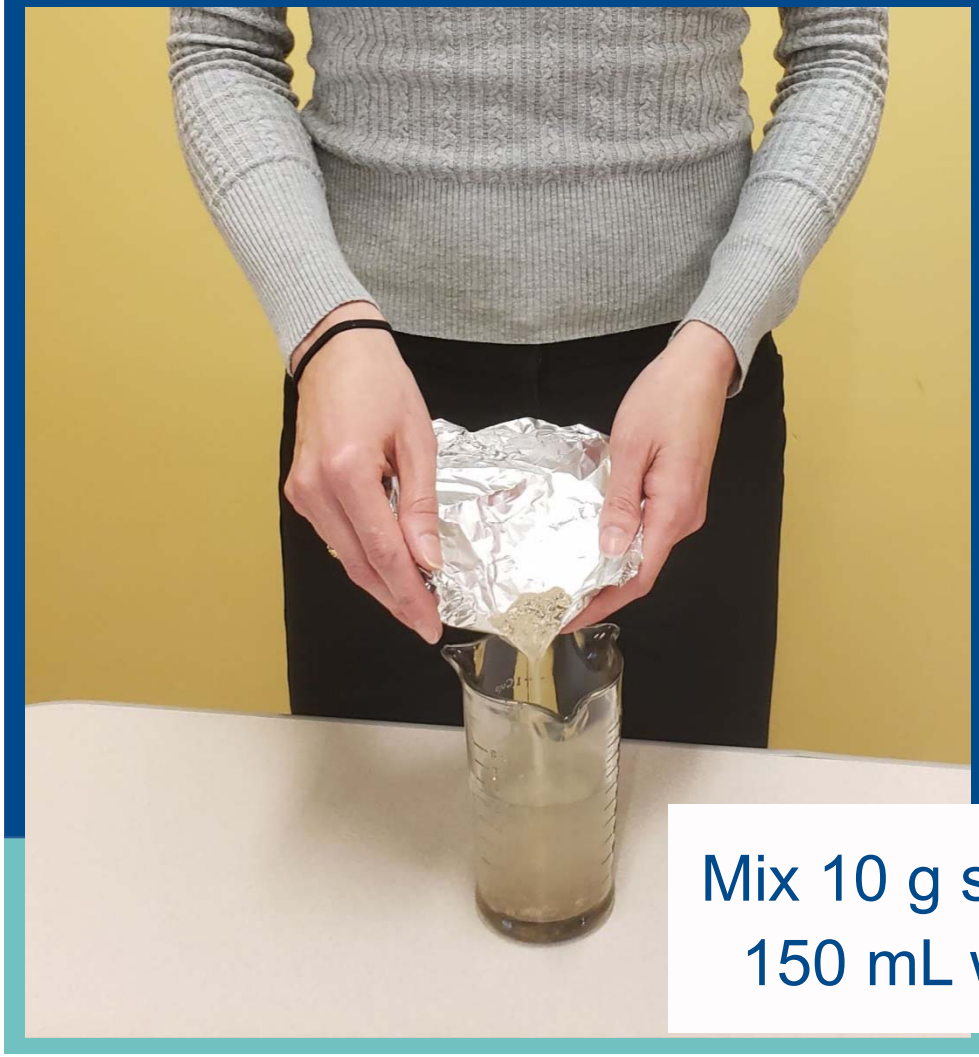

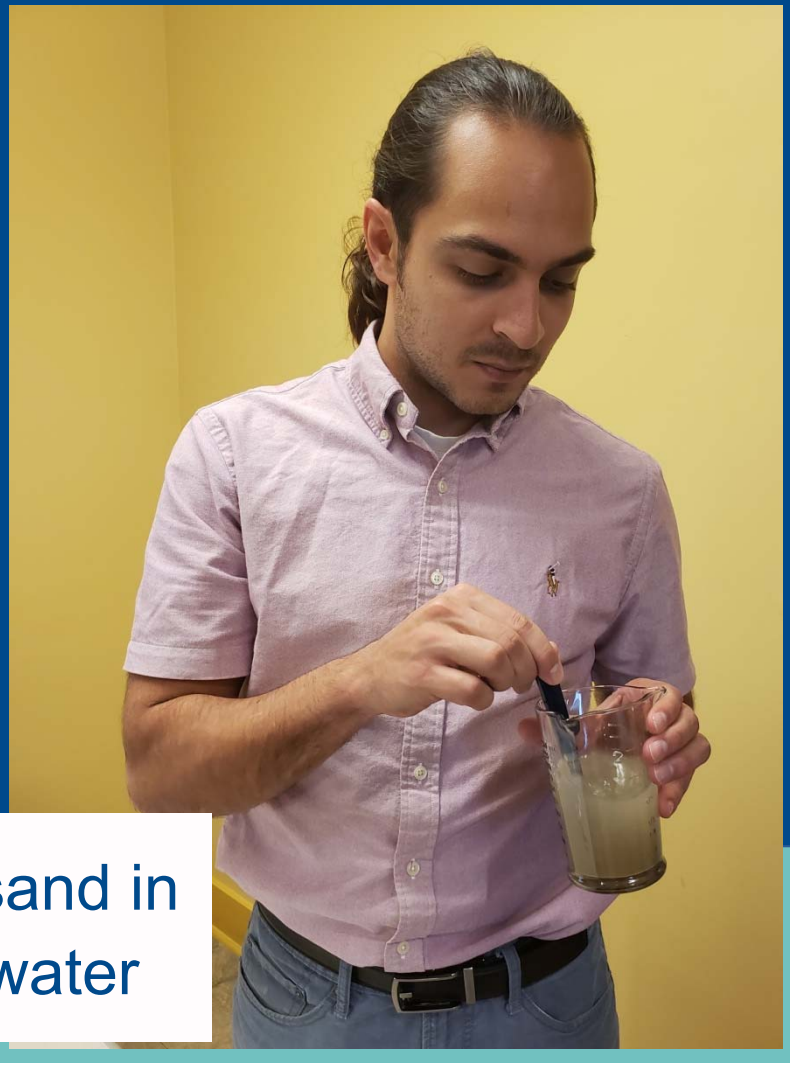

Mix 10 g sand in
150 mL water

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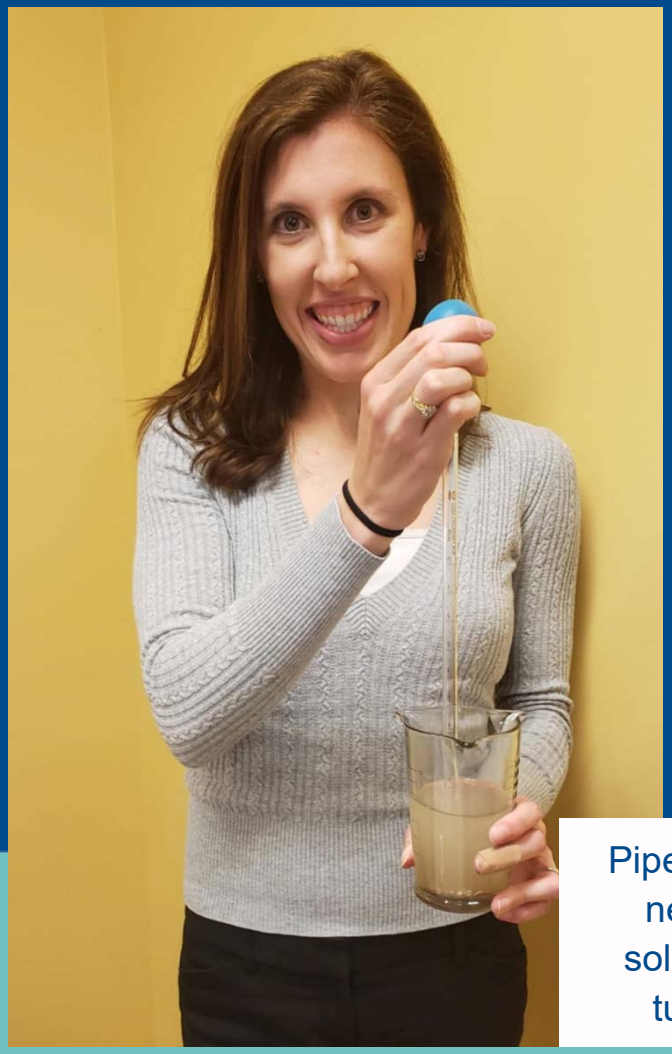

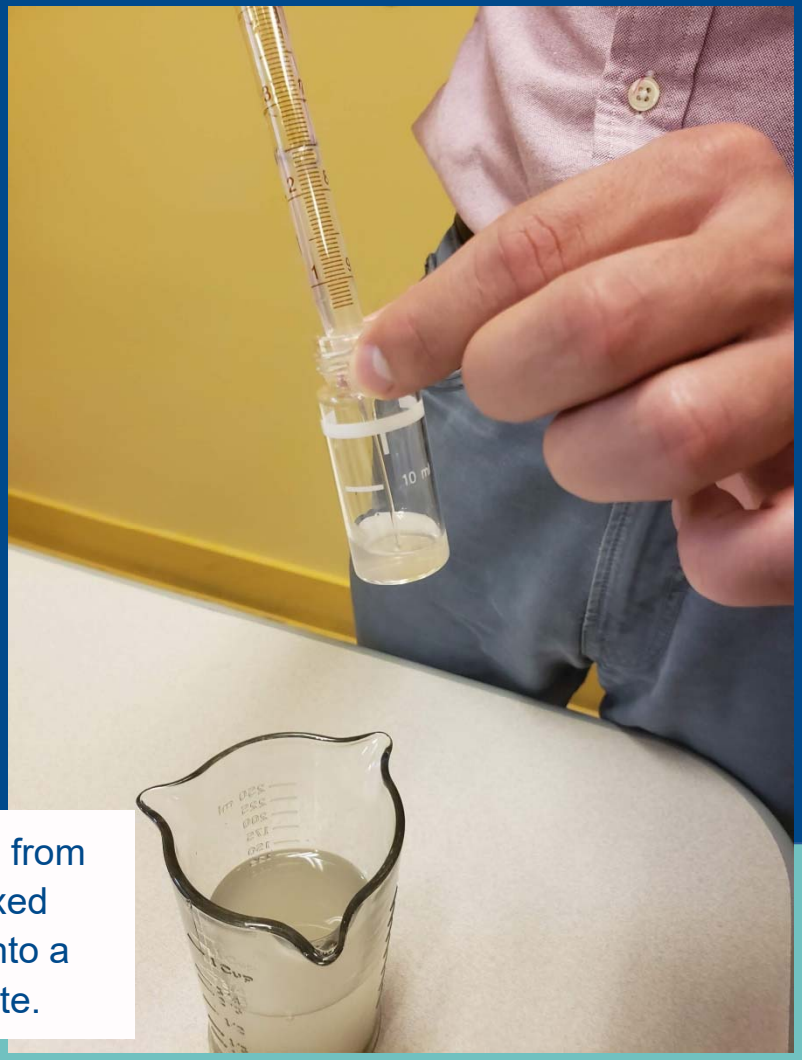

Pipette water sample from near surface of mixed solution and place into a turbidity-test cuvette.

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Place the cuvette into the turbidity test meter and leave it there, undisturbed, during the duration of the test.

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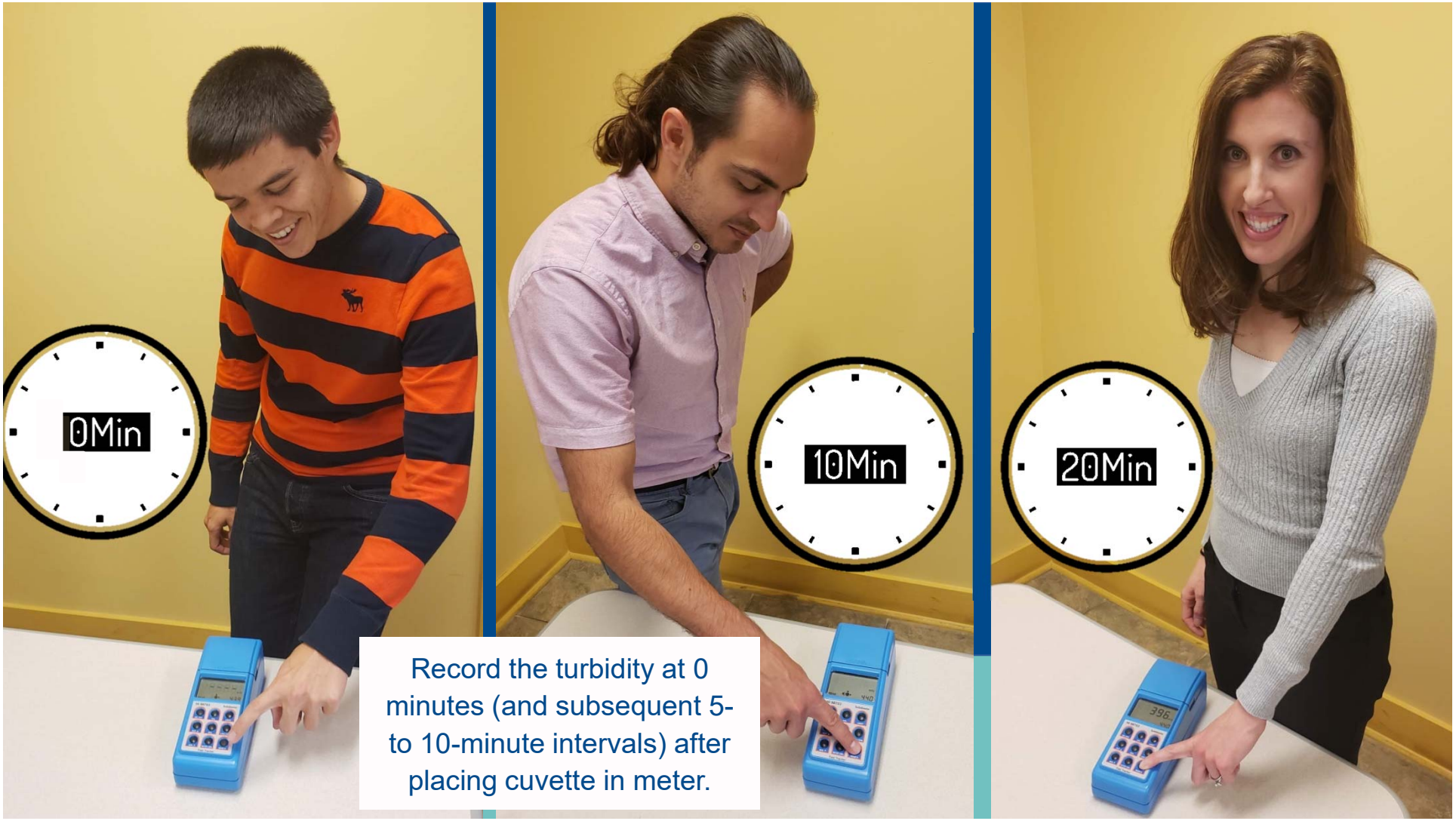
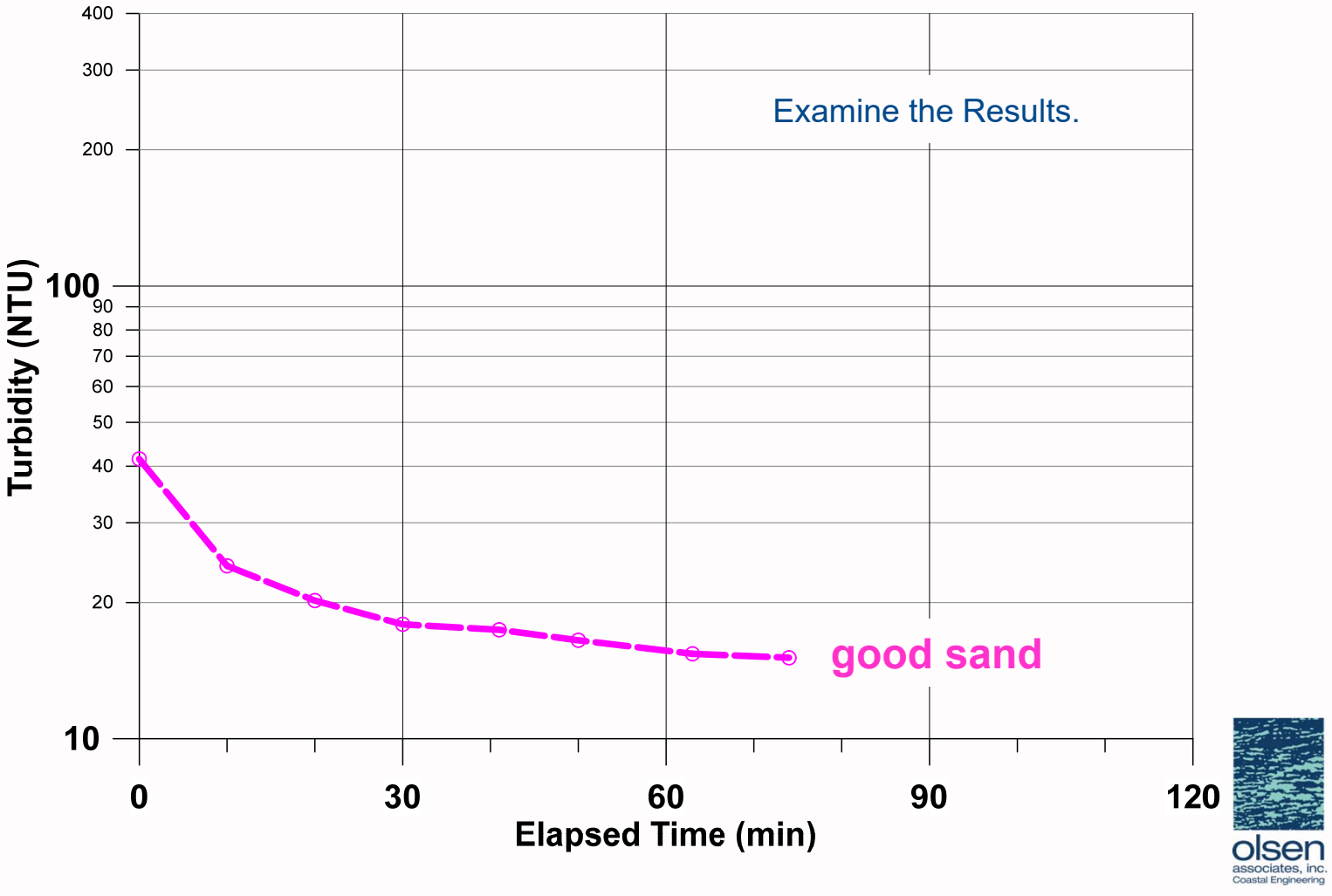


Record the turbidity at 0 minutes (and subsequent 5- to 10-minute intervals) after placing cuvette in meter.

GOOD SAND



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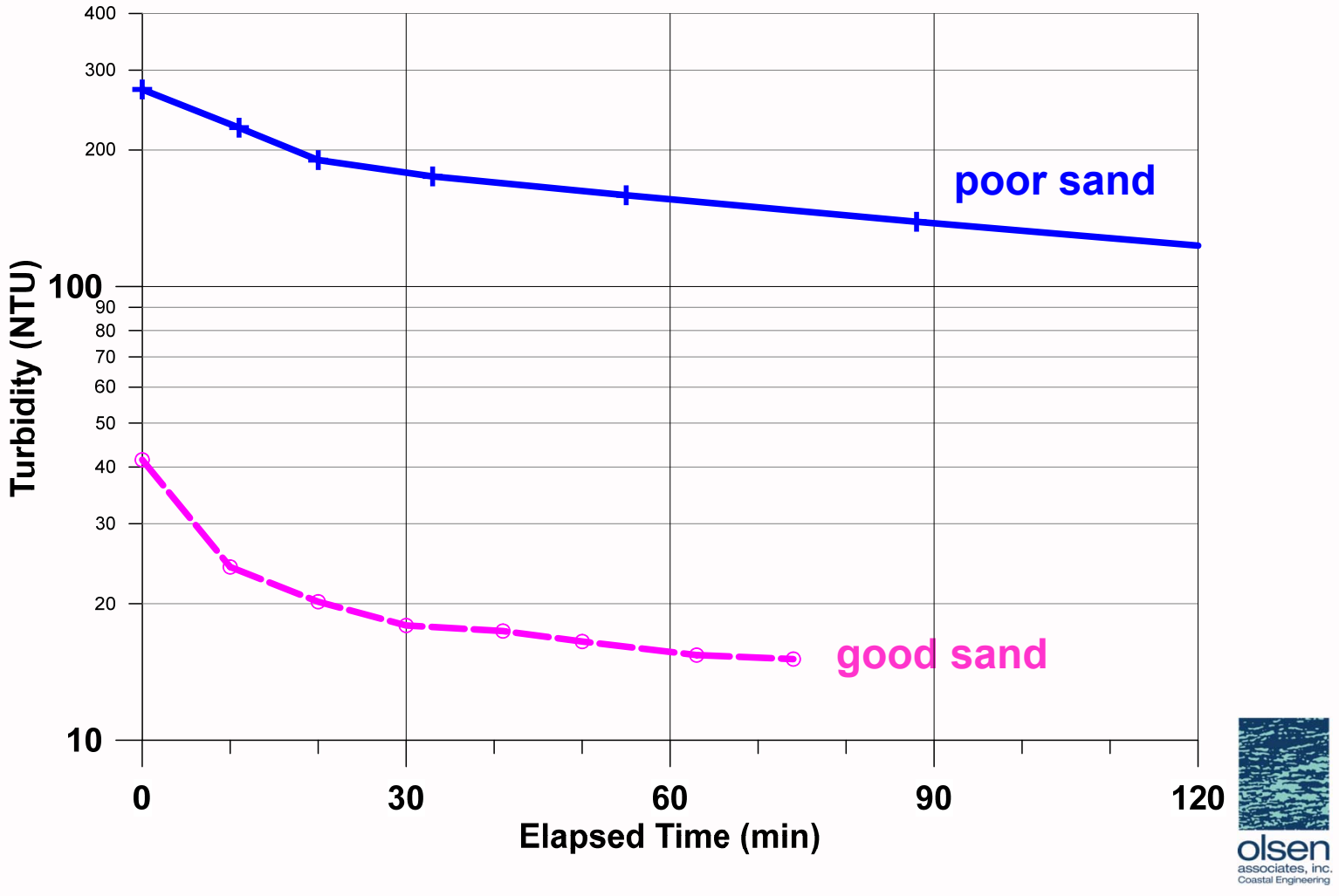
POOR SAND



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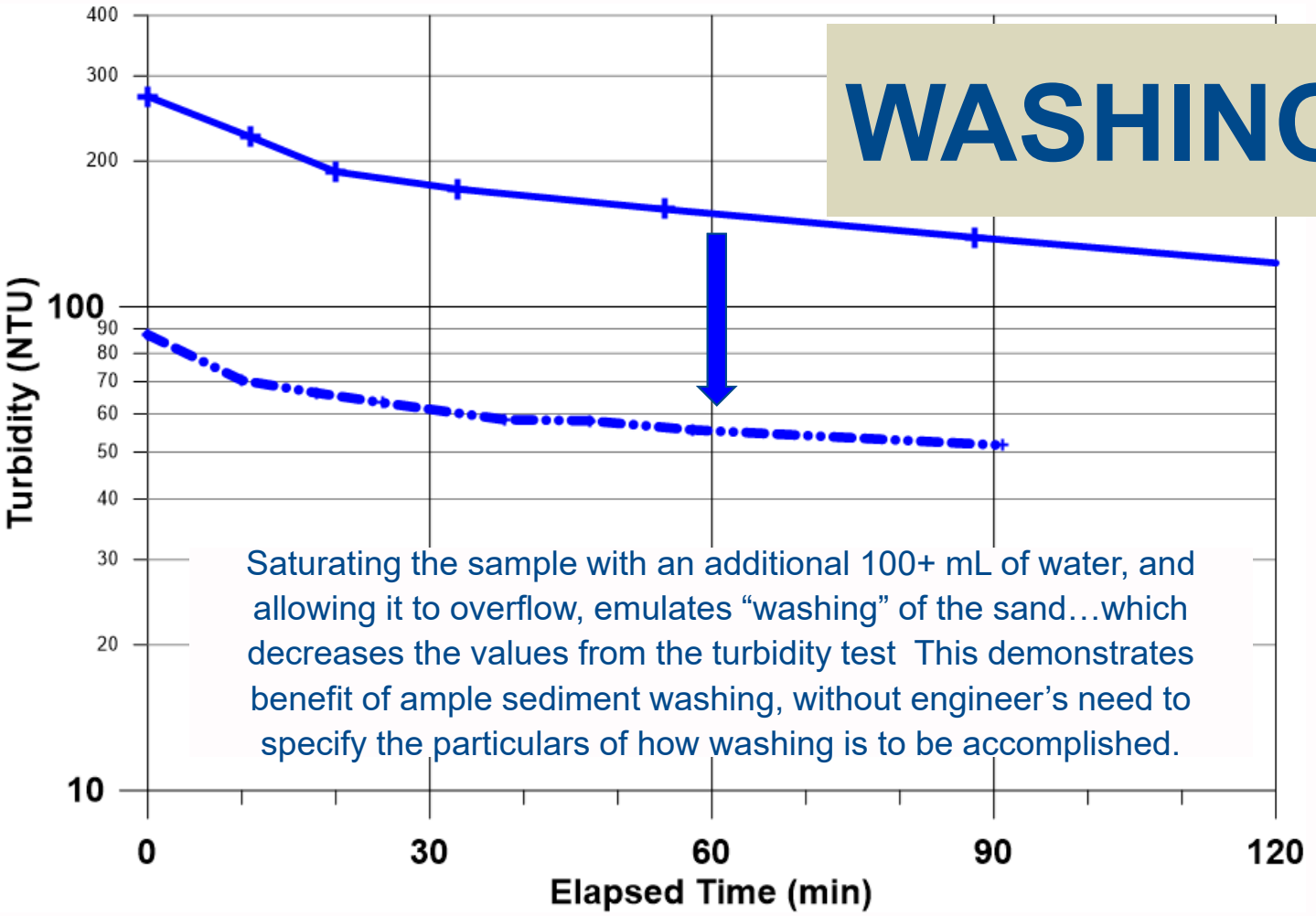
WASHING



Saturating the sample with an additional 100+ mL of water, and allowing it to overflow, emulates “washing” of the sand…which decreases the values from the turbidity test This demonstrates benefit of ample sediment washing, without engineer’s need to specify the particulars of how washing is to be accomplished.

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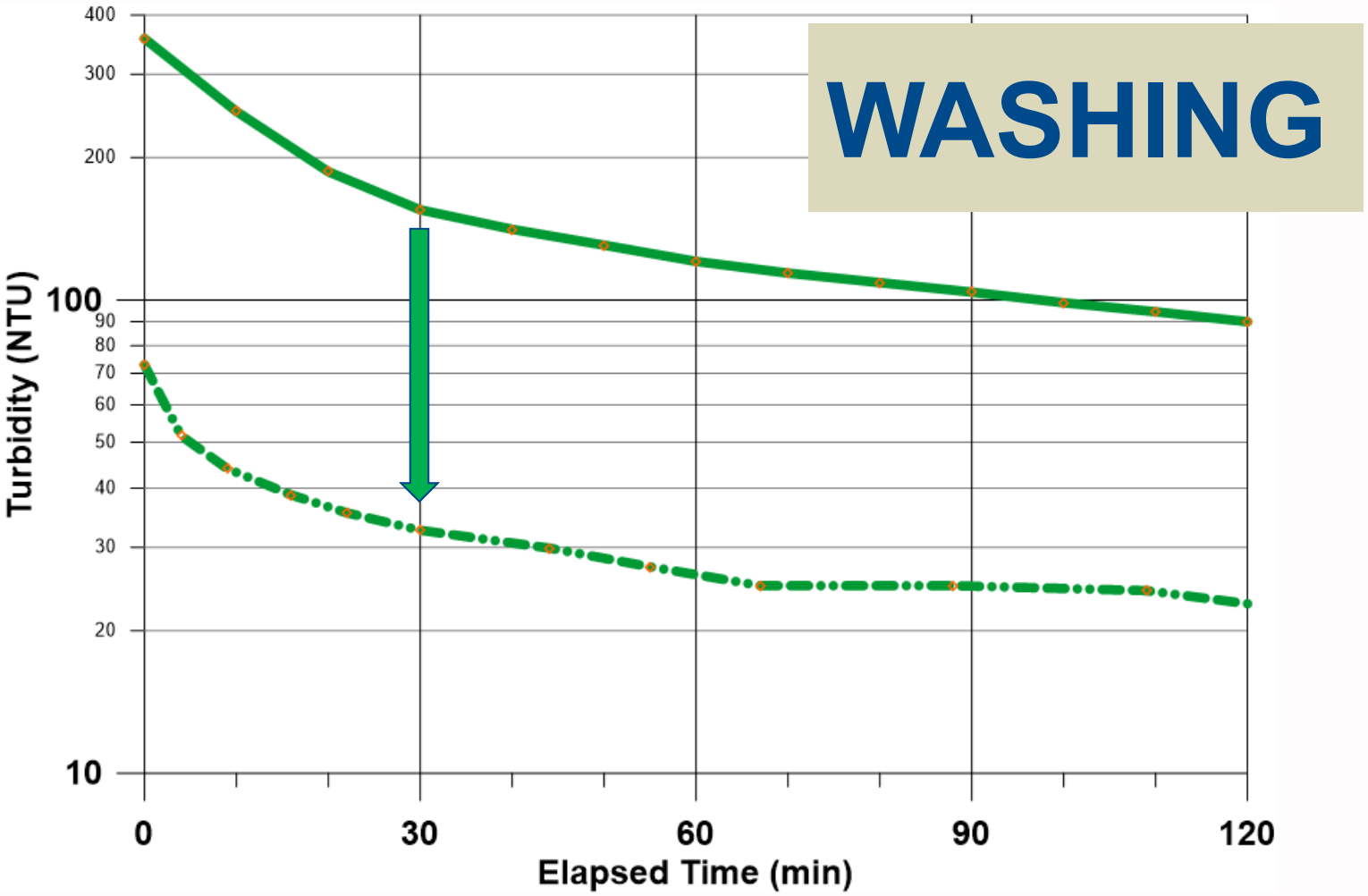

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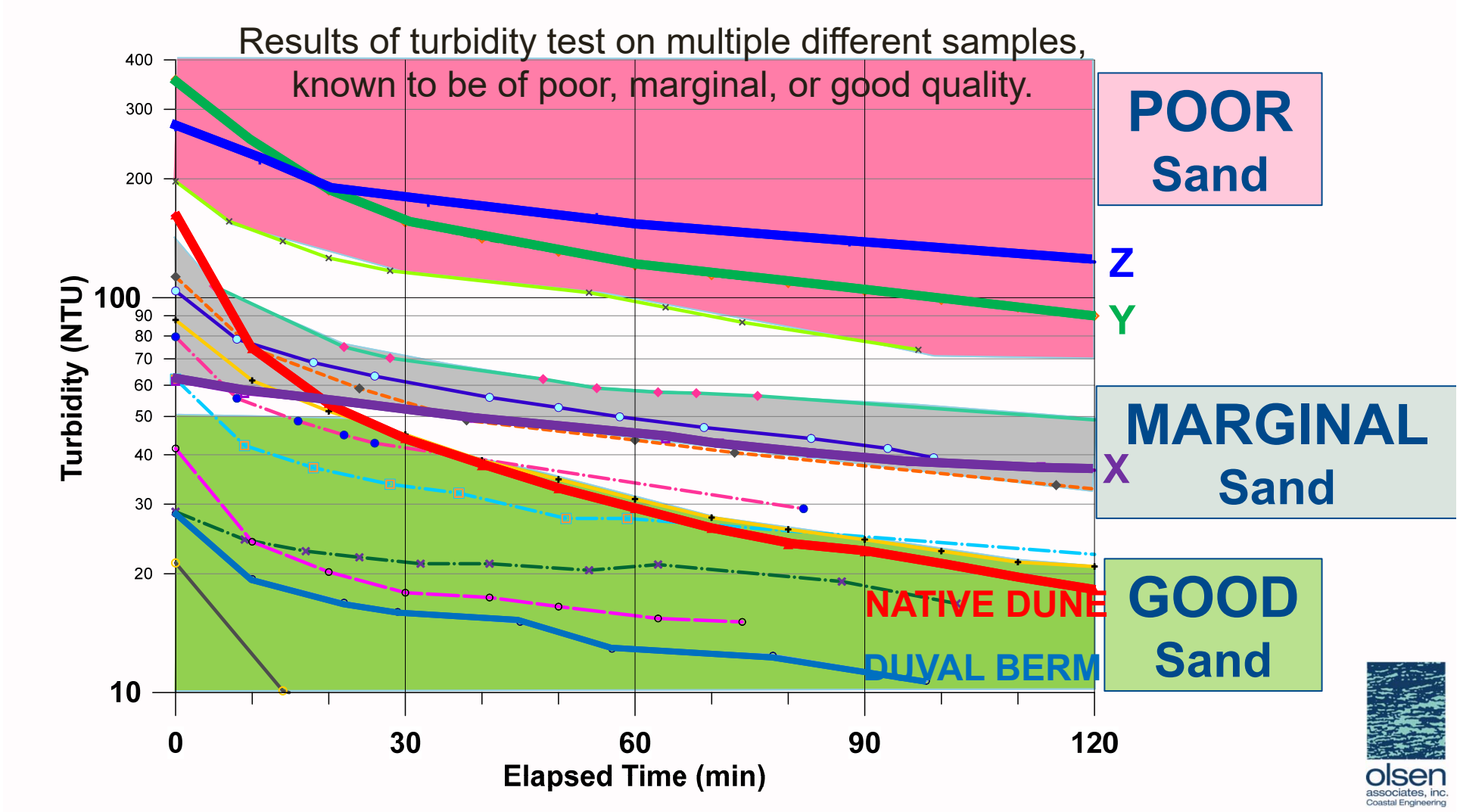
Results of turbidity test on multiple different samples, known to be of poor, marginal, or good quality.
Turbidity (NTU)
400
300
200
100
90
80
70
60
50
40
30
20
10
0
30
60
90
120
Elapsed Time (min)
POOR
Sand
Z
Y
MARGINAL
Sand
X
GOOD
Sand
NATIVE DUNE
DUVAL BERM
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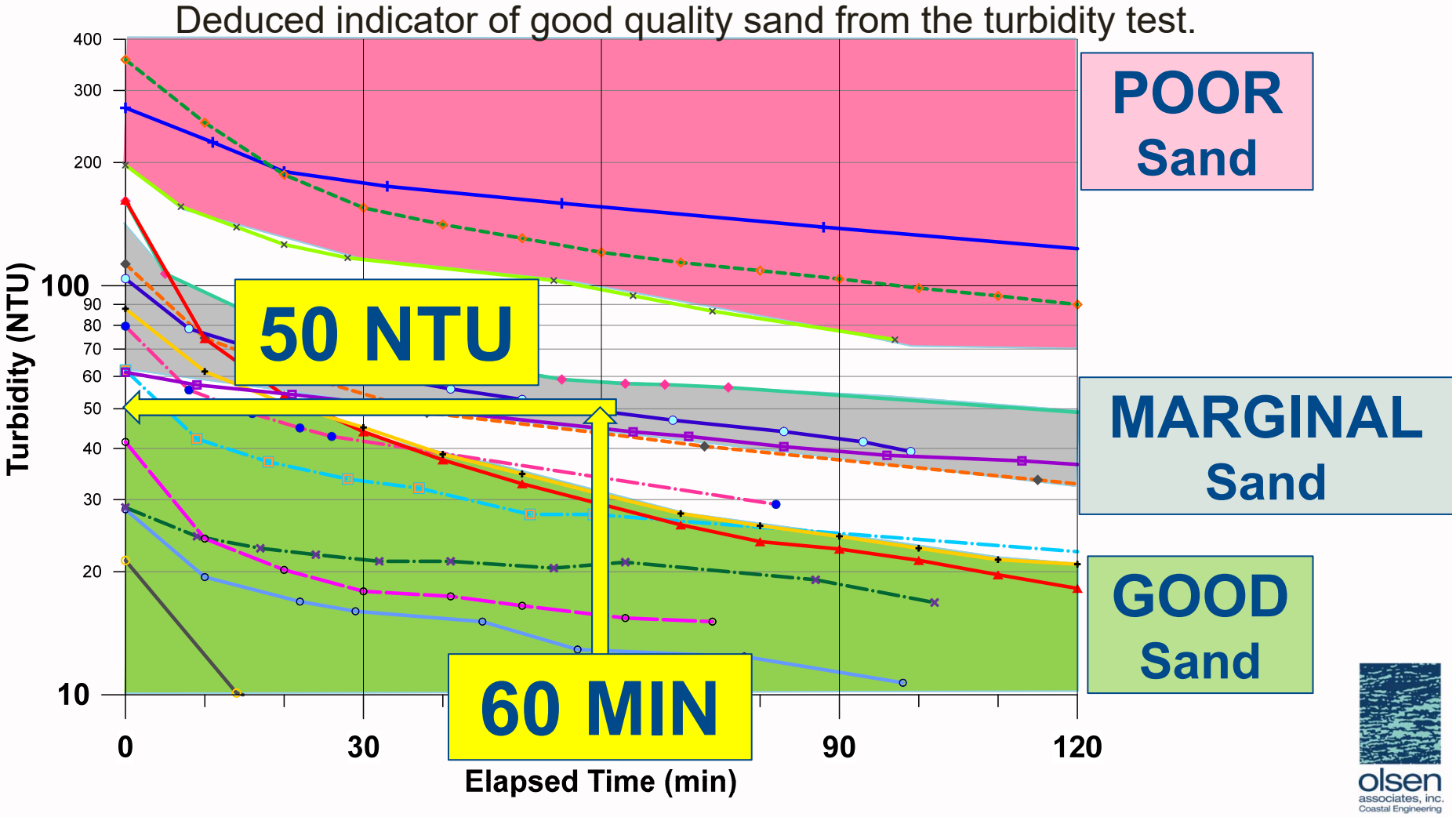

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Acceptable (“good”)
beach quality fill:

A mixture of 10 g sand & 150 mL water must measure less than 50 NTU turbidity within 1 hour

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1. Wet sieve (recommended) reveals higher fines content than dry sieve; but not enough to disqualify poor/marginal samples.

   Specify the methodology to be used by the lab.

2. Carbonate content of smaller grain sizes not significantly different.

3. Clay (vs. silt) content is higher in poor sediment, but impractical to test.

4. Turbidity test discerned poor vs. good fill sand.

   Simple, fast, inexpensive.

   Promotes washing of sand, without having to specify washing detail.

SUMMARY

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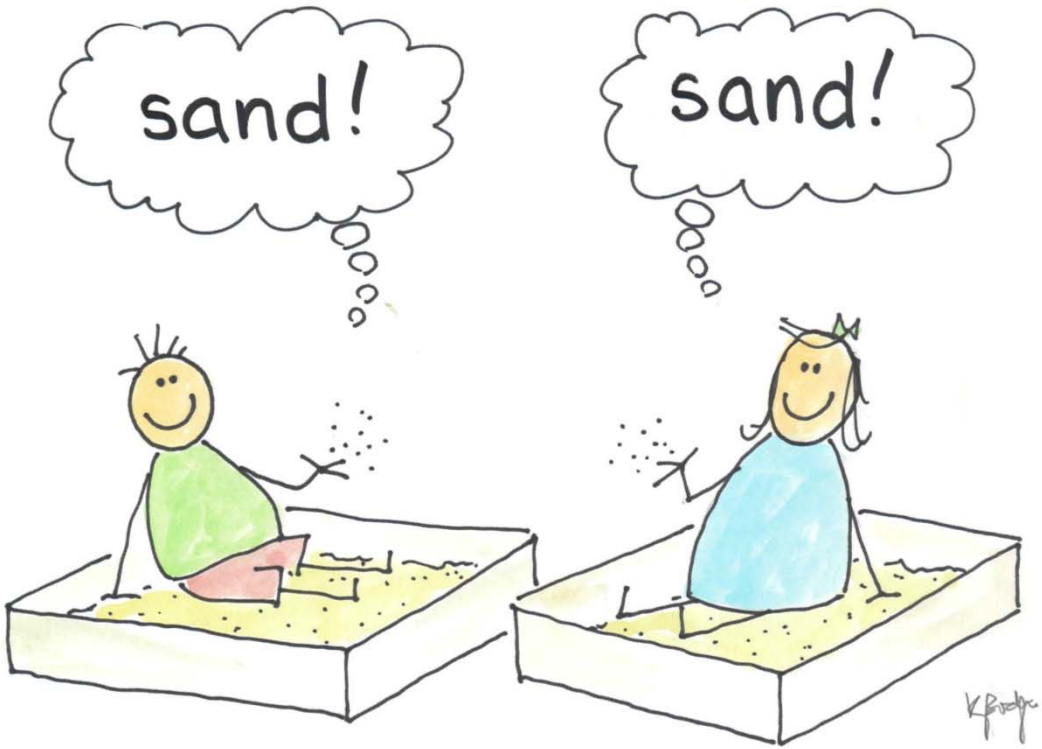

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