# Fate of Fines Study

## Sediment Loss During the Hydraulic Dredging Process


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# Bottom Line Up Front

- **Existing data shows a fines loss due to hydraulic dredging of greater than 50% from in-situ sources to post construction fill**

- **Itinerary**
  - Background
  - Objectives
  - Data Collection and Analysis
  - Environmental Considerations
  - Outcome Applicability
  - Future Work
  - Conclusions

# Background

- Originated with the SAND Study (ERDC/CHL TR-14-10)
- Monitor turbidity because of fine sediment loss

Table 6. Compatibility data for projects showing the borrow source and post-fill composite statistics.

| Project/Year | Fill Volume | Sediment source | Source composite stats | | | Post-fill beach composite stats | | |
|---|---|---|---|---|---|---|---|---|
| | | | Mean mm | Sorting phi | % passing #230 | Mean mm | Sorting phi | % passing #230 |
| Duval SPP, 2005 | 710,000 cy | Duval B/A "Area A" | 0.25 | 1.15 | 3.4 | 0.25 | 0.85 | 0.70 |
| Tampa Harbor O&M, Egmont Key, 2005 | 1.3 mcy | Egmont Channel and Mullet Key Cut | 0.35 | 1.58 | 25 | 0.27 | 1.21 | 2.5 |
| Ft. Pierce SPP, 2007 | 517,000 cy | Capron Shoal | 0.43 | 0.97 | 1.6 | 0.60 | 1.34 | 0.10 |
| IWW O&M, St. Augustine Inlet, 2008 | 122,648 cy | IWW, St. Augustine Inlet | 0.28 | 1.94 | 2.57 | 0.28 | 0.84 | 0.41 |
| Lee Co. SPP, Captiva Island, 2008 | 98,270 cy | Borrow Site VI | 0.40 | 1.04 | 0.87 | 0.51 | 1.34 | 0.53 |
| IWW, Matanzas Inlet, 2009 | 288,647 cy | IWW, Matanzas Inlet | 0.16 | 0.64 | 3.15 | 0.24 | 0.42 | 0.29 |
| John's Pass O&M, 2010 | 250,000 cy | John's Pass Entrance Channel, Shoal east of channel | 0.24, 0.16 | 0.73, 0.56 | 0.86, 1.69 | 0.22 | 1.07 | 0.21 |
| Treasure Is./Long Key SPP, 2010 | 160,000 cy | Blind Pass Entrance Channel | 0.24 | 1.59 | 1.71 | 0.18 | 0.89 | 0.21 |
| Duval SPP, 2011 | 689,015 cy | Duval B/A "A + A2" | 0.17-0.26 | - | 1.70 | 0.25 | 0.87 | 1.18 |
| IWW O&M, Bakers Haulover Inlet, 2011 | 33,000 cy | IWW, Bakers Haulover Inlet | 0.26 | 1.30 | 6.48 | 0.67 | 0.72 | 0.20 |
| Sand Key SPP, 2012 | 1.2 mcy | Borrow Area L | 0.18 | 0.96 | 3.04 | 0.28 | 1.37 | 0.58 |

SPP: Shore Protection Project, O&M: Operation and Maintenance, IWW: Intracoastal Waterway, cy: cubic yards, mcy: million cubic yards

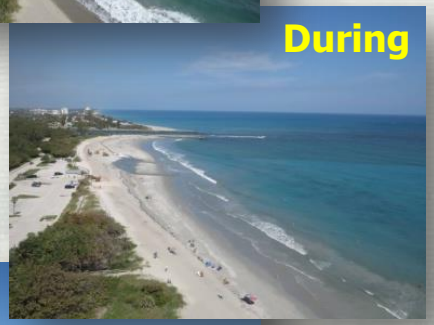
- State sets criteria for sediment quality via F.A.C. 62B-41.007(j)(k), a.k.a. FDEP "Sand Rule" • 5% in Beach fill
- Most conservative assumption of 0% fines loss

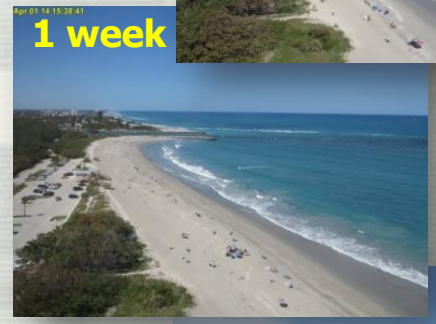
# Study Objectives

- **Quantify total fines loss and to provide reasonable assurance**
  - Benefit the Navigation program by retaining more sand in the system, closer placement, reserving ODMDS and DMMA capacity,
  - Benefit SPP by increasing the amount of sand available for beach construction.

- **Partner with the State and other agencies**

# Data Collection

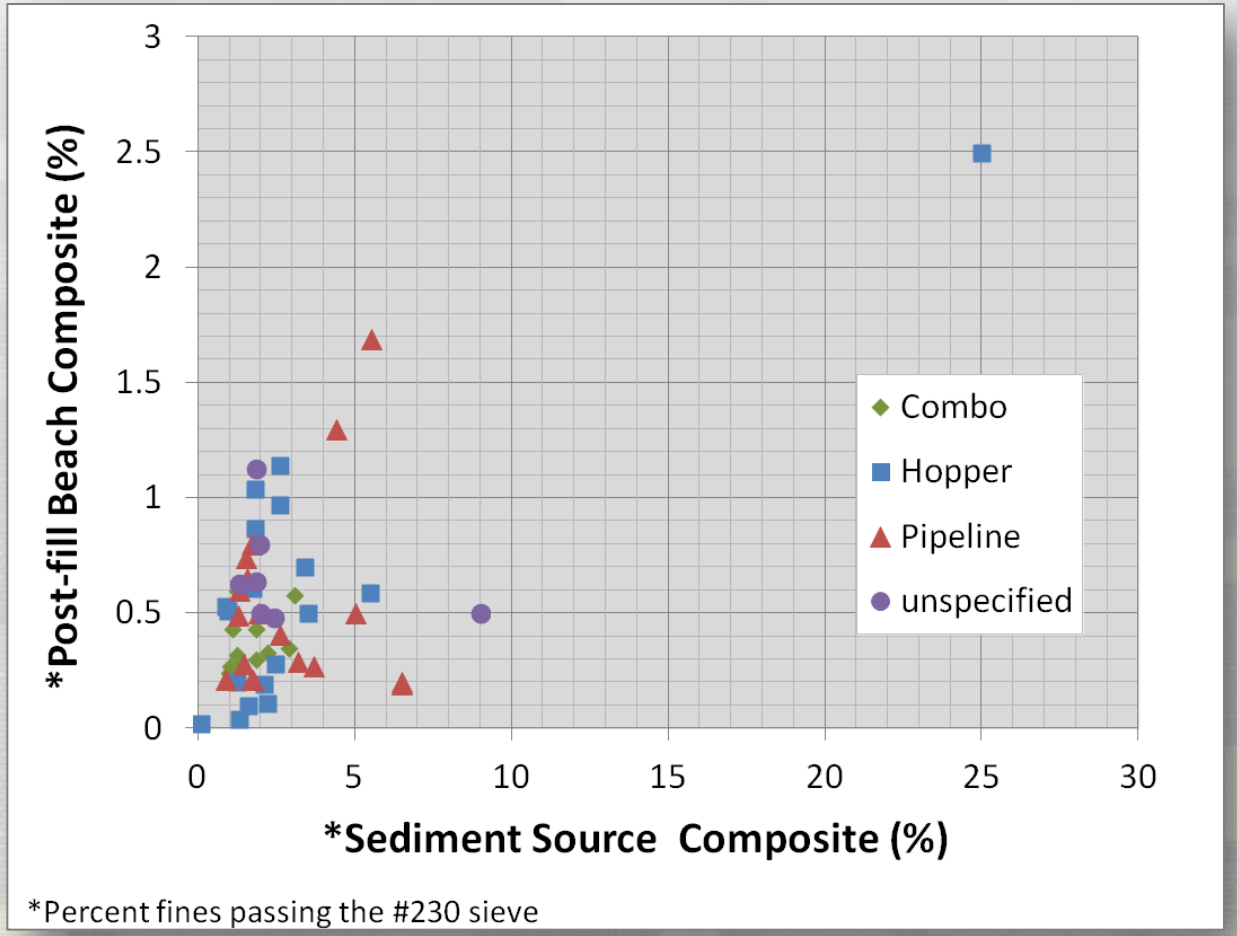


- **Hydraulic dredges (Hopper and Pipeline)**
- **Monitoring data from FDEP and USACE**
- **FY14 Projects sampled**
  - Delray Beach SPP
  - Hobe Sound O&M
  - IWW Jupiter O&M
  - Bal Harbor O&M
  - North Boca SPP
  - Ft. Pierce SPP
  - Gasparilla SPP
  - Ocean Ridge SPP
  - Longboat Key SPP

**Chelonia viridis plasticus**

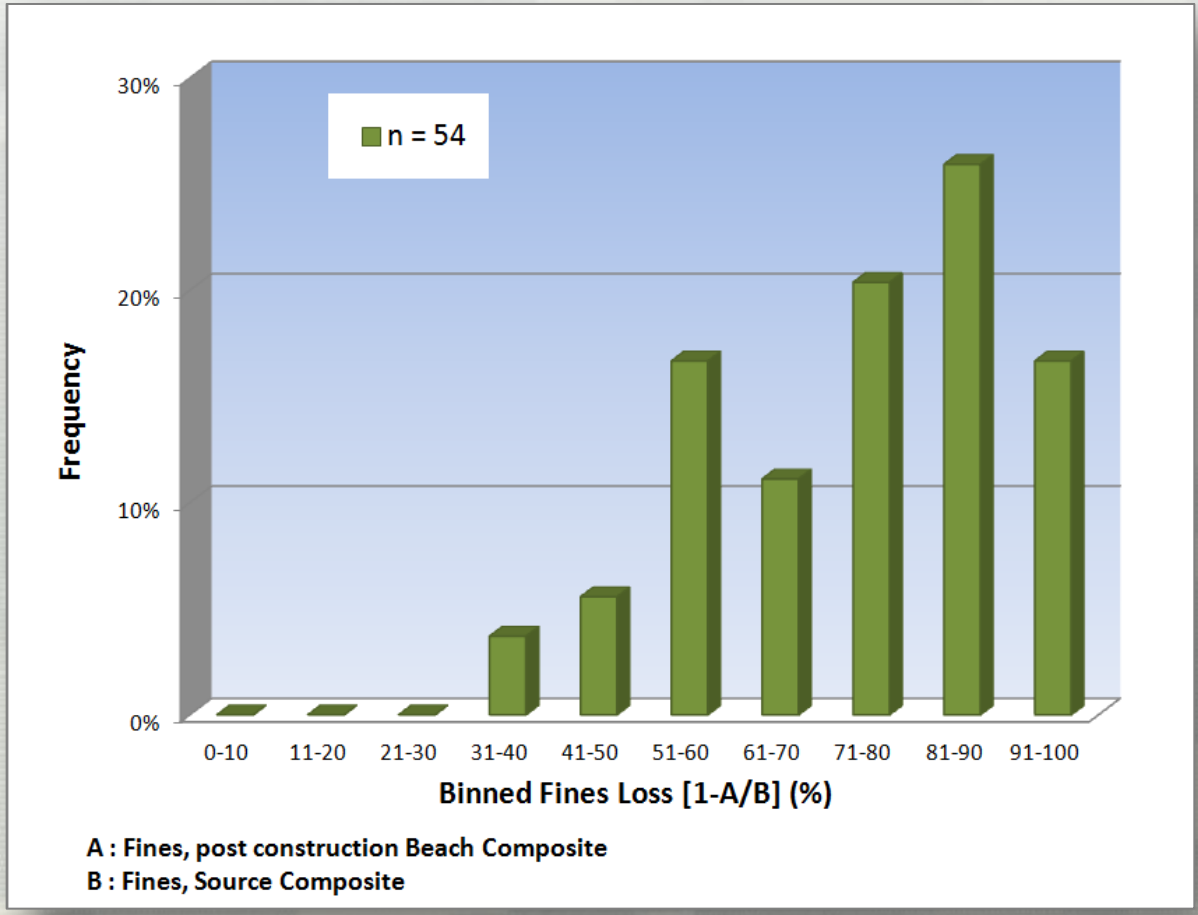
# Data Analysis

- **Statistical difference in fines content**
  - AASHTO precision and bias testing
- **Data spans the high and low in-situ fines contents**
- **Includes 17 hopper, 18 pipe line, 11 combo and 8 generically hydraulic**
- **Constraints:**
  - Few fines in the in-situ sources



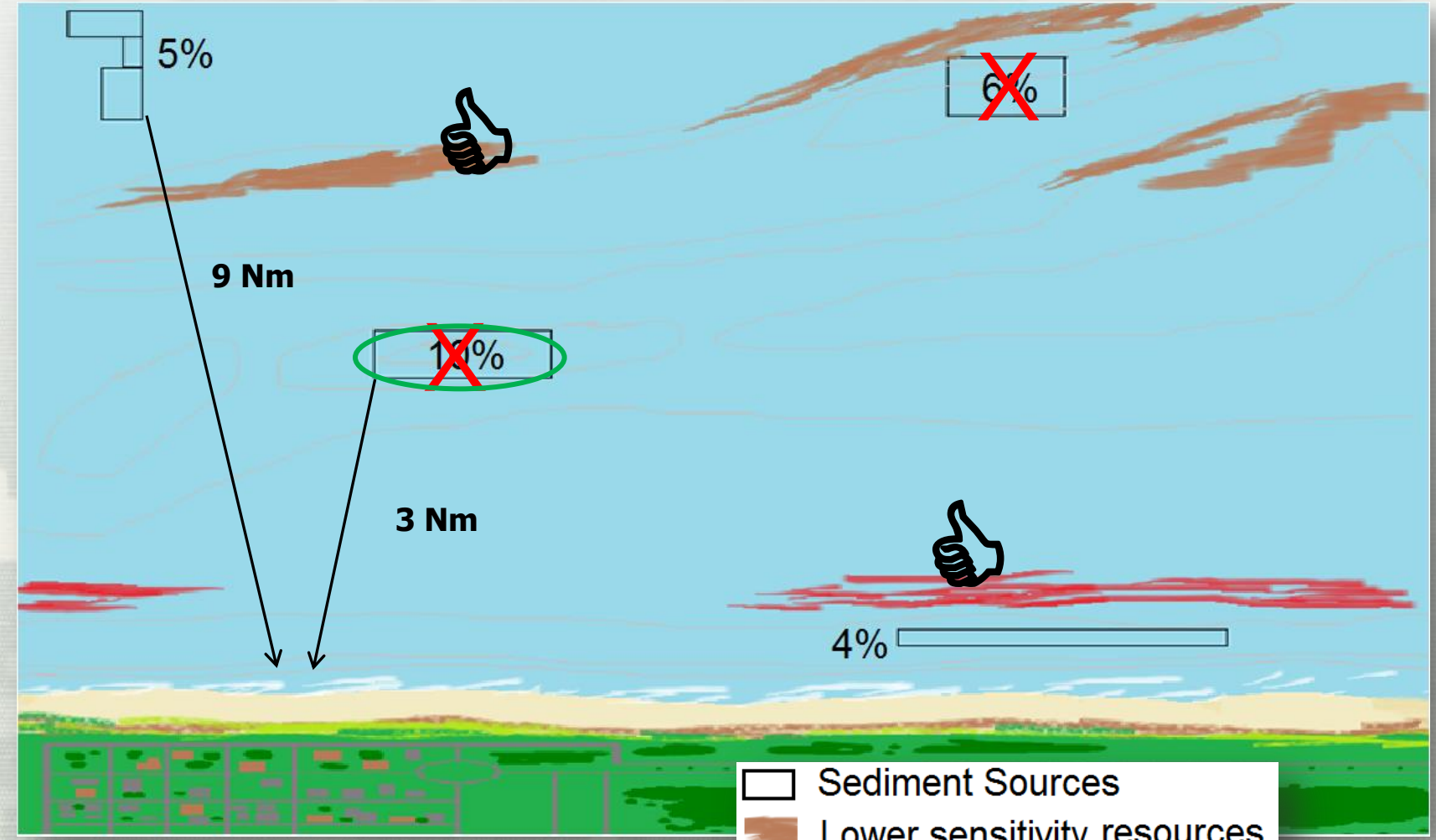

*Percent fines passing the #230 sieve

# Data Analysis

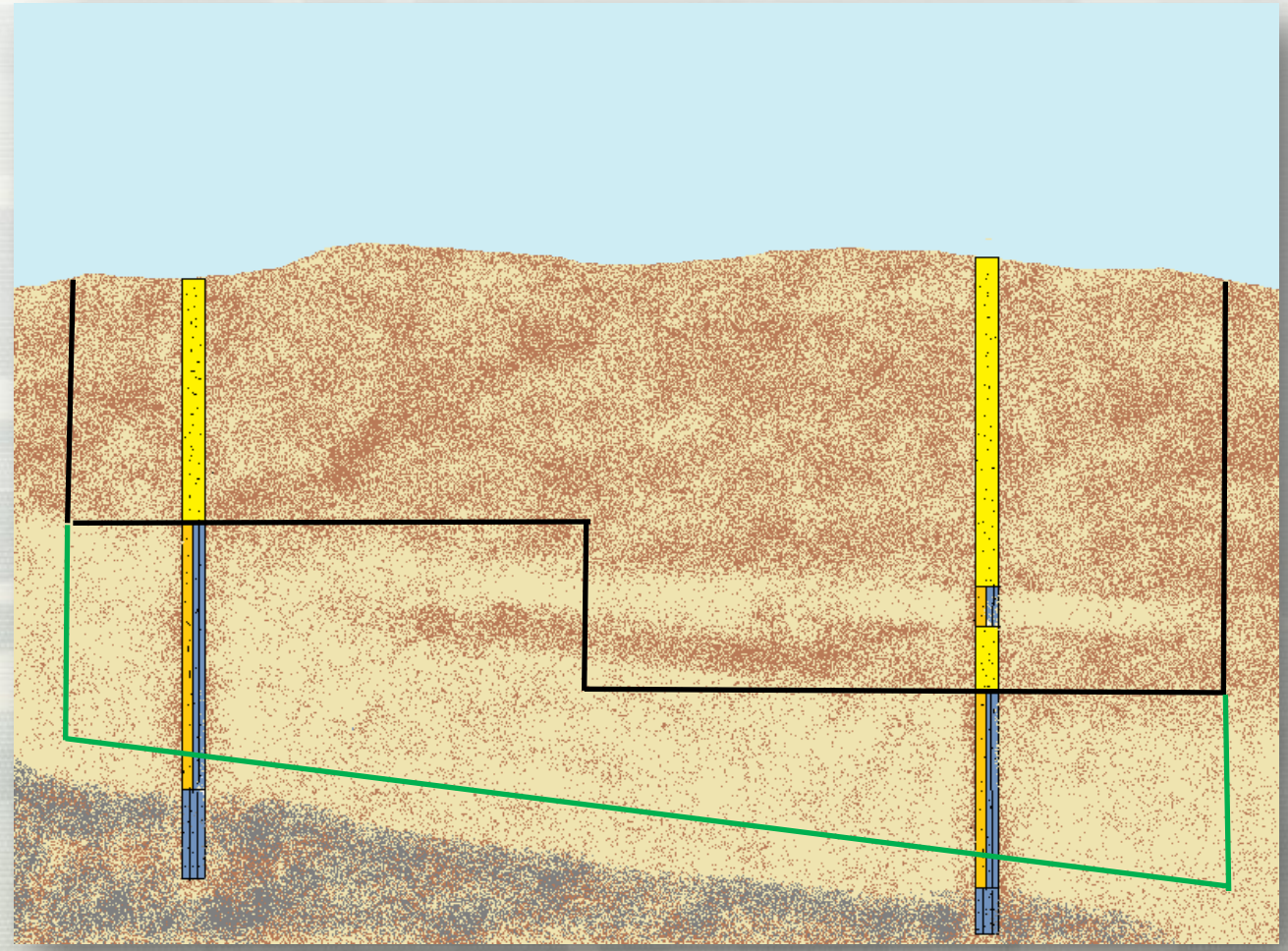



- n=54
- Mean loss: 74%
- Median loss: 78%
- Most frequent: 80-90%
- 91%  show greater than 50% loss

# Spatial Impact



# Vertical Impact



# Environmental Considerations

- Must not exceed turbidity requirements
- Must meet all other "Sand Rule" criteria for quality
- Must perform function
- Protect limited, high sensitivity/density resources

**Nearshore Resources**
**From: Palm Beach Reef Research Team**

**Offshore Resources**
**From: USACE/Anamar Jacksonville ODMDS EIS**

# Outcome Applicability

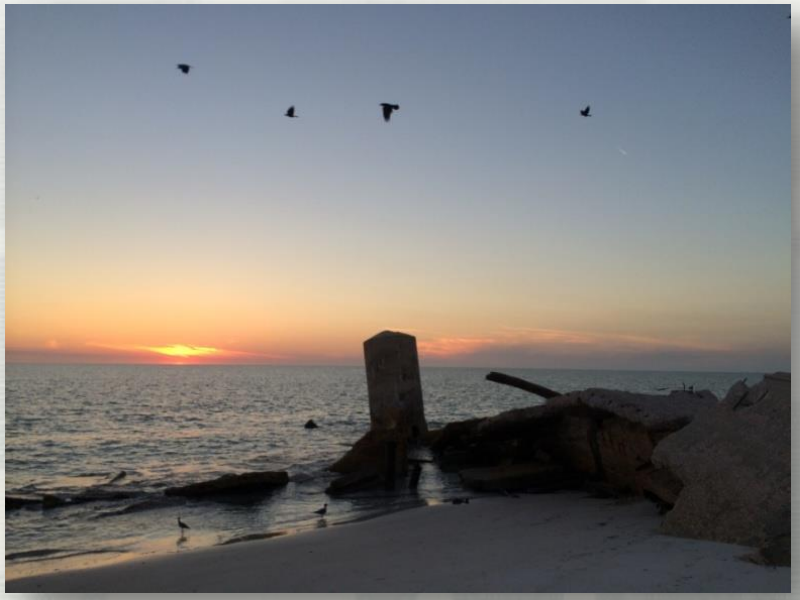
- Areas with limited sand resources
- Areas with sensitive nearshore resources
- Areas with marginal B/C ratios
- Projects with limited ODMDS/DMMA capacity
- Cases of unusual circumstance

# Future Work

- **8 projects scheduled in FY15**
  - **Egmont Key**
- **Where do the fines go?**
  - The steps in dredging process
  - Plume dynamics and transport
  - Background turbidity monitoring
- **What does this mean?**
  - Continue this study - reasonable assurance
  - FDEP and USACE are discussing a future test project.

# Conclusions

- **"Sand Rule"**
- **Findings indicate losses:**
  - Most frequent from 80-90%
  - Averaging in the 70%
  - 91% over 50% loss



- **Assume 50% loss of fines as new conservative estimate = 10% fines**
- **Better RSM practice, better environmental practice and better economic practice**