Handling Sand Laden Manure

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"If it doesn't make economic sense it doesn't make any sense at all."  
*John Dahl*

“Manure storage should be viewed as a cost center”  
*Leonard Massie*

"Every time you touch manure it costs you money".  
*Brian Holmes*
Removing Sand Laden Manure from the Barn

Viable Options:

- Tractor/Skid Steer Scrape
- Auger
- Vacuum Tanker
- Flush Flume
- Flush
- Gravity Flow
Gravity Flow Channel with Sluice Gate

24 - 30" DIA. PIPE

ACCUMULATED SAND

CROSS CHANNEL

ALLEY

ALLEY

ALLEY

MANURE STORAGE

SLUICE GATE

Push-In Protected from fall in

6 - 8 ft

2.4 ft.

Gravity Flow Channel with Sluice Gate
Transfer to Storage

Gravity
- 4 ft Elevation Difference - Organic
- 10 ft Elevation Difference - Sand

Pump – level or up-hill or long distance

Sand Bedding Settles Out
- Keep water away
- Provide access for clean out

Have an Alternative Plan B
Flushing to Remove Manure from Barn
What is the objective of sand separation?

A. Make downstream manure handling easier  
B. Reuse cleaned sand for bedding  
C. Produce sand free manure  
D. All the above  
E. Both A and B
Sand Cleaning Systems

Gravity Settling
  Sand Lanes
  Sand Trap

Mechanical
  McLanahan Sand Separator
  Parkson Tru-Grit
US Sieve Number

Fraction Passing (%)

Opening Size (mm)

Fine

Medium

Coarse

Wedel, 2000
# Slang and Trade Names of Commonly Used Bedding Sand

<table>
<thead>
<tr>
<th>Relative Size</th>
<th>ASTM Designation</th>
<th>Sand Name</th>
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<tbody>
<tr>
<td>Fine</td>
<td>--</td>
<td>Beach Sand, Blow Sand, Bank Run, Run-of-pit</td>
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<tr>
<td>Medium</td>
<td>C-144</td>
<td>Mason’s Sand, Mortar Sand, 3 mil, Regular 8, Number 8</td>
</tr>
<tr>
<td>Coarse</td>
<td>C-33</td>
<td>Washed Sand, Concrete Sand</td>
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Wedel, 2000
Sand Lanes –
Separate Cleaned Sand
Typical Flush Flume and Sand Settling Lanes

- Scrape Barn Alley
- Flush Flume
- Sand Settling Lane
- Sand Storage
- Pump 2,000-2,500 GPM
- Third Stage Storage
- Second Stage Storage
- First Stage Storage
Typical Flush Flume and Sand Settling Lanes

**Design Criteria:**

- **Pump Capacity** – 2,000-2,500 gpm
  - Screen Inlet for Trash
- **Dual Lanes** – 12’ wide
  - Length varies
  - Slope (0 - 1/4%)
  - Depth (8 - 12”)
  - Equipment Access Ramps
  - Energy Dissipater at Inlet
- **Organic Matter Settling** (optional)
- **Sand Drain Back Slab**
- **Sand Mixing & Storage Slab**
One Lane Drains & is Cleaned while Other Is Used
Cleaned Water Pumped To Flush Flume
Deposits in Sand Lane
Stage 1 Storage
Flushed Manure to Single Sand Lane
Flushed Manure to Single Sand Lane
McLanahan Sand Separator
Cyclone Separator
Sprayer
Sand Removal Auger
Sand Accumulation
Mixing/Settling Hopper
Discharge
Overflowing Hopper
Sprayer
Cyclone Separator
Parkson Tru-Grit Separator
Parkson Tru-Grit Sand Separator

Manure In

Sand Out

Manure In

Manure Out

Water In

Manure In
Accent Separator
Yields Sandy Manure Solids
Sand Traps –
Separate Cleaned Sand
Sand Trap for Flush System

Inlet

Ramp Down

Inlet

Screened Opening

Ramp Down
Sand traps are basically a 3 to 4 deep basin at the end of the alleys. The basin has a 24 ft level bottom between the drop off and ramp. The flush water remains in the basin 2 to 4 minutes allowing time for the sand to settle and the rapidly drains away through one 18” pipe or two 12” pipes.
Some organic matter remains on top of the sand in a sand trap, this material is washed away with the next flush, if the retention time is to long, manure will settle out with the sand.
Joe Harner
Kansas State

Drain from Free Stall Alleys – flush water flows up "beach"

Sand is stacked on the beach and drains back to the sand lane along the wall
Settling Basin – Yields Dirty Sand
Plan View - Sand Settling/Storage Basins

- INLET
- SETTLING BASIN
- OVER FLOW WEIR
- STORAGE BASIN
- OPTIONAL AUGER
- RAMP DOWN
Cut Away - Sand Settling / Storage Basins

SETTLING BASIN

STORAGE BASIN

INLET

OVER FLOW WEIR

ACCUMULATED SAND

DRIVABLE BOTTOM

MANURE AND LIQUIDS
Settling Tank
Conventional Removal from Sand Settling Basins/Tanks =

Skim and Haul =

Slurry Pumped Off First Wet Sand/Solids Bucketed Out
Variation on Skim and Haul

Watch Video? Yes
Houle Sand Settling Basins Following Flush Flume
Manure Storage Down Stream of Houle Sand Settling Basins
Settling Basin Following Flush Flume
Weeping Wall Chamber – Yields Dirty Sand
Concrete manure storage basin using tri-bar hog flooring in the walls. The outside basis shown are 26 ft wide. The interior wall has 8 ft solid section and 8 foot of flooring. The basin is sized to provide 1.25 cu.ft./cow/day storage with 30 to 45 days storage on each side.
As the basins fill, the hog flooring will plug and prevent water from draining out of the basin. Weekly scraping of the screen helps release more of the water.
Questions