MWEA Collection System Seminar

September 11, 2014

FLOW METER OPERATION & MAINTENANCE
Operations & Maintenance

• Permanent Meters
• Billing meters
• Meters used for Temporary Studies
Area - Velocity Flow Meter

- **Continuity Equation** $Q = A \times V$
- $Q =$ the volumetric flow rate
- $A =$ the cross sectional area of the flow
- $V =$ the mean velocity
Area Velocity Flow Meters
Area Velocity (Continuous Wave Doppler) Flow Meters

Advantages
- Easy installation & maintenance.
- Can measure flows down to 1 inch of level.
- No enclosure required.
- Relatively low cost.

Disadvantages
- Accuracy of $\pm 5\%$ in normal field conditions.
- Maintenance required (Sensor subject to fouling and grease).
Doppler - Area Velocity Meter Probe
Pressure - Depth sensor
Doppler - Area Velocity Meter Probe
Atmospheric Pressure
Pressure Sensors

- Atmospheric vent tube
DESICCANT - ATMOSPHERIC REFERENCE

- Blue is good!!
DESICCANT
It’s time to replace the desiccant
Pressure Sensors are expensive
Pressure - Depth sensor
Communicate with Maintenance staff
Site Selection - ?
Range Gated Doppler Flow Meter
ADFM

- Ultrasonic level sensor
ADFM Velocity Profile
Full Pipe Flow Meter (ADFM)
ADFM Flow Meter

- AC or DC powered
Radar Flow Meter
Radar Flow Meter
Radar Flow Meter
Radar Flow Meter
## Radar Flow Meters

### Advantages
- Non-contact level and velocity sensors.
- Will work in large & small pipes.
- Easy installation & maintenance.
- No enclosure required.
- Relatively low cost.

### Disadvantages
- Accuracy of $\pm 5\%-\%$ in normal field conditions.
- Surface velocity only.
- Requires trained technician for repair and calibration.
LASER - FLOW METER
LASER FLOW METER

- No contact with the flow
LASER FLOW METER

- Multiple velocity reads
LASER FLOW METER

- No contact with the flow
Laser Flow Meters

**Advantages**
- Non-contact level and velocity sensors.
- Multipoint profile, (15 measurements 5 horizontal and 3 vertical)
- Depth measurements (5%, 8% and 11% of depth)
- No enclosure required.
- Relatively low cost.

**Disadvantages**
- Accuracy of $\pm 5\%$ in normal field conditions.
- Maximum depth penetration is 6”
- Therefore the meter is seeing peak velocity and is unable to see the full profile of the flow
- Requires trained technician for repair and calibration.
Magnetic Flow Meter
Magnetic Field
Magnetic Flow Meter Probe
Magnetic Flow Meter Probe
Battery Powered Meters

- You get what you pay for
TRANSIT-TIME FLOW METER

- Multi-Path Meter
Transit-Time Flow Meter
Transit-Time Flow Meter
Transit Time Flow Meters

Four-path single-plane flow measurement configuration

Model 7658 Internal mount transducer

Path 4
Path 3
Path 2
Path 1

This configuration produces better than ±1% of true flow accuracy.
Transit-Time Flow Meters

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
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<tr>
<td>• High degree of accuracy (+2 to 5%) – Open Channel. (+0.5%) Full pipe application.</td>
<td>• Relatively high cost.</td>
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<td>• Good for large pipes.</td>
<td>• Air entrainment can cause issues.</td>
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<td>• Wide flow range.</td>
<td>• Requires a skilled technician and specialized equipment.</td>
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<td>• Ability to handle poor hydraulics.</td>
<td>• Above ground enclosure required.</td>
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• Cable Repair
  – Don’t step on the cables. You can nick the cable jacket and this may allow moisture to cause short circuits.
  – Most cables can not be repaired.
  – If the cable or probe are damaged, it is very costly to replace.
Magnetic (MAG) Flow Meter
Magnetic Flow Meters
Magnetic Flow Meters

**Advantages**
- High degree of accuracy (±0.5%) and consistent over full flow range when calibrated properly.
- No obstructions to flow.
- No moving parts.
- Wide flow range.
- Fixed area measurement

**Disadvantages**
- Requires a FULL pipe
- Relatively high construction cost.
- Power supply is required.
- Repairs require skilled technician and specialized equipment.
- Electronic components vulnerable to lightning damage.
Verify Your Information

UNIVERSAL
HUGE, PUBLICLY FUNDED
PROJECT CHECKLIST

- Come up with an idea.
- Get people really excited about it.
- Find some expert to say it will be financially feasible.
- Build it.

Watch it struggle, but live up to projections and cost taxpayers way more than they were told.

Verification
Pull out the maintenance file and check the settings
Check all of the settings
Parshall Flumes
Ultrasonic Down Looker
Parshall Flumes

**Advantages**
- High degree of accuracy (+2%) and consistent over full flow range when calibrated properly.
- No moving parts.
- Wide flow range.
- Sediment control.

**Disadvantages**
- Relatively high construction cost.
- Level measurement required.
- Possible construction flaws.
Parshall Flumes

Diagram showing a parshall flume with labeled parts including:
- Water surface
- Submerged flow
- Level floor
- Free flow
- Station 1
- Zero reference level for $H_a$ and $H_b$
- Slope 1/4
Parshall Flume with Foam
Parshall Flume with Solids
The Data Looks Good ????
Verify the As-Built Information
Velocity Profiling
Portable Velocity Meter

- Send it back to the factory once per year to be re-certified
Velocity Profile
Why isn't there any velocity reads?
Flow Lab Verification
Flow Lab Verification
Any Questions?