Continuous Flow Monitoring

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Water Board Academy / College of Storm Water
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Overview

- Need for continuous streamflow and BMP monitoring
- Current regulatory requirements for monitoring
- Challenges
- A draft 3-point plan:
  - Incentivize
  - Ensure data quality and consistency
  - Create central shared repository
- Discussion
Need for long-term continuous streamflow and Hydromod-BMP monitoring

- Calibration/validation of hydrologic models
- Verification of BMP design/operation
- Quantification of in-stream flow duration changes
- Test assumptions that underpin our current hydromodification management approach
- Adaptive management
Existing streamflow gauge system is sparse, most on basins >100sq-mi
San Diego County – R9-2007-0001
- HMP dated March 2011 - see next slide for discussion of flow monitoring

Ventura County – R4-2010-0108 (July 8, 2010)
- Attachment F - Monitoring Program – requires protocols for ongoing monitoring
  - May meet this requirement by participation in SCCWRP study and SMC

N. Orange County – R8-2009-0039, amended by R8-2010-0062
- No specific hydromod monitoring requirements

S. Orange County – R9-2009-0002
- Hydromod Plan (Oct 25, 2012) monitoring components only include stream benthic community and channel incision and widening
- No flow monitoring

LA County – R4-2012-00175 (Nov 8, 2012)
- Attachment E - Monitoring and Reporting Program
  - States that “Flow may be estimated using USEPA methods at receiving water monitoring stations where flow measuring equipment is not in place.”
  - Requires HMP within 1-yr; to include monitoring and effectiveness assessment

Central Coast – Resolution R3-2013-0032, Draft Post-Construction Requirements (July 12, 2013)
- No apparent monitoring requirements

Phase II – Small MS4 General Permit
- Specifies flow monitoring using pressure transducer or stage gage, but time period not clear
- Applies only to traditional permittees pop >50K that aren’t doing ASBS, TMDL or 303d monitoring
San Diego County MS4 Permit

- Requires a monitoring program to evaluate HMP effectiveness, per Sect. D.1.g(1)(k) of the Regional Board Order R9-2007-0001

- Monitoring:
  - Streamflow - HOBO level loggers
  - Rating curve (stage-discharge relationship)
    - SonTek FlowTracker Acoustic Doppler Velocimeter
  - Sediment Transport
    - Turbidity - YSI 6600 meters with 6136 optical turbidity probes
    - Bedload transport - US BLH-84 handheld wading bedload sampler
  - Precipitation – portable rain gauges
  - BMP (inflow and) outflow
Table 4 Recommended Field Indicators include:

- **Stream flow**
  - Assessment endpoint: long term flow magnitude and duration
- **BMP inflow and outflow**
  - Assessment endpoint: discharge magnitude and duration
## Cost Estimates
(From SCCWRP TR752)

**Table 6. Unit costs for one-time up front and recurring annual monitoring of major indicators.**

<table>
<thead>
<tr>
<th>Flow</th>
<th>One time, up front costs</th>
<th>Recurring Annual Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>pressure transducers</td>
<td>$1,250</td>
<td>annual data download/processing</td>
</tr>
<tr>
<td>station set up</td>
<td>$1,000</td>
<td>$5,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$2,250</td>
<td></td>
</tr>
</tbody>
</table>

| Biology and Geomorphology     |                          |                                 |
| site recon & selection        | $2,000                   |                                 |
| access and permits            | $1,000                   |                                 |
| **Total**                     | $3,000                   |                                 |

| Flow                          |                          |                                 |
| Field geomorphic assessment   | $2,000                   |                                 |
| field collection of inverts and algae | $2,000         |                                 |
| CRAM                          | $1,000                   |                                 |
| benthic inverts taxonomy      | $600                     |                                 |
| diatoms taxonomy              | $400                     |                                 |
| data entry, QA/QC            | $500                     |                                 |
| **Total**                     | $6,500                   |                                 |
Challenges

- Equipment costs
- Equipment security
- Labor costs:
  - Equipment installation
  - Development of a rating curve
    - Should have velocity and x-section measurements at a min of 6 stages representing the range of expected flows
  - Monitoring for significant x-sectional changes
  - Data downloads
  - Data integrity - QA/QC process
  - Data management
  - Data analysis and interpretation
- Resolution of precipitation data?
What’s at Stake?

Without continuous streamflow monitoring, no way to evaluate change in long-term duration of erosive flows.

From Judd Goodman’s presentation
It's the temporal analogue of this spatially inadequate sampling situation
So… A Draft 3-Point Plan for Moving Forward

1. Incentivize continuous flow monitoring
2. Ensure data quality and consistency
3. Utilize a central, shared repository
Incentivize!

- Better / cheaper equipment options
  - NEON aquatic monitoring – equipment standards/protocols
  - X-Prize to develop cheap and easy continuous streamflow data collection?
- Creative collaborations for data collection and processing
  - Could be great research project for local university or maybe even high school
- Establish a fund to pay for continuous stream flow monitoring in the most meaningful places, using fees from other projects where monitoring isn’t useful
Data Quality / Consistency

- Establish standards for equipment deployment and data collection
- NEON Aquatic Monitoring protocols
NEON Aquatic Monitoring

Aquatic Instrument System (AIS)

- **Aquatic In stream sensors**
  - Water temp, DO, turbidity, pH, conductivity
  - Chromophoric dissolved organic matter
  - Chlorophyll
  - **Discharge/water level**
- **Stream-side – meteorology**
  - Air temp, precipitation, barometric pressure, PAR, net radiation
  - Wind speed and direction
  - Camera
- **Groundwater sensors**
  - Temperature, level and conductivity
NEON Aquatic Monitoring

Sensors and Infrastructure Designs

- COTS Sensors and Instruments
- Sensor measurement defined
- Sensor manufacturers being selected
  - Awaiting NSF approval
- Sensor installation designs ongoing
- Make designs available to the public

- Accepting applications for an instrumentation working group
  - General discussions
  - Workshops
NEON Aquatic Sensor Selection, Infrastructure Design, Data Management Protocols

All designs, protocols and data will be publically available
Estimated by end of 2013
Stream flow data ➔ CEDEN
- California Environmental Data Exchange Network - www.ceden.org
- Central location to find and share information about CA’s water bodies, including streams, lakes, rivers, and the coastal ocean.
- Aggregates data from multiple monitoring efforts across the state and makes them available to public.

BMP inflow/outflow data ➔?
- Possibly incorporate into ASCE Water Quality Data Base or develop similar program
- Establish standard set of reporting parameters
- Use to inform new designs / compliance planning
Discussion

or

?
Appx A – Bibliography of Source Info on Streamflow Measurement

   - Volume 1. Measurement of Stage and Discharge
   - Volume 2. Computation of Discharge
