WY 2015
MONITORING DESIGN

SUPPORT FOR MQ1:
IDENTIFICATION OF HIGH LEVERAGE WATERSHEDS AND SUB-WATERSHEDS

SOURCES PATHWAYS AND LOADINGS
WORKGROUP MEETING
SPRING 2014
PREVIOUS METHODS

Long-Term Loads Monitoring
Stormwater Characterization
• Continuous flow, turbidity
• Annual loads from continuously estimated POCs
• Regressions of grab sample data with turbidity or flow
• Average Particle Ratios for each hydrophobic POC
QUESTIONS FOR THE WORKGROUP

Primary question: What is the most cost effective monitoring design scenario for MQ1: Identifying and ranking (high/medium/low) polluted drainages?

Q1. Monitoring Design Scenarios: Which scenario provides the best trade-off between scientific rigor (# samples, method inter-comparison), number of sites visited (maximum identification of leverage areas), and analytes included?
   - Should other monitoring scenarios be considered to ensure data are useful for other management questions?
   - Should the trace metals suite be added to the analyte list as an indicator of urbanization or source areas (generally, and specifically in association with PCBs/Hg)?

Q2. Remote Sampler Methods: Which method is likely to provide the most comparable results for PCBs and Hg? Are there other samplers we should use?
   - To provide comparison between manual and passive designs?
   - To provide comparison between sites of differing watershed characteristics?

Q3. Site Selection Rationale: What is the right balance of sites chosen based on each rationale in relation to the primary question?
   - Are there other rationale that could be considered to ensure data are useful for other management questions?
GOAL: Identify high leverage watersheds; develop input data for other management questions.
Guadalupe R. at Hwy 101

The graph illustrates the estimated PCB concentration (pg/mg) over the accumulated samples collected during the monitoring program. The data is represented using running means with different sample sizes: (n=4), (n=8), and (n=16). The running mean (n=16) is shown in green, (n=8) in blue, and (n=4) in orange. The horizontal dashed lines indicate the concentration thresholds.
Item #5

PCB (ug/kg) (1 composite)

- Pulgas Ck (North)
- Sunnyvale East Ch
- North Richmond PS
- San Leandro Ck
- Zone 4 Line A
- Guadalupe R.

PCB (ug/kg) (2 composites)

- Pulgas Ck (North)
- Sunnyvale East Ch
- North Richmond PS
- San Leandro Ck
- Zone 4 Line A
- Guadalupe R.
Trade-off: More sites, or more certainty about each site?
QUESTIONS TO THE WORKGROUP

Is one composite sample per site sufficient to distinguish high vs low polluted watersheds?

Does one composite provide sufficient certainty for developing input data to the RWSM or for other management questions?
Goal: Identify a remote sampling method that reproduces similar results in ranking watersheds in terms of pollutant concentrations

Questions for workgroup:

- Are there other remote samplers we should consider?
- Which sampler is likely to produce the most useful PCB and Hg information relative to our management questions?
- How many sites and samplers per site should we test?
REMOTE SAMPLER OPTIONS
(SEE HANDOUT)

Single-stage siphon sampler

- Air vent
- Intake tube
- Water level in sample bottle at end of sampling
- Intake nozzle
- 0.5-liter sample bottle
- Approximate water level in stream at beginning of bottle filling
- ROD
- AIR VENTS
- BALLAST
REMOTE SAMPLER OPTIONS
(SEE HANDOUT)

Walling Tube Sediment Trap
REMOTE SAMPLER OPTIONS
(SEE HANDOUT)

Hamlin Sediment Trap

![Hamlin Sediment Trap Image]

Mercury

<table>
<thead>
<tr>
<th>Method</th>
<th>mg/kg dw</th>
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<tbody>
<tr>
<td>Fuller</td>
<td>0.15</td>
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<tr>
<td>Hamlin</td>
<td>0.2</td>
</tr>
<tr>
<td>Norton-FL</td>
<td>0.15</td>
</tr>
<tr>
<td>Norton</td>
<td>0.2</td>
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<tr>
<td>Centrifuge</td>
<td>0.25</td>
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</table>
Goal: Identify a remote sampling method that reproduces similar results in ranking watersheds in terms of pollutant concentrations

Questions for workgroup:

- Are there other remote samplers we should consider?
- Which sampler is likely to produce the most useful PCB and Hg information relative to our management questions?
- How many sites and samplers per site should we test?
Question: What inter-comparison component should be done and at what level?

8 discrete grab samples VS 8-aliquot composites

Which analytes?
SSC and Hg, and PCBs?

Particulate and PCB and Hg concentrations in water VS Particulate PCB and Hg concentrations in sediment

Our recommendation:
6
Q1. Monitoring Design Scenarios: Which scenario provides the best trade-off between scientific rigor and number of sites visited?

- Should other monitoring scenarios be considered that might ensure the data are useful for other management questions?
## MONITORING OPTIONS

<table>
<thead>
<tr>
<th>Sampling design</th>
<th>Composite Sites</th>
<th>Number of Remote Sampler Types/Site</th>
<th>Remote Sampler Sites</th>
<th>Remote Sampler Only Sites</th>
<th>Total Sites</th>
<th>Option</th>
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<tbody>
<tr>
<td>Composite-1</td>
<td>24</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td>30</td>
<td>A</td>
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<td></td>
<td>20</td>
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<td></td>
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<td>26</td>
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<td>Composite-2</td>
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<td>1</td>
<td>6</td>
<td>6</td>
<td>18</td>
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<td></td>
<td>16</td>
<td>D</td>
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<td>Composite-3</td>
<td>8</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td>14</td>
<td>E</td>
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<td></td>
<td>7</td>
<td>2</td>
<td></td>
<td></td>
<td>13</td>
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*All options assume inter-comparison study at allocations presented previously.*
**Question:**
Should the trace metals suite be added to the analyte list as an indicator of urbanization or source areas (generally, and specifically in association with PCBs/Hg)?

<table>
<thead>
<tr>
<th></th>
<th>Cd</th>
<th>Zn</th>
<th>Cu</th>
<th>Pb</th>
<th>As</th>
<th>Ag</th>
<th>Cr</th>
<th>Ni</th>
<th>Fe</th>
<th>Al</th>
<th>Mn</th>
<th>Se</th>
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<td><strong>PCBs</strong></td>
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<tr>
<td>Z4LA</td>
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<td>0.49</td>
<td>-0.19</td>
<td>0.47</td>
<td>0.22</td>
<td>-0.03</td>
<td>0.07</td>
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<td>-0.05</td>
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<tr>
<td>Guadalupe</td>
<td>0.75</td>
<td>0.76</td>
<td>0.74</td>
<td>0.82</td>
<td>0.55</td>
<td>0.44</td>
<td>0.26</td>
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<tr>
<td>Z4LA</td>
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<td>0.72</td>
<td>0.82</td>
<td>0.81</td>
<td>-0.16</td>
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<td>0.37</td>
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<td>Guadalupe</td>
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<td>0.44</td>
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</tbody>
</table>

A dash (-) indicates p>0.05; * p<0.05; ** p<0.01; *** p<0.001

Are there any specific Hg and PCB source areas that are also characteristically sources of trace metals?
Site Selection Rationale: What is the right balance of sites selected for characterization based on each rationale in relation to the primary question?

- Are there other rationale that could be considered that might ensure the data are useful for other management questions?
## SITE SELECTION RATIONALE

Based on a hypothetical number of sites: **20**

<table>
<thead>
<tr>
<th>Rationale</th>
<th>% Allocation</th>
<th>Sites #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sites representative of broad environmental gradients (e.g. size, imperviousness)</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>1. Identify high leverage watersheds (distributed across Phase I permittees)</td>
<td>60-70%</td>
<td>14</td>
</tr>
<tr>
<td>• Watersheds with suspected high pollution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Sites with ongoing or planned management actions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Identify sources (nested sampling design)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Strategic large watersheds (n=4) with USGS gauges</td>
<td>1 site/yr</td>
<td>1/20</td>
</tr>
<tr>
<td>3. Validating false negative findings or unexpected concentrations</td>
<td>10-15%</td>
<td></td>
</tr>
<tr>
<td>4. Sites to fill gaps along environmental gradients or source areas</td>
<td>10-15%</td>
<td></td>
</tr>
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</table>
End
## MONITORING OPTIONS

<table>
<thead>
<tr>
<th>Equivalent Costs</th>
<th>Sampling design</th>
<th>Number of Storms/Site/Year</th>
<th>Number of Sites</th>
<th>Uncertainty Level</th>
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<tbody>
<tr>
<td>Composite-1</td>
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<td>21</td>
<td>High</td>
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<td>Composite-2</td>
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<td>11</td>
<td>Medium</td>
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<tr>
<td>Composite-3</td>
<td>3</td>
<td>7</td>
<td>Lower</td>
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</table>

<table>
<thead>
<tr>
<th>Passive Sampler</th>
<th>Number of Sampler Types/Site</th>
<th>Number of Sites</th>
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</thead>
<tbody>
<tr>
<td>Options</td>
<td>1</td>
<td>6</td>
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<td>Options</td>
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<td>6</td>
</tr>
<tr>
<td>Options</td>
<td>?</td>
<td>?</td>
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</tbody>
</table>
Sunnyvale East Channel

- Running mean (n=4)
- Running mean (n=8)
- Running mean (n=16)

Estimated PCB (pg/mg)

Accumulated samples collected during monitoring program
Question:
Are the results biased due to seasonal effects on antecedent moisture, storm magnitude, and mobilization processes?
Question:
Are the results biased due to seasonal effects on antecedent moisture, storm magnitude, and mobilization processes?
REMOTE SAMPLER OPTIONS
(SEE HANDOUT)

Screened Inline Flow Through Sediment Trap (SIFT)
REMOTE SAMPLER OPTIONS
(SEE HANDOUT)

Continuous low-level aquatic monitoring sampler (CLAM)

Disassembled View
CONTINGENCY PLAN?
WHAT TO DO IF DROUGHT CONTINUES?
EL NIÑO PREDICTED
PARTICLE RATIO DATA QUALITY

Guadalupe R. at 101

Zone 4 Line A
METHODS AND MANAGEMENT QUESTIONS

MQ1: Contributions to Impairment
MQ2: Bay-wide Loads
MQ3: Trends
MQ4: Management Effectiveness

- Stormwater Characterization Monitoring
- Regional Watershed Spreadsheet Model
- Long Term Loads Stations
- Monitor Downstream of Management Actions
- Monitor Source Areas
- Bay - Margins Model