Follow-up Investigations from Multi-media Data Collection

Dave Dilks

Spokane River Regional Toxics Task Force

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Task Description

- Original Scope
  - Identify river reaches where multi-media (i.e. water, sediment, biofilm) data indicate effects from non-point sources
  - Provide a best estimate of the mass loading and aerial extent of contamination
  - Prioritize identified reaches for further study
- Current Focus
  - Data strongly suggest Mission Reach should be the priority segment
  - What steps could we take next to identify source of contamination?

Data Considered

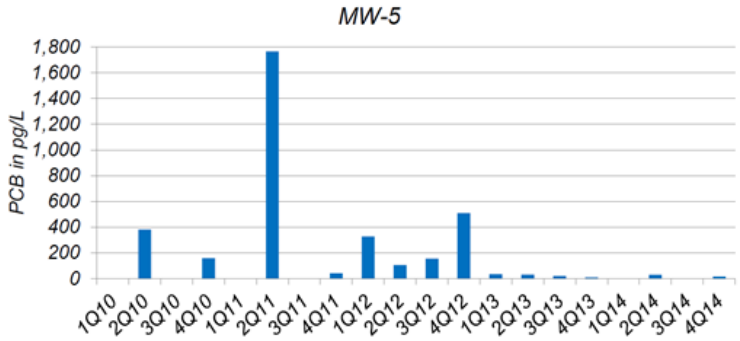
- Water Column
  - 2014, 2015, 2018 synoptic surveys
- Biofilm
  - 2018, 2019 Ecology surveys
- Sediment
  - 2018 Ecology (biofilm) survey
- Groundwater
  - 2010 – 2019 up-gradient of Kaiser

Prioritization of Reaches for Further Study

Reach	Biofilm (ppb)	Water Column Mass Balance (mg/day)	Sediment (ppb)	Comments
Upstream of Barker	<200	Negligible	No data	
Barker to Trent	500-1000	~130	14	Kaiser plume being addressed, up-gradient sources significant?
Trent to Upriver Dam	300-1400	Net negative	14	
Upriver Dam to Greene	600-1500*	Net neutral	No data	*Small PCB signal (~2000 ppb) in biofilm near GE site
Greene to USGS Gage	>2000	~40	90-130	
USGS Gage to Nine Mile	300-700	~40	No data	

Kaiser Up-Gradient Groundwater Task

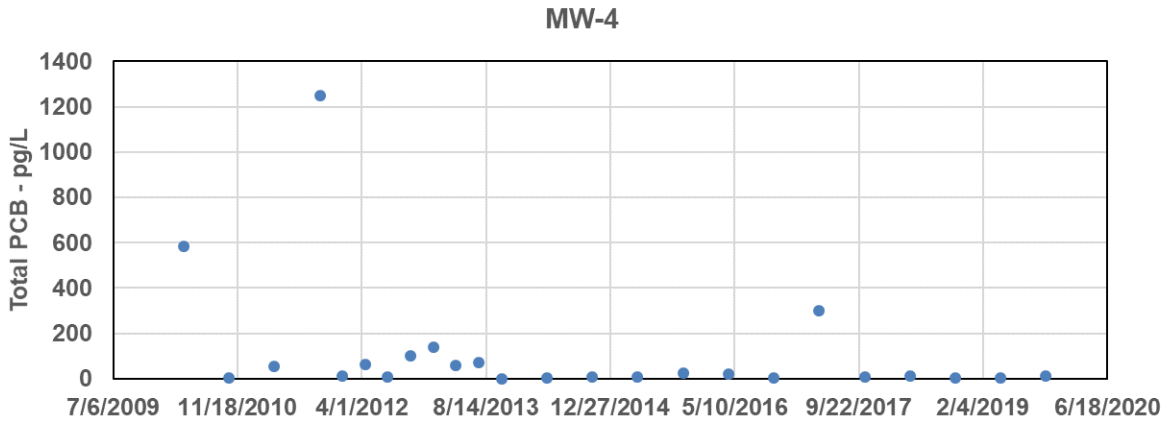
- Prior evaluation of up-gradient contribution was inconclusive due to mostly low concentrations with occasional spikes

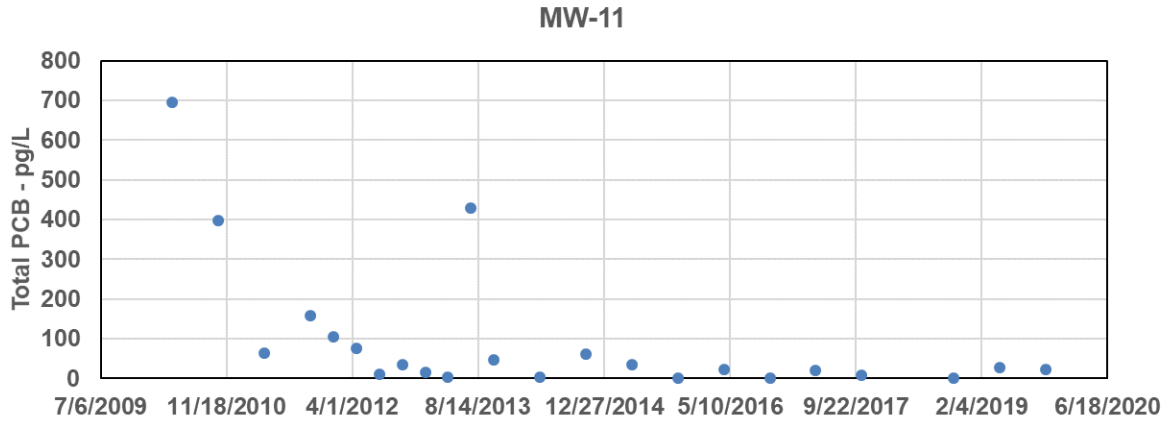


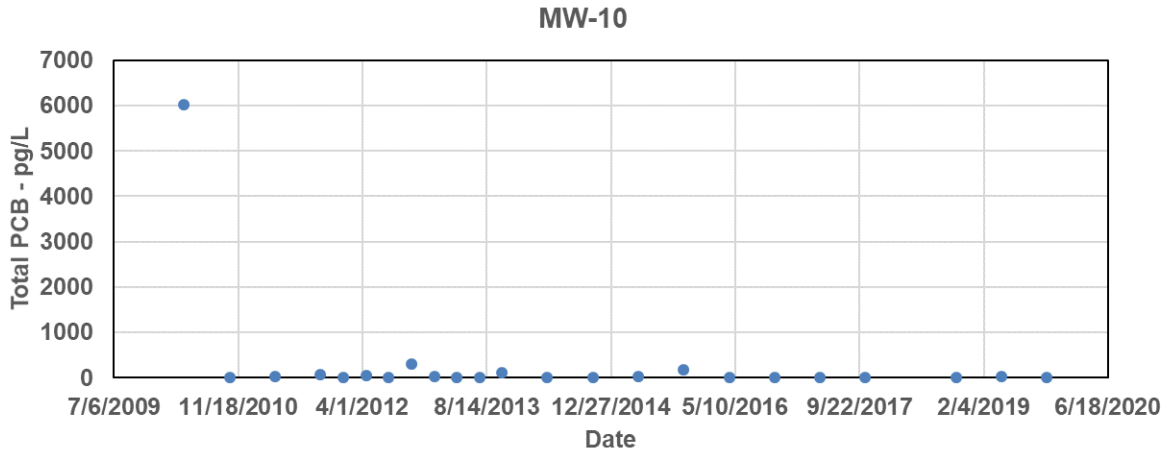
- Review recent data, make a qualitative determination of whether future study of up-gradient PCB sources is warranted

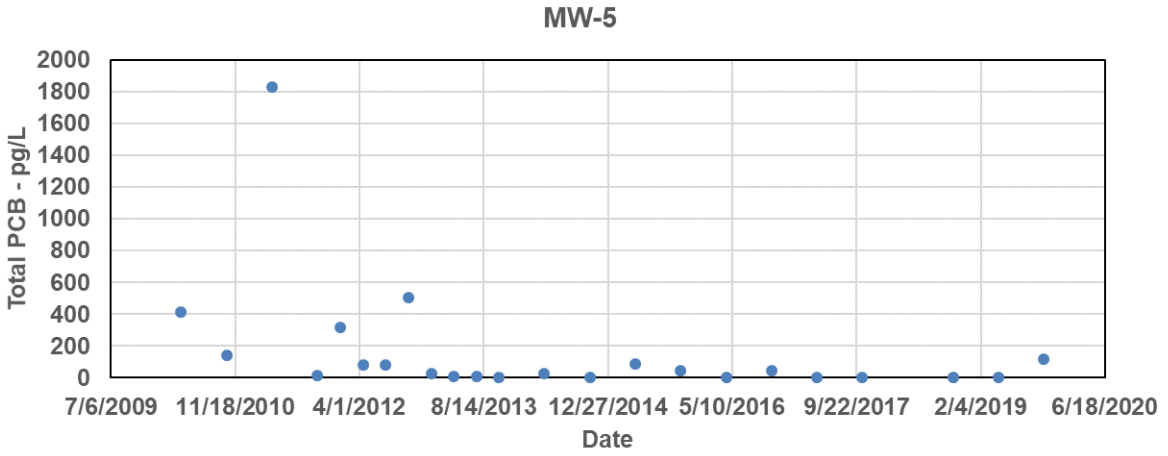
Kaiser Up-Gradient Groundwater

- No concentrations >400 ug/l observed since mid-2013
  - Additional investigation of up-gradient source does not appear necessary
  - Defer final conclusions until after TetraTech study is complete









Prioritization of Reaches for Further Study

- Greene to USGS Gage reach has highest biofilm and sediment PCBs
- Barker to Trent already being addressed via Kaiser remediation

Reach	Biofilm (ppb)	Water Column Mass Balance (mg/day)	Sediment (ppb)	Comments
Upstream of Barker	<200	Negligible	No data	
Barker to Trent	500-1000	~130	14	Contribution of sources up-gradient of Kaiser looking un-important
Trent to Upriver Dam	300-1400	Net negative	14	
Upriver Dam to Greene	600-1500*	Net neutral	No data	
✓ **Greene to USGS Gage**	>2000	~40	90-130	Top priority
USGS Gage to Nine Mile	300-700	~40	No data	

Initial Environmental Forensics

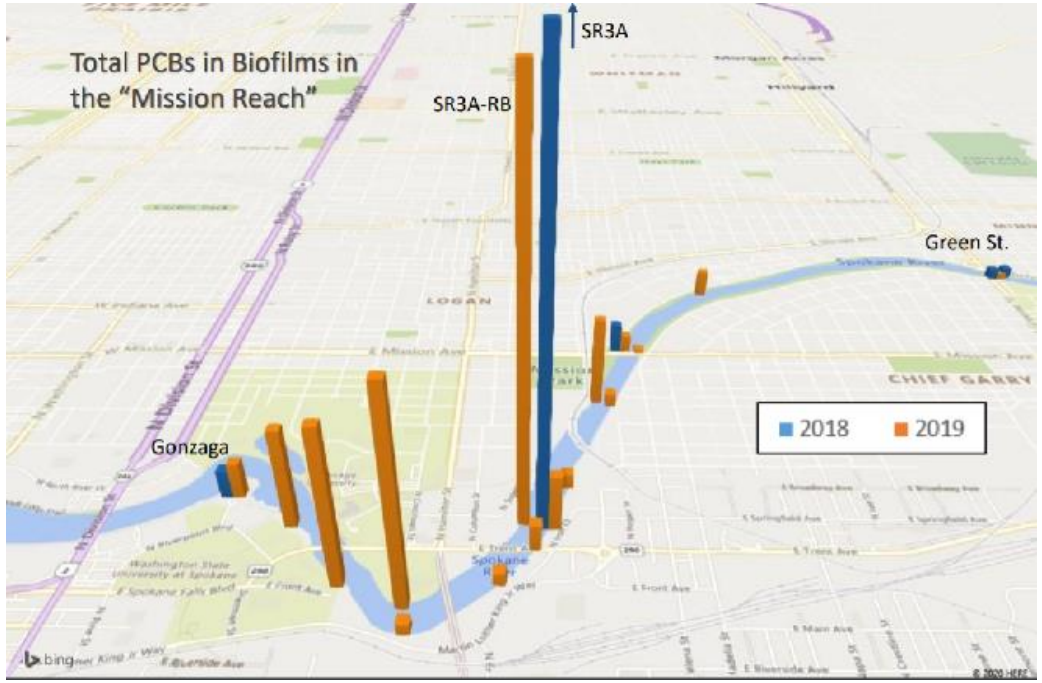
- Examine available data to help identify a possible source
  - Potential source categories
  - Spatial distribution of contamination
  - Transport mechanisms between potential source and river

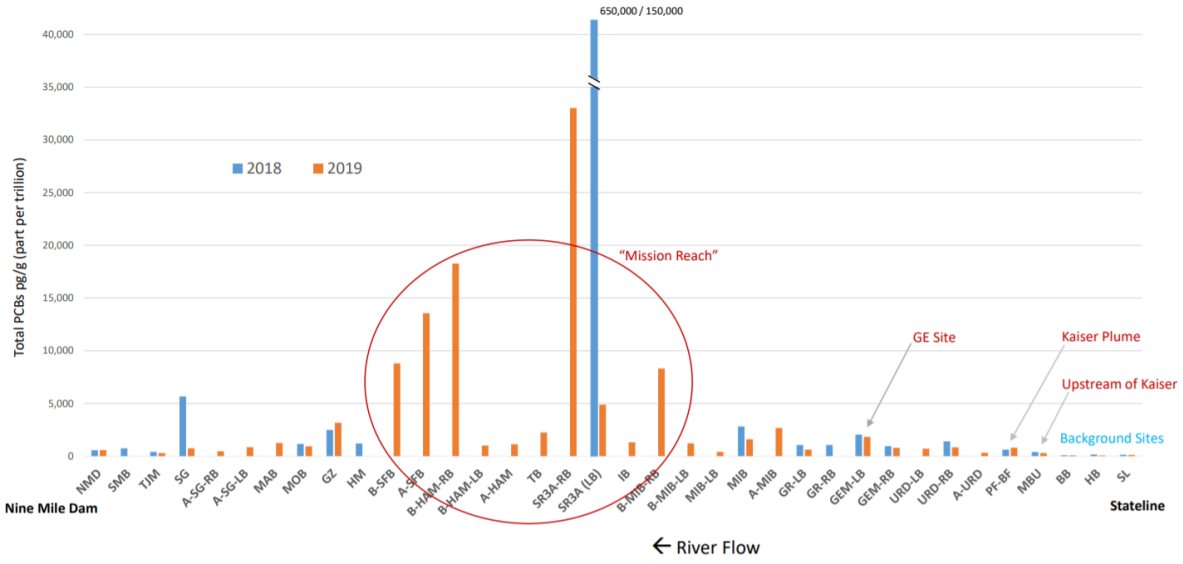
Initial Forensics towards Defining a Source

- Potential source categories
  - Contaminated river fill
  - Contaminated bottom sediments
  - Landside surface contamination
  - Landside subsurface contamination
    - Near-bank or further upland

Initial Forensics towards Defining a Source

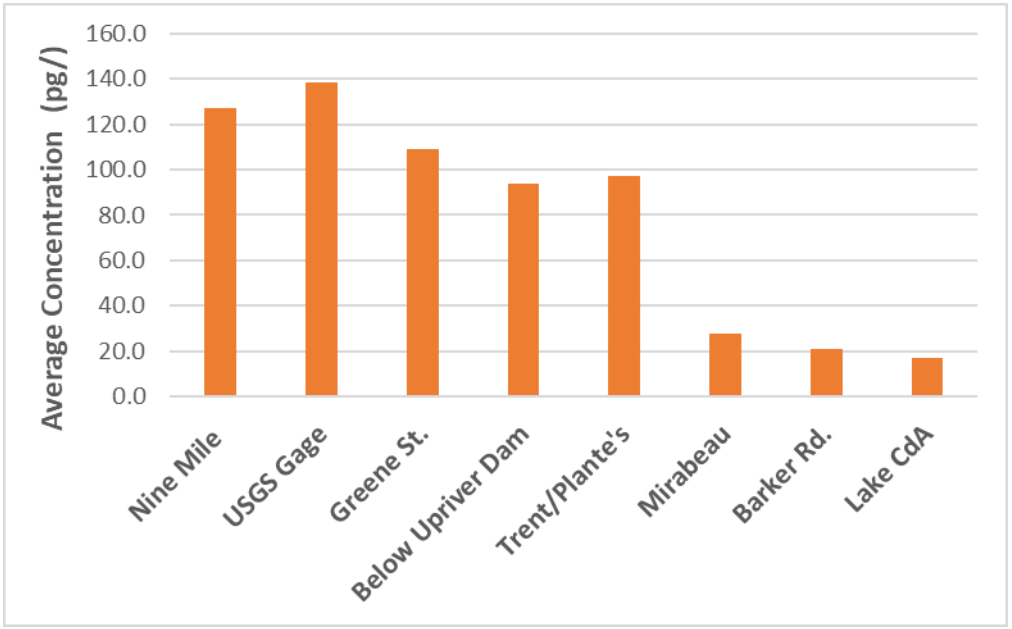
- Spatial distribution of biofilm PCB concentration
  - Biofilm PCB concentrations elevated in Mission Reach
  - Concentrations revert to background levels downstream of Mission Reach





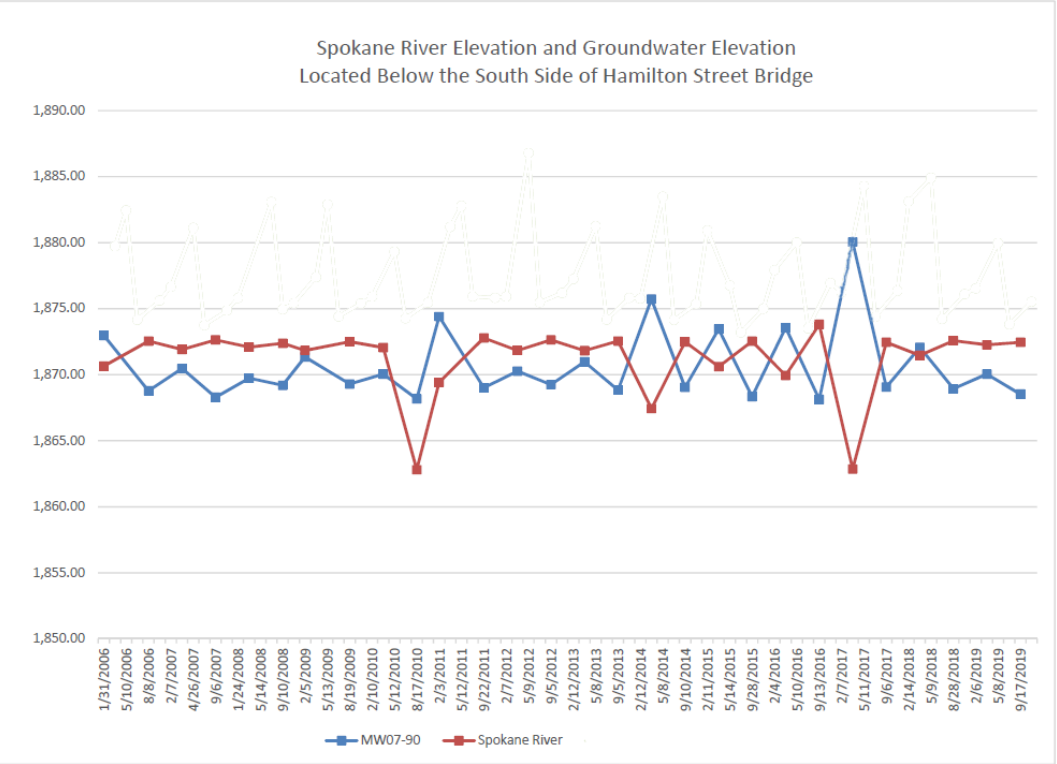
Initial Forensics towards Defining a Source

- Spatial distribution of water column PCB concentration
  - No significant increase in water column PCB concentrations downstream of hot spot



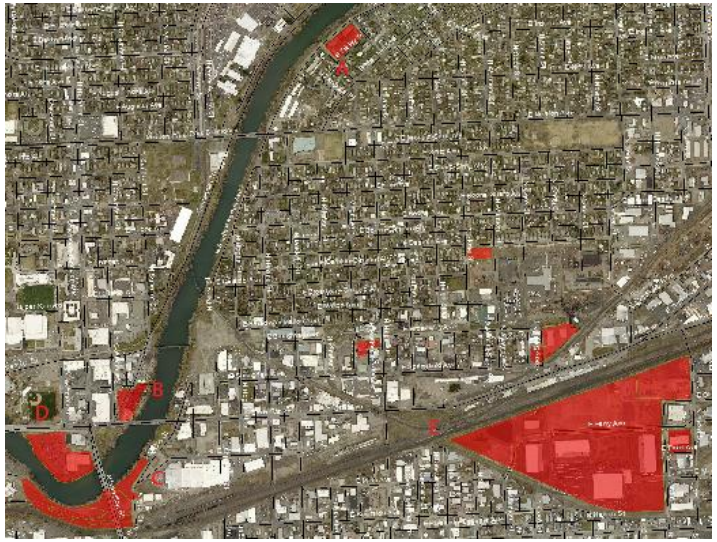
Initial Forensics Examine Delivery Pathways Source

- Continuous groundwater loading pathway doesn't exist
  - Contaminated area is in a losing reach, i.e. net loss of river flow to groundwater
  - Segment can be gaining at select times and locations
    - Groundwater elevation at Hamilton St. bridge is occasionally above river level



Initial Forensics towards Defining a Source

- Stormwater and CSO outfalls exist in Mission Reach
  - Elevated PCB concentrations observed in outfalls near Trent Bridge
  - City of Spokane hazard assessment indicates areas of historical contamination, e.g.
    - “Playfair Race Track – 2400 E. Main: 2002 Phase I assessment showed high PCB levels on some testing and high potential for more in the region. Multiple PCB containing transformers were known to be at the site as well.”



  - No evidence of particularly stormwater high concentrations upstream of SR3A
  - Downstream MS4/CSO loads are higher with no apparent biofilm impact

Initial Forensics towards Defining a Source: Key Points

- Biofilm PCB concentrations elevated in Mission Reach revert to background levels downstream of hot spot
- No concurrent increase in water column PCB concentrations downstream of hot spot
- Stormwater and CSO pathways exist
- Groundwater pathway exists
  - At select times and locations

Competing Evidence in Terms of Source Origin

Potential Source	Arguments in Favor	Arguments Against
Contaminated Bottom Fill	• Consistent with localized biofilm contamination, absence of water column impact	• Fill has been there many decades, likely “spent”
Contaminated Bottom Sediments	• Consistent with localized biofilm contamination, absence of water column impact • Anecdotal evidence of buried drum	• High energy segment with little deposition makes historical sediment contamination unlikely
Upland Surface Contamination	• MS4 and CSO outfalls exist in area	• Existing outfall concentrations aren’t compelling
Upland Subsurface Contamination	• Known areas of historical contamination exist • Localized times of gaining	• Net losing reach • No downstream signal in biofilm or water column

How Can We Explain Observed Spatial Patterns with An Upland Source?

- Absence of water column signal could be explained by intermittent loading (e.g. stormwater/CSO loads or intermittent groundwater)
  - If intermittent loading didn't occur during times of water column sampling, that would explain the absence of water column signal
- No solid explanation for lack of a downstream biofilm signal
  - Particulates from MS4/CSO loading settle to the bottom?
  - Biofilm serves as biological treatment system??
    - Scavenges load from water column before downstream biofilm is contaminated

Potential Next Steps

- Narrow down potential for groundwater contribution
- Deeper dive into surface soil contamination
- Determine likelihood of bottom fill contribution
- Additional biofilm sampling to narrow down contributing area(s)
- Deeper dive into biofilm data

Potential Next Steps

- Narrow down potential for groundwater contribution
  - Define times and/or locations where groundwater is delivered to river
    - Monitor groundwater levels, existing wells or install piezometers
    - Near-bank water quality monitoring could identify presence of groundwater contribution
- Deeper dive into surface soil contamination
- Determine likelihood of stream bottom contribution
- Additional biofilm sampling to narrow down contributing area(s)
- Deeper dive into biofilm data

Potential Next Steps

- Narrow down potential for groundwater contribution
- Deeper dive into surface soil contamination
  - Targeted MS4 and/or CSO sampling
  - PCB-sniffing dog
- Determine likelihood of stream bottom contribution
- Additional biofilm sampling to narrow down contributing area(s)
- Deeper dive into biofilm data

Potential Next Steps

- Narrow down potential for groundwater contribution
- Deeper dive into surface soil contamination
- Determine likelihood of stream bottom contribution
  - Deeper dive into the origin of fill
  - Visual survey of bottom characteristics
  - PCB sampling of fill material
  - Sub-bottom profiling for buried drums/transformers
- Additional biofilm sampling to narrow down contributing area(s)
- Deeper dive into biofilm data

Potential Next Steps

- Narrow down potential for groundwater contribution
- Deeper dive into surface soil contamination
- Determine likelihood of stream bottom contribution
- Additional biofilm sampling to narrow down contributing area(s)
  - Results of geostatistical analyses indicate that samples spaced 100 ft apart would be required to pinpoint source location
- Deeper dive into biofilm data

Potential Next Steps

- Narrow down potential for groundwater contribution
- Deeper dive into surface soil contamination
- Determine likelihood of bottom fill contribution
- Additional biofilm sampling to narrow down contributing area(s)
- Deeper dive into biofilm data
  - Assessment of significance of observed levels of biofilm contamination
    - PCB in Mission Park fish not nearly as elevated in 2012 as they were in 2005
    - Compare estimated mass of PCB in biofilm to estimate mass of fish in segment
  - Pattern comparison between PCBs in biofilm and PCBs in fish

Potential Next Steps and Feasibility to Conduct Near Term

Source Category	Feasibility
Upland Subsurface	
Monitor levels in existing wells	H
Monitor levels in new wells	L
Near-bank quality monitoring	H
Upland Surface	
Targeted outfall sampling	H
PCB-sniffing dog	H
Stream Bottom	
Deeper dive into the origin of fill	H
Visual survey of bed characteristics	H
PCB sampling of fill material	H
Sub-bottom profiling	M

Category	Feasibility
Additional Biofilm Monitoring	
Survey with more detailed spatial coverage	L
Detailed Review of Existing Data	
Compare mass of PCB in biofilm to mass of fish to assess significance	H
Pattern comparison: fish and biofilm	H