**Spokane River Regional Toxics Task**

2016 Technical Workshop – Takeaways

**Workshop Attendees: 107**

**Briefing Session:** Allyson King, Clinical Professor at Washington State University, gave a presentation titled “The Big Picture and Systems Thinking.” The presentation focused on integrated water resource management and the importance of systems thinking.

* System Leaders: “focus on creating the conditions that can produce change and that can eventually cause change to be self-sustaining.”
* Avoid common missteps in socio-ecological systems: tragedy of the commons, shifting the burden, eroding of the goals; and identify limits to capacity, and make investment before they are needed.

**Session 1: SRRTTF Understanding of the Spokane River**

This session presented the understanding of PCBs in the Spokane River gained by the Task Force, focused on a detailed analysis of the August, 2014 and August, 2015 data collection efforts. The session also looked at key information gaps.

*Presenters:*

Dave Dilks: “SRRTTF Understanding of the Spokane River”

Shawn Hinz: “SRRTTF Sampling Event August 2015”

**Session 1 Takeaways**

* Explore contaminated sites: (MTCA, CERCLA, RCRA, Open/Closed)
  + Consider aroclor patterns and homologs
  + Were PCBs an issue on cleanup sites - location in relation to higher levels of fish and river water column concentrations, cleanup levels, confirm type of cleanup
  + Note: See Martha Maggi/Pam Marti report on well and cleanup site locations (Posted at <http://srrttf.org/?p=5757>)
  + Where does the “mass” of remediated soil go? Landfill? Is this another pathway?
* Homolog or Aroclor Analysis: Use to assist in Source identification (for example: runoff versus site-specific contribution)
* Consider congener pattern analysis to determine an appropriate blank correction methodology.
* Consider normalizing stormwater to a drainage area. This has been done in the City of Spokane but may not be relevant elsewhere.
* Atmospheric Deposition: Waste-to-Energy plant air quality model can be used to predict
  + Direct deposition to water body. No clear way to model uptake by fish and indirect pathway to water through soil. It is designed to evaluate the impact of a point source and not impacts from regional sources.
  + EAP: atmospheric deposition desk study (complete)
  + EAP: Atmospheric Deposition field study, 2016 (QAPP to be completed soon)
* Consider direct sampling of seeps.
* J and NJ flagged data - Should they be included in analysis of data?

**Lunch Presentations:**

Ken Zarker: “Considering TSCA Reform Preserving States Authority”

Doug Krapas: Inland Empire Paper- TSCA

**Lunch Discussion Takeaways:**

* Consider a broader chemical strategy
* Convert the chemical market. Focus on chemical economy: comprehensive, transparent, participatory, hazard based, transformative, and innovative.
* Working on alternatives assessment: how do you move towards safer? (NCASI)
* Solutions:
  + Technical
    - Develop alternatives (non-chlorinated products)
    - Develop products w/reduced levels of PCBs
    - Develop new end of pipe treatment for PCB abatement
    - Perform risk assessment of all 209 congeners (are all bad?)
  + Regulatory/Policy/legal
    - Eliminate allowance for inadvertently produced PCB
    - General phase-out of allowance
    - Regulate only the 12 dioxin-like PCBs
    - Do not regulate lower congener PCBs
    - Provide NPDES permit offsets for inadvertently produced PCBs
    - Streamline approval/cost for new chemical products
  + Use a Stakeholder Task Force to vet and offer solutions

**Session 2: Fish**

This session provided an understanding of how concentrations of PCBs in fish from the Spokane River relate to the 303(d) list of Impaired Waterbodies, State water quality criteria for the protection of human health, and the Department of Health’s fish consumption advisory process.

*Presenters:*

Dave Dilks: “General Overview: Fish Tissue and Water Quality Standards”

Cheryl Niemi: “Water Quality Criteria for PCBs and the Linkage to the use of Fish Tissue for Impairment Listings – and – Washington’s new Proposed Rule for Human Health Criteria and Implementation Tools”

Dave McBride: “How Fish Tissue Data is used to develop a Fish Advisory”

Brandee Era-Miller: “Fish Tissue Data Summary for the Spokane River”

Will Hobbs: “Predicting reductions in fish tissue PCB concentrations”

**Session 2: Takeaways:**

* Focus on all PCBs or on higher weight PCBS?
* Are fish getting exposed to water column, sediment, or both? Fingerprinting can help to determine this. Modeling would also help (water quality plus a food web model).
* Homolog distribution in fish. Greg Cavallo has done this with the Spokane Serdar data. Look for the patterns, focus on sources that have similar distribution, compare to areas of sediment deposition and concentration.
* Homolog/Congener/Aroclor distribution in river (water column): Does the distribution change at different points in the river? How does this compare to known discharges?
* Consider Hangman Creek sediment deposition in Spokane River as a hot spot.
* Sediment reservoirs will increase the lag time.
* What do we know about sediment?
* Are fish a source of PCBs in the Spokane River Water Column?

**Session 3:** **Comprehensive Plan**

This session described the inputs that will be considered as part of the comprehensive plan, how these inputs will be estimated, and how they will be used to develop the plan. Case studies from other sites that have conducted similar activities were also provided.

*Presenters:*

Dave Dilks: “Comprehensive Plan to Control PCBs in the Spokane River Watershed”

Dale Norton: “Assessment of Selected Toxic Chemicals in the Puget Sound Basin, 2007-2011”

Kat Ridolfi: “What Can We Learn from Other Comprehensive Plans: San Francisco Bay PCB TMDL”

Chris Urban: “Illinois Lake Michigan (near shore) PCB TMDL”

**Session 3: Takeaways**

* Add industrial discharge to waste water treatment plants (WWTP)
* Key Uncertainties
  + Stormwater inputs in areas lacking standard MS4 type infrastructure (e.g. drywells, swales, etc)
  + Soil contamination sources (ambient soil and hot spots). Need information from Ecology and Idaho Department of Environmental Quality (IDEQ). Note: See Martha Maggi/Pam Marti report on well and cleanup site locations (Posted at <http://srrttf.org/?p=5757>)
  + What sources contribute to fish? Via sediment? Via water column?
* Focus? All PCBs or higher weight congeners?
* Comprehensive Plan: uncertainty, learning is an adaptive process. The plan will be adaptive.

**Session 4: Best Management Practices – Exploring Possibilities**

*Presenters:*

Kat Ridolfi: “"Best Management Practices for Reducing PCB loads--Examples and Implementation Experience in the San Francisco Bay Area"

Marcia Davis: “City of Spokane LID BMP”

Rob Lindsay: “Toxics Management Planning Spokane County Regional WRF”

**Session 4: Takeaways**

* Look at all options and determine appropriate practices for the Spokane River.
* Assessing appropriateness of each BMP? How much does it remove? How much does it cost? who will take responsibility for implanting it?
* What is the endpoint? Fish tissue or Water column or both?
* 2 scales for implementation: individual scale and outcome?
* Post implementation monitoring: Future studies to include assessing the effectiveness of implementation. Consider how the effectiveness of a BMP will be measured.
* San Francisco: millions of dollars spent and still only have a course understanding of the magnitude of PCB sources and transport pathways; most effective BMPs still not totally clear
  + Treatment BMP options: discharge to ground (Spokane has a lot of dry wells, would like to learn more), diversion to treatment plant; wastewater: PCB minimization in influent.
* Site remediation: identify and dispose; demolition/remodeling practices
* Use the Brownfields program as an opportunity to demonstrate BMPs for management of demolition materials.
* Identify PCBs during inspections. Decision tree for identifying opportunity areas.
* San Francisco: Load reduction plans, involve 4 steps: stormwater monitoring in wet weather to identify watershed; start doing drive-by in sections to find places for follow up sampling; perform sediment sampling along target properties; then work with property owners to design some kind of management for these properties.

**Regulatory:**

* TSCA inadvertent exception: change PCB regulatory use standard from nominal 50 ppm to 1 ppm
* Create a national coalition (include color pigment manufacturers) to address TSCA regulatory changes.
* Use Cost Benefit Analysis to support change.

**Institutional, Governmental Practices, Control**

* Consider older neighborhoods, industrial areas, and areas with high stormwater concentrations.
* Consider disposal methods and ensure safe disposal.
* Street sweeping or targeted areas via city and county road departments and Washington Department of Transportation.

**Education**

* Legacy versus inadvertent PCBs: how are they different, provide public information
* Community meetings
* Outreach and partner with contractor
* There is a difference between PCB education and a branding campaign. Coordinate across the state on PCB education.

**Stormwater**

* Bioretention stormgarden with BioChar or fungi fillers
* Need for pre- and post- monitoring to determine effectiveness

**Wastewater Treatment**

* Reduce influent (source control, TSCA reform)
* Need to better understand PCBs in biosolids.
* Public Education – septic and public owned treatment works (POTW)

**Remediation**

* Existing cleanup sites have a potential to impact the river. Note: See Martha Maggi/Pam Marti report on well and cleanup site locations (Posted at <http://srrttf.org/?p=5757>)
* Identify sources (caulk, light ballast) in older buildings and during demolition

**Session 5: “Next Steps/Where Do We Go From Here”**

This session focused on obtaining perspectives and input from invited guests and other workshop participants on the body of work performed (sampling, data analysis, approach for comprehensive plan and application of relevant BMPs) and any insights they had about additional data collection and analysis that would assist with future source identification and reduction efforts. In addition, the session focused on identifying potential next steps for the SRRTTF to take regarding the analysis of data generated from 2014 and 2015 sampling events, collection of new data, preparation of a comprehensive plan, and source identification and reduction actions.

**Review of the 2015 Priorities**

* Data Management workshop-database recommendation to Task Force (workshop held Feb. 11, 2016)
* Further investigate groundwater concentrations. Between Barker and Trent? (Ecology in coordination with Spokane County are currently sampling groundwater)
* Track upgradient/upland sites-focus on the Barker to Trent reach. (2015 sampling and GW sampling)
* Sediment Sampling (Ecology reported on 2013 sample results)
* Additional work using the current year data:
  + Green Street Flows
  + Congener Analysis (using data mining from the 2014 synoptic survey)
  + Lake Coeur d’Alene outlet (flows and concentration)

**Next Steps identified at the workshop (a start, but not exhaustive)**

* Use homologs and congeners in fish to identify sources (even if the final endpoint is not fish)
* Use Aroclors to tie the fish PCBs to Toxic Control Program (TCP) sites.
* Need a presentation on fish metabolism.
* Define what is meant by “sediment.”
* Sediment: include current data and discussion in Comprehensive Plan
  + Sediment: available data: 2003-2004 sediment samples (EAP); 2013 Urban Waters sampling- Trent to Green Street.
  + Consider suspended sediment.
* Are septic systems relevant?
* Theoretical evaluation of drywell inputs: Drywells and inventoried in both Spokane and Kootenai Counties.
* Consider gaining and losing reaches when evaluating inputs (septic and drywell).
* TCP data - In Ecology’s Environmental Information Management system (EIM). Note: See also Martha Maggi/Pam Marti report on well and cleanup site locations (Posted at <http://srrttf.org/?p=5757>)
* All activities should lead to finding and removing sources of PCBs.
* Consider Ecology’s sampling of city stormwater - 2012 report.
* Re-apply Serdar Food Web model to 2014, 2015 water column data. (Segment by segment).
* BMPs: business inspection, on-site sampling.
* Intensive data mining of water, fish, and sediment (LimnoTech?).
* Complete the Comprehensive Plan.
* Reduce sources and implement pilot projects on source cleanup.
* See where wet weather sampling takes the Task Force.
* Focus on Barker to Trent groundwater input and source identification.
* Database: determine needs for care and maintenance of the database.
* Outreach: PCB education and/or Task Force branding. Cross state effort for PCB education (not branding).
* Measurable Progress.
* Half-life of fish tissue-next samples?
* Request for quantifiable BMPs as part of comprehensive plan.
* Cross pollination: TSCA reform, BMPs, Duwamish to Spokane (coordinate efforts).

**Session 6: Data Management**

This session focused on identifying data management system(s) that will, through the use of reliably-collected scientific data, help SRRTTF identify, evaluate, reduce toxics loading (specifically PCB), and trend the environmental impacts of reduction activities in the Spokane River.

*Presenters:*

Jake Kleinknecht: “Environmental Information Management System (EIM)”

Tim Towey: “Data Management Session Microsoft Access Tools”

Greg Cavallo: Delaware River Basin Commission (DBRC) database/ lessons learned

Beth Schmoyer: “Earthsoft’s EQuIS™ Database Lower Duwamish Waterway Source Data Management”

**Session 6: Takeaways**

* EIM: zero cost, can take a long time for data to be loaded. Legacy system that will be used and maintained by Ecology for the duration. Cannot house the AQ data, no auto reporting, cannot graph homolog patterns or positive matrix identification, does not link to QC data. Other databases can feed into EIM to meet Ecology requirements for permittees. EIM is used by the Toxics Cleanup Program.
* LimoTech originally created an Access database for the Task Force data has not been updated since 2013. Has the capability of developing the tools that the Task Force would need including data visualization, model simulation, decisions tools, GIS, calculations on blank correction. There would be cost associated with developing the database , in addition to routine care and maintenance. Separate from EIM (but could interface with EIM) and is not dynamic (would require periodic release of new database).
* Greg Cavallo: ***without standardizing data and data collection and reporting, it will be very challenging moving forward.*** In the long term, the data will tell you if the efforts are successful.
* DBRC will give their database to the Task Force. (No charge). Would require care and maintenance.
* EQuIS : can be adapted to suit the needs of the Task Force. Versatile and can talk to GIS for visualization/mapping. Significant upfront cost pluse care and maintenance.
* EQuIS: Contact Earthsoft and have a demo on their capabilities. Could answer a lot of the questions. (Perhaps worwhile for a Task Force meeting.)
* **Standardization and Consistency.** Tool comes second. The Task Force needs to develop the data quality objectives and work to standardize the data to be more consistent.
* Data Management work group can recommend next steps this should be a future Task Force meeting agenda.

**Notes from Lester McKee:**

**Day 1**

There are many methods for testing the quality of data. Blanks are just one. If the measured concentration in the river water has a congener profile that is consistent with Aroclors and the blanks do not, does that not indicate that the blanks should NOT be subtracted? Have you checked the congener patterns in your QA steps to determine if the data make sense or not? As a default, SFEI does not blank correct. We flag the data if for any reason any QA method shows a concern. For example, if 10 QA blanks on 10 different lab days show a very consistent PCB source profile in the lab (e.g., a few or many congeners that are consistently measured and high), this would be an indicator that there is a consistent problem. In such an instance the offending congeners should show up in the field samples also as indicated by specific high congener concentrations that are consistently higher than the same specific congener concentrations in the blank. If they do not, that would indicate some other issue in the lab. Have the congener profiles been checked as an indicator of what to do with the blanks? Again, the SFEI default would be no blank subtraction unless there was clear and consistent evidence across all the QA methods that that is necessary.

**Concentration conceptual model**

I think you all are thinking about this but it never hurts to emphasize that concentration is not independent of flow. This is a tricky concept for everyone to get their heads around consistently. For example, as you go downstream, the mass of PCBs in transport in the river can be diluted by the entry of cleaner water. In such as instance, the mass in transport would increase only slightly at the same time as concentration decreases. When dirtier water enters the river, the mass and the concentration in transport in the river would increase more drastically. So I agree with you that it’s really tricky to use concentration changes as an indicator of a source. Load or mass is the only conservative parameter and is the best indicator to use.

**Mass balance conceptual model**

A QA step to consider is to normalize your loads to watershed areas upstream from each sampling point or point of interest. The normalized loads should make sense. Loads from industrial urban areas should be greater than from general residential urban areas should be greater than loads from rural areas. If not, then why not? Area normalized loads from each of these land use types should be consistent with other data reported in peer-reviewed world or national literature. If not, then why not? For the Bay Area, our cleanest rural dominated watersheds have climatically averaged yields of <1 g/sqkm. General urban mixed land use areas can have yields of 1-5 g/sqkm. Urban watersheds dominated by industrial sources have yields of >5 g/sqkm. Really polluted smaller very industrial areas have yields of 80 g/sqkm or more.

**Atmospheric deposition**

Measurement of atmospheric deposition is very tricky. I would start with measurements from elsewhere and use these in your mass balance before you start trying to measure atmospheric deposition. My literature review from 10 years ago could be augmented with more recent literature and data from elsewhere. In the Bay Area there was just one local effort to estimate PCB deposition from atmospheric sources (Tsai et al., 2002). Data collected by this study cover 6 months and were from a single location (Concord, Ca) in the northern part of the San Francisco Bay Area. Taking the average of the monthly estimates provided by Tsai et al. (2002), the average annual dry deposition is approximately 0.92 ng/m2/d or 0.34 μg/m2/y (monthly range 0.14-0.75 μg/m2/y). This is considerably lower than the estimate for urban United Kingdom by Harrad, (1994) (310 μg/m2/y) which might have included both wet and dry deposition. A study completed in Paris found a dry deposition of 29 μg/m2/y and that dry deposition only accounted for 35% of the total deposition of PCBs (Granier and Chevreuil, 1997). A study in Switzerland found a dry deposition of 1.06 μg/m2/y (Rossi et al., 2004). Apparently, a ratio of 2:1 wet:dry is common but others have used a ratio of 10:1 (see references in Granier and Chevreuil, 1997) or even 12:1 (Rossi et al., 2004).

PCB concentrations in rainfall have been measured around the world and range between 1.3-35 ng/L (Bremle and Larsson, 1997; Rossi et al., 2004). Given that wet deposition appears to dominate in other systems, wet deposition data for PCBs should be collected to support a confident understanding of the contribution of atmospheric PCB sources to urban stormwater.

Remember, not all mass entering a watershed finds its way to storm drain conveyances. For the Bay Area, Tsai and Hoenicke (2001) used runoff coefficients (the percentage of rainfall that forms stream flow on an annual basis for a defined watershed area) for each land use category to estimate approximate loss factors: Commercial/industrial (60-95%); Residential (20-50%); Agricultural/open (5-50%).

**Day 2**

**PCB reduction plan**

In the Bay Area, we are approaching decisions about how to best reduce PCBs loads by systematically combining information of the amount of pollution likely for different types of sites with the number of sites (opportunity). There are a few major efforts ongoing right now to identify more opportunity sites:

1. Stormwater monitoring during wet weather at the watershed and subwatershed scale in areas where there are high proportions of old industrial area or possible PCB producing source areas such as rail lines, metals and waste recycling, auto-recycling, electrical distribution/use etc.
2. Dry-by inspections of industrial facilities to identify candidate properties for further follow-up and sampling
3. Composite sediment and soil sampling around targeted properties to verify sources
4. Management: Onsite remediation, nearfield offsite retrofit treatment, or property referral depending on the situation

**How much will it cost?**

Keep in mind the preliminary cost estimates that Kat showed were influenced by a lack of knowledge about opportunity and the general mode of the muni’s in the Bay Area at the moment to argue to the regulatory agencies that management of PCBs is cost prohibitive. Most of the costs presented have assumed that the cost is only associated with PCBs reduction when in reality, there are multiple benefits beyond PCBs. Many of the implementation actions would be done anyway (for example road rehab projects) where reduction of PCB loads is an added bonus rather than the other way around.

**Treatment effectiveness of performance**

There was a question about effectiveness of stormwater treatment retrofit. We have done a bunch of performance studies in the Bay Area on raingardens and other types of biotreatment. We have developed some performance curves that will be published in the next few months. But generally, if biotreatment is implemented in areas where there is PCBs in runoff, the PCBs in that runoff will be captured as long at the LID feature is well maintained and bypass is not occurring beyond the design specs. In the Bay area, the design spec is to treat 80% of the incipient annual rainfall or all storms with a rainfall rate of <0.2 in/hr.

**Sources in wastewater influent**

In the Bay Area, EBMUD, one of our wastewater management districts, have found high concentrations of PCBs in their collection systems in spot locations. It might be worth a call to them or our local water board to get the latest on where they determined that was coming from. The possibilities that were being discussed were caulk use the collection pipes or leaching from industrial facilities. I don’t know what subsequent investigations ended up showing and then what if any management measures were then implemented. A call to EBMUD might yield some useful information.

**Notes from Lisa Rodenburg:**

The first thing I want to say, and I say this first to emphasize its importance, **is that you need to develop some way of sharing your data, preferably via a common data format such as an Access database**.  I've seen the data from the SCRWRF and the synoptic data, and they are in two completely different formats.  I asked a couple of times to see if I could get data from the Spokane city WWTP, or the stormwater or fish data, but so far I haven't seen any of it. It is hard for me or anyone else to get a handle on the big picture when we only get to see snippets of data.  
  
Based on my cursory examination of the PCB congener data from the synoptic survey**, it seems pretty clear to me that the Spokane River is suffering from some PCB sources that derive from Aroclors as well as some sources that do not have an Aroclor fingerprint.**  **The sources that do not look like Aroclors may come from either non-Aroclor (i.e., inadvertent) sources or from atmospheric deposition/stormwater.** Certainly non-Aroclor sources are important:  as I mentioned, in some samples, PCB 11 is as much as 20% of the total PCBs in the water column.  It is also clear that there is a 'schmutz' source that contains the same congeners you would typically find in an Aroclor, but not in the right proportions.  This suggests that the PCBs originally were associated with Aroclors but have undergone a lot of weathering, and that is totally consistent with an atm deposition source, but also with a stormwater source.    
  
**This mix of Aroclor, inadvertent, and schmutz sources is not unique to the Spokane River.  What IS a little unusual is that all three of these source categories seem to be almost equally important and I don't think that any of them can be ignored if you want to ever meet your PCB target.  So my best guess is that you are going to have to move forward on all three fronts simultaneously.  Fingerprinting will definitely help you figure out the relative importance of these source categories in the water column.**  
  
I have not seen the fish data yet.  If it is of sufficient quality (i.e. 1668 and enough of it) then fingerprinting of the fish data should help you tie water sources to fish sources.  Our work in the Portland Harbor superfund site seems to support this (but it is not published yet).   This is important because although all three source types seem to be important in the water, they might not all be important in the fish.  Obviously (?) you would want to prioritize the sources to the fish.  The Portland Harbor work does show that PCB 11 bioaccumulates in the benthic organisms (mussels, worms, and clams) with BSAFs of 3-13.  PCB 11 was also detected in the fish and osprey eggs.  So you probably won't be able to ignore the inadvertent sources.  Portland Harbor data seems to show that both Aroclor and schmutz sources are important there.  
  
The atmospheric sampling currently ongoing might allow us to determine whether this 'background' or 'schmutz' source really is atm dep, but I would not get my hopes up too much.  In the Delaware River, the fingerprint we thought was related to atm dep in the sediment didn't really match the fingerprint we observed in the atmosphere.  That discrepancy could have been due to different methods (ECD for air, 1668 for everything else), but I suspect it is also related to partitioning processes.  So again, don't pin your hopes on being able to definitively say that the schmutz is atmospheric.  If the schmutz comes from stormwater, it will peak during high stormwater flows.  If it is atmospheric, it will be pretty much constant all year.  If it is atmospheric related to snowpack, it will peak during snowmelt.  So the monthly sampling should help answer this question.  
  
Even if you can say with confidence that the schmutz is atmospheric, data from the IADN (see paper I sent) and the NJ atm dep network (paper in development) both suggest that atmospheric sources aren't going down at a rapid pace, even with all of the human efforts to eliminate PCBs from electrical equipment, etc.  So don't pin your hopes on that, either.  
  
FYI looking at the synoptic data, it was suggested that there is a source of PCBs near Barker Road.  Without doing any PMF, if you just visually look at the fingerprint at SR4 (at Greene Street Bridge), SR7 (Below Trent Bridge) and SR9 (at Barker Road Bridge) there are clear differences in the fingerprints between these sites.  Those differences definitely suggest a discrete source, and with fingerprinting we might be able to tie it to a specific Aroclor.  
  
I tried to answer all of your questions below.  I'm not the expert on a lot of this stuff, so I always provided some kind of answer, but take them all with a grain of salt!  
  
Lisa  
  
**Questions and Answers**

* Do you think it would be beneficial to look at individual congener data or homologs from water column data to identify potential sources?

Yes

* Do you think it would be beneficial to compare congeners in fish with those in the water column and how is that best performed?

Yes, depending on the quality of the fish data

* If the water column PCB levels don’t explain measured fish levels, is there a way to back into the missing inputs from a congener/homolog perspective?

Maybe...very tricky

* Are there other data analysis methods such as Positive Matrix Factorization (PMF) that would help with source identification?

Yes, PMF should help, and there are some lower-tech ways.  When you pay me or anyone else to do a fingerprinting analysis, you are paying mostly for expertise and the time and attention to look closely at the data.  The model that they choose to use (PMF or UNMIX or whatever) is less important.  Whatever approach you use, I think it will be important to do the fingerprinting on ALL of the available data (water, fish, stormwater, effluents, sediment, etc.)  Making comparisons across media might help you figure out where the fish are getting their PCBs.

* Do we need to explore sediment as a source of PCBs to fish and the water column, and if so, how?

Based on what I've been told about the relative lack of sediment accumulation in the river, I would wait on this, since it would involve a large data collection effort.  Sediment is inherently very heterogeneous, so you have to collect a LOT of samples.  I would wait until you do some fingerprinting to see if the water column data can explain the fish data.  If it doesn't then you might want to start measuring sediment.  However, you should also consider that it would be best for your sediment data to be tied in time with the water data...so if you are doing a big water survey, you might want to collect some sediment and freeze it for later analysis.

* Do we need further quantification of stormwater loadings, and if so, how should it be done?

My gut feeling here is probably yes, I bet stormwater is going to be important.  Since your  PCB concentrations in wastewater are similar to those in wastewater from NY, NJ, DE, and PA, I would guess that the stormwater concentrations are also similar to those locations.  And stormwater is a significant PCB source in all of those places.  Sampling stormwater is very difficult.  Lester McKee can tell you all about it.

* Are there other parallel activities (data generation or analysis) that should be undertaken:
  + Overlay locations where PCB congener level data for the water column, fish, sediment or other data exist on the river to determine where detailed analyses of fish/water/sediment could be performed or should be performed?

Since this is fairly low cost, it is probably worth doing.  Would probably happen anyway in the course of a fingerprinting analysis.

* + Data mining for specific information such as regional groundwater data?

Only if you think that groundwater is important.  I know you have one identified groundwater source, but it is not clear that there are others.  Groundwater is a much localized source, so 'regional' groundwater data is probably not helpful.  Even 500 feet from the river the groundwater might not be tied to the river.  In the Portland Harbor, they had some groundwater data but it was pretty much useless because the wells weren't that close to the river.  Plus I bet any groundwater data you find measured only Aroclors and is all non-detect.

* Is there value at this point to see if fish tissue data (2005 / 2012) align with the riverine PCB concentrations measured in the 2014 and 2015 water column or align with recent sediment PCB data (e.g., is there value to conducting a more rigorous food web model)?

I do not think there is any point in doing this on a sum PCB basis.  Based on my limited understanding of food web modeling, you would have to do at least homologues here.  Even at the homologue level, I'm not confident that this would help you link fish sources to sediment or water sources.  But I'm certainly not the expert on this.