FINAL

RMP Mercury Strategy Meeting
March 13, 2026
9AM – 12PM
Meeting Summary

Strategy Team Members in attendance:	
Craig Jones (Integral Consulting)	Bridgette DeShields (Integral Consulting)
Richard Looker (SFBRWQCB)	Setenay Frucht (SFBRWQCB)
Gerardo Martinez (SFBRWQCB)	Sarah Jacobs (SFBRWQCB)
Tom Mumley	James Downing
Chris Sommers (BAMSC/EOA, Inc.)	Michelle Williams
Lisa Austin (CCCWP/ACCWP/Geosyntec Consulting)	Lisa Welsh (CCCWP/ACCWP/Geosyntec Consulting)

RMP Staff and Contractors in attendance:

- Jay Davis (SFEI)
- Martin Trinh (SFEI)
- Don Yee (SFEI)
- Pedro Avellaneda (SFEI)
- Matthew Héberger (SFEI)
- Lester McKee (SFEI)
- Kara Scheu (Integral Consulting)
- Samuel McWilliams (Integral Consulting)

1. Introductions, Meeting Goals, Agenda Review (00:00:00) (9:00)

Jay Davis welcomed the group and led a round of introductions. The group welcomed Sarah Jacobs, who will be stepping in for the Water Board in place of Kevin Lunde. Jay reviewed the agenda which included an update from Matt and Pedro on the Watershed Dynamic Model (WDM) for mercury; updates from Jay, Don, and Lester on the mercury synthesis; and a discussion led by the Water Board on mercury TMDL wasteload allocation achievement methods.

2. Discussion: WDM Update (9:11)

Matthew Héberger provided an update on the WDM, describing it as a rainfall-runoff and pollutant loading model used to estimate flows, sediment concentrations, and, in the near future, contaminant loads such as mercury and PCBs. He explained that the model has been under development since 2020 and has undergone significant revisions since he assumed responsibility for it. He noted that earlier versions of the model contained errors and inconsistencies that limited its ability to accurately calibrate sediment, which is a prerequisite for developing a reliable mercury model. To address this, he initiated a series of technical meetings with modeling experts, including a prior meeting on January 23 and an upcoming session scheduled for April 17, and emphasized the importance of continued stakeholder engagement and oversight to improve model performance.

Matt outlined the project timeline and acknowledged that the team was approximately two weeks behind schedule but expected to catch up in the coming weeks. He stated that current efforts are focused on recalibrating hydrology and sediment processes, with plans to incorporate mercury simulations shortly thereafter. He indicated that the team aims to produce preliminary results by mid-May and publish a report in June. He also emphasized that substantial preparatory data collection had already been completed, enabling rapid progress once model corrections were finalized.

Matt then described several fundamental issues identified in the model. He explained that unrealistic representations of erosion and sediment transport at the land surface level had produced implausible outputs, such as extremely high sediment yields in areas like Alameda and Bay Farm Island. He noted that these issues stemmed in part from insufficient calibration data and emphasized the importance of expanding the dataset used for validation. He further described problems with “runaway” sediment deposition and erosion within channels, where the model either accumulated excessive sediment or allowed unlimited scour due to simplified assumptions about sediment storage. He stated that these issues undermined the physical realism of the model and prevented accurate simulation of pollutant transport, as sediment-bound contaminants were not being routed correctly through the system.

In addition, Matt identified errors in sediment delivery ratios, noting that values greater than one were observed despite being physically impossible. He explained that these inconsistencies were present across multiple sediment size classes and required correction to ensure model credibility. He also reported additional challenges uncovered during revisions, including inaccuracies in hydrologic forcing data due to improper temporal disaggregation, as well as input errors in reservoir modeling that reversed flow pathways between water supply withdrawals and downstream releases. He stated that these issues have now been corrected, resulting in improved model inputs and performance.

Matt highlighted efforts to strengthen model calibration by expanding the observational dataset from five to 17 USGS gauges and incorporating additional RMP data, including recent pollutant monitoring datasets. He emphasized that the Bay's hydrologic and geologic variability makes it a challenging system to model and that increasing spatial and temporal coverage of calibration data is critical to improving model accuracy.

Jay emphasized the importance of maintaining the June reporting deadline, noting that delays in the WDM could propagate to the linked in-Bay modeling effort that depends on WDM outputs. He emphasized the need for vigilance in managing the timeline and suggested further discussion to ensure alignment across modeling teams. Chris Sommers asked for clarification on stakeholder meeting scheduling and confirmed that the next meeting would occur on April 17, with subsequent meetings to be determined. The group discussed aligning future meetings with the Sources, Pathways, and Loadings Work Group (SPLWG) schedule in mid-May.

Tom Mumley commended the group's work, noting it was a strong example of model validation rather than simple calibration. He emphasized the importance of ensuring that model physics are sound, even when outputs appear reasonable, and stated that improving the model's physical realism significantly enhances its credibility for management applications. He also discussed the implications of the updated sediment model for estimating mercury loads and evaluating compliance with wasteload allocations, suggesting that the team would soon be able to generate meaningful insights into load estimates and regulatory timelines. Matt agreed and noted that while a full uncertainty analysis would not be completed by June, the team aims to provide preliminary ranges and error estimates to contextualize model outputs.

Setenay Frucht asked about the availability of mercury concentration data for calibration and potential risks to delivering the synthesis report. Matt responded that the model relies on soil sample data collected over the past 10 to 15 years and committed to providing a more detailed summary at the April 17 meeting. Chris raised concerns about temporal alignment between model outputs and underlying data, questioning whether the model represents current conditions or historical baselines. Matt explained that the model currently simulates water years from approximately 1994 to 2020 using land use data circa 2020, with the ability to incorporate earlier land use scenarios if needed, though uncertainties remain. Chris also highlighted potential implications for consistency with existing load reduction accounting methods and emphasized the need for further discussion on how model outputs will integrate with regulatory frameworks. Sam

McWilliams suggested that some of these topics would be addressed in a subsequent recovery modeling presentation.

Action Items:

- Distribute link to model outputs and technical materials referenced in presentation (Matthew Héberger, after meeting)
- Finalize and communicate updated stakeholder meeting schedule, including confirmation of meeting sequence beyond April 17 (Matthew Héberger / Jay Davis, before April 17, 2026)
- Evaluate whether to align third stakeholder modeling meeting with May 14–15 SPLWG meeting or schedule separately (Matthew Héberger / Jay Davis, before April 17, 2026)
- Provide detailed summary of mercury concentration datasets used for calibration (Matthew Héberger, by April 17, 2026 meeting)
- Share compiled table and map of calibration/validation monitoring locations (Matthew Héberger / Pedro Avelleneda, following meeting or at April 17, 2026 meeting)
- Develop preliminary uncertainty bounds or error ranges for model outputs to include in June report (Matthew Héberger, by June 2026)
- Facilitate follow-up discussion on model timeframes, data alignment, and implications for load reduction accounting (Matthew Héberger / Jay Davis / Chris Sommers / modeling team, offline or at future meetings)

3. Discussion: Recovery Trajectory Modeling Update 9:37 – Integral

Kara Scheu provided an update on the in-Bay mercury modeling effort, explaining that the team's primary objective is to improve the existing mercury mass balance framework by incorporating a spatially explicit, hydrodynamic and sediment transport model. She stated that the work builds on the previous TMDL box model, which represented mercury inputs and outputs at the scale of the entire Bay, including watershed inputs, urban runoff, wastewater, atmospheric deposition, bed erosion, and export through the Golden Gate. Kara emphasized that the current effort aims to increase fidelity by resolving spatial variability in sediment transport and mercury dynamics across different regions of the Bay, allowing the team to better evaluate recovery trajectories under different management scenarios.

Kara explained that the modeling approach leverages SFEI's existing hydrodynamic model and incorporates sediment transport processes by adding three sediment size classes and a spatially variable sediment bed informed by USGS grain size data and modeled shear stress. She noted that the model tracks sediment and associated mercury from watershed inputs, stormwater outfalls, and internal redistribution between Bay subregions. She also described the use of three representative water years, including wet, average, and dry conditions, to capture variability in hydrologic forcing and sediment loading, and explained that the team plans to simulate mercury load reduction scenarios by applying incremental annual reductions and evaluating resulting recovery in surface sediment.

Kara highlighted that watershed sediment loads from the Watershed Dynamic Model will serve as a key input, and she acknowledged that delays in WDM outputs could affect the modeling timeline. She presented preliminary results demonstrating expected patterns of sediment transport, including finer sediment remaining in suspension and coarser sediment moving as bed load, and stated that the model will be validated against observed bathymetric changes and sediment accumulation patterns. She also noted that mercury concentrations have been mapped by reach and will be applied to track contaminant transport through the system.

Kara then identified two key decision points for the group. First, she raised the question of how to handle watershed sediment inputs given the timing mismatch with WDM outputs, presenting the option of using interim empirical estimates to maintain schedule versus waiting for finalized model results. Second, she asked the group to confirm the appropriate thickness of the biologically active surface sediment layer used to calculate mercury concentrations, noting that this assumption influences modeled recovery rates.

Jay facilitated discussion on the surface sediment layer assumption, proposing continued use of a 15-centimeter active layer with sensitivity analysis. Tom Mumley supported this approach, emphasizing the importance of maintaining consistency with prior analyses and avoiding unnecessary complexity, while acknowledging inherent uncertainty. Craig Jones agreed and added that sediment mixing depth varies spatially across the Bay, but affirmed that 15 centimeters is an appropriate and practical assumption for this modeling effort. Setenay noted that maintaining a conservative assumption aligns with TMDL requirements. The group reached agreement to proceed with the 15-centimeter layer while exploring sensitivity as needed.

The discussion then shifted to loading assumptions and future scenarios. Tom questioned the use of outdated TMDL loading estimates and emphasized the need to incorporate updated understanding of source contributions, particularly for bed erosion and differences between urban and non-urban stormwater loads. Kara responded that the team would prioritize improving estimates of bed erosion and use the best available data for other sources, while also retaining the original box model framework for comparison. Tom further stressed that the modeling should directly address management-relevant questions, particularly how extending timelines for achieving wasteload allocations would affect Bay recovery. Kara agreed and clarified that the model can simulate extended recovery trajectories by extrapolating results across longer time horizons.

Jay redirected the group to the decision regarding whether to wait for WDM outputs or proceed with empirical estimates. Kara explained that using empirical inputs would allow the team to stay on schedule but would require additional model runs later, while waiting for WDM outputs would delay progress by several weeks. Samuel McWilliams added that any interim approach would still require estimates of sediment loads by size class, which complicates the use of empirical data. Tom and Lester McKee both recommended waiting for WDM outputs, noting that the delay would be relatively short and that maintaining data consistency would improve model reliability. Kara acknowledged that waiting would delay the schedule by approximately three to four weeks but stated that the team would attempt to absorb the delay.

Chris then emphasized the importance of defining clear recovery scenarios for the modeling effort. He suggested evaluating scenarios based on different timelines for achieving wasteload allocations, such as meeting targets by 2028 versus extending timelines by one or more decades. He also recommended aligning assumptions with existing PCB modeling frameworks and considering how implementation actions, such as green stormwater infrastructure, influence load reduction trajectories. Kara agreed and noted that the model can simulate both gradual reductions and extended timelines, provided that target conditions are clearly defined.

The group discussed potential scenario timelines, with participants suggesting 2028 as a baseline and additional scenarios extending to approximately 2040 or beyond. Jay emphasized the need to keep scenarios simple and actionable, while Samuel explained that the modeling framework uses combinations of representative water years to approximate long-term variability rather than simulating continuous multi-decade periods. Tom also raised the possibility of using simpler box model analyses in parallel to quickly explore scenario sensitivity, while Kara noted that the more detailed model would soon provide similar insights with greater spatial resolution.

Craig clarified that the model tracks mercury and sediment at a high spatial resolution, allowing results to be aggregated or disaggregated across Bay regions as needed. Don asked whether observed sediment accretion rates accounted for subsidence, and Kara and Samuel clarified that the bathymetric data reflect net changes and are derived directly from USGS datasets, with subsidence not explicitly incorporated. Don suggested that subsidence may need to be considered in interpreting results for areas such as the South Bay.

Action Items

- Use a 15-centimeter active surface sediment layer for modeling and include sensitivity analysis for alternative depths (Kara Scheu / Integral team, before next model runs)
- Incorporate updated and best-available mercury loading data, including revised understanding of watershed and bed erosion sources (Kara Scheu / Integral team with input from Matthew Héberger and others, ongoing)
- Maintain and run comparisons against the original one-box mercury model to evaluate consistency and reasonableness of updated model outputs (Kara Scheu / Integral team, during modeling phase)
- Define and finalize recovery modeling scenarios, including baseline (e.g., 2028 attainment) and extended timelines (e.g., ~2040 or longer) for wasteload allocation achievement (Jay Davis / Chris Sommers / modeling team)
- Coordinate offline to align watershed loading assumptions and ensure consistency with updated WDM outputs and regulatory frameworks (Integral team / SFEI / Water Board staff, near-term)
- Explore incorporation or consideration of subsidence effects when interpreting sediment accretion results, particularly in the South Bay (Kara Scheu / Integral team, follow-up analysis)

4. Discussion: Mercury Synthesis Update

Jay opened the agenda item by proposing to skip the detailed biota presentation due to time constraints and instead share annotated slides after the meeting. He summarized that recent 2024 fish data, particularly for striped bass, showed no change compared to 2019 and continued to align with the long-term lack of trend. He also noted that wetland restoration monitoring data from both the South Bay salt ponds and North Bay indicated no long-term impact of restoration activities on mercury levels in bird eggs or fish. With no objections from the group, Jay transitioned the discussion to Lester's portion of the mercury synthesis.

Lester explained that his task was to synthesize information on mercury loading from the Guadalupe River and, in future work, the Central Valley. He clarified that the objective of his contribution was to produce a concise synthesis section using existing data rather than generating new analyses. Lester outlined the proposed structure of the section, including an introduction summarizing mining history and prior load estimates, a methods section describing data sources and analytical approaches, results presenting measured concentrations and loads, and a discussion focused on interpretation. He framed the discussion around three key questions: estimating annual and average loads, calculating rolling five-year averages of mercury particle ratios and loads, and evaluating trends and expected trajectories to support modeling efforts.

Lester then presented preliminary data compilation efforts, explaining that he was aggregating datasets from multiple studies, including SFEI, Balance Hydrologics, AECOM, and Tetra Tech, spanning water years 2003 through 2023. He showed measured wet-season mercury loads across approximately 16 years of monitoring and highlighted the influence of extreme events, particularly a major 2017 storm that contributed a disproportionately large load in a short period. He explained that long-term averages are strongly influenced by hydrologic variability and that rolling five-year averages better reflect underlying conditions. He also noted that dry-season loads contribute only a small fraction of annual totals, typically two to three percent.

Lester described the regression-based methods used to estimate loads during periods without direct measurements, including distinguishing between typical conditions and high-intensity storm “release events” that mobilize mercury from legacy mining areas. He emphasized that different estimation methods can produce varying results for individual years, particularly for extreme events, but tend to converge when averaged over longer timeframes. He then introduced an alternative sediment-based approach for estimating loads, noting that it produced broadly similar long-term results despite methodological differences. He stressed that no single method is perfect and that each involves trade-offs, but that consistency across methods at longer timescales provides confidence in overall estimates.

Lester addressed questions from Gerardo and Richard regarding variability, explaining that mercury loads exhibit far greater variability than mercury concentrations on suspended particles. He presented evidence showing that load variability can span hundreds of times across years, whereas particle concentration variability is much lower. Based on this, he argued that the existing monitoring design, which targets large storm events likely to mobilize mercury, remains robust and appropriate for capturing key processes. He suggested that the primary challenge lies not in monitoring design but in how the resulting data are interpreted to assess compliance with regulatory targets.

Lester also outlined remaining work, including completing rolling five-year analyses, compiling additional datasets, and conducting a more detailed evaluation of trends. He emphasized that trend analysis would require careful interpretation and could be more analytically intensive than data compilation. He then posed some questions to the group, particularly whether rolling averages should be based solely on observed data or include modeled estimates, and whether multiple approaches should be presented to inform future regulatory decisions.

Setenay responded that the Water Board would review Lester’s materials in more detail offline and follow up with comments. Gerardo emphasized that Lester’s questions about how to calculate rolling averages aligned with broader regulatory considerations, particularly existing Basin Plan language that specifies how progress should be measured. He noted that current requirements rely on measured flow and concentration data, which may not align with the more interpretive approaches Lester presented. Gerardo suggested that the group may need to consider revising Basin Plan language or adopting hybrid approaches that incorporate both measured and modeled data to better evaluate progress toward load reduction targets.

James Downing agreed that variability in the data makes it difficult to demonstrate clear progress at this stage but expressed interest in seeing further analysis to support future decisions. Lester added that earlier claims of trends in recent reports had been removed following review, reducing potential contention and leaving trend interpretation as an open discussion for the group. He concluded by noting that his load estimates would directly inform the in-Bay modeling work and that the Guadalupe River represents a distinct and important mercury source requiring dedicated analysis separate from broader watershed modeling efforts.

Jay then transitioned the discussion to Don's section of the mercury synthesis. Don opened his presentation by revisiting atmospheric mercury inputs, noting that the prior TMDL estimated approximately 27 kilograms per year and posing the question of whether that value remains reasonable. He explained that recent literature and global assessments indicate that while mercury emissions declined in North America and Europe following reductions in coal combustion, global emissions have increased, with some studies suggesting approximately one to two percent annual increases. Don emphasized that these global trends suggest that earlier declines in atmospheric mercury have stalled or partially reversed. However, he noted that local data, including observations from nearby monitoring stations such as Sequoia National Park, do not show statistically significant trends, with high variability and weak regression relationships. He concluded that atmospheric deposition remains a relatively small component of the overall Bay mercury budget and is not a controllable management lever, though its relative contribution could increase over time.

Don then transitioned to evaluating the assumption of a 15-centimeter active sediment mixed layer used in prior modeling. He reviewed multiple lines of evidence, including USGS studies using lead-210 profiles, U.S. Army Corps tracer studies, and RMP observations of redox transition depths and sediment grab samples. He explained that these datasets consistently indicate mixing depths on the order of several centimeters to a few tens of centimeters over annual to decadal timescales. He also referenced biological mixing from benthic organisms as supporting evidence. Based on this synthesis, Don concluded that a 15-centimeter mixed layer is a reasonable and defensible assumption for modeling, while acknowledging that spatial variability exists and that sensitivity analyses could explore alternative depths.

Richard Looker asked how the choice of mixed layer depth influences modeling outcomes, recalling that in earlier TMDL work the 15-centimeter depth defined the control volume for the active sediment reservoir and influenced both estimates of upward flux from buried mercury and recovery. Craig Jones responded that the mixed layer should now be viewed as a dynamic and spatially variable control volume influenced by erosion and deposition processes. He explained that the new modeling framework allows for more spatially explicit treatment of sediment dynamics and could incorporate variability in mixing depth based on sediment type and geomorphic setting. Tom added that while the model is sensitive to this parameter, the group previously agreed that 15 centimeters is an appropriate starting point and that refinements can occur through adaptive modeling. Don followed up by asking how such spatial variability could be implemented, and Craig explained that sediment type and morphology would serve as key inputs for stratifying mixing behavior.

Don next presented an analysis exploring whether bed sediment mercury concentrations could serve as a proxy for suspended sediment concentrations. He described pairing water column samples with nearby sediment samples in space and time and calculating particulate mercury concentrations using both direct measurements and differences between total and dissolved mercury. He reported that the resulting relationships were extremely noisy, with poor statistical correlations and several artifacts, including repeated pairing of single sediment samples with multiple water samples and the occurrence of physically unrealistic negative particulate concentrations due to analytical noise. Don concluded that this approach does not provide a reliable proxy, particularly when particulate mercury is inferred by difference rather than directly measured. Jay and others agreed that even with improved measurements, conceptual differences between suspended and bed sediment processes would limit the strength of any relationship.

Richard clarified that the original intent of the suspended sediment target was to link watershed load reductions to in-Bay sediment quality and ultimately to biological endpoints such as fish tissue concentrations. He explained that the framework attempted to connect incoming suspended sediment concentrations with the long-term sediment reservoir in the Bay, but acknowledged that this linkage may not be functioning as intended. Tom observed that most measured values appear far above target levels, raising questions about whether the current approach effectively tracks progress. Don added that suspended sediment in the Bay is largely composed of resuspended historical material rather than newly delivered watershed inputs, further complicating interpretation. Richard concluded that the group may need to reconsider how targets are defined and operationalized, including potential revisions to better distinguish between source inputs and in-Bay conditions.

Don then addressed the potential contribution of bed erosion as a source of mercury. He explained that for erosion of historically contaminated sediments to be a major contributor, specific conditions would need to be met, including substantial past deposition of high-mercury sediments followed by subsequent erosion over large spatial areas. He presented evidence from coring studies and bathymetric analyses indicating that such conditions are relatively rare. Most areas of the Bay are either persistently depositional or persistently erosional, with limited overlap between historically contaminated depositional zones and current erosional zones. He concluded that while localized subsurface mercury hotspots may exist, their contribution to the overall mercury budget is likely small.

Finally, Don provided a preliminary estimate of mercury export associated with dredging and sediment management activities using DMMO data. He estimated that approximately 1.6 million cubic yards of sediment are removed annually through upland disposal, reuse, or ocean disposal, corresponding to roughly 150 kilograms of mercury per year based on average sediment concentrations. He noted that this is a rough estimate but suggested it could represent a non-negligible pathway in the overall mercury budget. Jay concluded the discussion by acknowledging Don's synthesis as a strong starting point and noting that further refinement and discussion would continue in subsequent meetings.

Action Items:

- Share annotated biota slides with additional explanatory notes (Jay Davis, post-meeting)
- Compile and integrate external datasets (Balance Hydrologics, AECOM, Tetra Tech) with SFEI data to complete the Guadalupe River loading dataset (Lester McKee, before next meeting)
- Generate final figures for long-term time series of mercury concentrations, particle ratios, and loads (2003–2023) (Lester McKee, before next meeting)
- Complete rolling five-year average analyses for both particle ratios and loads (Lester McKee, before next meeting)
- Conduct detailed trend analysis and develop interpretation of trends and expected trajectories (Lester McKee, before next meeting)
- Develop and present Central Valley mercury loading section using the same structure as the Guadalupe River section (Lester McKee, for next team meeting)
- Evaluate and recommend preferred method for calculating rolling five-year averages (observed data only vs. modeled/continuous estimates vs. hybrid approach) (Lester McKee with input from Water Board and stakeholders)

- Review and provide feedback on Lester's proposed data summaries, questions, and analytical approach (Water Board staff including Setenay and Gerardo)
- Assess implications of current Basin Plan language for load calculations and determine whether revisions or alternative approaches are needed (Water Board staff with stakeholders, future discussion)
- Coordinate with Integral modeling team to provide finalized Guadalupe River load estimates for use in in-bay modeling (Lester McKee / Integral team, prior to model integration)
- Share presentation materials and supporting analyses on atmospheric mercury trends, mixed layer depth, and sediment relationships (Don Yee, post-meeting)
- Conduct sensitivity analyses on mixed layer depth (e.g., shallower and deeper than 15 cm) within the modeling framework (Craig Jones / modeling team, during model development)
- Explore approaches to incorporate spatial variability in sediment mixing depth based on sediment type and geomorphic setting (Craig Jones / modeling team, future modeling refinement)
- Evaluate whether suspended sediment mercury targets should be revised, replaced, or supplemented with alternative metrics (e.g., bed sediment concentrations) (Water Board staff with stakeholders)
- Refine or discontinue use of particulate mercury estimated by difference (total minus dissolved) due to high uncertainty and poor reliability (Don Yee / team)
- Evaluate feasibility of using directly measured particulate mercury data for improved analyses (Don Yee / team)
- Further investigate relationship (or lack thereof) between bed sediment and suspended sediment mercury concentrations, including potential alternative analytical approaches (Don Yee / team)
- Review and discuss the role of bed erosion in mercury loading and determine whether to retain or remove it as a significant component in the mass balance framework (Modeling team / stakeholders, future discussion)
- Refine estimate of mercury export associated with dredging and sediment management using more detailed DMMO data (Don Yee / team, follow-up analysis)
- Convene a focused subgroup or future discussion to revisit sediment target definitions and their linkage to management objectives and biological endpoints (Water Board staff / SFEI / stakeholders, future meeting)

5. Discussion: Mercury Wasteload Allocations Achievement Method 11:30

Richard opened the discussion by framing the objective as evaluating how to demonstrate progress toward stormwater wasteload allocations under the Total Maximum Daily Load framework. He explained that the intent of the discussion was to review the three existing TMDL methods for demonstrating progress, assess their strengths and limitations, and consider potential modifications to better accommodate emerging tools such as watershed models. Richard emphasized that the current TMDL language, developed in the early 2000s, does not explicitly support modeling-based approaches, as such tools were not available or sufficiently developed at the time. He stated that incorporating modeling into compliance demonstrations would likely require targeted revisions to both the TMDL language and supporting staff report guidance.

Richard then described the three existing methods. He explained that the first method, which relies on accounting for load reductions from implemented control measures, was designed primarily for permit compliance and feasibility rather than direct measurement of environmental outcomes. He noted that this approach avoids the impracticality of requiring intensive monitoring to demonstrate load reductions within short permit cycles but is inherently indirect and uncertain. He contrasted this with the second method, which involves estimating loads from flow and concentration data and comparing them to allocations. He described this as a more direct approach but acknowledged that it requires extensive data collection and must contend with substantial interannual variability driven by hydrology. Richard then described the third method, which focuses on mercury concentrations on suspended sediment particles, explaining that this approach is closely tied to the scientific basis of the TMDL and may reduce variability by avoiding dependence on sediment load fluctuations.

Richard highlighted that while the load-based approach aligns most directly with the regulatory metric, it may be burdensome and difficult to implement at the necessary scale. He suggested that the particle concentration approach could offer advantages in terms of stability and interpretability, as it relates more directly to desired in-Bay conditions and may be less sensitive to hydrologic variability. However, he acknowledged that both approaches require robust data collection and that neither currently incorporates modeling in a formally recognized way under the TMDL.

Lester reflected on the potential role of modeling, suggesting that a hybrid modeling and monitoring approach could provide value by linking watershed inputs to in-Bay responses and supporting interpretation of measured data. He emphasized that modeling could help provide boundary conditions for in-Bay models but noted that, fundamentally, compliance determinations still rely on measured data and its interpretation. Richard agreed and clarified that current TMDL language implies reliance on intensive observational methods, such as turbidity surrogate approaches, and does not support using modeled outputs as primary evidence of compliance without revision.

Tom provided historical context, explaining that the absence of modeling in the original TMDL reflected the limited tools available at the time rather than a conceptual limitation. He emphasized that the program is now in a different position, with advancing modeling capabilities that could support simpler and more efficient compliance demonstrations.

Tom advocated for exploring the simplest defensible approach, noting that existing methods require extensive data collection and may not be practical. He also suggested that, given current understanding, urban stormwater mercury loads may not be a dominant driver of Bay recovery, which could further support simplifying the compliance framework.

Richard cautioned that any simplification for mercury must be considered carefully in the broader regulatory context, particularly with respect to potential implications for the PCBs TMDL. He noted that adopting a simplified approach for mercury could create expectations for similar changes in PCB compliance frameworks, which may not be appropriate given the greater complexity of PCB sources and dynamics. Tom responded that differences between mercury and PCBs could justify distinct approaches and expressed confidence that such distinctions could be maintained.

Don weighed in, emphasizing that load-based approaches are inherently complicated by temporal variability, whereas particle concentration may provide a more stable and detectable signal. He argued that while loads remain necessary to understand recovery timelines, particle concentration offers a more robust indicator of whether the system is trending toward desired conditions. Don also noted that modeling would be necessary to extrapolate particle concentration across watersheds, as direct sampling alone cannot achieve full spatial coverage.

Richard agreed and expanded on the concept of using models to predict both loads and particle concentrations, paired with targeted monitoring to calibrate and validate predictions. He acknowledged that this represents a new way of thinking, as prior efforts focused on modeling loads rather than concentrations. He proposed that a hybrid approach could be developed for particle concentration, similar to load-based modeling, but emphasized that this would require further methodological development and validation.

Lisa Austin raised concerns about implementation, particularly the challenge of translating watershed-scale measurements into compliance metrics for municipal stormwater programs. She noted that measurements at watershed outlets integrate contributions from multiple sources, including non-urban areas, which complicates attribution to regulated sources. She highlighted ongoing monitoring efforts, such as fixed monitoring stations, and suggested that combining these datasets with modeling could provide a viable path forward, though she expressed uncertainty about how particle concentration modeling would be operationalized.

Lester responded that one of the key advantages of a modeling approach would be its ability to separate urban and non-urban contributions, thereby addressing attribution challenges. However, he cautioned that while models may be effective at distinguishing source categories, they may be less reliable for spatial extrapolation of particle concentrations without strong underlying data and assumptions. Matt added that current watershed models estimate sediment runoff and rely on externally defined “potency factors” for contaminant concentrations, reinforcing the challenge of using models to independently predict particle concentrations.

Richard acknowledged these limitations but suggested that models could still play a useful role in guiding monitoring design rather than directly predicting concentrations. He proposed using the Watershed Dynamic Model to identify dominant sources and mass contributions, which could then inform a weighted observational strategy targeting the most important inputs. He emphasized that this approach would use modeling to support efficient data collection and interpretation rather than replace empirical measurements.

Tom concluded by suggesting that the group revisit these questions once initial watershed and in-Bay modeling results are available, as those outputs will provide a stronger basis for evaluating the relative importance of watershed loads and determining the appropriate level of complexity for compliance demonstrations. He emphasized that future discussions should be grounded in improved understanding of system behavior, including how mercury mass drives bioaccumulation and recovery in the Bay. Richard closed the agenda item by summarizing a potential path forward, including the use of modeling to inform monitoring strategies and the need to further explore hybrid approaches, while acknowledging that time constraints required deferring additional discussion to future meetings.

Action Items:

- Evaluate and propose potential revisions to TMDL language to allow for hybrid modeling and monitoring approaches for demonstrating wasteload allocation attainment (Richard Looker / Water Board staff, future drafting effort)
- Assess whether to prioritize a particle concentration–based approach, a load-based approach, or maintain both pathways for compliance demonstration (Water Board staff with stakeholder input, upcoming discussions)
- Explore development of a hybrid modeling and monitoring framework for particle concentration, including conceptual design and feasibility (SFEI modeling team / Water Board staff, future work)
- Determine whether hybrid modeling approaches should also be developed for load-based compliance pathways (Water Board staff / modeling team, future discussion)
- Identify data collection needs and design an observational program to support particle concentration characterization, particularly during high sediment transport events (SFEI / stormwater programs / modeling team, future planning)

- Evaluate how watershed models (e.g., WDM) can be used to guide monitoring design by identifying dominant source areas and weighting factors for sampling (SFEI modeling team, future analysis)
- Assess model capabilities and limitations for predicting particle concentrations versus loads, including evaluation of potency factor assumptions (SFEI modeling team, future technical review)
- Develop approach for separating urban (MS4) versus non-urban contributions within compliance demonstrations (SFEI / Water Board staff / stakeholders)
- Evaluate implications of any mercury TMDL compliance modifications for PCB TMDL frameworks to avoid unintended regulatory precedent (Water Board staff)
- Revisit compliance approach options after initial watershed and in-Bay modeling results are available to inform decision-making (All stakeholders)

6. Next Steps (03:28:00) 12:12

Jay concluded the meeting by summarizing next steps. Meeting materials, including slides, a written summary, and a recording, will be distributed shortly after the meeting. He also noted that the biota presentation had been deferred due to time constraints and committed to annotating and sharing those slides to ensure that participants, including Richard, could review the material in full. Jay reiterated that the team remains on track to produce a draft synthesis by the end of April, explaining that Don, Lester, and he would continue developing their respective sections in the interim. He acknowledged that key components, particularly watershed and in-Bay modeling results, may not be fully complete by that deadline but emphasized that the team would compile a draft synthesis using available information while continuing to integrate modeling outputs as they become available.

Jay noted that Matt would provide updated sediment modeling results by mid-April, which would inform ongoing synthesis efforts, and confirmed that in-Bay modeling would proceed in parallel. Lester added an additional action item, stating that the Water Board would review the presentation materials and provide written feedback on preferred figures, tables, and data presentation approaches for the synthesis document. Jay confirmed this request and welcomed input from all stakeholders, encouraging broader feedback to help shape the final product. He concluded by acknowledging the productive discussion, emphasizing the significant workload ahead, and confirming that the group would reconvene soon with more complete analyses.