Appendix 8

Final Report: Pilot Stormwater Diversion Project,
North Richmond Stormwater Pump Station

FINAL REPORT: PILOT STORMWATER DIVERSION PROJECT

North Richmond Stormwater Pump Station
Contra Costa, California

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1.0 EXECUTIVE SUMMARY

Normally, municipal staff would never consider deliberately diverting stormwater into their community's sanitary sewage treatment systems, but that is exactly what this award-winning pilot project accomplished. The motivation was a requirement established in the 2009 National Pollutant Discharge Elimination System (NPDES) Permit for Urban Stormwater Discharges issued to the Contra Costa Clean Water Program's (CCCWP) 21 permittees, along with all of the other municipal stormwater permittees in the San Francisco Bay Area. Order number R2-2009-0074, issued on October 14, 2009 and commonly known as "The Municipal Regional Permit" (MRP), was the first Bay Area municipal stormwater permit adopted after water quality plans for mercury and polychlorinated biphenyls (PCBs), known as "Total Maximum Daily Loads," or TMDLs, had been formally established for the Bay. Those TMDL plans call for substantial reduction of pollutant loads from urban stormwater discharges to the Bay – e.g., a 90 percent reduction in the total load of PCBs from all Bay Area stormwater discharges. The MRP issued in 2009 (known as MRP 1.0) required pilot projects to evaluate the feasibility of reducing PCB loads by various methods of treatment and source control. Provision C.12.f of the MRP required permittees to evaluate diversion of dry weather and wet weather urban runoff into sanitary sewage conveyance and treatment systems to determine if diversion to sanitary treatment is a useful tool for reducing PCB loads from urban runoff.

Contra Costa County Watersheds Program (County) led the pilot project for CCCWP. The County owns the North Richmond Stormwater Pump Station (NRSPS) and maintenance is shared through a Joint Exercise of Powers Agreement (JEPA) with the City of Richmond (both CCCWP permittees). The County partnered with the West County Wastewater District (WCWD), to provide conveyance capacity and treatment service. Converting the aging Pump Station facility to divert stormwater gave the County the opportunity to include facility improvements. Project funding came from the County and City and was supplemented with funds from the CCCWP (supported by all CCCWP permittees), as well as grant funds from the United States Environmental Protection Agency. In general, the County and City funds went to the Pump Station improvements and the EPA and CCCWP funds covered the added costs of planning, designing, implementing, monitoring, and reporting on the diversion pilot project.

The County completed construction of the diversion infrastructure in the fall of 2015. Pilot tests of dry and wet weather diversions of water from the pump station to WCWD were successfully completed by November 2015, and results formally reported to the County by January 2016. This final project report documents the project implementation and lessons learned for

inclusion in the annual “Urban Creeks Monitoring Report”, a deliverable required in the MRP. Findings and recommendations are expected to guide actions during the next five year MRP.

The lessons learned from this pilot project include both good news and bad news.

The Good News:

- CCCWP permittees complied with provision C.12.f of MRP 1.0 by collaborating with several partners to complete a pump station stormwater diversion pilot with a permanent, “hard-piped” diversion system installed at the NRSPS.
- WCWD experienced no overflows, sewage treatment system upsets, or other disruptions to operations as a result of the pilot diversion project.
- In addition to rehabilitating existing infrastructure, the NRSPS diversion project offers new operational flexibility to the Pump Station owners.
- Project partners gained a new understanding of the incentives and opportunities that can potentially support co-management of urban runoff with water reclamation systems originally designed for sanitary sewage.
- There is now an established partnership and relationship between the County and WCWD, and with new infrastructure now in place and the pilot successfully completed, there is an opportunity to pursue grant funding to support stormwater harvest and use projects in the future.

The Bad News:

- The wet and dry diversion pilot tests accomplished miniscule load reductions: e.g., about one milligram (0.001 grams) of PCBs, against a required Baywide PCB load reduction of 18,000 grams by the year 2028.
- Conveyance limitations of the sanitary sewage system prohibit substantial scale-up of the pilot to larger diversion flows. The diversion pump installed pumps 200 to 250 gallons per minute into the WCWD collection system. Larger flow rates risk sanitary sewer overflows. The design of the pump station provides 135,000 gallons per minute of stormwater pumping capacity, about 600 times more volume than the diversion. That might be comparable to a person sipping water from a gushing fire hydrant.
- Even if all of the stormwater from the 339 acre catchment served by the NRSPS could be captured and treated – which would require a substantial capital project - the total PCB load reduction possible is on the order of one to ten grams at best, still a tiny fraction of the overall load reduction mandate for the Bay.
- The total project cost was over $1.4 million which included some necessary upgrades to the existing Pump Station infrastructure. The cost for a "stand-alone" stormwater diversion project would be approximately $1 million.

This is an example of opportunistically combining stormwater quality enhancement and municipal infrastructure restoration into one project. The project evolved and changed from its inception five years ago. Initially the project included substantial improvements to the Pump Station until the estimated costs approached $2 million. Then the project was changed to only include improvements to the extent needed to complete the stormwater diversion. The total

final project cost was $1,440,000. The actual construction contract for the pump station project was $469,469. Design of the pump station project cost an additional $280,000. Both these design and construction costs reflected a project to divert stormwater plus some improvements to the Pump Station facilities. The remaining $690,531 of the project cost, over and above design and construction, comes from planning studies, monitoring, reporting, project management, and multi-agency coordination. A diversion project of this scale, implemented as a "stand-alone," without including any infrastructure rehabilitation, would cost close to $1,000,000 for planning, construction, monitoring, project management, and reporting.

In summary, this project achieved the objective of installing and pilot testing urban runoff diversion infrastructure. Diversion of dry and wet weather urban runoff into the nearest water reclamation facility offers only incremental PCB load reduction benefits. Diversion is not a "silver bullet" that will make a significant difference to PCB loads; however, consideration of multiple water quality benefits, such as trash controls, water resource development, and reduction of bacteria, oil and grease, and other urban pollutants discharged to Wildcat Marsh and the Bay may motivate additional, expanded stormwater harvest and use projects in this watershed. Water resource needs may be the overall driver. The newly installed diversion infrastructure installed can harvest and re-use up to 50 million gallons per year of urban runoff, primarily as dry weather urban runoff, should WCWD choose to implement longer term diversions. Overall, the immediate benefit of extending the useful life of the NRSPS and having diversion capabilities, opens longer term planning opportunities that makes this project a success.

On February 25, 2016, the NRSPS Stormwater Diversion Project was awarded the honor of Environmental Project of the Year by the Northern California Chapter of the American Public Works Association (Appendix A). The award named CCCWP as "an essential partner in the development and construction of this innovative project."

2.0 BACKGROUND

This section begins with a summary of the thought process that led to investigation of urban runoff diversions as a tool for implementing TMDLs for pollutants of concern in urban stormwater. The project partners are then described, followed by a description of the project setting.

2.1 ORIGINS OF THE STORMWATER DIVERSION CONCEPT

Completion of this pilot project culminates a thought process that has evolved in the Bay Area over the past fifteen years. Table 1 below documents some of the major milestones in this thought process. Details presented below help understand the regulatory and decision making context that led to this pilot project.

Table 1 Timeline of NRSPS Diversion Pilot Project Development

Time Frame	Milestone
2000 – 2002	Baywide investigation of PCBs in storm drain system sediment leads to discovery of 20 mg/kg PCBs at Ettie Street Pump Station
2006	Water Board accepts East Bay Municipal Utility District (EBMUD) monitoring at Ettie Street Pump Station diversion as a tSupplemental Environmental Project
2008	EPA Water Quality Improvement Fund grant awarded to support NRSPS diversion pilot
2009	MRP 1.0 Adopted
2010	EBMUD Report on Ettie Street Pump Station Diversion completed BASMAA Feasibility Evaluation Report submitted to Water Board
2010 – 2013	San Francisco Estuary Institute monitors water quality at NRSPS
2011 – 2013	CCCWP and the County negotiate agreement with WCWD to accept diversion flows
2013 – 2014	NRSPS rehabilitation and diversion design completed
2015	MRP 2.0 issued NRSPS stormwater diversion project constructed, diversion monitored for dry and wet weather event

Since the advent of the Clean Water Act in 1973, communities have generally tried to keep urban runoff separate from sewage treatment conveyance and infrastructure (sanitary sewage systems). Treating the volumes of runoff generated by storm flows would require development of sufficient treatment capacity that would be unused most of the time. Additionally, the very different compositions of sanitary sewage compared to urban runoff recommend different methods of treatment. Some older cities, such as San Francisco, Portland, and Seattle, have conveyance systems that were originally designed to combine sanitary sewage and storm flows. Those communities have to use much larger treatment systems compared to separate systems, and are continuously working to reduce incidents of combined system overflows of partially–treated water during large storm events. In more modern cities with separate systems, municipal workers implement programs to reduce inflow and infiltration (I & I) of stormwater into their sanitary sewage systems.

More recently, some beach communities in California have begun to implement dry weather diversions of urban runoff into their sanitary sewage systems. A review by the Bay Area Stormwater Management Agencies Association (BASMAA) documented case studies of voluntary diversions to sanitary sewers (BASMAA, 2010). In all cases examined, the motivation was to reduce impacts of bacteria from dry weather urban runoff on nearby beaches. The economic and human health benefits resulting from such dry weather diversions are clear – avoiding beach closures is important to any seaside community. Also, the diversion flows are generally small compared to the sanitary sewage conveyance and treatment capacity, so the risk of conveyance system overflows and/or treatment system disruption is less with dry weather diversions compared to wet weather diversions.

In all of the voluntary diversions reviewed by BASMAA (2010), diversions were designed and operated to shut down during wet weather events to protect the sanitary sewage systems. That is an important point that will inform the lessons learned and recommendations from this pilot project. Substantial equalization and storage capacity is needed for diversion to sanitary sewage systems to make a significant impact on stormwater pollutant loads.

In the Bay Area, the interest in management of stormwater by diversion to sanitary sewers began at the Ettie Street Pump Station (ESPS), located in West Oakland. In the 2000 – 2002 time frame, the discovery of sediments in the sump of the ESPS having PCB concentrations up to 20 mg/kg, well above thresholds of concern for stormwater discharges to the Bay, led staff of the San Francisco Bay Regional Water Quality Control Board (Water Board) to ask whether diversion from the pump station to the nearby East Bay Municipal Utility District (EBMUD) wastewater treatment plant was a reasonable approach to preventing PCB-contaminated sediments from reaching the Bay. EBMUD agreed to monitor a pilot diversion project at the Ettie Street pumping station (EBMUD, 2010). The pilot study was a Supplemental Environmental Project delivered by EBMUD in lieu of a penalty related to a prior incident (Water Board Order No. R2-2006-0028). The study demonstrated that small flows (up to 50 gallons per minute) could safely be diverted into the EBMUD wastewater collection system during a storm event, and that the loads reduced or avoided by the diversion were small in comparison to pollutant loads conveyed by the storm pumps at Ettie Street to the Bay. Interestingly, since the time that sediments with high PCB concentrations were removed from the Ettie Street pump station wet well, PCB concentrations in sediments exceeding 1 mg/kg have not been observed at that location.

During the time that the Ettie Street diversion pilot was being developed by EBMUD, the MRP was being developed by Water Board staff. MRP 1.0 (Order No. R2-2009-0074) included requirements for pilot projects to test diverting stormwater from pump stations into sanitary sewers. Provisions C.11.f (for mercury) and C.12.f (for PCBs) for MRP 1.0 state that:

- Task Description – The Permittees shall evaluate the reduced loads of mercury and PCBs from diversion of dry weather and first flush stormwater flows to sanitary sewers. The knowledge and experience gained through pilot implementation will be used to determine the implementation scope of urban runoff diversion in subsequent permit terms. The Permittees shall document the knowledge and experience gained through pilot implementation, and this documentation will provide a basis for determining the implementation scope of urban runoff diversion projects in subsequent permit terms.
- Implementation Level – The Permittees shall implement pilot projects to address the role of pump stations as a source of pollutants of concern (primarily PCBs and secondarily mercury). This work is in addition to Provisions C.2 and C.10 that address dissolved oxygen depletion and trash impacts in receiving waters. The objectives of this provision are: to implement five pilot projects for urban runoff diversion from stormwater pump stations to POTWs; evaluate the reduced loads of mercury and PCBs resulting from the diversion; and gather information to guide the

selection of additional diversion projects required in future permits. Collectively, the Permittees shall select five stormwater pump stations and five alternates by evaluating drainage characteristics and the feasibility of diverting flows to the sanitary sewer.

(1) The Permittees should work with the local POTW on a watershed, program, or regional level to evaluate feasibility and to establish cost sharing agreements. The feasibility evaluation shall include, but not be limited to, costs, benefits, and impacts on the stormwater and wastewater agencies and the receiving waters relevant to the diversion and treatment of the dry weather and first flush flows.

(2) From this feasibility evaluation, the Permittees shall select five pump stations and five alternates for pilot diversion studies. At least one urban runoff diversion pilot project shall be implemented in each of the five counties (San Mateo, Contra Costa, Alameda, Santa Clara, and Solano). The pilot and alternate locations should be located in industrially dominated catchments where elevated PCB and mercury concentrations are documented.

(3) The Permittees shall implement flow diversion to the sanitary sewer at the five pilot pump stations. As part of the pilot studies, they shall monitor and measure PCB and mercury load reduction.

The reporting requirements of this provision included a feasibility evaluation report for diversion opportunities throughout the Bay Area. That report was completed as a regional project by BASMAA (2010). The final report requirement for each diversion project stated that:

The March 15, 2014 Integrated Monitoring Report shall include:

- Evaluation of pilot program effectiveness.
- PCBs (and mercury) loads reduced.
- Updated feasibility evaluation procedures to guide future diversion project selection.

Following adoption of MRP 1.0 in 2009, the CCCWP selected the NRSPS for the pilot project and the County Public Works Department agreed to be the project lead. The San Francisco Estuary Institute (SFEI) monitored the NRSPS to characterize loads of PCBs and mercury from 2010 to 2013; SFEI's work was initially funded by the EPA Water Quality Improvement fund grant, and later by BASMAA as one of four monitoring projects implemented as a regional collaboration. Negotiation with WCWD to gain their acceptance of the pilot project took place between 2011 and 2013, including two meetings with the WCWD Board of Directors. The design of the project was completed in 2014, and construction was completed in 2015. Dry and wet weather diversion were monitored in the fall of 2015, concurrent with completion of the diversion infrastructure.

This report fulfills the final report requirement established by provisions C.11.f and C.12.f of MRP 1.0. It is included in the 2016 Urban Creeks Monitoring Report, two years later than the required submittal, because of unavoidable delays in the planning, design, and construction of

the diversion infrastructure. Water Board staff were closely involved in the development of this project and have been kept informed in writing as to progress on completion of this requirement.

2.2 PROJECT PARTNERS

The success of this project results from collaboration among project partners listed in Table 2 below. Details of their roles in developing and implementing this project provided below help understand the institution complexity of this kind of project that spans several jurisdictions and affects many interested parties.

Table 2 Partners in the NRSPS Diversion Pilot Project

Partner	Role
Contra Costa County Department of Public Works	Owner of the NRSPS facility
City of Richmond	Responsible for a portion of the NRSPS maintenance
Contra Costa County Flood Control and Water Conservation District	Designs and builds flood protection facilities Restores and enhances natural resources in creeks
West County Wastewater District	Provides sanitary sewage treatment to its service area Operates NRSPS under and O&M agreement with the County (Appendix B) Permitted dry and wet weather diversions for treatment in this pilot study(Appendix C)
Contra Costa Clean Water Program (on behalf of 21 permittees)	Supports facilitation, planning, and monitoring through staff and consultant labor, and direct fiscal contributions
United States Environmental Protection Agency, Region 9	Awarded and Managed Water Quality Improvement Fund Grant
San Francisco Estuary Partnership	Contract Manager for Water Quality Improvement Fund Grant
San Francisco Estuary Institute	Monitoring contractor for grant and subsequent BASMAA-funded project at NRSPS
Bay Area Stormwater Management Agencies Association	Regional planning and coordination
San Francisco Bay Regional Water Quality Control Board	Regulatory incentives to implement project; supported application for EPA Water Quality Improvement Fund grant; participated in discussions with WCWD

During the development of MRP 1.0, County staff determined that needed rehabilitation of the NRSPS presented an opportunity to implement a pilot diversion project. The two original low-flow pumps at the NRSPS had failed. Replacement of the low flow pumps presented an opportunity to build a diversion connection to the West County Wastewater District, which has sanitary sewage conveyance located next to the NRSPS. The County sought and obtained grant funding administered by the San Francisco Estuary Project through U.S. EPA's San Francisco Bay Area Water Quality Improvement Fund. The project is one of several in the "Estuary 2100 Phase 2: Building Partnerships for Resilient Watersheds" program. The grant provided $496,649 in EPA funds, matched by $186,383 from the County to plan, design,

construct, and monitor an engineered diversion into WCWD. This report also fulfills the final report deliverable requirement of that grant.

Grant funding was used for design, project management, and monitoring of the pilot diversion. Overall costs to complete the diversion exceeded the original grant fund and County match. Additional funds needed for design and construction of the rehabilitation were provided by the County and the City of Richmond. Additional funds needed for monitoring and reporting on the pilot project were provided by the CCCWP (which includes program contributions from the County and the City of Richmond as permittees). The CCCWP contribution was premised on the fact that project completion gained compliance with the MRP provision for all permittees.

The City of Richmond participated as a "silent partner" in this project. City of Richmond staff expressed concerns in the development of this project because of legal matters that the City is addressing. The City of Richmond shares a common outfall with WCWD to discharge treated sanitary sewage to the Bay. The NPDES permit for the common outfall provides joint liability for WCWD and Richmond, and so the City of Richmond's legal concerns over issues such as I&I also relate to WCWD, to some extent.

The WCWD engaged in discussions with County staff in order to prepare the Feasibility Study for the stormwater diversion. Concerns expressed by WCWD staff and Board members included the potential for spills, disruptions to the sewage treatment system, and incurring costs to rate payers that were unrelated to the service of sanitary sewage treatment. WCWD staff and Board members also acknowledged their role as environmental stewards and were willing to move forward with a diversion project, conditioned on their concerns being addressed. The participation of Water Board staff in these discussions was essential to achieving consensus. After a diversion concept plan had been proposed and refined to be responsive to WCWD concerns, an "agreement" in the form of a WCWD Waste Discharge Permit was developed to support the pilot project (Appendix C). Because of the limited scope of the pilot project, WCWD agreed to waive fees for the connection to their sanitary sewage conveyance system and for accepting/treating the discharge. Through its existing contract with the County to operate and maintain the NRSPS, WCWD did charge for the labor and expense of monitoring the discharge to verify it would not cause an upset of WCWD's activated sludge treatment system.

2.3 PROJECT SETTING

The community-wide North Richmond Storm Drain Project was built in the early 1970s and included construction of the NRSPS. The NRSPS is designed to manage the stormwater for a portion of the City of Richmond, San Pablo and the unincorporated County area of North Richmond (Figure 1). The project consists of a network of stormwater collection pipes which drain into the wet well of the pump station. The stormwater is then pumped into the discharge channel of the pump station which drains by gravity into a 78-inch discharge pipeline.

The project site is located in a watershed comprised mainly of industrial and residential land (Figure 1). The storm drain collection system delivers stormwater to the NRSPS located on the southwest corner of Gertrude Avenue and Richmond Parkway. The station's 78-inch discharge pipeline runs westward from the pump station along an easement on the Chevron Chemical Company property just south of Gertrude Avenue. At about 950 feet downstream of the pump station, the pipeline expands into an 8-foot by 4-foot box culvert which crosses Gertrude Avenue and runs into a trapezoidal earth channel that drains to Wildcat Creek.

The storm drain collection system consists of over 14,000 linear feet of reinforced concrete pipe in sizes ranging from 15 inches to 84 inches in diameter. The collection system drains an approximate 339 acres area west of 13th Street between Wildcat Creek to the north and Castro Street to the south.

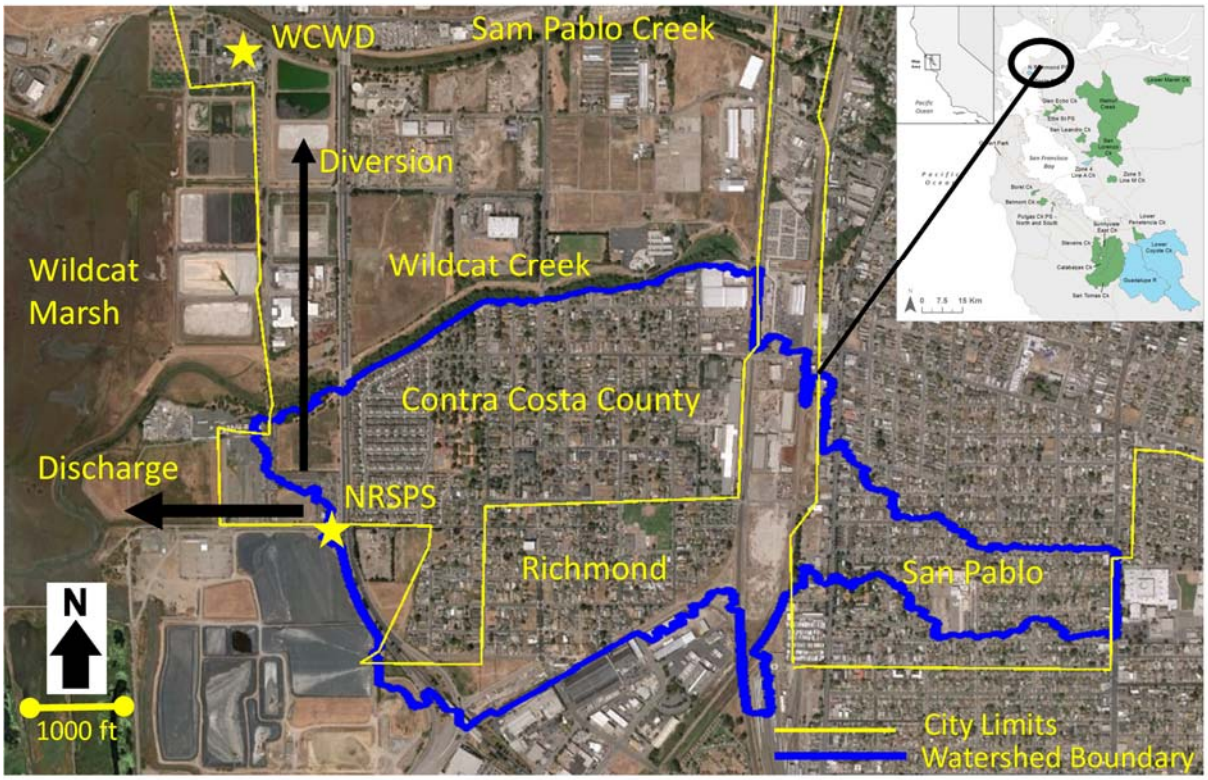


Figure 1 Watershed Setting of the NRSPS

The NRSPS's structure consists of a 3-level main structure and a discharge channel. The lowest level of the main structure, approximately 25 feet below ground, is the pump station wet well where stormwater from the collection system is received. Stormwater entering the station is routed to two compartments where it is lifted to the station's discharge channel by the stormwater pumps. The NRSPS is designed for a firm capacity of 135,000 gallons per minute (gpm). Four pumps, each capable of pumping 45,000 gpm of stormwater, are provided in the

station. Three of these pumps provide for the firm capacity of the station while the fourth one serves as the standby unit.

The pumping station is designed to handle smaller dry-weather flows as well as storm flows. The original design had two pumps rated at 3,500 gpm each that were set to operate in lead-lag mode. Those low flow pumps were replaced during the rehabilitation with a smaller, 250 gpm pump used for diversion and a larger, 2,500 gpm pump which was connected directly to the discharge channel. The 250 gpm pump was selected because the nearest sewage system conveyance had a capacity restriction of 0.6 million gallons per day (mgd) to 1.4 mgd, or 400 to 1000 gpm (Figure 2). The design intention was to minimize the chance of surging the manhole as a result of the diversion.

A model of the NRSPS watershed was developed using EPA's Stormwater Management Model 5.0 (SWMM). The model was used to explore how increasing diversion volumes related to increased percentages of storm flow treated (Appendix D). Even though the pump station's rated capacity is 135,000 gpm, smaller diversion pumps (i.e., up to 1,900 gpm) can capture significant percentages of overall storm flow for the three events modeled (Table 3), because of the storage and equalization capacity in the stormwater conveyance system leading up to the NRSPS.

Table 3 SWMM Model Predictions for the Percent Stormwater Treated Under a Range of Theoretical Diversion Flows

Theoretical Diversion Flow (gpm)	Percent of stormwater treated for different storm events		
	April 4, 2013	September 21, 2013	February 2005-October 2013
500	3	2	2
1400	68	25	36
1900	84	44	44

Table 3 denotes theoretical outcomes of diversion scenarios. As noted above, actual diversion flows in this project were limited to 250 gpm for safety reasons. To achieve greater diversion flows, and therefore larger amounts of stormwater treated, either an alternative to WCWD treatment would be needed, or some means of storing and conveying water to WCWD other than the existing WCWD conveyance system would be needed. This is described in more detail in Section 7.0 below (conclusions and lessons learned).

Figure and Data Provided by Ken Cook, District Engineer, WCWD on 10/9/2012

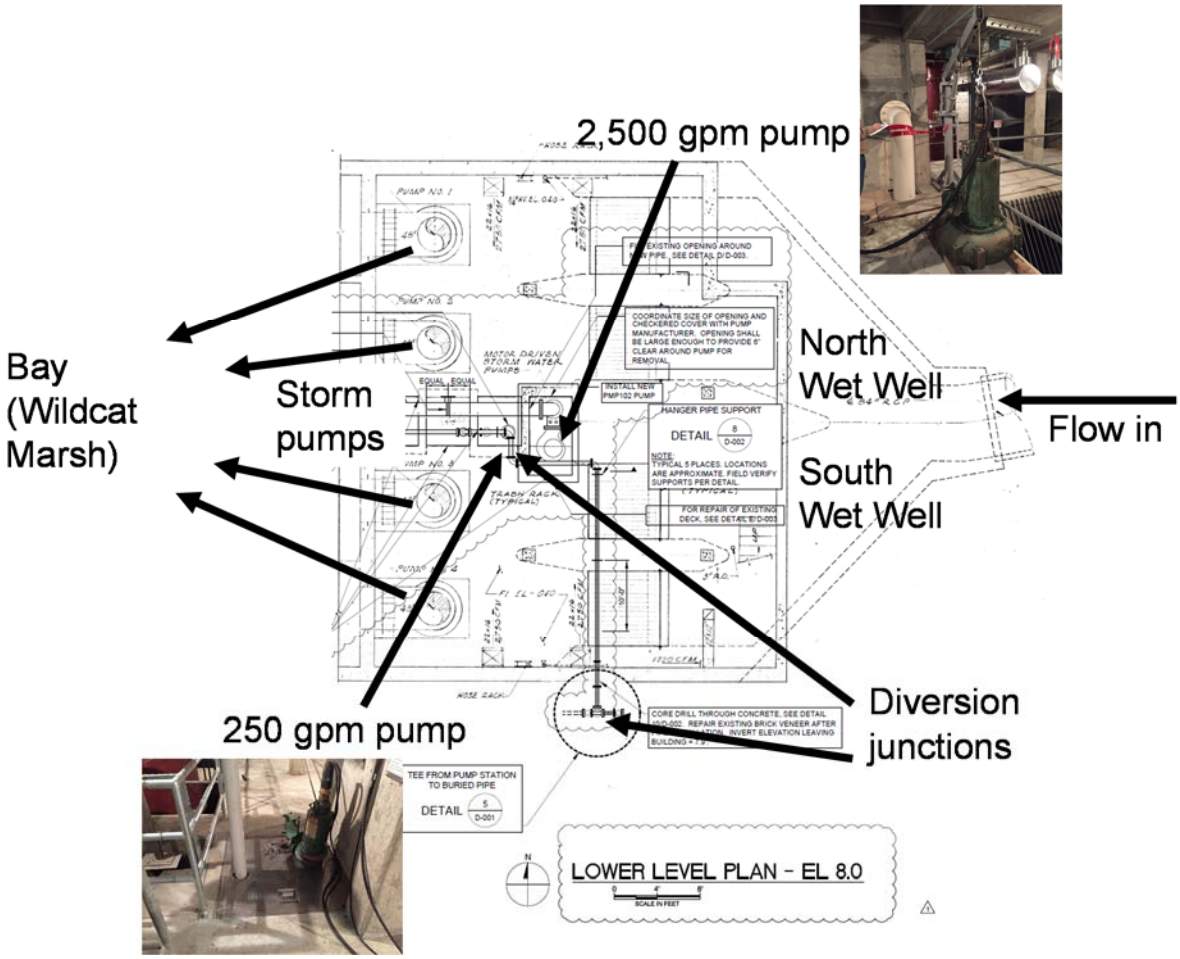
Figure 2 Sewage System Conveyance Capacity in Vicinity of NRSPS

4.0 DIVERSION INFRASTRUCTURE INSTALLED

On April 14, 2015, the Contra Costa County Board of Supervisors awarded a construction contract for the North Richmond Pump Station Stormwater Diversion Project to improve the pump station and provide the capability of diverting stormwater to the WCWD treatment plant for a short, specified period of time. As noted above, the diversion was a NPDES Permit

requirement for the County, the Flood Control District, and all 19 cities and towns in the County. The approved construction contract amount was $469,369. The project was funded with grant funds from the Environmental Protection Agency, through the San Francisco Estuary Partnership, and with partnering funds from the CCCWP, City of Richmond, and County. Construction began on July 13, 2015 and was completed on November 24, 2015.

The project removed two 3500 gpm pumps that did not work and replaced them with two new pumps, one rated at 250 gpm and one rated at 2500 gpm (Figure 3). The new 2500 gpm pump is connected to a 14-inch discharge pipe that drains out to the Bay. The new 250 gpm pump is hooked up to a discharge pipe to the Bay as well, but also to a 4-inch discharge pipe from the pump to the outside of the pump station building. Diversion junctions inside the building and outside the building allow flexibility in routing flows from the 4 inch diversion pipe to the Bay, to WCWD, or to alternative treatment and storage should such facilities become available in the future.



Base figure as provided by the County from design drawings completed by Brown and Caldwell as a subcontractor to LCA Architects

Figure 3 Summary of Key NRSPS Improvements Related to the Diversion Project

Details showing the construction and operation of the valved diversion junctions are shown in Figure 4 below. The design goal for allowing two pathways for diverted water is to provide flexibility for NRSPS owners to explore alternative or supplemental options to treatment with sanitary sewage systems located nearby.

A temporary discharge pipe was installed from the pump station building to an existing Wastewater District manhole in Gertrude Avenue. The temporary discharge pipe was linked to a permanent manhole connection installed as part of this project (Figure 5). The manhole connection included a temporary float switch sensor that would automatically shut down the diversion pump if the manhole surged.

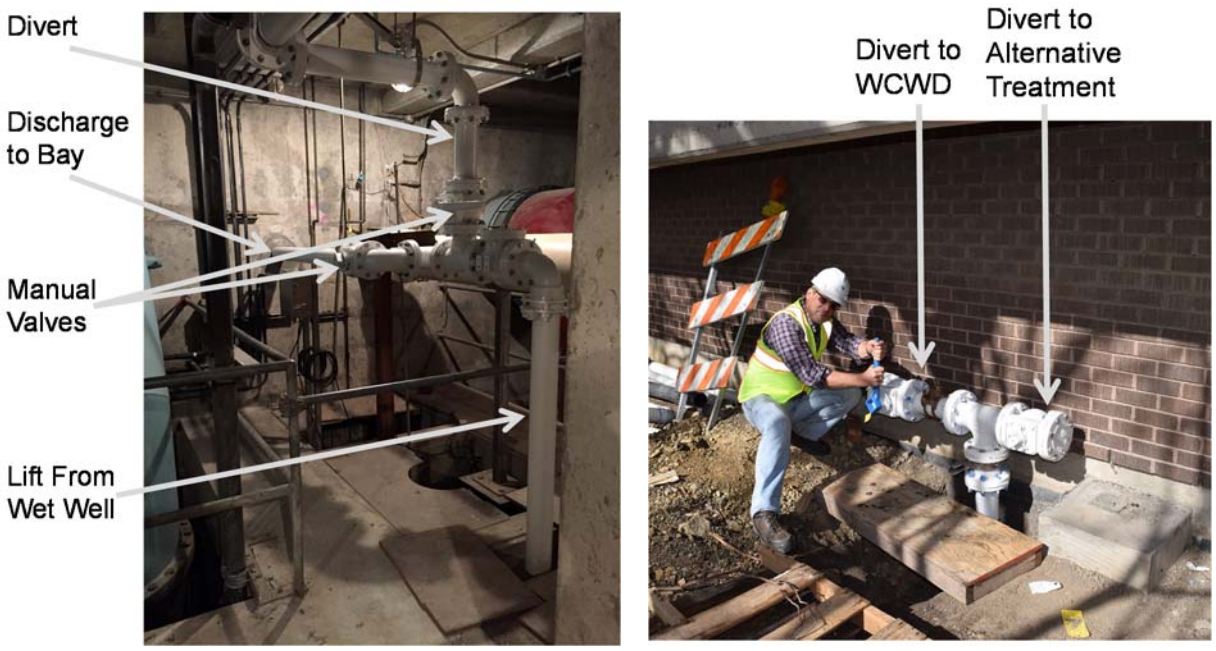


Figure 4 **Valved Diversion Junctions Inside and Outside Building Provide Operational Flexibility**

Figure 5 Permanent Manhole Connection to WCWD Linked to the NRSPS via a Temporary Pipe Aligned Along West Gertrude Avenue

Comparison of the size of pipes conveying diversion flows, low flows, and storm flows helps appreciate the size of the diversion in relation to the conveyance capacity of the NRSPS (Figure 6). The 250 gpm diversion flow pipe is 4 inches in diameter, about the size of an adult's hand. The newly installed 2,500 gpm low flow pump feeds a pipe, connected only to the Bay, which is 14 inches in diameter, about the length of an adult's forearm. Storm flows are forced to the Bay by three existing 45,000 gpm pumps, each one discharging through a 48 inch pipe, about an adult's chest height. The small volume of diversion flows in relation to storm flows helps manage expectations in regards to the pollutant loads reduced by the diversion pilot project described in Section 5.0 below.

Figure 6 Comparison of the Pipe Sizes Conveying 250 gpm Diversion Flow, 2,500 gpm Low Flows, and 35,000 gpm storm flows

Other needed repair and rehabilitation work at the NRSPS was completed in addition to restoring a low flow pump and installing a diversion pump, valves and pipes. The two non-functioning pumps and the old sensor equipment was demolished and removed. The old motor control panel could not be modified to accommodate the new set of pumps, so a separate control panel was installed along with new level sensors. Overall, the project helps extend the useful life of the NRSPS in addition to adding stormwater diversion capability. The description of project costs in Section 6.0 parses out costs of the diversion pilot from those for the necessary repair and rehabilitation at the NRSPS to help understand the cost of infrastructure enhancements addressing only water quality improvement.

5.0 WET AND DRY WEATHER PILOT TESTS

During the completion of construction of the diversion, dry weather and wet weather pilot diversions to WCWD were tested. A temporary pump and discharge pipe was linked to the permanent manhole connection located on Gertrude Avenue. The temporary pump provided around 200 gpm of flow to the WCWD collection system; however, dry weather flows are around 100 gpm, therefore the dry weather diversion did not operate continuously. For the dry weather diversion, an average diversion flow rate of 100 gpm was assumed, accounting for pump down time between diversion runs. A temporary pump was necessary because the

diversion pilot needed to be conducted before the project was completed. The County was concerned that opportunities for rain events would be lost if the pilot was postponed until installation and testing of the permanent diversion pump had been completed.

The dry weather pilot diversion was completed on September 23, 2015 (Appendix E). The wet weather diversion was completed on November 2, 2015 (Appendix F). Table 4 below summarizes key data from the reports on the diversion pilots. The diversion flow volumes listed in Column A of Table 4 are multiplied by average pollutant concentrations listed in Column B to calculate pollutant loads diverted as shown in Column C. Column D shows ratios of pollutant concentrations to suspended sediment concentrations (SSC), effectively the pollutant concentration in suspended sediments. It is assumed that all sediment is removed from the diverted stormwater at the WCWD treatment plant, along with all pollutants attached to the sediment particles such as PCBs and Mercury.

Table 4 Monitoring Results from Wet and Dry Weather Diversion Pilots at NRSPS

(A) Diversion Information		(B) Average Pollutant Concentration				(C) Pollutant Load Diverted				(D) Pollutant Concentration in Suspended Sediments		
		mg/L	ng/L			kg	mg			ng/g		
Type and Date	Flow Diverted (gal)[1]	SSC	Hg	MeHg	PCB	SSC	Hg	MeHg	PCB	Hg SSC	MeHg SSC	PCB SSC
Dry 9/10/2015 to 9/23/2015	456,000	34	9.1	0.06	0.37	59	16	0.10	0.64	270	2	11
Wet 11/2/2015	32,000	52	36	0.49	7.0	6	4	0.06	0.84	690	9	134

1. Flow for the dry weather event was estimated based on 100 gpm x 60 minutes / hr x 8 hrs per day x 9.5 working days

The flow volume was more than ten-fold larger for the dry weather diversion because it went on for nine and a half working days, as compared to a half a working day for the brief wet weather event sampled on November 2. Despite the much larger flow volume diverted, the PCB loads diverted to WCWD are comparable for the wet and dry pilot tests. This is because the SSC concentration was higher during wet weather (52 mg/L compared to 34 mg/L), and the monitored PCB concentrations in the suspended sediments conveyed by the wet weather event were more than ten-fold higher compared to the dry weather event (134 ng/g compared to 11 ng/g). The same was true for methylmercury (MeHg). Mercury (Hg) concentrations in wet weather suspended sediments were only around three-fold higher compared to dry weather (690 vs 270 ng/g), and so the mercury loads diverted by the dry weather diversion ended up being four-fold greater than the wet weather diversion. The total PCBs removed by treatment

during the pilot period was almost one and a half milligrams (1.48 mg) and total Mercury removed was 20 milligrams.

These pollutant concentrations in suspended sediments are consistent with regional trends. Stormwater from a pilot test at 1st Street and Cutting Blvd. in Richmond were recently shown to have mercury / SSC ratios of approximately 1 (Contra Costa Clean Water Program, 2015). PCB The average PCB to suspended sediment ratio of 134 at the NRSPS is typical of older urban areas along the Bay (Contra Costa Clean Water Program, 2013), and consistent with previous monitoring conducted by the San Francisco Estuary Institute (BASMAA, 2014).

6.0 PROJECT COSTS

The overall cost of executing this pilot project was $1,440,000. The actual construction contract for the pump station rehabilitation was $469,469; that cost included the construction and contractor labor related to the diversion pilot. Design of the pump station project cost an additional $280,000. Both design and construction reflected a project to divert storm water plus some improvements to the pump station facilities. The remaining project costs, over and above design and construction, comes from planning study, monitoring, reporting, project management, and multi-agency coordination that results from implementing a grant funded pilot project involving multiple jurisdictions with the goal of fulfilling a regulatory mandate.

The following subsections provide a more detailed analysis of costs provided by Contra Costa County to help parse out the base cost of the rehabilitation of the NRSPS from the cost of enhancements needed to accomplish the goal of diverting urban runoff to WCWD. Though the multiple project partners and funders necessitated extensive parsing out of the project costs, the important cost information for most readers is the estimate to replicate this project as a standalone stormwater diversion project, rather than an add-on to a rehabilitation.

6.1 FACILITY IMPROVEMENT

Stormwater flowing to the NRSPS comes from the City of Richmond, the unincorporated community of North Richmond, and, to a small extent, the City of San Pablo. The City of Richmond and County share the cost of maintaining, improving, and operating the pump station. Even though the purpose of the project was to divert stormwater to the Wastewater District, some work resulted in improvements to the existing pump station facilities. To divide the project costs amongst the funding partners, costs associated with improvements to the facilities needed to be separated from the costs associated solely with stormwater diversion. Those project costs that improved the pump station facilities had a long-term benefit to the pump station operations. Those project costs associated solely with the temporary stormwater diversion did not help improve pump station operations. The new 2,500 gpm pump is used for lifting low storm flows in the pump station and will save the large 45,000 gpm pumps from being used to evacuate the wet wells during low flow events. The new 250 gpm pump was used for the temporary diversion of stormwater to the WCWD treatment plant, but can also be

used to lift dry weather flows in the pump station and extend the service life of both the 2,500 gpm pump and the large 45,000 gpm pumps. The four 45,000 gpm storm pumps (Figure 3) are the primary workhorses of the NRSPS and the most valuable asset and most expensive component. Anything that extends their service life is a benefit to the County and City.

6.2 STORMWATER DIVERSION COMPONENTS

That portion of the project that related solely to the temporary diversion of stormwater consists of a permanent discharge pipe installed from the 250 gpm pump to a connection point on the outside of the building. In addition, a temporary discharge hose was installed from the connection point outside the pump station building to the WCWD manhole in Gertrude Avenue. A sensor conduit was also installed from the building to the manhole. Lastly, a permanent discharge pipe was installed into the manhole from the edge of the pavement on Gertrude Avenue to connect with the temporary discharge pipe from the pump station, and a sensor conduit was installed into the manhole. A temporary sensor was placed in the manhole to measure the flow and elevation of the flows within the WCWD manhole to make sure diversion flows did not exceed the capacity of the sewer line.

6.3 CONSTRUCTION COST SPLIT

The contractor bid the project on a lump sum basis, but provided a breakdown of costs for all elements of the project. Those elements of the project that constitute the temporary stormwater diversion and facility improvements are shown in Table 5 below.

Table 5 North Richmond Pump Station Rehabilitation and Diversion Construction Costs

Task No.	Description	Stormwater Diversion	Facility Improvements	Totals
1	Temporary Diversion Pipes (4-inch)	$31,000		$31,000
2	Temporary Diversion electrical work (50%)	$32,500		$32,500
3	Facility electrical improvement work (50%)		$32,500	$32,500
4	Facility pump improvement work		$183,100	$183,100
5	Facility demolition/preparation work		$34,000	$34,000
6	Water control during construction		$22,400	$22,400
7	Miscellaneous Costs	$5,267	$22,602	$27,869
8	Mobilization and Overhead	$20,034	$85,966	$106,000
	Total Construction Cost	**$88,801**	**$380,568**	**$469,369**

1. Miscellaneous Costs, and Mobilization and Overhead are soft costs that are split between Stormwater Diversion and Facility Improvements in proportion to the hard costs for each one (18.9%/81.1%).
2. The cost split for electrical work between the temporary diversion component and the facility improvements component (50%/50%) was provided by the contractor, Valentine Corporation.
3. Total construction cost based on the construction contract awarded to Valentine Corporation on April 1, 2015.
4. Cost breakdown for each task provided by the contractor, Valentine Corporation.

6.4 MOST LIKELY PUMP STATION STORMWATER DIVERSION PROJECT COSTS

How does this project compare to other likely stormwater diversion projects in the Bay Area? In some ways the North Richmond Pump Station is different from other pump stations in the Bay Area. These differences need to be examined in order to determine the cost estimate for the most likely pump station diversion project, a project applicable to the average pump station in the Bay Area.

6.4.1 Pump Replacement

The NRSPS has suffered from decades of deferred maintenance. As result, the two original smaller 3500 gpm pumps had not been working for years. In addition, the original dry weather flows were based on agricultural land-uses. Today's land-uses, and the land-uses reflected in the General Plan, are more residential and produce less dry weather flows. The combination of a lower demand and two nonfunctioning pumps resulted in a design to install the new diversion project pumps in place of the nonfunctioning pumps. The average pump station will likely have all of its pumps maintained and operating, and may not be able to remove an operational pump for a small stormwater diversion pump. The size of the stormwater diversion pump is based on the limiting capacity of the wastewater district facility accepting the stormwater flows, however, it is likely a much smaller pump size than that needed for pump station operations. Finding a new spot to place a stormwater diversion pump in an existing pump station may or may not present a problem.

6.4.2 Agency Coordination

In some cases, the pump station and wastewater district accepting the stormwater is owned by the same agency. In this case, the NRSPS is owned by Contra Costa County and the wastewater treatment plant is owned by the West County Wastewater District. The WCWD, though supportive of the project, was naturally concerned about the potential impact the diversion of stormwater might have on their treatment plant. As result, two years of stormwater sampling and analysis was conducted to determine the constituents in the stormwater. A Feasibility Study was prepared to determine the feasibility of diverting stormwater from the pump station to the treatment plant from an engineering perspective and, given the pollutants and pollutant loading in the stormwater, determine if there were any impacts on the wastewater treatment train. The WCWD expressed some additional concerns that prompted a second Technical Study which addressed those concerns. This initial planning effort, from initiating the stormwater sampling to the WCWD accepting the project design concept, took over3 years.

6.4.3 Facility Improvement

Due to the extensive deferred maintenance of the NRSPS, a portion of the stormwater diversion project resulted in improvements to the pump station facilities. Some of the costs that would be part of a stand-alone stormwater diversion project were identified as a facility

improvement in the NRSPS project. However, in a typical stormwater diversion project many of those costs would be a project cost. For example, the cost of water control during construction was identified as a facility improvement in the NRSPS project, whereas a stand-alone stormwater diversion project would have to account for that type of cost.

6.4.4 Stormwater Diversion Project Costs

For the NRSPS project, the contract items were divided between those needed for the stormwater diversion and those that resulted in improvements to the existing pump station facility. However, the costs assigned to the stormwater diversion part of the project are not representative of a stand-alone stormwater diversion project. Using the construction contract for the NRSPS project and assigning costs to project elements for a more likely stormwater diversion project results and a more realistic cost estimate for a stand-alone stormwater diversion project. Table 5 above shows the cost split between stormwater diversion elements and facility improvement elements for the NRSPS Stormwater Diversion Project. Table 6 shows the contract costs associated with a more likely stand-alone stormwater diversion project. This estimated construction cost is based on the construction contract for the NRSPS Stormwater Diversion Project plus change orders associated with the stormwater diversion component of the project. The estimated construction contract cost (approximately $160,000) from Table 6 can be used to build a total project cost estimate for a stormwater diversion project using the costs of the project elements for the NRSPS Stormwater Diversion Project and adjusting them accordingly. For example, the $280,000 design cost for the full project was adjusted, proportionally, to $95,000 for a smaller stand-alone stormwater diversion project. The final project cost estimate for a stand-alone stormwater diversion project is shown on Table 7.

Table 6 Most Likely Stormwater Diversion Construction Costs

Task	Description	Stormwater Costs	Diversion
1	Diversion pipes within building	$31,000	
2	Diversion pipes outside building	$10,000	
3	Electrical work	$32,500	
4	250 GPM pump	$15,410	
5	Water control	$22,400	
6	Miscellaneous	$8,918	
8	Mobilization and Overhead	$33,920	
9	Change Orders	$4,519	
	Total Construction Cost	**$158,667**	

Table 7 North Richmond Stormwater Diversion Project Final Cost Estimate for Stormwater Diversion Only

Task No.	Task Description	Notes	Cost Estimate
1	Project Management	1	$268,000.00
2	Pre-project lab work	2	$137,000
3	Monitoring	3	$150,000
4	Diversion staff costs	4	$12,000
5	Feasibility Report	5	$76,000
6	Technical Report	6	$59,000
7	Final Report	7	$10,000
8	Design	8	$95,000
9	Construction Contract	9	$160,000
10	Construction Management	10	$16,000
		TOTAL	**$983,000**

1. Project Management costs include pre-project work with SFEI and Wastewater District
2. Advance fieldwork and lab analysis performed by SFEI funded primarily with grants
3. Additional two years of monitoring funded by BASMAA
4. Estimated by the Wastewater District and includes $2000 County staff time
5. Feasibility Study completed on November 7, 2012
6. Technical Report completed on November 20, 2013
7. Final Report identifies how project objective was met and lessons learned
8. Design includes CEQA, permitting, right-of-way, and engineering and architectural work
9. Construction cost estimate taken from Table 1
10. Estimated to be 10% of construction contract amount

7.0 CONCLUSIONS AND LESSONS LEARNED

The magnitude of the diverted pollutant loads in this pilot test compared to regulatory mandates is sobering. Diverting almost a milligram of PCBs during a prolonged (9.5 days) diversion or a single (0.5 day) storm event achieves almost nothing compared to the current Baywide mandate of reducing 18,000 grams of PCBs (18 million milligrams) from all stormwater sources each year. This pilot test achieved a tiny fraction - about 0.00001 percent - of the 18 kg load reduction goal established by the TMDL for PCBs in San Francisco Bay.

Scaling the pilot up to the maximum diversion capacity, 250 gpm operated year-round, 24 hours a day seven days a week, would not extend the PCB load reductions by an appreciable amount. Note from Table 3 above that a theoretical wet weather diversion of 500 gpm captures only two to three percent of the storm flows modeled. It would take much larger diversion flows – i.e. thousands of gallons per minute – to capture appreciable amounts of storm flows. Diversions of that scale would require either separate offline high rate treatment, or offline storage and equalization so that WCWD could treat and use the water when it is needed by recycled water customers. Any such approach is a much more substantial and costly engineering endeavor than what has been achieved at the NRSPS through this pilot project.

Overall, stormwater diversion to sanitary does not appear to be a tool that will provide substantive progress towards meeting PCB load reduction goals established by the TMDL.

Monitoring at the NRSPS shows that the estimated watershed PCB load is no more than approximately 10 grams per year generated in that drainage (BASMAA, 2014; Hunt et al., 2012). Even with an impressive capture and use project that harvested nearly all stormwater from the NRSPS service area, 10 grams per year is a very small step towards attaining a load reduction goal of 18,000 grams per year.

From a cost perspective, a diversion project of this scale, implemented as a "stand-alone," without including any infrastructure rehabilitation, would cost close to $1,000,000 for planning, design, construction, monitoring, project management, and reporting.

In summary, this project achieved the objective of installing and pilot testing urban runoff diversion infrastructure. Diversion of dry and wet weather urban runoff into the nearest water reclamation facility offers only incremental PCB load reduction benefits. Diversion is not a "silver bullet" that will make a significant difference to PCB loads; however, consideration of multiple water quality benefits, such as trash controls, water resource development, and reduction of bacteria, oil and grease, and other urban pollutants discharged to Wildcat Marsh and the Bay may motivate additional, expanded stormwater harvest and use projects in this watershed.

Water resource needs may be the overall driver. The newly installed diversion infrastructure can harvest and re-use approximately 50 million gallons[1] per year of urban runoff, primarily as dry weather urban runoff, should WCWD desire to use the infrastructure to implement longer term diversions. Overall, the immediate benefit of extending the useful life of the NRSPS and having diversion capabilities, opens longer term planning opportunities that makes this project a success.

On February 25, 2016, the NRSPS Stormwater Diversion Project was awarded the honor of Environmental Project of the Year by the Northern California Chapter of the American Public Works Association (Appendix A). The award named CCCWP as "an essential partner in the development and construction of this innovative project."

8.0 REFERENCES

Applied Marine Sciences, 2015. Field Sampling Report, North Richmond Pump Station Dry Weather Diversion, Water Quality Monitoring, December 1, 2015 (Appendix F)

Amec Foster Wheeler, 2016. Field Sampling Report, Diversion – Wet Weather Monitoring. North Richmond Pump Station, Contra Costa County, California. January, 2016 (Appendix G).

Bay Area Stormwater Management Agencies Association (BASMAA), 2010. Stormwater Pump Station Diversions Feasibility Evaluation. Prepared by Brown and Caldwell for Bay Area Stormwater Management Agencies Association (BASMAA), December 1, 2010.

[1] This figure is based on an assumed 100 gpm of dry weather flow year-round, diverted 365 days per year, 24 hours a day, with 10 percent down time for storms and maintenance.

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Contra Costa Clean Water Program, 2015. Delta Methylmercury Control Study Preliminary Data Report. Submitted to the Central Valley Regional Water Quality Control Board, October 15, 2015.

East Bay Municipal Utility District, 2010. Environmental Enhancement Project and Supplemental Environmental Project: Characterization of Stormwater Flows, Diversion of Dry Weather and First Flush Flows to a Publicly Owned Treatment Works. July, 2010.

Hunt, J., Gluchowski, D., Gilbreath, A., and McKee, L.J., 2012. Pollutant Monitoring in the North Richmond Pump Station: A Pilot Study for Potential Dry Flow and Seasonal First Flush Diversion for Wastewater Treatment. A report for the Contra Costa County Watershed Program. Funded by a grant from the US Environmental Protection Agency, administered by the San Francisco Estuary Project. San Francisco Estuary Institute, Richmond, CA. http://www.sfei.org/sites/default/files/NorthRichmondPumpStation_Final_19112012_ToCCCWP.pdf

APPENDIX A

Award - Environmental Project of the Year by the Northern California Chapter of the American Public Works Association (February 25, 2016)

AMERICAN PUBLIC WORKS ASSOCIATION
APWA
NORTHERN CALIFORNIA CHAPTER

Northern California Chapter
Proudly Proclaims the

NORTH RICHMOND PUMP STATION STORMWATER DIVERSION PROJECT

as the

2016 ENVIRONMENT PROJECT OF THE YEAR

and Recognizes the

Contra Costa Clean Water Program

As an Essential Partner in the Development and Construction of this Innovative Project

Brian Balbas
2016 Chapter President
February 25, 2016

amec foster wheeler

APPENDIX B

Joint Exercise of Powers Agreement between Contra Costa County and the West County Wastewater District for Maintenance of the NRSPS (August 11, 1981)

Stand - Maintenance

In the Board of Supervisors
of
Contra Costa County, State of California

August 11, 19 81

In the Matter of

Approving and Authorizing Joint Exercise of Powers Agreement with West Contra Costa Sanitary District for Maintenance of the North Richmond Storm Drain Pump Station.
0330-607331

The Public Works Director having recommended that the Board of Supervisors approve and authorize its Chairman to execute the revised Joint Exercise of Powers Agreement with the West Contra Costa Sanitary District (formerly the San Pablo Sanitary District) for the District to maintain the North Richmond Storm Drain Pump Station on behalf of the County; and

The Public Works Director having reported that this revised Agreement reflects changes in accounting and billing procedures and supersedes the original Agreement entered between the County and San Pablo Sanitary District on April 16, 1974;

IT IS BY THE BOARD ORDERED that the recommendation of the Public Works Director is APPROVED and the Chairman is AUTHORIZED to execute the Agreement.

PASSED by the Board on August 11, 1981 by the following vote:

AYES: Supervisors Fahden, Schroder, McPeak, Torlakson, Powers
NOES: None

ABSENT: None

I hereby certify that the foregoing is a true and correct copy of an order entered on the minutes of said Board of Supervisors on the date aforesaid.

Witness my hand and the Seal of the Board of Supervisors affixed this 11th day of August, 19 81

J. R. OLSSON, Clerk

By Linda L. Page, Deputy Clerk
Linda L. Page

Originator: Public Works Dept.
Maintenance Division

cc: County Administrator
Auditor-Controller
Public Works Director
Accounting Division
Maintenance
West Contra Costa Sanitary via Maintenance

H-24 3/79 15M

AGREEMENT

(JOINT EXERCISE OF POWERS - NORTH RICHMOND
STORM DRAIN PUMP STATION - MAINTENANCE)

1. PARTIES & DATE. Effective on August 11, 1981 the WEST CONTRA COSTA SANITARY DISTRICT, a political subdivision of the State of California, hereinafter referred to as "DISTRICT," and the COUNTY OF CONTRA COSTA, a political subdivision of the State of California, hereinafter referred to as "COUNTY," pursuant to Government Code Sections 6500 et seq., do mutually promise and agree as hereinafter set forth.

2. PURPOSE & SCOPE. This agreement supersedes the agreement entered into by SAN PABLO SANITARY DISTRICT and COUNTY OF CONTRA COSTA on April 16, 1974. COUNTY has constructed a storm drain system including a pumping station, in the unincorporated area of North Richmond on West Gertrude Avenue directly across from Deal Auto Wrecking at 400 West Gertrude, and has need to provide for the maintenance and operation of said pumping station, which DISTRICT is willing to provide.

3. MUTUAL PROMISES. DISTRICT shall be responsible for the maintenance and operation of said pumping station, in accordance with Paragraphs 4 and 5, below, COUNTY shall bear the cost of said maintenance and operation, including the cost of all utilities serving the pump station, such as electrical, telephone, water, sewers, natural gas, propane gas and telemetering. COUNTY also agrees to bear all costs associated with property ownership, such as frontage improvement costs and special assessments, which might be applicable.

4. DEFINITIONS.

a. "Maintenance" includes replacement and/or repair of all elements and components of the pumping station and appurtenances, including but not limited to the pumping units, engines, motors, structures, fuel storage, electrical panels, and piping, and routine maintenance such as cleaning, painting, lubrication, and maintenance of landscaping.

b. "Operation" includes operation of the pumping units and auxiliary facilities.

5. STANDARD. All operation and maintenance work shall be performed in accordance with good engineering practice and shall initially follow the Operation and Maintenance Manual to be prepared by County's consultant and furnished by COUNTY.

6. METHOD. DISTRICT will bill COUNTY every six months for actual direct labor costs, including reasonable overhead costs, the cost of supplies, and cost of services by others. DISTRICT will be allowed to add a surcharge which equals 5% of the total cost to cover the administrative and interest costs for funds advanced by DISTRICT. DISTRICT grants to the COUNTY the right to install monitoring

devices in DISTRICT'S treatment plant at locations designated by DISTRICT for the purpose of receiving monitoring signals originating at COUNTY'S pumping station. Except for emergency work, no single maintenance or operational task for which the estimated cost exceeds TWO THOUSAND FIVE HUNDRED DOLLARS ($2,500.00) shall be performed without first obtaining written approval from the appropriate COUNTY authority. In the event of emergency, DISTRICT shall notify COUNTY immediately of its repair work.

7. PAYMENT. COUNTY, upon being billed by DISTRICT for operation and maintenance costs, will reimburse DISTRICT within 30 days of receipt of invoice. DISTRICT annually will submit, no later than February 1 of each year, its estimate of annual operation and maintenance costs for COUNTY budgetary purposes. It is understood that the actual operation and maintenance costs from year to year may be greater or less than the estimated annual cost. The frequency of billing periods may be adjusted by mutual agreement of COUNTY and DISTRICT. There will be strict accountability of all DISTRICT costs and expenditures for operation and maintenance of the pump station. COUNTY reserves the right to review the financial books and records of DISTRICT with respect to charges invoiced to COUNTY.

8. INDEMNIFICATION. COUNTY, insofar as it may legally do so, shall indemnify and hold harmless DISTRICT, its officers, agents and employees from any and all liability, claims or losses resulting from, or associated with, DISTRICT'S maintenance of the pump station except where claim or damage results from negligence or willful misconduct on the part of DISTRICT, its officers, agents and employees. DISTRICT assumes responsibility for Workers' Compensation coverage and DISTRICT shall defend and indemnify COUNTY for and hold it harmless from any claims or losses on the part of DISTRICT'S employees which are governed by Workmens' Compensation. All other insurance coverage shall be furnished by COUNTY. DISTRICT shall not be liable for damage resulting from acts beyond its control, including labor strikes or stoppages, power outages, inability to procure fuel, and vandalism.

9. TERMINATION. This agreement will continue in full force and effect from year to year until rescinded or terminated. The agreement may be terminated at the end of any fiscal year by either party submitting written notification of termination to the other party on or before April 1 of the final year.

COUNTY OF CONTRA COSTA

By _____
Chairman, Board of Supervisors

ATTEST: J.R. Olsson
County Clerk

By _____
Deputy

Approved as to Form:
John B. Clausen, County Counsel

By _____

WEST CONTRA COSTA SANITARY DISTRICT

By _____
President

By _____
Secretary

Approved as to Form:
Robert W. Pelletreau, Board Attorney

By _____

APPENDIX C

Waste Water Discharge Permit No. SD-019 (September 16, 2015)

West County Wastewater District

WASTEWATER DISCHARGE PERMIT

PERMIT No. SD-019

In accordance with the West County Wastewater District (District) Wastewater Discharge Ordinance, No. 11-7-00 (Ordinance):

Contra Costa Public Works Department
North Richmond Pump Station
Richmond Parkway at W. Gertrude Avenue
Richmond, CA 94801

Is hereby authorized to discharge water from the North Richmond Pump Station into the District sewer system in accordance with the conditions set forth in this permit. Compliance with the Local Limits outlined in the Ordinance must be maintained for all discharges to the District's collection system and treatment plant. Compliance with this permit does not relieve the Contra Costa County Public Works Department (permittee) of its obligation to comply with any or all applicable pretreatment regulations, standards or requirements under local, State, and Federal laws, including any such regulations, standards, requirements, or laws that may become effective during the term of this permit.

Non-compliance with any term or condition of this permit shall constitute a violation of the District's Ordinance. Any person who violates permit conditions is subject to civil and criminal penalties and enforcement as outlined in the Ordinance and Federal pretreatment standards.

This permit shall become effective on **September 16, 2015** and shall expire at midnight on **September 15, 2018.** If the permittee wishes to continue to discharge wastestreams that are covered by the District's Ordinance, an application must be filed for renewal on or before February 28, 2018 (a minimum of 90 days before the permit expires).

Wastewater Discharge Permits are not transferable. The permittee shall notify the District prior to any change in ownership or operation, provide the succeeding owner or operator with a copy of this permit and notify them that an application for renewal of the permit may be required.

Brian E. Hill

Brian Hill
Water Pollution Control Plant Superintendant

PART 1 – EFFLUENT LIMITATIONS

A. Description of Discharge(s)

The permittee is authorized to discharge water from the connection listed below.

Outfall #	Description
1	Runoff from the stormwater collection system at the North Richmond Pump Station into a manhole on W. Gertrude Avenue

B. Discharge Limits

During the term of this permit all water generated and discharged from the facility shall comply with the District's Ordinance and shall not exceed the District's Specific Discharge Limitations:

Local Limits			
Total Metals	**Daily Maximum mg/L**	**Additional Parameters**	**Daily Maximum mg/L**
Arsenic (As)	0.37	Cyanide (CN^-)*	0.4
Cadmium (Cd)	0.5	Phenolic Compounds	8.0
Chrome (Cr)	2.0	Chloroform	3.34
Copper (Cu)	3.0	Methylene Chloride	0.18
Lead (Pb)	2.0	Tetrachloroethylene	14.26
Mercury (Hg)	0.02	Tributyltin	0.19
Nickel (Ni)	0.8		
Selenium	1.0	pH	6.0 – 12.0 units
Silver (Ag)	0.3	Temperature	< 130° F
Zinc (Zn)	5.0		

The permittee shall not discharge any wastewater that is prohibited under Section 2 of the District's Ordinance during the term of this permit.

The maximum flow of stormwater regulated by flow restrictor or pump capacity shall at no time exceed **400 gallons per minute** unless previous written authorization is provided by the District.

PART 2 – MONITORING REQUIREMENTS

The permittee shall monitor this outfall for the following:

Weekly and Monthly Monitoring Requirements

Sample Parameter(s)	Frequency	Sampling Period(s)	Sampling Method
pH[1]	1x/week	October – December	Single Grab
Flow[2]	Continuous	October- December	Metered

Arsenic (As)(T)	1x/week	October- December	Single Grab
Cadmium (Cd)(T)	1x/week	October – December	Single Grab
Chromium (Cr)(T)	1x/week	October – December	Single Grab
Copper (Cu)(T)	1x/week	October – December	Single Grab
Lead (Pb)(T)	1x/week	October- December	Single Grab
Mercury (Hg)(T)	1x/week	October- December	Single Grab
Nickel (Ni)(T)	1x/week	October- December	Single Grab
Selenium (Se)(T)	1x/week	October – December	Single Grab
Silver (Ag)(T)	1x/week	October – December	Single Grab
Zinc (Zn)(T)	1x/week	October – December	Single Grab

(T) = Total

Quarterly Monitoring Requirements

Sample Parameter(s)	**Frequency**	**Sampling Period(s)**	**Sampling Method**
EPA Method 608	Quarterly[3]	Jan-Mar; Apr-Jun; Jul-Sep; Oct-Dec	Composite[4]
EPA Method 624	Quarterly[3]	Jan-Mar; Apr-Jun; Jul-Sep; Oct-Dec	Composite[4]
EPA Method 625	Quarterly[3]	Jan-Mar; Apr-Jun; Jul-Sep; Oct-Dec	Composite[4]
Arsenic (As)(T)	Quarterly[3]	Jan-Mar; Apr-Jun; Jul-Sep; Oct-Dec	Composite[4]
Cadmium (Cd)(T)	Quarterly[3]	Jan-Mar; Apr-Jun; Jul-Sep; Oct-Dec	Composite[4]
Chromium (Cr)(T)	Quarterly[3]	Jan-Mar; Apr-Jun; Jul-Sep; Oct-Dec	Composite[4]
Copper (Cu)(T)	Quarterly[3]	Jan-Mar; Apr-Jun; Jul-Sep; Oct-Dec	Composite[4]
Lead (Pb)(T)	Quarterly[3]	Jan-Mar; Apr-Jun; Jul-Sep; Oct-Dec	Composite[4]
Mercury (Hg)(T)	Quarterly[3]	Jan-Mar; Apr-Jun; Jul-Sep; Oct-Dec	Composite[4]
Nickel (Ni)(T)	Quarterly[3]	Jan-Mar; Apr-Jun; Jul-Sep; Oct-Dec	Composite[4]
Selenium (Se)(T)	Quarterly[3]	Jan-Mar; Apr-Jun; Jul-Sep; Oct-Dec	Composite[4]
Silver (Ag)(T)	Quarterly[3]	Jan-Mar; Apr-Jun; Jul-Sep; Oct-Dec	Composite[4]
Zinc (Zn)(T)	Quarterly[3]	Jan-Mar; Apr-Jun; Jul-Sep; Oct-Dec	Composite[4]

1. pH shall be measured in the field using a properly maintained and calibrated pH meter.

2. **Flow** - The permittee shall quantify the volume of water that is generated from regulated process operations, and is discharged to the sewer, using meters and/or totalizers, where feasible. Meter must be non-resettable; the total volume shall be recorded daily and record(s) submitted monthly.

3. Results from quarterly sampling may also be used to comply with the weekly sampling requirements for the week measurements are taken; only required for quarters when discharge occurs.

4. Composite grab sampling techniques shall be used and be representative of the total flow over a 24 hour discharge period.

Sampling & Analyses - All sampling and analyses required by the permit shall be performed in accordance with the techniques described in 40 CFR Part 136 and amendments thereto, using validated analytical methods approved by the EPA [40 CFR 403.12(g)] or by methods specified in the permit. Analyses shall use only wastewater methods.

The permittee shall maintain all equipment so that accurate and reliable readings are provided. Calibration of equipment shall be performed at a minimum of once per year and more often if/when necessary.

The permittee is responsible for monitoring discharge. The District will periodically monitor for compliance with the parameters outlined above and District's local limits.

PART 3 – REPORTING REQUIREMENTS

All self-monitoring reports shall contain the following certification signed by a duly authorized representative using these words:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision and in accordance with the system designed to insure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person(s) who manage the system, or those directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for knowingly submitting false information, including the possibility of fine and imprisonment for knowing violations."

Unless otherwise stated all information and reports required by the District shall be submitted as follows:

Information/Report for:	Due Before 5:00 p.m.
January	February 28th
February	March 30th
March	April 30th
April	May 30th
May	June 30th
June	July 30th
July	August 30th
August	September 30th
September	October 30th
October	November 30th
November	December 30th
December	January 30th

1. **Flow Report** - submit monthly a report outlining daily flow meter readings, gallons discharged per day, the total volume discharged each month, and a summary of the results of monthly and weekly monitoring requirements.

2. **Flow Meter Calibration & Report** – A minimum of once every calendar year (January 1st – December 31st), the flow meter (and any associated monitoring and/or recording equipment) shall be calibrated by a qualified, independent third party and certified that they are operating within specifications. The calibration report shall be submitted before the 15th of the month following the month the calibration(s) are performed.

3. **pH Meter Calibration(s) & Report** – portable pH meter(s) should be calibrated prior to each use. Meters shall be calibrated according to equipment specifications and using buffers appropriate for proper measurement of the waste stream(s) being monitored. Logs shall be kept to verify: date of calibration, the initials and name of the technician performing the calibration(s), buffers used, the before & after pH readings, and any problems noted and/or maintenance, etc. Logs shall be kept onsite and available for review upon request.

   Failure to provide the required reports within 30 days after the due date will be considered as significant noncompliance as outlined in the District's Sewer User Ordinance [Section 1.2 (45) (f)]. Reports need to be submitted by mail, fax, or in-person. If the report is submitted electronically, the permittee must also submit by mail or fax a certification statement as is outlined in 40 CFR 403.6 (a) (2) (ii) and to be signed by an authorized representative of the facility.

4. **Sampling & Analyses:**

   - Representative Sampling - Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge. All samples shall be taken at the monitoring points specified in the permit. All equipment used for sampling and analysis must be routinely calibrated, inspected and maintained to ensure its accuracy. Monitoring points shall not be changed without notification to and written approval by the District.

- Increased Sampling/Monitoring - In addition to any monitoring requirements of this permit, if the permittee monitors any pollutant at the point(s) of compliance more frequently than required by the permit, using test procedures prescribed in 40 CFR Part 136 and amendments thereto, or otherwise approved by EPA or as specified in the permit, the results of such monitoring shall be included in any calculations of the daily maximum and monthly averages. Pollutant discharge results shall be summarized and reported to the District; such increased monitoring frequency shall also be indicated in the report.

- Permit Violations and Automatic Re-sampling - If the results of analyses of the permittee's discharge indicate that a violation of the permit has occurred, the permittee, according to 40 CFR 403.12(g) must:

  a) Inform the District of the violation within 24 Hours of becoming aware of the violation and;
  b) The permittee shall also repeat the sampling and analysis and submit the results of the repeat analysis within 30 days after becoming aware of the violation.

  Exceptions to the requirement of repeat sampling and analysis are if the District samples the facility at least once per month, and/or, if the District performs sampling at the facility between the time the initial sample was collected (that indicated there was a violation) and when the results of that sample event were received.

- Record Contents - Facilities shall maintain records of all information resulting from any monitoring activities, including documentation associated with Best Management Practices. Copies of records shall be submitted to the District and originals shall be kept by the permittee; records of sampling and analysis shall include:

  a) The date, the exact place(s), time(s), and methods of sampling or measurements, and sample preservation techniques or procedures;
  b) Who performed the sampling or measurement (name and company);
  c) The date(s) analyses were performed;
  d) The person(s) who performed the analysis;
  e) The analytical technique(s)/method(s) used;
  f) The results of such analyses;
  g) Laboratory Quality Assurance and Quality Control reports (QA/QC);
  h) A record of sample possession from the time the sample was collected to the time the report of analysis was completed (Chain of Custody).

5. **Changes**

The facility is required to notify the District, in writing, of any significant changes to the User's operations or system which might alter the nature, quality, or volume of its discharge at least 90 days before the change. The facility is required to submit such information as may be deemed necessary to evaluate the changed condition, including submission of an updated wastewater discharge application. The District may modify this permit in response to changed conditions or anticipated changes in conditions.

6. **Retention of Records** – The facility shall maintain records of all information resulting from any monitoring activities, including documentation associated with Best Management Practices. Copies of records shall be submitted to the District and originals shall be kept by the permittee; records of sampling and analysis shall include:

   i) The date, the exact place(s), time(s), and methods of sampling or measurements, and sample preservation techniques or procedures;
   j) Who performed the sampling or measurement (name and company);
   k) The date(s) analyses were performed;
   l) The person(s) who performed the analysis;
   m) The analytical technique(s)/method(s) used;
   n) The results of such analyses;
   o) Laboratory Quality Assurance and Quality Control reports (QA/QC);
   p) A record of sample possession from the time the sample was collected to the time the report of analysis was completed (Chain of Custody).

7. **Waste Disposal** - The permittee shall maintain records to verify that any hazardous materials and/or wastes that are prohibited from discharge to the sanitary were disposed of properly. Wastes must be handled, stored, and disposed of according to applicable local, state, and federal regulations. Records of disposal and/or recycling of such wastes must be retained by the permittee for a period of three years. These records shall include the amount of waste generated and the method of final disposal (including appropriate waste manifests).

PART 4 – NOTIFICATION OF SLUG DISCHARGE AND BYPASS

The permittee shall notify the District immediately of any changes at the facility affecting the potential for a slug discharge and bypass.

The permittee shall notify the District immediately upon the occurrence of an accidental discharge of substances prohibited by Section 2 of the District's Ordinance or any slug loads or spills that may enter the sewer.

1. Bypass – the intentional diversion of wastestreams from any portion of an Industrial User's treatment facility [40 CFR 403.17 (a)].

2. Slug Discharge(s) - any discharge of a non-routine, episodic nature, including but not limited to an accidental spill or a non-customary batch Discharge, which has a reasonable potential to cause Interference or Pass Through, or in any other way violate the POTW's regulations, local limits or permit conditions. The results of such activities shall be available to the District upon request.

The permittee is required to notify the District immediately of any changes at the facility affecting the potential for a slug discharge, and if the District determines a plan is required, the permittee shall develop a plan that contains, at a minimum, the following:

a) Description of discharge practices, including non-routine batch Discharges;
b) Description of stored chemicals;
c) Procedures for immediately notifying the POTW of Slug Discharges, including any Discharge that would violate a prohibition under 40 CFR Part§ 403.5(b) with procedures for follow-up written notification within five days;
d) If necessary, procedures to prevent adverse impact from accidental spills, including inspection and maintenance of storage areas, handling and transfer of materials, loading and unloading operations, control of plant site run-off, worker training, building of containment structures or equipment, measures for containing toxic organic pollutants (including solvents), and/or measures and equipment for emergency response.

PART 5 – STANDARD CONDITIONS

The permittee shall comply with all requirements of this permit, all conditions specified in the District's Wastewater Discharge Ordinance (11-7-00).

PART 6 – CIVIL AND CRIMINAL PENALTIES

The facility is subject to civil and criminal penalties for violation(s) of Pretreatment Standards and requirements, and any applicable compliance schedule(s); reference Section 5 of the District's Wastewater Discharge Ordinance.

PART 7 - PERMIT EXTENSION

The District reserves the right to extend the permit if necessary. The District must provide a written notice to the permittee at least 90 days before the permit expires. The permit cannot be extended beyond the maximum of five years permit limit [40 CFR 403.8 (f1) (iii) (A)].

End of Permit

amec foster wheeler

APPENDIX D

SWMM Modeling for North Richmond Pump Station, Options for Minimizing Stormwater Discharge into the Bay (March 4, 2016)

Memo

To: Mitch Avalon
Contra Costa County
Project Manager of the
NRSPS Diversion Pilot

From: Sandy Chang
Dr. Khalil E.P. Abusaba

Tel: (510) 663-4100

Fax: (510) 663-4141

Project: 5025153001.01

cc: Cece Sellgren, Contra Costa County Watershed Program

Rob Carson, Contra Costa Clean Water Program

Date: March 4, 2016

Subject: SWMM Modeling for North Richmond Pump Station, Options for Minimizing Stormwater Discharge into the Bay

1.0 EXECUTIVE SUMMARY

The estimated dry weather flow rate for the NRSPS ranges from 80 gpm to 140 gpm. The percentage of stormwater that could be treated by using diversion pumps of varying size to provide onsite or offsite treatment is summarized in Table 1 below.

Table 1. Percent of stormwater that could be treated at the NRSPS under various assumed treatment capacities.

Treatment capacity (gpm)	% stormwater treated		
	April 4, 2013	September 21, 2013	February 2005-October 2013
500	3	2	2
1400	68	25	36
1900	84	44	44

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180 Grand Avenue, Suite 1100
Oakland, California 94612-3066
USA
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amecfw.com

2.0 INTRODUCTION

The purpose of this memorandum is to document the approach and findings of flow modeling applied to the sub-watershed that drains into the North Richmond Pump Station (NRPS) (Fig. 1). This work is being done to assist Contra Costa County, as one of the NRSPS co-owners, who is taking the lead on a pilot project with the consent of the other co-owner, the City of Richmond. This modeling work has been done to support the design of a pilot project to divert stormwater from the NRSPS into the nearby West County Wastewater District (WCWD) sewage treatment plant (CCCWP, 2012).

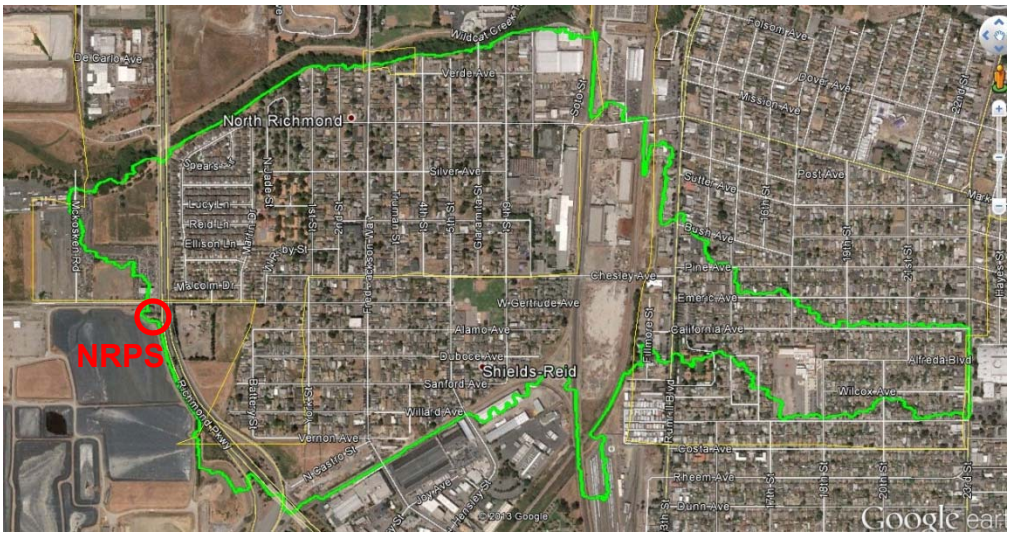


Figure 1: Delineation of sub-catchment drainage into NRPS (Contra Costa County).

The pilot diversion project is one of several pollutant reduction pilot projects required by the San Francisco Bay Regional Water Quality Control Board (SFRWQCB) through the Municipal Regional Stormwater National Pollutant Discharge Elimination System (NPDES) Permit (Order No. R2-2009-0074, a.k.a. "the MRP"). The goal of pollutant reduction pilot projects required under the MRP is to evaluate the feasibility, costs, and benefits of different approaches to reducing stormwater loads of polychlorinated biphenyls (PCBs) and mercury discharged into the Bay. This pilot project evaluates the circumstances under which it may be feasible and cost effective to co-manage stormwater discharges from the NRSPS with municipal sanitary sewage using treatment capacity available at WCWD.

The NRPS was originally designed with four high flow pumps, each with a rated capacity of 45,000 gpm. Three of the pumps are duty pumps, one is a standby, giving the NRSPS a capacity of 135,000 gpm. The original design also included two smaller pumps for lower flows, each rated at 3500 gpm. Currently, only the three high flow pumps are functional. During periods of low flows, including both light rainfall events and prolonged periods of dry weather

urban runoff that occur in the summer, the collection system upstream of the NRSPS are filled and emptied every one to two days by the high flow pumps operating in short bursts lasting no more than a few minutes. The current mode of operation is less than ideal, because of excessive use of the high flow pumps in a manner different from the design intent, and because of potential problems caused by accumulation of standing, stagnant water in the collection system.

As part of implementing this pilot project, low flow pumping capacity will be restored. Dry weather flow rates were likely higher in the early 1970s, when the NRSPS was designed, compared to current dry weather flow rates. Present-day dry weather inflow rates were estimated using modeling to support design of the diversion. In addition to estimating dry weather inflow rates, modeling is used to forecast how much stormwater can be diverted to either WCWD and/or an onsite stormwater that may be constructed in the future.

This study modeled five scenarios:

Scenario 1: The current system (with no low flow pumps operational). This scenario was used to estimate current dry weather inflow rates.

Scenario 2: The current system with 400 gpm low flow pumping capacity. This scenario was used to model dry weather and first flush diversions to WCWD.

Scenario 3: 400 gpm diversion to WCWD along with onsite treatment capacity of 100 gpm

Scenario 4: 400 gpm diversion to WCWD along with onsite treatment capacity of 1000 gpm

Scenario 5: 400 gpm diversion to WCWD along with onsite treatment capacity of 1500 gpm

These five scenarios address two key questions that need to be answered prior to proceeding with design of the pilot diversion project:

What is the current dry weather flow rate into the NRSPS?

How much stormwater can be treated, either onsite or by WCWD, under different design scenarios?

3.0 APPROACH

The NRPS was modeled using the EPA Storm Water Management Model (SWMM 5.0), a dynamic rainfall-runoff simulation model specifically adapted for designs related to urban storm water runoff, sanitary sewers, and other drainage systems. SWMM 5.0 has the capability to include pollutant loading and other water quality parameters, climate inputs such as precipitation and evaporation, groundwater interactions, as well as hydraulic mass balancing. The scope of this work was limited to analysis of water quantities.

Model design relied on specifications as outlined in the North Richmond Storm Drain Project Storm Drain System & Outfall Channel as-built[1] (Fig. 2) and the Pump Station and Discharge System design plans[2]. Using these drawings for guidance, a detailed model domain was created (Fig. 3) to mimic the stormwater conveyance system. Additional model inputs include the sub-watershed delineation as provided by Contra Costa County (Fig. 1) and rainfall data from the Richmond City Hall rain gauge[3] operated by the County.

Continuous water level monitoring data from the time period September 27, 2012 to May 21, 2013 were provided by the San Francisco Estuary Institute (SFEI), who has been monitoring flow and water quality at the NRSPS since 2010. Water level variation was used in Scenario 1 (existing conditions) to estimate dry weather inflow rates. Model dry weather inflow rates were varied until the timing of the rise and fall of water levels most closely matched the frequency of pump operation based on the continuous monitoring observations made by SFEI staff.

The three operational pumps were modeled as a single pump that varies between 7000 gpm (ramp up speed) and 135,000 gpm to match the inflow rates. This is not an exact replica of actual pump operations; the pumps turn on and off and ramp up and down their operating speeds in response to changing water levels. As a result, actual operations involve a certain lag time for the discharge pumps to match water inflow rates. In the model, the pumps respond to changing water levels instantaneously. This approximation is not thought to be a significant factor affecting the findings presented in this memorandum.

In the model, dry weather diversions and wet weather diversions (to WCWD) were assigned unique pumps. This was simply a modeling convenience to tabulate separately the volumes of stormwater vs. dry weather flows diverted – in the actual design of the pilot project, the same pump would be used to divert low flows as would be used to divert storm flows.

The models for each scenario are provided in a companion thumb drive to this memorandum.

[1] Contra Costa County Flood Control & Water Conservation District, 1972. Contra Costa county North Richmond Storm Drain Project, Project No. W.S.-Calif.-436, Storm Drain System & Outfall Channel, November 21.

[2] Brown and Caldwell, 1972. Contra Costa County, North Richmond Storm Drain Project HUD Project No. W.W.-Calif.-436, Pump Station and Discharge System. November.

[3] The Richmond City Hall (RHL) rain gauge data, operated by Contra Costa County with website maintained by the California Department of Water Resources, is available at: http://cdec.water.ca.gov/cgi-progs/selectQuery?station_id=RHL&sensor_num=16&dur_code=E&start_date=&end_date=now

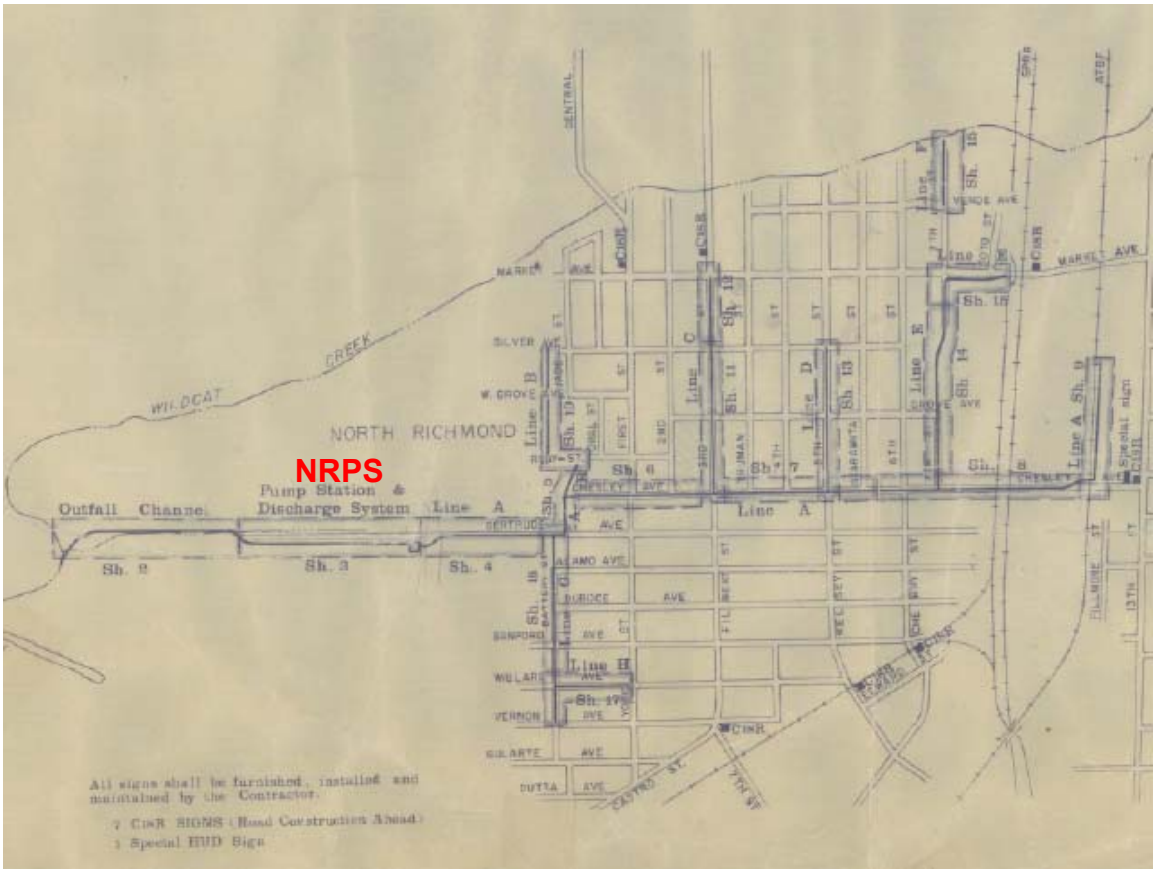


Figure 2: Storm Drain System of North Richmond Storm Drain Project (1972).

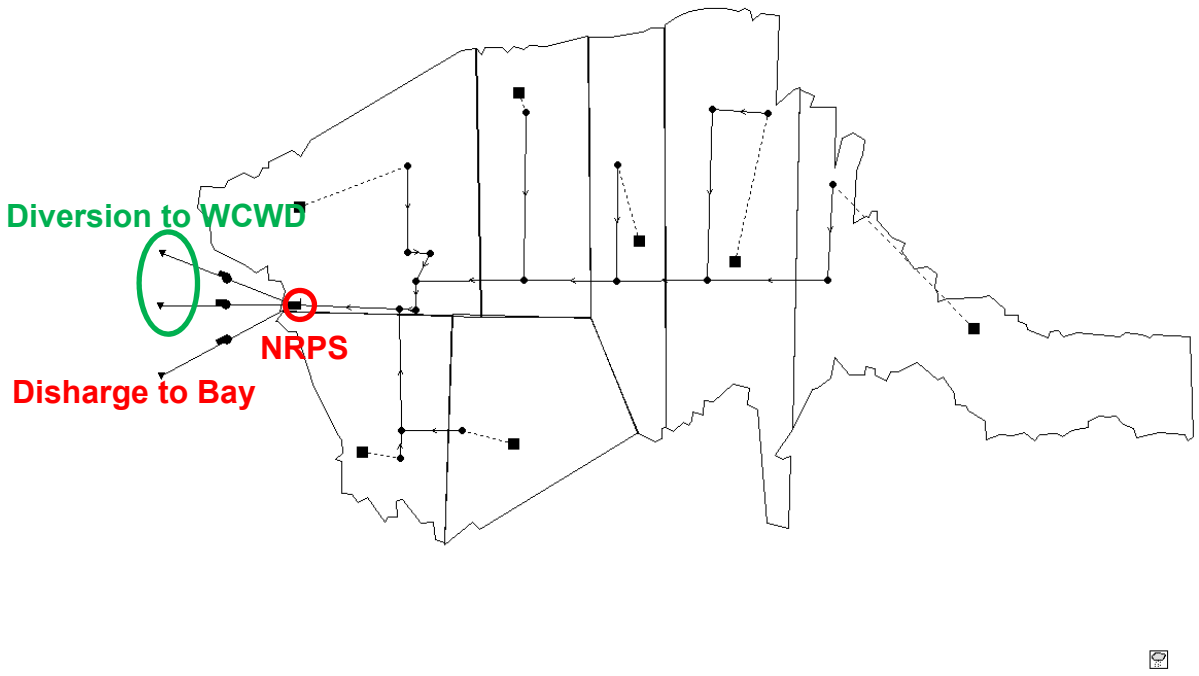


Figure 3: Watershed model with drainage system and diversion.

4.0 RESULTS

4.1 Scenario 1: Existing Conditions

The purpose of this base case is to estimate the dry weather inflow rate. Important calibrating observations include measurements made by San Francisco Estuary Institute (SFEI). Dry weather flow rates can be estimated with the following approaches:

1) The storage volume of the system when full and after pumps turn off can be calculated form geometry, and the dry weather inflow rate estimated based on the change in storage volume over time.
2) Alternatively, dry weather flow rates can be varied in the SWMM 5.0 model to find the closest match in model performance to the observed water level oscillations.
3) The volume pumped out on any particular pump run can be estimated based on pump run times and estimates or measurements of pump run speeds (rpm) and wet well

levels. This latter approach was piloted by SFEI in the 2012 -2013 through their monitoring on behalf of the San Francisco Bay Regional Monitoring Program.

Results from first two approaches are compared below. Comparisons to the third approach, using pump run times and speeds in conjunction with water level data, are deferred until completion of the annual monitoring reports for NRPS monitoring by SFEI.

The NRPS design plans show that when water elevation reaches -9.46 ft, water backs up into the upstream conveyance system – in other words, the conveyance system is design to provide storage buffer. Considering the volume of the pipe that is below elevation -2.83 ft (when the storm pumps are configured to turn on according to the NRPS manual), the system has an estimated storage capacity of 412,500 gal, including the pump station, when the conveyance system is full. The pumps are configured to switch off at elevation -5.58 ft. The storage volume in the system that is below elevation -5.58 feet is 205,300 gal. By difference, the amount of water pumped out each time the pumps switch on during dry weather flows is approximately 207,000 gal.

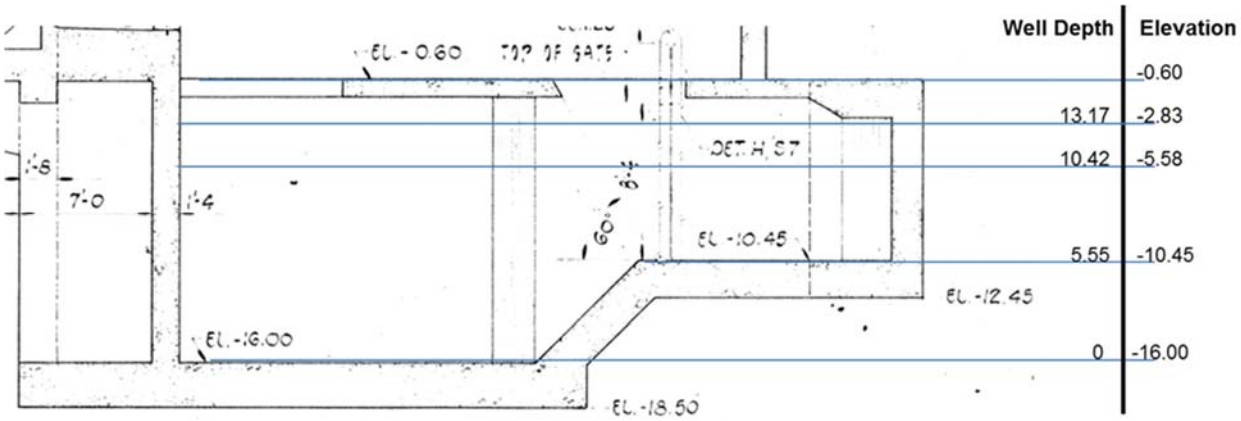


Figure 4: Cross-sectional view of wet well (Brown and Caldwell, 1972).

Based on SFEI's well level data from September 27, 2012 to October 10, 2013, before the first storm event, the pump turned on at an average interval of 1.52 days, ranging between 1.39 days to 1.80 days during the dry season (i.e., between seven weeks after the last rain event of the season to the first rain event of the next season). This corresponds to an estimated dry weather inflow rate of 95 gpm, with a likely range from 80 gpm to 100 gpm.

For comparison, the modeled dry weather flow that predicts a pump cycling frequency of 1.52 days is 130 gpm. Modeling dry weather flows ranging from 110 gpm to 140 gpm predicts pump cycling frequencies of 1.80 days to 1.39 days. One key difference is that according to SFEI, their depth gage was located on the elevated platform of the wet well, at elevation -10.45 (Fig. 5). If that is the case, the pump start up and shut off depths would appear to be at depths 12.5 ft and 9 ft, respectively, in contrast to 13.17 ft and 10.42 ft according to the NRPS manual. To

replicate the SFEI data, the pump trigger depths were adjusted accordingly to the observed depth for comparison (Fig.6).The modeled water level variations closely match observed water level oscillations as reported by SFEI during both dry and wet weather conditions, as seen in Figure 5 and 6 for October 3-23, 2012.

In summary, the estimated dry weather inflow rate to the NRSPS is at least 80 gpm and could be as much as 140 gpm.

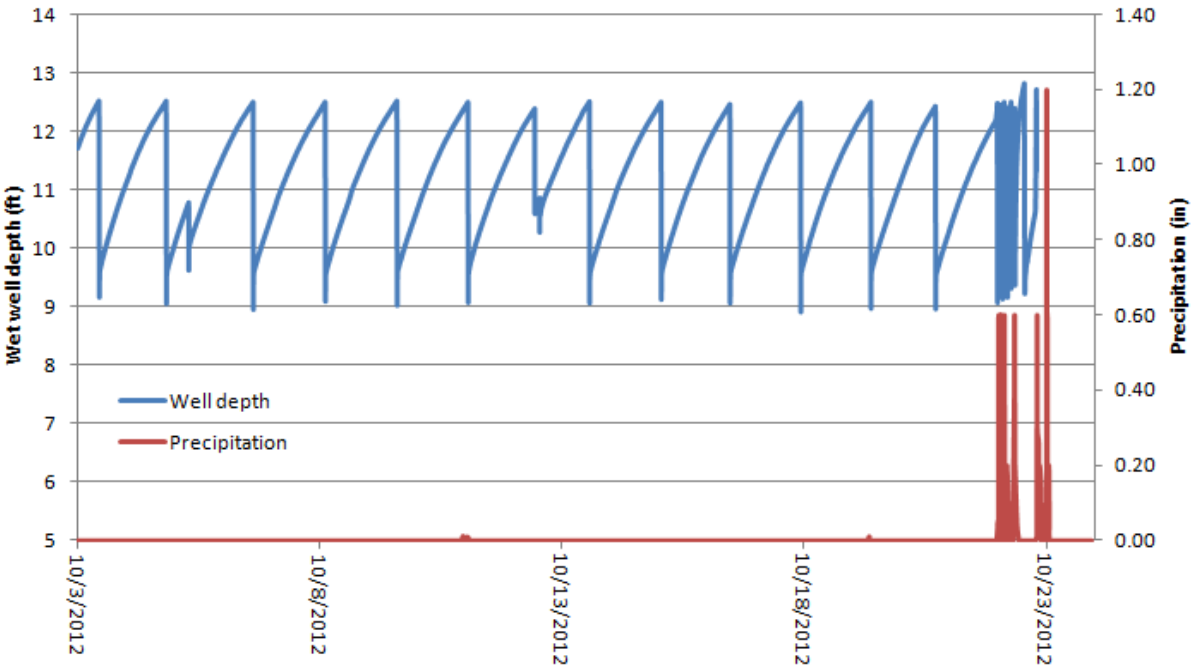


Figure 5: Wet well depth as observed by SFEI and rainfall as recorded by the Richmond City Hall rain gauge.

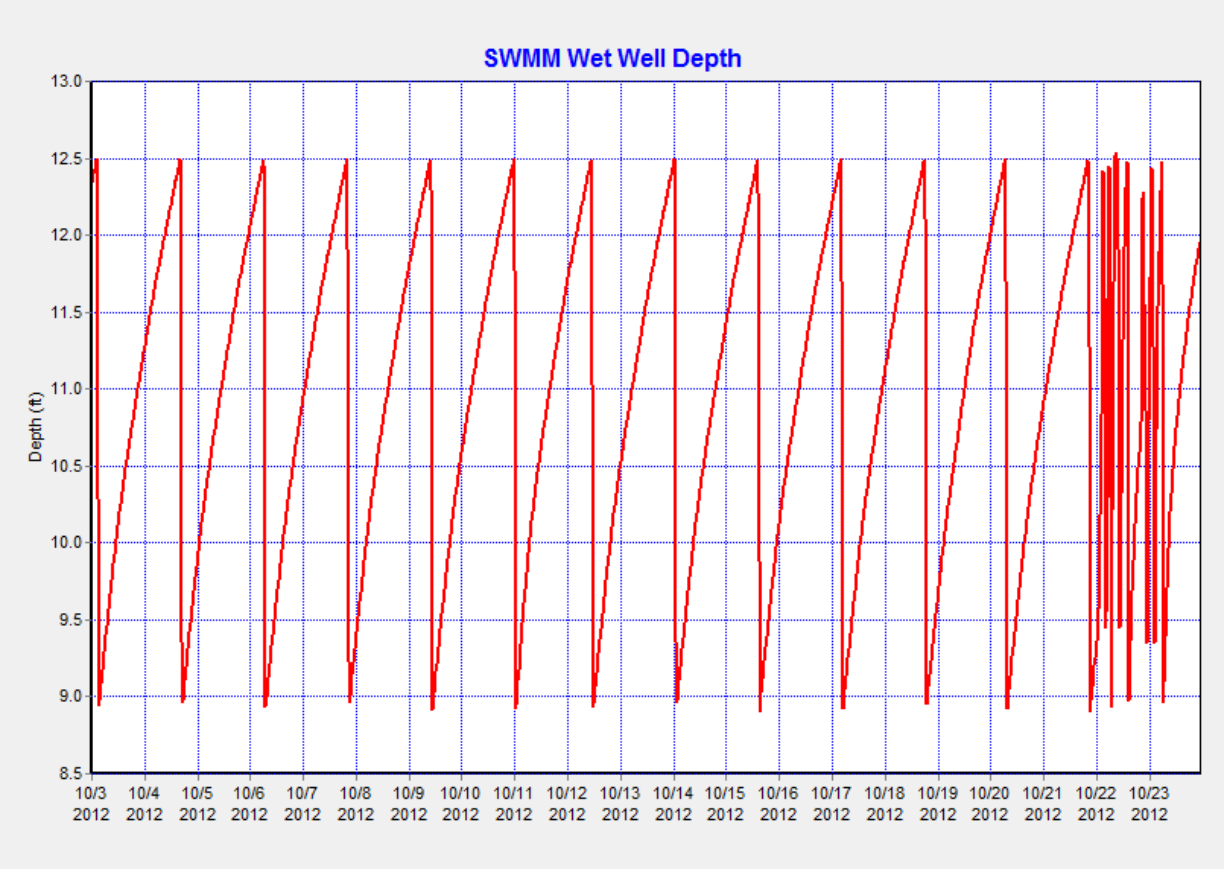


Figure 6: Wet well depth as modeled by SWMM using dry weather flow of 130 gpm and start up and shut off depth of 12.5 ft and 9 ft, respectively.

While there are some differences between the two dry weather flow estimates, with volume estimation method resulting in 80 gpm to 104 gpm while the model method resulting in 110 gpm to 140 gpm, there were several approximations that may lead to this discrepancy. One that is readily observed in figure 5 is the inconsistency of the pump in terms of shut off of the pump, which makes replicating the pump action difficult. Additionally, the range in estimated dry weather flow rates reflects the fact that dry weather flow rates are not expected to be constant. Furthermore, estimation of very low (i.e., three digit) dry weather flow rates based on variations of relatively large (i.e., six digit) storage volumes in an irregularly shaped conveyance system will have limited precision and accuracy. If more precise and accurate estimates of dry weather flow rate are desired, direct measurement in the conveyance channel using weirs or flumes would be necessary.

4.2 Scenario 2: Current System with Diversion to WCWD

This scenario evaluates a pilot project to divert up to 400 gpm dry weather flows and stormwater into WCWD. A diversion pump with a capacity of 400 gpm[4] was added to the model in Scenario 1, using the start up and shut off depths as specified in the original manual. The pump was programmed in the model to turn on at a water elevation of –4.5 ft and turn off at a water elevation of –5.58 ft. Considering the geometry of the collection system, this corresponds to a volume interval of 81,000 gallons. The recent September 21, 2013 rain event was examined as an example of how a pilot diversion during dry weather prior to an early season storm might operate.

When the model assumed a dry weather flow rate of 130 gpm, the storm pump is only on approximately 30 minutes every two days, equivalent to 0.89% utilization. This means that if the maximum diversion flow rate permitted is 400 gpm, then the time needed to drain the collection system to the shut off level each day in dry weather conditions is 13.3 hrs. Diversion capacity will be overwhelmed when inflow to NRPS exceed 260 gpm.

This would be the case for the most recent storm event on September 21, 2013. Unlike rain events most common in the Bay Area, the rain intensity was very high over a short period of time, with 0.66 in of rain over 2.5 hours (Fig. 7). This resulted in a spike in the wet well since the drainage system did not have the time to absorb and equilibrate the additional water (Fig. 8). Prior to this event, there had been no rainfall for three months. The steady oscillation of the wet well water elevation as seen in Figure 8 represents the accumulating and dry weather flow and subsequent draining of the well via the 400 gpm diversion pump, without any contribution from the storm pump.

At the onset of the rain event, the WCWD “wet” pump was activated due to the increased inflow into the well (Fig. 9). Sustained in the first hour of the rain event, the “wet” diversion pump only turns off when the storm pump turned on to prevent the wet well from flooding. This is also reflected in the depth of the wet well with the steep elevation drop after the initial peak in Figure 8. Since the diversion pump was not able to keep ahead of the storm, a single pulse was discharged into the Bay (Fig. 10). If total outflow from the rain event is defined as the combined discharge to the Bay and the wet weather diversion to WCWD, this set up was able to treat **32%** of the stormwater for this particular event, equivalent to the fuchsia portion of Figure 10.

[4] 400 gpm was selected based on the capacity of the nearby 36 inch sanitary sewage conveyance to WCWD. WCWD has provided information showing that during a five year, 24 storm event, the available capacity is 0.6 to 1.4 mgd. This corresponds to available capacity of approximately 400 to 1,100 gpm.

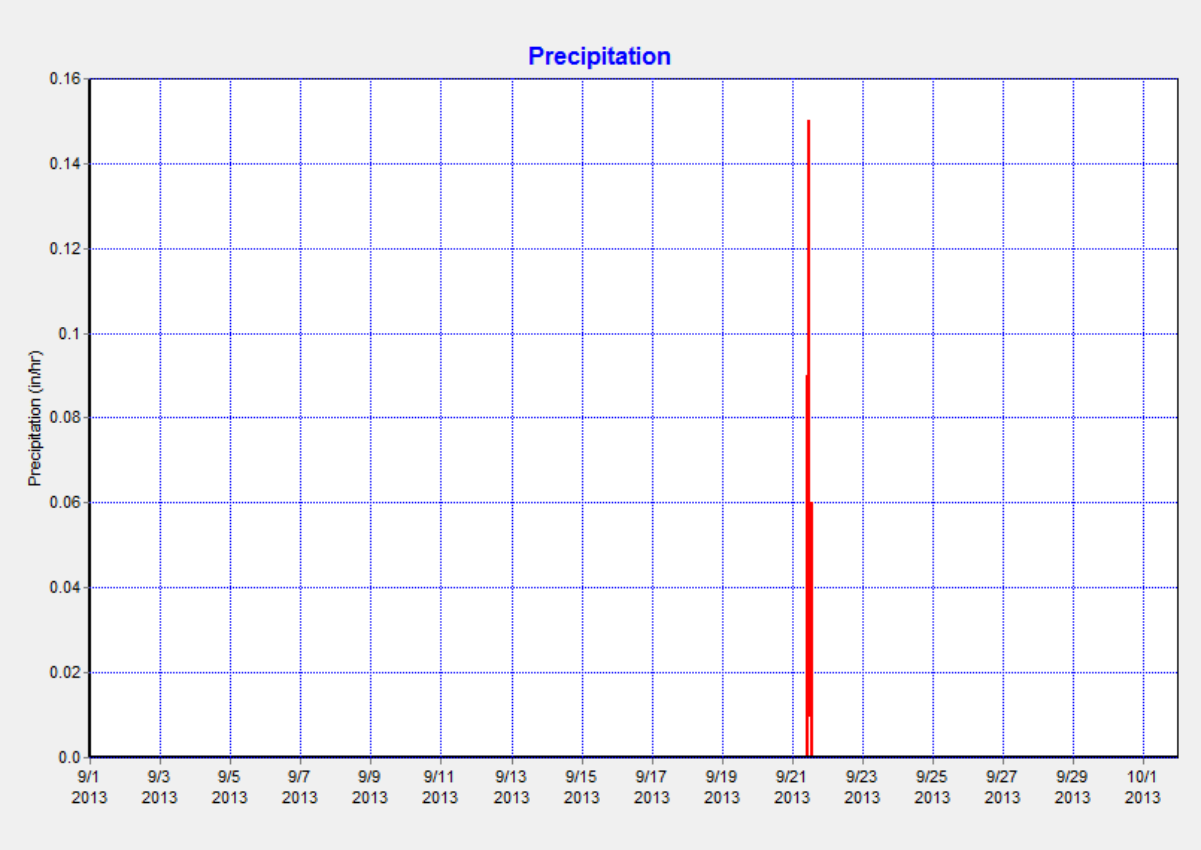


Figure 7: Precipitation as measured by Richmond City Hall rain gauge for September 2013.

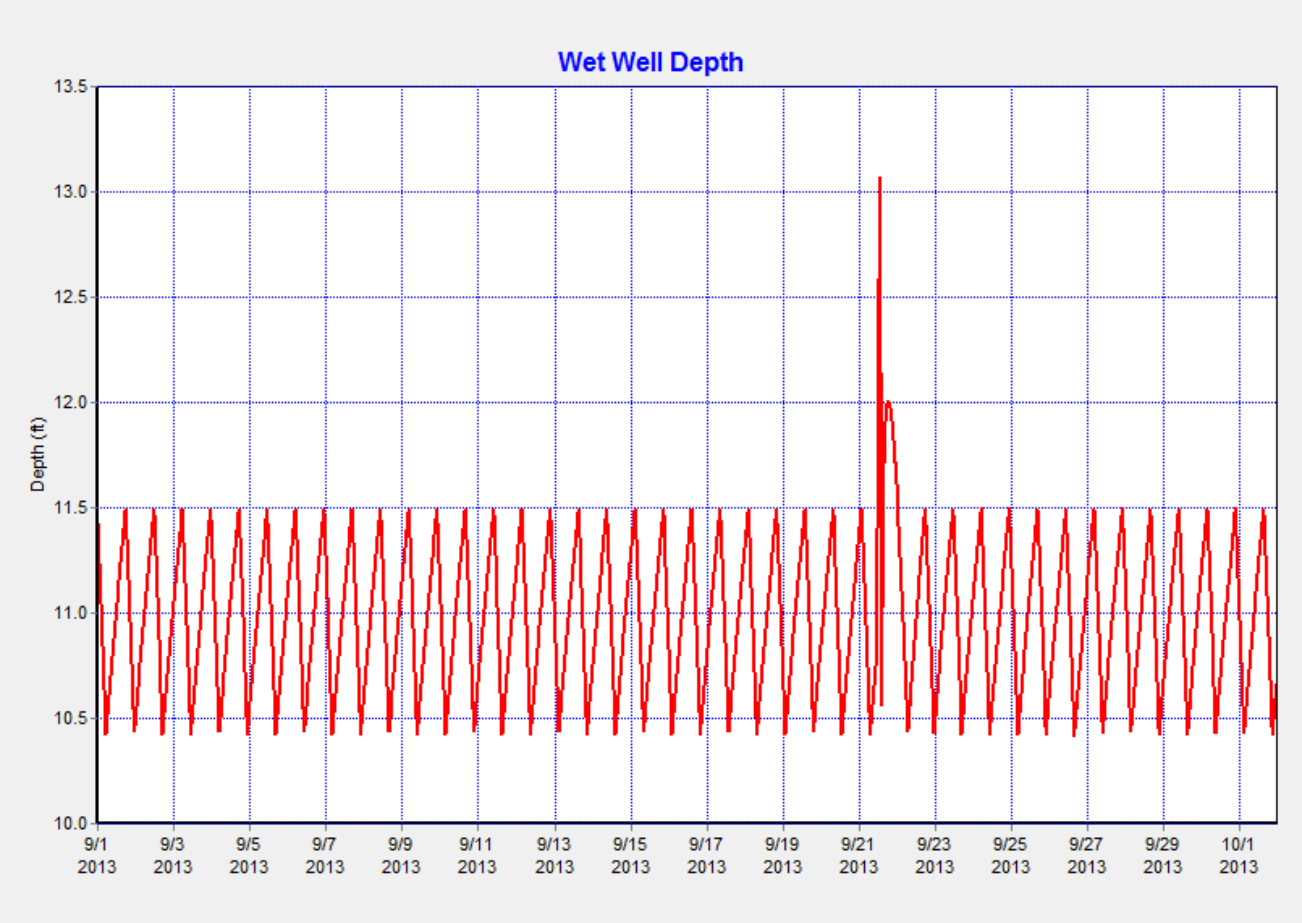


Figure 8: Depth of wet well for September 2013.

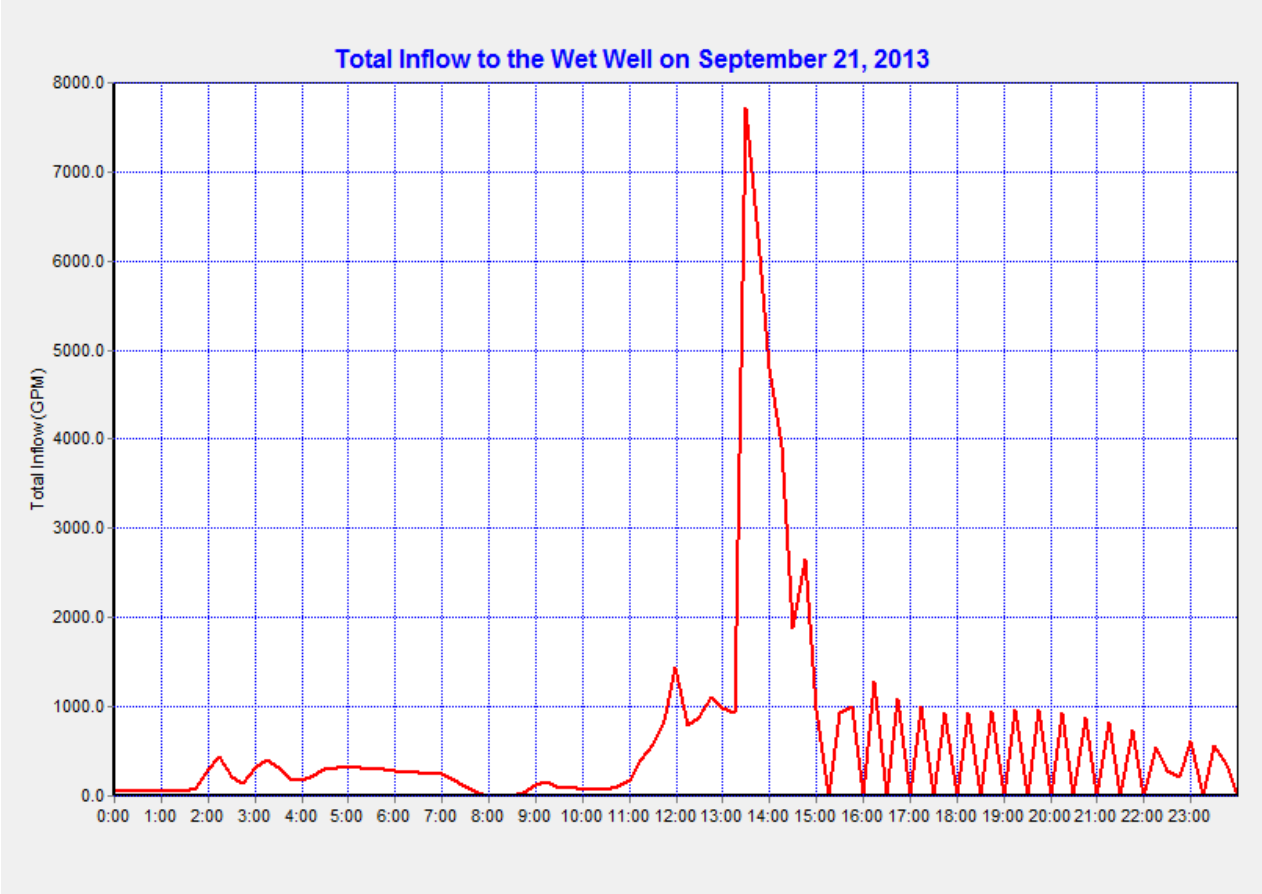
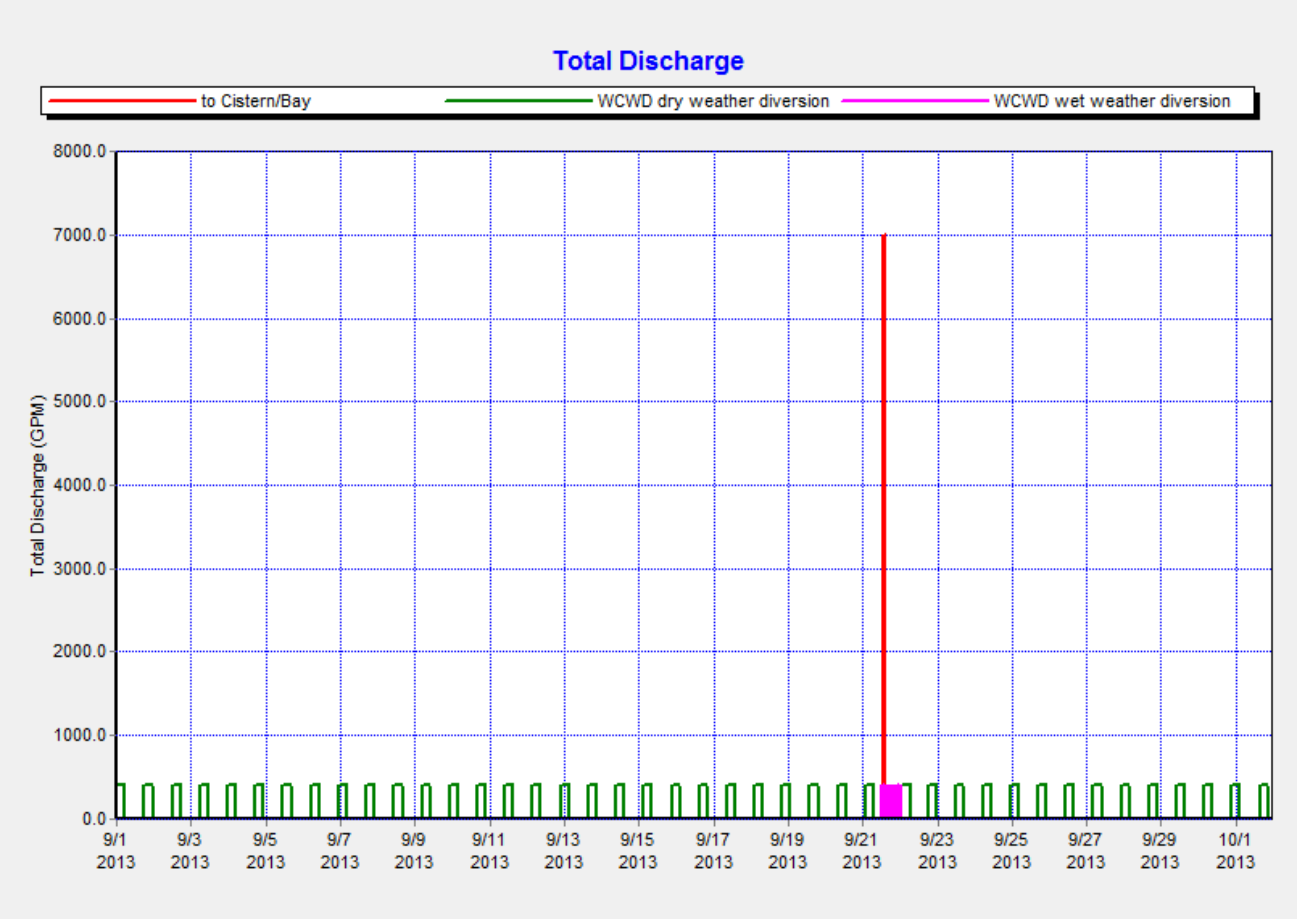


Figure 9: Flow into the wet well


Total Discharge
to Cistern/Bay
WCWD dry weather diversion
WCWD wet weather diversion
Total Discharge (GPM)
8000.0
7000.0
6000.0
5000.0
4000.0
3000.0
2000.0
1000.0
0.0
9/1 2013
9/3 2013
9/5 2013
9/7 2013
9/9 2013
9/11 2013
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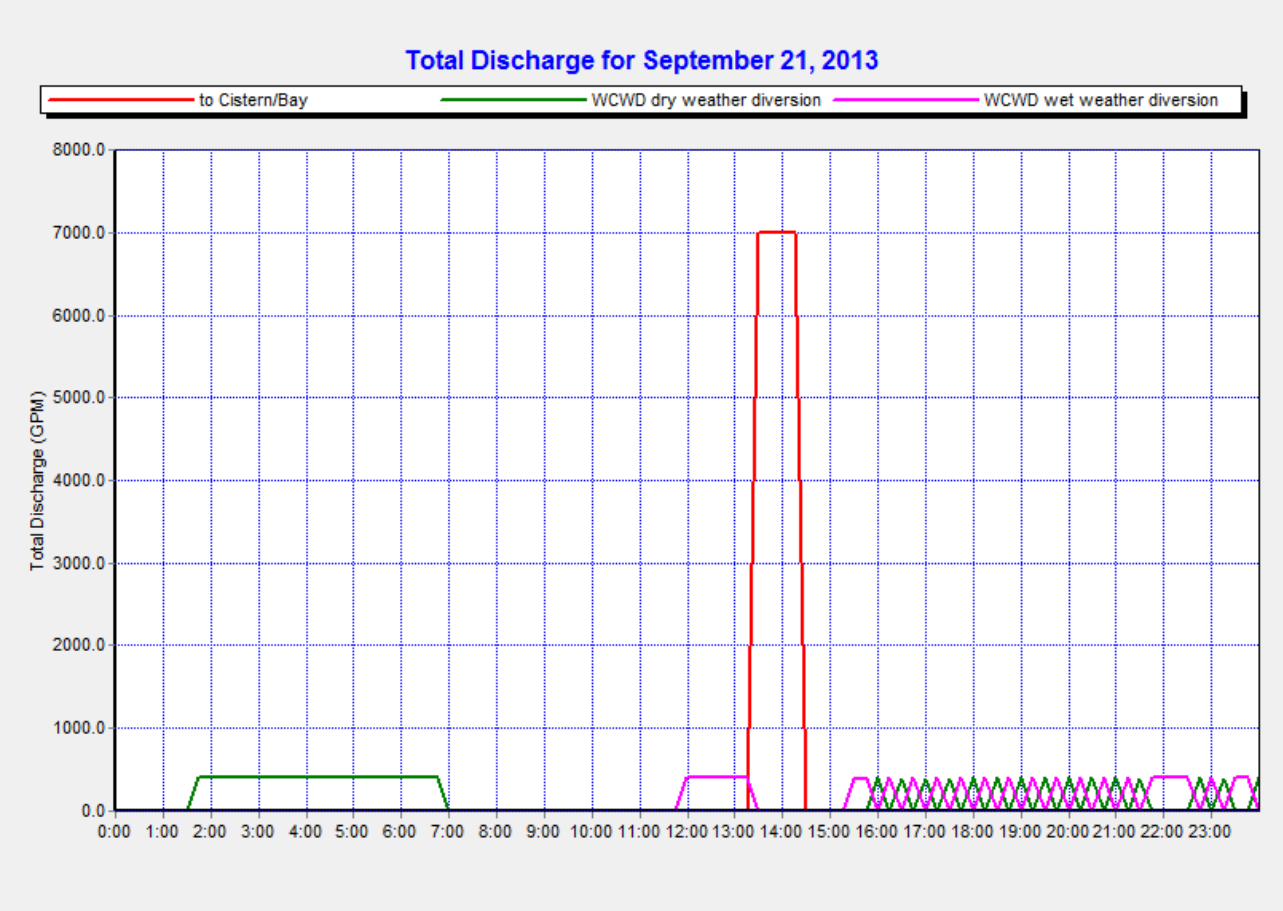

Figure 10: Discharge distribution for September 2013, first flush event for the entire month (top) and zoomed in to the rain event (bottom).

Note the switching between the “dry” and “wet” pumps in the bottom figure of Figure 10. This is due to the significant oscillation in the modeled inflow, as seen in Figure 6. This is likely a modeling artifact, resulting from the fact that modeled pumps do not have ramp-up or ramp down times, and that their flow rates do not vary with dynamic head, as they do in the real world. This could be improved with a more detailed modeling approach, but the presented simple approximation is sufficient to understand how a pump sized small enough to avoid overwhelming WCWD conveyance capacity would function during an early season storm.

From February 1, 2005 to October 1, 2013, having a continuously running 400gpm diversion pump would result in diverting **51% of total inflow** (combined wet and dry weather). If only the wet weather flow and the storm pump outflow were considered, **30% of storm flow** was diverted to WCWD in the model.

4.3 Scenario 3: Current System with Diversion and 100 gpm Onsite Treatment Capacity

An onsite treatment system was added to Scenario 3 by replacing the "wet" diversion pump with a small pump with a rated capacity of 100 gpm and startup depth of 12.5 ft. In this scenario, the onsite treatment was only active after the diversion pump shut off, though it was still the first line of defense during the wet season and served the important role of peak shaving. For the period between February 1, 2005 and October 1, 2013, **62% of total flow was diverted**, and approximately **2% of storm water was treated** onsite.

The storm on September 21, 2013 is examined as a point of comparison to Scenario 2. Recalling it was a high intensity storm where 0.66 inches of rain was produced over 2 hours (Fig. 11), the storm pumps had to turn on to mitigate the rainfall. Because the onsite pump as specified here is very small, only **2%** of the rain event was captured and treated onsite for this storm (Fig. 12).

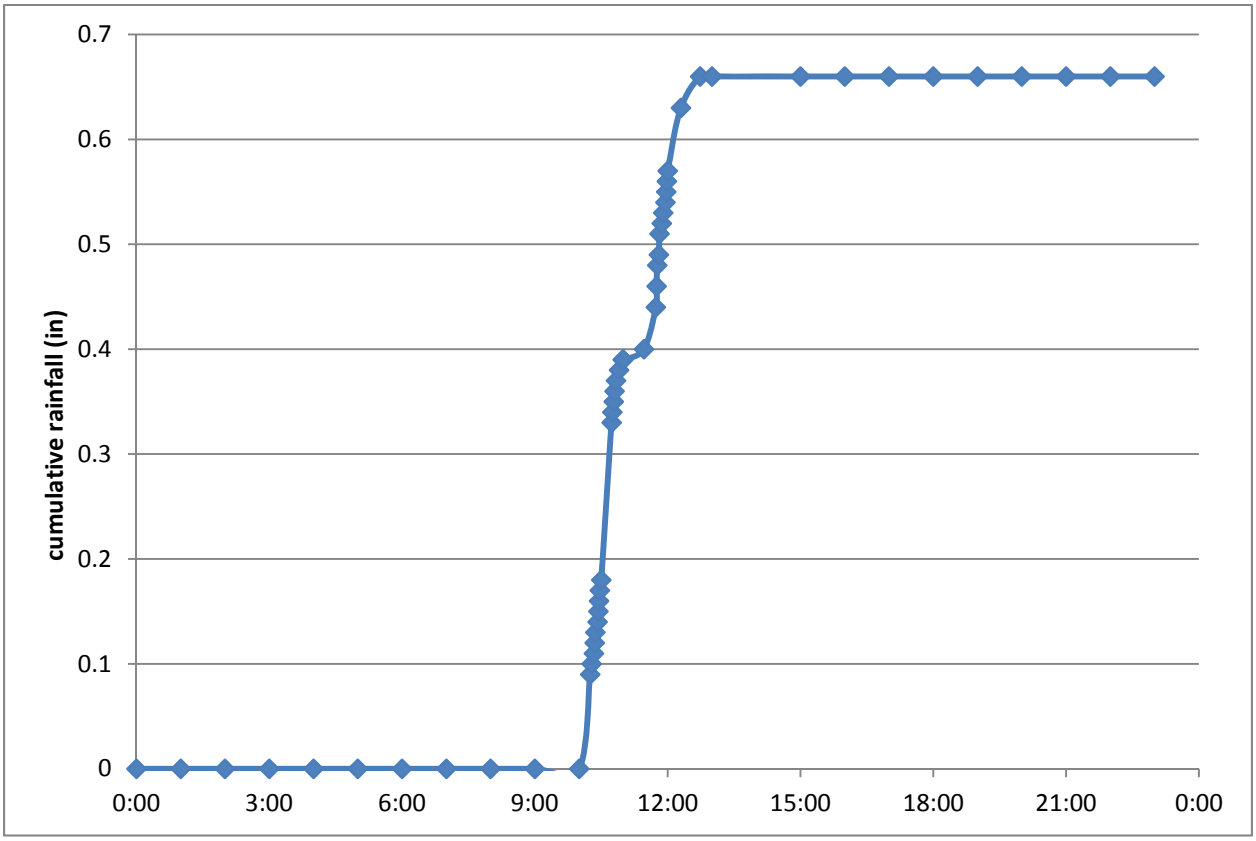

Figure 11: Cumulative rainfall as measured at Richmond City Hall for September 21, 2013.

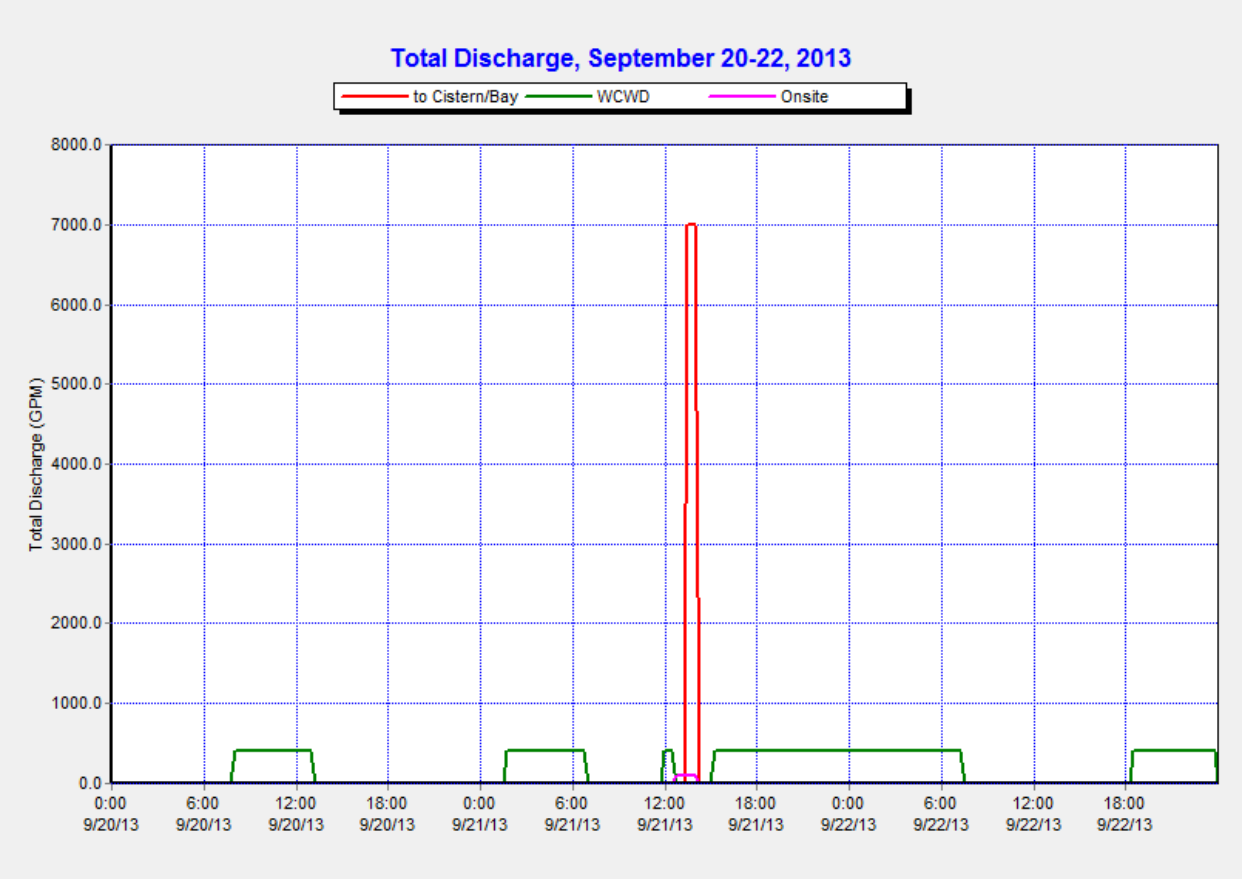

Figure 12: September 21, 2013 storm event outflow for 100 gpm onsite treatment.

In contrast to the September 21 flashy storm event, the April 4, 2013 storm event was more representative of typical storms in the Bay Area, with lower intensity over a longer duration (Fig. 13). In this case, 0.62 inches of rain fell over 11 hours. Because of the lower rain intensity, the diversion pump to WCWD would still turn on during the rain event because of the low inflow into the wet well. When the inflow rate exceeds typical dry flow rate, the onsite system cannot keep up with wet well elevation rise and the storm pump must turn on accordingly (Fig. 14). In this event, the **3%** of storm water treated onsite.

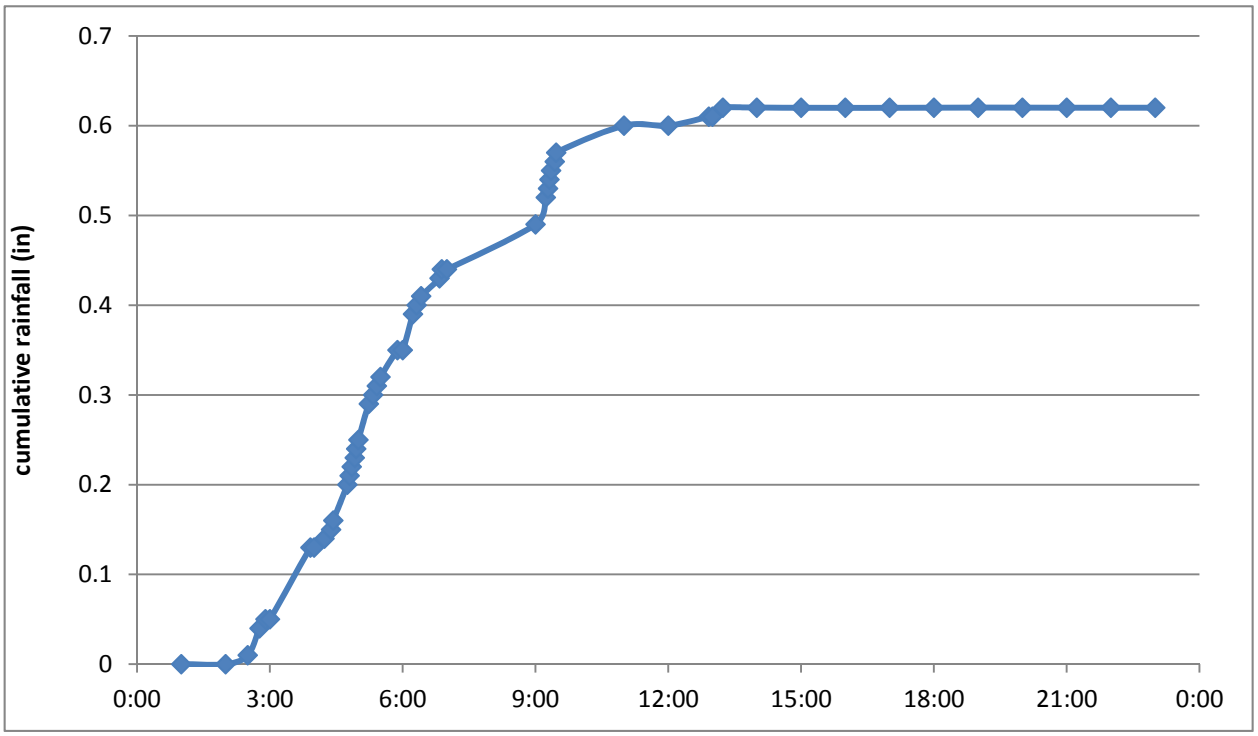

Figure 13: Cumulative rainfall as measured at Richmond City Hall for April 4, 2013.

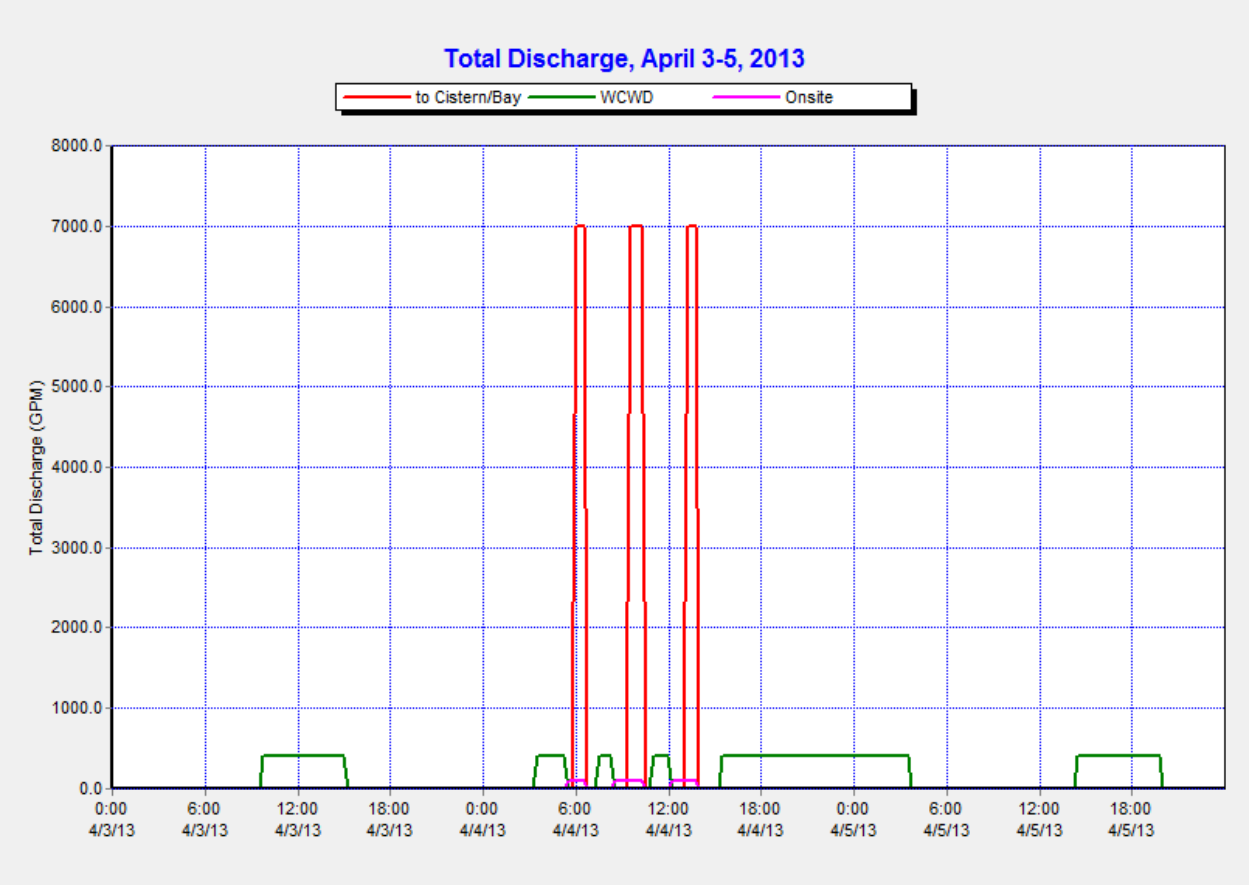

Figure 14: April 4, 2013 storm event outflow for 100 gpm onsite treatment.

4.4 Scenario 4: Current System with Diversion and 1000 gpm Onsite Treatment Capacity

In this Scenario, the onsite treatment capacity was increased to 1000 gpm. The diversion pump was designed such that it shuts off if either the onsite or storm pump was on, or if the flow into the well was greater than the dry weather flow rate. For the period between February 1, 2005 and October 1, 2013, **59% of total flow was diverted**, and approximately **36% of storm water was treated** onsite. Note that in Scenario 3, a slightly higher amount of flow was diverted in comparison to this scenario. This is because the diversion would take up some of the rainfall after rain event or during rain events when the rainfall intensity is low, as seen in the April storm.

The discharge distribution from the September and April storms from this scenario was to compared to the 100 gpm onsite treatment option. Once again, because of the high intensity of the September rain event, the 1000 gpm onsite pump was not able to capture the inflow and the storm pump had to turn on for support (Fig. 15). As a consequence, the outflow profile looked

similar to that of the 100 gpm onsite treatment except with a shorter duration diversion to WCWD following the rain event, resulting in **25%** treatment. In contrast, the 1000 gpm pump was able to capture enough flow in the April event to decrease the number of storm pump activations from three to two (Fig. 16), resulting in **68%** treatment. Note that the onsite pump remained on for a long enough duration such that when the diversion pump turned back on, it returned to its normal duration, rather than elongated to accommodate the residual rainfall that subsequently infiltrated into the sub catchment system.

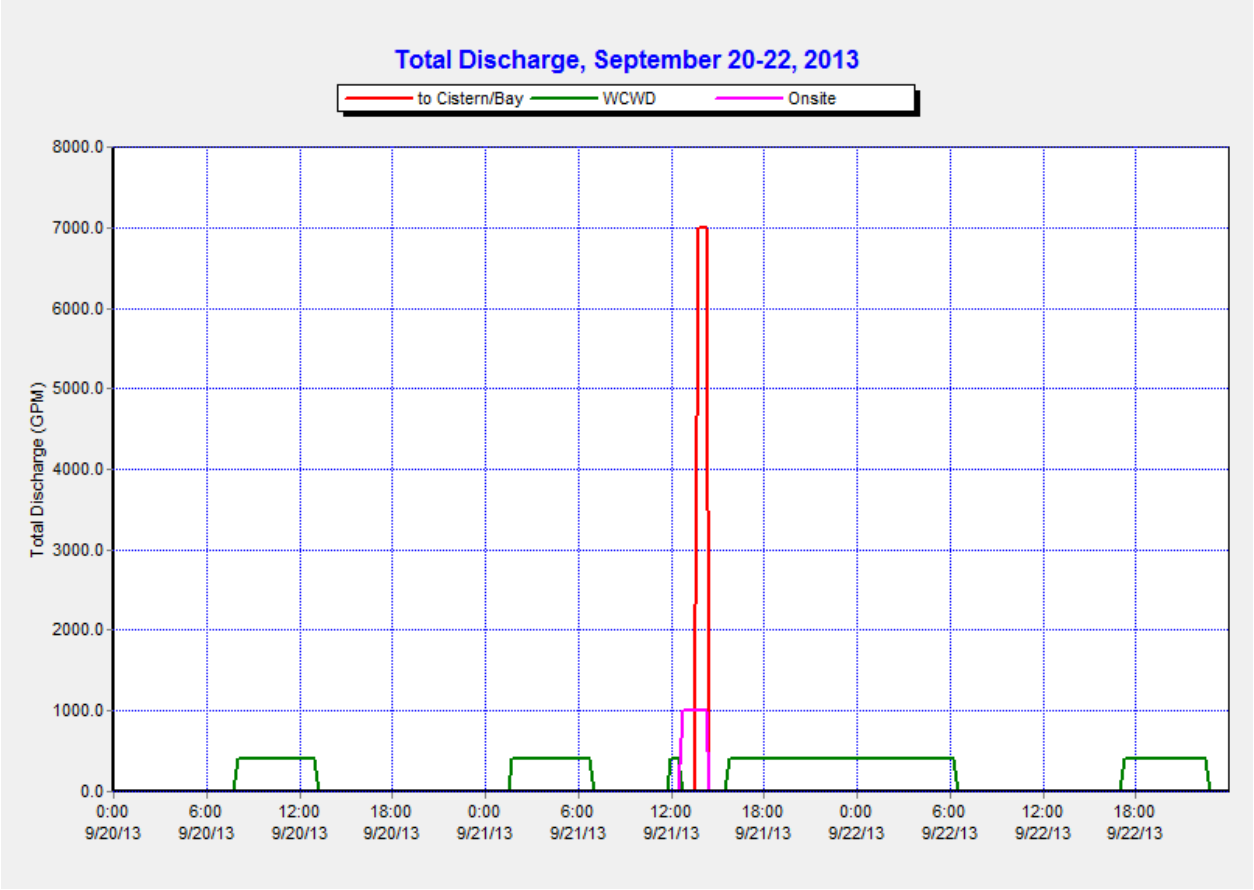

Figure 15: September 21, 2013 storm event outflow for 1000 gpm onsite treatment.

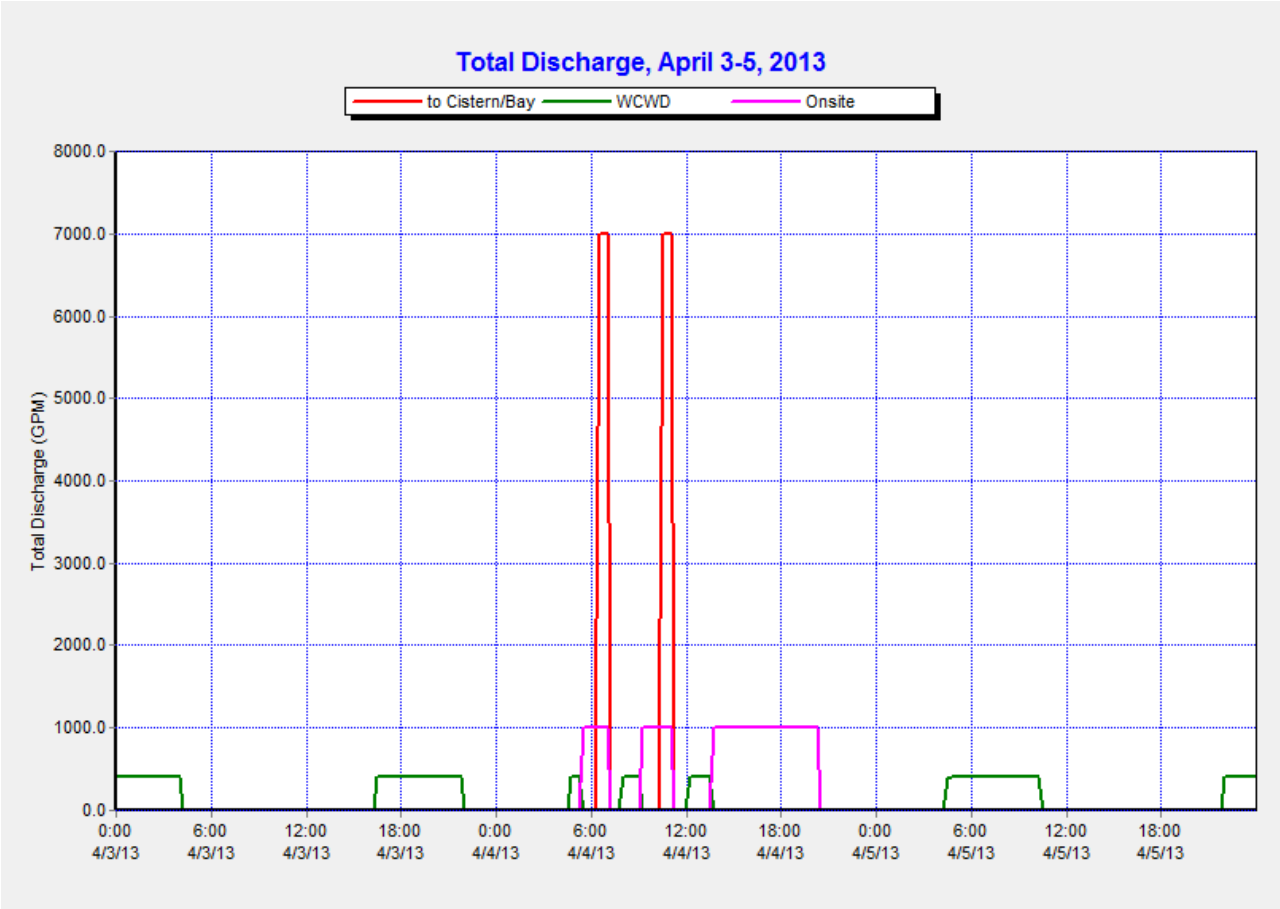

Figure 16: April 4, 2013 storm event outflow for 1000 gpm onsite treatment.

4.5 Scenario 5: Current System with Diversion and 1500 gpm Onsite Treatment Capacity

In this Scenario, the onsite treatment capacity was increased to 1500 gpm. The diversion pump was designed such that it shuts off if either the onsite or storm pump was on, or if the flow into the well was greater than the dry weather flow rate. For the period between February 1, 2005 and October 1, 2013, **60% of total flow was diverted**, and approximately **44% of storm water was treated** onsite. While the September rain event did not change much with this upgrade (Fig. 17), with **44%** of the stormwater was treated. The change in pump capacity resulted in only one storm pump start up during the April event (Fig. 18) and **84%** treatment, as well as less diversion to WCWD during the period.

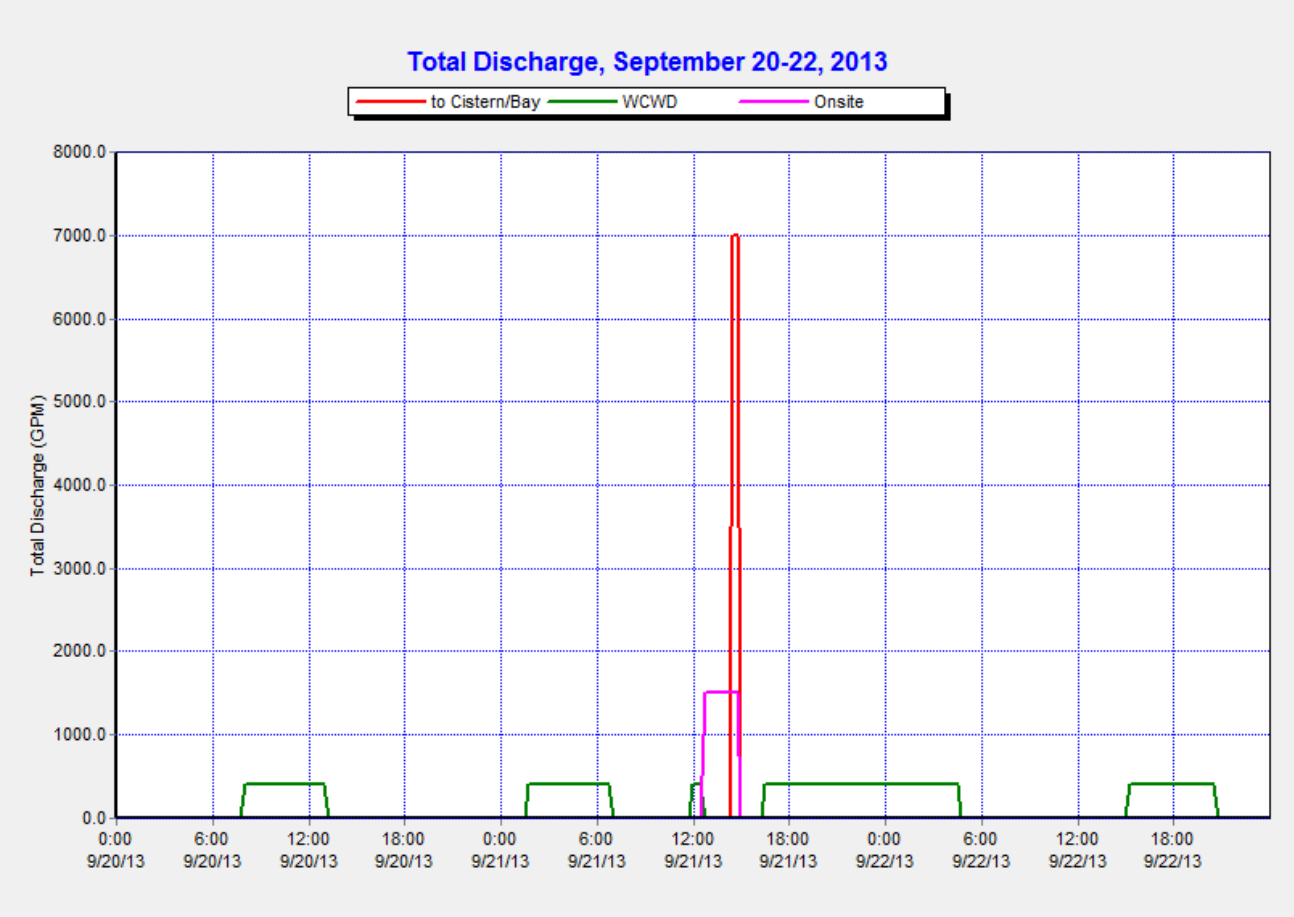

Figure 17: September 21, 2013 storm event outflow for 1500 gpm onsite treatment

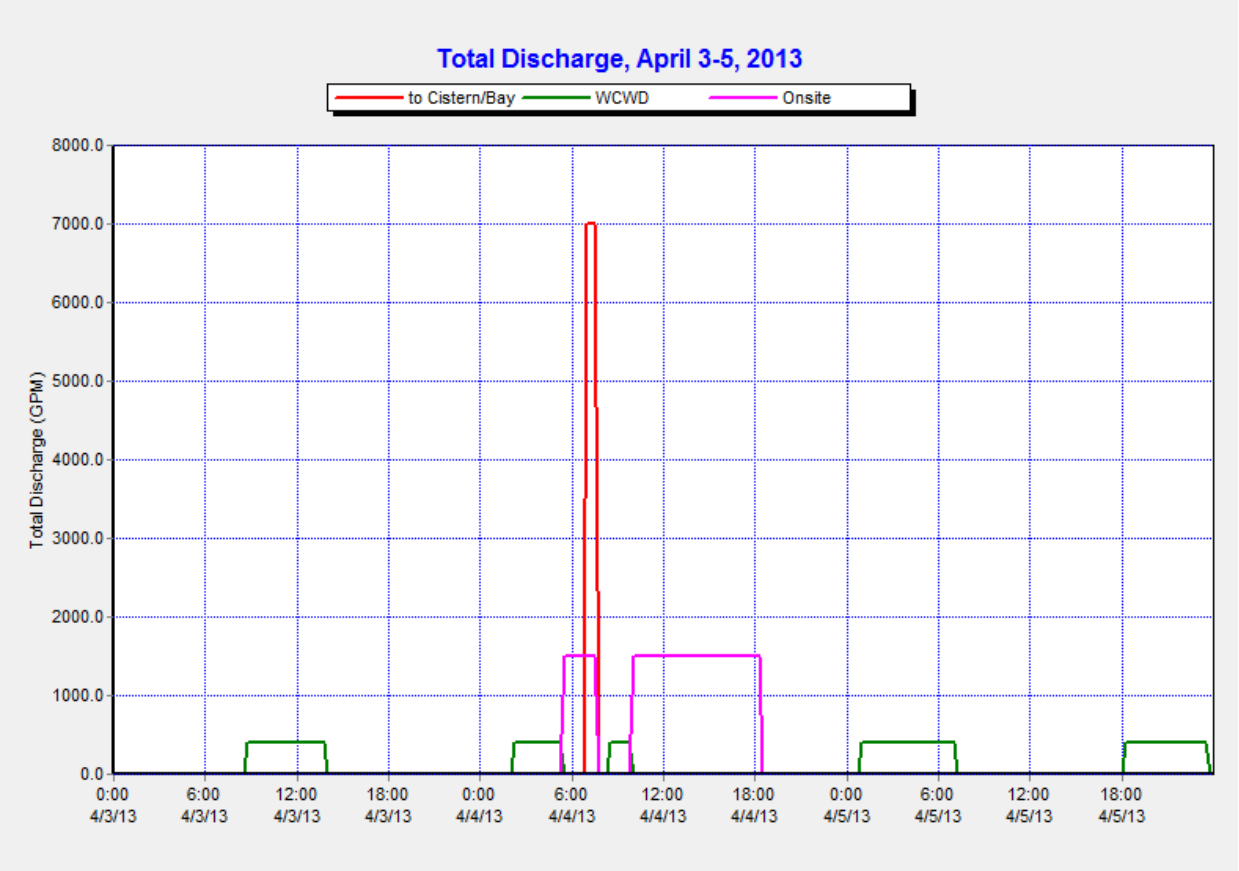

Figure 18: April 4, 2013 storm event outflow for 1500 gpm onsite treatment.

To capture the September event, the onsite treatment had to increase incrementally only to 1550 gpm, which resulted in **100%** treatment for that event (Fig. 19). This is possible because the event is short, even though the intensity was high.

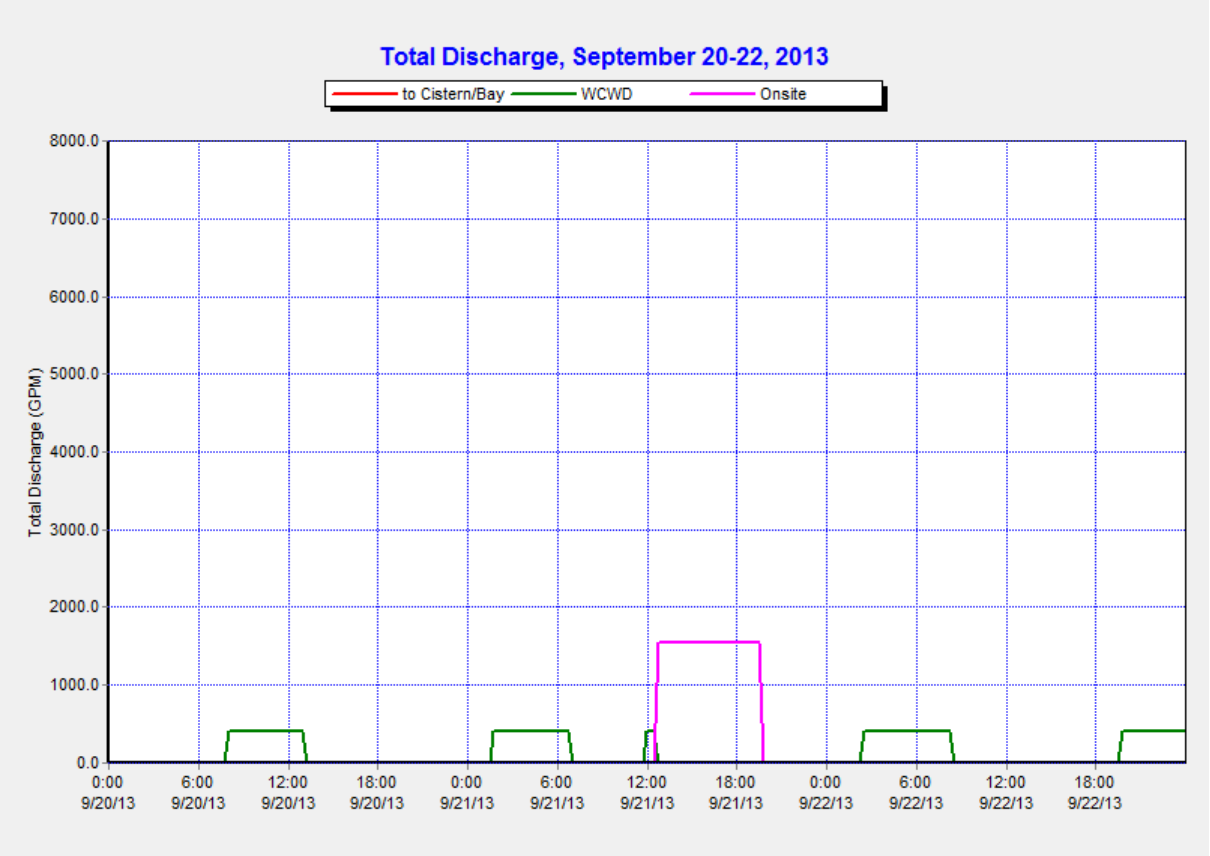

Figure 19: September 21, 2013 storm event outflow for 1550 gpm onsite treatment

5.0 SUMMARY

The estimated dry weather flow rate for the NRSPS ranges from 80 gpm to 140 gpm. The percentage of stormwater that could be treated by using diversion pumps of varying size to provide onsite or offsite treatment is summarized in Table 1 below.

Table 1. Percent of stormwater that could be treated at the NRSPS under various assumed treatment capacities.

Treatment capacity (gpm)	% stormwater treated		
	April 4, 2013	September 21, 2013	February 2005-October 2013
500	3	2	2
1400	68	25	36
1900	84	44	44

APPENDIX E

Field Sampling Report, North Richmond Pump Station Dry Weather Diversion, Water Quality Monitoring (December 1, 2015)

Field Sampling Report

North Richmond Pump Station Dry Weather Diversion, Water Quality Monitoring

December 1, 2015

Submitted to:

Ms. Cece Sellgren
Stormwater Manager
Contra Costa County Watershed Program

Submitted by:

APPLIED marine SCIENCES

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1. Introduction

This report details activities associated with implementation of dry weather diversion water quality monitoring component of the North Richmond Pump Station (NRPS) Stormwater Diversion Project – Low Flow Sediment and Stormwater Sampling and Analysis. All sampling was conducted by Applied Marine Sciences, Inc. (AMS) personnel between September 10, 2015 and September 23, 2015.

2. Field Sampling Report

2.1. Objectives

The objectives of the sampling effort were as follows:

1. Collect up to ten water quality samples for analysis of PCB congeners, total mercury (Hg), total methyl-mercury (meHg) total organic carbon (TOC), and suspended sediment concentration (SSC) by ALS Group (ALS).
2. Collect required quality assurance (QA) samples consistent with California Surface Water Ambient Monitoring Program (SWAMP) Measurement Quality Objectives (MQOs) methods and frequencies.
3. Assess laboratory data quality using relevant SWAMP MQOs (SWAMP 2008).

2.2. Sampling Activities

Sampling activities for the NRPS dry diversion water quality monitoring study are summarized in Table 1. In total, AMS monitored nine of the ten possible diversion days; one day was intentionally skipped to be consistent with the original scope of work, which called for monitoring up to seven days of the target ten diversion days. Upon receiving direction to sample beyond the original seven days contracted, AMS then monitored each of the remaining diversion dates.

All field samples were collected from the diversion pipe exiting the NRPS. Field personnel filled sample containers using a new hose (25’ drinking water quality) attached to a spigot in the PVC diversion pipe that was installed by the construction contractor for monitoring purposes (Figure 1). Sampling personnel flushed the hose for a minimum of one minute prior to sample collection and used standard “clean hands / dirty hands” protocols for sample collection.

Field monitoring incorporated two types of field blanks in order to assess possible effects of the sampling protocols on the analytical results: (1) a bottle blank for which laboratory-provided blank water was transferred at the NRPS from its container of origin to a field sample container in order to assess effect of environmental conditions present and “clean hands / dirty hands” sampling, and (2) an equipment blank for which blank water was rinsed through a sampling hose in a laboratory setting in order to assess any contamination associated with the equipment used and “clean hands / dirty hands” sampling protocol.

Table 1. Sampling Activities for NRPS Dry Weather Diversion Water Quality Monitoring Study.

Sampling Event	Sample Date	Sample Time	Field Samples	Field Blanks	Field Dup	Comments
NRP-D-01	10/Sep/2015	10:30	X			
NRP-D-02	11/Sep/2015	08:15	X			
NRP-D-03	14/Sep/2015	08:30	X			
NRP-D-04	15/Sep/2015	NA				No samples collected
NRP-D-05	16/Sep/2015	08:45	X	X		Bottle blank
NRP-D-06	17/Sep/2015	08:15	X		X	
NRP-D-07	18/Sep/2015	08:40	X			
NRP-D-08	21/Sep/2015	08:45	X	X		Equipment blank
NRP-D-09	22/Sep/2015	08:35	X			
NRP-D-10	23/Sep/2015	08:35	X			

Figure 1. Monitoring Spigot at Diversion Pipe

2.3. Sample Labeling

The sample ID labeling system used for water quality samples is as follows:

WWW- E-DD

Where:

WWW	=	Watershed / site identifier (i.e., NRP)
E	=	Event type (i.e., D for dry diversion)
DD	=	Diversion day # (e.g., 10 for the 10th day of the diversion)

Field duplicate samples were indicated by use of a "5" in the tens place of the diversion date (e.g., NRP-D-56 indicates a field duplicate sample collected on the 6th diversion day). Field blank samples were labeled by the laboratory prior to delivery to AMS.

2.4. Results

Analyte concentrations reported by ALS are summarized in Table 2. As is typical for laboratory analytical reports, especially those associated with analysis of organic pollutants, some proportion of analytical results are flagged with qualifiers to be used in association with data interpretation. For that reason, the user should reference the spreadsheet Electronic Data Deliverable (EDD) for concentration data to be used in higher-level analyses and interpretation.

It should be noted that the laboratory reported PCB concentration data for individual congeners only. The summaries presented below were calculated by AMS and make use of a substitution of ½ of the method detection limit (MDL) for any congeners or other analytes (i.e., SSC) reported as non-detects (NDs). Any data reported between the MDL and Reporting Limit (RL) were quantified as reported by the lab for calculation of totals and basic statistics. Also any data that are qualified but not rejected outright are included in calculation of the total PCBs.

Table 2. Summary of NRPS Dry Weather Diversion Analytical Results.

Sampling Event	Hg (ng/L)	meHg (ng/L)	PCBs (pg/L)	SSC (mg/L)	Comments
NRP-D-01	6.65	0.08	191	91.5	
NRP-D-02	7.96	0.07	431	93.8	
NRP-D-03	8.07	0.07	174	90.4	
NRP-D-05	6.90	0.06	271	<1.8	Non-detect on SSC
NRP-D-06	8.85	0.06	415	3.1	
NRP-D-07	11.60	0.05	218	<1.9	Non-detect on SSC
NRP-D-08	12.50	0.06	509	16.7	
NRP-D-09	10.00	0.04	596	5.3	
NRP-D-10	9.65	0.03	548	1.9	
Avg.	9.1	0.06	373	34	
Min.	6.65	0.03	174	<1.8	
Max.	12.50	0.08	596	93.8	

3. Quality Assurance

All monitoring results were checked against SWAMP MQOs and qualified, as required, consistent with applicable California Environmental Data Exchange Network (CEDEN) QA codes.[1] A brief summary of data quality review follows by analyte type:

3.1.1. Inorganics (meHg and Hg)

In general, all measurements for Hg and meHg met SWAMP MQOs. The main exception to this is in the case of field blanks collected for analysis of meHg. For both Hg and meHg analyses, both of the field blanks collected resulted in concentrations exceeding laboratory RLs, resulting in a qualifier of "VIP" being applied to the affected field blank data. In the case of Hg, blank concentrations were relatively low compared with all field sample data (i.e., < 5x the concentration of the field samples). In the case of meHg, however, the highest concentration reported for all Project data is associated with the equipment blank field blank collected on Sept 21; for this reason both the affected field blank and field sample data are qualified with "VIP." All other field sample and field blank data was reported below laboratory RLs, suggesting that the detectable presence of meHg at low concentrations in field samples may be an artifact of sampling protocols.

The Hg field sample / field duplicate pair collected on September 17th was slightly outside of SWAMP MQO control limits (CLs) for precision, with a calculated relative percent difference (RPD) of 26% vs. the CL of 25%. Both the field sample and field duplicate of this pair were flagged with a "VFDP" qualifier to indicate this, but this outcome is not expected to greatly alter the interpretation of the data.

3.1.2. Synthetic Organics (PCBs)

For several of the PCB congeners analyzed, minor blank contamination was identified associated with analysis of field blank or lab blank samples. QA samples reported at concentrations greater than RLs, as well as associated field sample data for which concentrations were reported as less than five times (5x) greater than associated blank concentrations, were flagged with a "VIP" qualifier, indicating a possible high bias. As the sums of the concentration of qualified blank data (approx 40 pg/L for lab blank samples and approx 30 pg/L for field blank samples) were relatively low compared to sum of the individual PCB congeners in the field samples (Table 2), this issue does not appear to provide much of a high bias to the calculated sums of PCBs.

There were also a small number of PCB congeners for which the field duplicate samples did not meet the typically-used SWAMP MQO for precision (RPD <25%). Affected congener data, both within the field sample and field duplicate, were flagged with a "VFDP" qualifier in these situations. Similar to the case for Hg discussed above, this outcome is not expected to greatly alter the interpretation of the data. It should be noted that the sum of PCBs reported for the field sample / field duplicate pair showed consistency, with an associated RPD of 1.5%.

As is typical for analysis of organic compounds, a small number of surrogate analyses fell outside of SWAMP MQO recommended control limits. These QA samples were flagged with a "VGN" qualifier to indicate this, but it is again not expected to affect the interpretation of data.

[1] http://ceden.waterboards.ca.gov/Metadata/ControlledVocab.php

3.1.3. Conventional Parameters (SSC)

All SSC data met recommended SWAMP MQOs.

4. Discussion

AMS field personnel coordinated with CCCWP and construction contractor to arrange sampling access at the pump station. Due to the uncertain duration of diversion activities, AMS targeted sample collection activities to coincide with the initiation of the diversion process each monitoring day. It is unknown how long contractors continued pumping each day before there was insufficient water to continue diversions, but there was sufficient flow each day to support sampling activities.

There was minimal rainfall reported and no observable runoff during the monitoring period. Between 9pm and 11pm on September 16, 2015, 0.02" of rainfall was reported at Weather Underground monitoring station KCARICHM24[2], which is located approximately 0.5 mi to the northeast of the NRPS.

5. References

SWAMP 2008. Surface Water Ambient Monitoring Program Quality Assurance Project Plan, Version 1.0. Prepared for the California State Water Quality Control Board by the SWAMP Quality Assurance Team. September 1, 2008.

[2] http://www.wunderground.com/personal-weather-station/dashboard?ID=KCARICHM24#history/s20150916/e20150916/mdaily

APPENDIX F

Field Sampling Report, Diversion – Wet Weather Monitoring.
North Richmond Pump Station, Contra Costa County, California (January, 2016)

FIELD SAMPLING REPORT
DIVERSION – WET WEATHER MONITORING

North Richmond Pump Station
Contra Costa County, California

Prepared for:

Contra Costa County Watershed Program
Martinez, California

Prepared by:

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180 Grand Avenue, Suite 1100
Oakland, California 94612

January 2016

Project No. 5025153002.04

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Contra Costa County, California

1.0 INTRODUCTION

This report summarizes the activities and results of monitoring a wet weather stormwater diversion from the North Richmond Stormwater Pump Station ("NRPS"), to the West County Wastewater District (WCWD) conducted by Amec Foster Wheeler Environment & Infrastructure, Inc. ("Amec Foster Wheeler") on November 2, 2015. The diversion was a pilot project required under provision C.11.f and C.12.f of the Municipal Regional Stormwater NPDES Permit issued to the 18 permittees of the Contra Costa Clean Water Program (Clean Water Program). The Contra Costa County Watersheds Program, a permittee of the Clean Water Program, carried out this diversion pilot on behalf of all permittees of the Clean Water Program, in fulfillment of commitments made under a United States Environmental Protection Agency Water Quality Improvement Fund grant.

The NRPS has been renovated with new low-flow pumps and other improvements by the Valentine Corporation (Valentine), a general engineering contractor. Valentine provided Amec Foster Wheeler access to the NRPS during this stormwater diversion pilot; Valentine also installed an operated a temporary sump pump that was used for the pilot diversion. Amec Foster Wheeler sampled diverted stormwater and submitted samples for analysis of total mercury, methylmercury, polychlorinated biphenyls (PCBs), and suspended sediment concentrations (SSC).

2.0 FIELD SAMPLING REPORT

This section summarizes the field effort. The objectives, activities, and quality assurance / quality control measures implemented in the field are described in the subsections below.

2.1 OBJECTIVES

The objectives of the sampling program were:

- Collect up to ten samples at different times intervals spaced roughly across the hydrograph of the storm event.
- Collect one time interval sample in duplicate and up to three field blanks.
- Sample analysis for PCB, total mercury, total methylmercury and SSC by McCambell Analytical, Inc. of Pittsburg, CA (Table 1).

2.2 SAMPLING ACTIVITIES

A suitable storm event for the diversion monitoring program began at approximately 11:00 pm on Sunday, November 1st. The Richmond City Hall station recorded 0.62 inch of rain by the end of the event at approximately 5:00 pm November 2nd (California Department of Water Resources, 2015). Figure 1 plots rainfall measured at the Richmond City Hall for the storm event. Most of the rain fell between 4 and 8 am on the morning of November 2nd. Watershed Program staff contacted Amec Foster Wheeler at about 6 AM to initiate sampling.

After testing for toxicity to activated sludge bacteria and finding no impairment of respiratory activity by the water in the pump station wet well, WCWD approved diversion of stormwater at approximately 9:00 am on November 2, 2015, and Valentine began pumping stormwater from the NRPS wet well to the sanitary sewer system via a system of PVC pipes. The initial stormwater diversion flow from the wet well was "choppy" due to debris such as leaves clogging the screen protecting the diversion intake pipes. After adjusting the height of the intake, a steady pumped flow rate of approximately 212 gallons per minute (gpm) was recorded after 9:30 am and maintained for the duration of the diversion. The large 45,000 gpm wet weather pumps did not turn on during the diversion sampling event. According to onsite Valentine staff, the large diversion pumps did operate several times during the storm event prior to diversion, so this was not a true "first flush" diversion pilot.

Amec Foster Wheeler staff completed field sampling of diverted stormwater between 9:30 and 11:30 am. Nine samples were collected: five stormwater samples, one field duplicate, and three field blanks (Table 2). To facilitate collection of stormwater diversion monitoring samples, Valentine installed a gate valve and spigot in the piping. A hose was attached to the spigot and flushed with diverted stormwater prior to collecting each sample. Stormwater samples were collected directly into sampling bottles from the hose. Field blanks used laboratory-provided blank water to fill the sample bottles. The field blank bottles were filled at the same location as the stormwater samples after the flow was turned off.

All samples were analyzed for total mercury, methylmercury and total PCB concentrations. Suspended sediment concentrations were measured in all samples except the field blanks.

2.3 QUALITY ASSURANCE

Monitoring results were checked against SWAMP MQOs. In general, all measurements met SWAMP MQOs with a few exceptions.

The calculation of the relative percent difference (RPD) for the field sample/ field duplicate pair were less than the SWAMP MQO control limits for precision of 25%, for all parameters including individual PCB congeners, except methylmercury. The methylmercury RPD was 31% versus the control limit of 25%. However, given the narrow range of data, this result is not expected to greatly alter the interpretation of the data.

The field blanks returned non-detectable concentrations of mercury, methylmercury and PCBs.

2.4 RESULTS

Analyte concentrations reported by McCambell Analytical are summarized in Table 3. Complete results, including any flagged or qualified results, are included as Appendix A. Total PCB concentrations were calculated from individual congeners. Congener concentrations reported as non-detects were replaced with one half of the method detection limit. This is consistent with the NRSPS Dry Weather Diversion Field Sampling report (Applied Marine Sciences, 2015), and reporting procedures established by the Bay Area Stormwater Management Agencies Association Regional Monitoring Coalition.

Measured concentrations of SSC, total Hg, methylmercury, and PCBs showed low variability across the 2.5 hour diversion monitoring event. Total mercury concentrations ranged from a minimum of 31 ng/L to a maximum of 42 ng/L. Methylmercury concentrations ranged from 0.4 ng/L to 0.51 ng/L. Total PCB concentrations ranged from a minimum of 4,671 pg/L to a maximum of 8,562 pg/L. Suspended sediment concentrations ranged from 49.3 mg/L to 53.9 mg/L.

Figures 2 through 4 show total mercury, methylmercury, and PCB concentrations plotted against SSC. As these parameters are generally associated with fine particulate matter in stormwater the small range of SSC in diverted stormwater is reflected in the small range of total mercury, methylmercury and PCB concentrations. The correlation between SSC and total Hg and PCB is not statistically significant for the sample size (critical correlation coefficient = 0.81 for $n = 6$ at $\alpha = 0.05$). There was a significant correlation between SSC and methylmercury. For all correlation analyses, poor correlations with SSC are expected because the range of SSC measurements in the data set is small – i.e., less than 10 percent variation from the lowest SSC measurement to the highest SSC measurement. Robust correlations of pollutants with SSC are best derived when the measured SSC varies between less than 10 mg/L up to 100 mg / L or greater, with several intermediate samples of differing SSC concentrations.

The purpose of regression analysis vs. SSC is to estimate the ratio of pollutants to suspended sediments based on the slope of the regression line. An alternative approach is to calculate individual pollutant to SSC ratios for each sample, and then determine the average ratio, as shown in Table 3. The mercury / SSC ratio of suspended sediments at the NRSPS wet weather event averaged 0.7 +/- 0.07 µg/g (ppm). For context, this is consistent with the expected concentration of mercury in urban sediments; stormwater from the 1st and Cutting area in Richmond were recently shown to have mercury / SSC ratios of approximately 1 (Contra Costa Clean Water Program, 2015). Suspended sediments in the NRSPS had approximately 9 +/- 2 ng/g (ppb) methylmercury; this is approximately ten time greater than watershed background methylmercury to suspended sediment concentrations recently

measured by the Contra Costa Clean Water Program (2015). PCB to suspended sediment ratios at the NRSPS average 135 +/- 26 ng/g (ppb); this is typical of older urban areas of the Bay (Contra Costa Clean Water Program, 2013).

3.0 DIVERSION VOLUME AND MASS

As noted above, diversion of stormwater was approved by WCWD staff at approximately 9 am. A steady state pumping rate of 212 gpm was reached at about 9:30 am. An estimate of the total volume of stormwater diverted to the WCWD and the associated mass load of SSC, total mercury and PCB is presented in Table 4. Assuming a constant pumping rate, and that each stormwater sample was representative of the water quality for a given time interval, it is possible to calculate the mass diverted for each parameter by multiplying the flow rate times the elapsed time between samples, and the concentration. Based on this calculation approximately 32,012 gallons of stormwater, 4.2 mg of Hg, 0.05 mg of methylmercury, 0.80 mg of PCBs, and 6.2 kg of suspended sediment were diverted into the WCWD sewer system during the wet weather diversion monitoring program (Table 4).

4.0 DISCUSSION

Amec Foster Wheeler completed a wet weather diversion monitoring program at the NRSPS on November 2, 2015. Nine samples were collected and analyzed for SSC, total and methylmercury, and 40 PCB congeners. Analytical results showed that there was little variability across time for the diversion monitoring program for SSC, total mercury and PCBs. No methylmercury was detected in any stormwater sample.

Results of the diversion monitoring indicate that approximately 32,012 gallons of stormwater, 4.2 mg of Hg, 0.05 mg of methylmercury, 0.80 mg of PCBs, and 6.2 kg of suspended sediment were diverted into the WCWD sewer system between 9 and 11:30 am on November 2, 2015.

5.0 REFERENCES

Applied Marine Sciences, 2015. Field Sampling Report, North Richmond Pump Station Dry Weather Diversion, Water Quality Monitoring, December 1, 2015.

California Department of Water Resources. Retrieved January 3, 2016, from http://cdec.water.ca.gov/cgiprogs/selectQuery?station_id=RHL&sensor_num=16&dur_code=E&start_date=2015-11-01&end_date=2015-11-03&geom

Contra Costa Clean Water Program, 2014. Integrated Monitoring Report, Part C: Pollutants of Concern Implementation Plan. Submitted to the San Francisco Bay Regional Water Quality Control Board April 1, 2014.

Contra Costa Clean Water Program, 2015. Delta Methylmercury Control Study Preliminary Data Report. Submitted to the Central Valley Regional Water Quality Control Board, October 15, 2015.

amec
foster
wheeler

TABLES

TABLE 1

ANALYTICAL METHODS

North Richmond Pump Station
Contra Costa County, California

Analyte	Method	Reporting Limit	Units
Mercury	EPA E1631E	0.5	ng/L
Methyl Mercury	EPA 1630/FGS-070	0.05	ng/L
Total PCBs	EPA E1668C	Variable	pg/L
Suspended Sediment Concentration	ASTM D3977-B	1	mg/L

Abbreviations

ASTM = American Society for Testing and Materials
EPA = Environmental Protection Agency
mg/L = milligrams per liter
NA = not analyzed
ng/L = nanograms per liter
PCB = polychlorinated biphenyl
pg/L = picograms per liter

TABLE 2

SAMPLES AND ANALYTICAL METHODS

North Richmond Pump Station
Contra Costa County, California

Sample ID	Sample Type	Analyte and Method			
		Mercury by EPA E1631E	Methyl Mercury by EPA 1630/FGS-070	PCBs by EPA E1668C	Suspended Sediment Concentration by ASTM D3977-B
NRPS15-001	Stormwater	X	X	X	X
NRPS15-002	Stormwater	X	X	X	X
NRPS15-003	Field Duplicate	X	X	X	X
NRPS15-004	Field Blank	X	X	X	NA
NRPS15-005	Stormwater	X	X	X	X
NRPS15-006	Stormwater	X	X	X	X
NRPS15-007	Field Blank	X	X	X	NA
NRPS15-008	Stormwater	X	X	X	X
NRPS15-009	Field Blank	X	X	X	NA

Abbreviations

ASTM = American Society for Testing and Materials
EPA = Environmental Protection Agency
NA = not analyzed
PCB = polychlorinated biphenyl

TABLE 3

SUMMARY ANALYTICAL RESULTS

North Richmond Pump Station
Contra Costa County, California

Sample ID	Type	Time	Parameters				Ratios		
			Mercury (ng/L)	Methyl Mercury (ng/L)	Total PCBs (pg/L)	SSC (mg/L)	Hg/SSC (µg/g)	MeHg/SSC (ng/g)	PCB/SSC (ng/g)
NRPS15-001	Stormwater	9:37	37	0.51	8293	54	1	9	154
NRPS15-002	Stormwater	9:52	36	0.51	7763	54	1	9	145
NRPS15-003	Field Duplicate	9:56	42	0.70	8342	53	1	13	158
NRPS15-004	Field Blank	10:10	ND	ND	68 *	NA	NA	NA	NA
NRPS15-005	Stormwater	10:28	37	0.40	6371	50	1	8	129
NRPS15-006	Stormwater	10:56	31	0.42	6664	49	1	8	135
NRPS15-007	Field Blank	11:00	ND	ND	68 *	NA	NA	NA	NA
NRPS15-008	Stormwater	11:31	32	0.42	4418	50	1	8	88
NRPS15-009	Field Blank	11:24	ND	ND	68 *	NA	NA	NA	NA
		Average	36	0.49	4673	52	0.69	9	135
		Standard Deviation	4.0	0.11	3651	2.1	0.07	2	26

Notes

* Calculation of total PCBs used 1/2 the method detection limit for ND congeners

Abbreviations:

mg/L = miligrams per liter
NA = not analyzed
ND = not detected
ng/L = nanograms per liter
PCB = polychlorinated biphenyl
pg/L = picograms per liter
SSC = suspended sediment concentration

TABLE 4

VOLUME AND MASS ESTIMATES
North Richmond Pump Station
Contra Costa County, California

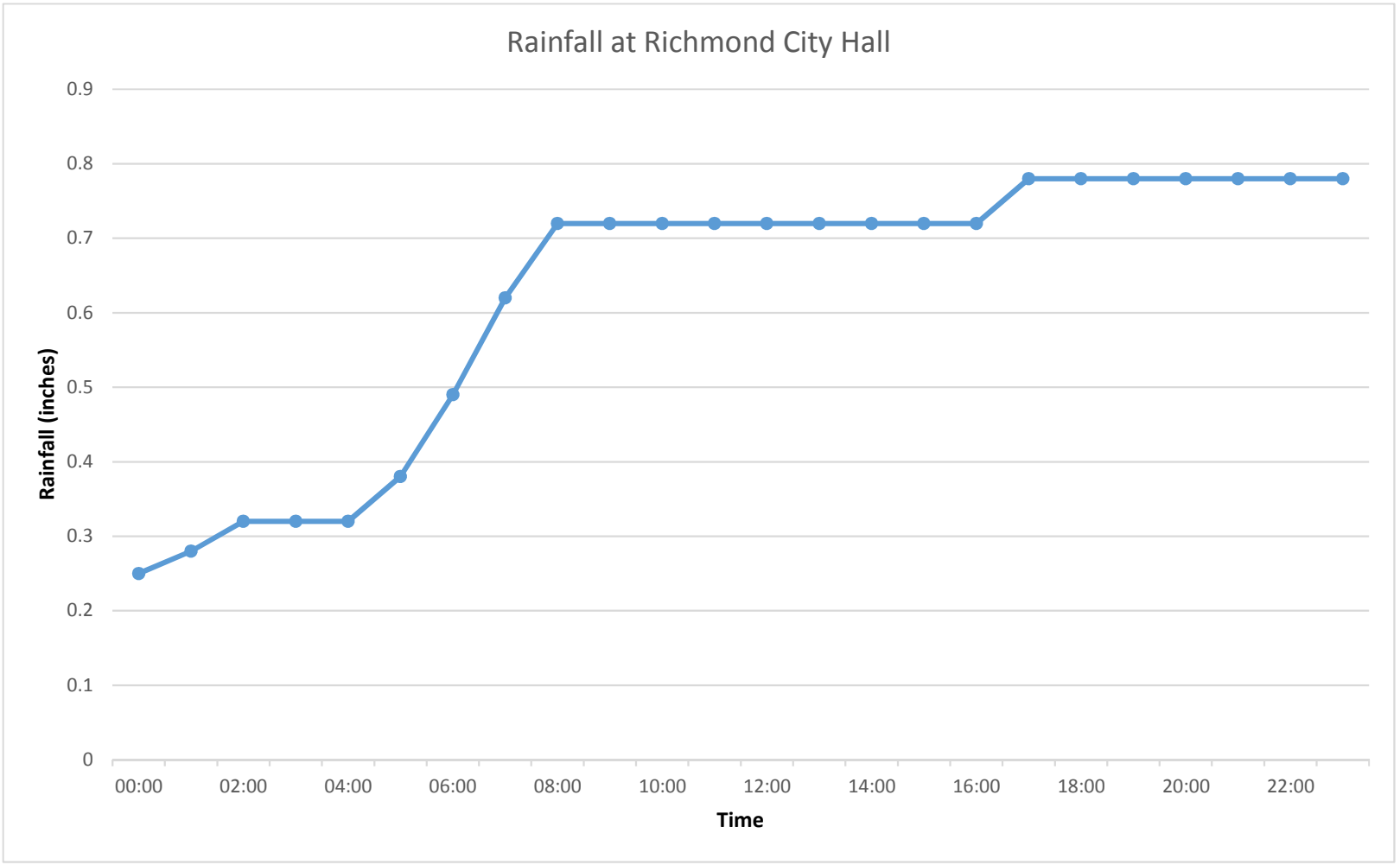
Sample ID	Time	Elapsed Time (min)	Volume Diverted (gallons) [1]	Concentration				Mass							
				Hg (ng/L)	MeHg (ng/L)	PCBs (pg/L)	SSC (mg/L)	Hg ng	MeHg ng	PCBs pg	SSC mg	Hg mg	MeHg mg	PCBs mg	SSC kg
Start Diversion	9:00	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NRPS15-001	9:37	37	7844	37	0.506	8292.55	53.9	1,098,623	15,024	246,226,541	1,600,426	1.10	0.02	0.25	1.60
NRPS15-002	9:52	15	3180	36	0.507	7763.25	53.5	433,350	6,103	93,450,122	644,006	0.43	0.01	0.09	0.64
NRPS15-005	10:28	36	7632	37	0.401	6371.3	49.5	1,068,930	11,585	184,066,857	1,430,055	1.07	0.01	0.18	1.43
NRPS15-006	10:56	28	5936	31	0.417	6663.75	49.3	696,570	9,370	149,734,463	1,107,771	0.70	0.01	0.15	1.11
NRPS15-008	11:31	35	7420	32	0.415	4418.1	50.4	898,800	11,656	124,093,384	1,415,610	0.90	0.01	0.12	1.42
		TOTALS	**32,012**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**4.20**	**0.05**	**0.80**	**6.20**

Notes:
1. 212 gpm steady state flow rate from diversion pump.

Abbreviations:
-- = not applicable
kg = kilograms
MeHg = methyl mercury
mg = miligrams
mg/L = miligrams per liter
min = minutes
ng = nanograms
ng/L = nanograms per liter
PCB = polychlorinated biphenyl
pg = picograms
pg/L = picograms per liter
SSC = suspended sediment concentration

amec
foster
wheeler

FIGURES



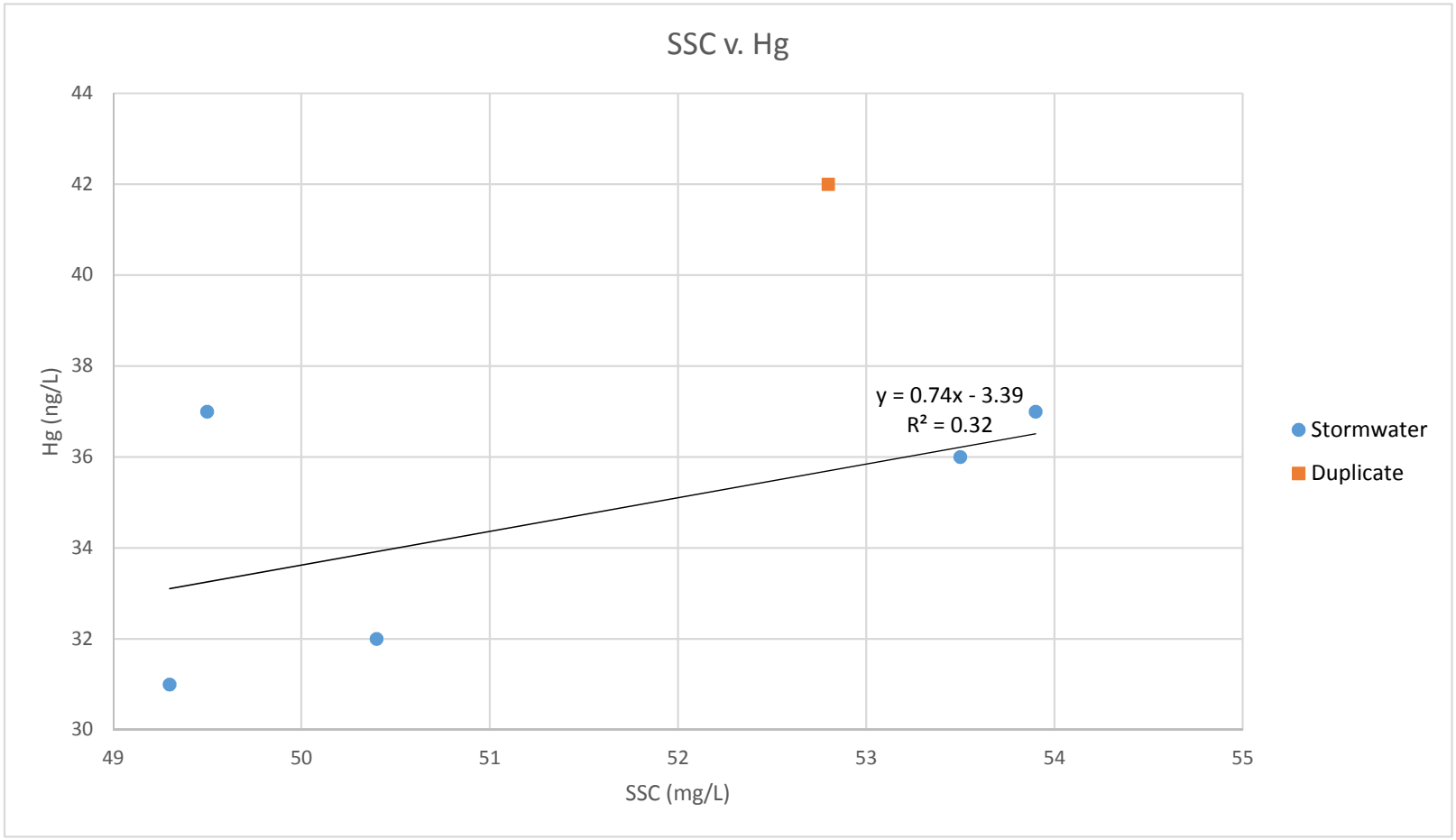
RAINFALL MEASURED AT RICHMOND CITY HALL, NOVEMBER 2, 2015
North Richmond Pump Station
Contra Costa County, California

amec foster wheeler

Figure **1**

Date: 1/12/16	Project No.	5025153002.04

\\Oad-fs1\doc_safe\5000s\5025153002\3000 rpt\Field Sampling Report_011216\02 tbls-figs\



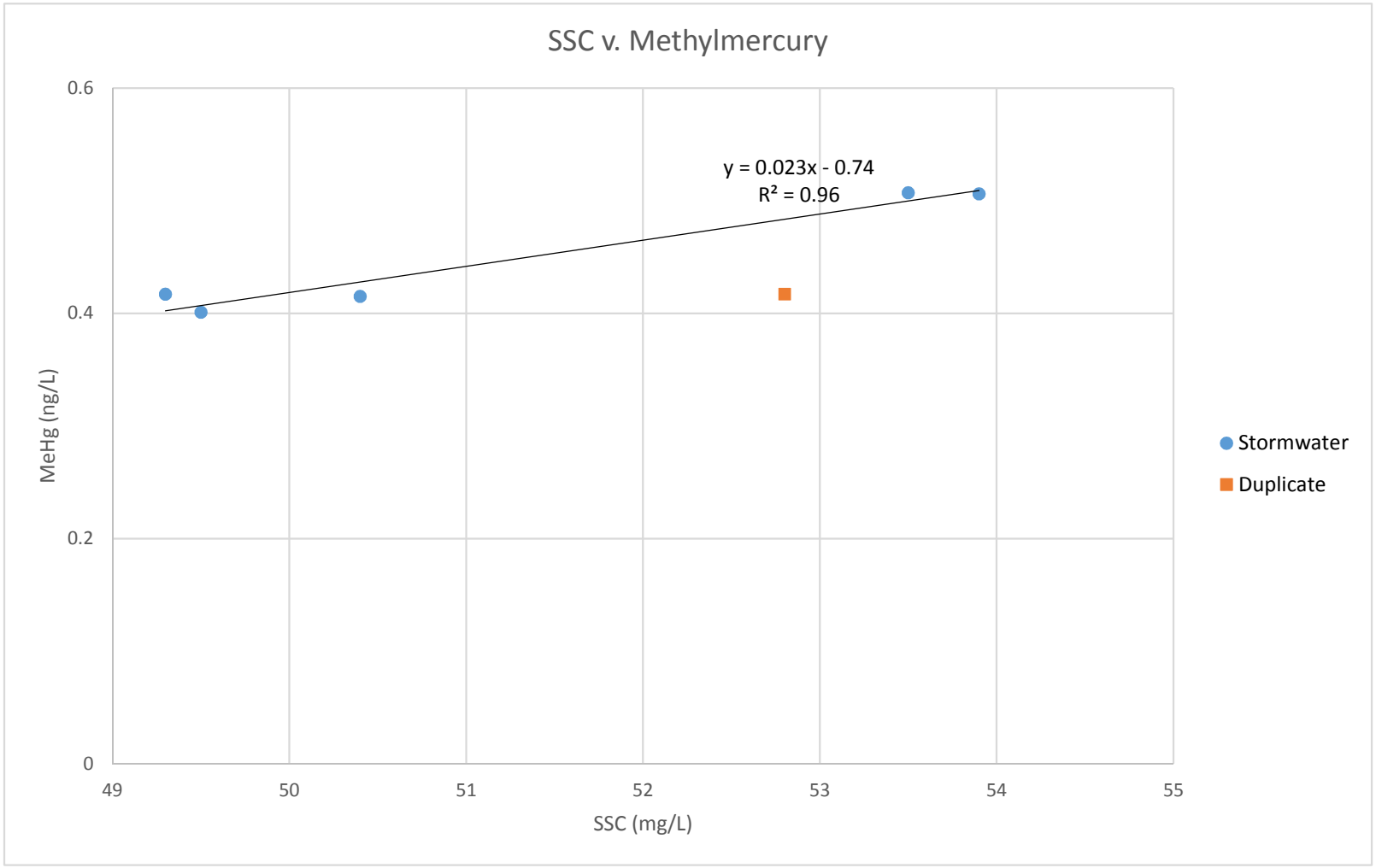
SCATTER PLOT OF SSC
AND TOTAL MERCURY
North Richmond Pump Station
Contra Costa County, California

amec foster wheeler

Date: 1/12/16	Project No.	5025153002.04

Figure
2

\\Oad-fs1\doc_safe\5000s\5025153002\3000 rpt\Field Sampling Report_011216\02 tbls-figs\



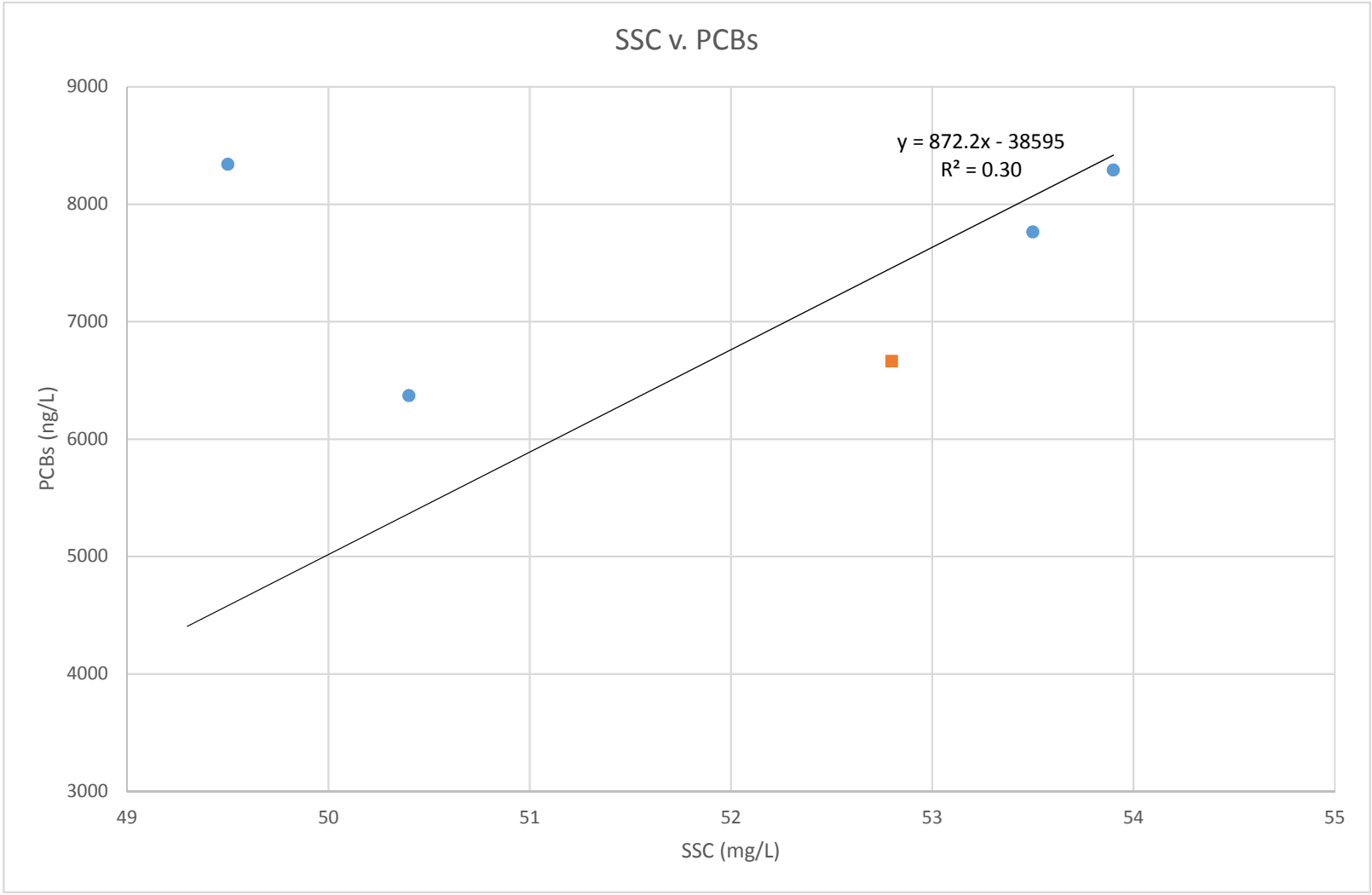
SCATTER PLOT OF SSC AND METHYLMERCURY
North Richmond Pump Station
Contra Costa County, California

amec foster wheeler

Date: 1/12/16	Project No.	5025153002.04

Figure 3

\\Oad-fs1\doc_safe\5000s\5025153002\3000 rpt\Field Sampling Report_011216\02 tbls-figs\



SCATTER PLOT OF SSC
AND TOTAL PCBs
North Richmond Pump Station
Contra Costa County, California

amec foster wheeler

Figure
4

Date: 1/12/16	Project No.	5025153002.04

\\Oad-fs1\doc_safe\5000s\5025153002\3000 rpt\Field Sampling Report_011216\02 tbls-figs\

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APPENDIX A

Laboratory Certificates

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11720 Northcreek Pkwy N, Suite 400
Bothell, WA 98011
425.686.1996 Phone
425.686.3096 Fax

19 November 2015

Rosa Venegas
McCampbell Analytical, Inc
1534 Willow Pass Rd
Pittsburg, CA 94565

RE: MMHg

Enclosed are the analytical results for samples received by Eurofins Frontier Global Sciences. All quality control measurements are within established control limits and there were no analytical difficulties encountered with the exception of those listed in the case narrative section of this report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Amy Goodall
Project Manager

eurofins | Frontier Global Sciences

11720 Northcreek Pkwy N, Suite 400
Bothell, WA 98011
425.686.1996 Phone
425.686.3096 Fax

McCampbell Analytical, Inc	Project: MMHg	
1534 Willow Pass Rd	Project Number: North Richmond Pump Station	**Reported:**
Pittsburg CA, 94565	Project Manager: Rosa Venegas	19-Nov-15 15:09

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
1511071-001C NRPSIS-001	1511087-01	Water	02-Nov-15 09:37	04-Nov-15 09:30
1511071-002C NRPSIS-002	1511087-02	Water	02-Nov-15 09:52	04-Nov-15 09:30
1511071-003C NRPSIS-003	1511087-03	Water	02-Nov-15 09:56	04-Nov-15 09:30
1511071-004C NRPSIS-004	1511087-04	Water	02-Nov-15 10:10	04-Nov-15 09:30
1511071-005C NRPSIS-005	1511087-05	Water	02-Nov-15 10:28	04-Nov-15 09:30
1511071-006C NRPSIS-006	1511087-06	Water	02-Nov-15 10:56	04-Nov-15 09:30
1511071-007C NRPSIS-007	1511087-07	Water	02-Nov-15 11:00	04-Nov-15 09:30
1511071-008C NRPSIS-008	1511087-08	Water	02-Nov-15 11:31	04-Nov-15 09:30
1511071-009C NRPSIS-009	1511087-09	Water	02-Nov-15 11:24	04-Nov-15 09:30

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Amy Goodall, Project Manager

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McCampbell Analytical, Inc	Project: MMHg	
1534 Willow Pass Rd	Project Number: North Richmond Pump Station	**Reported:**
Pittsburg CA, 94565	Project Manager: Rosa Venegas	19-Nov-15 15:09

SAMPLE RECEIPT

Samples were received at Eurofins Frontier Global Sciences (EFGS) on 11/4/2015 9:30:00 AM . The samples were received intact, on-ice within a sealed cooler at 1.4 degrees Celsius.

SAMPLE PREPARATION AND ANALYSIS

Samples were prepared and analyzed for methyl mercury by cold vapor gas chromatography atomic fluorescence spectrometry (CV-GC-AFS) in accordance with EPA 1630 (EFGS-070).

ANALYTICAL AND QUALITY CONTROL ISSUES

Method blanks were prepared for every preparation to assess possible blank contribution from the sample preparation procedure. The method blanks were carried through the entire analytical procedure. All blanks fell within the established acceptance criteria with the exception of any items narrated above or flagged and described in the notes and definitions section of the report.

Liquid spikes, certified reference material (CRM) or a quality control samples (QCS) were prepared for every preparation as a measure of accuracy. All liquid spikes, CRMs and/or QCS samples fell within the established acceptance criteria with the exception of any items narrated above or flagged and described in the notes and definitions section of the report.

As an additional measure of the accuracy of the methods used and to check for matrix interference, matrix spikes (MS) and matrix spike duplicates (MSD) were digested and analyzed. All of the matrix spike recoveries fell within the established acceptance criteria with the exception of any items flagged and described in the notes and definitions section of the report.

A reasonable measure of the precision of the analytical methods is the relative percent difference (RPD) between a matrix spike recovery and a matrix spike duplicate recovery and between laboratory control sample recovery and laboratory control sample duplicate recoveries. All of the relative percent differences established acceptance criteria with the exception of any items flagged and described in the notes and definitions section of the report.

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Sample Receipt Checklist

EFGS Work Order: 1511087

Client: McCampbell Analytical

Date & Time Received: 11/4/15 10:00

Date Labeled: 11/4/15 Labeled By: BB

Project:

Received By: LM

Label Verified By: CMK

# of Coolers Received: 1 Samples Arrived By: ✓ Shipping Service ____ Courier ____ Hand ____ Other (Specify:____)

Coolant: ☐ None/Ambient ☑ Loose Ice ☐ Gel Ice ☐ Dry Ice Coolant Required: Y/N Temp Blank Used: Y/N for Cooler(s):____

Notify Project Manager if packages/coolers are received without coolant or with thawed coolant and at a temperature in excess of 6°C. PM notified: Y/N

Cooler Information:	Y/N/NA	Comments
The coolers do not appear to be tampered with:	Y	
Custody Seals are present and intact:	N	
Custody seals signed:	N	

TID: 4350	CF: -0.3 °C		Date/time: 11/4/15 10:00	By: LM	
Cooler 1: 1.7 °C	w/ CF: 1.4 °C		Cooler 4: °C	w/ CF:	°C
Cooler 2: °C	w/ CF:	°C	Cooler 5: °C	w/ CF:	°C
Cooler 3: °C	w/ CF:	°C	Cooler 6: °C	w/ CF:	°C

Chain of Custody:	Y/N/NA	Comments
Sample ID/Description:	Y	
Date and time of collection:	Y	
Sampled by:	N	
Preservation type:	N	
Requested analyses:	Y	
Required signatures:	Y	
Internal COC required:	N	

Sample Condition/Integrity:	Y/N/NA	Comments
Sample containers intact/present:	Y	
Sample labels are present and legible:	Y	
Sample ID on container/bag matches COC:	Y	
Correct sample containers used:	Y	
Samples received within holding times:	Y	
Sample volume sufficient for requested analyses:	Y	
Correct preservative used for requested analyses:	Y	

Anomalies/Non-conformances (attach additional pages if needed):

1511087

McCampbell Analytical, Inc.

SUB CHAIN-OF-CUSTODY RECORD

1534 Willow Pass Rd
Pittsburg, CA 94565-1701
Phone: (925) 252-9262
Fax: (925) 252-9269

WorkOrder: 1511071 **ClientCode:** AMEC **EDF:** NO

Subcontractor:

Eurofins Frontier Global Sciences
11720 Northcreek Pkwy N, Suite 400
Bothell, WA 98011

TEL: (425) 686-1996
FAX: (425) 686-3096
ProjectNo: North Richmond Pump Station
Acct #:

Subcontractor Standard TAT:

Date Received: 11/02/2015

Lab ID	Client ID	Matrix	Collection Date	TAT	Requested Tests: E1630				
1511071-001C	NRPSIS-001	Water	11/2/2015 9:37	5 day(s)	1				
1511071-002C	NRPSIS-002	Water	11/2/2015 9:52	5 day(s)	1				
1511071-003C	NRPSIS-003	Water	11/2/2015 9:56	5 day(s)	1				
1511071-004C	NRPSIS-004	Water	11/2/2015 10:10	5 day(s)	1				
1511071-005C	NRPSIS-005	Water	11/2/2015 10:28	5 day(s)	1				
1511071-006C	NRPSIS-006	Water	11/2/2015 10:56	5 day(s)	1				
1511071-007C	NRPSIS-007	Water	11/2/2015 11:00	5 day(s)	1				
1511071-008C	NRPSIS-008	Water	11/2/2015 11:31	5 day(s)	1				
1511071-009C	NRPSIS-009	Water	11/2/2015 11:24	5 day(s)	1				

Comments: **PLEASE USE 'CLIENT ID' AS THE SAMPLE ID AND EMAIL ASAP!**

Please email results to Maria Venegas at subdata@mccampbell.com upon completion.

		Date/Time			Date/Time
Relinquished by:	[signature]	11/3	**Received by:**	[signature] Lars Moffet	11/4/15 10:00
Relinquished by:			**Received by:**	EFGS	

No Seal
UPS
12 885 54E 01 ~~444~~ 4460 4789
11/4/15 LM
1.4°C

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Bothell, WA 98011
425.686.1996 Phone
425.686.3096 Fax

McCampbell Analytical, Inc	Project: MMHg	
1534 Willow Pass Rd	Project Number: North Richmond Pump Station	**Reported:**
Pittsburg CA, 94565	Project Manager: Rosa Venegas	19-Nov-15 15:09

1511071-001C NRPSIS-001

1511087-01

Analyte	Result	Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Sequence	Analyzed	Method	Notes
Sample Preparation: EFGS-013 Methyl Hg Distillation for Water											
Methyl Mercury (as Mercury)	**0.506**	0.026	0.050	ng/L	1.25	F511180	13-Nov-15	5K16026	14-Nov-15	EPA 1630/FGS-070	

Eurofins Frontier Global Sciences, Inc.

Amy Goodall

Amy Goodall, Project Manager

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McCampbell Analytical, Inc	Project: MMHg	
1534 Willow Pass Rd	Project Number: North Richmond Pump Station	**Reported:**
Pittsburg CA, 94565	Project Manager: Rosa Venegas	19-Nov-15 15:09

1511071-002C NRPSIS-002

1511087-02

Analyte	Result	Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Sequence	Analyzed	Method	Notes
Sample Preparation: EFGS-013 Methyl Hg Distillation for Water											
Methyl Mercury (as Mercury)	**0.507**	0.026	0.050	ng/L	1.25	F511180	13-Nov-15	5K16026	14-Nov-15	EPA 1630/FGS-070	

Eurofins Frontier Global Sciences, Inc.

Amy Goodall

Amy Goodall, Project Manager

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McCampbell Analytical, Inc	Project: MMHg	
1534 Willow Pass Rd	Project Number: North Richmond Pump Station	**Reported:**
Pittsburg CA, 94565	Project Manager: Rosa Venegas	19-Nov-15 15:09

1511071-003C NRPSIS-003

1511087-03

Analyte	Result	Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Sequence	Analyzed	Method	Notes
Sample Preparation: EFGS-013 Methyl Hg Distillation for Water											
Methyl Mercury (as Mercury)	**0.696**	0.026	0.050	ng/L	1.25	F511180	13-Nov-15	5K16026	14-Nov-15	EPA 1630/FGS-070	

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McCampbell Analytical, Inc	Project: MMHg	
1534 Willow Pass Rd	Project Number: North Richmond Pump Station	**Reported:**
Pittsburg CA, 94565	Project Manager: Rosa Venegas	19-Nov-15 15:09

1511071-004C NRPSIS-004

1511087-04

Analyte	Result	Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Sequence	Analyzed	Method	Notes
Sample Preparation: EFGS-013 Methyl Hg Distillation for Water											
Methyl Mercury (as Mercury)	ND	0.026	0.050	ng/L	1.25	F511180	13-Nov-15	5K16026	14-Nov-15	EPA 1630/FGS-070	U

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McCampbell Analytical, Inc	Project: MMHg	
1534 Willow Pass Rd	Project Number: North Richmond Pump Station	**Reported:**
Pittsburg CA, 94565	Project Manager: Rosa Venegas	19-Nov-15 15:09

1511071-005C NRPSIS-005

1511087-05

Analyte	Result	Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Sequence	Analyzed	Method	Notes
Sample Preparation: EFGS-013 Methyl Hg Distillation for Water											
Methyl Mercury (as Mercury)	**0.401**	0.026	0.050	ng/L	1.25	F511180	13-Nov-15	5K16026	14-Nov-15	EPA 1630/FGS-070	

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McCampbell Analytical, Inc	Project: MMHg	
1534 Willow Pass Rd	Project Number: North Richmond Pump Station	**Reported:**
Pittsburg CA, 94565	Project Manager: Rosa Venegas	19-Nov-15 15:09

1511071-006C NRPSIS-006

1511087-06

Analyte	Result	Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Sequence	Analyzed	Method	Notes
Sample Preparation: EFGS-013 Methyl Hg Distillation for Water											
Methyl Mercury (as Mercury)	**0.417**	0.026	0.050	ng/L	1.25	F511180	13-Nov-15	5K16026	14-Nov-15	EPA 1630/FGS-070	

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425.686.3096 Fax

McCampbell Analytical, Inc	Project: MMHg	
1534 Willow Pass Rd	Project Number: North Richmond Pump Station	**Reported:**
Pittsburg CA, 94565	Project Manager: Rosa Venegas	19-Nov-15 15:09

1511071-007C NRPSIS-007

1511087-07

Analyte	Result	Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Sequence	Analyzed	Method	Notes
Sample Preparation: EFGS-013 Methyl Hg Distillation for Water											
Methyl Mercury (as Mercury)	ND	0.026	0.050	ng/L	1.25	F511180	13-Nov-15	5K16026	14-Nov-15	EPA 1630/FGS-070	U

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Amy Goodall

Amy Goodall, Project Manager

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425.686.3096 Fax

McCampbell Analytical, Inc	Project: MMHg	
1534 Willow Pass Rd	Project Number: North Richmond Pump Station	**Reported:**
Pittsburg CA, 94565	Project Manager: Rosa Venegas	19-Nov-15 15:09

1511071-008C NRPSIS-008

1511087-08

Analyte	Result	Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Sequence	Analyzed	Method	Notes
Sample Preparation: EFGS-013 Methyl Hg Distillation for Water											
Methyl Mercury (as Mercury)	**0.415**	0.026	0.050	ng/L	1.25	F511180	13-Nov-15	5K16026	14-Nov-15	EPA 1630/FGS-070	

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McCampbell Analytical, Inc	Project: MMHg	
1534 Willow Pass Rd	Project Number: North Richmond Pump Station	**Reported:**
Pittsburg CA, 94565	Project Manager: Rosa Venegas	19-Nov-15 15:09

1511071-009C NRPSIS-009

1511087-09

Analyte	Result	Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Sequence	Analyzed	Method	Notes
Sample Preparation: EFGS-013 Methyl Hg Distillation for Water											
Methyl Mercury (as Mercury)	ND	0.026	0.050	ng/L	1.25	F511180	13-Nov-15	5K16026	14-Nov-15	EPA 1630/FGS-070	U

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McCampbell Analytical, Inc	Project: MMHg	
1534 Willow Pass Rd	Project Number: North Richmond Pump Station	**Reported:**
Pittsburg CA, 94565	Project Manager: Rosa Venegas	19-Nov-15 15:09

Quality Control Data

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch F511180 - EFGS-013 Methyl Hg Distillation for Water											
Blank (F511180-BLK1)					Prepared & Analyzed: 13-Nov-15						
Methyl Mercury (as Mercury)	0.032	0.026	0.050	ng/L							J
Blank (F511180-BLK2)					Prepared: 13-Nov-15 Analyzed: 14-Nov-15						
Methyl Mercury (as Mercury)	ND	0.026	0.050	ng/L							U
Blank (F511180-BLK3)					Prepared: 13-Nov-15 Analyzed: 14-Nov-15						
Methyl Mercury (as Mercury)	ND	0.026	0.050	ng/L							U
LCS (F511180-BS1)					Prepared & Analyzed: 13-Nov-15						
Methyl Mercury (as Mercury)	1.168	0.026	0.050	ng/L	1.0010		117	70-130			
LCS Dup (F511180-BSD1)					Prepared & Analyzed: 13-Nov-15						
Methyl Mercury (as Mercury)	1.168	0.026	0.050	ng/L	1.0010		117	70-130	0.0104	25	
Duplicate (F511180-DUP1)		**Source: 1510485-02RE1**			Prepared: 13-Nov-15 Analyzed: 14-Nov-15						
Methyl Mercury (as Mercury)	0.319	0.026	0.050	ng/L		0.317			0.703	35	
Matrix Spike (F511180-MS1)		**Source: 1510485-05RE1**			Prepared: 13-Nov-15 Analyzed: 14-Nov-15						
Methyl Mercury (as Mercury)	1.922	0.026	0.050	ng/L	1.0010	0.423	150	65-130			QM-07
Matrix Spike (F511180-MS2)		**Source: 1511087-02RE1**			Prepared: 13-Nov-15 Analyzed: 14-Nov-15						
Methyl Mercury (as Mercury)	1.915	0.026	0.050	ng/L	1.0010	0.507	141	65-130			QM-07
Matrix Spike Dup (F511180-MSD1)		**Source: 1510485-05RE1**			Prepared: 13-Nov-15 Analyzed: 14-Nov-15						
Methyl Mercury (as Mercury)	1.917	0.026	0.050	ng/L	1.0010	0.423	149	65-130	0.271	35	QM-07
Matrix Spike Dup (F511180-MSD2)		**Source: 1511087-02RE1**			Prepared: 13-Nov-15 Analyzed: 14-Nov-15						
Methyl Mercury (as Mercury)	1.973	0.026	0.050	ng/L	1.0010	0.507	146	65-130	2.95	35	QM-07

Eurofins Frontier Global Sciences, Inc.

The results in this report only apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Amy Goodall, Project Manager

eurofins | Frontier Global Sciences

11720 Northcreek Pkwy N, Suite 400
Bothell, WA 98011
425.686.1996 Phone
425.686.3096 Fax

McCampbell Analytical, Inc	Project:	MMHg	
1534 Willow Pass Rd	Project Number:	North Richmond Pump Station	**Reported:**
Pittsburg CA, 94565	Project Manager:	Rosa Venegas	19-Nov-15 15:09

Notes and Definitions

U	Analyte was not detected and is reported as less than the LOD or as defined by the client. The LOD has been adjusted for any dilution or concentration of the sample.
QM-07	The spike recovery was outside control limits for the MS and/or MSD. The batch was accepted based on LCS and LCSD recoveries within control limits and, when analysis permits, acceptable AS/ASD.
J	The result is an estimated concentration.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

Eurofins Frontier Global Sciences, Inc.

The results in this report only apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Amy Goodall, Project Manager

McCampbell Analytical, Inc.
"When Quality Counts"

Analytical Report

WorkOrder: 1511071 **Amended:** 01/06/2016

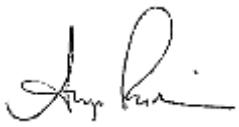
Report Created for: AMEC

2101 Webster Street, 12th Floor
Oakland, CA 94612

Project Contact: Emily Sportsman
Project P.O.:
Project Name: North Richmond Pump Station

Project Received: 11/02/2015

Analytical Report reviewed & approved for release on 11/10/2015 by:



Angela Rydelius,
Laboratory Manager

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Glossary of Terms & Qualifier Definitions

Client: AMEC
Project: North Richmond Pump Station
WorkOrder: 1511071

Glossary Abbreviation

95% Interval	95% Confident Interval
DF	Dilution Factor
DI WET	(DISTLC) Waste Extraction Test using DI water
DISS	Dissolved (direct analysis of 0.45 µm filtered and acidified water sample)
DLT	Dilution Test
DUP	Duplicate
EDL	Estimated Detection Limit
ITEF	International Toxicity Equivalence Factor
LCS	Laboratory Control Sample
MB	Method Blank
MB % Rec	% Recovery of Surrogate in Method Blank, if applicable
MDL	Method Detection Limit
ML	Minimum Level of Quantitation
MS	Matrix Spike
MSD	Matrix Spike Duplicate
N/A	Not Applicable
ND	Not detected at or above the indicated MDL or RL
NR	Data Not Reported due to matrix interference or insufficient sample amount.
PDS	Post Digestion Spike
PDSD	Post Digestion Spike Duplicate
PF	Prep Factor
RD	Relative Difference
RL	Reporting Limit (The RL is the lowest calibration standard in a multipoint calibration.)
RPD	Relative Percent Deviation
RRT	Relative Retention Time
SPK Val	Spike Value
SPKRef Val	Spike Reference Value
SPLP	Synthetic Precipitation Leachate Procedure
TCLP	Toxicity Characteristic Leachate Procedure
TEQ	Toxicity Equivalents
WET (STLC)	Waste Extraction Test (Soluble Threshold Limit Concentration)

Analytical Qualifiers

B	analyte detected in the associated Method Blank and in the sample
J	Result is less than the RL/ML but greater than the MDL. The reported concentration is an estimated value.
S	spike recovery outside accepted recovery limits
M	Estimated Maximum Possible Concentration

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1668C
Date Prepared:	11/18/15-11/23/15	**Analytical Method:**	E1668C
Project:	North Richmond Pump Station	**Unit:**	pg/L

40 PCB Congeners

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-001	**1511071-001A**	**Water**	**11/02/2015 09:37**	**GC36**	**113093**

Analytes	TEF WHO '05	Result	Qualifiers	MDL	ML	DF	Ion Ratio	RRT	TEQ	Date Analyzed
PCB 008		ND		4.0	50	1				11/18/2015 13:14
PCB 018/030		**62**		3.2	50	1	1.12	0.92		11/18/2015 13:14
PCB 020/028		**110**		3.7	50	1	1.02	0.85		11/18/2015 13:14
PCB 031		**95**		2.2	50	1	1.01	0.82		11/18/2015 13:14
PCB 033		ND		2.4	50	1				11/18/2015 13:14
PCB 044/047/065		**120**		9.9	100	1	0.77	1.01		11/18/2015 13:14
PCB 049/069		**58**	J	4.4	100	1	0.81	0.96		11/18/2015 13:14
PCB 052		**170**		3.2	50	1	0.8	1		11/18/2015 13:14
PCB 056		**60**		3.3	50	1	0.78	0.92		11/18/2015 13:14
PCB 060		**31**	J	3.3	50	1	0.73	0.94		11/18/2015 13:14
PCB 066		**110**		2.5	50	1	0.70	0.87		11/18/2015 13:14
PCB 070/074/076		**230**		8.2	200	1	0.75	0.84		11/18/2015 13:14
PCB 086/097/109/119		**94**	J	5.6	200	1	1.58	0.94		11/18/2015 13:14
PCB 087/125		ND		5.7	200	1				11/18/2015 13:14
PCB 090/101/113		**370**		5.4	200	1	1.59	1		11/18/2015 13:14
PCB 095		**300**		2.4	200	1	1.59	1.19		11/18/2015 13:14
PCB 099		**150**		2.5	100	1	1.57	1.05		11/18/2015 13:14
PCB 105	0.00003	**180**		2.6	50	1	1.54	1	0.0054	11/18/2015 13:14
PCB 110/115		**520**		4.5	100	1	1.61	1		11/18/2015 13:14
PCB 118	0.00003	**390**		2.6	100	1	1.58	1	0.0117	11/18/2015 13:14
PCB 128/166		**130**		3.3	100	1	1.22	1.05		11/18/2015 13:14
PCB 129/138/163		**890**		5.7	200	1	1.23	1		11/18/2015 13:14
PCB 132		**230**		2.5	50	1	1.21	1.01		11/18/2015 13:14
PCB 135/151		**250**		3.9	100	1	1.26	1.02		11/18/2015 13:14
PCB 141		**160**		2.4	50	1	1.21	0.96		11/18/2015 13:14
PCB 147/149		**550**		2.8	100	1	1.25	0.97		11/18/2015 13:14
PCB 153/168		**650**		4.3	100	1	1.24	0.96		11/18/2015 13:14
PCB 156/157	0.00003	**100**		4.9	100	1	1.3	1	0.003	11/18/2015 13:14
PCB 158		**97**		1.9	50	1	1.21	1.02		11/18/2015 13:14
PCB 170		**270**		1.5	50	1	1.07	0.99		11/18/2015 13:14
PCB 174		**390**		3.4	50	1	1.05	0.97		11/18/2015 13:14
PCB 177		**230**		1.7	50	1	1.09	0.99		11/18/2015 13:14
PCB 180/193		**660**		4.1	100	1	1.07	0.97		11/18/2015 13:14
PCB 183/185		**250**		3.5	100	1	1.06	0.97		11/18/2015 13:14
PCB 187		**400**		2.1	50	1	1.05	1.06		11/18/2015 13:14

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1668C
Date Prepared:	11/18/15-11/23/15	**Analytical Method:**	E1668C
Project:	North Richmond Pump Station	**Unit:**	pg/L

40 PCB Congeners

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-001	**1511071-001A**	**Water**	**11/02/2015 09:37**	**GC36**	**113093**

Analytes	TEF WHO '05	Result	Qualifiers	MDL	ML	DF	Ion Ratio	RRT	TEQ	Date Analyzed
PCB 194		**89**		1.6	50	1	0.99	1		11/18/2015 13:14
PCB 195		**36**	J	1.8	50	1	0.93	0.97		11/18/2015 13:14
PCB 201		**21**	J	1.9	50	1	0.89	1.04		11/18/2015 13:14
PCB 203		**65**		1.7	50	1	0.92	0.96		11/18/2015 13:14
								Total TEQ:	0.0201	

Isotope Dilution	REC (%)	Limits	
13C-PCB 028	99	5-145	11/18/2015 13:14
13C-PCB 111	77	10-145	11/18/2015 13:14
13C-PCB 178	74	10-145	11/18/2015 13:14
Surrogate			
13C-PCB 001	12	5-145	11/18/2015 13:14
13C-PCB 003	30	5-145	11/18/2015 13:14
13C-PCB 004	30	5-145	11/18/2015 13:14
13C-PCB 015	53	5-145	11/18/2015 13:14
13C-PCB 019	33	5-145	11/18/2015 13:14
13C-PCB 037	74	5-145	11/18/2015 13:14
13C-PCB 054	46	5-145	11/18/2015 13:14
13C-PCB 077	67	10-145	11/18/2015 13:14
13C-PCB 081	70	10-145	11/18/2015 13:14
13C-PCB 104	59	10-145	11/18/2015 13:14
13C-PCB 105	62	10-145	11/18/2015 13:14
13C-PCB 114	60	10-145	11/18/2015 13:14
13C-PCB 118	64	10-145	11/18/2015 13:14
13C-PCB 123	66	10-145	11/18/2015 13:14
13C-PCB 126	68	10-145	11/18/2015 13:14
13C-PCB 155	65	10-145	11/18/2015 13:14
13C-PCB 156/157	60	10-145	11/18/2015 13:14
13C-PCB 167	77	10-145	11/18/2015 13:14
13C-PCB 169	44	10-145	11/18/2015 13:14
13C-PCB 188	99	10-145	11/18/2015 13:14
13C-PCB 189	68	10-145	11/18/2015 13:14
13C-PCB 202	111	10-145	11/18/2015 13:14
13C-PCB 205	49	10-145	11/18/2015 13:14
13C-PCB 206	42	10-145	11/18/2015 13:14
13C-PCB 208	52	10-145	11/18/2015 13:14
13C-PCB 209	37	10-145	11/18/2015 13:14

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1668C
Date Prepared:	11/18/15-11/23/15	**Analytical Method:**	E1668C
Project:	North Richmond Pump Station	**Unit:**	pg/L

40 PCB Congeners

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-001	**1511071-001A**	**Water**	**11/02/2015 09:37**	**GC36**	**113093**

Analytes	TEF WHO '05	Result	Qualifiers	MDL	ML	DF	Ion Ratio	RRT	TEQ	Date Analyzed

Analyst(s): MG

(Cont.)

CDPH ELAP 1644 ♦ NELAP 4033ORELAP

Angela Rydelius, Lab Manager

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1668C
Date Prepared:	11/18/15-11/23/15	**Analytical Method:**	E1668C
Project:	North Richmond Pump Station	**Unit:**	pg/L

40 PCB Congeners

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-002	**1511071-002A**	**Water**	**11/02/2015 09:52**	**GC36**	**113093**

Analytes	TEF WHO '05	Result	Qualifiers	MDL	ML	DF	Ion Ratio	RRT	TEQ	Date Analyzed
PCB 008		ND		4.0	50	1				11/18/2015 14:22
PCB 018/030		**47**	J	3.2	50	1	1.07	0.92		11/18/2015 14:22
PCB 020/028		**92**		3.7	50	1	1.07	0.85		11/18/2015 14:22
PCB 031		**74**		2.2	50	1	1.01	0.82		11/18/2015 14:22
PCB 033		ND		2.4	50	1				11/18/2015 14:22
PCB 044/047/065		**100**		9.9	100	1	0.8	1.01		11/18/2015 14:22
PCB 049/069		**46**	J	4.4	100	1	0.8	0.96		11/18/2015 14:22
PCB 052		**130**		3.2	50	1	0.78	1		11/18/2015 14:22
PCB 056		**54**		3.3	50	1	0.79	0.92		11/18/2015 14:22
PCB 060		**25**	J	3.3	50	1	0.77	0.94		11/18/2015 14:22
PCB 066		**91**		2.5	50	1	0.75	0.87		11/18/2015 14:22
PCB 070/074/076		**200**	J	8.3	200	1	0.76	0.84		11/18/2015 14:22
PCB 086/097/109/119		**79**	J	5.7	200	1	1.75	0.94		11/18/2015 14:22
PCB 087/125		ND		5.8	200	1				11/18/2015 14:22
PCB 090/101/113		**370**		5.4	200	1	1.63	1		11/18/2015 14:22
PCB 095		**260**		2.4	200	1	1.62	1.19		11/18/2015 14:22
PCB 099		**130**		2.5	100	1	1.64	1.05		11/18/2015 14:22
PCB 105	0.00003	**170**		2.6	50	1	1.49	1	0.0051	11/18/2015 14:22
PCB 110/115		**470**		4.5	100	1	1.64	1		11/18/2015 14:22
PCB 118	0.00003	**360**		2.6	100	1	1.55	1	0.0108	11/18/2015 14:22
PCB 128/166		**120**		3.3	100	1	1.22	1.05		11/18/2015 14:22
PCB 129/138/163		**870**		5.8	200	1	1.22	1		11/18/2015 14:22
PCB 132		**220**		2.5	50	1	1.24	1.01		11/18/2015 14:22
PCB 135/151		**240**		3.9	100	1	1.23	1.02		11/18/2015 14:22
PCB 141		**160**		2.4	50	1	1.27	0.96		11/18/2015 14:22
PCB 147/149		**540**		2.8	100	1	1.23	0.97		11/18/2015 14:22
PCB 153/168		**630**		4.3	100	1	1.26	0.96		11/18/2015 14:22
PCB 156/157	0.00003	**100**		4.9	100	1	1.28	1	0.003	11/18/2015 14:22
PCB 158		**86**		1.9	50	1	1.25	1.02		11/18/2015 14:22
PCB 170		**280**		1.5	50	1	1.01	0.99		11/18/2015 14:22
PCB 174		**420**		3.5	50	1	1.06	0.97		11/18/2015 14:22
PCB 177		**240**		1.7	50	1	1.07	0.99		11/18/2015 14:22
PCB 180/193		**700**		4.1	100	1	1.07	0.97		11/18/2015 14:22
PCB 183/185		**260**		3.6	100	1	1.07	0.97		11/18/2015 14:22
PCB 187		**410**		2.1	50	1	1.03	1.06		11/18/2015 14:22

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1668C
Date Prepared:	11/18/15-11/23/15	**Analytical Method:**	E1668C
Project:	North Richmond Pump Station	**Unit:**	pg/L

40 PCB Congeners

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-002	**1511071-002A**	**Water**	**11/02/2015 09:52**	**GC36**	**113093**

Analytes	TEF WHO '05	Result	Qualifiers	MDL	ML	DF	Ion Ratio	RRT	TEQ	Date Analyzed
PCB 194		**96**		1.6	50	1	0.9	1		11/18/2015 14:22
PCB 195		**40**	J	1.8	50	1	0.89	0.97		11/18/2015 14:22
PCB 201		**20**	J	1.9	50	1	0.84	1.04		11/18/2015 14:22
PCB 203		**70**		1.7	50	1	0.90	0.96		11/18/2015 14:22
								Total TEQ:	0.0189	

Isotope Dilution	REC (%)	Limits	
13C-PCB 028	109	5-145	11/18/2015 14:22
13C-PCB 111	75	10-145	11/18/2015 14:22
13C-PCB 178	77	10-145	11/18/2015 14:22
Surrogate			
13C-PCB 001	9	5-145	11/18/2015 14:22
13C-PCB 003	30	5-145	11/18/2015 14:22
13C-PCB 004	30	5-145	11/18/2015 14:22
13C-PCB 015	60	5-145	11/18/2015 14:22
13C-PCB 019	38	5-145	11/18/2015 14:22
13C-PCB 037	85	5-145	11/18/2015 14:22
13C-PCB 054	55	5-145	11/18/2015 14:22
13C-PCB 077	76	10-145	11/18/2015 14:22
13C-PCB 081	80	10-145	11/18/2015 14:22
13C-PCB 104	57	10-145	11/18/2015 14:22
13C-PCB 105	62	10-145	11/18/2015 14:22
13C-PCB 114	61	10-145	11/18/2015 14:22
13C-PCB 118	65	10-145	11/18/2015 14:22
13C-PCB 123	67	10-145	11/18/2015 14:22
13C-PCB 126	69	10-145	11/18/2015 14:22
13C-PCB 155	65	10-145	11/18/2015 14:22
13C-PCB 156/157	67	10-145	11/18/2015 14:22
13C-PCB 167	85	10-145	11/18/2015 14:22
13C-PCB 169	50	10-145	11/18/2015 14:22
13C-PCB 188	100	10-145	11/18/2015 14:22
13C-PCB 189	75	10-145	11/18/2015 14:22
13C-PCB 202	117	10-145	11/18/2015 14:22
13C-PCB 205	54	10-145	11/18/2015 14:22
13C-PCB 206	45	10-145	11/18/2015 14:22
13C-PCB 208	54	10-145	11/18/2015 14:22
13C-PCB 209	37	10-145	11/18/2015 14:22

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1668C
Date Prepared:	11/18/15-11/23/15	**Analytical Method:**	E1668C
Project:	North Richmond Pump Station	**Unit:**	pg/L

40 PCB Congeners

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-002	**1511071-002A**	**Water**	**11/02/2015 09:52**	**GC36**	**113093**

Analytes	TEF WHO '05	Result	Qualifiers	MDL	ML	DF	Ion Ratio	RRT	TEQ	Date Analyzed

Analyst(s): MG

(Cont.)

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1668C
Date Prepared:	11/18/15-11/23/15	**Analytical Method:**	E1668C
Project:	North Richmond Pump Station	**Unit:**	pg/L

40 PCB Congeners

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-003	**1511071-003A**	**Water**	**11/02/2015 09:56**	**GC36**	**113093**

Analytes	TEF WHO '05	Result	Qualifiers	MDL	ML	DF	Ion Ratio	RRT	TEQ	Date Analyzed
PCB 008		ND		4.0	50	1				11/18/2015 15:28
PCB 018/030		**59**		3.2	50	1	1.04	0.92		11/18/2015 15:28
PCB 020/028		**110**		3.7	50	1	1.03	0.85		11/18/2015 15:28
PCB 031		**90**		2.2	50	1	1.08	0.82		11/18/2015 15:28
PCB 033		ND		2.4	50	1				11/18/2015 15:28
PCB 044/047/065		**120**		9.9	100	1	0.81	1.01		11/18/2015 15:28
PCB 049/069		**55**	J	4.4	100	1	0.74	0.96		11/18/2015 15:28
PCB 052		**150**		3.2	50	1	0.77	1		11/18/2015 15:28
PCB 056		**57**		3.3	50	1	0.78	0.92		11/18/2015 15:28
PCB 060		**29**	J	3.3	50	1	0.73	0.94		11/18/2015 15:28
PCB 066		**110**		2.5	50	1	0.77	0.87		11/18/2015 15:28
PCB 070/074/076		**220**		8.2	200	1	0.75	0.84		11/18/2015 15:28
PCB 086/097/109/119		**100**	J	5.7	200	1	1.51	0.94		11/18/2015 15:28
PCB 087/125		ND		5.7	200	1				11/18/2015 15:28
PCB 090/101/113		**400**		5.4	200	1	1.57	1		11/18/2015 15:28
PCB 095		**280**		2.4	200	1	1.58	1.19		11/18/2015 15:28
PCB 099		**140**		2.5	100	1	1.58	1.05		11/18/2015 15:28
PCB 105	0.00003	**180**		2.6	50	1	1.51	1	0.0054	11/18/2015 15:28
PCB 110/115		**520**		4.5	100	1	1.63	1		11/18/2015 15:28
PCB 118	0.00003	**400**		2.6	100	1	1.51	1	0.012	11/18/2015 15:28
PCB 128/166		**130**		3.3	100	1	1.27	1.05		11/18/2015 15:28
PCB 129/138/163		**920**		5.7	200	1	1.24	1		11/18/2015 15:28
PCB 132		**230**		2.5	50	1	1.23	1.01		11/18/2015 15:28
PCB 135/151		**240**		3.9	100	1	1.28	1.02		11/18/2015 15:28
PCB 141		**160**		2.4	50	1	1.24	0.96		11/18/2015 15:28
PCB 147/149		**560**		2.8	100	1	1.31	0.97		11/18/2015 15:28
PCB 153/168		**640**		4.3	100	1	1.26	0.96		11/18/2015 15:28
PCB 156/157	0.00003	**100**		4.9	100	1	1.21	1	0.003	11/18/2015 15:28
PCB 158		**100**		1.9	50	1	1.18	1.02		11/18/2015 15:28
PCB 170		**290**		1.5	50	1	1.03	0.99		11/18/2015 15:28
PCB 174		**390**		3.4	50	1	1.03	0.97		11/18/2015 15:28
PCB 177		**230**		1.7	50	1	1.03	0.99		11/18/2015 15:28
PCB 180/193		**700**		4.1	100	1	1.04	0.97		11/18/2015 15:28
PCB 183/185		**250**		3.5	100	1	1.05	0.96		11/18/2015 15:28
PCB 187		**380**		2.1	50	1	1.05	1.06		11/18/2015 15:28

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1668C
Date Prepared:	11/18/15-11/23/15	**Analytical Method:**	E1668C
Project:	North Richmond Pump Station	**Unit:**	pg/L

40 PCB Congeners

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-003	**1511071-003A**	**Water**	**11/02/2015 09:56**	**GC36**	**113093**

Analytes	TEF WHO '05	Result	Qualifiers	MDL	ML	DF	Ion Ratio	RRT	TEQ	Date Analyzed
PCB 194		**100**		1.6	50	1	0.91	1		11/18/2015 15:28
PCB 195		**42**	J	1.8	50	1	0.89	0.97		11/18/2015 15:28
PCB 201		**21**	J	1.9	50	1	0.83	1.04		11/18/2015 15:28
PCB 203		**71**		1.7	50	1	0.83	0.96		11/18/2015 15:28
								Total TEQ:	0.0204	

Isotope Dilution	REC (%)	Limits	
13C-PCB 028	97	5-145	11/18/2015 15:28
13C-PCB 111	70	10-145	11/18/2015 15:28
13C-PCB 178	68	10-145	11/18/2015 15:28
Surrogate			
13C-PCB 001	13	5-145	11/18/2015 15:28
13C-PCB 003	21	5-145	11/18/2015 15:28
13C-PCB 004	20	5-145	11/18/2015 15:28
13C-PCB 015	31	5-145	11/18/2015 15:28
13C-PCB 019	20	5-145	11/18/2015 15:28
13C-PCB 037	45	5-145	11/18/2015 15:28
13C-PCB 054	26	5-145	11/18/2015 15:28
13C-PCB 077	44	10-145	11/18/2015 15:28
13C-PCB 081	44	10-145	11/18/2015 15:28
13C-PCB 104	26	10-145	11/18/2015 15:28
13C-PCB 105	34	10-145	11/18/2015 15:28
13C-PCB 114	34	10-145	11/18/2015 15:28
13C-PCB 118	35	10-145	11/18/2015 15:28
13C-PCB 123	36	10-145	11/18/2015 15:28
13C-PCB 126	37	10-145	11/18/2015 15:28
13C-PCB 155	31	10-145	11/18/2015 15:28
13C-PCB 156/157	35	10-145	11/18/2015 15:28
13C-PCB 167	42	10-145	11/18/2015 15:28
13C-PCB 169	28	10-145	11/18/2015 15:28
13C-PCB 188	40	10-145	11/18/2015 15:28
13C-PCB 189	37	10-145	11/18/2015 15:28
13C-PCB 202	46	10-145	11/18/2015 15:28
13C-PCB 205	27	10-145	11/18/2015 15:28
13C-PCB 206	22	10-145	11/18/2015 15:28
13C-PCB 208	25	10-145	11/18/2015 15:28
13C-PCB 209	20	10-145	11/18/2015 15:28

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1668C
Date Prepared:	11/18/15-11/23/15	**Analytical Method:**	E1668C
Project:	North Richmond Pump Station	**Unit:**	pg/L

40 PCB Congeners

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-003	**1511071-003A**	**Water**	**11/02/2015 09:56**	**GC36**	**113093**

Analytes	TEF WHO '05	Result	Qualifiers	MDL	ML	DF	Ion Ratio	RRT	TEQ	Date Analyzed

Analyst(s): MG

(Cont.)

CDPH ELAP 1644 ♦ NELAP 4033ORELAP

Angela Rydelius, Lab Manager

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1668C
Date Prepared:	11/18/15-11/23/15	**Analytical Method:**	E1668C
Project:	North Richmond Pump Station	**Unit:**	pg/L

40 PCB Congeners

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-004	**1511071-004A**	**Water**	**11/02/2015 10:10**	**GC36**	**113093**

Analytes	TEF WHO '05	Result	Qualifiers	MDL	ML	DF	Ion Ratio	RRT	TEQ	Date Analyzed
PCB 008		ND		4.1	50	1				11/18/2015 16:32
PCB 018/030		ND		3.2	50	1				11/18/2015 16:32
PCB 020/028		ND		3.8	50	1				11/18/2015 16:32
PCB 031		**3.9**	J	2.2	50	1	1.14	0.83		11/18/2015 16:32
PCB 033		ND		2.4	50	1				11/18/2015 16:32
PCB 044/047/065		ND		10	100	1				11/18/2015 16:32
PCB 049/069		ND		4.5	100	1				11/18/2015 16:32
PCB 052		**3.9**	J	3.2	50	1	0.74	1		11/18/2015 16:32
PCB 056		ND		3.3	50	1				11/18/2015 16:32
PCB 060		ND		3.3	50	1				11/18/2015 16:32
PCB 066		ND		2.5	50	1				11/18/2015 16:32
PCB 070/074/076		ND		8.3	200	1				11/18/2015 16:32
PCB 086/097/109/119		ND		5.7	200	1				11/18/2015 16:32
PCB 087/125		ND		5.8	200	1				11/18/2015 16:32
PCB 090/101/113		**7.0**	J	5.4	200	1	1.46	1		11/18/2015 16:32
PCB 095		**4.5**	J	2.4	200	1	1.33	1.19		11/18/2015 16:32
PCB 099		ND		2.5	100	1				11/18/2015 16:32
PCB 105	0.00003	**3.5**	JM	2.6	50	1	2.71	1	0.000105	11/18/2015 16:32
PCB 110/115		**9.3**	J	4.6	100	1	1.42	1		11/18/2015 16:32
PCB 118	0.00003	**7.4**	J	2.6	100	1	1.44	1	0.000222	11/18/2015 16:32
PCB 128/166		ND		3.3	100	1				11/18/2015 16:32
PCB 129/138/163		**17**	J	5.8	200	1	1.1	1		11/18/2015 16:32
PCB 132		**3.9**	J	2.5	50	1	1.2	1.02		11/18/2015 16:32
PCB 135/151		ND		4.0	100	1				11/18/2015 16:32
PCB 141		**3.5**	J	2.4	50	1	1.09	0.96		11/18/2015 16:32
PCB 147/149		**8.7**	J	2.8	100	1	1.34	0.97		11/18/2015 16:32
PCB 153/168		**11**	J	4.4	100	1	1.1	0.96		11/18/2015 16:32
PCB 156/157		ND		4.9	100	1				11/18/2015 16:32
PCB 158		ND		1.9	50	1				11/18/2015 16:32
PCB 170		**6.0**	JM	1.5	50	1	1.4	0.99		11/18/2015 16:32
PCB 174		**7.0**	J	3.5	50	1	1.08	0.97		11/18/2015 16:32
PCB 177		**2.7**	JM	1.7	50	1	0.28	0.99		11/18/2015 16:32
PCB 180/193		**14**	J	4.2	100	1	1.00	0.97		11/18/2015 16:32
PCB 183/185		ND		3.6	100	1				11/18/2015 16:32
PCB 187		**6.2**	J	2.1	50	1	1.15	1.06		11/18/2015 16:32

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1668C
Date Prepared:	11/18/15-11/23/15	**Analytical Method:**	E1668C
Project:	North Richmond Pump Station	**Unit:**	pg/L

40 PCB Congeners

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-004	**1511071-004A**	**Water**	**11/02/2015 10:10**	**GC36**	**113093**

Analytes	TEF WHO '05	Result	Qualifiers	MDL	ML	DF	Ion Ratio	RRT	TEQ	Date Analyzed
PCB 194		**2.7**	JM	1.6	50	1	1.07	1		11/18/2015 16:32
PCB 195		ND		1.8	50	1				11/18/2015 16:32
PCB 201		ND		1.9	50	1				11/18/2015 16:32
PCB 203		**2.1**	JM	1.7	50	1	0.63	0.96		11/18/2015 16:32
								Total TEQ:	0.000327	

Isotope Dilution	REC (%)	Limits	
13C-PCB 028	81	5-145	11/18/2015 16:32
13C-PCB 111	70	10-145	11/18/2015 16:32
13C-PCB 178	59	10-145	11/18/2015 16:32
Surrogate			
13C-PCB 001	31	5-145	11/18/2015 16:32
13C-PCB 003	34	5-145	11/18/2015 16:32
13C-PCB 004	30	5-145	11/18/2015 16:32
13C-PCB 015	35	5-145	11/18/2015 16:32
13C-PCB 019	28	5-145	11/18/2015 16:32
13C-PCB 037	46	5-145	11/18/2015 16:32
13C-PCB 054	32	5-145	11/18/2015 16:32
13C-PCB 077	59	10-145	11/18/2015 16:32
13C-PCB 081	57	10-145	11/18/2015 16:32
13C-PCB 104	30	10-145	11/18/2015 16:32
13C-PCB 105	54	10-145	11/18/2015 16:32
13C-PCB 114	52	10-145	11/18/2015 16:32
13C-PCB 118	52	10-145	11/18/2015 16:32
13C-PCB 123	52	10-145	11/18/2015 16:32
13C-PCB 126	58	10-145	11/18/2015 16:32
13C-PCB 155	28	10-145	11/18/2015 16:32
13C-PCB 156/157	48	10-145	11/18/2015 16:32
13C-PCB 167	50	10-145	11/18/2015 16:32
13C-PCB 169	47	10-145	11/18/2015 16:32
13C-PCB 188	35	10-145	11/18/2015 16:32
13C-PCB 189	47	10-145	11/18/2015 16:32
13C-PCB 202	42	10-145	11/18/2015 16:32
13C-PCB 205	37	10-145	11/18/2015 16:32
13C-PCB 206	29	10-145	11/18/2015 16:32
13C-PCB 208	30	10-145	11/18/2015 16:32
13C-PCB 209	26	10-145	11/18/2015 16:32

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1668C
Date Prepared:	11/18/15-11/23/15	**Analytical Method:**	E1668C
Project:	North Richmond Pump Station	**Unit:**	pg/L

40 PCB Congeners

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-004	**1511071-004A**	**Water**	**11/02/2015 10:10**	**GC36**	**113093**

Analytes	TEF WHO '05	Result	Qualifiers	MDL	ML	DF	Ion Ratio	RRT	TEQ	Date Analyzed

Analyst(s): MG

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CDPH ELAP 1644 ♦ NELAP 4033ORELAP

Angela Rydelius, Lab Manager

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1668C
Date Prepared:	11/18/15-11/23/15	**Analytical Method:**	E1668C
Project:	North Richmond Pump Station	**Unit:**	pg/L

40 PCB Congeners

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-005	**1511071-005A**	**Water**	**11/02/2015 10:28**	**GC36**	**113093**

Analytes	TEF WHO '05	Result	Qualifiers	MDL	ML	DF	Ion Ratio	RRT	TEQ	Date Analyzed
PCB 008		ND		4.0	50	1				11/18/2015 17:37
PCB 018/030		**38**	J	3.2	50	1	1.02	0.92		11/18/2015 17:37
PCB 020/028		**82**		3.7	50	1	0.99	0.85		11/18/2015 17:37
PCB 031		**66**		2.2	50	1	1.05	0.82		11/18/2015 17:37
PCB 033		ND		2.4	50	1				11/18/2015 17:37
PCB 044/047/065		**86**	J	9.9	100	1	0.76	1.01		11/18/2015 17:37
PCB 049/069		**40**	J	4.4	100	1	0.82	0.96		11/18/2015 17:37
PCB 052		**110**		3.2	50	1	0.8	1		11/18/2015 17:37
PCB 056		**47**	J	3.3	50	1	0.76	0.93		11/18/2015 17:37
PCB 060		**23**	J	3.3	50	1	0.73	0.94		11/18/2015 17:37
PCB 066		**88**		2.5	50	1	0.73	0.87		11/18/2015 17:37
PCB 070/074/076		**180**	J	8.2	200	1	0.78	0.84		11/18/2015 17:37
PCB 086/097/109/119		**77**	J	5.7	200	1	1.56	0.94		11/18/2015 17:37
PCB 087/125		ND		5.7	200	1				11/18/2015 17:37
PCB 090/101/113		**320**		5.4	200	1	1.61	1		11/18/2015 17:37
PCB 095		**220**		2.4	200	1	1.6	1.19		11/18/2015 17:37
PCB 099		**120**		2.5	100	1	1.66	1.05		11/18/2015 17:37
PCB 105	0.00003	**150**		2.6	50	1	1.56	1	0.0045	11/18/2015 17:37
PCB 110/115		**410**		4.5	100	1	1.61	1		11/18/2015 17:37
PCB 118	0.00003	**320**		2.6	100	1	1.52	1	0.0096	11/18/2015 17:37
PCB 128/166		**100**		3.3	100	1	1.29	1.05		11/18/2015 17:37
PCB 129/138/163		**740**		5.7	200	1	1.24	1		11/18/2015 17:37
PCB 132		**180**		2.5	50	1	1.28	1.01		11/18/2015 17:37
PCB 135/151		**190**		3.9	100	1	1.23	1.02		11/18/2015 17:37
PCB 141		**130**		2.4	50	1	1.24	0.96		11/18/2015 17:37
PCB 147/149		**450**		2.8	100	1	1.25	0.97		11/18/2015 17:37
PCB 153/168		**530**		4.3	100	1	1.22	0.96		11/18/2015 17:37
PCB 156/157	0.00003	**86**	J	4.9	100	1	1.28	1	0.00258	11/18/2015 17:37
PCB 158		**76**		1.9	50	1	1.26	1.02		11/18/2015 17:37
PCB 170		**240**		1.5	50	1	1.03	0.99		11/18/2015 17:37
PCB 174		**330**		3.4	50	1	1.08	0.97		11/18/2015 17:37
PCB 177		**200**		1.7	50	1	1.1	0.99		11/18/2015 17:37
PCB 180/193		**600**		4.1	100	1	1.06	0.97		11/18/2015 17:37
PCB 183/185		**210**		3.5	100	1	1.04	0.97		11/18/2015 17:37
PCB 187		**330**		2.1	50	1	1.07	1.06		11/18/2015 17:37

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1668C
Date Prepared:	11/18/15-11/23/15	**Analytical Method:**	E1668C
Project:	North Richmond Pump Station	**Unit:**	pg/L

40 PCB Congeners

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-005	**1511071-005A**	**Water**	**11/02/2015 10:28**	**GC36**	**113093**

Analytes	TEF WHO '05	Result	Qualifiers	MDL	ML	DF	Ion Ratio	RRT	TEQ	Date Analyzed
PCB 194		**89**		1.6	50	1	0.81	1		11/18/2015 17:37
PCB 195		**33**	J	1.8	50	1	0.85	0.97		11/18/2015 17:37
PCB 201		**20**	J	1.9	50	1	0.77	1.04		11/18/2015 17:37
PCB 203		**61**		1.7	50	1	0.88	0.96		11/18/2015 17:37
								Total TEQ:	0.0167	

Isotope Dilution	REC (%)	Limits	
13C-PCB 028	93	5-145	11/18/2015 17:37
13C-PCB 111	66	10-145	11/18/2015 17:37
13C-PCB 178	68	10-145	11/18/2015 17:37
Surrogate			
13C-PCB 001	9	5-145	11/18/2015 17:37
13C-PCB 003	21	5-145	11/18/2015 17:37
13C-PCB 004	20	5-145	11/18/2015 17:37
13C-PCB 015	39	5-145	11/18/2015 17:37
13C-PCB 019	24	5-145	11/18/2015 17:37
13C-PCB 037	54	5-145	11/18/2015 17:37
13C-PCB 054	31	5-145	11/18/2015 17:37
13C-PCB 077	53	10-145	11/18/2015 17:37
13C-PCB 081	55	10-145	11/18/2015 17:37
13C-PCB 104	32	10-145	11/18/2015 17:37
13C-PCB 105	41	10-145	11/18/2015 17:37
13C-PCB 114	39	10-145	11/18/2015 17:37
13C-PCB 118	41	10-145	11/18/2015 17:37
13C-PCB 123	42	10-145	11/18/2015 17:37
13C-PCB 126	45	10-145	11/18/2015 17:37
13C-PCB 155	39	10-145	11/18/2015 17:37
13C-PCB 156/157	42	10-145	11/18/2015 17:37
13C-PCB 167	53	10-145	11/18/2015 17:37
13C-PCB 169	32	10-145	11/18/2015 17:37
13C-PCB 188	55	10-145	11/18/2015 17:37
13C-PCB 189	46	10-145	11/18/2015 17:37
13C-PCB 202	64	10-145	11/18/2015 17:37
13C-PCB 205	33	10-145	11/18/2015 17:37
13C-PCB 206	26	10-145	11/18/2015 17:37
13C-PCB 208	31	10-145	11/18/2015 17:37
13C-PCB 209	21	10-145	11/18/2015 17:37

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1668C
Date Prepared:	11/18/15-11/23/15	**Analytical Method:**	E1668C
Project:	North Richmond Pump Station	**Unit:**	pg/L

40 PCB Congeners

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-005	**1511071-005A**	**Water**	**11/02/2015 10:28**	**GC36**	**113093**

Analytes	TEF WHO '05	Result	Qualifiers	MDL	ML	DF	Ion Ratio	RRT	TEQ	Date Analyzed

Analyst(s): MG

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1668C
Date Prepared:	11/18/15-11/23/15	**Analytical Method:**	E1668C
Project:	North Richmond Pump Station	**Unit:**	pg/L

40 PCB Congeners

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-006	**1511071-006A**	**Water**	**11/02/2015 10:56**	**GC36**	**113278**

Analytes	TEF WHO '05	Result	Qualifiers	MDL	ML	DF	Ion Ratio	RRT	TEQ	Date Analyzed
PCB 008		ND		4.1	50	1				11/22/2015 23:46
PCB 018/030		**38**	JB	3.2	50	1	1.16	0.92		11/22/2015 23:46
PCB 020/028		**72**		3.8	50	1	1.04	0.85		11/22/2015 23:46
PCB 031		**50**	JB	2.2	50	1	1.01	0.83		11/22/2015 23:46
PCB 033		ND		2.4	50	1				11/22/2015 23:46
PCB 044/047/065		**70**	J	9.9	100	1	0.83	1.01		11/22/2015 23:46
PCB 049/069		**31**	JM	4.4	100	1	0.99	0.96		11/22/2015 23:46
PCB 052		**94**		3.2	50	1	0.85	1		11/22/2015 23:46
PCB 056		**43**	J	3.3	50	1	0.80	0.92		11/22/2015 23:46
PCB 060		**18**	J	3.3	50	1	0.85	0.94		11/22/2015 23:46
PCB 066		**56**		2.5	50	1	0.75	0.87		11/22/2015 23:46
PCB 070/074/076		**130**	J	8.3	200	1	0.87	0.84		11/22/2015 23:46
PCB 086/097/109/119		**75**	J	5.7	200	1	1.53	0.94		11/22/2015 23:46
PCB 087/125		ND		5.8	200	1				11/22/2015 23:46
PCB 090/101/113		**260**		5.4	200	1	1.66	1		11/22/2015 23:46
PCB 095		**240**		2.4	200	1	1.45	1.19		11/22/2015 23:46
PCB 099		**89**	J	2.5	100	1	1.7	1.05		11/22/2015 23:46
PCB 105	0.00003	**150**		2.6	50	1	1.75	1	0.0045	11/22/2015 23:46
PCB 110/115		**480**		4.5	100	1	1.59	1		11/22/2015 23:46
PCB 118	0.00003	**340**		2.6	100	1	1.59	1	0.0102	11/22/2015 23:46
PCB 128/166		**130**		3.3	100	1	1.19	1.05		11/22/2015 23:46
PCB 129/138/163		**860**		5.8	200	1	1.25	1		11/22/2015 23:46
PCB 132		**300**		2.5	50	1	1.24	1.02		11/22/2015 23:46
PCB 135/151		**230**		4.0	100	1	1.37	1.02		11/22/2015 23:46
PCB 141		**160**		2.4	50	1	1.27	0.96		11/22/2015 23:46
PCB 147/149		**530**		2.8	100	1	1.31	0.97		11/22/2015 23:46
PCB 153/168		**480**		4.3	100	1	1.21	0.96		11/22/2015 23:46
PCB 156/157	0.00003	**86**	J	4.9	100	1	1.33	1	0.00258	11/22/2015 23:46
PCB 158		**93**		1.9	50	1	1.19	1.02		11/22/2015 23:46
PCB 170		**320**		1.5	50	1	1.14	0.99		11/22/2015 23:46
PCB 174		**330**		3.5	50	1	1.07	0.97		11/22/2015 23:46
PCB 177		**200**		1.7	50	1	1.02	0.99		11/22/2015 23:46
PCB 180/193		**580**		4.2	100	1	1.06	0.97		11/22/2015 23:46
PCB 183/185		**180**		3.6	100	1	1.16	0.96		11/22/2015 23:46
PCB 187		**300**		2.1	50	1	1.13	1.06		11/22/2015 23:46

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1668C
Date Prepared:	11/18/15-11/23/15	**Analytical Method:**	E1668C
Project:	North Richmond Pump Station	**Unit:**	pg/L

40 PCB Congeners

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-006	**1511071-006A**	**Water**	**11/02/2015 10:56**	**GC36**	**113278**

Analytes	TEF WHO '05	Result	Qualifiers	MDL	ML	DF	Ion Ratio	RRT	TEQ	Date Analyzed
PCB 194		**120**		1.6	50	1	0.77	1		11/22/2015 23:46
PCB 195		**53**		1.8	50	1	0.9	0.97		11/22/2015 23:46
PCB 201		ND		1.9	50	1				11/22/2015 23:46
PCB 203		**75**		1.7	50	1	0.82	0.96		11/22/2015 23:46
								Total TEQ:	0.0173	

Isotope Dilution	REC (%)	Limits	
13C-PCB 028	109	5-145	11/22/2015 23:46
13C-PCB 111	65	10-145	11/22/2015 23:46
13C-PCB 178	65	10-145	11/22/2015 23:46
Surrogate			
13C-PCB 001	63	5-145	11/22/2015 23:46
13C-PCB 003	80	5-145	11/22/2015 23:46
13C-PCB 004	73	5-145	11/22/2015 23:46
13C-PCB 015	90	5-145	11/22/2015 23:46
13C-PCB 019	82	5-145	11/22/2015 23:46
13C-PCB 037	99	5-145	11/22/2015 23:46
13C-PCB 054	81	5-145	11/22/2015 23:46
13C-PCB 077	101	10-145	11/22/2015 23:46
13C-PCB 081	87	10-145	11/22/2015 23:46
13C-PCB 104	67	10-145	11/22/2015 23:46
13C-PCB 105	106	10-145	11/22/2015 23:46
13C-PCB 114	84	10-145	11/22/2015 23:46
13C-PCB 118	85	10-145	11/22/2015 23:46
13C-PCB 123	77	10-145	11/22/2015 23:46
13C-PCB 126	101	10-145	11/22/2015 23:46
13C-PCB 155	46	10-145	11/22/2015 23:46
13C-PCB 156/157	84	10-145	11/22/2015 23:46
13C-PCB 167	72	10-145	11/22/2015 23:46
13C-PCB 169	85	10-145	11/22/2015 23:46
13C-PCB 188	64	10-145	11/22/2015 23:46
13C-PCB 189	95	10-145	11/22/2015 23:46
13C-PCB 202	70	10-145	11/22/2015 23:46
13C-PCB 205	75	10-145	11/22/2015 23:46
13C-PCB 206	47	10-145	11/22/2015 23:46
13C-PCB 208	45	10-145	11/22/2015 23:46
13C-PCB 209	26	10-145	11/22/2015 23:46

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1668C
Date Prepared:	11/18/15-11/23/15	**Analytical Method:**	E1668C
Project:	North Richmond Pump Station	**Unit:**	pg/L

40 PCB Congeners

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-006	**1511071-006A**	**Water**	**11/02/2015 10:56**	**GC36**	**113278**

Analytes	TEF WHO '05	Result	Qualifiers	MDL	ML	DF	Ion Ratio	RRT	TEQ	Date Analyzed

Analyst(s): MG

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CDPH ELAP 1644 ♦ NELAP 4033ORELAP

Angela Rydelius, Lab Manager

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1668C
Date Prepared:	11/18/15-11/23/15	**Analytical Method:**	E1668C
Project:	North Richmond Pump Station	**Unit:**	pg/L

40 PCB Congeners

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-007	1511071-007A	Water	11/02/2015 11:00	GC36	113278

Analytes	TEF WHO '05	Result	Qualifiers	MDL	ML	DF	Ion Ratio	RRT	TEQ	Date Analyzed
PCB 008		ND		4.1	50	1				11/22/2015 20:33
PCB 018/030		ND		3.2	50	1				11/22/2015 20:33
PCB 020/028		**4.9**	JB	3.8	50	1	0.95	0.85		11/22/2015 20:33
PCB 031		ND		2.3	50	1				11/22/2015 20:33
PCB 033		ND		2.5	50	1				11/22/2015 20:33
PCB 044/047/065		ND		10	100	1				11/22/2015 20:33
PCB 049/069		ND		4.5	100	1				11/22/2015 20:33
PCB 052		ND		3.2	50	1				11/22/2015 20:33
PCB 056		ND		3.3	50	1				11/22/2015 20:33
PCB 060		ND		3.3	50	1				11/22/2015 20:33
PCB 066		ND		2.6	50	1				11/22/2015 20:33
PCB 070/074/076		ND		8.5	200	1				11/22/2015 20:33
PCB 086/097/109/119		ND		5.8	200	1				11/22/2015 20:33
PCB 087/125		ND		5.9	200	1				11/22/2015 20:33
PCB 090/101/113		ND		5.5	200	1				11/22/2015 20:33
PCB 095		ND		2.5	200	1				11/22/2015 20:33
PCB 099		ND		2.6	100	1				11/22/2015 20:33
PCB 105		ND		2.7	50	1				11/22/2015 20:33
PCB 110/115		ND		4.6	100	1				11/22/2015 20:33
PCB 118	0.00003	**3.3**	J	2.7	100	1	1.40	1	0.000099	11/22/2015 20:33
PCB 128/166		ND		3.3	100	1				11/22/2015 20:33
PCB 129/138/163		ND		5.9	200	1				11/22/2015 20:33
PCB 132		ND		2.6	50	1				11/22/2015 20:33
PCB 135/151		ND		4.0	100	1				11/22/2015 20:33
PCB 141		ND		2.5	50	1				11/22/2015 20:33
PCB 147/149		ND		2.9	100	1				11/22/2015 20:33
PCB 153/168		ND		4.4	100	1				11/22/2015 20:33
PCB 156/157		ND		5.0	100	1				11/22/2015 20:33
PCB 158		ND		2.0	50	1				11/22/2015 20:33
PCB 170		ND		1.6	50	1				11/22/2015 20:33
PCB 174		ND		3.5	50	1				11/22/2015 20:33
PCB 177		ND		1.8	50	1				11/22/2015 20:33
PCB 180/193		ND		4.2	100	1				11/22/2015 20:33
PCB 183/185		ND		3.6	100	1				11/22/2015 20:33
PCB 187		ND		2.2	50	1				11/22/2015 20:33

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1668C
Date Prepared:	11/18/15-11/23/15	**Analytical Method:**	E1668C
Project:	North Richmond Pump Station	**Unit:**	pg/L

40 PCB Congeners

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-007	**1511071-007A**	**Water**	**11/02/2015 11:00**	**GC36**	**113278**

Analytes	TEF WHO '05	Result	Qualifiers	MDL	ML	DF	Ion Ratio	RRT	TEQ	Date Analyzed
PCB 194		ND		1.7	50	1				11/22/2015 20:33
PCB 195		ND		1.9	50	1				11/22/2015 20:33
PCB 201		ND		2.0	50	1				11/22/2015 20:33
PCB 203		ND		1.8	50	1				11/22/2015 20:33
									Total TEQ:	0.0000990

Isotope Dilution	REC (%)	Limits	
13C-PCB 028	114	5-145	11/22/2015 20:33
13C-PCB 111	92	10-145	11/22/2015 20:33
13C-PCB 178	81	10-145	11/22/2015 20:33
Surrogate			
13C-PCB 001	70	5-145	11/22/2015 20:33
13C-PCB 003	72	5-145	11/22/2015 20:33
13C-PCB 004	59	5-145	11/22/2015 20:33
13C-PCB 015	83	5-145	11/22/2015 20:33
13C-PCB 019	62	5-145	11/22/2015 20:33
13C-PCB 037	102	5-145	11/22/2015 20:33
13C-PCB 054	62	5-145	11/22/2015 20:33
13C-PCB 077	112	10-145	11/22/2015 20:33
13C-PCB 081	108	10-145	11/22/2015 20:33
13C-PCB 104	56	10-145	11/22/2015 20:33
13C-PCB 105	91	10-145	11/22/2015 20:33
13C-PCB 114	89	10-145	11/22/2015 20:33
13C-PCB 118	90	10-145	11/22/2015 20:33
13C-PCB 123	92	10-145	11/22/2015 20:33
13C-PCB 126	95	10-145	11/22/2015 20:33
13C-PCB 155	67	10-145	11/22/2015 20:33
13C-PCB 156/157	89	10-145	11/22/2015 20:33
13C-PCB 167	91	10-145	11/22/2015 20:33
13C-PCB 169	98	10-145	11/22/2015 20:33
13C-PCB 188	52	10-145	11/22/2015 20:33
13C-PCB 189	84	10-145	11/22/2015 20:33
13C-PCB 202	56	10-145	11/22/2015 20:33
13C-PCB 205	73	10-145	11/22/2015 20:33
13C-PCB 206	60	10-145	11/22/2015 20:33
13C-PCB 208	54	10-145	11/22/2015 20:33
13C-PCB 209	55	10-145	11/22/2015 20:33

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1668C
Date Prepared:	11/18/15-11/23/15	**Analytical Method:**	E1668C
Project:	North Richmond Pump Station	**Unit:**	pg/L

40 PCB Congeners

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-007	**1511071-007A**	**Water**	**11/02/2015 11:00**	**GC36**	**113278**

Analytes	TEF WHO '05	Result	Qualifiers	MDL	ML	DF	Ion Ratio	RRT	TEQ	Date Analyzed

Analyst(s): MG

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1668C
Date Prepared:	11/18/15-11/23/15	**Analytical Method:**	E1668C
Project:	North Richmond Pump Station	**Unit:**	pg/L

40 PCB Congeners

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-008	**1511071-008A**	**Water**	**11/02/2015 11:31**	**GC36**	**113278**

Analytes	TEF WHO '05	Result	Qualifiers	MDL	ML	DF	Ion Ratio	RRT	TEQ	Date Analyzed
PCB 008		ND		4.1	50	1				11/22/2015 22:41
PCB 018/030		**50**	JB	3.2	50	1	1.09	0.92		11/22/2015 22:41
PCB 020/028		**130**		3.8	50	1	1.03	0.85		11/22/2015 22:41
PCB 031		**38**	JB	2.2	50	1	1.03	0.82		11/22/2015 22:41
PCB 033		ND		2.4	50	1				11/22/2015 22:41
PCB 044/047/065		**110**		10	100	1	0.78	1.01		11/22/2015 22:41
PCB 049/069		**24**	J	4.5	100	1	0.79	0.96		11/22/2015 22:41
PCB 052		**130**		3.2	50	1	0.76	1		11/22/2015 22:41
PCB 056		**33**	J	3.3	50	1	0.82	0.92		11/22/2015 22:41
PCB 060		**16**	J	3.3	50	1	0.76	0.94		11/22/2015 22:41
PCB 066		**57**		2.5	50	1	0.82	0.87		11/22/2015 22:41
PCB 070/074/076		**190**	J	8.3	200	1	0.8	0.84		11/22/2015 22:41
PCB 086/097/109/119		**55**	J	5.7	200	1	1.50	0.94		11/22/2015 22:41
PCB 087/125		ND		5.8	200	1				11/22/2015 22:41
PCB 090/101/113		**190**	J	5.4	200	1	1.60	1		11/22/2015 22:41
PCB 095		**120**	J	2.4	200	1	1.57	1.19		11/22/2015 22:41
PCB 099		**72**	J	2.5	100	1	1.56	1.05		11/22/2015 22:41
PCB 105	0.00003	**110**		2.6	50	1	1.55	1	0.0033	11/22/2015 22:41
PCB 110/115		**350**		4.5	100	1	1.57	1		11/22/2015 22:41
PCB 118	0.00003	**300**		2.6	100	1	1.56	1	0.009	11/22/2015 22:41
PCB 128/166		**74**	J	3.3	100	1	1.18	1.05		11/22/2015 22:41
PCB 129/138/163		**580**		5.8	200	1	1.23	1		11/22/2015 22:41
PCB 132		**130**		2.5	50	1	1.22	1.01		11/22/2015 22:41
PCB 135/151		**140**		4.0	100	1	1.26	1.02		11/22/2015 22:41
PCB 141		**93**		2.4	50	1	1.25	0.96		11/22/2015 22:41
PCB 147/149		**360**		2.8	100	1	1.26	0.97		11/22/2015 22:41
PCB 153/168		**430**		4.4	100	1	1.24	0.96		11/22/2015 22:41
PCB 156/157	0.00003	**61**	J	4.9	100	1	1.26	1	0.00183	11/22/2015 22:41
PCB 158		**60**		1.9	50	1	1.21	1.02		11/22/2015 22:41
PCB 170		**180**		1.5	50	1	1.05	0.99		11/22/2015 22:41
PCB 174		**220**		3.5	50	1	1.04	0.97		11/22/2015 22:41
PCB 177		**130**		1.7	50	1	1.03	0.99		11/22/2015 22:41
PCB 180/193		**450**		4.2	100	1	1.05	0.97		11/22/2015 22:41
PCB 183/185		**140**		3.6	100	1	1.04	0.97		11/22/2015 22:41
PCB 187		**220**		2.1	50	1	1.07	1.06		11/22/2015 22:41

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1668C
Date Prepared:	11/18/15-11/23/15	**Analytical Method:**	E1668C
Project:	North Richmond Pump Station	**Unit:**	pg/L

40 PCB Congeners

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-008	**1511071-008A**	**Water**	**11/02/2015 11:31**	**GC36**	**113278**

Analytes	TEF WHO '05	Result	Qualifiers	MDL	ML	DF	Ion Ratio	RRT	TEQ	Date Analyzed
PCB 194		**65**		1.6	50	1	0.89	1		11/22/2015 22:41
PCB 195		**28**	J	1.8	50	1	0.87	0.97		11/22/2015 22:41
PCB 201		**12**	J	1.9	50	1	0.86	1.04		11/22/2015 22:41
PCB 203		**44**	J	1.7	50	1	0.93	0.96		11/22/2015 22:41
								Total TEQ:	0.0141	

Isotope Dilution	REC (%)	Limits	
13C-PCB 028	113	5-145	11/22/2015 22:41
13C-PCB 111	93	10-145	11/22/2015 22:41
13C-PCB 178	80	10-145	11/22/2015 22:41
Surrogate			
13C-PCB 001	51	5-145	11/22/2015 22:41
13C-PCB 003	61	5-145	11/22/2015 22:41
13C-PCB 004	49	5-145	11/22/2015 22:41
13C-PCB 015	74	5-145	11/22/2015 22:41
13C-PCB 019	51	5-145	11/22/2015 22:41
13C-PCB 037	93	5-145	11/22/2015 22:41
13C-PCB 054	52	5-145	11/22/2015 22:41
13C-PCB 077	96	10-145	11/22/2015 22:41
13C-PCB 081	97	10-145	11/22/2015 22:41
13C-PCB 104	55	10-145	11/22/2015 22:41
13C-PCB 105	83	10-145	11/22/2015 22:41
13C-PCB 114	81	10-145	11/22/2015 22:41
13C-PCB 118	82	10-145	11/22/2015 22:41
13C-PCB 123	84	10-145	11/22/2015 22:41
13C-PCB 126	88	10-145	11/22/2015 22:41
13C-PCB 155	60	10-145	11/22/2015 22:41
13C-PCB 156/157	79	10-145	11/22/2015 22:41
13C-PCB 167	88	10-145	11/22/2015 22:41
13C-PCB 169	64	10-145	11/22/2015 22:41
13C-PCB 188	89	10-145	11/22/2015 22:41
13C-PCB 189	81	10-145	11/22/2015 22:41
13C-PCB 202	98	10-145	11/22/2015 22:41
13C-PCB 205	59	10-145	11/22/2015 22:41
13C-PCB 206	48	10-145	11/22/2015 22:41
13C-PCB 208	58	10-145	11/22/2015 22:41
13C-PCB 209	40	10-145	11/22/2015 22:41

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1668C
Date Prepared:	11/18/15-11/23/15	**Analytical Method:**	E1668C
Project:	North Richmond Pump Station	**Unit:**	pg/L

40 PCB Congeners

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-008	**1511071-008A**	**Water**	**11/02/2015 11:31**	**GC36**	**113278**

Analytes	TEF WHO '05	Result	Qualifiers	MDL	ML	DF	Ion Ratio	RRT	TEQ	Date Analyzed

Analyst(s): MG

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1668C
Date Prepared:	11/18/15-11/23/15	**Analytical Method:**	E1668C
Project:	North Richmond Pump Station	**Unit:**	pg/L

40 PCB Congeners

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-009	**1511071-009A**	**Water**	**11/02/2015 11:24**	**GC36**	**113278**

Analytes	TEF WHO '05	Result	MDL	ML	DF	Ion Ratio	RRT	TEQ	Date Analyzed
PCB 008		ND	4.3	50	1				11/22/2015 21:37
PCB 018/030		ND	3.4	50	1				11/22/2015 21:37
PCB 020/028		ND	4.0	50	1				11/22/2015 21:37
PCB 031		ND	2.4	50	1				11/22/2015 21:37
PCB 033		ND	2.6	50	1				11/22/2015 21:37
PCB 044/047/065		ND	11	100	1				11/22/2015 21:37
PCB 049/069		ND	4.7	100	1				11/22/2015 21:37
PCB 052		ND	3.4	50	1				11/22/2015 21:37
PCB 056		ND	3.5	50	1				11/22/2015 21:37
PCB 060		ND	3.5	50	1				11/22/2015 21:37
PCB 066		ND	2.7	50	1				11/22/2015 21:37
PCB 070/074/076		ND	8.8	200	1				11/22/2015 21:37
PCB 086/097/109/119		ND	6.1	200	1				11/22/2015 21:37
PCB 087/125		ND	6.2	200	1				11/22/2015 21:37
PCB 090/101/113		ND	5.8	200	1				11/22/2015 21:37
PCB 095		ND	2.6	200	1				11/22/2015 21:37
PCB 099		ND	2.7	100	1				11/22/2015 21:37
PCB 105		ND	2.8	50	1				11/22/2015 21:37
PCB 110/115		ND	4.8	100	1				11/22/2015 21:37
PCB 118		ND	2.8	100	1				11/22/2015 21:37
PCB 128/166		ND	3.5	100	1				11/22/2015 21:37
PCB 129/138/163		ND	6.2	200	1				11/22/2015 21:37
PCB 132		ND	2.7	50	1				11/22/2015 21:37
PCB 135/151		ND	4.2	100	1				11/22/2015 21:37
PCB 141		ND	2.6	50	1				11/22/2015 21:37
PCB 147/149		ND	3.0	100	1				11/22/2015 21:37
PCB 153/168		ND	4.6	100	1				11/22/2015 21:37
PCB 156/157		ND	5.2	100	1				11/22/2015 21:37
PCB 158		ND	2.1	50	1				11/22/2015 21:37
PCB 170		ND	1.6	50	1				11/22/2015 21:37
PCB 174		ND	3.7	50	1				11/22/2015 21:37
PCB 177		ND	1.8	50	1				11/22/2015 21:37
PCB 180/193		ND	4.4	100	1				11/22/2015 21:37
PCB 183/185		ND	3.8	100	1				11/22/2015 21:37
PCB 187		ND	2.3	50	1				11/22/2015 21:37

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1668C
Date Prepared:	11/18/15-11/23/15	**Analytical Method:**	E1668C
Project:	North Richmond Pump Station	**Unit:**	pg/L

40 PCB Congeners

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-009	**1511071-009A**	**Water**	**11/02/2015 11:24**	**GC36**	**113278**

Analytes	TEF WHO '05	Result	MDL	ML	DF	Ion Ratio	RRT	TEQ	Date Analyzed
PCB 194		ND	1.7	50	1				11/22/2015 21:37
PCB 195		ND	2.0	50	1				11/22/2015 21:37
PCB 201		ND	2.1	50	1				11/22/2015 21:37
PCB 203		ND	1.8	50	1				11/22/2015 21:37
								Total TEQ: 0	

Isotope Dilution	REC (%)	Limits	
13C-PCB 028	114	5-145	11/22/2015 21:37
13C-PCB 111	91	10-145	11/22/2015 21:37
13C-PCB 178	80	10-145	11/22/2015 21:37
Surrogate			
13C-PCB 001	75	5-145	11/22/2015 21:37
13C-PCB 003	77	5-145	11/22/2015 21:37
13C-PCB 004	62	5-145	11/22/2015 21:37
13C-PCB 015	88	5-145	11/22/2015 21:37
13C-PCB 019	64	5-145	11/22/2015 21:37
13C-PCB 037	106	5-145	11/22/2015 21:37
13C-PCB 054	61	5-145	11/22/2015 21:37
13C-PCB 077	117	10-145	11/22/2015 21:37
13C-PCB 081	115	10-145	11/22/2015 21:37
13C-PCB 104	58	10-145	11/22/2015 21:37
13C-PCB 105	97	10-145	11/22/2015 21:37
13C-PCB 114	94	10-145	11/22/2015 21:37
13C-PCB 118	94	10-145	11/22/2015 21:37
13C-PCB 123	96	10-145	11/22/2015 21:37
13C-PCB 126	102	10-145	11/22/2015 21:37
13C-PCB 155	69	10-145	11/22/2015 21:37
13C-PCB 156/157	96	10-145	11/22/2015 21:37
13C-PCB 167	98	10-145	11/22/2015 21:37
13C-PCB 169	109	10-145	11/22/2015 21:37
13C-PCB 188	51	10-145	11/22/2015 21:37
13C-PCB 189	90	10-145	11/22/2015 21:37
13C-PCB 202	55	10-145	11/22/2015 21:37
13C-PCB 205	76	10-145	11/22/2015 21:37
13C-PCB 206	63	10-145	11/22/2015 21:37
13C-PCB 208	54	10-145	11/22/2015 21:37
13C-PCB 209	56	10-145	11/22/2015 21:37

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1668C
Date Prepared:	11/18/15-11/23/15	**Analytical Method:**	E1668C
Project:	North Richmond Pump Station	**Unit:**	pg/L

40 PCB Congeners

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-009	**1511071-009A**	**Water**	**11/02/2015 11:24**	**GC36**	**113278**

Analytes	TEF WHO '05	Result	MDL	ML	DF	Ion Ratio	RRT	TEQ	Date Analyzed

Analyst(s): MG

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1631E
Date Prepared:	11/9/15	**Analytical Method:**	E1631E
Project:	North Richmond Pump Station	**Unit:**	ng/L

Mercury by CVAF

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-001	1511071-001B	Water	11/02/2015 09:37	PSA2	112506

Analytes	Result	RL	DF	Date Analyzed
Mercury	**37**	2.5	5	11/10/2015 11:57

Analyst(s): BBO

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-002	1511071-002B	Water	11/02/2015 09:52	PSA2	112506

Analytes	Result	RL	DF	Date Analyzed
Mercury	**36**	2.5	5	11/10/2015 12:22

Analyst(s): BBO

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-003	1511071-003B	Water	11/02/2015 09:56	PSA2	112506

Analytes	Result	RL	DF	Date Analyzed
Mercury	**42**	2.5	5	11/10/2015 12:27

Analyst(s): BBO

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-004	1511071-004B	Water	11/02/2015 10:10	PSA2	112506

Analytes	Result	RL	DF	Date Analyzed
Mercury	ND	0.50	1	11/10/2015 11:42

Analyst(s): BBO

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1631E
Date Prepared:	11/9/15	**Analytical Method:**	E1631E
Project:	North Richmond Pump Station	**Unit:**	ng/L

Mercury by CVAF

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-005	1511071-005B	Water	11/02/2015 10:28	PSA2	112506

Analytes	Result	RL	DF	Date Analyzed
Mercury	**37**	2.5	5	11/10/2015 12:47

Analyst(s): BBO

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-006	1511071-006B	Water	11/02/2015 10:56	PSA2	112506

Analytes	Result	RL	DF	Date Analyzed
Mercury	**31**	2.5	5	11/10/2015 12:32

Analyst(s): BBO

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-007	1511071-007B	Water	11/02/2015 11:00	PSA2	112506

Analytes	Result	RL	DF	Date Analyzed
Mercury	ND	0.50	1	11/10/2015 11:47

Analyst(s): BBO

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-008	1511071-008B	Water	11/02/2015 11:31	PSA2	112506

Analytes	Result	RL	DF	Date Analyzed
Mercury	**32**	2.5	5	11/10/2015 12:36

Analyst(s): BBO

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	E1631E
Date Prepared:	11/9/15	**Analytical Method:**	E1631E
Project:	North Richmond Pump Station	**Unit:**	ng/L

Mercury by CVAF

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-009	1511071-009B	Water	11/02/2015 11:24	PSA2	112506

Analytes	Result	RL	DF	Date Analyzed
Mercury	ND	0.50	1	11/10/2015 11:52

Analyst(s): BBO

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	ASTM D3977-B
Date Prepared:	11/6/15	**Analytical Method:**	ASTM D3977-B
Project:	North Richmond Pump Station	**Unit:**	mg/L

Suspended Sediment Concentration (SSC) in Water

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-001	1511071-001D	Water	11/02/2015 09:37	WetChem	112590

Analytes	Result	RL	DF	Date Analyzed
Suspended Sediment Concentration	**53.9**	1.00	1	11/06/2015 15:15

Analyst(s): AL

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-002	1511071-002D	Water	11/02/2015 09:52	WetChem	112590

Analytes	Result	RL	DF	Date Analyzed
Suspended Sediment Concentration	**53.5**	10.0	1	11/06/2015 15:20

Analyst(s): AL

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-003	1511071-003D	Water	11/02/2015 09:56	WetChem	112590

Analytes	Result	RL	DF	Date Analyzed
Suspended Sediment Concentration	**52.8**	1.00	1	11/06/2015 15:25

Analyst(s): AL

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-005	1511071-005D	Water	11/02/2015 10:28	WetChem	112590

Analytes	Result	RL	DF	Date Analyzed
Suspended Sediment Concentration	**49.5**	1.00	1	11/06/2015 15:30

Analyst(s): AL

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Analytical Report

Client:	AMEC	**WorkOrder:**	1511071
Date Received:	11/2/15 20:38	**Extraction Method:**	ASTM D3977-B
Date Prepared:	11/6/15	**Analytical Method:**	ASTM D3977-B
Project:	North Richmond Pump Station	**Unit:**	mg/L

Suspended Sediment Concentration (SSC) in Water

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-006	1511071-006D	Water	11/02/2015 10:56	WetChem	112590

Analytes	Result	RL	DF	Date Analyzed
Suspended Sediment Concentration	**49.3**	1.00	1	11/06/2015 15:35

Analyst(s): AL

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
NRPSIS-008	1511071-008D	Water	11/02/2015 11:31	WetChem	112590

Analytes	Result	RL	DF	Date Analyzed
Suspended Sediment Concentration	**50.4**	1.00	1	11/06/2015 15:40

Analyst(s): AL

CLIENT: AMEC
Work Order: 1511071
Project: North Richmond Pump Station

ANALYTICAL QC SUMMARY REPORT

BatchID: 113093

SampleID **MB-113093**	TestCode: **1668_PCB40_W**	Units: **pg/L**	Prep Date: **11/18/2015**
Batch ID: **113093**	TestNo: **E1668C**	Run ID: **GC36_151123A**	Analysis Date: **11/18/2015**

Analyte	Result	MDL	ML	SPKValue	SPKRefVal	%REC	Limits	RPDRefVal	%RPD	RPDLimit	Qual
PCB 001	ND	9.9	20				-				
PCB 003	ND	7.1	50				-				
PCB 004	ND	2.3	50				-				
PCB 008	ND	4.2	50				-				
PCB 015	ND	1.9	20				-				
PCB 018/030	ND	3.3	50				-				
PCB 019	ND	2.1	20				-				
PCB 020/028	ND	3.9	50				-				
PCB 031	ND	2.3	50				-				
PCB 033	ND	2.5	50				-				
PCB 037	2.20	1.8	20				-				JM
PCB 044/047/065	ND	10	100				-				
PCB 049/069	ND	4.6	100				-				
PCB 052	ND	3.3	50				-				
PCB 054	ND	2.6	50				-				
PCB 056	ND	3.4	50				-				
PCB 060	ND	3.4	50				-				
PCB 066	ND	2.6	50				-				
PCB 070/074/076	ND	8.6	200				-				
PCB 077	ND	2.6	50				-				
PCB 081	ND	2.2	50				-				
PCB 086/097/109/119	ND	5.9	200				-				
PCB 087/125	ND	6.0	200				-				
PCB 090/101/113	ND	5.6	200				-				
PCB 095	ND	2.5	200				-				
PCB 099	ND	2.6	100				-				
PCB 104	ND	2.7	50				-				
PCB 105	ND	2.7	50				-				
PCB 106	ND	5.3	50				-				
PCB 110/115	ND	4.7	100				-				
PCB 114	ND	3.0	50				-				
PCB 118	ND	2.7	100				-				
PCB 123	ND	3.4	50				-				
PCB 126	ND	5.5	50				-				
PCB 128/166	ND	3.4	100				-				
PCB 129/138/163	ND	6.0	200				-				
PCB 132	ND	2.6	50				-				
PCB 135/151	ND	4.1	100				-				
PCB 141	ND	2.5	50				-				
PCB 147/149	ND	2.9	100				-				
PCB 153/168	ND	4.5	100				-				
PCB 155	ND	1.9	50				-				
PCB 156/157	ND	5.1	100				-				
PCB 158	ND	2.0	50				-				
PCB 167	ND	3.7	50				-				
PCB 169	ND	2.8	50				-				

CLIENT: AMEC
Work Order: 1511071
Project: North Richmond Pump Station

ANALYTICAL QC SUMMARY REPORT

BatchID: 113093

SampleID **MB-113093**	TestCode: **1668_PCB40_W**	Units: **pg/L**	Prep Date: **11/18/2015**
Batch ID: **113093**	TestNo: **E1668C**	Run ID: **GC36_151123A**	Analysis Date: **11/18/2015**

Analyte	Result	MDL	ML	SPKValue	SPKRefVal	%REC	Limits	RPDRefVal	%RPD	RPDLimit	Qual
PCB 170	ND	1.6	50				-				
PCB 174	ND	3.6	50				-				
PCB 177	ND	1.8	50				-				
PCB 180/193	ND	4.3	100				-				
PCB 183/185	ND	3.7	100				-				
PCB 187	ND	2.2	50				-				
PCB 188	ND	2.0	50				-				
PCB 189	ND	4.4	50				-				
PCB 194	ND	1.7	50				-				
PCB 195	ND	1.9	50				-				
PCB 201	ND	2.0	50				-				
PCB 202	ND	4.0	100				-				
PCB 203	ND	1.8	50				-				
PCB 205	ND	5.1	50				-				
PCB 206	ND	3.9	50				-				
PCB 208	ND	4.8	50				-				
PCB 209	ND	3.7	50				-				
Isotope Dilution											
13C-PCB 028	1830			2000		91	5 - 145				
13C-PCB 111	1570			2000		78	10 - 145				
13C-PCB 178	1540			2000		77	10 - 145				
Surrogate											
13C-PCB 001	882			2000		44	5 - 145				
13C-PCB 003	860			2000		43	5 - 145				
13C-PCB 004	858			2000		43	5 - 145				
13C-PCB 015	956			2000		48	5 - 145				
13C-PCB 019	860			2000		43	5 - 145				
13C-PCB 037	1250			2000		62	5 - 145				
13C-PCB 052	2070			2000		103	5 - 145				
13C-PCB 054	956			2000		48	5 - 145				
13C-PCB 077	1400			2000		70	10 - 145				
13C-PCB 081	1400			2000		70	10 - 145				
13C-PCB 104	1080			2000		54	10 - 145				
13C-PCB 105	1410			2000		70	10 - 145				
13C-PCB 114	1400			2000		70	10 - 145				
13C-PCB 118	1400			2000		70	10 - 145				
13C-PCB 123	1410			2000		71	10 - 145				
13C-PCB 126	1390			2000		69	10 - 145				
13C-PCB 155	1300			2000		65	10 - 145				
13C-PCB 156/157	2950			4000		74	10 - 145				
13C-PCB 167	1540			2000		77	10 - 145				
13C-PCB 169	1640			2000		82	10 - 145				
13C-PCB 188	949			2000		47	10 - 145				
13C-PCB 189	1470			2000		74	10 - 145				
13C-PCB 194	2290			2000		115	10 - 145				
13C-PCB 202	951			2000		48	10 - 145				
13C-PCB 205	1300			2000		65	10 - 145				

CLIENT: AMEC
Work Order: 1511071
Project: North Richmond Pump Station

ANALYTICAL QC SUMMARY REPORT

BatchID: 113093

SampleID **MB-113093**	TestCode: **1668_PCB40_W**	Units: **pg/L**	Prep Date: **11/18/2015**
Batch ID: **113093**	TestNo: **E1668C**	Run ID: **GC36_151123A**	Analysis Date: **11/18/2015**

Analyte	Result	MDL	ML	SPKValue	SPKRefVal	%REC	Limits	RPDRefVal	%RPD	RPDLimit	Qual
13C-PCB 206	1020			2000		51	10 - 145				
13C-PCB 208	925			2000		46	10 - 145				
13C-PCB 209	1020			2000		51	10 - 145				

CLIENT: AMEC
Work Order: 1511071
Project: North Richmond Pump Station

ANALYTICAL QC SUMMARY REPORT

BatchID: 113093

SampleID **LCS-113093**	TestCode: **1668_PCB40_W**	Units: **pg/L**	Prep Date: **11/18/2015**
Batch ID: **113093**	TestNo: **E1668C**	Run ID: **GC36_151123B**	Analysis Date: **11/18/2015**

Analyte	Result	MDL	ML	SPKValue	SPKRefVal	%REC	Limits	RPDRefVal	%RPD	RPDLimit	Qual
PCB 001	1050	9.9	20	1000	0	105	60 - 135				
PCB 003	1040	7.1	50	1000	0	104	60 - 135				
PCB 004	1010	2.3	50	1000	0	101	60 - 135				
PCB 015	975	1.9	20	1000	0	98	60 - 135				
PCB 019	1000	2.1	20	1000	0	100	60 - 135				
PCB 037	1030	1.8	20	1000	0	103	60 - 135				
PCB 054	1020	2.6	50	1000	0	102	60 - 135				
PCB 077	1030	2.6	50	1000	0	103	60 - 135				
PCB 081	1030	2.2	50	1000	0	103	60 - 135				
PCB 104	1030	2.7	50	1000	0	103	60 - 135				
PCB 105	1000	2.7	50	1000	0	100	60 - 135				
PCB 114	992	3.0	50	1000	0	99	60 - 135				
PCB 118	1030	2.7	100	1000	0	103	60 - 135				
PCB 123	968	3.4	50	1000	0	97	60 - 135				
PCB 126	995	5.5	50	1000	0	100	60 - 135				
PCB 155	1010	1.9	50	1000	0	101	60 - 135				
PCB 156/157	2040	5.1	100	2000	0	102	60 - 135				
PCB 167	963	3.7	50	1000	0	96	60 - 135				
PCB 169	993	2.8	50	1000	0	99	60 - 135				
PCB 188	984	2.0	50	1000	0	98	60 - 135				
PCB 189	1000	4.4	50	1000	0	100	60 - 135				
PCB 202	995	4.0	100	1000	0	100	60 - 135				
PCB 205	1050	5.1	50	1000	0	105	60 - 135				
PCB 206	981	3.9	50	1000	0	98	60 - 135				
PCB 208	1030	4.8	50	1000	0	103	60 - 135				
PCB 209	1020	3.7	50	1000	0	103	60 - 135				
Isotope Dilution											
13C-PCB 028	1920			2000		96	15 - 145				
13C-PCB 111	1630			2000		81	40 - 145				
13C-PCB 178	1660			2000		83	40 - 145				
Surrogate											
13C-PCB 001	1860			2000		93	15 - 145				
13C-PCB 003	1680			2000		84	15 - 145				
13C-PCB 004	1650			2000		82	15 - 145				
13C-PCB 015	1630			2000		81	15 - 145				
13C-PCB 019	1600			2000		80	15 - 145				
13C-PCB 037	1660			2000		83	15 - 145				
13C-PCB 054	1610			2000		81	15 - 145				
13C-PCB 077	1640			2000		82	40 - 145				
13C-PCB 081	1710			2000		86	40 - 145				
13C-PCB 104	1730			2000		87	40 - 145				
13C-PCB 105	1740			2000		87	40 - 145				
13C-PCB 114	1740			2000		87	40 - 145				
13C-PCB 118	1760			2000		88	40 - 145				
13C-PCB 123	1790			2000		90	40 - 145				
13C-PCB 126	1540			2000		77	40 - 145				
13C-PCB 155	1980			2000		99	40 - 145				

CDPH ELAP 1644 ♦ NELAP 4033ORELAP

Angela Rydelius, Lab Manager

CLIENT: AMEC
Work Order: 1511071
Project: North Richmond Pump Station

ANALYTICAL QC SUMMARY REPORT

BatchID: 113093

SampleID **LCS-113093**	TestCode: **1668_PCB40_W**	Units: **pg/L**	Prep Date: **11/18/2015**
Batch ID: **113093**	TestNo: **E1668C**	Run ID: **GC36_151123B**	Analysis Date: **11/18/2015**

Analyte	Result	MDL	ML	SPKValue	SPKRefVal	%REC	Limits	RPDRefVal	%RPD	RPDLimit	Qual
13C-PCB 156/157	3580			4000		90	40 - 145				
13C-PCB 167	1870			2000		94	40 - 145				
13C-PCB 169	1640			2000		82	40 - 145				
13C-PCB 188	1740			2000		87	40 - 145				
13C-PCB 189	1840			2000		92	40 - 145				
13C-PCB 202	1600			2000		80	40 - 145				
13C-PCB 205	1640			2000		82	40 - 145				
13C-PCB 206	1450			2000		73	40 - 145				
13C-PCB 208	1340			2000		67	40 - 145				
13C-PCB 209	1460			2000		73	40 - 145				

CLIENT: AMEC
Work Order: 1511071
Project: North Richmond Pump Station

ANALYTICAL QC SUMMARY REPORT

BatchID: 113278

SampleID **MB-113278**	TestCode: **1668_PCB40_W**	Units: **pg/L**	Prep Date: **11/23/2015**
Batch ID: **113278**	TestNo: **E1668C**	Run ID: **GC36_151123C**	Analysis Date: **11/22/2015**

Analyte	Result	MDL	ML	SPKValue	SPKRefVal	%REC	Limits	RPDRefVal	%RPD	RPDLimit	Qual
PCB 001	ND	9.9	20				-				
PCB 003	ND	7.1	50				-				
PCB 004	ND	2.3	50				-				
PCB 008	ND	4.2	50				-				
PCB 015	ND	1.9	20				-				
PCB 018/030	3.60	3.3	50				-				J
PCB 019	ND	2.1	20				-				
PCB 020/028	6.20	3.9	50				-				J
PCB 031	3.80	2.3	50				-				JM
PCB 033	ND	2.5	50				-				
PCB 037	ND	1.8	20				-				
PCB 044/047/065	ND	10	100				-				
PCB 049/069	ND	4.6	100				-				
PCB 052	ND	3.3	50				-				
PCB 054	ND	2.6	50				-				
PCB 056	ND	3.4	50				-				
PCB 060	ND	3.4	50				-				
PCB 066	ND	2.6	50				-				
PCB 070/074/076	ND	8.6	200				-				
PCB 077	ND	2.6	50				-				
PCB 081	ND	2.2	50				-				
PCB 086/097/109/119	ND	5.9	200				-				
PCB 087/125	ND	6.0	200				-				
PCB 090/101/113	ND	5.6	200				-				
PCB 095	ND	2.5	200				-				
PCB 099	ND	2.6	100				-				
PCB 104	ND	2.7	50				-				
PCB 105	ND	2.7	50				-				
PCB 106	ND	5.3	50				-				
PCB 110/115	ND	4.7	100				-				
PCB 114	ND	3.0	50				-				
PCB 118	ND	2.7	100				-				
PCB 123	ND	3.4	50				-				
PCB 126	ND	5.5	50				-				
PCB 128/166	ND	3.4	100				-				
PCB 129/138/163	ND	6.0	200				-				
PCB 132	ND	2.6	50				-				
PCB 135/151	ND	4.1	100				-				
PCB 141	ND	2.5	50				-				
PCB 147/149	ND	2.9	100				-				
PCB 153/168	ND	4.5	100				-				
PCB 155	ND	1.9	50				-				
PCB 156/157	ND	5.1	100				-				
PCB 158	ND	2.0	50				-				
PCB 167	ND	3.7	50				-				
PCB 169	ND	2.8	50				-				
PCB 170	ND	1.6	50				-				

CLIENT: AMEC
Work Order: 1511071
Project: North Richmond Pump Station

ANALYTICAL QC SUMMARY REPORT

BatchID: 113278

SampleID **MB-113278**	TestCode: **1668_PCB40_W**	Units: **pg/L**	Prep Date: **11/23/2015**
Batch ID: **113278**	TestNo: **E1668C**	Run ID: **GC36_151123C**	Analysis Date: **11/22/2015**

Analyte	Result	MDL	ML	SPKValue	SPKRefVal	%REC	Limits	RPDRefVal	%RPD	RPDLimit	Qual
PCB 174	ND	3.6	50				-				
PCB 177	ND	1.8	50				-				
PCB 180/193	ND	4.3	100				-				
PCB 183/185	ND	3.7	100				-				
PCB 187	ND	2.2	50				-				
PCB 188	ND	2.0	50				-				
PCB 189	ND	4.4	50				-				
PCB 194	ND	1.7	50				-				
PCB 195	ND	1.9	50				-				
PCB 201	ND	2.0	50				-				
PCB 202	ND	4.0	100				-				
PCB 203	ND	1.8	50				-				
PCB 205	ND	5.1	50				-				
PCB 206	ND	3.9	50				-				
PCB 208	ND	4.8	50				-				
PCB 209	ND	3.7	50				-				
Isotope Dilution											
13C-PCB 028	2140			2000		107	5 - 145				
13C-PCB 111	1760			2000		88	10 - 145				
13C-PCB 178	1570			2000		79	10 - 145				
Surrogate											
13C-PCB 001	1100			2000		55	5 - 145				
13C-PCB 003	1150			2000		58	5 - 145				
13C-PCB 004	956			2000		48	5 - 145				
13C-PCB 015	1450			2000		73	5 - 145				
13C-PCB 019	1080			2000		54	5 - 145				
13C-PCB 037	1840			2000		92	5 - 145				
13C-PCB 052	1820			2000		91	5 - 145				
13C-PCB 054	1060			2000		53	5 - 145				
13C-PCB 077	2140			2000		107	10 - 145				
13C-PCB 081	2090			2000		105	10 - 145				
13C-PCB 104	1060			2000		53	10 - 145				
13C-PCB 105	1800			2000		90	10 - 145				
13C-PCB 114	1740			2000		87	10 - 145				
13C-PCB 118	1780			2000		89	10 - 145				
13C-PCB 123	1780			2000		89	10 - 145				
13C-PCB 126	1820			2000		91	10 - 145				
13C-PCB 155	1340			2000		67	10 - 145				
13C-PCB 156/157	3580			4000		89	10 - 145				
13C-PCB 167	1830			2000		91	10 - 145				
13C-PCB 169	1940			2000		97	10 - 145				
13C-PCB 188	1070			2000		53	10 - 145				
13C-PCB 189	1680			2000		84	10 - 145				
13C-PCB 194	2200			2000		110	10 - 145				
13C-PCB 202	1160			2000		58	10 - 145				
13C-PCB 205	1470			2000		73	10 - 145				
13C-PCB 206	1270			2000		64	10 - 145				

CLIENT: AMEC
Work Order: 1511071
Project: North Richmond Pump Station

ANALYTICAL QC SUMMARY REPORT

BatchID: 113278

SampleID **MB-113278**	TestCode: **1668_PCB40_W**	Units: **pg/L**	Prep Date: **11/23/2015**
Batch ID: **113278**	TestNo: **E1668C**	Run ID: **GC36_151123C**	Analysis Date: **11/22/2015**

Analyte	Result	MDL	ML	SPKValue	SPKRefVal	%REC	Limits	RPDRefVal	%RPD	RPDLimit	Qual
13C-PCB 208	1080			2000		54	10 - 145				
13C-PCB 209	1140			2000		57	10 - 145				

CLIENT: AMEC
Work Order: 1511071
Project: North Richmond Pump Station

ANALYTICAL QC SUMMARY REPORT

BatchID: 113278

SampleID **LCS-113278**	TestCode: **1668_PCB40_W**	Units: **pg/L**	Prep Date: **11/23/2015**
Batch ID: **113278**	TestNo: **E1668C**	Run ID: **GC36_151123D**	Analysis Date: **11/22/2015**

Analyte	Result	MDL	ML	SPKValue	SPKRefVal	%REC	Limits	RPDRefVal	%RPD	RPDLimit	Qual
PCB 001	1080	9.9	20	1000	0	107	60 - 135				
PCB 003	1060	7.1	50	1000	0	106	60 - 135				
PCB 004	1030	2.3	50	1000	0	103	60 - 135				
PCB 015	1040	1.9	20	1000	0	104	60 - 135				
PCB 019	1040	2.1	20	1000	0	104	60 - 135				
PCB 037	1050	1.8	20	1000	0	105	60 - 135				
PCB 054	1050	2.6	50	1000	0	105	60 - 135				
PCB 077	1010	2.6	50	1000	0	101	60 - 135				
PCB 081	1040	2.2	50	1000	0	104	60 - 135				
PCB 104	1040	2.7	50	1000	0	104	60 - 135				
PCB 105	1010	2.7	50	1000	0	101	60 - 135				
PCB 114	1000	3.0	50	1000	0	100	60 - 135				
PCB 118	1030	2.7	100	1000	0	103	60 - 135				
PCB 123	992	3.4	50	1000	0	99	60 - 135				
PCB 126	995	5.5	50	1000	0	100	60 - 135				
PCB 155	1020	1.9	50	1000	0	103	60 - 135				
PCB 156/157	2000	5.1	100	2000	0	100	60 - 135				
PCB 167	967	3.7	50	1000	0	97	60 - 135				
PCB 169	965	2.8	50	1000	0	97	60 - 135				
PCB 188	1030	2.0	50	1000	0	103	60 - 135				
PCB 189	1000	4.4	50	1000	0	100	60 - 135				
PCB 202	1020	4.0	100	1000	0	101	60 - 135				
PCB 205	1020	5.1	50	1000	0	102	60 - 135				
PCB 206	993	3.9	50	1000	0	99	60 - 135				
PCB 208	1000	4.8	50	1000	0	100	60 - 135				
PCB 209	1020	3.7	50	1000	0	102	60 - 135				
Isotope Dilution											
13C-PCB 028	2020			2000		101	15 - 145				
13C-PCB 111	1460			2000		73	40 - 145				
13C-PCB 178	1370			2000		69	40 - 145				
Surrogate											
13C-PCB 001	972			2000		49	15 - 145				
13C-PCB 003	1030			2000		51	15 - 145				
13C-PCB 004	874			2000		44	15 - 145				
13C-PCB 015	1170			2000		59	15 - 145				
13C-PCB 019	894			2000		45	15 - 145				
13C-PCB 037	1400			2000		70	15 - 145				
13C-PCB 054	903			2000		45	15 - 145				
13C-PCB 077	1390			2000		69	40 - 145				
13C-PCB 081	1380			2000		69	40 - 145				
13C-PCB 104	880			2000		44	40 - 145				
13C-PCB 105	1100			2000		55	40 - 145				
13C-PCB 114	1110			2000		55	40 - 145				
13C-PCB 118	1140			2000		57	40 - 145				
13C-PCB 123	1150			2000		58	40 - 145				
13C-PCB 126	1060			2000		53	40 - 145				
13C-PCB 155	1380			2000		69	40 - 145				

CLIENT: AMEC
Work Order: 1511071
Project: North Richmond Pump Station

ANALYTICAL QC SUMMARY REPORT

BatchID: 113278

SampleID **LCS-113278**	TestCode: **1668_PCB40_W**	Units: **pg/L**	Prep Date: **11/23/2015**
Batch ID: **113278**	TestNo: **E1668C**	Run ID: **GC36_151123D**	Analysis Date: **11/22/2015**

Analyte	Result	MDL	ML	SPKValue	SPKRefVal	%REC	Limits	RPDRefVal	%RPD	RPDLimit	Qual
13C-PCB 156/157	2230			4000		56	40 - 145				
13C-PCB 167	1160			2000		58	40 - 145				
13C-PCB 169	1160			2000		58	40 - 145				
13C-PCB 188	963			2000		48	40 - 145				
13C-PCB 189	1210			2000		60	40 - 145				
13C-PCB 202	773			2000		39	40 - 145				S
13C-PCB 205	1100			2000		55	40 - 145				
13C-PCB 206	964			2000		48	40 - 145				
13C-PCB 208	759			2000		38	40 - 145				S
13C-PCB 209	914			2000		46	40 - 145				

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

Quality Control Report

Client:	AMEC	**WorkOrder:**	1511071
Date Prepared:	11/9/15	**BatchID:**	112506
Date Analyzed:	11/10/15	**Extraction Method:**	E1631E
Instrument:	PSA2	**Analytical Method:**	E1631E
Matrix:	Water	**Unit:**	ng/L
Project:	North Richmond Pump Station	**Sample ID:**	MB/LCS-112506 1511071-001BMS/MSD

QC Summary Report for Mercury by CVAF

Analyte	MB Result	LCS Result	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
Mercury	ND	2.45	0.50	2.5	-	98	80-120

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
Mercury	132	138	100	36.65	95	101	80-120	4.45	20

McCampbell Analytical, Inc.
1534 Willow Pass Rd
Pittsburg, CA 94565-1701
(925) 252-9262

CHAIN-OF-CUSTODY RECORD

WorkOrder: 1511071 **ClientCode: AMEC**

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Report to:
Emily Sportsman
AMEC
2101 Webster Street, 12th Floor
Oakland, CA 94612
(510) 663-4232 FAX: 510-663-4141

Email: emily.sportsman@amec.com
cc/3rd Party: khalil.abusaba@amec.com;
PO:
ProjectNo: North Richmond Pump Station

Bill to:
Accounts Payable
AMEC
2101 Webster Street, 12th Floor
Oakland, CA 94612

Requested TATs: 15 days; 5 days;

Date Received: **11/02/2015**
Date Printed: **11/05/2015**

Lab ID	Client ID	Matrix	Collection Date	Hold	Requested Tests (See legend below)											
					1	2	3	4	5	6	7	8	9	10	11	12
1511071-001	NRPSIS-001	Water	11/2/2015 9:37	☐	A	B	C	D								
1511071-002	NRPSIS-002	Water	11/2/2015 9:52	☐	A	B	C	D								
1511071-003	NRPSIS-003	Water	11/2/2015 9:56	☐	A	B	C	D								
1511071-004	NRPSIS-004	Water	11/2/2015 10:10	☐	A	B	C									
1511071-005	NRPSIS-005	Water	11/2/2015 10:28	☐	A	B	C	D								
1511071-006	NRPSIS-006	Water	11/2/2015 10:56	☐	A	B	C	D								
1511071-007	NRPSIS-007	Water	11/2/2015 11:00	☐	A	B	C									
1511071-008	NRPSIS-008	Water	11/2/2015 11:31	☐	A	B	C	D								
1511071-009	NRPSIS-009	Water	11/2/2015 11:24	☐	A	B	C									

Test Legend:

1	1668_PCB40_W	2	HGPSA1_W	3	MethylMercury_W	4	SSC_W
5		6		7		8	
9		10		11		12	

Prepared by: Maria Venegas

Comments:

NOTE: Soil samples are discarded 60 days after results are reported unless other arrangements are made (Water samples are 30 days).
Hazardous samples will be returned to client or disposed of at client expense.

McCampbell Analytical, Inc.
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1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

WORK ORDER SUMMARY

Client Name: AMEC **QC Level:** **Work Order:** 1511071
Project: North Richmond Pump Station **Client Contact:** Emily Sportsman **Date Received:** 11/2/2015
Comments: **Contact's Email:** emily.sportsman@amec.com

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Lab ID	Client ID	Matrix	Test Name	Containers /Composites	Bottle & Preservative	De-chlorinated	Collection Date & Time	TAT	Sediment Content	Hold	SubOut
1511071-001A	NRPSIS-001	Water	E1668C (40 PCB Congeners)	2	1LA	☐	11/2/2015 9:37	15 days	Present	☐	
1511071-001B	NRPSIS-001	Water	E1631E (Mercury by CVAF)	1	500mL CG, Pre-Cl w/ HCl	☐	11/2/2015 9:37	5 days	Present	☐	
1511071-001C	NRPSIS-001	Water	EM1630 (Methyl Mercury)	1	500mL HDPE, Pre-Cl	☐	11/2/2015 9:37	5 days	Present	☐	SubOut
1511071-001D	NRPSIS-001	Water	ASTM D3977-B (SSC)	1	1L HDPE, unprsv.	☐	11/2/2015 9:37	5 days	Present	☐	
1511071-002A	NRPSIS-002	Water	E1668C (40 PCB Congeners)	2	1LA	☐	11/2/2015 9:52	15 days	Present	☐	
1511071-002B	NRPSIS-002	Water	E1631E (Mercury by CVAF)	1	500mL CG, Pre-Cl w/ HCl	☐	11/2/2015 9:52	5 days	Present	☐	
1511071-002C	NRPSIS-002	Water	EM1630 (Methyl Mercury)	1	500mL HDPE, Pre-Cl	☐	11/2/2015 9:52	5 days	Present	☐	SubOut
1511071-002D	NRPSIS-002	Water	ASTM D3977-B (SSC)	1	1L HDPE, unprsv.	☐	11/2/2015 9:52	5 days	Present	☐	
1511071-003A	NRPSIS-003	Water	E1668C (40 PCB Congeners)	2	1LA	☐	11/2/2015 9:56	15 days	Present	☐	
1511071-003B	NRPSIS-003	Water	E1631E (Mercury by CVAF)	1	500mL CG, Pre-Cl w/ HCl	☐	11/2/2015 9:56	5 days	Present	☐	
1511071-003C	NRPSIS-003	Water	EM1630 (Methyl Mercury)	1	500mL HDPE, Pre-Cl	☐	11/2/2015 9:56	5 days	Present	☐	SubOut
1511071-003D	NRPSIS-003	Water	ASTM D3977-B (SSC)	1	1L HDPE, unprsv.	☐	11/2/2015 9:56	5 days	Present	☐	
1511071-004A	NRPSIS-004	Water	E1668C (40 PCB Congeners)	2	1LA	☐	11/2/2015 10:10	15 days	None	☐	
1511071-004B	NRPSIS-004	Water	E1631E (Mercury by CVAF)	1	500mL CG, Pre-Cl w/ HCl	☐	11/2/2015 10:10	5 days	None	☐	
1511071-004C	NRPSIS-004	Water	EM1630 (Methyl Mercury)	1	500mL HDPE, Pre-Cl	☐	11/2/2015 10:10	5 days	None	☐	SubOut
1511071-005A	NRPSIS-005	Water	E1668C (40 PCB Congeners)	2	1LA	☐	11/2/2015 10:28	15 days	Present	☐	

NOTES: - STLC and TCLP extractions require 2 days to complete; therefore, all TATs begin after the extraction is completed (i.e., One-day TAT yields results in 3 days from sample submission).

- MAI assumes that all material present in the provided sampling container is considered part of the sample - MAI does not exclude any material from the sample prior to sample preparation unless requested in writing by the client.

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http://www.mccampbell.com / E-mail: main@mccampbell.com

WORK ORDER SUMMARY

Client Name: AMEC
Project: North Richmond Pump Station
Comments:

QC Level:
Client Contact: Emily Sportsman
Contact's Email: emily.sportsman@amec.com

Work Order: 1511071
Date Received: 11/2/2015

☐ WaterTrax ☐ WriteOn ☐ EDF ☐ Excel ☐ Fax ☑ Email ☐ HardCopy ☐ ThirdParty ☐ J-flag

Lab ID	Client ID	Matrix	Test Name	Containers /Composites	Bottle & Preservative	De-chlorinated	Collection Date & Time	TAT	Sediment Content	Hold	SubOut
1511071-005B	NRPSIS-005	Water	E1631E (Mercury by CVAF)	1	500mL CG, Pre-Cl w/ HCl	☐	11/2/2015 10:28	5 days	Present	☐	
1511071-005C	NRPSIS-005	Water	EM1630 (Methyl Mercury)	1	500mL HDPE, Pre-Cl	☐	11/2/2015 10:28	5 days	Present	☐	SubOut
1511071-005D	NRPSIS-005	Water	ASTM D3977-B (SSC)	1	1L HDPE, unprsv.	☐	11/2/2015 10:28	5 days	Present	☐	
1511071-006A	NRPSIS-006	Water	E1668C (40 PCB Congeners)	2	1LA	☐	11/2/2015 10:56	15 days	Present	☐	
1511071-006B	NRPSIS-006	Water	E1631E (Mercury by CVAF)	1	500mL CG, Pre-Cl w/ HCl	☐	11/2/2015 10:56	5 days	Present	☐	
1511071-006C	NRPSIS-006	Water	EM1630 (Methyl Mercury)	1	500mL HDPE, Pre-Cl	☐	11/2/2015 10:56	5 days	Present	☐	SubOut
1511071-006D	NRPSIS-006	Water	ASTM D3977-B (SSC)	1	1L HDPE, unprsv.	☐	11/2/2015 10:56	5 days	Present	☐	
1511071-007A	NRPSIS-007	Water	E1668C (40 PCB Congeners)	2	1LA	☐	11/2/2015 11:00	15 days	None	☐	
1511071-007B	NRPSIS-007	Water	E1631E (Mercury by CVAF)	1	500mL CG, Pre-Cl w/ HCl	☐	11/2/2015 11:00	5 days	None	☐	
1511071-007C	NRPSIS-007	Water	EM1630 (Methyl Mercury)	1	500mL HDPE, Pre-Cl	☐	11/2/2015 11:00	5 days	None	☐	SubOut
1511071-008A	NRPSIS-008	Water	E1668C (40 PCB Congeners)	2	1LA	☐	11/2/2015 11:31	15 days		☐	
1511071-008B	NRPSIS-008	Water	E1631E (Mercury by CVAF)	1	500mL CG, Pre-Cl w/ HCl	☐	11/2/2015 11:31	5 days		☐	
1511071-008C	NRPSIS-008	Water	EM1630 (Methyl Mercury)	1	500mL HDPE, Pre-Cl	☐	11/2/2015 11:31	5 days		☐	SubOut
1511071-008D	NRPSIS-008	Water	ASTM D3977-B (SSC)	1	1L HDPE, unprsv.	☐	11/2/2015 11:31	5 days		☐	
1511071-009A	NRPSIS-009	Water	E1668C (40 PCB Congeners)	2	1LA	☐	11/2/2015 11:24	15 days	None	☐	
1511071-009B	NRPSIS-009	Water	E1631E (Mercury by CVAF)	1	500mL CG, Pre-Cl w/ HCl	☐	11/2/2015 11:24	5 days	None	☐	

NOTES: - STLC and TCLP extractions require 2 days to complete; therefore, all TATs begin after the extraction is completed (i.e., One-day TAT yields results in 3 days from sample submission).

- MAI assumes that all material present in the provided sampling container is considered part of the sample - MAI does not exclude any material from the sample prior to sample preparation unless requested in writing by the client.

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WORK ORDER SUMMARY

Client Name: AMEC
Project: North Richmond Pump Station
Comments:

QC Level:
Client Contact: Emily Sportsman
Contact's Email: emily.sportsman@amec.com

Work Order: 1511071
Date Received: 11/2/2015

☐ WaterTrax ☐ WriteOn ☐ EDF ☐ Excel ☐ Fax ☑ Email ☐ HardCopy ☐ ThirdParty ☐ J-flag

Lab ID	Client ID	Matrix	Test Name	Containers /Composites	Bottle & Preservative	De-chlorinated	Collection Date & Time	TAT	Sediment Content	Hold	SubOut
1511071-009C	NRPSIS-009	Water	EM1630 (Methyl Mercury)	1	500mL HDPE, Pre-Cl	☐	11/2/2015 11:24	5 days	None	☐	SubOut

NOTES: - STLC and TCLP extractions require 2 days to complete; therefore, all TATs begin after the extraction is completed (i.e., One-day TAT yields results in 3 days from sample submission).

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CHAIN-OF-CUSTODY RECORD

1511071

17697

PROJECT NAME: North Richmond Pump Station		DATE: 2Nov	PAGE 1 OF 1
PROJECT NUMBER:	LABORATORY NAME: McCampbell / CLIENT INFORMATION:	REPORTING REQUIREMENTS: see email	
RESULTS TO: see comments	LABORATORY ADDRESS: 1534 Willow Pass Rd Pittsburg, CA 94565		
TURNAROUND TIME: standart			
SAMPLE SHIPMENT METHOD: Courier	LABORATORY CONTACT: Rosa Venegas	GEOTRACKER REQUIRED YES (NO)	
	LABORATORY PHONE NUMBER: 925-252-9262	SITE SPECIFIC GLOBAL ID NO.	

SAMPLERS (SIGNATURE): E. Sportsman, K. Abusaba

ANALYSES

DATE	TIME	SAMPLE NUMBER	SSC	PCB	Total Hg	Methyl Hg	CONTAINER TYPE AND SIZE	Soil (S), Water (W), Vapor (V), or Other (O)	Filtered	Preservative Type	Cooled	MS/MSD	No. of Containers	ADDITIONAL COMMENTS
2Nov	9:37	NRPS15-001	✓	✓	✓	✓		W	N		Y			
	9:52	002	✓	✓	✓	✓								
	9:56	003	✓	✓	✓	✓								
	10:10	004		✓	✓	✓								
	10:28	005	✓	✓	✓	✓								
	10:56	006	✓	✓	✓	✓								
	11:00	007		✓	✓	✓								
	11:31	008	✓	✓	✓	✓								
	11:24	009		✓	✓	✓								
			6	18	9	9	= 42 bottles							

RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME
SIGNATURE:	2Nov	2:34	SIGNATURE:	11/2	1750
PRINTED NAME: E. Sportsman			PRINTED NAME: Julio Venegas		
COMPANY: AFW			COMPANY: McCampbell		
SIGNATURE:	11/2/15	16:00	SIGNATURE:		
PRINTED NAME: Julio Venegas			PRINTED NAME:		
COMPANY: McCampbell			COMPANY:		
SIGNATURE:			SIGNATURE:		
PRINTED NAME:			PRINTED NAME: Jena Alfaro		
COMPANY:			COMPANY: MAI		

TOTAL NUMBER OF CONTAINERS: 42

SAMPLING COMMENTS: 3 coolers
1 L plastic SSC, 2 x 1 L Amber PCB
1 x 500 mL THg 1 x 500 mL Methyl Hg

Results to: Khalil.Abusaba@amecfw.com
emily.sportsman@amecfw.com

ICE T°: 4.7
GOOD CONDITION
HEAD SPACE ABSENT
DECHLORINATED IN LAB
PRESERVATION

APPROPRIATE CONTAINERS	PRESERVED IN LAB
VOAS	O&G
METALS	OTHER

amec

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Sample Receipt Checklist

Client Name: **AMEC** Date and Time Received: **11/2/2015 8:38:58 PM**

Project Name: **North Richmond Pump Station** LogIn Reviewed by: Maria Venegas

WorkOrder №: **1511071** Matrix: Water Carrier: Courier

Chain of Custody (COC) Information

Chain of custody present?	Yes ☑	No ☐
Chain of custody signed when relinquished and received?	Yes ☑	No ☐
Chain of custody agrees with sample labels?	Yes ☑	No ☐
Sample IDs noted by Client on COC?	Yes ☑	No ☐
Date and Time of collection noted by Client on COC?	Yes ☑	No ☐
Sampler's name noted on COC?	Yes ☑	No ☐

Sample Receipt Information

Custody seals intact on shipping container/cooler?	Yes ☐	No ☐	NA ☑
Shipping container/cooler in good condition?	Yes ☑	No ☐	
Samples in proper containers/bottles?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	

Sample Preservation and Hold Time (HT) Information

All samples received within holding time?	Yes ☑	No ☐	
Sample/Temp Blank temperature	Temp: 4.7°C		NA ☐
Water - VOA vials have zero headspace / no bubbles?	Yes ☐	No ☐	NA ☑
Sample labels checked for correct preservation?	Yes ☑	No ☐	
pH acceptable upon receipt (Metal: <2; 522: <4; 218.7: >8)?	Yes ☐	No ☐	NA ☑
Samples Received on Ice?	Yes ☑	No ☐	

(Ice Type: WET ICE)

UCMR3 Samples:

Total Chlorine tested and acceptable upon receipt for EPA 522?	Yes ☐	No ☐	NA ☑
Free Chlorine tested and acceptable upon receipt for EPA 218.7, 300.1, 537, 539?	Yes ☐	No ☐	NA ☑

** NOTE: If the "No" box is checked, see comments below.*

Comments:

amec foster wheeler

APPENDIX B

Field Notes

2 Nov

North Richmond Pump Station
Stormwater diversion

9:10 on site. Identify - has permission to divert.
Diversion in place.

9:26 turned pump on @ ~9am
flow is 'choppy' due to debris, leaves, etc getting into line

pump @ ~212 gpm
based on flow meter

Samples will be
NRPS-15-001
NRPS15-001

SGC	1L plastic
nutrients	500mL plastic w/ acid
THg	1L glass pre-preserved
PCB	2x 1L amber

"Rain in the Rain"

9:37 start collecting
NRPS 15-001

9:52 NRPS 15-002
~~dup 001~~

9:56
NRPS15-003 field dup

10:10 NRPS15-004 field blank
w/DI
not for SSC (PCB + Hg only)

10:28 NRPS-005

10:56 NRPS-006

11:00 NRPS-007 field blank
no SSC
PCB + Hg only

11:31 NRPS-008

11:24 NRPS-009 field blank
no SSC
Hg-RB only

large pumps did NOT turn on during diversion.

small pump 'kept up'

finished sampling ~11:30

"Rain in the Rain"