RANCHO MURIETA COMMUNITY SERVICES DISTRICT

15160 JACKSON ROAD
RANCHO MURIETA, CA 95683
916-354-3700
FAX – 916-354-2082

AGENDA

(*Amended November 16, 2015)

"Your Independent Local Government Agency Providing
Water, Wastewater, Drainage, Security, and Solid Waste Services"

REGULAR BOARD OF DIRECTORS MEETINGS ARE HELD
3rd Wednesday of Each Month

REGULAR BOARD MEETING
NOVEMBER 18, 2015

Open Session 5:00 p.m.
RMCSD Administration Building – Board Room
15160 Jackson Road
Rancho Murieta, CA 95683

BOARD MEMBERS

Gerald Pasek	President
Betty Ferraro	Vice President
Morrison Graf	Director
Michael Martel	Director
Mark Pecotich	Director

STAFF

Darlene J. Gillum	General Manager
Greg Remson	Security Chief
Paul Siebensohn	Director of Field Operations
Eric Thompson	Controller
Suzanne Lindenfeld	District Secretary

RANCHO MURIETA COMMUNITY SERVICES DISTRICT

REGULAR BOARD MEETING

NOVEMBER 18, 2015

Open Session 5:00 p.m.

All persons present at District meetings will place their cellular devices in silent and/or vibrate mode (no ringing/sound of any kind). During meetings, these devices will be used only for emergency purposes and, if used, the party called/calling will exit the meeting room for conversation. Other electronic and internet enabled devices are to be used in the "silent" mode. Under no circumstances will recording devices or problems associated with them be permitted to interrupt or delay District meetings.

AGENDA

RUNNING TIME

1. CALL TO ORDER - Determination of Quorum - President Pasek **(Roll Call)** 5:00

2. ADOPT AGENDA (Motion)

3. SPECIAL ANNOUNCEMENTS AND ACTIVITIES

4. COMMENTS FROM THE PUBLIC 5:05

Members of the public may comment on any item of interest within the subject matter jurisdiction of the District and any item specifically agendized. Members of the public wishing to address a specific agendized item are encouraged to offer their public comment during consideration of that item. With certain exceptions, the Board may not discuss or take action on items that are not on the agenda.

If you wish to address the Board at this time or at the time of an agendized item, as a courtesy, please state your name and address. Speakers presenting individual opinions shall have 3 minutes to speak. Speakers presenting opinions of groups or organizations shall have 5 minutes per group.

5. CONSENT CALENDAR (Motion) **(Roll Call Vote)** *(5 min.)* 5:10

All the following items in Agenda Item 5 will be approved as one item if they are not excluded from the motion adopting the consent calendar.

- **a.** Approval of October 21, 2015 Board Meeting Minutes
- **b.** Bills Paid Listing

6. STAFF REPORTS (Receive and File)

- **a.** General Manager's Report
- **b.** Administration/Financial Report
- **c.** Security Report
- **d.** Water/Wastewater/Drainage Report

7. CORRESPONDENCE

- **a.** Email from Brad Sample, dated October 21, 2015
- **b.** Letter from Brad Sample, dated November 10, 2015

8. **RECEIVE PRESENTATION OF THE DRAFT 2014-2015 ANNUAL AUDIT REPORT BY LARRY BAIN, CPA** (Receive and File) *(15 min.)* 5:15

9. **CONSIDER APPROVAL OF THE SOLAR POWER PROJECT - CEQA SERVICES, SUPPORT AND DOCUMENTATION PROPOSAL** (Discussion/Action) (Motion) **(Roll Call Vote)** *(5 min.)* 5:30

10. **CONSIDER SELECTION OF SPECIAL DISTRICT COMMISSIONER FOR THE SACRAMENTO LOCAL AGENCY FORMATION COMMISSION** (Discussion/Action) (Motion) *(5 min.)* 5:35

11. **CONSIDER ADOPTION OF RESOLUTION R2015-14, ACCEPTING WATER LINE EASEMENT AT THE RETREATS WEST** (Discussion/Action) (Motion) **(Roll Call Vote)** *(5 min.)* 5:40

12. **CONSIDER ADOPTION OF RESOLUTION R2015-15, ELECTING TO BE SUBJECT TO GOVERNMENT CODE SECTION 22893 TO ESTABLISH HEALTH VESTING REQUIREMENTS FOR FUTURE ANNUITANTS UNDER THE PUBLIC EMPLOYEES' MEDICAL AND HOSPITAL CARE ACT** (Discussion/Action) (Motion) **(Roll Call Vote)** *(5 min.)* 5:45

13. **CONSIDER ADOPTION OF DISTRICT RESOLUTION R2015-16, AMENDING THE AMOUNT OF EMPLOYER PAID MEMBER CONTRIBUTIONS TO THE PUBLIC EMPLOYEES RETIREMENT SYSTEM (PERS) FOR REPRESENTED EMPLOYEES FROM TWO PERCENT (2%) TO ONE PERCENT (1%)** (Discussion/Action) (Motion) **(Roll Call Vote)** *(5 min.)* 5:50

14. **CONSIDER ADOPTION OF DISTRICT RESOLUTION R2015-17, AMENDING THE AMOUNT OF EMPLOYER PAID MEMBER CONTRIBUTIONS TO THE PUBLIC EMPLOYEES RETIREMENT SYSTEM (PERS) FOR NON-REPRESENTED EMPLOYEES FROM TWO PERCENT (2%) TO ONE PERCENT (1%)** (Discussion/Action) (Motion) **(Roll Call Vote)** *(5 min.)* 5:55

15. **RECEIVE SECURITY AD HOC COMMITTEE UPDATE** (Discussion/Action) *(15 min.)* 6:00
    - **a.** Gate Policy
    - **b.** North Gate Use Agreement
    - **c.** Security Impact Fee Policy
    - **d.** Surveillance Camera Policy

16. **RECEIVE UPDATES** (Discussion/Action) *(15 min.)* 6:15
    - **a.** Parks Committee
    - **b.** Development - County Notice of Preparation
    - **c.** Recycled Water Project
    - **d.** Ad Hoc Committee Formation

17. RECEIVE WATER TREATMENT PLANT EXPANSION PROJECT UPDATE 6:30

(Discussion/Action) *(5 min.)*

a. Water Treatment Plant Expansion Project Engineering Report

18. REVIEW AND SELECT CONFERENCE/EDUCATION OPPORTUNITIES 6:35

(Discussion/Action) *(5 min.)*

19. REVIEW MEETING DATES/TIMES:

Special Board Meeting: December 2, 2015 - open session at 4:00 p.m.
Joint Security Committee Meeting: December 3, 2015 - 10:00 a.m. at District Office
Regular Board Meeting: December 16, 2015 - open session at 5:00 p.m.
Board Goal Workshop: January 13, 2016 - open session at 2:00 p.m.
Regular Board Meeting: January 20, 2016 - open session at 5:00 p.m.

20. COMMENTS/SUGGESTIONS – BOARD MEMBERS AND STAFF 6:40

In accordance with Government Code 54954.2(a), Directors and staff may make brief announcements or brief reports of their own activities. They may ask questions for clarification, make a referral to staff or take action to have staff place a matter of business on a future agenda.

21. ADJOURNMENT (Motion) 6:45

"In accordance with California Government Code Section 54957.5, any writing or document that is a public record, relates to an open session agenda item and is distributed less than 72 hours prior to a regular meeting, will be made available for public inspection in the District offices during normal business hours. If, however, the document is not distributed until the regular meeting to which it relates, then the document or writing will be made available to the public at the location of the meeting."

Note: This agenda is posted pursuant to the provisions of the Government Code commencing at Section 54950. The date of this posting is November ~~13~~16, 2015. Posting locations are: 1) District Office; 2) Plaza Foods; 3) Rancho Murieta Association; 4) Murieta Village Association.

RANCHO MURIETA COMMUNITY SERVICES DISTRICT

Board of Directors Regular Meeting
MINUTES
October 21, 2015
5:00 p.m. Open Session

1. CALL TO ORDER/ROLL CALL

President Gerald Pasek called the regular meeting of the Board of Directors of Rancho Murieta Community Services District to order at 5:01 p.m. in the District meeting room, 15160 Jackson Road, Rancho Murieta. Directors present were Gerald Pasek, Betty Ferraro, Morrison Graf, Michael Martel, and Mark Pecotich. Also present were Darlene J. Gillum, General Manager; Paul Siebensohn, Director of Field Operations; Eric Thompson, Controller; and Suzanne Lindenfeld, District Secretary.

2. ADOPT AGENDA

Motion/Ferraro to adopt the agenda. **Second/Graf. Ayes: Pasek, Ferraro, Graf, Martel, Pecotich. Noes: None. Absent: None. Abstain: None.**

3. SPECIAL ANNOUNCEMENTS AND ACTIVITIES

Darlene Gillum stated that the District received the Transparency Certificate of Excellence from the California Special Districts Association, Special District Leadership Foundation.

4. COMMENTS FROM THE PUBLIC

Keith Golden, Sloughhouse, commented on the Developer presentation and his concern with adequate water supply when the District drills the augmentation well. President Pasek stated that the Water Supply Assessment Report will be going to the Board for review in a few weeks at which time the report will be made available to the public. Darlene Gillum stated the CEQA report was done in 2014 and is available on the District's website.

Brad Sample commented on his concern regarding asbestos and wanting to ensure the updated methods of testing are conducted. Mr. Sample also commented that he feels a water quality report needs to be completed and that the developers should pay for it, with the District overseeing it. Director Martel asked if he had any concerns regarding the water quality at this time. Mr. Sample stated that he did not at this time.

John Merchant commented on Sacramento County conducting an EIR and asking environmental comments. Mr. Merchant stated he feels the District should hire someone to advise the District before the EIR is done.

5. CONSENT CALENDAR

Motion/Martel to adopt the consent calendar. **Second/Ferraro. Roll Call Vote: Ayes: Pasek, Ferraro, Graf, Martel, Pecotich. Noes: None. Absent: None. Abstain: None.**

6. STAFF REPORTS

Under Agenda Item 6b, President Pasek stated that this year, budget-wise, the District should break even. Director Martel stated his goal is not have any rate increases.

Under Agenda Item 6c, Director Martel commented on his disappointment in the District hiring private security to augment the Security Department, his feeling that the District needs to develop an action plan to prevent crime and vandalism, and that security services can be done better than it currently is. Director Ferraro commented on Rancho Murieta Country Club (RMCC) hiring four (4) outside security persons to patrol their property Halloween weekend.

Director Martel commented on the need for more tax money to pay for an increase in Security services.

Under Agenda Item 6d, President Pasek commented on the reservoirs being at 80% capacity and no groundwater use yet.

7. CORRESPONDENCE
None.

8. CONSIDER APPROVAL OF REGIONAL WATER AUTHORITY PROJECT AGREEMENT FOR CASH FOR GRASS REBATE PROGRAM
Darlene Gillum gave a brief summary of the recommendation to approve the agreement with the Regional Water Authority for Cash for Grass Rebate Program. In early August 2015, the District was notified by the Regional Water Authority (RWA) that we had been awarded $30,590 to participate in the Prop 84 Drought Grant Irrigation Efficiency project. The Prop 84 grant requires the District to pay a 25% match ($7,647) in the form of water surveys provided to each participant. The District's 25% match will be paid out of the 2015 Water Conservation Operational Budget.

The terms of the rebate program are up to $500 per single family residential account and up to $1,500 for large commercial, industrial, or institutional accounts. The rebate is applicable only to the installation of recommended irrigation system upgrades as a result of the water survey, including turf replacement.

President Pasek commented that he did not feel the District needed to provide the program since the State already has one in place which offers more of a rebate and is easier to receive. Darlene stated that residents can apply for rebates from both programs, the maximum from the District is $500 and the maximum from the State, including the amount received from the District, is $2,000.

Director Pecotich stated that the District should be sure to note that on the website along with linking Rancho Murieta Association's architectural application for review on the District's website.

Les Clark commented on the amount of administration time that will be spent overseeing the rebate program which includes project files, document retention, and the continued report to Regional Water Authority until 2025.

Motion/Martel to approve the Regional Water Authority Project Agreement for Cash for Grass Rebate Program. **Second/Ferraro. Roll Call Vote: Ayes: Ferraro, Martel, Pecotich. Noes: Pasek, Graf. Absent: None. Abstain: None.**

9. DISCUSS PARKS COMMITTEE AGENDA ITEMS

Darlene Gillum stated that she has not spoken with LAFCo yet but hopes to before the Parks Committee meeting on October 22, 2015.

Richard Shanahan, District General Counsel, explained that, based on his review of various resolutions and the LAFCo website, it appears that recreation is an authorized power and that, through the 1990-91 parks agreements and Parks Committee, the District has been exercising that power. He also expressed his concerns that it is uncertain whether the park funds and fees are District money and fees or whether the funds/fees are private/RMA money. He cautioned against levying and imposing a community park fee (which is found in District Code chapter 8), but not actually collecting the fee. If the fee being collected is actually the District's fee that Rancho Murieta Association (RMA) collects, and then there is state law mandated financial reporting and other requirements that should be done. The funds could be at risk if the District is not in compliance with these requirements. If the fee is not a District fee, then the District can repeal the Parks Fee and only have an advisory role in the parks. Mr. Shanahan recommended that the MOU clearly resolve and address these questions.

Director Martel commented on his feeling that RMA has not maintained the Parks Fees collected appropriately and are not in compliance with the required reporting.

Mr. Shanahan also stated that the new Memorandum of Understand needs to be done since the current developers are not parties to the previous Parks Agreements and their obligation to comply with the agreements is uncertain. Mr. Shanahan asked if the County collects a park fee under the Quimby Act. John Sullivan stated no, the County discontinued that in 1979.

Mr. Shanahan also commented on the concern that if the District takes over the parks, they may have to be open to the public or maintained as resident-only parks. He explained that under certain circumstances a public agency may operate a residents-only park and he cited to the City of Palo Alto Foothills Park as an example.

Director Ferraro commented on how hard it has been to get the Parks Committee financial records from RMA.

Director Pecotich asked for Board input regarding the District creating a bond to pay for a community center. Darlene Gillum stated that she feels it is too early in the process for the District to spend the staff time and expenses to consider this.

John Merchant stated that the Parks Fees accounting should be managed by an outside agency.

10. RECEIVE WATER TREATMENT PLANT EXPANSION PROJECT UPDATE

Paul Siebensohn gave an update on the Water Treatment Plant Expansion Project. Recent work included: painting of equipment, piping and siding replacement; GE's & TESCO Controls commissioning activities with loop checking of instrumentation and equipment control; installation of canopy and ancillary room lighting; equipment commissioning including pumps and neutralization tank. As of this update the project is holding to schedule, barring any commissioning issues that may arise.

11. RECEIVE WATER CONSERVATION UPDATE
Paul Siebensohn gave an updated on water conservation. NOAA continues to show that drought persists or intensifies for our. A recent article from the Los Angeles Time regarding El Nino indicates a potential of over 40% normal precipitation for our area in the January through March 2016 timeframe.

The State drought mandates and the District water conservation schedule are still in effect. Calendar year to date, three hundred forty-two (342) conservation tags have been issued and five (5) fines levied.

12. REVIEW AND SELECT CONFERENCE/EDUCATION OPPORTUNITIES
No discussion.

13. REVIEW MEETING DATES AND TIMES
Directors Graf and Martel will not be at the November 4, 2015 Special Board meeting.

14. COMMENTS FROM THE PUBLIC
Paul Siebensohn reminded everyone that due to the cooler weather and shorter days, they should cut back on their irrigation times.

Director Martel commented on his disappointment with the barcode report he received, stating that not everyone that has them is listed. Darlene Gillum stated she will look into the matter. He also commented on the need for Security to work on preventing vandalism and the Board to discuss vehicle options before the next Security vehicle is obtained.

Director Graf commented on his tour of the water plants and commented on what a good job the Water Department does with such a small staff. He also asked about the Security ad hoc committee comments that are due October 23, 2015. Darlene Gillum stated that that deadline will be extended as she intends to send out a more detailed information sheet out to the Directors to comment on.

President Pasek asked when staff intends to notify the community regarding the suggested midge fly plan. Paul Siebensohn stated that he intends to get community input in the December/January time frame.

Director Ferraro thanked Director Pecotich for all his efforts regarding the Parks Committee.

Director Pecotich stated that the ad hoc committee formation will move forward after the SOLOS group meets with the developers. President Pasek stated that SOLOS needs to define what they mean by “reasonable” development. Director Pecotich commented on his feeling that what is going on in the community regarding development is hostile and not good for the community.

Darlene Gillum stated that at the October Presidents meeting, items discussed included RMCC irrigation upgrade is near completion. President Pasek stated that with this upgrade, RMCC is projecting that they will need 20% less recycled water and suggested that the District get that in writing. Director Martel commented on the need to look at the piping since it is 45 years old.

President Pasek commented on hearing that Security has allowed flatbeds of kids into the community for trick or treating on Halloween. Darlene stated she will look into it.

Darlene stated that the 2014 compensation report has been posted to our website and submitted to the State Controller's Office.

Suzanne commented on the Board Secretary training she attended earlier this week. From discussions with other District's it appears as going to two (2) board meeting a month instead of committee meetings is the trend as they are found to be more efficient and effective. Also, most Districts conduct their Board meetings during the work day.

Suzanne reminded everyone of the upcoming time change on November 1, 2015.

15. ADJOURNMENT

Motion/Ferraro to adjourn at 7:16 p.m. **Second/Pecotich. Ayes: Pasek, Ferraro, Graf, Martel, Pecotich. Noes: None. Absent: None. Abstain: None.**

Respectfully submitted,

Suzanne Lindenfeld
District Secretary

MEMORANDUM

Date: November 10, 2015

To: Board of Directors

From: Eric Thompson, Controller

Subject: Bills Paid Listing

Enclosed is the Bills Paid Listing Report for **October 2015**. Please feel free to call me before the Board meeting regarding any questions you may have relating to this report. This information is provided to the Board to assist in answering possible questions regarding large expenditures.

The following major expense items (excluding payroll-related items) are listed ***in order as they appear*** on the Bills Paid Listing Report:

Vendor	Project/Purpose	Amount	Funding
A Leap Ahead IT	Admin Server	$8,780.28	Operating Expense
California Waste Recovery Systems	Solid Waste Monthly Contract	$46,415.03	Operating Expense
County of Sacramento	2015/2016 Contribution (SCGA)	$6,000.00	Operating Expense
J B Bostick Company	Various Asphalt Patching	$13,590.00	Operating Expense
Kirby's Pump & Mechanical, Inc	Repair Cantova Lift Station	$7,942.17	Operating Expense
Roebbelen Construction Management	WTP Expansion	$391,735.27	Construction Acct Funding, Bonds, Letter of Credit, & Operating Expense
Sacramento Metropolitan Air Quality Mgt District	Annual Permit FY15-16	$11,516.00	Operating Expense
Useware, Inc	Annual Support 11/1-10/30/16	$13,520.00	Operating Expense
Bartkiewicz, Kronick & Shanahan	Legal Services	$9,033.05	Operating Expense
GSRMA	Insurance	$42,447.74	Operating Expense
Golden State Flow Measurement	Water Meters	$9,817.63	Operating Expense
S. M. U. D.	Monthly Bill	$30,324.65	Operating Expense

Rancho Murieta Community Services District

Bills Paid Listing for October 2015

Ck Number	Date	Vendor	Amount	Purpose
CM30019	10/2/2015	California Public Employees' Retirement Sys	$33,755.12	Payroll
CM30020	10/2/2015	Guardian Life Insurance	$4,965.32	Payroll
CM30021	10/2/2015	Vision Service Plan (CA)	$466.80	Payroll
CM30022	10/9/2015	A Leap Ahead IT	$8,780.28	Admin Server
CM30023	10/9/2015	Accounting & Association Software Group	$123.75	IT Support
CM30024	10/9/2015	American Family Life Assurance Co.	$544.11	Payroll
CM30025	10/9/2015	Aramark Uniform & Career Apparel, LLC	$350.51	Uniform Service - Water
CM30026	10/9/2015	BlueLine Rental, LLC	$2,754.00	Backhoe rental
CM30027	10/9/2015	California Public Employees' Retirement Sys	$10,808.13	Payroll
CM30028	10/9/2015	California Waste Recovery Systems	$46,415.03	Solid Waste Monthly Contract
CM30029	10/9/2015	CDW Government Inc.	$2,474.95	Director Laptops
CM30030	10/9/2015	Chemtrade Chemicals US LLC	$2,399.57	Liquid Aluminum
CM30031	10/9/2015	Capital One Commercial	$1,398.24	Monthly Supplies
CM30032	10/9/2015	County of Sacramento	$6,000.00	2015/2016 contribution (SCGA)
CM30033	10/9/2015	Ditch Witch Equipment Company, Inc.	$1,080.94	Vactor 500 hr Service
CM30034	10/9/2015	Employment Development Department	$2,723.76	Payroll
CM30035	10/9/2015	Environmental Resource Associates	$606.21	Laboratory Analysis
CM30036	10/9/2015	Express Office Products, Inc.	$166.76	Office Supplies
CM30037	10/9/2015	Folsom Lake Fleet Services	$1,251.19	#214 Service
CM30038	10/9/2015	Groeniger & Company	$989.13	Maint & Repair Supplies
CM30039	10/9/2015	Hach Company	$1,875.04	Maint & Repair Supplies
CM30040	10/9/2015	J B Bostick Company	$13,590.00	Various Asphalt Patching
CM30041	10/9/2015	Kirby's Pump & Mechanical Inc.	$7,942.17	Repair Cantova Lift Station
CM30042	10/9/2015	Legal Shield	$55.63	Payroll
CM30043	10/9/2015	Lauren Madrigal	$100.00	Toilet Rebate
CM30044	10/9/2015	McMaster-Carr Supply Co.	$471.79	Maint & Repair Supplies
CM30045	10/9/2015	Nationwide Retirement Solution	$3,954.00	Payroll
CM30046	10/9/2015	Normac	$576.52	Maint & Repair Supplies
CM30047	10/9/2015	Operating Engineers Local Union No. 3	$600.00	Payroll
CM30048	10/9/2015	Plaza Foods Supermarket	$14.90	Supplies
CM30049	10/9/2015	Prodigy Electric & Controls Inc.	$1,208.82	Exterior Lighting Repair
CM30050	10/9/2015	Rancho Murieta Ace Hardware	$287.57	Monthly Supplies
CM30051	10/9/2015	Roberta Reid	$100.00	Toilet Rebate
CM30052	10/9/2015	Roebbelen Construction Management Services	$391,735.27	WTP#1 Expansion
CM30053	10/9/2015	Sacramento Metropolitan Air Quality Mgt District	$11,516.00	Annual Permit FY15-16
CM30054	10/9/2015	Socius	$3,654.80	Dymamics GP Adv 11/15-11/16
CM30055	10/9/2015	State of California	$60.00	Pesticide Certification
CM30056	10/9/2015	TASC	$122.69	Payroll
CM30057	10/9/2015	TelePacific Communications	$539.17	Monthly Phone Bill
CM30058	10/9/2015	Tom's House of Hydraulics Inc.	$17.77	Flatbed Truck Repair

Rancho Murieta Community Services District

Bills Paid Listing for October 2015

Ck Number	Date	Vendor	Amount	Purpose
CM30059	10/9/2015	U.S. Bank Corp. Payment System	$3,141.25	Monthly Gasoline Bill
CM30060	10/9/2015	U.S. HealthWorks Medical Group, PC	$188.00	Pre-Employment Screening
CM30061	10/9/2015	USA Blue Book	$1,306.83	Gloves
CM30062	10/9/2015	Useware, Inc.	$13,520.00	Annual Support 11/1-10/30/16
CM30063	10/9/2015	W.W. Grainger Inc.	$1,066.84	Maint & Repair Supplies
EFT	10/9/2015	EFTPS	$9,480.19	Payroll
EFT	10/9/2015	EFTPS	$57.68	Payroll
CM30064	10/23/2015	A&D Automatic Gate and Access	$161.88	South Gate Barcode Reader Repair
CM30065	10/23/2015	Action Cleaning Systems	$1,172.00	Monthly Cleaning Service
CM30066	10/23/2015	All Electric Motors, Inc.	$469.80	Motor Repairs
CM30067	10/23/2015	American Family Life Assurance Co.	$544.11	Payroll
CM30068	10/23/2015	Applications By Design, Inc.	$2,239.25	Barcode Decals
CM30069	10/23/2015	Aramark Uniform & Career Apparel, LLC	$107.93	Uniform Service - Water
CM30070	10/23/2015	Arnolds For Awards	$178.69	Director Supplies
CM30071	10/23/2015	ASR - Sacramento Uniform	$518.25	Uniforms
CM30072	10/23/2015	AT&T	$114.00	Monthly Internet Bill - Admin
CM30073	10/23/2015	Bartkiewicz, Kronick & Shanahan	$9,033.05	Legal Services
CM30074	10/23/2015	Borges & Mahoney	$1,101.04	WTP Repairs
CM30075	10/23/2015	California Laboratory Services	$2,169.72	Monthly Lab Tests
CM30076	10/23/2015	California Public Employees' Retirement Sys	$8,579.00	Payroll
CM30077	10/23/2015	California Public Employees' Retirement Sys	$10,134.62	Payroll
CM30078	10/23/2015	Caltronics Business Systems	$1,560.62	Copier - Admin.
CM30079	10/23/2015	Cell Energy Inc.	$477.94	Batteries
CM30080	10/23/2015	County of Sacramento	$2,792.34	Off-Duty Sheriff's Program
CM30081	10/23/2015	Edward R. Bacon Company, Inc.	$184.22	Maint & Repair Supplies
CM30082	10/23/2015	Employment Development Department	$2,259.38	Payroll
CM30083	10/23/2015	Express Office Products, Inc.	$810.37	Office Supplies
CM30084	10/23/2015	Fastenal	$444.34	Maint & Repair Supplies
CM30085	10/23/2015	Folsom Lake Fleet Services	$3,814.87	#216 Service
CM30086	10/23/2015	Ford Motor Credit Company LLC	$234.78	2012 Ford Escape Lease Pmt.
CM30087	10/23/2015	Jeff Francetic	$50.00	Drip System Rebate
CM30088	10/23/2015	Franchise Tax Board	$100.00	Payroll
CM30089	10/23/2015	Gallery & Barton	$1,170.00	Legal Consulting
CM30090	10/23/2015	Galls/Quartermaster	$133.44	Uniforms
CM30091	10/23/2015	Golden State Flow Measurement	$9,817.63	Water Meters
CM30092	10/23/2015	GSRMA	$42,447.74	Insurance
CM30093	10/23/2015	Greenfield Communications	$142.97	Internet/TV
CM30094	10/23/2015	Groeniger & Company	$1,096.20	Maint & Repair Supplies
CM30095	10/23/2015	Hastie's Capitol Sand and Gravel Co.	$1,188.86	Construction Sand
CM30096	10/23/2015	Leroy Heimbecker	$100.00	Toilet Rebate

Rancho Murieta Community Services District

Bills Paid Listing for October 2015

Ck Number	Date	Vendor	Amount	Purpose
CM30097	10/23/2015	Legal Shield	$55.63	Payroll
CM30098	10/23/2015	National Notary Association	$179.00	Membership
CM30099	10/23/2015	Nationwide Retirement Solution	$3,954.00	Payroll
CM30100	10/23/2015	Operating Engineers Local Union No. 3	$600.00	Payroll
CM30101	10/23/2015	PDF Tactical	$3,535.77	Contract Security Guard
CM30102	10/23/2015	Pitney Bowes	$698.32	Postage Machine Lease
CM30103	10/23/2015	Public Agency Retirement Services	$300.00	Payroll
CM30104	10/23/2015	Rancho Murieta Association	$150.00	Landscaping
CM30105	10/23/2015	Rancho Murieta Association	$438.54	Smud @ North Gate
CM30106	10/23/2015	Romo Landscaping	$770.00	Landscaping
CM30107	10/23/2015	S. M. U. D.	$30,324.65	Monthly Bill
CM30108	10/23/2015	Sierra Chemical Co.	$1,551.08	Chlorine
CM30109	10/23/2015	Sierra Office Supplies	$100.44	Office Supplies
CM30110	10/23/2015	Frank Simmons	$100.00	Toilet Rebate
CM30111	10/23/2015	Sprint	$1,277.16	Monthly Cell Phone Bill
CM30112	10/23/2015	Jim Starkey	$100.00	WPRV Rebate
CM30113	10/23/2015	State of California	$98.00	Pre-Employment Screening
CM30114	10/23/2015	Jeralynn Strong	$68.02	WPRV Rebate
CM30115	10/23/2015	Synectic Technologies	$400.93	Telephone Hardware
CM30116	10/23/2015	TASC	$62.75	Payroll
CM30117	10/23/2015	TASC	$122.69	Payroll
CM30118	10/23/2015	U.S. Jetting, LLC	$184.53	Maint & Repair Supplies
CM30119	10/23/2015	W.W. Grainger Inc.	$1,544.19	Maint & Repair Supplies
CM30120	10/23/2015	Western Exterminator Co.	$470.00	Mthly Srv & Rodent Control
CM30121	10/23/2015	Zep Sales & Service	$124.90	Supplies
EFT	10/23/2015	EFTPS	$9,524.47	Payroll
EFT	10/26/2015	Pitney Bowes	$1,500.00	Postage Machine Refill
		TOTAL	**$758,820.84**	
		CFD#1 Bank of America Checking		
	No Transactions During the Month of October			
		TOTAL	**$0.00**	

Rancho Murieta Community Services District
Bills Paid Listing for October 2015

Ck Number	Date	Vendor	Amount	Purpose
		CFD 2014-1 Bank of America Checking		
CM2010	10/9/2015	Corelogic Solutions, LLC	$190.00	CFD 2014-1 Admin cost
CM2011	10/9/2015	NBS	$754.16	CFD 2014-1 Admin Cost
		TOTAL	**$944.16**	
		EL DORADO PAYROLL		
Checks: # CM11365 to CM11377 and Direct Deposits: DD08379 to DD08435			$ 107,963.97	Payroll
EFT	10/31/2015	National Payment Corp	$133.34	Payroll
		TOTAL	**$108,097.31**	

MEMORANDUM

Date: November 12, 2015

To: Board of Directors

From: Darlene J. Gillum, General Manager

Subject: General Manager's Report

Following are highlights since our last Board Meeting:

FINANCE/IT
Eric has been working with Larry Bain to finalize the District's audit for 2014-2015. Larry will be at the November Board Meeting to present the audit and answer any questions.

HUMAN RESOURCES
Our annual employee appreciation/holiday luncheon is scheduled for December 9, 2015.

SECURITY
Interviews were held on Friday, November 13, 2015, with internal candidates for the Sergeant position. The interview panel included me, Chief Remson, and Marc Moore, former Security Manager for Serrano Homeowners Association. Each candidate will also take a supervisor assessment test.

WATER
In October, the community's residential gallons per capita per day (R-GPCD) usage was 173 gallons, a reduction of 21% over September R-GPCD, which is a reflection of the cooler and wetter weather pattern. Calendar year to date, residential conservation through October as compared to the same period in 2013 is 32%.

WASTEWATER
Tom Guinn, AECOM, reports that the deadline for submission of the Title XVI application is December 10, 2015. A preliminary report of the projects and priorities that Paul, Gabriel, and Kevin have been working on will be presented at the November Board Meeting. We will need to schedule a Special Board Meeting (we are targeting December 2) for the Board to approve the grant application and the project(s) to be included.

AUGMENTATION WELLS
Nothing new to report.

DRAINAGE
Nothing new to report.

SOLAR POWER PROJECT

The Request for Proposal for the CEQA services work related to the Solar Power arrays/fields was released on November 2, 2015. The deadline for submittal of questions was November 6, 2015 and answers were posted on November 9, 2015. In response to a request from an interested firm for a site visit, Paul scheduled a non-mandatory site visit for Thursday, November 12, 2015. Four (4) firms attended the site visit. Proposals are due Monday November 16, 2015 by 4:00 p.m. The proposal and staff recommendation will be on the November Board Meeting agenda; however, it will be a late add-on to the board packet.

DEVELOPMENT

The Notice of Preparation of a Draft Environmental Impact Report for Rancho Murieta North was released by Sacramento County Department of Community Development and received by the District on November 6, 2015. Comments are due no later than 30 days after receipt of the notice.

The Water Supply Assessment (WSA) of the proposed Rancho Murieta North development project is nearing completion. I contacted Shelby Maples, County Planning Project Manager, to inquire if providing the WSA to the County in December would be acceptable to their schedule. She responded that December is fine for our submittal. The reason I have pushed out delivery of the draft WSA is to allow sufficient time for Maddaus Water Management (MWM) to conduct their internal QA/QC review of the document. Several of MWM staff are out of the office between now and Thanksgiving.

ESCUELA SECURITY GATE

A preliminary discussion of the Escuela gate will be included on the Joint Security Meeting agenda for December 3, 2015.

MEMORANDUM

Date: November 10, 2015

To: Board of Directors

From: Eric Thompson, Controller

Subject: Administration / Financial Reports

Enclosed is a combined financial summary report for **October 2015**. Following are highlights from various internal financial reports. Please feel free to call me before the Board meeting regarding any questions you may have relating to these reports.

This information is provided to the Board to assist in answering possible questions regarding under or over-budget items. In addition, other informational items of interest are included.

Water Consumption - Listed below are year-to-date water consumption numbers using weighted averages:

	12 month rolling % increase	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Residences	0.1%	2,517	2,517	2,517	2,517								

	Weighted average	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Cubic Feet	1,817	1,854	2,068	1,873	1,475								
Gallons per day	453	462	516	467	368								
Planning Usage GPD	**583**												

Lock-Offs **–** For the month of October, there were 18 lock-offs.

Aging Report **–** Delinquent accounts totaled $45,749 which was 8.48% of the total accounts receivable balance of $539,348. Past due receivables increased approximately 25.1% or $9,166.

Summary of Reserve Accounts as of October 31, 2015 **–** The District's reserve accounts have increased $60,718 since the beginning of the fiscal year. On November 4, 2015 the District submitted what should be its final demand to the Reynen & Bardis letters of credit in the amount of $453,786. Total Water Treatment Expansion Project (WTP) costs, as of October 31, 2015, are just under $12 million. As mentioned in the previous finance report, future WTP expansion costs will be allocated between the District and CFD 2014 as provided for in the Financing and Services Agreement (FSA). The total amount of reserves held by the District on October 31, 2015 was $4,613,485. See the Reserve Fund Balances table below for information by specific reserve account.

Reserve Fund Balances

Reserve Descriptions	*Fiscal Yr Beg Balance July 1, 2015*	*YTD Collected & Interest Earned*	*YTD Spent*	*Period End Balance Oct 31, 2015*
Water Capital Replacement (200-2505)	**671,239**	**71,032**	**(0)**	**742,271**
Sewer Capital Replacement (250-2505)	**1,475,914**	**118,812**	**(11,571)**	**1,583,155**
Drainage Capital Replacement (260-2505)	**46,370**	**40**	**(0)**	**46,410**
Security Capital Replacement (500-2505)	**20,602**	**14,060**	**(5,973)**	**28,689**
Admin Capital Replacement (xxx-2505-99)	**38,386**	**0**	**(0)**	**38,386**
Sewer Capital Improvement Connection (250-2500)	**4,028**	**0**	**(0)**	**4,028**
Capital Improvement (xxx-2510)	**291,453**	**9,202**	**(0)**	**300,655**
Water Supply Augmentation (200-2511)	**1,751,059**	**17,448**	**(0)**	**1,768,507**
WTP Construction Fund Reserve (200-2513)	**253,716**	**1,099,184**	**(1,251,516)**	**101,384**
Total Reserves	***4,552,767***	***1,329,778***	***(1,269,060)***	***4,613,485***

Inter-fund Borrowing Balances

Inter-fund Borrowing	*Fiscal Yr Beg Balance July 1, 2015*	*YTD Interest*	*YTD Repayment*	*Period End Balance Oct 31, 2015*
Sewer Loan to WTP Construction Fund	**1,418,143**	**1,568**	**(48,346)**	**1,371,365**
WSA Loan to WTP Construction Fund	**472,714**	**523**	**(16,115)**	**457,122**
N. Gate Security Loan from Drainage Fund	**108,875**	**119**	**(7,731)**	**101,263**
Total Inter-fund Borrowing	***1,999,732***	***2,210***	***(72,192)***	***1,929,750***

PARS GASB 45 Trust **-** The PARS GASB 45 Trust, which is the investment trust established to fund Other Post Employment Benefits, had the following returns:

Period ended September 30, 2015		
1-Month	3-Months	1-Year
-1.75%	-4.73%	-1.32%

Financial Summary Report (year-to-date through October 31, 2015)

***Revenues*:**

Water Charges, year-to-date, are **below** **budget $75,482 or (9.5%)**

Sewer Charges, year-to-date, are **above** **budget $469 or 0.1%**

Drainage Charges, year-to-date, are **below budget $66 or (0.1%)**

Security Charges, year-to-date, are **above budget $753 or 0.2%**

Solid Waste Charges, year-to-date, are **above budget $18 or 0.0%**

Total Revenues, which includes other income, property taxes, and interest income year-to-date, are **below** budget **$28,681 or (1.3%)** (Water Conservation Efforts - YTD residential water usage is down 12.9% compared to budget).

Expenses: **Year-to-date total operating expenses are below budget $19,842 or 1.0%.** There have been no operational reserve expenditures so far this year. Operational reserve expenditures cover projects funded from reserves which are also recorded as operational expenses through the income statement as required by Generally Accepted Accounting Principles (GAAP).

Water Expenses, year-to-date, are **above budget $115,797 or 20.6%.** Savings were seen in the following categories: repairs and maintenance, chemicals, memberships, and conservation. These savings were more than offset by the temporary filtration expenses related to the WTP Expansion project. Project-to-date, the District has paid $265,603 for temporary filtration ($224,590 in the current fiscal year).

Sewer Expenses, year-to-date, are **below budget by $100,428 or (28.9%).** Savings have been seen across most sewer expense categories so far this year, with the largest savings being seen in salaries and wages, repairs and maintenance, chemicals, consulting, power, and training.

Drainage Expenses, year-to-date, are **below budget by $5,690 or (13.5%)**. Year-to-date wages and employer costs are over budget $3,161, but are more than offset by savings in consulting, repairs and maintenance, and equipment rental.

Security Expenses, year-to-date, are **below budget by $11,610 or (3.3%).** Security was under budget by $29K in wages and employer costs through the end of October. This savings is related to a vacancy in the Security (patrol) Department during the first part of the fiscal year. These savings are offset by roughly $15K paid to PDF Tactical, which provided contract patrol personnel during the vacancy.

Solid Waste Expenses, year-to-date, are **above budget by $87 or 0.0%**.

General Expenses, year-to-date, are **above budget by $17,998 or 4.6%.** This variance is comprised almost solely of legal expenses.

Net Income: Year-to-date unadjusted net income, before depreciation, is $234,439 versus a budget of $243,278. Net income/(Loss) adjusted for estimated depreciation expense is ($124,773).

The full-year expected net operating income before depreciation, per the 2015-2016 budget is $44,782.

Rancho Murieta Community Services District
Summary Budget Performance Report
YTD THROUGH OCTOBER 2015

	% of Total	Annual Budget	% of Total	YTD Budget	YTD Actuals	% of Total	YTD VARIANCE Amount	YTD VARIANCE %
REVENUES								
Water Charges	33.1%	$2,009,940	37.1%	$792,815	$717,333	34.0%	($75,482)	(9.5%)
Sewer Charges	22.0%	1,331,590	20.6%	441,209	441,678	20.9%	469	0.1%
Drainage Charges	3.1%	187,130	2.9%	62,380	62,314	3.0%	(66)	(0.1%)
Security Charges	20.7%	1,253,900	19.5%	417,964	418,717	19.8%	753	0.2%
Solid Waste Charges	10.5%	636,658	9.9%	212,220	212,238	10.1%	18	0.0%
Other Income	1.9%	116,750	1.7%	36,040	78,277	3.7%	42,237	117.2%
Interest Earrnings	0.0%	1,090	0.0%	515	3,905	0.2%	3,390	658.3%
Property Taxes	8.7%	528,480	8.2%	176,160	176,160	8.3%		0.0%
Total Revenues	***100.0%***	***6,065,538***	***100.0%***	***2,139,303***	***2,110,622***	***100.0%***	***(28,681)***	***(1.3%)***
OPERATING EXPENSES								
Water/Sewer/Drainage								
Wages	14.7%	887,710	13.8%	262,400	259,185	13.8%	(3,215)	(1.2%)
Employer Costs	7.2%	430,690	7.2%	136,100	131,376	7.0%	(4,724)	(3.5%)
Capital Project Labor Alloc	0.0%		0.0%		(46,536)	-2.5%	(46,536)	0.0%
Power	7.5%	453,900	5.5%	104,641	94,478	5.0%	(10,163)	(9.7%)
Chemicals	3.4%	204,400	4.4%	83,095	38,833	2.1%	(44,262)	(53.3%)
Maint & Repair	6.0%	359,220	6.0%	113,030	61,321	3.3%	(51,709)	(45.7%)
Meters/Boxes	0.9%	54,000	0.9%	16,500	15,923	0.8%	(577)	(3.5%)
Lab Tests	0.7%	44,200	0.7%	12,400	12,251	0.7%	(149)	(1.2%)
Permits	1.2%	73,100	1.2%	22,801	19,239	1.0%	(3,562)	(15.6%)
Training/Safety	0.4%	21,500	0.5%	8,800	1,769	0.1%	(7,031)	(79.9%)
Equipment Rental	1.0%	57,500	1.1%	21,550	237,801	12.7%	216,251	1,003.5%
Other	7.5%	454,166	9.0%	170,644	136,000	7.2%	(34,644)	(20.3%)
Subtotal Water/Sewer/Drainage	**50.5%**	**3,040,386**	**50.2%**	**951,961**	**961,640**	**51.3%**	**9,679**	**1.0%**
Security								
Wages	11.1%	671,100	10.4%	197,300	178,363	9.5%	(18,937)	(9.6%)
Employer Costs	6.4%	386,400	6.4%	121,500	111,405	5.9%	(10,095)	(8.3%)
Off Duty Sheriff Patrol	0.1%	4,000	0.1%	2,700	5,367	0.3%	2,667	98.8%
Other	1.9%	113,360	1.7%	32,679	47,434	2.5%	14,755	45.2%
Subtotal Security	**19.5%**	**1,174,860**	**18.7%**	**354,179**	**342,569**	**18.3%**	**(11,610)**	**(3.3%)**
Solid Waste								
CWRS Contract	9.2%	556,740	9.8%	185,580	185,640	9.9%	60	0.0%
Sacramento County Admin Fee	0.6%	34,740	0.6%	11,580	11,607	0.6%	27	0.2%
HHW Event	0.1%	9,000	0.0%			0.0%		0.0%
Subtotal Solid Waste	**10.0%**	**600,480**	**10.4%**	**197,160**	**197,247**	**10.5%**	**87**	**0.0%**
General / Admin								
Wages	8.4%	505,100	7.6%	143,900	146,156	7.8%	2,256	1.6%
Employer Costs	5.0%	302,200	5.0%	94,400	85,893	4.6%	(8,507)	(9.0%)
Insurance	1.4%	86,400	1.5%	28,800	29,012	1.5%	212	0.7%
Legal	0.7%	42,000	0.7%	14,000	31,839	1.7%	17,839	127.4%
Office Supplies	0.4%	22,800	0.4%	7,600	7,154	0.4%	(446)	(5.9%)
Director Meetings	0.3%	18,000	0.3%	6,000	2,900	0.2%	(3,100)	(51.7%)
Telephones	0.1%	6,000	0.1%	2,000	2,330	0.1%	330	16.5%
Information Systems	1.3%	79,400	1.9%	36,662	36,521	1.9%	(141)	(0.4%)
Community Communications	0.1%	5,900	0.1%	1,800	1,870	0.1%	70	3.9%
Postage	0.4%	22,200	0.4%	7,400	6,090	0.3%	(1,310)	(17.7%)
Janitorial/Landscape Maint	0.3%	17,820	0.3%	5,940	6,549	0.3%	609	10.3%
Other	1.6%	97,210	2.3%	44,223	18,413	1.0%	(25,810)	(58.4%)
Subtotal General / Admin	**20.0%**	**1,205,030**	**20.7%**	**392,725**	**374,727**	**20.0%**	**(17,998)**	**(4.6%)**
Total Operating Expenses	***100.0%***	***6,020,756***	***100.0%***	***1,896,025***	***1,876,183***	***100.0%***	***(19,842)***	***(1.0%)***
Operating Income (Loss)	***100.0%***	***44,782***	***100.0%***	***243,278***	***234,439***	***100.0%***	***(8,839)***	***(3.6%)***
Non-Operating Expenses								
Net Income (Loss)	***100.0%***	***44,782***	***100.0%***	***243,278***	***234,439***	***100.0%***	***(8,839)***	***(3.6%)***

Rancho Murieta Community Services District
Budget Performance Report by FUND
YTD THROUGH OCTOBER 2015

	% of Total	Annual Budget	% of Total	YTD Budget	YTD Actuals	% of Total	YTD VARIANCE Amount	YTD VARIANCE %
WATER								
REVENUES								
Water Charges	98.3%	$2,009,940	98.8%	$792,815	$717,333	93.4%	($75,482)	(9.5%)
Interest Earnings	0.0%	80	0.0%	40	1,255	0.2%	1,215	3,037.5%
Other Income	1.7%	34,850	1.2%	9,948	49,265	6.4%	39,317	395.2%
Total Water Revenues	**100.0%**	**2,044,870**	**100.0%**	**802,803**	**767,853**	**100.0%**	**(34,950)**	**(4.4%)**
EXPENSES (excluding depreciation)								
Wages	27.2%	479,360	25.2%	141,696	167,257	24.6%	25,561	18.0%
Employer Costs	13.2%	232,890	13.1%	73,494	81,775	12.0%	8,281	11.3%
Capital Project Labor Alloc	0.0%		0.0%		(46,536)	-6.9%	(46,536)	0.0%
Power	17.2%	303,400	10.1%	56,841	52,756	7.8%	(4,085)	(7.2%)
Chemicals	7.1%	124,500	8.9%	50,035	16,802	2.5%	(33,233)	(66.4%)
T&O - Chemicals/Treatment	0.4%	7,200	0.6%	3,600	4,608	0.7%	1,008	28.0%
Maint & Repair	9.1%	161,070	9.8%	55,030	30,486	4.5%	(24,544)	(44.6%)
Meters/Boxes	3.1%	54,000	2.9%	16,500	15,923	2.3%	(577)	(3.5%)
Lab Tests	1.6%	28,000	1.2%	7,000	2,835	0.4%	(4,165)	(59.5%)
Permits	1.8%	32,000	1.8%	10,000	8,996	1.3%	(1,004)	(10.0%)
Training/Safety	0.5%	9,300	0.5%	2,600	1,153	0.2%	(1,447)	(55.7%)
Equipment Rental	2.1%	37,000	2.3%	13,200	232,196	34.2%	218,996	1,659.1%
Other Direct Costs	16.6%	292,906	23.6%	132,903	110,445	16.3%	(22,458)	(16.9%)
Operational Expenses	**100.0%**	**1,761,626**	**100.0%**	**562,899**	**678,696**	**100.0%**	**115,797**	**20.6%**
Water Income (Loss)	**16.1%**	**283,244**	**42.6%**	**239,904**	**89,157**	**13.1%**	**(150,747)**	**(62.8%)**
38.9% Net Admin Alloc	**16.1%**	**283,529**	**16.2%**	**91,206**	**82,882**	**12.2%**	**(8,324)**	**(9.1%)**
Total Net Income (Loss)	***0.0%***	***(285)***	***26.4%***	***148,698***	***6,275***	***0.9%***	***(142,423)***	***(95.8%)***
SEWER								
REVENUES								
Sewer Charges	98.5%	1,331,590	98.6%	441,209	441,678	98.8%	469	0.1%
Interest Earnings	0.0%	140	0.0%	60	54	0.0%	(6)	(10.0%)
Other Income	1.5%	20,140	1.4%	6,108	5,515	1.2%	(593)	(9.7%)
Total Sewer Revenues	**100.0%**	**1,351,870**	**100.0%**	**447,377**	**447,247**	**100.0%**	**(130)**	**0.0%**
EXPENSES (excluding depreciation)								
Wages	30.5%	346,210	29.5%	102,336	71,156	28.9%	(31,180)	(30.5%)
Employer Costs	14.8%	167,700	15.3%	53,079	39,317	15.9%	(13,762)	(25.9%)
Power	12.4%	140,700	13.1%	45,600	39,848	16.2%	(5,752)	(12.6%)
Chemicals	6.2%	70,300	8.3%	28,660	15,416	6.3%	(13,244)	(46.2%)
Maint & Repair	16.4%	186,250	15.6%	54,000	29,735	12.1%	(24,265)	(44.9%)
Lab Tests	1.4%	16,200	1.6%	5,400	9,416	3.8%	4,016	74.4%
Permits	3.1%	35,100	3.7%	12,801	10,243	4.2%	(2,558)	(20.0%)
Training/Safety	1.1%	12,200	1.8%	6,200	616	0.2%	(5,584)	(90.1%)
Equipment Rental	1.4%	16,000	1.8%	6,350	5,605	2.3%	(745)	(11.7%)
Other Direct Costs	12.8%	145,270	9.4%	32,511	25,157	10.2%	(7,354)	(22.6%)
Operational Expenses	**100.0%**	**1,135,930**	**100.0%**	**346,937**	**246,509**	**100.0%**	**(100,428)**	**(28.9%)**
Sewer Income (Loss)	**19.0%**	**215,940**	**29.0%**	**100,440**	**200,738**	**81.4%**	**100,298**	**99.9%**
29.7% Net Admin Alloc	**19.1%**	**216,475**	**20.1%**	**69,635**	**63,280**	**25.7%**	**(6,355)**	**(9.1%)**
Total Net Income (Loss)	***0.0%***	***(535)***	***8.9%***	***30,805***	***137,458***	***55.8%***	***106,653***	***346.2%***
DRAINAGE								
REVENUES								
Drainage Charges	100.0%	187,130	100.0%	62,380	62,314	100.0%	(66)	(0.1%)
Interest Earnings	0.0%	50	0.0%	25	14	0.0%	(11)	(44.0%)
Total Drainage Revenues	**100.0%**	**187,180**	**100.0%**	**62,405**	**62,328**	**100.0%**	**(77)**	**(0.1%)**
EXPENSES (excluding depreciation)								
Wages	43.5%	62,140	43.6%	18,368	20,772	57.0%	2,404	13.1%
Employer Costs	21.1%	30,100	22.6%	9,527	10,284	28.2%	757	7.9%
Power	6.9%	9,800	5.2%	2,200	1,874	5.1%	(326)	(14.8%)
Chemicals	1.7%	2,400	1.9%	800	2,007	5.5%	1,207	150.9%
Maint & Repair	8.3%	11,900	9.5%	4,000	1,100	3.0%	(2,900)	(72.5%)
Permits	4.2%	6,000	0.0%			0.0%		0.0%
Equipment Rental	3.2%	4,500	4.7%	2,000		0.0%	(2,000)	(100.0%)
Other Direct Costs	11.2%	15,990	12.4%	5,230	398	1.1%	(4,832)	(92.4%)
Operational Expenses	**100.0%**	**142,830**	**100.0%**	**42,125**	**36,435**	**100.0%**	**(5,690)**	**(13.5%)**
Drainage Income (Loss)	**31.1%**	**44,350**	**48.1%**	**20,280**	**25,893**	**71.1%**	**5,613**	**27.7%**
6.1% Net Admin Alloc	**31.1%**	**44,461**	**34.0%**	**14,302**	**12,997**	**35.7%**	**(1,305)**	**(9.1%)**
Total Net Income (Loss)	***-0.1%***	***(111)***	***14.2%***	***5,978***	***12,896***	***35.4%***	***6,918***	***115.7%***
SECURITY								
REVENUES								
Security Charges	91.6%	1,253,900	91.6%	417,964	418,717	91.2%	753	0.2%
Interest Earnings	0.0%	400	0.0%	200	297	0.1%	97	48.5%
Property Tax	4.8%	65,040	4.8%	21,680	21,680	4.7%		0.0%
Other Income	3.6%	49,160	3.6%	16,384	18,480	4.0%	2,096	12.8%

Rancho Murieta Community Services District
Budget Performance Report by FUND
YTD THROUGH OCTOBER 2015

	% of Total	Annual Budget	% of Total	YTD Budget	YTD Actuals	% of Total	YTD VARIANCE Amount	YTD VARIANCE %
Total Security Revenues	**100.0%**	**$1,368,500**	**100.0%**	**$456,228**	**$459,174**	**100.0%**	**$2,946**	**0.6%**
EXPENSES (excluding depreciation)								
Wages	57.1%	671,100	55.7%	197,300	178,363	52.1%	(18,937)	(9.6%)
Employer Costs	32.9%	386,400	34.3%	121,500	111,405	32.5%	(10,095)	(8.3%)
Equipment Repairs	0.4%	4,900	0.4%	1,468	694	0.2%	(774)	(52.7%)
Vehicle Maintenance	0.8%	9,600	0.9%	3,200	4,820	1.4%	1,620	50.6%
Vehicle Fuel	1.7%	19,390	2.0%	7,200	5,991	1.7%	(1,209)	(16.8%)
Off Duty Sheriff Patrol	0.3%	4,000	0.8%	2,700	5,367	1.6%	2,667	98.8%
Other	6.8%	79,470	5.9%	20,811	35,929	10.5%	15,118	72.6%
Operational Expenses	**100.0%**	**1,174,860**	**100.0%**	**354,179**	**342,569**	**100.0%**	**(11,610)**	**(3.3%)**
Security Income (Loss)	**16.5%**	**193,640**	**28.8%**	**102,049**	**116,605**	**34.0%**	**14,556**	**14.3%**
20.3% Net Admin Alloc	**12.6%**	**147,961**	**13.5%**	**47,738**	**43,252**	**12.6%**	**(4,486)**	**(9.4%)**
Total Net Income (Loss)	***3.9%***	***45,679***	***15.3%***	***54,311***	***73,353***	***21.4%***	***19,042***	***35.1%***
SOLID WASTE								
REVENUES								
Solid Waste Charges	100.0%	636,658	99.9%	212,220	212,238	99.9%	18	0.0%
Interest Earnings	0.0%	300	0.1%	150	120	0.1%	(30)	(20.0%)
Total Solid Waste Revenues	**100.0%**	**636,958**	**100.0%**	**212,370**	**212,358**	**100.0%**	**(12)**	**0.0%**
EXPENSES (excluding depreciation)								
CWRS Contract	92.7%	556,740	94.1%	185,580	185,640	94.1%	60	0.0%
Sacramento County Admin Fee	5.8%	34,740	5.9%	11,580	11,607	5.9%	27	0.2%
HHW Event	1.5%	9,000	0.0%			0.0%		0.0%
Operational Expenses	**100.0%**	**600,480**	**100.0%**	**197,160**	**197,247**	**100.0%**	**87**	**0.0%**
Solid Waste Income (Loss)	**6.1%**	**36,478**	**7.7%**	**15,210**	**15,111**	**7.7%**	**(99)**	**(0.7%)**
5.0% Net Admin Alloc	**6.1%**	**36,444**	**5.9%**	**11,723**	**10,653**	**5.4%**	**(1,070)**	**(9.1%)**
Total Net Income (Loss)	***0.0%***	***34***	***1.8%***	***3,487***	***4,458***	***2.3%***	***971***	***27.8%***
OVERALL NET INCOME(LOSS)	***100.0%***	***44,782***	***100.0%***	***243,279***	***234,440***	***100.0%***	***(8,839)***	***(3.6%)***

RANCHO MURIETA COMMUNITY SERVICES DISTRICT

INVESTMENT REPORT

CASH BALANCE AS OF OCTOBER 31, 2015

INSTITUTION		YIELD		BALANCE
CSD FUNDS				
EL DORADO SAVINGS BANK				
SAVINGS		0.03%	$	86,930.20
CHECKING		0.02%	$	93.39
PAYROLL		0.02%	$	67,048.37
AMERICAN WEST BANK				
EFT		0.05%	$	13,761.65
LOCAL AGENCY INVESTMENT FUND (LAIF)				
UNRESTRICTED		0.36%	$	1,673,934.75
RESTRICTED RESERVES		0.36%	$	3,988,483.80
CALIFORNIA ASSET MGMT (CAMP)				
OPERATION ACCOUNT		0.12%	$	598,693.06
UNION BANK				
PARS GASB45 TRUST	(balance as of 9/30/15)		$	873,615.95
	TOTAL		**$**	**7,302,561.17**
BOND FUNDS				
COMMUNITY FACILITIES DISTRICT NO. 1 (CFD)				
BANK OF AMERICA				
CHECKING		0.00%	$	21,516.19
CALIFORNIA ASSET MGMT (CAMP)				
SPECIAL TAX		0.12%	$	8,311.43
COMMUNITY FACILITIES DISTRICT NO. 2014-1 (CFD)				
BANK OF AMERICA				
CHECKING		0.00%	$	900,304.89
WILMINGTON TRUST	(balances as of 10/31/15)			
BOND RESERVE FUND		0.02%	$	391,566.71
BOND ADMIN EXPENSE		0.02%	$	40,404.10
BOND SPECIAL TAX FUND		0.02%	$	369,147.32
BOND ACQ & CONSTRUCTION		0.02%	$	837.96
BOND REDEMPTION ACCOUNT		0.00%	$	-
BOND COI		0.00%	$	-
BOND SURPLUS		0.00%	$	-
			$	**1,732,088.60**
	TOTAL ALL FUNDS		**$**	**9,034,649.77**

The investments comply with the CSD adopted investment policy.

PREPARED BY: Eric Thompson, Controller

MEMORANDUM

Date: November 11, 2015

To: Board of Directors

From: Greg Remson, Security Chief

Subject: Security Report for the Month of October 2015

OPERATIONS

Halloween overall went smoothly. There were lots of kids and adults out in the good weather. There were also many guests that came to Rancho Murieta for the evening.

Both of our new Patrol Officers, Kyle Karr and Branden Arino, have completed their training and are working on their own.

INCIDENTS OF NOTE

October 2, Friday, reported at 10:00 a.m. on Agradar Drive. Burglary. Jewelry was taken from a bedroom. No sign of forced entry. Sacramento County Sheriff's Department (SSD) report was filed.

October 5, Monday, reported at 3:30 p.m. on Poncho Conde at Murieta Drive. Hit and run with property damage. A vehicle struck the stone entrance post, also damaging the stop sign. Unknown persons replaced the stop sign.

October 5, Monday, reported at 4:22 p.m. at the Gazebo. Theft of a brown motorcycle cover.

October 14, Wednesday, reported at 7:30 a.m. on Lago Drive. Hit and run with property damage. An unknown vehicle rear ended a parked, unoccupied vehicle and left the scene. California Highway Patrol (CHP) responded for a report. The driver returned to the scene after taking the kids to school.

October 14, Wednesday, reported at 12:32 p.m. at the Country Store. Public intoxication. Report of a female who was stumbling and fell while walking. Parking lot and area checked clear.

October 16, Friday, reported at 11:45 a.m. on Lago Drive. Suspicious person. Older male in a golf cart asked 15 year old female if she wanted a ride. Information forwarded to SSD.

October 18, Sunday, reported at 10:35 p.m. on Rebano Court. Family violence. Advised to call SSD.

October 21, Wednesday, reported at 9:39 a.m. on the South Course #8. Vandalism. Wires to the sprinklers were cut. Referred to SSD.

October 23, Friday, reported at 9:27 p.m. at the Post Office area. Public intoxication. Transported home by a sober friend.

October 23, Friday, reported at 11:50 p.m. at Clementia Park. Public intoxication. Adult son retrieved by his father.

October 25, Sunday, reported at 10:54 a.m. at Murieta Plaza. Water theft. Report of water being taken from a hydrant and pumped into a machine on a flat bed. Area checked clear.

October 30, Friday, reported at 8:32 a.m. at the Villas. Public intoxication. Known resident went home.

October 31, Saturday, reported at 1:24 p.m. at Clementia Park. Theft. Juveniles took property from the bed of a pickup. Victim located suspects and retrieved property. SSD notified.

During October, Security Officers responded to calls including knocking over garbage cans, marijuana smoking, trespassing, loud music, and parties.

RANCHO MURIETA ASSOCIATION COMPLIANCE/GRIEVANCE/SAFETY COMMITTEE MEETING
The meeting was held on October 5, 2015 at the Rancho Murieta Association (RMA) office. There were hearings regarding parking, property maintenance, stored vehicles, park hours, and speeding. The next meeting is scheduled for November 2, 2015.

MEMORANDUM

Date: November 13, 2015

To: Board of Directors

From: Paul Siebensohn, Director of Field Operations

Subject: Water/Wastewater/Drainage Report

The following is District Field Operations information and projects staff has worked on since the last Regular Board meeting.

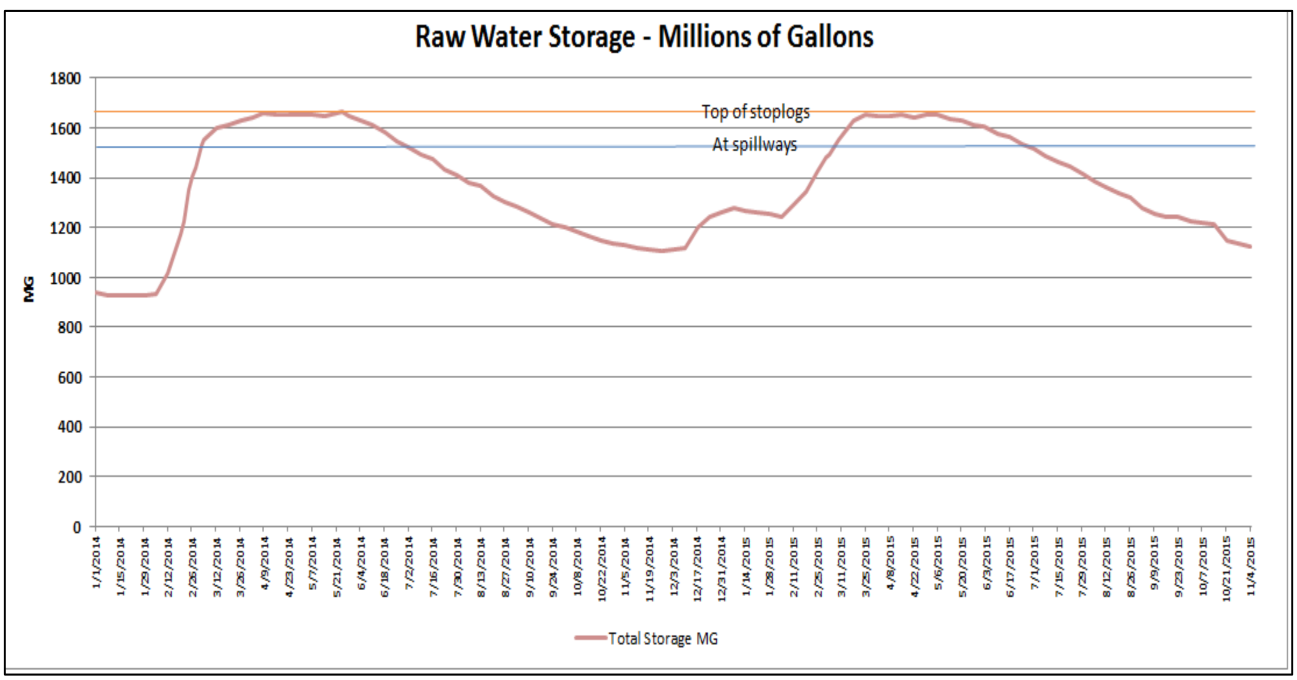
WATER

Plant #2 is solely providing the District's water needs and is set at 1.5 mgd producing an average of 1.1 mgd. Water treatment plant production flow for October was 44,145,000 gallons.

Water Source of Supply

On November 4, 2015, the combined raw water storage for Calero, Chesbro, and Clementia Reservoirs measured approximately 1,124.3 MG (3,450.6 AF) of which 960.4 MG (2,947.5 AF) is usable due to dead storage. For Calero and Chesbro Reservoirs alone, the storage measured 862.3 MG (2,646.6 AF), or 813 MG (2,193.6AF) usable.

For reference, a recent average year's production has been 580.1 MG (1,781 AF). The reservoirs are at 80 percent capacity as measured to their spillways. Below is a graphical representation of the storage reservoir levels this year to date.

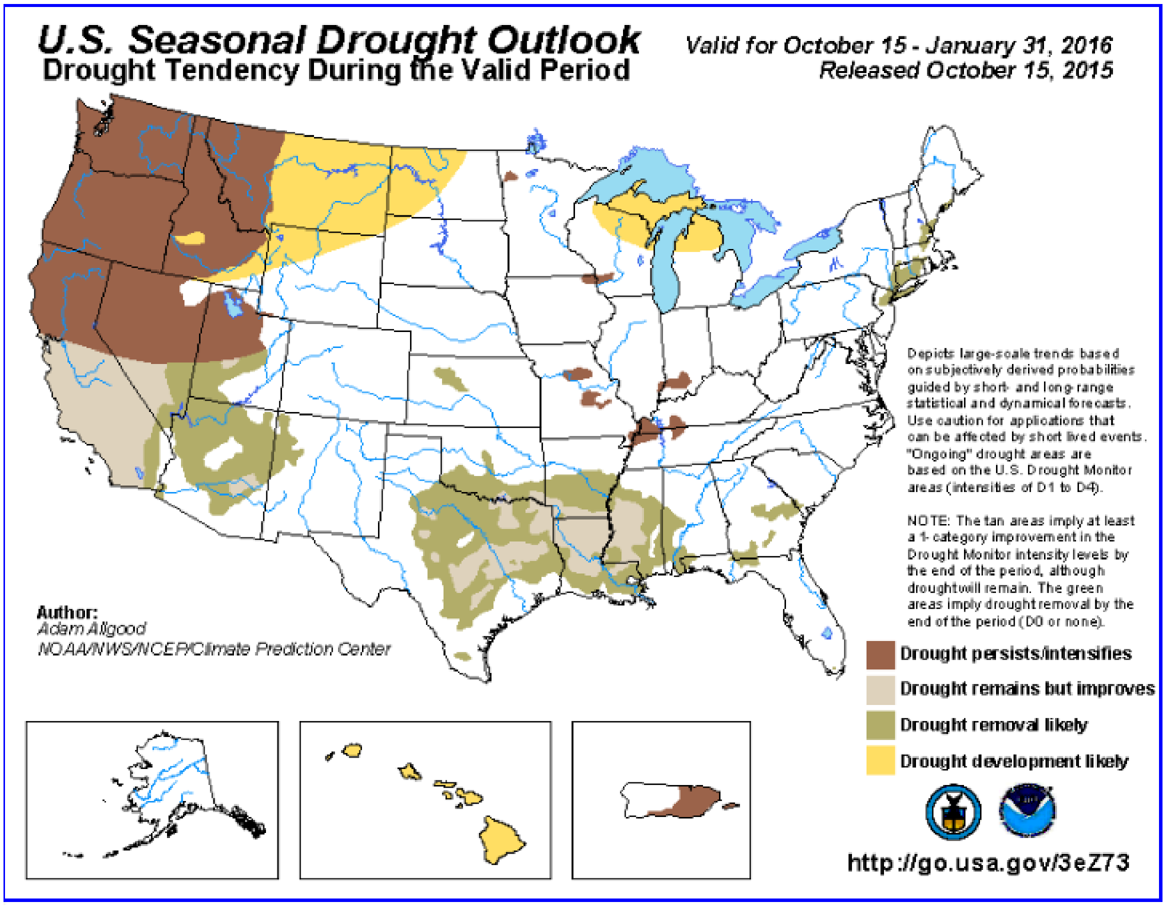


CONSERVATION

The US Drought Monitor and US Seasonal Drought Outlook graphics shown below indicates that California continues to be in exceptional drought.

The State drought mandates and our water conservation schedule is still in effect and staff is continuing monitoring the community for compliance. Calendar year to date, 342 tags have been issued and 5 fines levied to gain compliance with the District's water conservation program.

The community's October potable usage was 28.1% less than October 2013 potable use, showing that the community continues to do an excellent job conserving water. The residential gallons per capita per day usage for October 2015 was 172 R-GPCD.



WASTEWATER TREATMENT, COLLECTION AND RECLAMATION

Influent wastewater flow averaged 0.332 million gallons a day, for a total around 10.3 MG, (31.6 AF) for the month. This is approximately 138 gpd per sewer connection. On November 4, 2015 secondary wastewater storage measured 24 MG (73.4 AF), of which 19.2 MG (58.8 acre-feet) is usable volume.

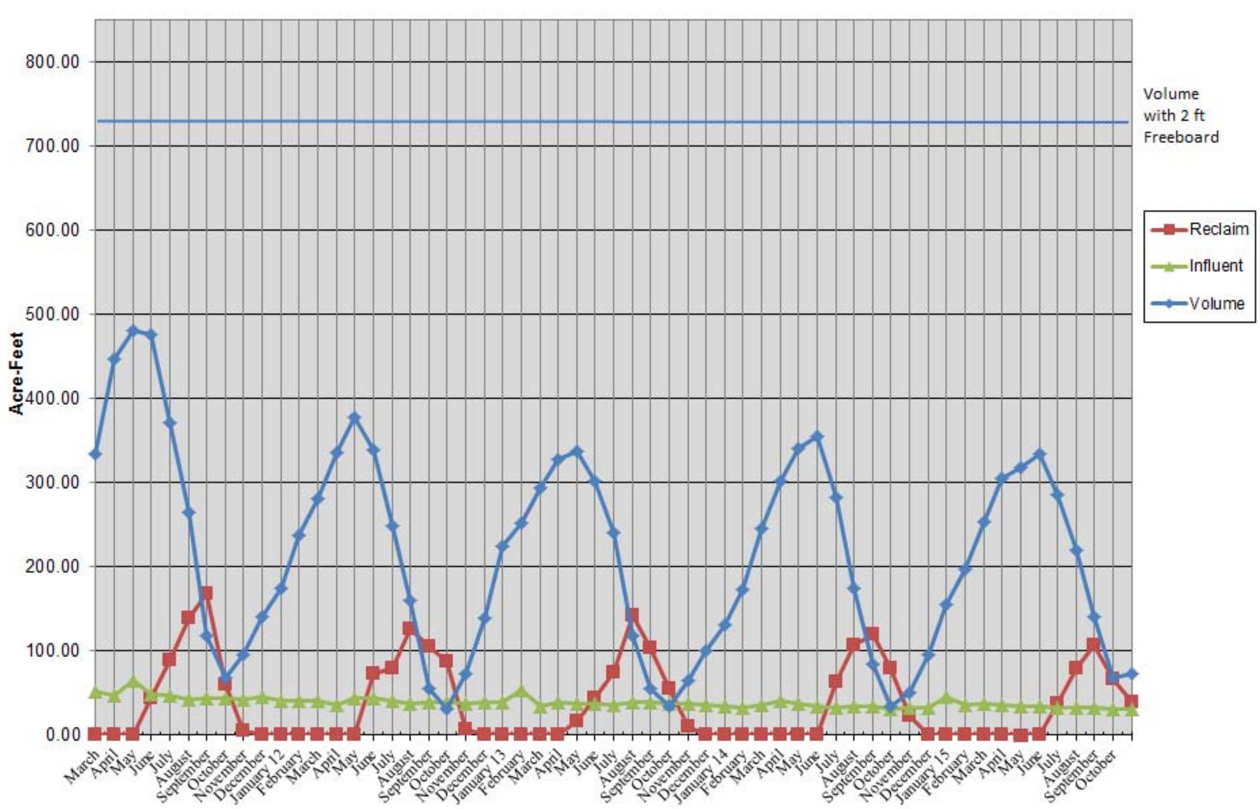
The District delivered 12,490,000 gallons of recycled water to Rancho Murieta Country Club (RMCC) at their requested flow rate. We also delivered 730,000 gallons of recycled water to the

Van Vleck ranch as part of the easement agreement we maintain with the Ranch and to draw down our secondary storage levels to accommodate winter inflows. The reclamation facility is off line now for the winter season and RMCC has drawn down their recycled water holding ponds, 16 and 17, as part of managing the prevention of recycled water spills due to rainfall runoff.

Maintenance in the collection system included video inspections of the sewer main in Unit #2 lateral F and in Unit #3 lateral H.

The graph below shows where our secondary storage is comparable to previous years, measured on the first Wednesday of each month.

Volume of Secondary Wastewater in Reservoirs 2011-2015



DRAINAGE / CIA DITCH

Utility staff has continued inspecting drainage culverts and ditch flow lines to prepare for the upcoming winter season which may provide higher than average rainfall. Maintenance included thoroughly cleaning the Chesbro protection ditch, vegetation control in North Unit 4, zone 2, B, and flow line modification in North Unit 3 zone 3, A near 4 park Via Del Cerrito.

The CIA ditch is back in operation per the request of the Anderson Ranch. Recent rains, shorter days and cooler nights have allowed the Cosumnes River to flow again which allowed the Department of Water Resources to lift the curtailments for water diversions that were previously in place due to the drought.

WATER METERING AND UTILITY STAFF WORK

Utility staff replaced eight (8) ¾", two (2) 1" water meters, and one (1) MXU radio read units. Five (5) water service lines were repaired, due to leaks. Also completed were ten (10) underground service alerts (USAs), four (4) water service restores, nine (9) final reads, and two (2) toilet rebate inspection.

Darlene Gillum

From: bsample@ecorisk.com
Sent: Wednesday, October 21, 2015 1:25 PM
To: Darlene Gillum
Cc: Mark Pecotich
Subject: Development related questions
Attachments: FW: MMRPs for ongoing projects in Rancho Murieta; OHWD / Rancho Murieta Groundwater Recharge Project; Need for a study to evaluate the implications of development on water quality

Hi Darlene,

I forwarding to you a set of emails that I recently sent to Mark Pecotich in relation to three separate development-related issues. He asked that I pass them on to you so that they could be included as part of the development discussion at this evenings CSD Board meeting. I will try to make it to the meeting, but in case I cannot, I wanted you to have copies that could be included in the record, plus there are attachments with supporting documentation that should be considered. The three topics are as follows:

- **Asbestos** - I've talked to Joelle Inman, planner for the County who put me in touch with Eric Stackhouse who is in charge of mitigation monitoring for the County. It appears that the analytical methods used to test for asbestos in soil in Rancho Murieta are consistent with Air Resources Board guidance. However, I do not think that the method is suitable or appropriate for our situation where excavation will be (is) occurring within a densely populated residential community and adjacent to our water supply. I have talked with Dr. Neumann of the ARB developed the method. She indicated that a revision to the method and guidance is in the works. In the meantime, I will be contacting the Sacramento Metro Air Quality Management District as they are the key agency charged with overseeing naturally occurring asbestos monitoring.

  Ultimately we have an issue in that the method that is being used has been shown to have a high likelihood of not detecting asbestos when in fact it is present. Other methods are available that have higher resolution and are more reliable. Given that excavation for development will be located within the center of our community and adjacent to our water supply, I believe that it is essential that we obtain the best information possible before any large scale excavation occurs. I'm hoping that CSD can enter into discussions with both the County and the Developers to ensure that the most appropriate and reliable methods for asbestos analyses are used so that the community can have peace of mind that development will not result in exposure to naturally occurring asbestos.

- **OHWD / Rancho Murieta Groundwater Recharge Project** - was the OHWD / Rancho Murieta Groundwater Recharge Project funded by the state? Is this project current ongoing? Also, How does the groundwater well described in this project relate to the GW wells being discuss in support of development? Same or different wells? Is the project going to undergo a complete EIR in order to fully quantify the potential impacts associated with groundwater extraction?

- **Need for a study to evaluate the implications of development on water quality** - The current development plans propose substantial construction of houses, roads, and associated infrastructure in the immediate vicinity of our three drinking water reservoirs. This will result in a considerable alteration of the landscape around our drinking water. There is considerable information that stormwater runoff and other outputs from residential development can result in contamination of drinking water.

  Since these reservoirs are the only water supply for the entire community, it is imperative that any development that takes place within their catchment basins is done in a way that will not degrade water quality. With the EIR just getting ready to be initiated, we are at the perfect time to develop data that quantifies the potential impacts that proposed development may have on our water quality and that can be used to help guide appropriate mitigation to any impacts identified. This study should be conducted using funds from the Developers, but managed and directed by CSD (i.e., with no input from the developer concerning selection of a consultant, study design or analysis, etc.). Once completed, it could be provided to the County for inclusion in the EIR.

If you have any questions, please do not hesitate to contact me. Thanks much!

Brad

Bradley E. Sample, Ph.D.
Principal Scientist
Ecological Risk, Inc.
15036 Magno Ct.
Rancho Murieta, CA 95683
Mobile: 916-801-6440
Phone: 916-354-2255
email: bsample@ecorisk.com

California Environmental Protection Agency

Air Resources Board

Method 435

Determination of Asbestos Content of Serpentine Aggregate

Adopted: June 6, 1991

Method 435

Determination of Asbestos Content of Serpentine Aggregate

1 PRINCIPLE AND APPLICABILITY

1.1 Principle.

Asbestos fibers may be released from serpentine rock formations and are determined by microscopic techniques. The results are very sensitive to sampling procedures. The analytical results are reported in percent asbestos fibers which is the percent number of asbestos fibers contained in 400 randomly chosen particles of a bulk sample. Since the homogeneity of the material is unknown, the uncertainty in the sampling cannot be defined. The uncertainty of the analytical technique is two percent if twenty asbestos fibers are counted in a sample of 400 particles. The derivation of this uncertainty value is explained in Section 7.4.

1.2 Applicability.

This method is applicable to determining asbestos content of serpentine aggregate in storage piles, on conveyor belts, and on surfaces such as roads, shoulders, and parking lots.

2 DEFINITIONS

2.1 Bulk Sample

A sample of bulk material.

2.2 Grab Sample

A sample taken from a volume of material.

2.3 Composite Sample

A mixture or blend of material from more than one grab sample.

2.4 Serpentine

Serpentinite, serpentine rock or serpentine material.

2.5 Executive Officer

The term Executive Officer as used in this method shall mean the Executive Officer of the Air Resources Board (ARB) or Air Pollution Control Officer/Executive Officer of a local air pollution control district/air quality management district.

3 APPLICABLE SOURCES

This method can be used to obtain bulk material samples from three types of sources:

1. Serpentine aggregate storage piles,
2. Serpentine aggregate conveyor belts
3. Serpentine aggregate covered surfaces.

4 SAMPLING APPARATUS

4.1 Serpentine Aggregate Storage Piles.

Tube insertion often provides the simplest method of aggregate material investigation and sampling. Insertion tubes shall be adequate to provide a relatively rapid continuous penetration force.

4.1.1 Thin-walled tubes should be manufactured as shown in Figure 1. The tube should have an outside diameter between 2 to 5 inches and be made of metal or plastic having adequate strength for penetration into aggregate piles. These tubes shall be clean and free of surface irregularities including projecting weld seams. Further information on these tubes can be found in Table 1 and ASTM D 1587-83, which is incorporated herein by reference.

4.1.2 The insertion tube can be made out of commercially available two inch PVC Schedule 40 pipe. Further information on the tube can be found in Table 2.

4.1.3 A round point shovel may be used.

4.2 Serpentine Aggregate Conveyor Belts.

4.2.1 Sampling of aggregate off a conveyor belt requires a hand trowel, a small brush, and a dust pan.

4.2.2 Two templates as shown in Figure 2 are needed to isolate material on the conveyor belt.

4.2.3 An automated belt sampler may be used.

4.3 Serpentine Aggregate Covered Surfaces.

A shovel, a hand or machine-operated auger or other suitable equipment can be used to collect samples of aggregate materials on covered surfaces.

4.3.1 Hand-Operated Augers.

4.3.1.1 Helical Augers-Small lightweight augers such as spiral-type augers and ship-type augers may be used. A description of these augers can be found in ASTM D1452-80, which is incorporated herein by reference.

4.3.1.2 Orchard barrel and open spiral-type tubular augers may be used to collect samples. These augers range in size from 1.5 through 8 inches, and have the common characteristic of appearing essentially tubular when viewed from the digging end. Further description of these auger types can be found in ASTM D1452-80.

4.3.1.3 Clam Shell or Iwan-Type post-hole augers may be used to collect samples from surfaces generally 2 through 8 inches in diameter and have a common mean of blocking the escape of soil from the auger. Further description of these augers can be found in ASTM D1452-80.

4.3.2 Machine-Operated Augers

Machine-Operated Augers such as helical augers and stinger augers may be used. These augers are normally operated by heavy-duty, high-torque machines, designed for heavy construction work. Further description of these augers can be found in ASTM D1452-80.

4.3.3 A round point shovel can also be used to obtain a sample of aggregate covered surface material.

5 SAMPLING

The sampling procedure has been developed to provide an unbiased collection of bulk samples. A sampling plan, including a description of how the grab samples will be randomly collected and the number of samples to be collected, shall be developed. Prior to conducting any sampling the sampling plan shall be submitted to the Executive Officer for approval, if the sampling is conducted for determining compliance with a rule or regulation. The amount of composite 200 mesh material, as described below, shall be sufficient to provide sample to the source or Executive Officer, if requested, and a sample to be archived for future use.

A single test as described below shall cover:

a) 1000 tons of aggregate for piles and conveyor belts, or
b) one acre aggregate covered surface, or
c) one mile of aggregate covered road, or

d) two acres or two miles of dual aggregate covered shoulders.

Exposure to airborne asbestos fibers is a health hazard. Asbestos has been listed by the Governor as causing cancer and identified by the Air Resources Board as a toxic air contaminant. Serpentine aggregate may contain asbestos. Bulk samples collected can contain friable asbestos fibers and may release fibers during sampling, handling or crushing steps. Adequate safety precautions should be followed to minimize the inhalation of asbestos fibers. Crushing should be carried out in a ventilated hood with continuous airflow (negative pressure) exhausting through an HEPA filter. Handling of samples without these precautions may result in the inhalation of airborne asbestos fibers.

5.1 Serpentine Aggregate Storage Piles.

Serpentine aggregate storage piles typically have a conical or a triangular prism shape. The aggregate is introduced at the top of the pile and is allowed to flow over the side. This action, called sloughing, causes a size segregation to occur with the finer material deposited towards the top of the pile.

The locations where grab samples will be taken are randomly chosen over the surface of the pile. The method of randomly choosing the sampling locations is left up to sampling personnel but must follow the procedures specified in the sampling personnel plan. For 1000 tons of product, a grab sample shall be taken at a minimum of three randomly chosen sampling locations. A minimum of three grab samples shall be taken even if the product pile contains less than 1000 tons of material. The slough is raked or shoveled away from the sampling location. A sampling apparatus is inserted one foot into the pile and the material is removed and is placed in an appropriate sized sampling container. Some of the possible sampling apparatus is discussed in Section 4.1. Each of the grab samples shall be placed in the same sample container. This composited sample shall be crushed to produce a material with a nominal size of less than three-eighths of an inch. Before crushing, the sample must be adequately dried. ASTM Method C-702-80, which is incorporated herein by reference, shall be used to reduce the size of the crushed grab sample to a one pint aliquot. The one pint aliquot shall be further crushed using a Braun mill or equivalent to produce a material of which the majority shall be less than 200 Tyler mesh. An aliquot of the 200 mesh material shall be put into a labeled sealed container. The label shall contain all the information described in Section 6 (except item 4).

5.2 Serpentine Aggregate Conveyor Belts.

Serpentine aggregate is transported from the rock crushing plant to a product stacking belt and finally to a storage pile or to a waiting truck for delivery to a buyer.

The grab samples shall be taken from the product stacking belt or if this is not possible then at the first transfer point before the stockpile. The grab samples shall be collected by stopping the belt a minimum of three times or using an automated sampler. The method of randomly choosing the sampling locations and intervals is left up to sampling personnel but must follow the procedure specified in the sampling plan. For 1000 tons of product, a grab sample is taken at a minimum of three randomly selected intervals. A minimum of three samples shall be taken even if the generated product is less than 1000 tons. Each time the belt is stopped to take a grab sample, templates, as shown in Figure 2, are placed a minimum of six inches apart to isolate the material on the belt. The material within the templates is removed with a small shovel or with a brush and a dust pan for the finer material and is placed in an appropriate sized sampling container. This composited sample shall be crushed to produce a material with a nominal size of less than three-eighths of an inch. Before crushing, the sample must be adequately dried. ASTM Method C-702-80, which is incorporated herein by reference, shall be used to reduce the size of the crushed grab sample to a one pint aliquot. The one pint aliquot shall be further crushed using a Bruan mill or equivalent to produce a material which the majority of which shall be less than 200 Tyler mesh. An aliquot of the 200 mesh material shall be put into a labeled sealed container. The label must contain all the information listed in Section 6 (except item 4).

5.3 Serpentine Aggregate Covered Surfaces.

5.3.1 Serpentine Aggregate Covered Roads

A serpentine aggregate-covered road shall be characterized by taking grab samples from a minimum of three randomly chosen locations per mile of road. The method of randomly choosing the sampling locations is left up to sampling personnel but must follow the procedures specified in the sampling plan. A minimum of three samples shall be taken even if the road is less than one mile long. Section 4.3 describes some of the possible sampling apparatus used to collect the grab samples. Grab samples shall not contain underlying soils. Each of the grab samples shall be placed in the same sample container. This composited sample shall be crushed to produce a material with a nominal size of less than three-eighths of an inch. Before crushing, the sample must be adequately dried. ASTM Method C-702-80, which is incorporated herein by reference, shall be used to reduce the size of the crushed grab sample to a one pint aliquot. The one pint aliquot shall be further crushed using a Bruan mill or equivalent to produce a material which the majority of which shall be less than 200 Tyler mesh. An aliquot of the 200 mesh material shall be put into a labeled sealed container. The label must contain all the information listed in Section 6 (except item 4).

5.3.2 Serpentine Aggregate Covered Areas

A serpentine aggregate-covered play yard or parking lot shall be characterized by taking grab samples from a minimum of three randomly chosen locations per acre. The method of randomly choosing the sampling locations is left up to sampling personnel but must follow the procedures specified in the sampling plan. A minimum of three samples shall be taken even if the road is less than one mile long. Section 4.3 describes some of the possible sampling apparatus used to collect the grab samples. Grab samples shall not contain underlying soils. Each of the grab samples shall be placed in the same sample container. This composited sample shall be crushed to produce a material with a nominal size of less than three-eighths of an inch. Before crushing, the sample must be adequately dried. ASTM Method C-702-80, which is incorporated herein by reference, shall be used to reduce the size of the crushed grab sample to a one pint aliquot. The one pint aliquot shall be further crushed using a Bruan mill or equivalent to produce a material which the majority of which shall be less than 200 Tyler mesh. An aliquot of the 200 mesh material shall be put into a labeled sealed container. The label must contain all the information listed in Section 6 (except item 4).

5.3.3 Serpentine Aggregate Covered Road Shoulders

The sampling procedure specified in Section 5.3.1 or 5.3.2 shall be used for road shoulders covered with serpentine aggregate. The only difference is that a minimum of three grab samples shall be taken over a length of two miles of shoulder or over an area of two acres of shoulder surface. The word shoulder is meant to imply shoulders on both sides of the road. For serpentine aggregated covered shoulders, the sampling plan specified in Section 5 shall indicate whether the samples are collected on a two mile or two acre basis.

6 SAMPLING LOG

A sample log must be kept showing:

1) A unique sample number.
2) Facility name.
3) Facility address or location where sample is taken.
4) A rough sketch, video tape, or photograph of the specific sampling locations.
5) Date and time of sampling.
6) Name of person performing sampling.

7 ANALYTICAL PROCEDURES

7.1 Principle and Applicability.

Samples of serpentine aggregate taken for asbestos identification are first examined for homogeneity and preliminary fiber identification at low magnification. Positive identification of suspect fibers is made by analysis of subsamples with the polarized light microscope.

The principles of optical mineralogy are well established.[2,3] A light microscope equipped with two polarizing filters coupled with dispersion staining is used to observe specific optical characteristics of a sample. The use of plane polarized light allows the determination of refractive indices along specific crystallographic axes. Morphology and color are also observed. A retardation plate is placed in the polarized light path for determination of the sign of elongation using orthoscopic illumination. Orientation of the two filters such that their vibration planes are perpendicular (cross polars) allows observation of the birefringence and extinction characteristics of anisotropic particles.

Quantitative analysis involves the use of point counting. Point counting is a standard technique in petrography for determining the relative areas occupied by separate minerals in thin sections of rock. Background information on the use of point counting[3] and the interpretation of point count data[4] is available.

This method is applicable to all bulk samples of serpentine aggregate submitted for identification and quantification of asbestos components.

7.2 Range.

The analytical method may be used for analysis of samples containing from 0 to 100 percent asbestos. The upper detection limit is 100 percent. The lower detection limit is 0.25 percent.

7.3 Interferences.

Fibrous organic and inorganic constituents of bulk samples may interfere with the identification and quantitation of the asbestos content. Fine particles of other materials may also adhere to fibers to an extent sufficient to cause confusion in the identification.

7.4 Analytical Uncertainty.

The uncertainty method is two percent if twenty asbestos fibers are counted in a sample of 400 particles. The uncertainty of the analytical method may be assessed by a 95% confidence interval for the true percentage of asbestos fibers in the rock. The number of asbestos fibers in the sample is assumed to have a binomial distribution. If twenty asbestos fibers are found in a sample of 400 particles, a one-sided confidence interval for the true percentage has an upper bound of seven percent or an analytical uncertainty of two percent.[11] The confidence interval used here is an "exact" interval computed directly from the binomial distribution.

7.5 Apparatus.

7.5.1 Microscope. A low-power binocular microscope, preferable stereoscopic, is used to examine the bulk sample as received.

* Microscope: binocular, 10-45X
* Light Source: incandescent, fluorescent, halogen or fiber optic
* Forceps, Dissecting Needles, and Probes
* Glassine Paper, Clean Glass Plate, or Petri dish

* Compound Microscope requirements: A polarized light microscope complete with polarizer, analyzer, port for wave retardation plate, 360^{o} graduated rotating stage, substage condenser, lamp, and lamp iris

* Polarized Light Microscope: described above

* Objective Lenses: 10X

* Dispersion Staining Objective Lens: 10X

* Ocular Lens: 10X

* Eyepiece Reticule: 25 point or 100 point Chalkley Point Array or cross-hair

* Compensator Plate: 550 millimicron retardation

* First Order Red I Compensator: 530 namometers

7.6 Reagents.

Refractive Index Liquids: 1.490 - 1.570, 1.590 - 1.720 in increments of 0.002 or 0.004.

Refractive Index Liquids for Dispersion Staining: High-dispersion series, 1.550, 1.605, 1.630 (optical).

UICC Asbestos Reference Sample Set: Available from UICC MRC Pneumoconiosis Unit, Lisndough Hospital Penarth, Glamorgan CF6 1xw, UK and commercial distributors.

Tremolite-asbestos: Available from J. T. Baker.

Actinolite-asbestos: Available from J. T. Baker.

Chrysotile, Amosite, and Crocidolite is available from the National Institute of Standards and Technology.

Anthrophyllite, Tremolite, Actinolite will be available from the National Institute of Standards and Technology during the first quarter of 1990.

8 PROCEDURES

Exposure to airborne asbestos fibers is a health hazard. Bulk samples submitted for analysis are usually friable and may release fibers during handling or matrix reduction steps. All samples and slide preparations should be carried out in a ventilated hood or glove box with continuous airflow (negative pressure) exhausting through an HEPA filter. Handling of samples without these precautions may result in exposure of the analyst and contamination of samples by airborne fibers.

8.1 Sample Preparation.

An aliquot of bulk material is removed from the one pint sample container. The aliquot is spread out on a glass slide. A drop of staining solution with appropriate refractive index is added to the aliquot. A cover slide is placed on top of the sample slide.

The first preparation should use the refractive index solution for Chrysotile. If during the identification phase other asbestiforms are suspected to be present in the sample, due to their morphology, then additional analyses shall be performed with the appropriate solutions. Report the percentages of each asbestiform and combine percentages to determine total asbestos concentrations.

8.2 Fiber Identification.

Positive identification of asbestos requires the determination of the following optical properties:

Morphology (3 to 1 minimum aspect ratio)
Color and plechroism
Refractive indices
Birefringence
Extinction characteristics
Sign of elongation

Table 3 lists the above properties for commercial asbestos fibers. Natural variations in the conditions under which deposits of asbestiform minerals are formed will occasionally produce exceptions to the published values and differences from the UICC standards. The sign of elongation is determined by use of the compensator plate and crossed polars. Refractive indices may be determined by the Becke line test. Becke line test or dispersion staining shall be used to identify asbestos fibers. Central stop dispersion staining colors are presented in Table 4. Available high-dispersion (HD) liquids should be used.

8.3 Quantification of Asbestos Content.

Asbestos quantification is performed by a point-counting procedure. An ocular reticle (point array) or cross-hair is used to visually superimpose points on the microscope field of view. The point counting rules are as follows:

1. Record the number of points positioned directly above each particle or fiber.

2. Record only one point if two points are positioned over same particle or fiber.

3. Record the number of points positioned on the edge of a particle or fiber.

4. If an asbestos fiber and a matrix particle overlap so that a point is superimposed on their visual intersection, a point is scored for both categories.

5. If a test point lies over an ambiguous structure, no particle or fiber is recorded. Examples of "ambiguous" structures are:

   a) fibers whose dispersion colors are difficult to see

   b) structures too small to categorize.

6. A fiber mat or bundle is counted as one fiber.

For the purpose of the method, "asbestos fibers" are defined as mineral fibers having an aspect ratio greater than 3:1 and being positively identified as one of the minerals in Table 3.

A total of 400 points superimposed on either asbestos fibers or nonasbestos matrix material must be counted over at least eight different preparations of representative subsamples. Take eight forceps samples and mount each separately with the appropriate refractive index liquid. The preparation should not be heavily loaded. The sample should be uniformly dispersed to avoid overlapping particles and allow 25 - 50 percent empty area within the fields of view. Count 50 nonempty points on each preparation, using either

a reticle with 100 points (Chalkley Point Array) and counting 25 points in at least two randomly selected fields.

or

a reticle with 25 points (Chalkley Point Array) and counting at least two randomly selected fields.

or

a reticle with a standard cross-hair and counting at least 50 randomly selected fields.

For samples with mixtures of isotropic and anisotropic materials present, viewing the sample with slightly uncrossed polars or the addition of the compensator plate to the polarized light path will allow simultaneous discrimination of both particle types. Quantitation should be performed at 100X. Confirmation of the quantitation result by a second analyst on 10 percent of the analyzed samples should be used as standard quality control procedure. All optical properties in Section 8.2 shall be determined to positively identify asbestos.

EXCEPTION I

If the sample is suspected of containing no asbestos a visual technique can be used to report that the sample does not contain asbestos. The rules are as follows:

1. Prepare three slides as described in Section 8.3.

2. View 10 fields per preparation. Identify all fibers.

3. If all fibers are nonasbestos, report no asbestos were found and that visual technique was used.

4. If one fiber is determined to be asbestos, discontinue the visual method and perform the point counting technique as described above.

EXCEPTION II

If the sample is suspected to have an asbestos content in excess of ten percent, a visual technique can be used to report that the sample contains greater than ten percent asbestos. The standard operating procedure of the visual technique allowed in the National Institute of Standards and Technology's National Voluntary Laboratory Accreditation Program, Bulk Asbestos Handbook, National Institute of Standards and Technology publication number NISTIR 88-3879 dated October 1988, which is incorporated herein by reference, shall be followed.

9 CALCULATIONS

The percent asbestos is calculated as follows:

$$\% \text{ asbestos} = \left(\frac{a}{n}\right) 100\%$$

Where:

a	=	number of asbestos counts
n	=	number of nonempty points counted (400)
If a	=	0, report "No asbestos detected."
If a	>	0, report the calculated value to the nearest 0.25%

If "no asbestos detected: is reported by the point counting technique, the analyst may report the observation of asbestos fibers in the non-counted portions of the sample.

10 ALTERNATIVE METHODS

10.1 Alternative Sampling Methods.

Alternative sampling methods may be used as long as they are substantially equivalent to the sampling methods discussed in Section 5 and approved by the Executive Officer of the Air Resources Board. The ARB Executive Offcier may require the submittal of test data or otehr information to demonstrate equivalency.

10.2 Analytical Methods.

An alternative analytical method may be used as longas it produces results substantially equivalent to the results produced by the point counting method and approved by the Executive Officer of the Air Resources Board. The ARB Executive Officer may require the submittal of test data or other information to demonstrate equivalency.

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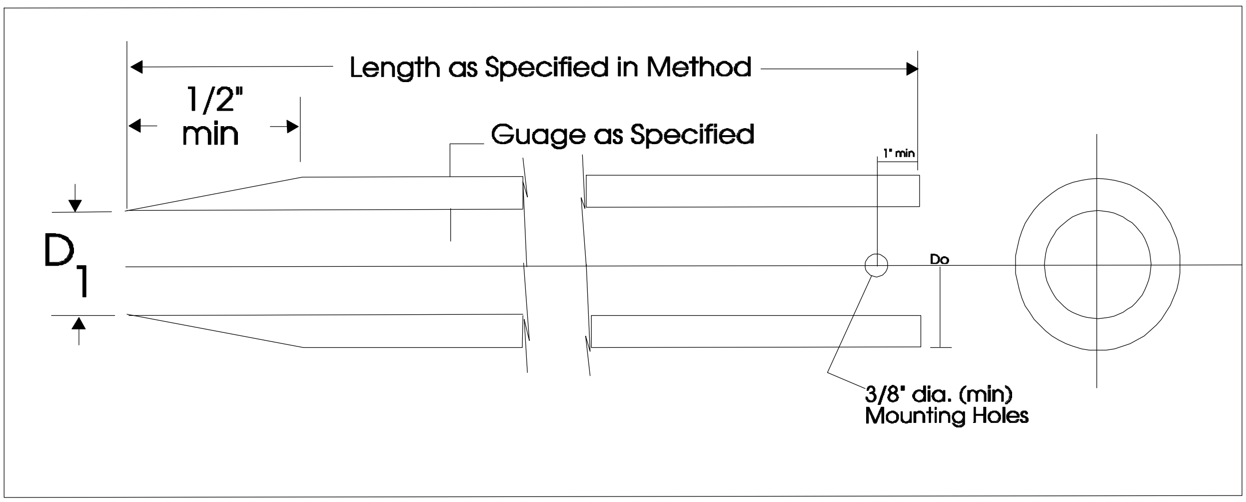
Figure 1

Thin Wall Tube for Sampling



Note 1 Minimum of two mounting holes on opposite sides for 2 to 3 inch diameter sampler.

Note 2 Minimum of four mounting holes spaced a 90° for samplers 4 inch diameter and larger.

Note 3 Tube held with hardened screws.

Note 4 Two inch outside-diameter tubes are specified with an 18-guage wall thickness to comply with area ratio criteria accepted for "undisturbed samples." Users are advised that such tubing is difficult to locate and can be extremely expensive in small quantities. Sixteen-guage tubes are generally readily available.

Table 1

Suitable Thin Walled Steel Sample Tube[A]

OUTSIDE DIAMETER:			
iches	2	3	5
millimeters	50.8	76.2	127
WALL THICKNESS:			
Bwg	18	16	11
inches	0.049	0.065	0.120
millimeters	1.24	1.65	3.05
TUBE LENGTH:			
inches	36	36	54
meters	0.91	0.91	1.45
CLEARNACE RATIO, %	1	1	1

[A] The three diameters recommended in Table 1 are indicated for purposes of standardization, and are not intended to indicate that sampling tubes of intermediate or larger diameters are not acceptable. Lengths of tubes shown are illustrative. Proper lengths to be determined as suited to field conditions.

Table 2

Dimensional Tolerances for Thin Walled Tubes

Nominal Tube Diameters from Table 1[A] Toelrances, inches			
Size Outside Diameter	2	3	4
Outside Diameter	+0.007 -0.000	+0.010 -0.000	+0.015 -0.000
Inside Diameter	+0.000 -0.007	+0.000 -0.010	+0.000 -0.015
Wall Thickness	+0.007	+0.010	+0.015
Ovality	0.015	0.020	0.030
Straightness	0.030/ft	0.030/ft	0.030/ft

A Intermediate or larger diameters should be proportional. Tolerances shown are essentially standard commercial manufacturing tolerances for seamless steel mechanical tubing. Specify only two of the first three toelrances; O. D. and I. D. or O. D. and Wall, or I. D. and Wall.

Figure 2

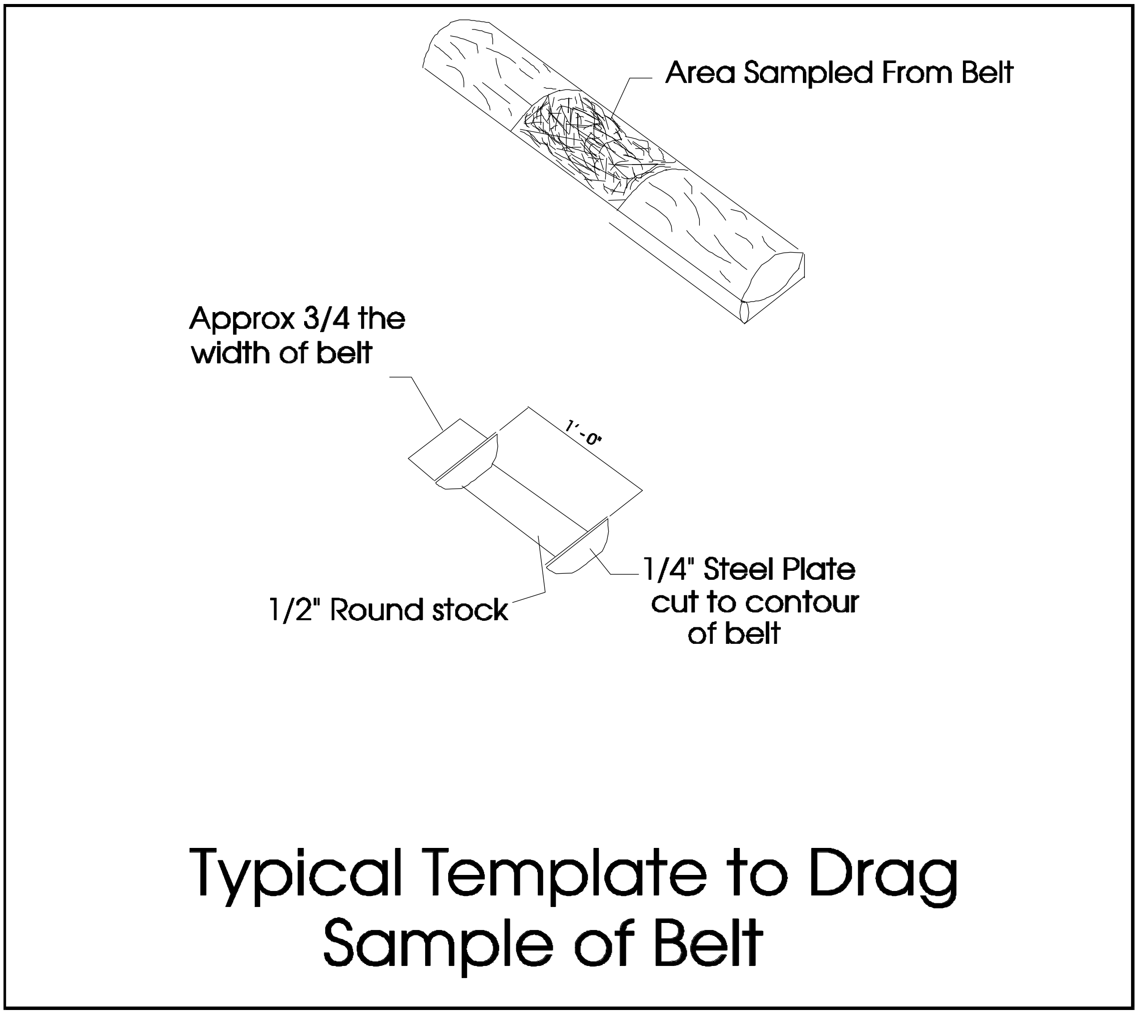

Area Sampled From Belt
Approx 3/4 the
width of belt
1'-0"
1/2" Round stock
1/4" Steel Plate
cut to contour
of belt
Typical Template to Drag
Sample of Belt

Table 3

Optical Properties of Asbestos Fibers

Mineral	Morphology[a], color	Refractive Indices[b] alpha	gamma	Birefringence	Extinction	Sign of Elongation
Chrysotile (asbestiform serpentine)	Wavy fibers. Fiber bundles have splayed ends and "kinks." Aspect ratio typically >10:1. Colorless[c], nonpleochloric.	1.493 - 1.560	1.517 - 1.562[f] (normally 1.556)	0.002 - 0.014	|| to fiber length	+ (length slow)
Amosite (asbestiform grunerite)	Straight, rigid fibers. Aspect ratio typically >10:1. Colorless to brown, nonpleochroic or weakly so. Opaque inclusions may be present.	1.635 - 1.696	1.655 - 1.729[f] (normally 1.696 - 1.710)	0.020 - 0.33	|| to fiber length	+ (length slow)
Crocidolite (asbestiform riebeckite)	Straight, rigid fibers. Thick fibers and bundles common, blue to purple-blue in color. Pleochroic. Birefringence is genreally masked by blue color.	1.654 - 1.701	1.668 - 1.717[e] (normally close to 1.700)	0.014 - 0.016	|| to fiber length	- (length fast)
Anthophyllite-asbestos	Stright fibers and fiber bundles showing spalyed ends. Colorless to light brown. pleochroic absent.	1.596 - 1.652	1.615 - 1.676[f]	0.019 - 0.024	|| to fiber length	+ (length slow)
Tremolite-actinolite-asbestos	Straight and curved fibers[d] and fiber bundles. Large bundles show spalyed ends. Tremolite is colorless and actinolite is green. Weakly to moderately pleochroic.	1.599 - 1.668	1.622 - 1.688[f]	0.023 - 0.020	|| to fiber length	+ (length slow)

a From Reference 6; colors cited are seen by observation with plane polarized light.
b From Reference 7 and 9.
c Fibers subjected to heating may be brownish.
d Fibers defined as having aspect ratio >3:1.
e ⊥ to fiber length.
f || to fiber length.

Table 4

Central Stop Dispersion Staining Colors[a]

Mineral	RI Liquid	nu |	nu ||
Chrysotile	1.550HD	blue	blue-magneta
Amosite	1.680	blue-magenta to pale blue	golden-yellow
	1.550HD	yellow to white	yellow to white
Crocidolite[b]	1.700	red-magenta	blue-magenta
	1.550HD	yellow to white	yellow to white
Anthophyllite	1.605HD	blue	gold to gold-magenta
Tremolite	1.605HD[c]	pale blue	yellow
Actinolite	1.630HD	gold-magenta to blue	gold
	1.630HD[c]	magenta	golden-yellow

a From Reference 11.10.

b Blue absorption color.

c Oblique extinction view.

A Discussion of Asbestos Detection Techniques for Air and Soil

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Prepared by

Anthony Perry
National Network of Environmental Management Studies Fellow

for

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Technology Innovation Program
Washington, DC
www.clu-in.org

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About the National Network for Environmental Management Studies

The National Network for Environmental Management Studies (NNEMS) is a comprehensive fellowship program managed by EPA's Office of Environmental Education. The purpose of the NNEMS Program is to provide students with practical research opportunities and experiences.

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CONTENTS

Table

INTRODUCTION

Asbestos is a toxic mineral known to produce debilitating health effects in humans. Because of its toxicity, it is necessary to have effective techniques [1] and methods [2] to detect and quantify asbestos in the environment. In the case of the Superfund Program, which is administered by the U.S. Environmental Protection Agency (EPA), effective detection techniques and methods are needed to aid in the discovery of contaminated sites, assess the severity of contamination, and to determine if cleanup efforts have been successful. Over the years, a number of techniques and methods have been developed for asbestos, but there is no clearly superior technique or method. Each technique or method has its own strengths and weaknesses, and these strengths and weaknesses must be carefully weighed to determine how to best detect asbestos under a given circumstance.

BACKGROUND

Asbestos is a toxic substance that causes asbestosis, mesothelioma, and lung cancer – diseases that impair breathing and are potentially fatal. There are two classes of asbestos: serpentine asbestos (i.e. chrysotile), which is more common, and amphibole asbestos, which experts generally regard as more dangerous (USEPA, 2004a; Virta, 2004; Hodgson and Darnton, 2000; GETF, 2003; Mossman et al., 1990). However, the toxicity of a given asbestos fiber depends on a number of other variables as well, including chemical composition, fiber shape, and fiber size (Harper and Bartolucci, 2003; Lippmann, 2000). Due to its toxicity, governmental regulations have been adopted to restrict the use of asbestos and establish methods to detect its presence. As a consequence of using microscopy techniques to detect the presence of asbestos, counting methods have been adopted to make the task of counting individual asbestos fibers less subjective and more standardized. Unfortunately, there are some problems with the established counting methods, including the fact that they do not reflect the available health data concerning asbestos fiber toxicity.

ASBESTOS MINERAL TYPES

Asbestos is a geologic term used for a group of naturally occurring silicate minerals that form fibers during crystallization (i.e., they have a “fibrous habit” [3]). All asbestos minerals share the same unique properties (i.e., they are “composed of strong and flexible fibers, resistant to heat, corrosion, abrasion, and ... can be woven” [GETF, 2003, p.1]) that make them desirable for myriad commercial products, including brake pads, insulation, tiling, and fire proofing (Mossman et al., 1990; Lippmann, 2000; GETF, 2003; USEPA, 2004a; 2004b). The mineral name for serpentine asbestos is chrysotile (Table 1), and its “asbestiform nature” [4] is due to certain crystallographic properties: its layered or sheet silicate structure rolls up into a cylindrical or “tubular” fibril due to a structural deformation (Lippmann, 2000). Chrysotile is by far the most common type of asbestos used for commercial purposes. It represents over 90 percent of the world’s production of asbestos (Mossman et al., 1990), as well as 95 percent of the asbestos used for commercial purposes in the United States (OSHA, 1997). Furthermore, an estimated 90 to 95 percent of the asbestos present in U.S. buildings is chrysotile (USEPA, 2004a).

Amphiboles are a group of ferromagnesium silicates similar in both their crystal form and chemical composition. They have a nominal formula of:

$$A_{0\text{-}1}B_2C_5T_8O_{22}(OH, F, Cl)_2$$

where A = K or Na; B = Fe^{3+}, Mg, and/or Fe^{2+}; and T = Si, Al, Cr, Fe^{3+}, and/or Ti (ISO, 1995; ISO 1999). There are five types of amphibole asbestos that are regulated by EPA: crocidolite (its mineral name is riebeckite), anthophyllite, amosite (grunerite), actinolite, and tremolite (Table 1). The different types of amphibole asbestos form fiber-like structures, like chrysotile, but fibrous growth instead occurs as straight chain structures rather than rolled up sheets (Lippman, 2000).

Table 1 — Mineral Forms of Asbestos

Commercial Name	Mineral Name	Mineral Group	Chemical Formula
Chrysotile	Chrysotile	Serpentine	$(Mg, Fe)_6(OH)_8Si_4O_{10}$
Crocidolite	Riebeckite	Amphibole	$Na_2(Fe^{3+})_2(Fe^{2+})_3(OH)_2Si_8O_{22}(\pm Mg)$
Anthophyllite	Anthophyllite	Amphibole	$(Mg, Fe)_2(OH)_2Si_8O_{22}$
Amosite	Grunerite	Amphibole	$Fe_2(OH)_2Si_8O_{22}(\pm Mg, Mn)$
Actinolite	Actinolite	Amphibole	$Ca_2Fe_5(OH)_2Si_8O_{22}(\pm Mg)$
Tremolite	Tremolite	Amphibole	$Ca_2Mg_5(OH)_2Si_8O_{22}(Fe)$
Richterite	Richterite	Amphibole	$Na(Ca, Na)Mg_5Si_8O_{22}(OH)_2$
Winchite	Winchite	Amphibole	$(Ca, Na)Mg_4(Al, Fe^{3+})Si_8O_{22}(OH)_2$

From: Lippmann, 2000, p. 66; Meeker et al., 2001; Christiansen et al., 2003

Other amphibole minerals, such as richterite and winchite (Table 1) are not regulated forms of asbestos, yet meet the definition of amphibole asbestos (according to a report by Meeker, et al. (2001) for the US Geological Survey (USGS)). They can be characterized as amphiboles because the morphologies and elemental compositions of each of these minerals is similar to the other five types of amphibole asbestos (Virta, 2004). Richterite and winchite most closely resemble actinolite and tremolite. Furthermore, they have been observed to produce the same ill-effects as the regulated amphiboles on humans in Libby, Montana, and elsewhere (Meeker et al., 2001; Thornton, 2004; Wylie and Verkouteren, 2000; Smith, 2004b). However, since they are not regulated, they are usually not included in the asbestos fiber count when using established counting methods to perform a microscopic analysis (GETF, 2003).

All of the regulated minerals mentioned also have a non-fibrous form in which they do not exhibit an asbestiform nature, but these forms are not regarded as asbestos (Lippmann 2000) and have not been found to be damaging to human health (Virta, 2004). Established counting methods usually do not consider the non-fibrous forms of regulated asbestos as asbestos and thus do not include them in the asbestos fiber count.

THE HEALTH EFFECTS OF ASBESTOS

While the use of asbestos has been seen as beneficial because of its commercial applications, the adverse health effects attributed to asbestos exposure have in general outweighed its benefits. Asbestos is regarded as exceedingly dangerous because the inhalation of asbestos fibers can lead to the development of debilitating health problems. All asbestos-related diseases appear to be caused from chronic exposure; acute exposure does not seem to result in serious illness (Koppikar, 2004).

Asbestosis, or “asbestos-induced pulmonary fibrosis” (Lippmann, 2000, p. 82), is a scarring of the lungs usually caused by long-term exposure to high doses of asbestos, which results in the deposition of collagen in the lungs. The stiffening of the lungs caused by the scarring and the build-up of collagen can interfere with gas-exchange, impair breathing, and eventually lead to death (Lippmann, 2000; Mossman et al., 1990). The scarring of the lungs occurs because the body generates an acid to dissolve the asbestos fibers, but the acid often has little effect on the asbestos and instead damages lung tissue. It may take 25 to 40 years for asbestosis to develop (USEPA, 2004a).

Mesothelioma, a malignant tumor of the lining of the lungs and the adjacent body wall, is another disease attributed solely to exposure to asbestos (USEPA, 2004a). This cancer usually occurs after years of occupational or environmental exposure to amphibole asbestos. Although, there is some evidence that people exposed to low levels of asbestos for short time periods have also developed the disease (Koppikar, 2004). Mesothelioma usually has a latency period of 35 to 45 years (Koppikar, 2004) and can occur up to 60 years following exposure. It responds poorly to radiation treatment or chemotherapy and is fatal (Lippmann, 2000). Amphiboles are more toxic than chrysotile in causing mesothelioma (USEPA, 2004a; Virta, 2004; Hodgson and Darnton, 2000; GETF, 2003; Mossman et al., 1990). In general, amphiboles are twice as likely to cause mesothelioma, while amosite (100 times more likely to lead to mesothelioma than chrysotile) and crocidolite (500 times more likely to cause mesothelioma) are especially damaging (Koppikar, 2004; Hodgson and Darnton, 2000).[5] Longer amphibole fibers in particular may result in mesothelioma because fibers with lengths greater than 8 µm cannot be cleared from pleural and peritoneal spaces (i.e., they are trapped at the mesothelial lining) because they are too big to exit the lymphatic channels that drain these spaces (Mossman, et al., 1990; Lippmann, 2000).

Asbestos exposure can also lead to lung cancer (or bronchogenic carcinoma), either in the epithelial lining of the large airways or in the terminal bronchioles. Combining cigarette smoking with asbestos exposure produces a synergistic effect in the creation of malignant tumors in the lungs (USEPA, 2004a; GETF, 2003), but it does not produce a synergistic effect in the development of mesothelioma (Mossman et al., 1990; Lippmann, 2000; Koppikar, 2004). The latency period for asbestos-related lung cancer can be 15 to 30 years (USEPA, 2004a), and incidents of lung cancer peak 25 years following asbestos exposure (Koppikar, 2004). It has been found that those exposed to amphiboles are 5 to 50 times more likely to develop lung cancer than those exposed only to chrysotile (Koppikar, 2004). Two amphiboles, amosite and crocidolite, are an estimated 10 to 50 times more likely to produce lung cancer than chrysotile (Hodgson and Darnton, 2000). The EPA has also noted differences in carcinogenicity for different asbestos fibers, with tremolite having a two orders of magnitude greater carcinogenic potency than chrysotile (Environ. Sci. Technol., 2003).

The development of stomach and bowel cancers also has been attributed to asbestos exposure (USEPA, 2004a). Asbestos fibers reach these regions of the body through the ingestion of fibers expelled from the lungs. More benign changes to the lungs, like the formation of pleural plaques, pleural thickening, and pleural effusions, also can be attributed to asbestos (Lippmann, 2000; Koppikar, 2004; Mossman et al., 1990).

The Toxicity of Asbestos Fibers

While it has been well-established that asbestos fibers are responsible for the host of problems outlined above, it is still not absolutely clear which asbestos fiber characteristics are most important in determining toxicity. However, evidence suggests that amphibole asbestos fibers are more toxic than chrysotile (Virta, 2004; GETF, 2003; Mossman et al., 1990; USEPA, 2004a; Virta, 2004; Hodgson and Darnton, 2000). The toxicity of asbestos fibers may be derived from the fibers' physical presence in the lungs, their chemical properties, or both. More research needs to be done to determine for sure which characteristics (e.g., fiber size, shape, and elemental composition) are most important in determining asbestos toxicity (Thornton, 2004).

The physical properties of asbestos fibers are important in determining toxicity because fiber size and fiber shape affect the ability of asbestos to enter the body and damage cells within the lungs. Fiber dimension determines the likelihood that a fiber will enter the body. Fibers with lengths less than 40 µm and diameters of less than 0.5 µm (or 1.5 µm if a person is a "mouth breather") can be inhaled into the lungs (Koppikar, 2004). Some argue that fibers with lengths less than 5 µm pose no threat to humans because they are small enough to be exhaled back out into the ambient air or expelled to the esophagus and ingested, but this claim has been disputed (Troast, 2004; Koppikar, 2004). This is an important point to reconcile because as much 85 to 95 percent of asbestos fibers are shorter than 5 µm and not counted according to some microscopy protocols (Koppikar, 2004). In a study discussed by Besson et al. (1999), 70 percent of analyzed chrysotile and 50 percent of analyzed amosite were determined to be shorter than 5 µm. Of those fibers that are in the range of respiration, longer fibers are more damaging because they are more likely to deposit in the lungs (Lippmann, 2000) and it is more difficult for phagocytes to phagocytize them, meaning they have greater durability in the lungs than shorter fibers (Harper and Bartolucci, 2003; Koppikar, 2004; Mossman, 1990). Also, the process of phagocytizing asbestos can damage the phagocytes themselves and result in the release of chemicals that can damage lung tissue (Lippmann, 2000). It is also more difficult to phagocytize fibers with greater aspect ratios [6] than fibers with smaller aspect ratios (i.e., fibers that are shorter and thicker) (Koppikar, 2004; Mossman, et al., 1990). This has lead some researchers, including Stanton, to declare that fibers that are long and thin are the most damaging (Lippmann, 2000; Mossman, et al., 1990). In fact, Stanton found long fibers to be the cause of mesothelioma, regardless of mineral composition, "after direct intrapleural or intraperitoneal injection into rodents" (Lippmann, 2000, p. 81). Fibers with smaller diameters (i.e., less than 0.1 µm) have been found to be more carcinogenic and more likely to cause mesothelioma (Egilman et al., 2003). According to Kohyama and Kurimori, asbestos fibers with diameters thinner than 0.25μm and lengths greater than 8μm display the greatest carcinogenicity (Besson, et al., 1999). Furthermore, according to Besson, et al. (1999), the carcinogenicity of asbestos fibers increases with increasing fiber length and decreasing diameter.

Fiber shape is another physical property that is an important indicator of toxicity because it helps determine how easily a fiber will enter the lungs and how easily it will be broken down by phagocytes. “Rod-like” amphibole fibers are straight, long, and thin (i.e., they have a high aspect ratio), and can more easily enter the body and penetrate deep into the lungs than curved chrysotile fibers, which have a greater likelihood of being intercepted and expelled before reaching the depths of the lungs. It is also more difficult for phagocytes to breakdown amphibole fibers because of their shape (and because of other properties) than chrysotile fibers (Mossman, et al., 1990; Koppikar, 2004).

The chemical properties of asbestos fibers are related to their toxicities because fibers with different elemental compositions react differently within the body. The major difference in chemical composition is between chrysotile and amphibole asbestos. The chemical composition of chrysotile is such that it is more soluble than amphiboles, which better resist dissolution. Because chrysotile is more soluble than amphiboles – as well as more likely to exhibit a shorter fiber length; a curly, instead of straight, shape; and a smaller aspect ratio – it is easier for the body to break down into smaller pieces and clear from the lungs (Hodgson and Darnton, 2000; Lippmann, 2000).

Translocation [7] of chrysotile fibers (or pieces of fibers) can be regarded as either beneficial (because the asbestos fibers are being broken down into smaller components and moved out of the lungs) or not beneficial (if this process spreads the damage as they migrate through the lungs) (Thornton, 2004). Evidence generally supports the former argument that the breakdown of chrysotile is beneficial in limiting damage to the lungs (Mossman et al., 1990; Hodgson and Darnton, 2000; Koppikar, 2004). Hodgson and Darnton (2000) report that chrysotile is not durable in the lungs (“[it is] cleared [from the lungs] in months” [p. 588]). Amphibole fibers do not undergo translocation as readily (“[they are] cleared in years” [Hodgson and Darnton, 2000, p. 588]), are a more durable presence in the lungs, and can continue to cause damage long after environmental exposure ends (Hodgson and Darnton, 2000; Koppikar, 2004).

While chemical composition is important in determining fiber durability, it also affects toxicity in another way. Ions cans be leached out of asbestos fibers and, depending on the type of element, can have different effects. For example, chrysotile has Mg^{2+} ions on its surface, which are cytotoxic (i.e., toxic to cells) and carcinogenic. Amphiboles can have cations, such as Fe^{2+} and Fe^{3+}, that can catalyze Fenton or Haber-Weiss reactions, which generate reactive oxygen species. These oxygen species are highly toxic and potentially mutagenic (Service, 1998) (Lippmann, 2000). The chemical compositions among the different amphibole types vary and this may explain their different toxicities. So, amphiboles are generally regarded as more toxic than chrysotile (also, amphiboles themselves vary in toxicity), but more research needs to be done to firmly establish the relative toxicities of the amphiboles and chrysotile, as well as the impact of fiber size and shape on toxicity (GETF, 2003).

While the toxicity of a fiber (which depends on fiber size, shape, and chemical composition) is an important variable in determining the likelihood of obtaining an asbestos-related disease, the degree of exposure must also be taken into consideration (Harper and Bartolucci, 2003). That is, the greater the length of exposure time and the greater the number of asbestos fibers that a person is exposed to, the greater the likelihood of obtaining a disease.

Asbestos Regulations

Over the years, the U.S. government has become increasingly aware of the health problems caused by asbestos and has responded by regulating its use. The federal government uses these regulations in an attempt to limit asbestos levels in the environment and in commercial products, and protect human health. Almost all states also have regulations to control asbestos (GETF, 2003). When possible, these regulations have taken into consideration estimates of risk resulting from exposure to asbestos (as determined by investigatory health studies), but regulations sometimes deviate from good science due to knowledge gaps and technological constraints involved in measuring asbestos. While these regulations are obviously important for protecting human health, they are also significant because they require the use of certain asbestos detection techniques.

The first important regulation dealing with asbestos is an Occupational Safety and Health Administration (OSHA) regulation aimed at limiting asbestos levels in the workplace and protecting worker health. It was last updated in 1994 (GETF, 2003). This regulation applies to the EPA when it conducts site cleanup under Superfund and serves as a guide under other situations (e.g., site assessment under Superfund) to help in determining the safety of the air. The level of asbestos in the air that is considered unsafe by the OSHA regulation has changed over time, but currently it is 0.1 fiber per cubic centimeter of air (0.1 f/cc) as determined by phase contrast microscopy (PCM) (GETF, 2003; Lippmann, 2000; OSHA, 1997). That is, if the asbestos content of the air is below 0.1 f/cc, then the air is safe. This level is partly based on risk, but also reflects the technological limitations existing at the time the regulation was established (i.e., 0.1 f/cc was the smallest amount of asbestos that could be confidently detected at the time with the chosen technology, PCM [Thornton, 2004]). Technologies used to detect asbestos have improved over time, making it possible to detect and measure even lower levels of asbestos, but the regulation has not changed.

The Asbestos Hazard Emergency Response Act (AHERA) was enacted in 1986 to protect children from asbestos contamination in schools. Under AHERA, asbestos-containing material (ACM) [8] is considered unsafe for children and has been outlawed in schools (i.e., it either has to be removed or certain safeguards have to be instituted). The limit of 1 percent asbestos by weight for ACM is a somewhat arbitrary level and was chosen because of technological constraints (i.e., polarized light microscopy (PLM) could not detect asbestos levels below this level) (Troast, 2004). By defining ACM as any material containing 1 percent asbestos, the EPA restricted the use of products and materials with detectable amounts of asbestos, but allowed the continued use of products and materials in which asbestos was only a very minor ingredient. Under AHERA, the government also established methods for measuring asbestos levels in air to ensure that the act of removing ACM from schools did not contaminate the air and that cleanup was complete. To do this, the legislation requires the use of transmission electron microscopy (TEM) (USEPA, 1987).

The EPA, under the National Emission Standards for Hazardous Air Pollutants (NESHAP), promulgated under the Clean Air Act, developed a regulation designed to protect the public from asbestos emitted as an air pollutant (it was last revised in 1990). This regulation restricts the release of asbestos fibers during the handling and processing of asbestos and ACM (USEPA, 1990c). It prohibits or severely restricts (with some exceptions) the use of asbestos or ACM for a number of purposes and regulates the emission of asbestos from asbestos mills and manufacturing operations so that there is “no visible emissions [9] of asbestos to the outside air” (USEPA, 1990c, 61.142, p. 1).

While all three of these regulations control asbestos in some way, it is important to note that they do so only under certain circumstances. They do not establish general limits for asbestos in the air and soil (however, the Clean Water Act does establish asbestos limits for water). This is significant because it leaves it to EPA, in administering the Superfund program, to determine for itself what levels of asbestos in the air and soil are acceptable.

Asbestos Counting Methods

The regulations mentioned above require various microscopy techniques for detecting asbestos in the environment and in commercial products. The reason that microscopy techniques are used is because in measuring asbestos, it is important to take into consideration only those asbestos structures [10] that could negatively impact human health (Harper and Bartolucci, 2003; Lippmann, 2000). That is, the asbestos structure number burden must be examined rather than the total mass or concentration of asbestos. To determine which structures pose a risk to human health, an analyst must examine the dimensions of asbestos structures to determine if they are within the range of sizes considered to be potentially toxic for humans. Other fiber characteristics, such as aspect ratio and asbestos type, often also need to be examined, making microscopy the obvious choice for asbestos analysis.

When using microscopy it is necessary to manually count each asbestos structure, so counting methods have been developed to make this process less subjective. Counting methods can standardize the counting process by establishing specific guidelines describing the characteristics that need to be possessed by a given fiber to be considered an asbestos fiber (and the characteristics needed for a structure to be considered an asbestos structure). There are a number of different counting methods, but the most important ones include the PCM, AHERA, PCME, and ISO 10312 (1995) counting methods.

Phase Contrast Microscopy (PCM) Counting Method

The phase contrast microscopy (PCM) counting method (which is used with PCM detection methods, such as NIOSH 7400) is the first important counting method. It establishes a definition of asbestos to be used when analyzing a sample with PCM. With the PCM counting method, fibers (or bundles of fibers) are considered to be asbestos if they appear to be asbestiform, have a length greater than 5 µm, and have an aspect ratio equal to or greater than 3:1. Bundles of fibers are counted as one fiber unless individual fibers within the bundle can be identified (and the requirements stated in the previous sentence are met). More complex structures, like clusters and matrices, are not counted, but their component parts that meet the definition of an asbestos fiber or bundle *are* counted (NIOSH, 1994a; OSHA, 1997). The PCM counting method has a distinct advantage over other counting methods in that it is the only counting method that can provide an estimate of risk. All studies examining the health effects caused by asbestos exposure measure asbestos levels using PCM (Chesson et al., 1990; Verma and Clark, 1995; OSHA, 1997; Koppikar, 2004). This is why OSHA uses PCM to detect asbestos in the workplace. However, the PCM counting method does not reflect present thinking about what types of asbestos structures cause health problems. For example, many experts now believe that fibers or bundles with lengths less than 5 µm do cause disease (Troast, 2004; Koppikar, 2004), but fibers or bundles shorter than 5 µm are not counted by the PCM counting method (Verma and Clark, 1995). Chesson, et al. (1990) states that “Fibers longer than 5 µm were chosen for the convenience of optical microscopic evaluation, not because there is necessarily any sharp distinction between the risk associated with fibers longer or shorter than this length” (p.438). It has also been determined that asbestos fibers have aspect ratios of 5:1 or greater (not 3:1 or greater) (USEPA, 1987). Another problem with using the PCM counting method is that there is no way of knowing if a fiber or bundle is actually an asbestos structure. This is because with PCM, fibers and bundles are identified as asbestos according to their morphology only (NIOSH, 1994a; OSHA, 1997). An analysis of elemental composition or crystal structure cannot be performed, so non-asbestos structures may be misidentified as asbestos structures. Finally, PCM cannot differentiate between the different types of asbestos, so in effect all asbestos types are considered to be equally likely to cause disease (Chesson et al., 1990; Verma and Clark, 1995). However, we know this is not true from the “Toxicity of Asbestos Fibers” section.

AHERA Counting Method

The next important counting method, the Interim Transmission Electron Microscopy Analytical Method, was developed in accord with the Asbestos Hazard Emergency Response Act (AHERA). It is more commonly referred to as the AHERA counting method. This method is used with transmission electron microscopy (TEM), and it counts as an asbestos structure any structure (i.e., fiber, bundle, cluster, or matrix) that has at least one verified asbestos fiber (using electron diffraction [ED] [11] and energy dispersive X-ray analysis [EDXA] [12]), an aspect ratio of 5:1 or greater, and a length greater than 0.5 µm. To be considered a fiber, a grouping must have zero, one, or two definable intersections (an intersection is “a nonparallel touching or crossing of fibers” [USEPA, 1987, p. 41865]). Each fiber counts as one structure. A bundle consists of three or more parallel fibrils with less than one fiber diameter separating the fibrils (a bundle counts as one structure). If a grouping has more than two intersections, it is considered either a cluster or a matrix. A cluster consists of asbestos fibers that have three or more intersections (it counts as one structure). A matrix consists of an asbestos fiber (or fibers) that has one end free and the other end embedded in or hidden by a particulate. A matrix counts as one structure. With this counting method, the asbestos fiber type (i.e. chrysotile or one of the five regulated amphibole varieties) is recorded and asbestos structures are separated into two groups according to length (i.e. those longer than 5μm and those shorter than 5μm) before being counted (USEPA, 1987).

There is one big advantage to using the AHERA counting method instead of the PCM counting method. The AHERA counting method (unlike the PCM counting method) reflects the current thinking in the health community about what kinds of asbestos structures are toxic. With AHERA, structures with lengths less than 5μm (but greater than 0.5μm) are counted; asbestos fibers are defined as having aspect ratios of 5:1 or greater; and because TEM is used instead of PCM, structures can be positively identified as asbestos and even the specific asbestos type can be identified (although different asbestos types are given equal weight during counting and thus are considered to be equally harmful to humans (Environ. Sci. Technol., 2003). The one big disadvantage to using the AHERA counting method is that, unlike the PCM counting method, results obtained from the AHERA counting method cannot be used to determine the health risk posed by a specific level of asbestos contamination (Chesson, et al., 1990; Verma and Clark, 1995; OSHA, 1997; Koppikar, 2004).

PCM-Equivalent (PCME) Counting Method

Another counting method, the "PCM-equivalent" (PCME), was designed to improve upon the PCM counting method by using TEM for analysis rather than PCM (PCME is not required by any regulations). With PCME, as with the PCM counting method, only fibers and bundles with lengths greater than 5 µm and aspect ratios greater than or equal to 3:1 are counted as asbestos structures. The PCME counting method differs from the PCM counting method in that fibers (and bundles) are only counted if they are positively identified as asbestos using ED and EDXA (once again, structures cannot be positively identified as asbestos using only PCM). Also, fibers and bundles must have diameters between 0.2 µm and 3.0 µm to be counted [13] because small diameter structures cannot be resolved using PCM (ISO, 1995; 1999), but they can with TEM (and structures with diameters larger than 3.0 µm cannot be inhaled and thus pose no health risk) (ISO 1995; 1999; NIOSH 7402). The advantage of the PCME method is that results from a TEM (or SEM) analysis can be used to predict risk. However, there are several problems with this counting method. First, two of the disadvantages of the PCM counting method also apply to this counting method: only asbestos structures with lengths greater than 5 µm are counted, so asbestos structures with shorter lengths are not considered to be a health threat; and different types of asbestos structures are given equal weight during counting, and are considered equal in terms of being a threat to human health. Secondly, those structures counted under PCME will not necessarily correlate to structures that would be counted using the PCM method. Even with the restriction on fiber (or bundle) diameter, more asbestos structures may be identified using TEM than PCM because of the higher resolving power of the electron microscope.

ISO 10312 Counting Method

The International Organization for Standardization (ISO) developed a new counting method for its direct-transfer (ISO 10312, 1995) TEM method (this method's use is not required by regulatory mandate). When using the ISO 10312 counting method, an analyst is responsible for thoroughly classifying all asbestos structures found, and it is left to someone else to separately interpret the results according to whichever criteria they find most appropriate. To restate, under this method a survey of all asbestos structures occurs and the interpretation of the results is performed separately. Under ISO 10312, a particle is considered to be an asbestos fiber if it has parallel or stepped sides, an aspect ratio of 5:1 or greater, a length equal to or greater than 0.5 µm, and ED and EDXA analysis confirms that it is asbestos. A bundle is a group of apparently attached parallel asbestos fibers, of which at least one fiber has an aspect ratio of 5:1 or greater. A cluster is an aggregate of 2 or more fibers, with or without bundles, that can be categorized as a disperse or compact cluster depending on if “at least one of the individual fibres or bundles can be separately identified and its dimensions measured” (ISO, 1995, p. 25). A matrix consists of one or more fibers, or bundles, connected to or partially covered by a particle or group of non-fibrous particles. A matrix can be either a disperse or compact matrix. When recording the counting results the structures are broken into two categories: those longer than 5 µm and those equal to or shorter than 5 µm. The asbestos types of each of the structures, and component fibers (when possible), are also recorded. The results can also be recorded as PCM-equivalent (PCME) (ISO, 1995; 1999). The advantage to the ISO 10312 counting method is that once the asbestos structures are surveyed the results can be reinterpreted at a later date (for instance, if opinions change about which kinds of asbestos structures pose a health risk to humans). The disadvantage of this approach is that it is much more time-consuming and thus more expensive.

One last point that should be made is that not all of the counting methods count complex asbestos structures in the same way. That is, with the PCM and PCME counting methods complex structures like clusters and matrices are not counted, but their asbestos fiber (and fiber bundle) components *are* counted (NIOSH, 1994a; OSHA, 1997; NIOSH, 1994b; ISO, 1995; 1999). With the AHERA or ISO 10312 counting methods, the component asbestos fibers in clusters and matrices are not counted, and instead, each complex asbestos structure is counted as one structure (USEPA, 1987; ISO, 1995; 1999). This difference is important because it will lead to different results when calculating the amount of asbestos present (Smith, 2004a).

ASBESTOS DETECTION TECHNIQUES

There are a number of asbestos detection techniques that have been developed over the years, the most important and widely used of which are microscopy techniques, such as phase contrast microscopy (PCM), transmission electron microscopy (TEM), scanning electron microscopy (SEM), and polarized light microscopy (PLM). Having accurate techniques for measuring asbestos levels is critical in determining the extent of asbestos contamination and the health risks for humans. The techniques mentioned in the previous section vary significantly, so it is important to understand their individual strengths and weaknesses to determine when they should be used and how they can be used most effectively. In this report, all of the established techniques will be analyzed to determine their ability to detect asbestos levels in air and soil.

Asbestos in Air

The detection of asbestos in air is important because this is the medium in which asbestos is most dangerous to humans. A number of successful methods have been developed to assess asbestos contamination in air, including ones using phase contrast microscopy (PCM), transmission electron microscopy (TEM), and scanning electron microscopy (SEM). Fortunately, detecting asbestos in air is a relatively easy process because obtaining a sample only requires one to filter particles out of the air. However, it is extremely important to have effective techniques and methods for measuring asbestos in the air because this is the medium in which asbestos is usually measured and in which health risks can most easily be determined. The detection of asbestos in the air is critical for the EPA under the Superfund program in determining the extent of contamination at Superfund sites, monitoring worker conditions, and in gauging the success of cleanup efforts.

Phase Contrast Microscopy (PCM)

PCM is an optical microscopy analytical technique that can be used to measure asbestos levels in air. Regulations issued by OSHA require the use of PCM to determine indoor asbestos air levels for occupational settings to ensure a safe working environment (OSHA, 1997; Millette et al., 2000). Several methods have been developed for PCM, but the most prevalent one was developed by the National Institute for Occupational Safety and Health (NIOSH) and is referred to as "NIOSH 7400." Other methods include ID-160 (which is OSHA's adaptation of NIOSH 7400); the American Society for Testing and Materials (ASTM) method, ASTM D4240-83; the OSHA/EPA Reference Method (ORM); and the NIOSH 7400 predecessor, NIOSH Physical and Chemical Analysis Method 239 (P&CAM 239).

NIOSH 7400 is the most accepted PCM method for asbestos determination and is used by virtually all commercial labs when PCM analysis is requested (DeMalo, 2004). This method, which was last revised in 1994, establishes requirements for both the preparation and microscopic examination of air samples. To conduct a PCM analysis following NIOSH 7400 guidelines, users must follow a number of steps from air sample collection to the documentation of results. The first step requires the collection of an air sample. This is usually done using a personal sampling pump to force air through a membrane filter to capture airborne asbestos fibers. The amount of time over which pumping occurs and the flow rate must be recorded to later calculate the number of fibers present per volume of air. Other methods of collecting air samples exist, such as using a personal passive dust sampler (Burdett and Revell, 2000), but methods other than NIOSH 7400 must be used. NIOSH 7400 advocates the use of a cellulose-ester membrane filter with 0.45 µm to 1.2 µm sized pores (filters with 0.8 µm sized pores are used for personal sampling, while 0.45 µm sized pore filters are required if the sample is to also be analyzed using TEM). In preparing for analysis following sample collection, the portion of the filter that is to be examined first has to be made "cleared" or "collapsed" (i.e. made transparent) using vaporized acetone heated by an aluminum block (the "hot block" method) to obtain a permanent mount and to make it easier to focus on the fibers. It next has to be treated by immersing the filter in triacetin. NIOSH 7400 also allows for other filter preparation methods. Other asbestos determination methods, like P&CAM 239, may use other filter preparation methods, such as the "non-permanent field mounting technique." The filter can then be examined under a positive phase contrast microscope, and the fibers counted with the aid of a Walton-Beckett graticule. Fibers are counted according to strict guidelines contained in the NIOSH 7400 method, which are the same as those in ID-160, P&CAM 239, and all other PCM methods. Fibers from a minimum of 20 random areas on the filter are counted and fibers are only accepted if they have a length greater than 5 µm and have an aspect ratio of 3:1 or greater. Some other counting restrictions also apply (NIOSH, 1994a; OSHA, 1997).

As mentioned above there is widespread agreement in the superiority of NIOSH 7400 over other PCM methods. Its acceptance lead ASTM to discontinue its own method, ASTM D4240-83, in 1995 (ASTM, 2004). Other methods, like OSHA's ID-160, are adaptations of NIOSH 7400 and are virtually identical it (OSHA, 1997). P&CAM 239 is an earlier NIOSH PCM method (officially published in 1979 [Schlecht and Shulman, 1995]) and NIOSH 7400 is considered to be an updated version. NIOSH 7400 differs from P&CAM 239 in that it requires the use of a slightly different filter, a different sample preparation technique (i.e., P&CAM 239 uses the dimethyl phthalate/diethyl oxalate method), the Walton-Beckett graticule to standardize observed areas, a standard test slide, and a change in the minimum recommended loading for the filter (NIOSH, 1994a). Both NIOSH and OSHA agree that NIOSH 7400 is a "more accurate and reliable" method than P&CAM 239 (USEPA, 1987, p. 41839). ORM is only used for the personal sampling of abatement workers and cannot be used for the area clearance analysis of air (USEPA, 1987).

There are a number of advantages associated with using PCM for determining the asbestos content of air as opposed to the other common asbestos determination techniques, TEM and SEM. The first advantage of this approach is that it is inexpensive (Millette et al., 2000) (e.g., \$8-10 per sample, "depending on turn around time" [DeMalo, 2004]) and relatively simple (OSHA, 1997). Because of its simplicity–sample preparation is easy and PCM does not require a complex electron microscope–users do not have to possess specialized knowledge in order to analyze samples (DeMalo, 2004) and samples can be analyzed much more quickly than with TEM and SEM (Virta, 2004). Also, because of the relative simplicity of the equipment required for PCM analysis compared to electron microscopy, analysis can be performed on-site (DeMalo, 2004), which makes it a convenient technique for monitoring asbestos exposure in the workplace (Millette et al., 2000, OSHA, 1997). Finally, PCM has "continuity with historical epidemiological studies" (OSHA, 1997), meaning that the results from a PCM analysis can be compared to health studies used to estimate the risk of acquiring an asbestos-related disease (Chesson et al., 1990; Verma and Clark, 1995). This makes the results from a PCM analysis more applicable in assessing risk than a TEM or SEM analysis. All of these advantages combine to explain why PCM's use is widespread in the determination of asbestos in air. Another point is that PCM's use is also fueled by OSHA requirements that require the use of this technique, rather than TEM and SEM, in determining asbestos concentrations in occupational environments. This more than anything else may explain why PCM is such a ubiquitous technique, as well as the fact that it is so cheap and easy to perform (Thornton, 2004). That is, the existence of OSHA regulations increased demand for PCM analysis, which encouraged more commercial labs to perform this technique, and ultimately resulted in a reduction in the price (DeMalo, 2004).

While it is advantageous to use PCM for a number of reasons, there are also a number of disadvantages to this technique. The main disadvantage with PCM is that it cannot distinguish between asbestos and non-asbestos fibers, which causes great uncertainty about the actual asbestos fiber concentration for a given area (NIOSH, 1994a; OSHA, 1997; Mossman et al., 1990; USEPA, 1987; Kominsky et al., 1991; DeMalo, 2004; Karaffa et al., 1987; GETF, 2003; Yamate, et al., 1984), nor can it distinguish between different types of asbestos fibers (Verma and Clark, 1995). Also, chain-like particles often appear fibrous when using PCM and may be counted as asbestos fibers (NIOSH, 1994a). A number of non-asbestos fiber-like structures (e.g., fiber glass, plant fibers [Chesson et al., 1990], anhydrite, gypsum, membrane structures, microorganisms, perlite veins, some synthetic fibers, sponge spicules and diatoms, and wollastonite) can interfere if present (OSHA, 1997; NIOSH, 1994a) and artificially boost the asbestos fiber count (Millette et al., 2000). Therefore, to have an accurate estimate of the asbestos fiber concentration one must be sure that a given site is devoid of any kind of interfering material. To ensure that interfering materials are kept out of the asbestos fiber count, "differential counting" can be used (OSHA, 1997; NIOSH, 1994a). To perform differential counting, electron microscopy (i.e., TEM) (NIOSH, 1994a; Verma and Clark, 1995), optical tests (i.e., PLM), or dispersion staining can be used in conjunction with PCM to identify the fraction of the sample representing asbestos fibers. Under the NIOSH 7400 method, TEM is advocated for differential counting and NIOSH 7402 is the recommended method (NIOSH, 1994a). However, to use this method requires having a great deal of experience differentiating between asbestos and non-asbestos fibers (OSHA, 1997). Another disadvantage of PCM, compared to TEM and SEM, is that its resolution is much worse, and consequently, PCM analysis misses many smaller fibers during fiber counting that can be caught using other techniques (OSHA, 1997; NIOSH, 1994a; Mossman et al., 1990; Verma and Clark, 1995; Karaffa et al., 1987; GETF, 2003).

Using PCM, the smallest fibers that are visible have diameters of about 0.20 to 0.25 µm (OSHA, 1997; NIOSH, 1994a; Harper and Bartolucci, 2003; Karaffa et al., 1987) or 0.3 µm (Verma and Clark, 1995), while the finest asbestos fibers may have diameters as small as 0.02 µm (OSHA, 1997; NIOSH, 1994a). A study from the 1980s determined that among asbestos fibers with lengths exceeding 5 µm, over 50 percent generally have diameters smaller than 0.4 µm – resulting in a significant proportion being "invisible" under PCM analysis (Egilman et al., 2003). In studies comparing PCM with TEM, it was found that PCM detected far fewer asbestos fibers. One study estimated, using TEM analysis, that asbestos fibers that are undetectable by PCM (i.e., fibers with lengths less than 5 µm and diameters of 0.2 µm or less) were present at 50 to 100 time the concentration of the larger, optically visible fibers. Because of its poor resolution, PCM can result in a significant underestimation of the asbestos fiber concentration in air (Millette et al., 2000; OSHA, 1997).

Transmission Electron Microscopy (TEM)

Another analytical technique used to detect asbestos fibers in air is transmission electron microscopy (TEM). This technique relies on electron microscopy rather than optical microscopy. With TEM, an electron microscope is used to transmit electrons through a specimen and produce an image. EPA regulations adopted with the Asbestos Hazard Emergency Response Act (AHERA) of 1986 require that TEM be used, following cleaning actions at school buildings to remove ACM, to ensure that no asbestos remains in the air (USEPA, 1987). To comply with this regulation the EPA's published method, the AHERA method, must be followed. However, other methods exist and are used for other tasks. These include: EPA Level II method (also known as the Yamate method), NIOSH 7402, EPA 540-2-90-005, ISO 10312, ISO 13794, and others that will not be discussed, like ASTM D6281-04.

The earliest widely accepted TEM method for analyzing asbestos in air is EPA Level II method (Yamate et al., 1984). This method is a direct-transfer TEM method that analyzes the morphology, electron diffraction pattern, and X-ray spectrum of asbestos to determine asbestos levels in the air (both the fiber concentration of asbestos and the amount of asbestos in grams per volume of air). This method was an attempt at refining earlier EPA methods by Samudra et al. (1977 and 1978) for the EPA. Level II was published along with the Level I method, a simpler method designed to screen many samples (in which X-ray analysis is not used), and the Level III method, a method that uses a more in-depth X-ray analysis designed to confirm asbestos identification for controversial samples. To follow the Level II method, air samples first have to be collected by pumping air through a polycarbonate membrane filter with a pore diameter of 0.4 µm (if contaminants that are too large to be respirable are present, then they can be filtered out using a size-selective inlet). The filter then has to be coated with carbon in a vacuum evaporator. The particulates are transferred to a TEM grid using a Jaffe washer (which is used to dissolve away the filter and leave only the particulates imbedded in the carbon film coating). The grid can be lightly coated in gold (to aid in the inspection of the sample with electron diffraction), and finally known areas of the grid (i.e., randomly chosen grid openings) are scanned for asbestos structures. When analyzing the prepared sample with a 80 or 100 kV transmission electron microscope, the morphology, electron diffraction pattern, and X-ray spectrum of any discovered asbestos structure are examined. Asbestos structures are classified according to structure type and asbestos type, and the size of each structure is recorded. Asbestos structures must contain asbestos fibers that appear fibrous (i.e., be parallel-sided), have aspect ratios of 3:1 or greater, and are confirmed to be asbestos using ED and EDXA. Asbestos levels in the air can then be calculated as the asbestos structure number concentration or as fiber mass per volume for each type of asbestos (Yamate et al., 1984).

With the enactment of AHERA in 1986 came the endorsement of an EPA-backed TEM method for the analysis of airborne asbestos fibers. This method, named the “Interim Transmission Electron Microscopy Analytical Method,” is also referred to as the “AHERA method.” The government requires that this direct-transfer method be used to test the air quality in schools in which ACM removal occurs to ensure that asbestos fiber concentrations are no higher than normal background levels. With this method an air sample is collected by pulling air through either a polycarbonate (PC) filter with a pore size of 0.4 µm or less or a mixed cellulose ester (MCE) filter with a pore size of 0.45 µm or less. To prepare the PC filter for TEM analysis, it is coated with a film of carbon in a vacuum evaporator, the filter is transferred to a TEM specimen grid and collapsed in a Jaffe washer using chloroform (condensation washing is required if the filter dissolves incompletely). With a MCE filter, the filter is partially collapsed with acetone vapor, etched with a plasma asher to expose embedded fibers, coated with a thin carbon film using a vacuum evaporator, and finally the filter is transferred to a TEM specimen grid and collapsed more completely (again using acetone). Either process should create “an intact film containing the particulates of the filter surface which is sufficiently clear for TEM analysis” (USEPA, 1987, p. 41864). An 80 to 120 kV transmission electron microscope with ED and EDXA capability should be used to examine the filter. To examine ED patterns, a thin film of gold can be evaporated onto the TEM specimen grid. Finally, the counting of verified (with ED and EDXA) asbestos fibers occurs by scanning random grid openings for “any continuous grouping of particles in which an asbestos fiber with an aspect ratio greater than or equal to 5:1 and a length greater than or equal to 0.5 µm” (USEPA, 1987, p. 41865). The concentration of asbestos structures in the air can then be calculated (USEPA, 1987).

NIOSH developed its own direct-transfer TEM method for analyzing asbestos in air in 1989 (it was later reissued in 1994). This method, NIOSH 7402, was designed to complement NIOSH's PCM method, NIOSH 7400, by validating results obtained from PCM analysis. NIOSH 7402 is very similar to the MCE filter preparation portion of the AHERA method: an air sample is collected on a cellulose ester membrane filter with a pore size between 0.45 µm and 1.2 µm (0.45 µm pore size filters are recommended for TEM), the filter is cleared with acetone vapor (other clearing techniques are also allowed), a film of carbon is evaporated onto the filter, and the filter is transferred to a TEM specimen grid and collapsed using a Jaffe wick washer and acetone. The specimen can then be analyzed using a circa-100 kV transmission electron microscope, with ED and EDXA capability to aid in the identification of asbestos fibers. Any fiber with a diameter of 0.25 µm and that meets the PCM definition of a asbestos fiber (i.e., that has an aspect ratio of 3:1 or greater and a length longer than 5 µm) is counted and the asbestos structure concentration can then be calculated (NIOSH, 1994b).

In 1990, the EPA published another method, the Superfund Method for the Determination of Asbestos in Ambient Air (USEPA, 1990b). This method, which is also known as EPA 540-2-90-005, was designed to help investigators better estimate the risk posed by asbestos at Superfund sites by more precisely estimating the asbestos content of air at low concentrations and provide data that could be compared with past (and future) epidemiological studies. This method relies primarily on indirect-transfer TEM analysis because the authors believe that there exists significant advantages of the indirect approach over direct-transfer TEM (i.e., improved sensitivity, ability to remove interfering particulates, and a more equal distribution of asbestos across the filter surface) (USEPA, 1990a). However, direct-transfer TEM will also be used because most of the studies designed to analyze risk are based on direct-transfer methods and direct-transfer results need to be compared with the results from indirect-transfer TEM so that risk can be assessed (this is because the size distributions of asbestos fibers obtained from both of these methods differ—the use of indirect methods has a tendency to break apart complex structures into smaller components). To prepare a sample using the indirect approach, an air sample is collected on a 0.45 µm MCE filter, the filter is ashed in a low-temperature asher (to remove organic particulates), the ash is dispersed ultrasonically in distilled water, the pH of the suspension is lowered with hydrochloric acid (to remove calcium sulfate fibers (i.e., gypsum) and carbonates), and the suspension is drawn through a 0.1 µm MCE filter. The filter is then collapsed with a chemical mixture and a thin film of carbon is evaporated on the filter surface. After the filter is transferred to a TEM specimen grid and the rest of the filter medium is dissolved using a solvent extraction procedure, TEM analysis can occur using a transmission electron microscope with ED and EDXA capability. To prepare a sample using the direct approach, an air sample is again collected on a MCE filter, but then the filter is collapsed with a chemical mixture, etched with a low-temperature plasma asher (to expose any fibers that were covered by filter polymer during the collapsing process), coated with a thin film of carbon, transferred to a TEM specimen grid, and dissolved through a solvent extraction procedure. The specimen can then be analyzed. During the analysis of a sample (using either approach), asbestos fibers (aspect ratio of 5:1 or greater) or more complex asbestos structures are classified according to asbestos type and size (structures are grouped into two categories: structures with lengths between 0.5 µm and 5 µm and those with lengths greater than 5 µm). The reason for the two groupings is that earlier methods, which were used to estimate risk, assumed that only those structures with lengths greater than 5 µm were biologically active, but many researchers now believe asbestos structures with lengths shorter than 5 µm are also biologically active. This method incorporates the entire range of asbestos structures so that results can be compared to past risk studies, but also records the presence of asbestos structures with shorter lengths so that this information can be used if new studies determine the risk posed by shorter length asbestos (USEPA, 1990b).

ISO developed the direct-transfer method, ISO 10312 (1995), as a method for both analyzing air samples with TEM and counting asbestos structures in a way that leaves the interpretation of results up to the user. With ISO 10312, an air sample is obtained by drawing air through either a PC capillary-pore filter with a maximum pore size of 0.4 µm or a MEC or cellulose nitrate filter with a maximum pore size of 0.45 µm, using a pump. Samples collected on PC filters are prepared by applying a coating of carbon through vacuum evaporation and after transferring the filter to a TEM specimen grid, dissolving away the filter medium using a solvent extraction procedure. "This procedure leaves a thin film of carbon which bridges the openings in the TEM specimen grid, and which supports each particle from the original filter in its original position" (ISO, 1995, p. 4). Samples collected on cellulose ester filters are prepared using a dimethyl-formamide and glacial acetic acid solution to collapse the filter to 15 percent of its original thickness, leaving the filter thin and transparent. The filter surface is then plasma etched with a plasma asher to ensure all the particles on the filter are exposed. Carbon is then evaporated onto the filter surface and after transferring the filter to a TEM specimen grid, the filter is dissolved away using a solvent extraction procedure. The specimens are analyzed by 80 to 100 kV TEM (using ED and EDXA to help with identification) and asbestos fibers are counted according to the classification methodology outlined in ISO (1995). All asbestos fibers with lengths greater than 0.5 µm and aspect ratios of 5:1 or greater are counted and grouped into subdivisions according to the type of asbestos and the fiber size (unless the PCME count is being determined, in which case every fibrous structure with a length greater than 5 µm, an aspect ratio of 3:1 or greater, and a diameter between 0.2 µm and 3.0 µm, would be counted). Using the collected information, the airborne concentration of asbestos structures can be calculated using whichever criteria is deemed most suitable (complex asbestos structures are usually counted as one structure, as are individual asbestos fibers). More complex "asbestos structures" (aggregates of asbestos fiber/s with or without other materials) are classified according to their structure type (i.e., bundle, cluster, or matrix [14]) (ISO, 1995).

ISO developed an indirect-transfer TEM method, ISO 13794 (1999), as an alternative to ISO 10312 (1995). This method is used to determine the asbestos fiber content of air and has the same counting method as that developed for ISO 10312. However, the total mass concentration of airborne asbestos can be calculated as well. With ISO 13794, air samples are collected by drawing air through PC capillary-pore filters (maximum pore size, 0.4 µm) or mixed esters of cellulose (MEC) or cellulose nitrate filters (0.8 µm maximum pore size). A portion of the filter is then ashed in an oxygen plasma asher (to remove organic materials), and the residual ash is dispersed in distilled water (with a lowered pH to remove water-soluble materials). A known amount of the aqueous dispersion is drawn through either a capillary-pore PC membrane filter with a maximum pore size of 0.2 µm or a cellulose ester membrane filter with a maximum pore size of 0.22 µm. If using a PC filter one must coat the filter with a thin film of carbon using vacuum evaporation, transfer the filter to a TEM specimen grid, and dissolve away the filter medium using solvent extraction, before analyzing. With a cellulose filter, the filter is treated with chemical agents to collapse it and then etched with an oxygen plasma to ensure that all of the particles are exposed. Next, the filter is coated with carbon using vacuum evaporation, transferred to a TEM specimen grid, and dissolved using a solvent extraction procedure. The specimen (prepared from either a PC or cellulose filter) is then examined using an 80 to 120 kV TEM microscope with ED and EDXA capability. Classification of the fibers is done according to asbestos type and size and then the asbestos structure concentration or the total mass concentration of airborne asbestos can be calculated (ISO, 1999).

There are great similarities between the five direct-transfer methods discussed above (especially in terms of sample collection and preparation), but important differences still remain. Before using any of the five methods, any advantages or disadvantages associated with them must be considered.

For EPA Level II, it is important to note that it is not used as much as some of the other methods because it is somewhat out of date (issued in 1984). Since 1984, other methods have improved upon EPA Level II design, presumably making the more recent methods more efficient and precise. An example of the inefficiency of EPA Level II includes the step when the particulates on the filter surface are transferred to the TEM specimen grid using a Jaffe washer. This process, which uses chloroform to dissolve the filter medium, can take 24 to 48 hours. Another problem with this method includes the fact that by using gold coating to help obtain a better ED pattern (the process of coating the TEM specimen grid with gold "establishes an internal standard for [electron diffraction] analysis" [Yamate et al., 1984, p. 16]), it becomes more difficult to observe small-diameter chrysotile. Also, EPA Level II is an unreliable method for calculating asbestos fiber mass because it is calculated by converting fiber dimension to fiber mass using a conversion factor. This calculation may not provide an accurate result because when performing this conversion it is assumed that a given fiber's cross-section is completely circular (which may not be the case) and its diameter is constant (which may not be the case). Also, the conversion factors, which are the density values for chrysotile (2.6 g/cm^3) and amphiboles (3.0 g/cm^3), are assumed to be constant (which may not be the case) (Yamate et al., 1984). The last problem with EPA Level II is that in the analysis portion of the method an asbestos fiber is defined as a fiber of any size with an aspect ratio of 3:1 or greater (Yamate et al., 1984), but one cannot make an assessment of risk from results obtained by this method because they do not correlate to results obtained by PCM analysis (risk studies rely on PCM analysis). Also, it has since been determined that asbestos fibers have an aspect ratio of 5:1 or greater (USEPA, 1987).

The AHERA method both improves upon EPA Level II and retains some of its weaknesses. One improvement is that AHERA provides two ways to prepare a sample (using a PC or MCE filter), giving more options to analysts. However, with PC filters an earlier problem remains: treatment in a Jaffe washer may not be sufficient to dissolve a PC filter completely even after 3 days. This is significant because if any undissolved filter medium remains the ability to obtain an ED pattern may be impaired. Also, the time required to process a sample will be greatly expanded. To remedy this problem the AHERA method advocates that condensation washing be used to clear a TEM specimen grid of all residual filter medium (condensation washing should clear the TEM specimen grid in approximately one hour). Another problem that AHERA does not solve is the fact that gold coating still has to be evaporated onto the TEM specimen grid to improve the ability to obtain an ED pattern for a given fiber. Also, results obtained using AHERA cannot be used to assess risk to humans because the AHERA definition of asbestos (a fiber confirmed to be asbestos by ED and EDXA with an aspect ratio of 5:1 or greater and a length greater than 0.5 µm) is not compatible with the definition used with PCM methods. However, it is important to note that AHERA was designed for a different purpose: detecting the presence of asbestos fibers to determine if a school building is really completely free of contamination (USEPA, 1987).

The NIOSH 7402 method is very similar to the MCE filter preparation portion of the AHERA method, but there are important differences. NIOSH 7402 advocates the use of acetone to clear the cellulose filter as the first sample preparation step (as in AHERA), but NIOSH 7402 allows other techniques as well, such as the “hot block” clearing technique (developed by Baron and Pickford in 1986 and used in NIOSH 7400) or the DMF clearing technique (developed by LeGuen and Galvin in 1981). After this step, NIOSH 7402 skips the step in which the surface of the filter is etched with a plasma asher. Instead, the filter is coated with carbon, making for a more streamlined preparation approach. However, this may result in more asbestos structures being covered by filter medium and thus difficult to detect. Finally, asbestos structures are counted differently with NIOSH 7402 than other methods because this method is designed to validate results obtained through PCM analysis (i.e., NIOSH 7400). For this reason results obtained by NIOSH 7402 cannot be compared to results obtained from other TEM methods (with NIOSH 7402, asbestos structures with diameters less than 0.25 µm are ignored and structures with aspect ratios between 3:1 and 5:1 are included) (NIOSH, 1994b).

ISO 10312 is a direct-transfer method that is similar to previous methods in how sample preparation is conducted. However, this method allows greater flexibility because either PC or cellulose filters can be used to prepare a sample. Furthermore, in developing this method the authors benefitted by having access to a number of earlier direct-transfer TEM methods from which to improve upon, making ISO 10312 more efficient by including measures such as condensation washing to more completely and quickly dissolve filter medium after transferring it to TEM specimen grids. The major difference between ISO 10312 and other direct-transfer methods is the counting method employed by ISO 10312. The counting method calls for the classification of asbestos structures according to size and asbestos type in an attempt to more completely survey asbestos structures that are present and make later re-evaluation of the results easier (ISO, 1995). The concentration of asbestos structures in the air can be calculated after the count is complete, but the results still cannot be translated into an estimate of risk because they cannot be accurately compared to results from a PCM analysis. If the fibers present are counted to obtain the PCM-equivalent count, all fibers with an aspect ratio of 3:1 or greater, lengths greater than 5 µm, and diameters between 0.2 µm and 3.0 µm, are counted (ISO, 1995). Yet, one still may not be able to correlate the airborne asbestos concentration obtained from the count with estimates of risk because the results may not be equivalent to results obtained by PCM. The procedure for preparing a sample is different under TEM and transmission electron microscopes have greater resolution, meaning that some fibers that PCM misses may be counted under the TEM method. Also, fibers included under PCM analysis may clearly have non-asbestos morphology under TEM analysis. Finally, because ISO 10312's counting method is so complicated compared to other methods, it is also more time-consuming and expensive to conduct (Millette et al., 2000).

As with the direct methods, the indirect-transfer TEM methods are similar; there is little difference in the way the samples are collected and prepared. However, EPA 540-2-90-005 is somewhat different from ISO 13794 in that it also requires the use of a direct-transfer method so that the results obtained by its indirect method can be compared to those from its direct method, which can then be compared to estimates of risk based on studies using PCM analysis. The problem with this is that the results obtained through direct-transfer TEM cannot be compared to results obtained from PCM analysis because of the greater resolution of the microscope in the TEM method and the inability to positively identify asbestos structures using PCM. The use of both indirect and direct approaches also complicates sample preparation and makes it more time-consuming. The other indirect-method, ISO 13794, does not include a direct method (ISO, 1999). This simplifies the sample preparation and analysis, but makes estimating risk more difficult. ISO 13794 also involves a more extensive classification process for asbestos structures (as with ISO 10312) in an attempt to make the re-evaluation of results easier (ISO, 1999). Although, both methods include counting methods designed to aid in the re-evaluation of results. Because the classification process of asbestos structures using ISO 13794 is so extensive it consumes more time and is more expensive. Also, using the results from ISO 13794 to calculate total mass concentration is just as problematic as with EPA Level II because both methods rely on the same assumptions (that may or may not be true) when converting fiber dimension to fiber mass. In performing the calculation it is assumed that a given fiber’s cross-section is completely circular, its diameter is constant, and a given asbestos fiber type has a certain density that never varies (ISO, 1999).

Traditionally, direct-transfer methods have been preferred when using TEM to analyze asbestos in air (Smith, 2004a). Direct methods have some significant advantages. First, using a direct method ensures that particulates will not be altered during sample preparation (Smith, 2004a) and the distribution of fiber sizes will remain as it was in the air (Kauffer et al., 1996a) [15]. Secondly, the possibility of experiencing a loss of asbestos fibers [16] or the introduction of interfering contaminants during sample preparation is less likely than when using an indirect method (USEPA, 1990b). Also, the preparation of samples using direct methods tends to be less complicated than with indirect methods, meaning that it may take less time to process a sample and therefore cost less as well. Being a simpler method may mean that personnel performing the sample preparation will require less training and need less experience (DeMalo, 2004).

While there is an advantage to using direct methods, indirect methods have their strengths as well. First, interfering particulates can be dissolved, or removed through other methods (e.g., ashing). Second, unlike with direct methods, the achievable detection limit [17] is not restricted. With direct methods the detection limit is restricted by the density of particulates on the surface of the filter; this is not the case with indirect methods (Kauffer et al., 1996a; USEPA, 1990b; ISO, 1999). For both of these reasons it is advantageous to use indirect methods when analyzing air samples with high levels of particulates. Also, with indirect methods there is a more equal distribution of particulates on the filter, and thus on the TEM specimen. This is important because only a small portion of the specimen gets analyzed, so if there is an uneven distribution of asbestos structures (which can happen when using direct methods) the accuracy and precision of the results can be negatively affected (ISO, 1995; Kauffer et al., 1996a; Smith, 2004a).

Three additional disadvantages of indirect methods include the fact that the size distribution of asbestos structures can be altered when complex structures are broken into their component parts or dissociated (Kauffer et al., 1996a); the ashing process can release contaminant asbestos fibers from the collection filter and artificially increase the asbestos structure count; and exposure to acidic conditions during sample preparation can cause magnesium to leach from chrysotile fibers. To prevent the leaching of magnesium, the suspension containing filtered materials and the acidic solution must be quickly filtered (ISO, 1999). Indirect methods have the potential of overestimating the presence of asbestos structures because the breakup of complex structures may lead to an artificially high asbestos structure count (as Kauffer et al. [1996a] states, "The fibre number concentrations measured by using the indirect preparation method are generally reported to be higher than when using a direct preparation method" (p. 322)). However, because indirect methods disperse "the majority of complex clusters and aggregates of fibers into their component fibres and bundles" (ISO, 1999, p. v), they are better at accurately quantifying the asbestos content in the air compared to direct methods (ISO, 1999; Smith, 2004a) and are preferred if it is necessary to measure the total mass concentration of asbestos, rather than the concentration of asbestos structures in the air. In general, direct-transfer TEM analysis can lead to an underestimation of the presence of asbestos structures because other particulates may obscure some asbestos fibers (USEPA, 1990b).

TEM could be considered a superior technique to PCM and SEM for several reasons. It has a number of advantages over PCM. First, transmission electron microscopes have greater resolution and thus can better detect smaller fibers (Mossman, et al., 1990; Kauffer et al., 1996a; Karaffa et al., 1987; GETF, 2003) and better examine a particulate's morphology. Secondly, TEM methods for analyzing airborne asbestos use EDXA to determine the elemental makeup of a fiber, which enables this technique to be able to determine if a fiber possesses a chemical composition characteristic of asbestos or not (DeMalo, 2004) (USEPA, 1987). The use of EDXA and the "observation of the 0.73 nm (002) reflection of chrysotile in the ED pattern" is critical when attempting to differentiate between chrysotile and halloysite, vermiculite scrolls, or palygorskite, because the visual examination of only morphology and ED patterns can lead to the misidentification of fibers (ISO, 1995, p. 18). When examining chrysotile, it is important that ED be performed first because EDXA can damage chrysotile's crystal structure and make obtaining an ED pattern difficult (ISO, 1995; Yamate et al., 1984). There are some other problems with EDXA: it is not practical to use it to analyze every fiber in a sample because the analysis is time consuming; nearby particulates may interfere with EDXA analysis; specimen tilting may adversely effect the X-ray acquisition from hidden particles; and the elemental ratios contained in an amphibole asbestos mineral's characteristic X-ray profile may vary slightly (the elemental ratio contained in chrysotile's profile varies much more) (Yamate et al., 1984). The advantages TEM has over PCM (i.e., greater resolution and ED and EDXA capability) make it a superior technique for monitoring air following cleanup actions (USEPA, 1987). "TEM coupled with aggressive sampling [18] should be recommended as the analytical method of choice for final post-abatement clearance testing" (Karaffa et al., 1987). In fact, PCM analysis of air has been found to be inadequate for post-abatement monitoring. Areas deemed free of asbestos using PCM were later found to be contaminated when using TEM (USEPA, 1987).

TEM also has some important advantages over SEM. First, TEM is a more widely accepted technique than SEM (which has no validated methods) for the determination of asbestos in air;

its use is also required by AHERA (DeMalo, 2004). Partly for this reason, TEM is in general much cheaper than SEM (TEM analysis costs about $75 per sample and SEM costs about $150 per sample), and TEM analysis is more widely available at commercial labs. Also, TEM methods use ED to determine the crystal structure of a given particulate to determine if it is characteristic of asbestos, or not. Neither PCM or SEM methods can do this, and when combined with its EDXA capability, TEM becomes the best technique for determining if a fiber is an asbestos fiber (DeMalo, 2004). However, there are some important points to remember when using ED: not all fibers can be examined because ED analysis can be time-consuming and diffraction patterns may not be recognizable due to contamination of the fiber; interference from nearby particles; the fact that fibers have too great or small of a diameter; or if the fibers are positioned in a way that prevents analysis (Yamate et al., 1984). Examining the morphology and ED pattern is sufficient to positively identify a chrysotile fiber, but to identify amphiboles it is necessary to also use EDXA because some non-amphibole minerals may produce ED patterns similar to amphiboles (NIOSH, 1994b). Still, TEM cannot *unequivocally* identify amphibole asbestos because even with the use of ED and EDXA it cannot differentiate between asbestos and non-asbestos amphibole mineral analogues (ISO, 1995; ISO, 1999). But, all in all, "[TEM] analysis is extremely reliable if sample preparation is performed correctly" (GETF, 2003, p. 71).

Despite the many strengths of TEM there also exists some disadvantages. Both the TEM sample preparation and analysis are more complicated than PCM, making it more labor intensive. It is also more expensive, partly because of its lack of simplicity, but also because the equipment needed to perform TEM analysis is much more expensive than PCM and because it is performed less frequently (it is not used to test airborne asbestos levels in the workplace, like PCM). Another disadvantage is that it has a high detection level because a much smaller portion of the collecting filter (or analysis filter in the case of indirect-transfer TEM) is examined (Yamate, et al., 1984; DeMalo, 2004). This introduces a greater uncertainty about any results obtained from TEM. PCM and SEM do not have this problem because more of the filter can be examined (DeMalo, 2004).

Scanning Electron Microscopy (SEM)

Another electron microscopy approach that can be used to detect asbestos structures in ambient air is scanning electron microscopy (SEM). With SEM an image is produced by scanning a targeted surface with an electron beam and then analyzing the resulting interactions. Several methods have been developed for analyzing air samples with SEM to detect asbestos, but none have been validated. Existing methods include the German VDI method and methods developed by the Asbestos Information Association (AIA) and the American Society for Testing and Materials (ASTM).

The use of SEM as an asbestos detection technique for air is advantageous for a number of reasons. Compared to PCM and TEM, SEM is better for examining the morphology of particulates because of the greater resolution of the scanning electron microscope. With SEM, fibers with smaller diameters and shorter lengths are more readily detected. SEM has a couple of advantages over TEM in that its sample preparation methods are simpler and a greater proportion of a collection filter can be analyzed, meaning that the detection limit is lower and it is more likely that the results an SEM analysis will be reproducible. Another strength that makes SEM better equipped than PCM to identify asbestos structures is the fact that EDXA can be used with SEM to determine the elemental composition of a given fiber (DeMalo, 2004).

Despite these strengths there are still some significant disadvantages to using SEM. While SEM benefits from having greater resolution for analyzing samples and the ability to use EDXA to help identify structures, TEM is still better suited for determining if a fiber is asbestos or non-asbestos and for identifying the specific type of asbestos because of its ability to use ED to determine crystal structure. Also, SEM is far more expensive than TEM (SEM costs ~$150 per sample, compared to ~$75 per sample for TEM) and less widely available, probably partly due to the fact that its use is not required by any governmental regulations (DeMalo, 2004).

Asbestos in Soil

Detecting asbestos in soil is important, especially for EPA's Superfund Program. At many Superfund sites across the United States, asbestos contamination in the soil is a major problem. The development of techniques to detect asbestos in soil is important for assessing sites in which contamination is suspected or has been confirmed, as well as determining how successful cleanup efforts have been. Efforts to develop soil techniques using PLM, TEM, and SEM have been made, but as of now no methods have been validated. Most methods being developed are adaptations of existing methods used to detect asbestos in bulk samples.

Detecting asbestos in soil is a difficult task and for microscopic analysis to be effective a number of inherent problems must be confronted. For example, nearly all soil methods use some type of indirect approach to prepare samples because perhaps the biggest hurdle to effectively analyzing soil samples is getting a homogeneous sample. Various approaches have been developed to improve homogenization to increase the reproducibility of results and ensure that the examined portion of a sample is representative of the whole (DeMalo, 2004). Another problem with detecting asbestos in soil is the fact that it is difficult to connect the results of a soil analysis to some estimate of risk. There are three reasons for this. First, even when the PCM/PCME counting method is used, the count from a soil analysis will not be identical to a count of asbestos structures in the air because of the different challenges posed by analyzing asbestos in a different medium (i.e., sample preparation is drastically different and many more interfering particles are present in soil). Second, because of the different sample preparation procedures it makes more sense to calculate the amount of asbestos present in soil using mass percent rather than the number count of asbestos structures per volume of air. However, "there is no direct relationship between mass estimates of asbestos concentrations and risk" (GETF, 2003, p. 72). Also, measuring asbestos using mass percent is notoriously inaccurate (Kauffer et al., 1996a). Third, and perhaps most importantly, it is difficult to know what level of asbestos in soil poses a similar health threat to a certain asbestos concentration in air because it is difficult to predict what portion of asbestos structures in soil will become airborne following disturbance.

Polarized Light Microscopy (PLM)

PLM is the first technique for detecting asbestos in soil. This technique relies on optical microscopy. Several different methods using this technique have been developed, but no PLM techniques have yet been validated by EPA or other respected international bodies, like ISO and ASTM. Current methods have been adapted from methods used for detecting asbestos in bulk materials, like NIOSH 9002 and EPA Method 600-R-93-116. Existing methods include two EPA methods: SRC-Libby-01 (Revision 2) and SRC-Libby-03 (Revision 1).

The first EPA method using PLM to detect asbestos in soil, Standard Operating Procedure (SOP) SRC-Libby-01 (Rev. 2), also known as "Qualitative Estimation of Asbestos in Coarse Soil by Visual Examination Using Stereomicroscopy and Polarized Light Microscopy" (Gibson, 2004) is based on parts of EPA Method 600-R-93-116 ("Test Method: Method for Determination of Asbestos in Bulk Building Materials" [USEPA, 1993]) and NIOSH 9002 (another method for detecting asbestos in bulk samples) (NIOSH, 1994c). SRC-Libby-01 is intended to be used for screening the coarse fraction (>¼") of soil samples for asbestos (particularly in Libby, Montana). Stereomicroscopy is used to look for asbestos fibers and PLM is used to confirm their presence. In following this method a soil sample is prepared according to guidelines established in SOP ISSI-Libby-01 (Brattin, 2000): the soil sample is dried, homogenized (by passing the sample through a sieve and then mixing), and then the portion of the sample that passed through a sieve is split into four groups using a dry riffle splitter (as outlined in USEPA, 1997). Next, the fraction of the soil sample that cannot pass through a ¼" sieve is examined by stereomicroscopy. The particles composing the coarse fraction are then physically segregated according to appearance into two groups—one characterized as "non-asbestos" and one characterized as "tentatively identified asbestos." Suspected asbestos particles with lengths smaller than 2-3 mm (or 1/10 of an inch) should not be physically segregated from non-asbestos particles because of the technical difficulty of the task. Particles grouped into the "tentatively identified asbestos" group are then examined by PLM to confirm the presence of asbestos. All confirmed asbestos structures are counted and the mass percent of asbestos is calculated by summing the mass of each individual asbestos particle and dividing the total mass of asbestos by the original soil sample weight (i.e., not just the weight of the soil sample that includes the coarse fraction, but also the portion of the original soil sample that was extracted from the coarse fraction during preparation) (Gibson, 2004).

The second EPA method that utilizes PLM in detecting asbestos in soil is SOP SRC-Libby-03 (Rev. 3), which is also known as "Analysis of Asbestos Fibers in Soil by Polarized Light Microscopy" (Brattin, 2004a).This method is based on earlier methods for detecting asbestos in bulk samples, including NIOSH 9002 (NIOSH, 1994c), EPA Method 600-R-93-116 (USEPA, 1993), and California EPA Air Resources Board (CARB) Method 435 (CARB, 1991). SRC-Libby-03 is appropriate for analyzing all types of asbestos, but is intended specifically for analyzing the content of soil for asbestos types that characterize the Libby, Montana, Superfund site. To process a sample according to this method, it has to be prepared according to guidelines outlined in NIOSH 9002, EPA Method 600-R-93-116, or CARB Method 43. After preparing the sample, PLM is used to confirm the presence of asbestos and asbestos fibers are categorized as one of three asbestos types according to attributes like morphology, refractive index, color, and birefringence:

- Libby amphibole (LA) – tremolite, actinolite, winchite, or richterite
- Other amphibole (OA) – amosite, crocidolite, or anthophyllite
- Chrysotile

Then, the mass percent of asbestos is estimated by one of two ways. The first way is to calculate the mass percent by visually estimating the fraction of the total material in a microscope field of view that is composed by asbestos and equating this fraction to a mass percent. The other way is to estimate mass percent by counting the number of asbestos structures present and equating the number count with a mass percent using a standard curve (Brattin, 2004a).

Of the two PLM methods discussed above, there are some important differences that must be considered when determining which to use. The first method, SRC-Libby-01 is a simpler method, meaning that it can be performed more quickly and analysts do not have to have as much experience to perform the analysis satisfactorily. However, there are some weaknesses to this approach. First, SRC-Libby-01 is only used to examine the coarse fraction of a soil sample, so to have a complete analysis the finer fraction must be analyzed using another method. Secondly, this is a qualitative method, meaning that it is used to screen for asbestos, but it is not necessarily suited for accurately quantifying the asbestos content of soil. This is emphasized by the fact that suspected asbestos particles smaller than 2-3 mm are disregarded when segregating “tentatively identified asbestos” from “non-asbestos” particles. Overlooking smaller asbestos particles may lead to an underestimation of the asbestos mass percent. This is especially true since mass percent is calculated by summing the mass of each confirmed asbestos fiber (that is, confirmed asbestos fibers from the “tentatively identified asbestos” group) and dividing by the weight of the sample. Also, this method also calls for the categorization of confirmed asbestos particles into one of three groups as described above: LA, OA, or chrysotile. However, since PLM is not equipped with ED or EDXA, these categorizations cannot be based on crystal structure or elemental composition and thus are likely to be wrong. Asbestos particles may be miscategorized or non-asbestos particles may be counted as asbestos particles, leading to an overestimation of the mass percent of asbestos (Gibson, 2004).

SRC-Libby-03, the other PLM method for soil, is a semi-quantitative method, meaning that it is better equipped to more accurately estimate the mass percent of asbestos in soil. But, this method requires a more complicated sample preparation process because it is not a screening method. This means it requires greater time and more experienced staff to analyze a sample. There are other potential weaknesses with this method. First, it permits three options for preparing a soil sample—by following steps outlined in NIOSH 9002, EPA 600-R-93-116, and CARB 435—which means that the strengths and weaknesses of each of these methods have to be weighed before selecting one (Brattin, 2004a).

Second, when estimating the mass percent of asbestos in soil one of two approaches has to be used—neither of which are ideal. The visual approach requires that an analyst estimate the area fraction of a microscope field of view containing asbestos and then equate this with mass percent. The problem with this approach is that it is difficult to estimate the area fraction represented by asbestos even if the analyst has a frame of reference for the sample. It is difficult to estimate the area fraction for asbestos, especially at low asbestos concentrations (Brattin, 2004a). This makes it likely that any estimate of the area fraction will be inaccurate and estimates will vary significantly between analysts. Also, the assumption that the area fraction can be equated to mass percent may be incorrect (Brattin, 2004a). The other approach calls for the analyst to estimate mass percent by comparing the number count for asbestos structures to a standard curve. If the standard curve is carefully constructed this approach may be a more accurate way of estimating mass percent, but there is still a potential for error because, as the author of this method states, this counting approach is a better estimate of area fraction than mass fraction. Also, this method states that an asbestos particle should be counted if it has an aspect ratio of 3:1 or greater, but expert consensus points to an aspect ratio of 5:1 or greater for asbestos. Counting particles with aspect ratios below 5:1 could lead to an overestimation of the asbestos content of soil. Finally, if the standard curve is based on Libby amphiboles, than the standard curve cannot be used for determining the mass percent of other types of asbestos (Brattin, 2004a).

Third, as with SRC-Libby-01, this method is not equipped to accurately categorize different types of asbestos because of the lack of ED and EDXA capability with PLM. This represents another place that error can be introduced to the analysis portion (Brattin, 2004a; Gibson, 2004). So, while SRC-Libby-03 may be better suited for more accurately determining the asbestos content of soil, compared to SRC-Libby-01, this does not mean that it is a problem-free method.

The use of PLM for detecting asbestos in soil has some advantages over other techniques. First, PLM is similar to PCM in that it relies on optical microscopy. Sample preparation is fairly simple with PLM, as is the instrumentation. For this reason, PLM analysis can be performed relatively quickly and cheaply: about $10 to analyze one sample (GETF, 2003) and does not require a lot of training for personnel (DeMalo, 2004).

However, there are some disadvantages to using PLM compared to TEM and SEM. PLM is “useful” at determining if a fiber is composed of asbestos (Vega, 2003) and can identify asbestos “down to 1% reliably” (GETF, 2003, p. 25), but like PCM, ED, and EDXA, cannot be used to help with identification. For this reason, positive identification of asbestos or specific asbestos types is impossible (GETF, 2003). Also, “False negative results (i.e., not finding the asbestos) are common....when the asbestos is very small or concealed in a matrix” (GETF, 2003, p. 25). The results obtained by PLM analysis, like any soil technique, are not very reproducible. This stems from the fact that it is difficult to get a homogeneous soil sample.

Transmission Electron Microscopy (TEM)

TEM is another technique used to detect asbestos in soil. This technique uses electron microscopy, unlike the optical approach represented by PLM. The TEM methods that have been developed include two EPA methods: EPA-Libby-07 (Rev. 3) (Brattin and Orr, 2004) and EPA-Libby-03 (Rev. 1) (Brattin, 2004b). None of these methods have been validated.

Standard Operating Procedure (SOP) EPA-Libby-07, also known as “Analysis of Asbestos in Soil by Transmission Electron Microscopy Following Water Sedimentation Fractionation,” was last revised on March 3, 2004. This method is based on two earlier methods, Berman’s bulk soil method (also known as, “The Search for a Method Suitable for Supporting Risk Assessment: The Determination of Asbestos in Soils and Bulk Materials: A Feasibility Study”) and EPA 540-R-97-028 (also known as, “Superfund Method for the Determination of Releasable Asbestos in Soils and Bulk Materials” [USEPA, 1997]), and can be used to detect the presence of all asbestos types, but is intended specifically for use at the Libby, Montana, Superfund site.

To prepare a sample following this method, a soil sample is first suspended in water and then allowed to settle for 30 minutes. Gravity will separate the larger soil particles (which will settle out of the top 5-10 cm of the water column) from the smaller asbestos particles (which will tend to remain in the upper portion of the water column). Fluid from the upper portion of the water column is then filtered through a MCE filter (with a 0.22 µm or smaller pore size) to extract the asbestos particles. The MCE filter is then prepared according to the usual steps required for direct-transfer TEM analysis: the filter is collapsed, etched with a plasma etcher, coated with carbon using a carbon evaporator, transferred to a TEM specimen grid, the filter medium is more completely dissolved in a Jaffe washer, and the specimen is analyzed with an 80 to 120 kV transmission electron microscope with ED and EDXA capability. Asbestos fibers are counted according to AHERA guidelines, but asbestos fibers with aspect ratios greater than or equal to 3:1 are also counted. The mass percent of asbestos is then calculated one of two ways. The first way is to sum the mass of each counted asbestos fiber to find the total mass of asbestos, which is then divided by the total weight of the soil on the filter. A second way is to convert the asbestos fiber count to a mass percent using a standard curve “based on at least three replicates of four different concentrations (0.2%, 0.5%, 1%, and 2%) and a control soil” (Brattin and Orr, 2004, p. 8).

The other method, EPA-Libby-03 (Brattin, 2004b), also known as “Analysis of Asbestos in Soil by TEM,” was last revised on February 9, 2004. This method is based on a method used to analyze asbestos in bulk materials, EPA Method 600-R-93-116 (USEPA, 1993), and was designed for determining the mass percent of asbestos in soil (grams of asbestos per 100 grams of soil), particularly the mass percent represented by the amphibole types that are prevalent in Libby, Montana. To analyze a sample using this method, soil containing asbestos first has to be ground according to SOP ISSI-Libby-01 (Brattin, 2000). Then, after the well-mixed soil sample undergoes ashing to remove organic material, the sample is ground using a mortar and pestle, and hydrochloric acid is added to reduce the size of particles and dissolve any carbonate-containing material. An aliquot of the dried, ground residue is then suspended in water (with the aid of a sonicator, which promotes the break up of the soil from the asbestos and the break up of complex asbestos structures into their component parts) and filtered through a 0.22 µm pore size (or smaller) MCE filter. The MCE filter is then treated according to the standard procedure for direct-transfer TEM analysis: the filter is collapsed, the surface is etched with a plasma etcher, it is coated with carbon, transferred to a TEM specimen grid, the filter medium is further collapsed in a Jaffe washer, and the specimen is then examined using an 80 to 120 kV transmission electron microscope with ED and EDXA capability. The counting method outlined in EPA-Libby-03 says to refer to the AHERA guidelines for counting asbestos fibers, but then states that fibers with aspect ratios of 3:1 or greater should be counted as well. Mass percent can be estimated using a conversion factor to convert the fiber dimension of an asbestos fiber to a mass value (this assumes that the cross-section of an asbestos fiber is perfectly square, its width is constant, and density is dependent on the asbestos type and is constant). Another way of estimating mass percent is to count the number of asbestos fibers and convert this to a mass percent using a calibration curve. “The standard curve will be based on at least three replicates of four different concentrations (0.2%, 0.5%, 1%, and 2%) and a control soil” (Brattin, 2004b, p. 10).

The two TEM methods discussed above have some similarities, as well as some differences. The differences that exist between each method must be understood to know how each can be applied most effectively. The most notable aspect of the first method, EPA-Libby-07 (Brattin and Orr, 2004), is the use of water sedimentation fractionation—a soil sample is suspended in water so that gravity can separate larger soil particles from small asbestos particles. However, this separation approach may have some problems associated with it. For example, if asbestos particles are attached to large soil particles, then the asbestos will sink to the bottom of the water column along with the soil particles and will not be counted during the analysis portion of the method, leading to an underestimation of the asbestos content of the soil sample. Also, for this approach to be effective all asbestos types must be suspended at the same level in the upper water column. However, the different asbestos types have different characteristics that may cause one type to sink faster than the others (particularly if one type has a greater tendency to not break apart and is more likely to remain as a large particle). Another potential problem with EPA-Libby-07 is the way that the mass percent of asbestos is estimated. Problems can arise when mass percent is estimated (as was discussed with previous soil methods), either by summing the individual masses of asbestos fibers and dividing by the sample weight (EPA-Libby-07 admits that this approach “may tend to bias low”) or by converting the number of asbestos fibers present to a mass percent using a standard curve. However, both TEM soil methods estimate mass percent in the same way (using either of the two options), so there is no difference between them in this respect. With EPA-Libby-03, problems could arise during the ashing and wet-grinding portion of the method and when the sonicator is used. The ashing process, for instance, can promote the decomposition of chrysotile and result in an underestimation of the amount of this type of asbestos (Brattin, 2004b). The purpose of these steps is to promote the breakup of asbestos particles from soil particles, but their effectiveness has not been determined or compared to the water sedimentation fractionation approach detailed in EPA-Libby-07. In fact, neither the precision or accuracy of either of these methods has yet been determined.

The first advantage of using TEM to detect asbestos in soil is that it is the best technique for positively identifying asbestos and differentiating between the asbestos types because of the high resolution of the transmission electron microscope and the possible use of ED and EDXA. “TEM easily identifies fibers when PLM is ‘non-detect’” (Christiansen et al., 2003). This technique is also cheaper than SEM (DeMalo, 2004).

The disadvantages to using TEM include the fact that TEM, because sample preparation is a complicated process, is more time-consuming than other techniques and requires more experienced personnel to perform the sample preparation, as well as the analysis. It is also more expensive than PLM (DeMalo, 2004). Results obtained from the analysis of soil samples using any technique are not very reproducible, but with TEM, results are even less reproducible because the effect of not having very homogeneous samples is magnified by the fact that only a very small part of the sample is being examined (i.e., there is a great possibility that the area of the filter or specimen being examined is not representative of the whole).

Scanning Electron Microscopy (SEM)

The third technique used to detect asbestos in soil is an approach that uses SEM to examine collected samples. EPA has developed one method, SRC-Libby-02 (Rev. 1), which was adapted from earlier work done by the U.S. Geological Survey (USGS) in 2002 and EMSL Analytical, Inc., in 2000 to aid in the creation of a soil method for EPA. SRC-Libby-02 is not a validated method (Brattin, 2003).

SRC-Libby-02 is designed primarily to measure the asbestos content (mass percent) of soil near or in the Libby, Montana, Superfund site. This method is designed to detect the asbestos types that are most prevalent in Libby (i.e., tremolite, winchite, and richterite amphiboles). This method is intended to detect asbestos in soil in which the asbestos content is less than 10 percent by mass. According to this method, samples can be analyzed using either a direct or indirect approach. If a given soil sample does not contain an “excessive” amount of organic material, then using the direct approach is fine. With the direct approach a portion of the soil sample is collected on a SEM stub, coated with carbon, and analyzed by SEM with EDXA capability. An excessive amount of organic material may be present if one has difficulty evaporating carbon onto the SEM stubs (the outgassing of organic material may occur in a vacuum and impair the coating of the stub with carbon), difficulty analyzing the sample (outgassing may also occur when the sample is in the scanning electron microscope), or if the quality of the stub is poor. The indirect approach must be used if the amount of organic material is deemed a problem. With the indirect approach an aliquot of a soil sample (well mixed) is first ashed in a muffle furnace to remove the organic material, the remaining soil is suspended in water, a portion of the suspension is filtered through a PC filter (without the aid of a pump, which may lead to the loss of sample), the filter (containing what remains of the sample) is mounted on a SEM stub, the stub is coated in carbon with a carbon evaporator (or with gold using a sputter coater), and finally the material on the stub is analyzed under a scanning electron microscope with EDXA capability. All structures that are shown by EDXA to be one of the Libby amphibole asbestos types are counted. When analyzing the sample, the fraction of the area covered by asbestos particles for a given field is estimated or measured and this number is used to estimate the mass percent (Brattin, 2003).

There are some problems with SRC-Libby-02, which help explain why this method has not yet been validated. First, SRC-Libby-02 was designed for a specific purpose (detecting the presence of the amphibole asbestos types that are prevalent in Libby, MT). It is unclear how effective this method would be at detecting chrysotile and other amphibole asbestos types. Second, SRC-Libby-02 relies on the use of an indirect sample preparation approach, which means it may share some of the unintended problems associated with TEM methods that use an indirect-transfer method. For example, the step added to promote the removal of organic material (the ashing step), followed by the step in which the remaining soil is dispersed in water, may promote the breakup of complex asbestos structures, giving a distorted picture of the actual state of asbestos in the soil sample. Although, this method is used to determine the asbestos content of soil as a mass percent and not as an asbestos structure concentration, so this may not be as significant. A problem specific to SRC-Libby-02's indirect sample preparation approach is the fact that the ashing step requires that the sample be heated to 480°C, but any chrysotile that is present may start to degrade because some parts of the sample may reach the temperature at which chrysotile starts to decompose (~500°C). This is another reason why this method may not be appropriate for measuring chrysotile content in soil. SRC-Libby-02 also relies on a direct sample preparation approach when the indirect approach is deemed unnecessary. Therefore some of the problems associated with direct-transfer TEM methods may also apply here. For instance, samples prepared using this approach are more likely to be more heterogeneous, which increases the likelihood that the portion of the sample being analyzed is not representative of the whole and increases uncertainty about what the actual asbestos content is. Another general problem with SRC-Libby-02 is that its counting method considers every fibrous particle with an elemental composition characteristic of asbestos (as determined by EDXA) to be asbestos even if its aspect ratio is lower than 5:1 (even if it is lower than 3:1). The inclusion of fibers with low aspect ratios can lead to an overestimation of the asbestos that is actually biologically reactive. This is also problematic because the use of only SEM and EDXA is not sufficient in determining if a fiber is amphibole asbestos or a non-asbestos mineral analogue. Third, in estimating the mass percent of asbestos the area fraction of the sample inhabited by asbestos is assumed to be equivalent to the mass percent. This is almost assuredly not true, but the authors justify this by saying that their method is intended to be a screening tool and that it is not important that the mass percent be exactly correct. In computing the asbestos mass percent it is assumed that the size-distribution of asbestos in soil samples is approximately constant (this may or may not be a good assumption. Finally, SRC-Libby-02 (and all other soil methods, for that matter) assumes that asbestos is evenly distributed throughout the sample when determining the asbestos content. Even distribution is unlikely and is a problem that all soil methods must overcome if they are to accurately determine asbestos content (Brattin, 2003).

The biggest advantage to using SEM to examine samples taken from soil is that complicated procedures to prepare samples (as with TEM) are unnecessary (DeMalo, 2004). This may mean that samples can be processed quicker, it is less likely that there will be a loss of sample during preparation stages, and that it will require less-experienced personnel to analyze the samples. Another advantage is that the resolution of scanning electron microscopes is better than those used with TEM or PLM, so SEM is better equipped to examine the morphology of fibers, as well as find fibers with small diameters and short lengths. Another advantage over PLM is that EDXA can be used with SEM, which greatly increases the ability to positively identify asbestos fibers and differentiate between the different asbestos types.

The disadvantages to using SEM include the fact that ED cannot be used with SEM, so TEM remains better at differentiating asbestos from non-asbestos fibers and at differentiating between the different types of asbestos. For example, it is difficult to differentiate between Libby amphiboles and some other fibrous-looking materials, like biotites and pyroxene, when only SEM and EDXA are used (Brattin, 2003). Also, SEM is much more expensive than other techniques and not as widely available as PLM or TEM (DeMalo, 2004).

CONCLUSION

Although asbestos detection techniques have been used for years, new techniques and methods are always being developed, and old techniques and methods are always being improved. The techniques discussed above have been used with mixed success. All techniques (and methods) have strengths and weaknesses and there is no technique (or method) that is superior to all others. In order to effectively detect asbestos one must take into consideration all the likely advantages and disadvantages, weigh them carefully, and then choose the best technique and method for a given task.

RECOMMENDATIONS

While it falls upon the analyst to choose techniques (and methods) carefully when detecting asbestos, there is still much that can be done by researchers to improve the way in which asbestos is detected and improve our ability to estimate risk. Researchers should take the following measures:

- Further research should be conducted to determine exactly how asbestos causes disease (i.e., the exact mechanism) and to obtain a greater understanding of the behavior of asbestos structures in the human body.

- Further research should be conducted to determine which asbestos characteristics are most important in determining toxicity (e.g., fiber size, shape, and elemental composition), so that a better technical definition of asbestos can be formulated and incorporated into existing counting methods.

- Research should be performed to determine the relative toxicities of all the different types of asbestos and, if practical, this information should be incorporated into existing counting methods. (“Participants discussed whether or not it was appropriate to treat the various forms of asbestos differently due to the varying levels of health risks posed. Some suggested that the best solution may be to do nothing – creating several sets of standards might not be worth the cost and complication” [GETF, 2003, p. 56].)

- Government regulations should be altered to include harmful, non-regulated asbestos types, like richterite and winchite, and asbestos detection methods should be changed to reflect the altered regulations.

- The appropriateness of current, government asbestos thresholds, like the one percent limit for asbestos in ACM and 0.1 f/cc for workplace air, should be reevaluated to determine if they correspond to predicted unacceptable levels of risk. For example, “It was noted that products that contain less than 1% asbestos can still create a significant airborne exposure hazard” (GETF, 2003, p. 53).

- Research should be conducted to determine with high confidence what levels of asbestos in the air and soil are safe for humans.

- Counting methods should be improved so that results from different techniques (and methods) could be more easily compared. Ideally, there would be one counting method that fulfilled the requirements of every technique.

- "The use of TEM for exposure measurements as a supplement, or in place of PCM should be evaluated ... The Health Effects Institute-Asbestos Research (HEI-AR) recommended OSHA consider TEM in the early 1990s" (GETF, 2003, p. 42).

- The accuracy and precision of all established techniques should be improved.

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NOTES

1. A technique is a tool, such as polarized light microscopy or transmission electron microscopy, used to detect a certain substance, like asbestos.

2. A method is a specific procedure that is followed when using a technique to detect a certain substance, like asbestos.

3. “Habit” is “the characteristic crystal growth form ... of a mineral, including characteristic irregularities” (ISO, 1995, p. 3).

4. “Asbestiform” is defined as “a specific type of mineral fibrosity in which the fibres and fibrils possess high tensile strength and flexibility” (ISO, 1995, p. 2).

5. It could be argued that chrysotile is potentially more toxic in causing mesothelioma because it breaks down more readily in the lungs and the chrysotile pieces could migrate out of the lungs to the pleura. However, there is no evidence to support this. (Thornton, 2004) Some have argued that chrysotile is a non-toxic form of asbestos – not just less toxic than amphiboles – but this appears to not be the case (Egilman et al., 2003; Hodgson and Darnton, 2000). Finally, still others argue that all asbestos forms are equally toxic, but most

researchers dispute this (Hodgson and Darnton, 2000).

6. The aspect ratio of a fiber is the ratio of the fiber's length to its width (e.g., 5:1).

7. Translocation is a mechanism through which the body breaks down foreign material and moves it through the lungs to expel it.

8. An ACM is "any material or product which contains more than 1 percent asbestos" by weight as determined by polarized light microscopy (USEPA, 1987, p. 41846).

9. "Visible emissions" are considered to be "any emissions, which are visually detectable without the aid of instruments, coming from regulated asbestos-containing material or asbestos-containing waste material, or from any asbestos milling, manufacturing, or fabricating operation" (USEPA, 1990c, Appendix A, p. 5).

10. An asbestos structure is defined as a single fiber, fiber bundle, cluster or matrix, containing at least one asbestos fiber (ISO, 1995; 1999). All asbestos structures are potentially damaging to human health if they can be inhaled into the lungs.

11. Electron diffraction (ED) or selected-area electron diffraction (SAED) is used to determine the crystal structure of a fiber.

12. Energy dispersive X-ray analysis (EDXA) or energy dispersive spectroscopy (EDS) is used to determine the elemental composition of a fiber.

13. With NIOSH 7402, only fibers with diameters greater than 0.25 µm are counted (NIOSH, 1994b).

14. ISO defines a bundle as "a structure composed of parallel, smaller diameter fibres attached along their lengths." A cluster is defined as "a structure in which two or more fibres, or fibre bundles, are randomly oriented in a connecting group." A matrix is "a structure in which one or more fibres, or fibre bundles, touch, are attached to, or partially concealed by, a single particle or connected group of nonfibrous particles." (ISO, 1995, p. 3)

15. Although, Kauffer, et al., (1996a) found that when comparing direct and indirect sample preparation methods, both provided similar results for fibers with lengths greater than 5μm (ultrasonics were not used); this was not the case for fibers with lengths less than 5μm. If ultrasonics are used to homogenize a sample and facilitate the recovery of fibers, then indirect sample preparation may significantly increase the number of fibers present.

16. The possibility of experiencing fiber loss during indirect sample preparation has been discussed by several authors, including Sahle and Laszlo (1996) and Kauffer et al. (1996b), but at least one paper has indicated that this worry may be overblown (Besson et al., 1999).

17. The detection limit is the number of asbestos structures that must be counted to ensure that the concentration is a non-zero value.

18. Aggressive sampling requires the use of a leaf blower, or some other instrument, to disturb asbestos-containing dust by increasing air turbulence, forcing asbestos particles into the air where they can be better analyzed. This type of sampling reflects a worst-case scenario (i.e., it produces the highest possible concentrations of asbestos in the air) and allows testing to occur more quickly.

California Environmental Protection Agency

Air Resources Board

DRAFT IMPLEMENTATION GUIDANCE DOCUMENT

Good Field Sampling and Laboratory Practices

Test Method 435:

Determination of Asbestos Content of Serpentine Aggregate

Rebecca Domingo-Neumann, Ph.D., P.G.

Jeff Wright, Section Manager

Naturally-Occurring Asbestos Symposium 2014

Association of Environmental & Engineering Geologists (AEG)

December 18, 2014 – Oakland, California

M435 Implementation Guidance Document **Topics**

- **Introduction**
- **Applicability**
- **Sampling Practices**
- **Sample Processing Practices**
- **Laboratory Sample Analysis**
- **Quality Control**

Introduction
Background

- 1990 ARB Asbestos Airborne Toxic Control Measure (ATCM) for Surfacing Applications.
- 2001 ARB Asbestos ATCM for Construction, Grading, Quarrying, and Surface Mining Operations.
- 2007 ARB M435 Interlaboratory Study (ILS).
  - Sample processing/analytical procedures varied.
  - Can affect reported asbestos content.

Introduction

Purpose

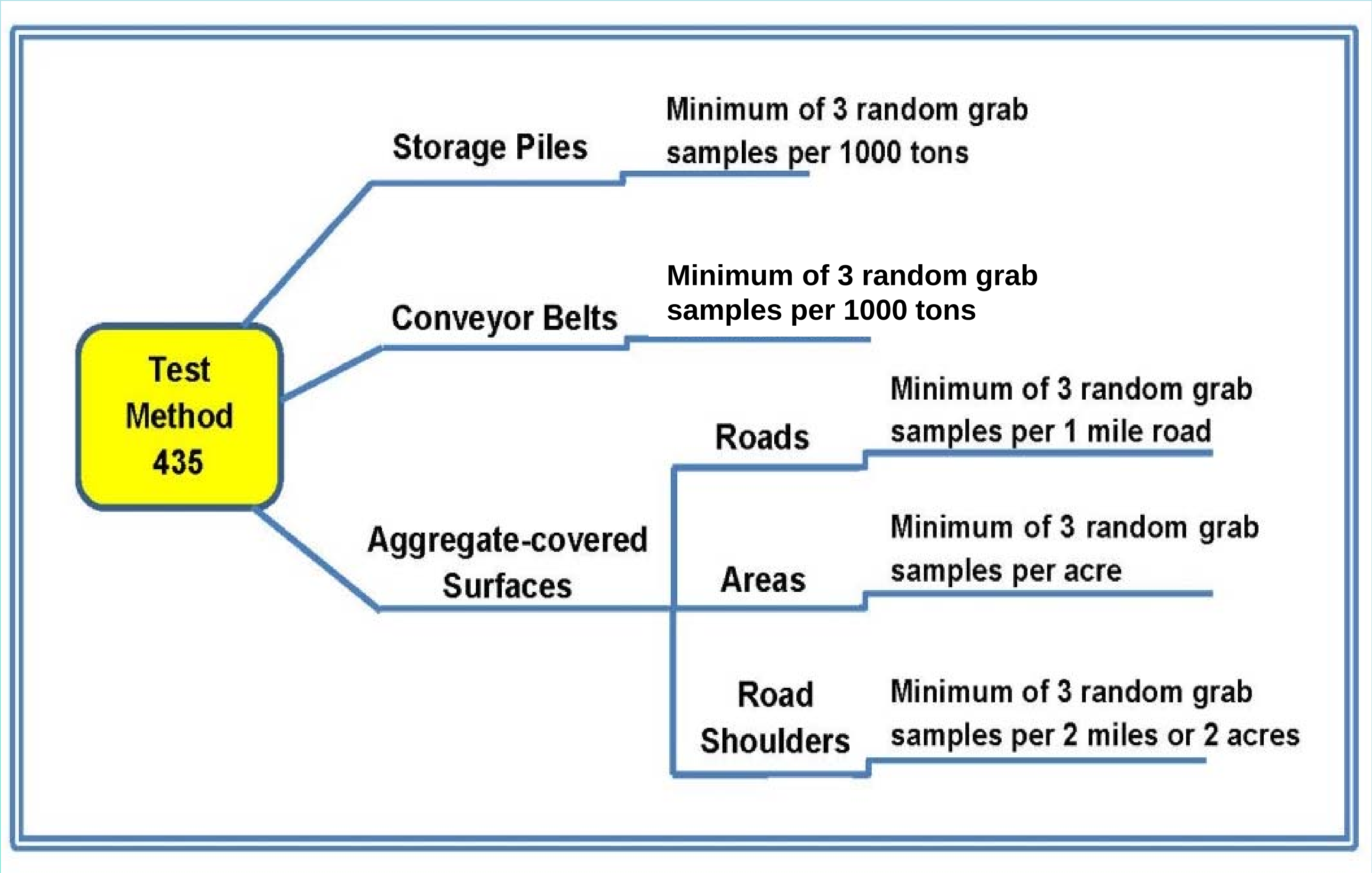
- Assist asbestos stakeholders in the application and performance of M435.
- Clarify procedures and recommend good field sampling and laboratory practices.
- Result in more accurate and repeatable M435 asbestos content measurements.

Applicability of M435

- Surfacing ATCM - M435 is the **required test method** to determine the asbestos content of surfacing aggregate materials.
- Construction ATCM - M435 is referenced as a **laboratory test method** to determine the asbestos content of bulk samples.
- M435 random sampling plan is not applicable for asbestos ATCM exemption requirements.

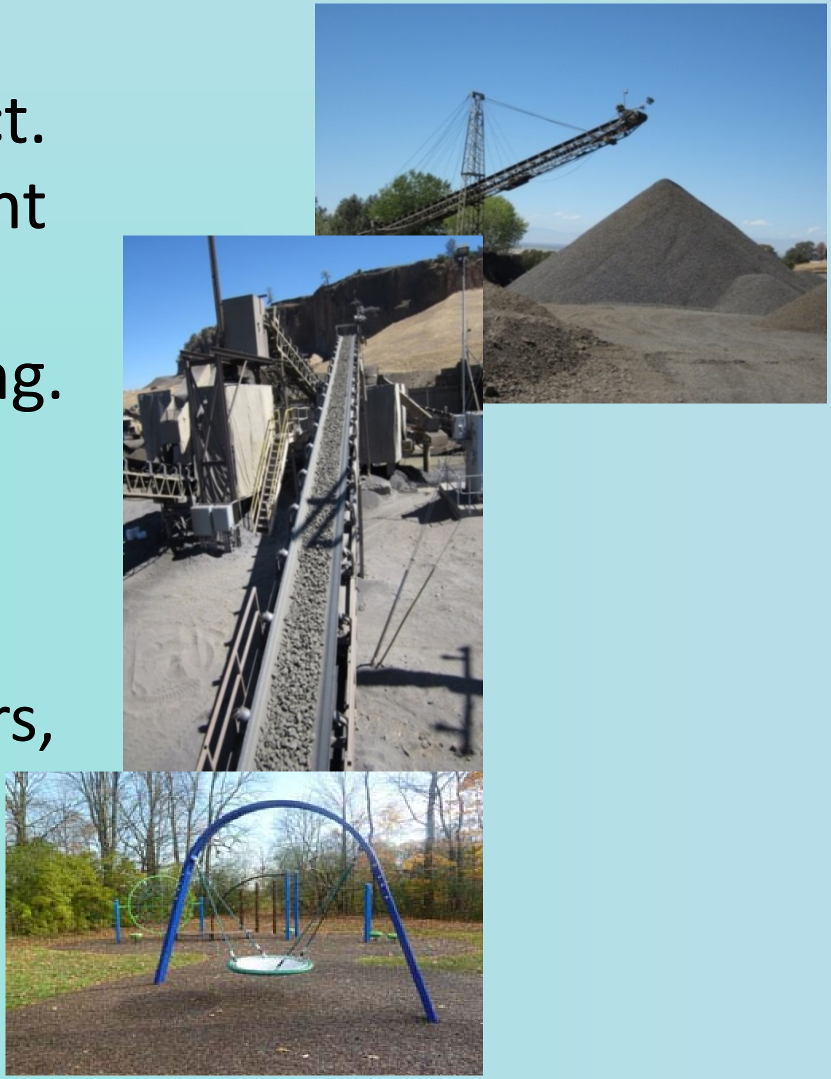
Sampling Practices for Aggregate Materials

Sources and Sampling Design



Sampling Practices for Aggregate Materials
Equipment and Procedures

- Storage piles - sloughing effect.
  – Sampling tubes, round point shovels, front loaders.
- Conveyor belts – less sloughing.
  – Automated or manual sampling using templates.
- Aggregate-covered surfaces.
  – Manual or automated augers, shovel, or other suitable equipment.



Sampling Practices for Aggregate Materials

Sample Documentation

- Complete sample description per M435.
- Sample acceptance criteria.
- Chain of custody documentation.
- Laboratory information management system.

Laboratory Sample Processing Practices

M435 Sample Processing

Aggregate Sample → Dry, crush to <3/8-inch nominal diameter, reduce to 1 pint aliquot → Pulverize majority to <75 µm diameter (<200 Tyler mesh)

↓

Analyze using Polarized Light Microscopy (PLM)

↓

400-point count rules
Determine % Asbestos

Laboratory Sample Processing Practices
Drying

- Purpose of drying: to remove moisture that would hinder complete pulverization.
- Recommend standardization of laboratory drying procedures (e.g., temperature, time).

Laboratory Sample Processing Practices

Crushing

- Sample must be crushed to a nominal size of <3/8 inch (~0.95 centimeter).
- Recommend use of jaw crushers:
  - Reliable.
  - Timely.
- Not recommended:
  - Use of hammers.
  - Restricting rock sample sizes.
  - Discarding large rock samples.

Laboratory Sample Processing Practices
Sequence of Post-crushing Procedures

- Post-crushing processing procedures:
  a) Sample size reduction.
  b) Homogenization.
  c) Pulverization.
- The sequence of these procedures affects the representativeness of the powder analyzed.
- The sequence also depends on what equipment are present in the laboratory.

Laboratory Sample Processing Practices

Sequences of Post-crushing Procedures

Available Post-crushing Equipment	Step 1	Step 2	Step 3
Braun Mill + Mixer (Sequence 1)	Pulverize entire crushed sample.	Use mixer to homogenize entire powdered sample.	Manually take 1 pint for analysis.
Braun Mill (no Mixer) (Sequence 2)	Pulverize entire crushed sample.	Manually homogenize powdered sample.	Manually take 1 pint for analysis.
Shatterbox (SB), Ball Mill (BM), or Freezer Mill (FM) + Mixer (Sequence 3)	Use mixer to homogenize entire crushed sample.	Manually take 1 pint crushed sample for pulverization.	Pulverize 1 pint crushed sample for analysis.
SB, BM, or FM (no Mixer) (Sequence 4)	Riffle split entire crushed sample and take 1 pint aliquot.	Pulverize 1 pint crushed sample.	Manually homogenize powdered sample for analysis.
M435: Braun Mill or Equivalent (no Mixer)	Riffle split entire crushed sample and take 1 pint aliquot.	Pulverize 1 pint crushed sample for analysis.	

Test Method 435

Laboratory Sample Processing Practices

Sequences of Post-crushing Procedures

	Available Post-crushing Equipment	Step 1	Step 2	Step 3
Recommended	**Braun Mill + Mixer (Sequence 1)**	Pulverize entire crushed sample.	Use mixer to homogenize entire powdered sample.	Manually take 1 pint for analysis.
	Braun Mill (no Mixer) (Sequence 2)	Pulverize entire crushed sample.	Manually homogenize powdered sample.	Manually take 1 pint for analysis.
	Shatterbox (SB), Ball Mill (BM), or Freezer Mill (FM) + Mixer (Sequence 3)	Use mixer to homogenize entire crushed sample.	Manually take 1 pint crushed sample for pulverization.	Pulverize 1 pint crushed sample for analysis.
	SB, BM, or FM (no Mixer) (Sequence 4)	Riffle split entire crushed sample and take 1 pint aliquot.	Pulverize 1 pint crushed sample.	Manually homogenize powdered sample for analysis.
Test Method 435	**M435: Braun Mill or Equivalent (no Mixer)**	Riffle split entire crushed sample and take 1 pint aliquot.	Pulverize 1 pint crushed sample for analysis.	

Laboratory Sample Processing Practices

Pulverization

- Recommend the use of the Braun Mill for pulverization.
- ILS results - Braun Mill produced powder with:
  - No leftover chunks.
  - Not over-pulverized.
  - Majority of particles: <75μm diameter.

Laboratory Sampling Processing Practices

Pulverization

- Equivalency of other pulverizers to the Braun Mill.
- M435-specific pulverization protocol for this equipment.
- Acceptable particle size distribution (PSD) and equivalent size characteristics.

Laboratory Sample Processing Practices
Pulverization

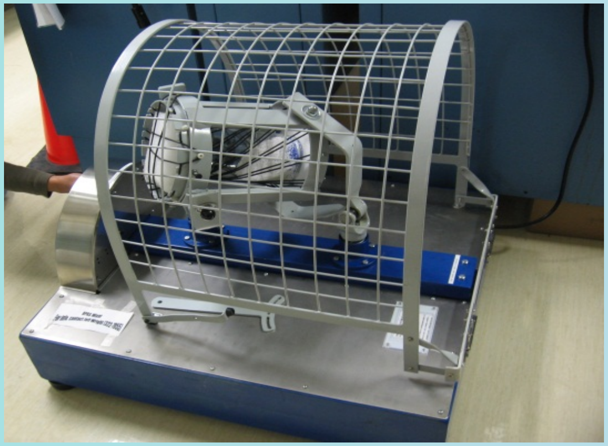
The recommended PSD:

- ≥98% of the powder passes through the 250-µm mesh sieve.
- 75- to 250-µm size fraction is 40 to 50% of the total mass of sample processed.
- <75-µm size fraction is 50 to 60% of the initial sample mass.

Laboratory Sample Processing Practices

Homogenization

- Increases powder homogeneity.
- Increases the likelihood that a representative aliquot of the field sample is analyzed.
- Increases accuracy and repeatability.
- Recommend:
  - use of a 3-dimensional mixer.



Laboratory Sample Processing Practices

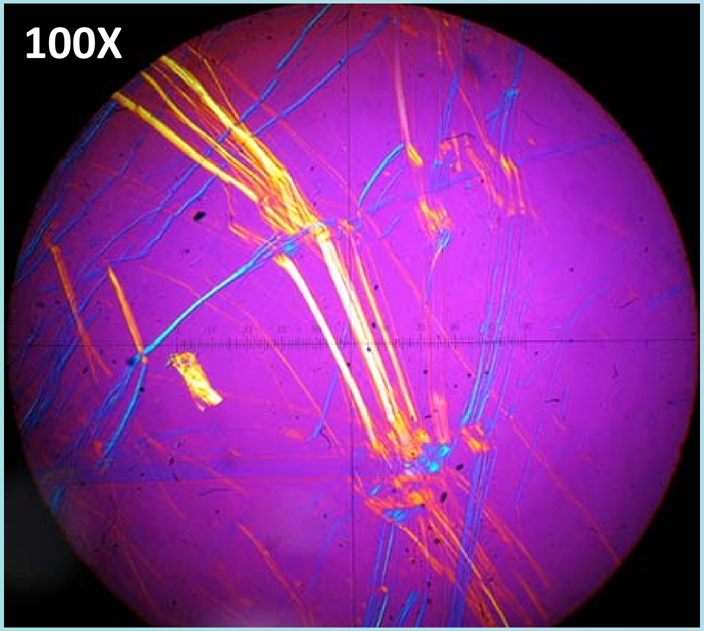
Sample Size Reduction of Crushed Sample

- Even number of equal width chutes.
- At least 8 chutes for coarse aggregate, or 12 chutes for fine aggregate.
- Minimum width of the individual chutes should be about 50% larger than the largest particles in the sample.

Laboratory Sample Analysis Procedures

Principles of M435 Asbestos Identification

- Morphology requirements.
- Optical characteristics determination by polarized light microscopy (M435 Table 3).



5 mm

Laboratory Sample Analysis Procedures
PLM Resolution

- Fine particles and fibers ≤2µm in length and ≤0.15µm in thickness.
- Smaller asbestos fibers may still be present.
- Other analytical techniques are not part of M435:
  - X-ray diffractometry (XRD).
  - Scanning electron microscopy (SEM).
  - Transmission Electron Microscopy (TEM).
- For example, the Department of Toxic Substances Control uses for schools a tiered analytical approach of PLM followed by TEM.

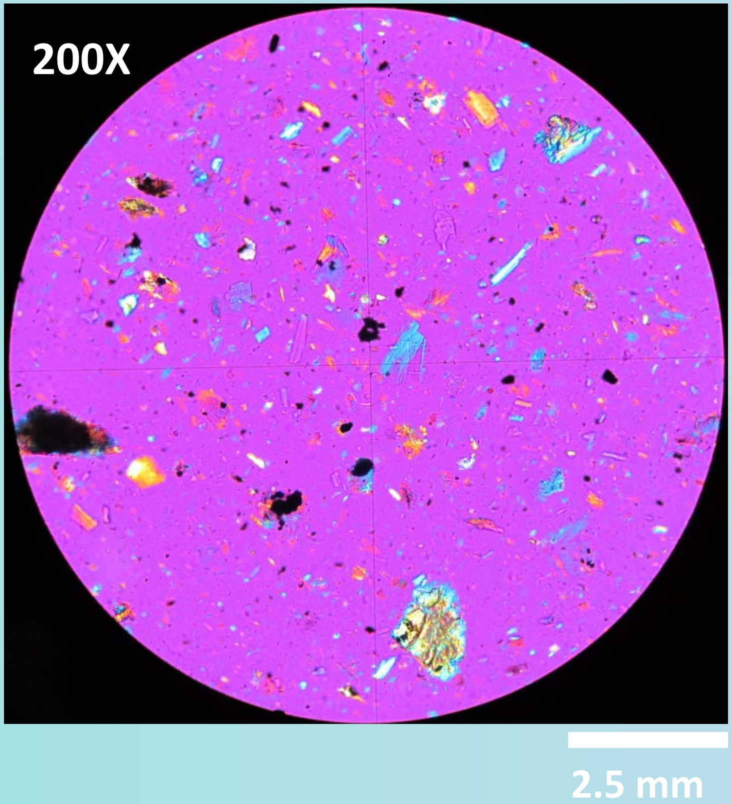
Laboratory Sample Analysis Procedures
Asbestos Quantification

- Required testing volume:
  - 1 pint powdered aliquot.
- Recommended powder mass:
  - 5 mg per PLM slide, particle loading of ~30%.
- Fiber identification requirements:
  - Length-to-width aspect ratio of ≥ 3:1 **and**
  - Asbestos optical properties (M435 Table 3).
  - Only asbestos characteristics, as described in M435 Table 3, should be used for asbestos identification.

Laboratory Sample Analysis Procedures

Asbestos Quantification

- Recommended point-count reticle:
  - Standard crosshair reticle.
- Additional objective lens recommended:
  - 20X PLM objective to verify optical properties.
- Increase in points counted:
  - Multiples of 400 (e.g., 800, 1,200, 1,600, etc.).
  - Additional points counted may increase false negative errors.



Quality Control
Sampling

- Sampling equipment cleanliness.
- Equipment cleaning protocol.
- Integrity of field samples.
- Protection of sample identity.
- Field log of M435 samples, including sampling details.

Quality Control
Processing

- Sample chain of custody.
- Laboratory information management system.
- Written SOP specific for M435.
- Processing blanks alongside regular field samples.
- Calibration of processing equipment.
- Particle size calibration check.

Quality Control

Analysis

- Microscope alignment.
- Refractive index liquid calibration.
- Asbestos proficiency training.
- Blind analytical replicates.
- Instrument cross checks.
- M435 laboratory protocol validation.
- Performance evaluation slides.
- Documentation of results.

California Environmental Protection Agency

Air Resources Board

For questions and comments, please contact:

Jeff Wright
Manager, DASPS
jeffrey.wright@arb.ca.gov
916.322.7055

Rebecca D. Neumann, Ph.D., P.G.
Air Pollution Specialist
rebecca.neumann@arb.ca.gov
916.324.1145

Visit the Test Method 435 website and join the Asbestos List Serve:
http://www.arb.ca.gov/toxics/asbestos/tm435/tm435.htm

ARB Monitoring and Laboratory Division
Data Analysis and Special Projects Section (DASPS)
P.O. Box 2815, Sacramento CA 95812

Project 14: OHWD / Rancho Murieta Groundwater Recharge Project

Benefits of this project include:

- Increasing water supply reliability and improving emergency supply response by injecting 4,000 acre-feet per year into the groundwater basin
- Providing Rancho Murieta with a reliable average of 300 AFY of water supply at all times
- Increase groundwater elevation by 2 to 5 feet in the aquifer in the vicinity of the recharge basin in the next 10 years

Detailed Description

The OHWD/Rancho Murieta Groundwater Recharge Project is a regional conjunctive use project that will divert 4,000 acre-feet per year (AFY) of available water owned by Rancho Murieta Community Services District (RMCSD) to spreading basins in the Omochumne-Hartnell Water District (OHWD) service area to allow recharge of the groundwater aquifer. This project will benefit RMCSD by allowing the recovery of some of the stored water during dry years to meet water supply shortages, while also benefiting OHWD by increasing groundwater levels in the aquifer that is utilized by land owners in the OHWD. The project also enhances regional salmon migration, as the project will assist in the reconnection of the groundwater with the Cosumnes River surface water; this connection is necessary to establish and maintain Fall river flows for salmon migration.

This project will be constructed in three phases—Phase 1, Phase 2 and Phase 3. Phase 1 consists of the installation of a diversion unit and construction of a spreading basin. During Phase 2, recovery well(s) and transmission pipeline(s) will be installed by RMCSD in close proximity to Rancho Murieta to fulfill its drought augmentation supply need. In Phase 3, an inflatable Obermeyer weir will be installed to improve diversion capabilities. OHWD and RMCSD are requesting funding for Phases 1 and 2 of this project, which can be operated without Phase 3. Phase 3 will be self-funded by OHWD using a combination of the District's resources and grant funding, if available. This project phase will be constructed later and will improve the efficiency of the project, but is not necessary for the function of the overall project.

During Phase 1 of the OHWD/Rancho Murieta Groundwater Recharge Project, a new pump station and intake will be installed on the Cosumnes River upstream of Blodgett Dam. The new pump station will be capable of drawing up to 30 cubic feet per second (cfs), and will draw water from a wet well placed in the river bank area hydraulically connected to the river. A culvert will connect this wet well to the intake structure, which will screen the diversion to protect fishery resources. Power sources for the lift station and fish screen will be installed by Sacramento Municipal Utility District (SMUD) as part of this project. The Phase 1 project will also include construction of approximately 600 feet of pipeline to convey the water from the pumping unit to the spreading basin. Existing soils in the project area will be tested to determine their suitability as a backfill around the pipeline and levee protection features. Pressure relief and vacuum valves would be installed to provide pipeline protection. A riprap outflow structure will be constructed in the spreading basin to dissipate energy from water flow and provide protection against soil erosion. The spreading basin will be constructed to allow infiltration of water and will require removal of top soil to improve the infiltration rates and provide earth material needed for constructing berms around the basin. A monitoring well will also be completed within the spreading basin to assess groundwater impacts. Field experience during drilling will determine if more than one well will be required.

The scope of work for Phase 1 of the OHWD/Rancho Murieta Groundwater Recharge Project includes engineering services; specifically project design, construction management and overall project management. All necessary permits will be obtained prior to construction, and the project will comply with all federal and state environmental laws necessary to accomplish the work. In addition, RMCSD will apply to the State Water Resources Control Board (SWRCB) to obtain a permit for a new point of diversion on the Cosumnes River for the project in addition to other ‘standard’ permits such as Sacramento County permits to drill and install a groundwater monitoring and recovery wells.

Once the project is operational, water will be diverted from the Cosumnes River at Blodgett Dam during high flow season to a 90-acre spreading basin located south of Folsom South Canal between the Cosumnes River and Deer Creek. Preliminary investigations in the Cosumnes River floodplain in nearby locations showed an infiltration rate of six to eight inches per day. These infiltration rates will allow for a direct groundwater recharge of 1,000 acre-feet per month, when surface water is available for recharge. Operation of the recharge facility will entail management of water into the recharge facility, after completion of facilities construction, and out of the recovery wells, after the completion of the Phase 2 project. The final operational parameters will depend on the quantity, quality, and availability of the source water and the infiltration capacity of the facility.

OHWD will be responsible for facilities maintenance, post-construction. Maintenance will generally consist of routine maintenance of equipment and removal of clogging materials from the recharge facility, which is the most crucial maintenance effort. Sediment would be removed by scraping and ripping to rejuvenate infiltration rates.

In Phase 2 of the project, RMCSD will construct wells in or near their service area to allow recovery of water during shortage periods. The recovery can take place on a regular cycle, such as the annual dry season, or it may simply be part of the long-term plan, such as for future drought protection.

The Phase 2 scope of work consists of construction of a 500 to 600 foot deep groundwater well capable of producing between 500 and 600 gallons per minute (gpm). RMCSD has identified several possible well sites in the area that, based on existing information, appear to be suitable. While one well is currently planned for construction, the District acknowledges that additional wells may need to be constructed in the future, depending on future development scenarios. In addition to the proposed well, a 5,000-foot 10-inch diameter transmission pipeline will be constructed to convey extracted groundwater to the District’s existing distribution system. The connection point will be a 10-inch diameter stub, located at the southwest end of the distribution system. No pretreatment of the groundwater is anticipated as the extracted water will be blended with available surface water supplies and will only be used in periods of water shortages or droughts.

Finally, in Phase 3 of the OHWD/Rancho Murieta Groundwater Recharge Project, OHWD will modify its existing flashboard dam by installing an inflatable Obermeyer weir on the upstream face of the existing structure. This weir structure will operate in conformance with required permits, reducing energy costs, and improving recharge during marginal seasons. This phase of the project is expected to be completed by 2020.

Each phase of the OHWD/Rancho Murieta Groundwater Recharge Project is independent and fully operational independent of subsequent project phases. The benefits of the proposed project were identified in the RMCSD's *Integrated Water Management Plan*, updated in 2010. Currently, RMCSD's only water supply is surface water diversions from the Cosumnes River during November through May. Water is currently stored in three surface water reservoirs for year-round use. The benefits conveyed by the proposed project are two-fold: first, the project will supply water in years when the river flows do not allow full diversions, providing a reliable water supply; and second, the project expands supply options should there be a catastrophic failure at the water plant, (wildfire as example) or if reservoir supplies become contaminated. A series of figures are included in the following pages to depict project location.

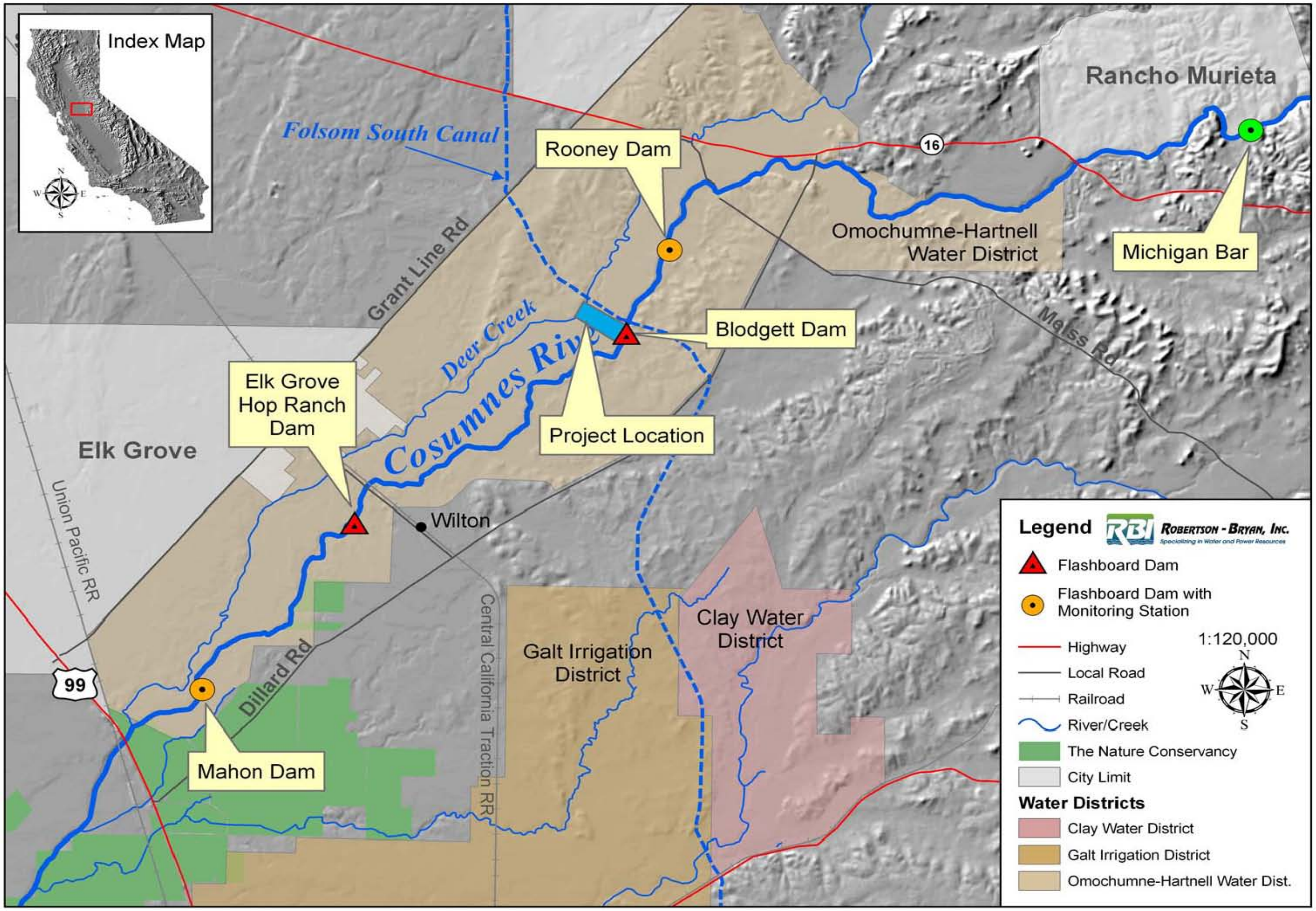


Figure 26: OHWD/Rancho Murieta Groundwater Recharge Project Location

Figure 27: OHWD Project Site

Figure 28: Rancho Murieta CSD Proposed Well and Pipeline

Budget Category (a): Direct Project Administration Costs

Direct project administration costs include general project administration tasks (claim preparation, communications with RWA, and council communications), Labor Compliance Program (LCP) implementation, and reporting (quarterly reports and final report). Included under this budget category are three tasks: administration, a labor compliance program, and reporting.

Task 1: Administration

Work to be completed as part of Task 1, Administration, includes Board communications, budget adjustments, project status meetings, communication with RWA and contractors, and between the two participating agencies, Omochumne-Hartnell Water District (OHWD) and Rancho Murieta Community Service District (RMCSD). For the purposes of this project, OHWD will be lead project sponsor for the Phase 1 project, while RMCSD will be the lead project sponsor for the Phase 2 project. To facilitate the transfer of grant funds, both OHWD and RMCSD have entered into an agreement with RWA through which any grant award reserved for the District's can be directed for use in project funding.

Task 2: Labor Compliance Program

Both OHWD and RMCSD plan to use a third-party's labor compliance program, as has been done previously. As the two project phases will be constructed independently, separate labor compliance programs will be prepared. Labor compliance services will include, at a minimum, monitoring and preparation of summary and status reports, receiving, reviewing, and processing certified payroll reports, conducting interviews, as well as collecting, reviewing, and processing other data. Annual reports to the Department of Industrial Relations (DIR) will also be prepared and submitted.

Task 2 Deliverables:

- Certified Labor Compliance Program
- Annual DIR Reports

Task 3: Reporting

Following execution of the grant agreement, quarterly reports will be prepared assessing the progress and accomplishments of the OHWD/Rancho Murieta Groundwater Recharge Project. A project completion report will also be prepared at the end of the project, anticipated to be in June of 2013. Both OHWD and RMCSD will keep all records and documents pertaining to the project for three years after project completion.

Task 3 Deliverables:

- Quarterly reports as specified in the Grant Agreement
- Completion report as specified in the Grant Agreement

Budget Category (b): Land Purchase/Easement

The proposed location of the project is not owned by OHWD or RMCSD. For the spreading basin location (part of the Phase 1 project), the land is owned by a private owner. OHWD has contacted the land owner and they are very interested in providing a land lease for the project. OHWD and the land owner are currently working toward developing a lease agreement for an initial 10-year period with an option for an additional 10-years, ensuring a 20-year lifetime on the spreading basin. A letter of support from the land owner to OHWD is included as supporting documentation to this Proposal. In addition, the necessary easements will be secured for the intake and pipeline portion of this project phase. For the Phase 2 project (extraction well and transmission pipeline), the proposed well location is within an easement dating back to 1995. However, portions of the transmission pipeline will be outside of the existing easement, so new easement extensions will need to be negotiated.

Budget Category (c): Planning/Design/Engineering/Environmental Documentation

Planning documents have been prepared to demonstrate the viability of the project and are described below. At this time, the concept (10%) design has been completed. Both Phase 1 and Phase 2 of the project will be constructed (concurrently) starting in July 2012 and will be operational by May 2013.

Task 4: Assessment and Evaluation

The *Central Sacramento County Groundwater Management Plan* (MWH, February 2006) documented water supplies and water uses within the Central Sacramento County and determined the long-term sustainable yield of groundwater from the Central Basin to be 273,000 acre-feet per year (AFY). Groundwater provides a substantial amount of the overall water supply for the region, and a goal of the groundwater management plan was to maintain or increase the amount of groundwater stored in the basin over the long term.

The *Rancho Murieta Community Services District Integrated Water Master Plan* (Rancho Murieta Community Services District, November 2009) evaluated the water supply and water demands for RMCSD and made recommendations for addressing the District's susceptibility to reductions in available water supply due to drought, as well as options for reducing reservoir drawdowns in average years. This plan identified using groundwater supply in a conjunctive use scenario to significantly reduce reservoir draw downs and eliminate drought deficits.

In 2010, the International Journal of Water Resources & Arid Environments published a paper entitled *Planning and Implementation of Groundwater Storage and Recovery Systems* (Ali Elhassan *et. al.*, Robertson-Bryan, Inc.) in which the use of infiltration basins as a groundwater recharge element was analyzed. The paper outlined a Phase 1 investigation where potential recharge locations in the South Sacramento County groundwater basin were analyzed. Specifically, the study identified three possible recharge site locations within the Floodplain Formation, including the area of the proposed project. This analysis was supported by other information accumulated by RMCSD from site-specific soil borings, aquifer gradations, and test well drilling in the area to support the anticipated well yield and project feasibility.

Task 4 Deliverables:

- None (studies previously completed)

Task 5: Final Design

Conceptual design (10% design) of the project has been completed; four additional design deliverables (namely the 30%, 60%, 90% and 100% designs) will be prepared and submitted as part of the project. Bid packages will be prepared along with the final (100%) design; as described in Task 8, at present, it is anticipated that the project will be split into four bid packages.

All materials used and procedures followed will conform to American Society for Testing and Materials (ASTM) designations, State specifications, and other applicable engineering standards such as American Society of Civil Engineers (ASCE), American Water Works Association (AWWA) and California Water Well Standards (California Department of Water Resources, Bulletin 74-81 and Bulletin 74-90).

Task 5 Deliverables:

- 30% Design Package
- 60% Design Package
- 90% Design Package
- 100% (Final) Design Package
- Bid Package for Construction of Diversion Unit, Conveyance System, Spreading Basin, and Monitoring Well
- Bid Package for Installation/Construction of Well Boring and Casing
- Bid Package for Installation/Construction of Well Head, Pump and Electrical Controls
- Bid Package for Transmission Pipeline

Task 6: Environmental Documentation

For this project, OHWD will draft, submit and adopt an Initial Study and Mitigated Negative Declaration (IS/MND) for the Phase 1 components of the OHWD/Rancho Murieta Groundwnater Recharge Project (intake, conveyance pipeline and spreading basin). Concurrently, RMCSD will prepare and adopt an IS/MND for the Phase 2 components of the project (extraction well and transmission pipeline). The IS/MND will document foreseeable and mitigatable adverse environmental impacts during the construction and operation of this project, as well as any mitigation or enhancement measures required to ensure the project does not cause significant adverse environmental impacts. The Final IS/MNDs are expected to be adopted by April 2012.

In addition to the IS/MNDs prepared for the project infrastructure, RMCSD will complete an IS for the Water Rights proceedings to allow for a second point of diversion and a second place of use for the river diversions. Minimal impacts are anticipated and a Mitigated Negative Declaration will subsequently be completed and adopted for the water rights portion of the project. The Final IS/MND for the Water Rights is expected to be adopted by November 2011.

Task 6 Deliverables:

- Draft and Final IS/MND for Phase 1 Infrastructure (intake, conveyance pipeline and spreading basin)
- Draft and Final IS/MND for Phase 2 Infrastructure (extraction well and transmission pipeline)
- Draft and Final IS/MND for Water Rights

Task 7: Permitting

For this project, five construction permits and two operational permits are required. To permit construction activities in or on the banks of a stream, a U.S. Army Corps of Engineers Section 404 Permit and a California Department of Fish and Game Section 1601 Permit will be required. A Regional Water Quality Control Board Section 401 Permit will also be required to ensure water quality compliance during construction in or on the bank of a stream. For the installation of the monitoring well at the spreading basin and for the extraction well, Sacramento County Well Permits will be required. For both projects, compliance with the State's General NPDES Permit for Stormwater Discharges during construction will be required.

For operation of the project, a California Division of Water Rights Additional Point of Diversion permit will be required to allow the diversion of water from the stream to the spreading basins and a California Department of Public health approval will be required to amend the RMCSD's water supply permit for allow the new water supply.

Task 7 Deliverables:

- Complete permit package including all permits.

Budget Category (d): Construction/Implementation

Task 8: Construction Contracting

At present, it is anticipated that the project will be split into four bid packages: one bid package will be distributed for the construction of a diversion unit, conveyance system, spreading basin and monitoring well; the second will be for construction of a monitoring well; the third will be for construction of well head facilities including plumbing, pump and electrical controls; and the fourth bid package will be for construction of the transmission pipeline. Bid packages may be combined; however, this decision will be made at the time of bidding.

Bid advertisement is expected to occur in March 2012, with one or more Notices to Proceed released in late June or July 2012. Construction of all elements of the project will occur concurrently, with above-ground well facilities trailing construction of the below-grade well casing.

Task 8 Deliverables:

- Public Notice to Bidders for each portion of the project
- Notice to Proceed for each portion of the project

Task 9: Construction

Construction of both phases of the project (Phase 1 and Phase 2) will occur concurrently and are expected to start in July 2012. Construction is expected to be completed by June 2013.

Mobilization and Site Preparation

Mobilization and site preparation for this project will include pre-construction surveys; grubbing and clearing for site access; prepping of the staging area, spreading basin site, diversion unit site and pipeline route; and the implementation of any required mitigation actions. Site preparation also includes designation of staging areas and grading access ramps to diversion unit site near the Cosumnes River and to the spreading basin to meet the existing levee road, and winterization of the site(s) in October in anticipation of winter season.

Project Construction

As part of Phase 1 construction, OHWD is proposing to install a new pump station and intake on the right bank of the Cosumnes River near River Mile 22, upstream of Blodgett Dam. The new pump would draw water from a wet well placed in a river bank area that is hydraulically connected to the river. A culvert would connect this wet well to the intake structure on the river. The intake structure would screen the diversion to protect fishery resources (fish screen or infiltration gallery). The pump will be designed to draw up to 30 cfs of water. The pumping unit would consist of the wet well caisson, a water pump, and electric motors. Pump and motor controls will be installed on a platform above the wet well. The platform will be placed above the 100-year flood levels. Power sources for the lift station and fish screen would be installed by Sacramento Municipal Utility District (SMUD) as part of this project.

OHWD would also install about 600 feet of pipeline to convey the water from the pumping unit to the spreading basin. Existing soils in the project area will be tested to determine its suitability as a backfill around the pipeline and levee protection features. Pressure relief and vacuum valves would be installed to provide pipeline protection. A riprap outflow structure will be constructed in the spreading basin to dissipate energy from water flow and provide protection against soil erosion. The spreading basin would be constructed to allow infiltration of water; removal of top soil will improve the infiltration rates and will provide earth material needed for constructing berms around the basin. A monitoring well, with up to four nested piezometers, would also be completed as part of the Phase 1 project within the spreading basin to assess groundwater impacts. Field experience during drilling will determine the final monitoring well design.

In Phase 2 construction, the new well site will be installed on westerly edge of RMCSD’s service area on agriculture lands. The new well will be constructed of 12- to 16-inch diameter steel casing with stainless steel screen, between 500 and 600 feet in depth. The well and associated well head facilities will be designed to pump between 500 and 600 gpm. The pumping unit would consist of an above-grade water pump and electric motors set on a platform. The platform will be placed above the 100-year flood levels. Power sources would be installed by Sacramento Municipal Utility District (SMUD) as part of this project.

Also as part of the Phase 2 construction, RMCSD will install approximately 5,000 feet of 10-inch pipeline to convey the water from the well site to the existing distribution system for a direct connection. Existing soils in the project area will be tested to determine its suitability as a backfill around the pipeline, and backfill will be augmented by select imported material for the pipe bedding and pipe zone, as appropriate for the type of pipe installed. Backflow valves would be installed to provide well protection.

Performance Testing and Demobilization

Following project construction, performance testing will be performed on new facilities. This includes a percolation test on the new spreading basin, a well drawdown and pump test on the new extraction well, leakage tests performed on all pipes, followed by full system flow tests conducted in the pipelines after the system is operational. Testing and demonstration of diversion pumps and associated electrical components, valves, gauges and other mechanical equipment will also be performed. Groundwater levels will be monitored starting upon project completion.

Budget Category (e): Environmental Compliance/Mitigation/Enhancement

Task 10: Environmental Compliance/Mitigation/Enhancement

Little environmental mitigation or enhancement actions beyond normal construction best management practices (BMPs) are expected to be required for the project. In the event that mitigation or enhancement measures are required for the water rights permitting, RMCSD will comply with any and all such requirements. Additionally, should mitigation or enhancement measures be required for the Section 401, 404, and/or 1601 permits, OHWD will comply with any and all such requirements. Examples of such mitigation measures may include the need for pre-construction surveys prior to construction and onsite biological monitoring during construction.

A Stormwater Pollution Prevention Plan (SWPPP) will also be prepared and implemented as part of project construction; thus only standard stormwater best management practices will likely be implemented through the construction period. Implementation of the approved Project Performance Monitoring Plan will also be conducted as part of this task. This includes implementation of the required performance monitoring, data assessment and reporting. The project performance monitoring will continue for 10 years following project completion, with annual project performance reporting.

Task 10 Deliverables:

- Mitigation and monitoring reports as required by permits & plans

Budget Category (f): Construction Administration

Task 11: Construction Administration

Construction Administration includes Construction Management services and other tasks associated with the bidding and contracting of the construction work. Some of the specific work items to be completed as part of this task include:

- Review contractor's schedule and make recommendations

- Manage and coordinate all project inquiries and contractor correspondence
- Maintain detailed project records
- Receive, log, and distribute all submittals for review
- Inspect completed construction
- Recommend final payment and submit all project files for archiving

Budget Category (g): Other Costs

Included in this budget category are permit fees and Task 12, Project Performance Monitoring Plan. This plan will be prepared to:

- Provide a framework for assessment and evaluation of project performance.
- Identify measures that can be used to monitor progress toward achieving project goals.
- Provide a tool to monitor and measure project process and guide final project performance reporting that will fulfill grant agreement requirements.
- Provide information to help improve current and future projects.
- Maximize the value of public expenditures to achieve desired environmental results.

Task 12: Project Performance Plan

As part of the overall grant application, a program-wide Performance Monitoring Plan will be prepared for all projects to be implemented under the grant award. This document will be a compilation of project-specific performance monitoring plans and will, for each project, identify the problem to be addressed by the project, summarize the project tasks, specifying the project goals and desired outcomes, and include a project performance measures table presenting output and outcome indicators, measurements tool and methods to be implemented and performance targets. The plan section for the OHWD/Rancho Murieta Groundwater Recharge Project will be prepared under this task.

Task 12 Deliverables:

- Project Performance Monitoring Plan

Budget Category (h): Construction/ Implementation Contingency

A construction/implementation contingency of 20% has been included and is based on prior experience and the early stage of the project. The contingency is detailed in Attachment 4.

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Source Water Protection Practices Bulletin

Managing Storm Water Runoff to Prevent Contamination of Drinking Water

Storm water runoff is rain or snow melt that flows off the land, from streets, roof tops, and lawns. The runoff carries sediment and contaminants with it to a surface water body or infiltrates through the soil to ground water. This fact sheet focuses on the management of runoff in urban environments; other fact sheets address management measures for other specific sources, such as pesticides, animal feeding operations, and vehicle washing.

SOURCES OF STORM WATER RUNOFF

Urban and suburban areas are predominated by impervious cover including pavements on roads, sidewalks, and parking lots; rooftops of buildings and other structures; and impaired pervious surfaces (compacted soils) such as dirt parking lots, walking paths, baseball fields and suburban lawns.

During storms, rainwater flows across these impervious surfaces, mobilizing contaminants, and transporting them to water bodies. All of the activities that take place in urban and suburban areas contribute to the pollutant load of storm water runoff. Oil, gasoline, and automotive fluids drip from vehicles onto roads and parking lots. Storm water runoff from shopping malls and retail centers also contains hydrocarbons from automobiles. Landscaping by homeowners, around businesses, and on public grounds contributes sediments, pesticides, fertilizers, and nutrients to runoff. Construction of roads and buildings is another large contributor of sediment loads to waterways. In addition, any uncovered materials such as improperly stored hazardous substances (e.g., household cleaners, pool chemicals, or lawn care products), pet and wildlife wastes, and litter can be carried in runoff to streams or ground water. Illicit discharges to storm drains (e.g., used motor oil), can also contaminate water supplies.

Parking lot runoff

Storm water is also directly injected to the subsurface through Class V storm water drainage wells. These wells are used throughout the country to divert storm water runoff from roads, roofs, and paved surfaces. Direct injection is of particular concern in commercial and light industrial settings (e.g., in and around material loading areas, vehicle service areas, or parking lots).

WHY IS IT IMPORTANT TO MANAGE STORM WATER RUNOFF NEAR THE SOURCES OF YOUR DRINKING WATER?

Impervious areas prohibit the natural infiltration of rainfall through the soil, which could filter some contaminants before they reach ground water. Also, impervious surfaces allow the surface runoff to move rapidly. Development reduces the amount of land available for vegetation, which can mitigate the effects of rapid runoff and filter contaminants. When the percentage of impervious cover reaches 10 to 20 percent of a watershed area, degraded water quality becomes apparent.

There are three primary concerns associated with uncontrolled runoff: (1) increased peak discharge and velocity during storm events resulting in flooding and erosion; (2) localized reduction in recharge; and (3) pollutant transport.

Erosion

When runoff is confined to narrow spaces, such as streets, the velocity at which water flows increases greatly with depth. This contributes to erosion in areas without vegetation cover, increased flooding in low lying areas, and sedimentation in surface water bodies. Sediment deposited in streams can increase turbidity, provide transport media for pathogenic bacteria and viruses, and decrease reservoir capacity. Sediments also smother aquatic species, leading to habitat loss and decreased biodiversity of aquatic species. The fast-running runoff is not afforded an opportunity to infiltrate into the subsurface, and ground waters are not recharged by rain events.

EPA considers nonpoint source pollution, including storm water runoff, to be one of the most important sources of contamination of the nation's waters. According to a nationwide study, 77 of 127 priority pollutants tested were detected in urban runoff. Some of the principal contaminants found in storm water runoff include heavy metals, toxic chemicals, organic compounds, pesticides and herbicides, pathogens, nutrients, sediments, and salts and other de-icing compounds. Some of these substances are carcinogenic; others lead to reproductive, developmental, or other health problems that are associated with long-term exposure. Pathogens can cause illness, even from short-term exposure, that can be fatal to some people.

Urban runoff is commonly collected in storm sewers and discharged to waterways untreated, so that any contaminants carried by the storm water are discharged to surface water bodies that are used as the sources of drinking water. In addition, about 20 percent of the population in the U.S. is served by combined sewer systems (for both sanitary waste and storm water) that, during heavy storm events, allow contaminants from sanitary sewage to discharge directly to waterways untreated.

AVAILABLE PREVENTION MEASURES TO ADDRESS STORM WATER RUNOFF

A variety of management practices, including pollution prevention and treatment devices, are available to abate storm water pollution. The most effective storm water pollution prevention plans combine these measures and reflect local soil, precipitation, and land use conditions. Some of the more widely-used management measures are described below.

Please keep in mind that individual prevention measures may or may not be adequate to prevent contamination of source waters. Most likely, individual measures should be combined in an overall prevention approach that considers the nature of the potential source of contamination, the purpose, cost, operational, and maintenance requirements of the measures, the vulnerability of the source waters, the public's acceptance of the measures, and the community's desired degree of risk reduction.

Pollution source control and prevention measures include public education to homeowners and business owners on good housekeeping, proper use and storage of household toxic materials, and responsible lawn care and landscaping; storm drain stenciling; hazardous materials collection; and eliminating illicit discharges. The incorporation of best management practices (BMPs) in building and site-development codes, if feasible, should be encouraged. On roadways, proper maintenance of rights-of-way, control of chemical and nutrient applications, street cleaning or sweeping, storm drain cleaning, use of alternative or reduced de-icing products, and equipment washing can reduce the pollutant content of runoff.

Without appropriate ***erosion and sedimentation control (ESC) measures***, construction activities can contribute large amounts of sediment to storm water runoff. Erosion can be controlled by planting temporary fast-growing vegetation, such as grasses and wild flowers. Covering top soil with geotextiles or impervious covers will also protect it from rainfall. Good housekeeping measures for construction sites include construction entrance pads and vehicle washing to keep sediment and soil on-site. Construction should be staged to reduce soil exposure, or timed to coincide with periods of low rainfall and low erosion potential, such as in the fall, rather than during spring rains. Other measures include sediment traps and basins; sediment fences; wind erosion controls; and sediment, chemical, and nutrient control.

If available, ordinances and regulations on construction activities can require plan reviews to ensure that erosion during construction is minimized or require ESC measures during construction. Inspections of ESC measures and repair of controls where needed will maintain the working order of these controls and maximize their benefit.

Local governments can use a variety of ***land use controls*** to protect source water from potential contamination. For example, subdivision controls help to ensure that expected development will not compromise drinking water quality or ground water recharge. Requiring proper storm water management in new developments and redevelopments will ensure that runoff does not become excessive as areas of paved surfaces increase. ***Low impact development*** incorporates maintaining pre-development hydrology, considering infiltration technology, and re-routing water to recharge the aquifer.

Minimizing directly connected impervious areas (DCIAs) is important to reducing the flow and volume of runoff. Planners should direct runoff from roofs, sidewalks, and other surfaces over grassed areas to promote infiltration and filtration of pollutants prior to surface water deposition. Porous design of parking lots also provides places for storm water to infiltrate to soils. ***Concrete grid pavement*** is typically placed on a sand or gravel base with void areas filled with pervious materials such as sand, gravel, or grass. Storm water percolates through the voids into the subsoil. Planting landscaped areas lower than the street level encourages drainage.

Concrete grid pavement

Structural designs are used to control runoff or temporarily store storm water on site. A number of structural devices have been developed to encourage filtration, infiltration, or settling of suspended particles. Some of the more commonly-used practices are described below.

Grassed swales are shallow, vegetated ditches that reduce the speed and volume of runoff. Soils remove contaminants by infiltration and filtration. Vegetation, or turf, prevents soil erosion, filters out sediment, and provides some nutrient uptake. Maintenance of grassed swales involves regular mowing, re-seeding, and weed control, along with inspections to check for erosion and ensure the integrity of the vegetative cover. To function properly, the inflow to the swale must be sheet flow from a filter strip or an impervious surface (i.e., not from the end of a pipe). Swales have demonstrated solids removals exceeding 80 percent. Apart from grassed swales, ***grassed waterways*** (wide, shallow channels lined with sod) are often used as outlets for runoff from terraces.

Buffer strips are combinations of trees, shrubs, and grasses planted parallel to a stream. Buffer strips should consist of three zones—about four or five rows of trees closest to the stream, one or two rows of shrubs, and a 20 to 24 foot wide grass zone on the outer edge. They decrease the velocity of runoff, thus moderating flooding and preventing stream bank erosion. The vegetation and soils also strain and filter sediments and chemicals. Buffer strips should be maintained by controlling weeds and mowing grasses once or twice annually. In the long term, each zone should be harvested and replanted. About 10 to 20 percent removal of solids has been demonstrated in buffer zones. These buffer strips, however, do not necessarily increase infiltration.


Filter strip

Filter strips are areas of close-growing vegetation on gently sloped land surfaces bordering a surface water body. They work by holding soils in place, allowing some infiltration, and filtering solid particles out of the runoff from small storms. Plants with dense root systems are preferred; the ideal species and mixes of vegetation are specific to the region. The width and length of the filter strip depends on the size and grade of the slope it drains. Maintenance activities include inspections, mowing, and removal of sediment build-up. Filter strips can remove nitrogen and phosphorus, but are less effective in filtering pesticides. They are most effective when water flow is even and shallow and if grass can regrow between rains.


Storm water pond

Storm water ponds (wet ponds) consist of a permanent pond, where solids settle during and between storms, and a zone of emergent wetland vegetation where dissolved contaminants are removed through biochemical processes. Wet ponds are usually developed as water features in a community, increasing the value of adjacent property. Other than landscape maintenance, only annual inspection of the outlets and shoreline is required. Vegetation should be harvested every 3 to 5 years, and sediment removed every 7 to 10 years. Wet ponds can achieve 40 to 60 percent phosphorus removal and 30 to 40 percent total nitrogen removal.

Constructed wetlands are similar to wet ponds, with more emergent aquatic vegetation and a smaller open water area. Storm water wetlands are different from natural wetlands in that they are designed to treat storm water runoff, and typically have less biodiversity than natural wetlands. A wetland should have a settling pond, or forebay, if significant upstream soil erosion is anticipated. Coarse particles remain trapped in the forebay, and maintenance is performed on this smaller pool. Wetlands remove the same pollutants as wet ponds through settling of solids and biochemical processes, with about the same efficiency. Maintenance requirements for wetlands are similar to those of wet ponds.

Infiltration practices (basins and trenches) are long, narrow stone-filled excavated trenches, 3 to 12 feet deep. Runoff is stored in the basin or in voids between the stones in a trench and slowly infiltrates into the soil matrix below, where filtering removes pollutants. Infiltration devices alone do not remove contaminants, and should be combined with a pretreatment practice such as a swale or sediment basin to prevent premature clogging. Maintenance consists of inspections annually and after major rain storms and debris removal, especially in inlets and overflow channels. Infiltration devices and associated practices can achieve up to 70 to 98 percent contaminant removal.


Infiltration basin

Swirl-type concentrators are underground vaults designed to create a circular motion to encourage sedimentation and oil and grease removal. The currents rapidly separate out settleable grit and floatable matter, which are concentrated for treatment, while the cleaner, treated flow discharges to receiving waters. Swirl concentrators have demonstrated total suspended solids and BOD removal efficiencies exceeding 60 percent.

BMPs for Class V storm water drainage wells address siting, design, and operation of these wells. Siting BMPs for storm water drainage wells include minimum setbacks from surface waters, drinking water wells, or the water table. Storm water drainage wells may also be prohibited from areas of critical concern, such as source water protection areas, or from areas where the engineering properties of the soil are not ideal for their performance. Available design BMPs for storm water drainage wells include sediment removal devices (such as oil/grit separators or filter strips), oil and grease separators, and pretreatment devices such as infiltration trenches or wetlands (described above). Maintenance of these BMPs is crucial to their proper operation. Management measures related to operation include spill response, monitoring, and maintenance procedures. Source separation, or keeping runoff from industrial areas away from storm water drainage wells, involves using containment devices such as berms or curbs (see the fact sheets on vehicle washing and small quantity chemical use for more information on these devices).

EPA's National Pollutant Discharge Elimination System (NPDES) Permitting Program regulates storm water runoff from municipal separate storm sewer systems (MS4s) and industrial activity (including construction). The current rules establish permit requirements for more than 5,000 MS4s nationwide. NPDES storm water permits issued to MS4s require these MS4s to develop the necessary legal authority to reduce the discharge of pollutants in storm water to the maximum extent practicable and to develop and implement a storm water management program that includes:

- Structural and source control measures to reduce pollutants from runoff from commercial and residential areas, including maintenance, monitoring, and planning activities;
- Detection and removal of illicit discharges and improper disposal into the storm sewer;
- Monitoring and control of storm water discharges from certain industrial activities; and
- Construction site storm water control.

In addition, the storm water rule for certain small MS4s requires post-construction storm water management controls. These local controls are in addition to existing federal regulations that require NPDES permits of all construction activities disturbing greater than one acre.

Recently, EPA developed a menu of BMPs that provides more than 100 fact sheets on measures that small MS4s could use to control urban storm water runoff. The menu is available from EPA's Web site at www.epa.gov/npdes.

FOR ADDITIONAL INFORMATION

These sources contain information on storm water management measures. All of the documents listed are available for free on the Internet. State departments of transportation or agriculture, whose contact information can be found on the Internet or in the phone book, are also good sources of information.

To pass local ordinances or regulations to affect storm water controls, contact city or county public works departments, zoning offices, permitting offices, or transportation departments, who typically have the authority to pass local ordinances. Contact local government authorities in your area to see if there are ordinances in place to manage storm water. Numerous examples of local source water protection-related ordinances for various potential contaminant sources can be found at http://www.epa.gov/r5water/ordcom/, http://www.epa.gov/owow/nps/ordinance/, and http://www.epa.gov/owow/nps/ordinance/links.htm.

The following resources provide information on selection and design of specific management measures:

The Center for Watershed Protection's Stormwater Manager's Resource Center (www.stormwatercenter.net) provides technical assistance storm water management issues.

Northern Arizona University offers a course on wet weather flow management, materials are available at http://jan.ucc.nau.edu/~dmh3/egr499/.

Texas Nonpoint SourceBOOK (www.txnpsbook.org) contains four manuals on storm water Best Management Practices, including "Urban Nonpoint Source Management," and an interactive BMP selector.

U.S. EPA, Office of Ground Water and Drinking Water. (September 1999). *The Class V Underground Injection Control Study. Volume 3: Storm Water Drainage Wells.* EPA/816-R-99-014c. Retrieved May 2, 2001, from the World Wide Web: http://www.epa.gov/safewater/uic/classv/stw-fact.pdf

U.S. EPA, Office of Science and Technology. (August 1999). *Preliminary Data Summary of Urban Stormwater Best Management Practices.* EPA-821-R-99-012. Retrieved February 7, 2001, from the World Wide Web: http://www.epa.gov/OST.

U.S. EPA, Office of Wastewater Management. (September 1992). *Storm Water Management for Industrial Activities: Developing Pollution Prevention Plans and BMPs.* Retrieved February 6, 2001, from the World Wide Web: http://www.epa.gov/owm/sw/indguide/index.htm

U.S. EPA, Office of Wetlands, Oceans, and Watersheds. (January 1993). *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters.* EPA-840-B-93-001c. Retrieved February 15, 2001, from the World Wide Web: http://www.epa.gov/OWOW

Washington State Department of Transportation. (February 1995). *Highway Runoff Manual*. M 31-16. Retrieved February 15, 2001, from the World Wide Web: http://www.wsdot.wa.gov/fasc/engineeringpublications/manuals/highway.pdf

Wyoming Department of Environmental Quality. (February 1999). *Urban Best Management Practices for Nonpoint Source Pollution.* Draft. Retrieved February 21, 2001, from the World Wide Web: http://deq.state.wy.us/wqd/urbbmpdoc.htm

University extension services are excellent sources for information on water quality issues, including storm water management. The Oregon Department of Agriculture offers comprehensive list of links to many of these on its Web site (http://www.oda.state.or.us/Natural_Resources/wq_ces.htm).

Following are examples of extension services that offer fact sheets on a variety of storm water management measures, including best management practices:

Iowa State University Extension (http://www.extension.iastate.edu/Pages/pubs/).

North Carolina Cooperative Extension Service (http://www.ces.ncsu.edu/resources/).

Oklahoma State University. Division of Agricultural Sciences and Natural Resources (http://agweb.okstate.edu/pearl/wqs).

Purdue University Cooperative Extension Service (http://www.agcom.purdue.edu/AgCom/Pubs/menu.htm).

New Jersey Stormwater Best Management Practices Manual

February 2004

C H A P T E R 1

Impacts of Development on Runoff

This chapter describes the adverse impacts unmanaged land development can have on groundwater recharge and stormwater runoff quality and quantity both at and downstream of a development site. The chapter also reviews the fundamental physical, chemical, and biological aspects of the rainfall-runoff process and how they can be altered by development. In doing so, the chapter demonstrates the need for the NJDEP Stormwater Management Rules at N.J.A.C. 7:8, which have been developed to directly address these adverse impacts. In addition, the chapter seeks to increase understanding of these physical, chemical, and biological processes in order to improve the design of structural and non-structural measures mandated by the Rules' groundwater recharge, stormwater quality, and stormwater quantity requirements.

Runoff Quantity

Development can dramatically alter the hydrologic response of an area and, ultimately, an entire watershed. Prior to development, native vegetation can either directly intercept precipitation or evapotranspirate that portion that has infiltrated into the ground back into the atmosphere. Development can remove this beneficial vegetation and replace it with turf grass lawns and impervious roofs, driveways, parking lots, and roads, thereby reducing the site's pre-developed evapotranspiration and infiltration rates. In addition, clearing and grading can remove surface depressions that store rainfall. Construction activities may also compact the soil and diminish its infiltration rate, resulting in increased rates and volumes of stormwater runoff from the development site.

Impervious areas directly connected to gutters, channels, and storm sewers can transport runoff more quickly than natural, vegetated conveyances. This shortening of the transport or travel time quickens the rainfall-runoff response of the site, causing flow in downstream waterways to peak faster and higher than under natural or predeveloped site conditions. These increases can create new and aggravate existing downstream flooding and erosion problems and can increase the quantity of sediment and other pollutants in the waterways.

Filtration of runoff and removal of pollutants by natural surface and channel vegetation is eliminated by storm sewers that discharge runoff directly into waterways. Increases in impervious area can also decrease opportunities for infiltration and reduce stream base flow and groundwater recharge. Reduced base flows and increased peak flows produce greater fluctuations between normal and storm flow rates, which can increase channel erosion and adversely impact aquatic organisms and habitats. Reduced base flows can negatively impact the hydrology of adjacent wetlands and the health of biological communities that depend on these base flows.

To address these impacts, planners, engineers, reviewers, and other participants in the design of stormwater management measures must rethink traditional approaches to both land development itself and the environmental problems it can cause. New approaches such as those described in this manual must be taken. For example, nonstructural stormwater management principles provide a prevent-minimize-mitigate approach that is preferred by the NJDEP Stormwater Management Rules. Under these Rules, nonstructural stormwater management techniques are a requirement for new land development projects. Nonstructural stormwater management measures, also known as Low Impact Development Best Management Practices (LID-BMPs), include reduction of impervious cover, maintenance of natural vegetation, and reduction of nutrient inputs. LID-BMP techniques can significantly reduce and even prevent the negative effects of land development on stormwater runoff described above. Nonstructural stormwater management practices are covered in detail in *Chapter 2: Low Impact Development Techniques*.

During heavy rainfall, many land developments increase the rate or volume of stormwater runoff, even those with well-designed LID techniques. Historically, this increased runoff was managed through state and/or local regulations that required peak runoff rates leaving a site after development to be equal to those that existed prior to development. It was believed that if the peak rate of runoff was maintained, the downstream waterways could assimilate the runoff in the same manner as before development. This control was accomplished using detention and retention basins that store and then gradually release the runoff.

However, this control methodology failed to account for the increased volume of runoff caused by land development. Watershed studies in New Jersey have demonstrated that this additional volume resulted in extended peak rates and increases in non-peak flows that increased flooding and erosion problems downstream. These same watershed studies determined that, by reducing peak post-development site runoff to rates less than pre-developed site conditions throughout the watershed, the volume of post-development runoff was redistributed and pre-development peaks were maintained or reduced throughout the watershed.

The Stormwater Management Rules incorporate these peak flow reduction requirements, which are similar to those previously published in the NJDEP Flood Hazard Area Control Act Rules and the New Jersey Department of Community Affairs (NJDCA) Residential Site Improvement Standards (RSIS).

Runoff Quality

In addition to increases in runoff volume, land development often results in the accumulation of pollutants on the land surface that runoff can mobilize and transport to streams. New impervious surfaces and cleared areas created by development can accumulate a variety of pollutants from the atmosphere, fertilizers, animal wastes, and leakage and wear from vehicles. Pollutants can include metals, suspended solids, hydrocarbons, pathogens, and nutrients. Common pollutants found in stormwater runoff are shown in Table 1-1.

In addition to increased pollutant loading, land development can adversely affect water quality and stream biota in more subtle ways. For example, stormwater falling on impervious surfaces or stored in detention or retention basins can become heated and raise the temperature of the downstream waterway, adversely affecting cold water fish species such as trout. Development can remove trees along streambanks that normally provide shading, stabilization, and leaf litter that falls into streams and becomes food for the aquatic community.

Table 1-1: Typical Stormwater Pollutants

Pollutant	Typical Concentration
Total suspended solids [a]	80 mg/l
Total phosphorus [b]	0.30 mg/l
Total nitrogen [a]	2.0 mg/l
Total organic carbon [d]	12.7 mg/l
Fecal coliform bacteria [c]	3600 MPN/100ml
E. Coli bacteria [c]	1450 MPN/100ml
Petroleum hydrocarbons [d]	3.5 mg/l
Cadmium [e]	2 ug/l
Copper [a]	10 ug/l
Lead [a]	18 ug/l
Zinc [e]	140 ug/l
Chlorides [f] (winter only)	230 mg/l
Insecticides [g]	0.1 to 2.0 ug/l
Herbicides [g]	to 5.0 ug/l

Notes

1. Data sources: [a] Schueler (1987), [b] Schueler (1995), [c] Schueler (1997), [d] Rabanal and Grizzard (1996), [e] USEPA (1983), [f] Oberts (1995), [g] Schueler (1996).
2. Concentrations represent mean or median storm concentrations measured at typical sites and may be greater during individual storms. Mean or median runoff concentrations from stormwater hotspots are higher than those shown.
3. Units: mg/l = milligrams/liter ug/l = micrograms/liter MPN = Most Probable Number

The following sections provide basic information on the most common pollutants associated with stormwater runoff from a broad range of land uses.

1. Solids/Floatables

Solids/floatables are primarily a surface water pollution concern. They are defined by the NJDEP as wastes or debris floating, suspended or otherwise contained in wastewater or waters of the state (N.J.A.C. 7:22A-1.4 et seq.). These materials include debris such as bottles, jars, cans, cardboard boxes, paper bags, newspapers, plastic containers and wrappings, condoms, hypodermic needles, leaves, and branches.

Solid/floatable materials are wastes that are inadvertently or purposefully disposed of either on land or directly into stormwater conveyances. Runoff transports this material to receiving waters where it can disperse, float, wash ashore onto beaches or embankments, or settle onto waterway bottoms. Solid/floatable material can create odors, aesthetic problems, and even toxic or corrosive gases that can emanate from bottom mud deposits.

2. Sediment

Sediment is one of the most significant pollutants created by development and transferred by its runoff. Sediments consist largely of soil materials eroded from uplands as a result of natural processes and human activities.

The greatest sediment loads are exported during the construction phase of land development. Adequate sediment and erosion control must be installed and maintained at the site to prevent the delivery of large quantities of sediment into downstream waterways and water bodies. Other pollutants such as nutrients and organic matter attached to the sediment can also be delivered. Requirements for appropriate erosion controls are available in the Standards for Soil Erosion and Sediment Control in New Jersey available from the State Soil Conservation Committee (SSCC) or local Soil Conservation Districts.

Sediment and other nonpoint source pollution from agricultural sources is also a major contributor to water quality problems in the state. Sediment from croplands clogs lakes, road ditches, canals, and culverts, particularly during and just after active tilling.

High concentrations of suspended sediment in streams and lakes cause many adverse consequences including increased turbidity, reduced light penetration, reduced prey capture for sight-feeding predators, clogged fish gills/filters, and reduced angling success. Additional impacts can result after sediment is deposited in slower moving waters. These include the smothering of benthic communities, alterations in the composition of the bottom substrate, and the rapid filling-in of small impoundments that create the need for costly dredging and reductions in the overall aesthetic value of the water resource. Sediment is also an efficient carrier of toxins and trace metals. Once deposited, pollutants in these enriched sediments can be remobilized under suitable environmental conditions and threaten benthic life.

3. Nutrients

Phosphorus and nitrogen are nutrients used by plants during photosynthesis. Phosphorus in natural waters occurs as phosphate in three classifications: orthophosphates (P04), polyphosphates (polymers of phosphoric acid), and organically bound phosphates. The most common forms of nitrogen are gaseous (N2), ammonia (NH3 or NH4), nitrite (NO2), nitrate (NO3), and nitrogen bound in organic compounds. Pollution from inorganic phosphorus (orthophosphates) and inorganic nitrogen (nitrates and ammonia) are of chief concern in New Jersey.

In general, undeveloped land produces relatively few nutrients; agricultural, residential, industrial, and commercial areas produce more nutrient loadings. In rural and residential areas, substantial amounts of nutrients originate from commercial fertilizers, manure from livestock feeding operations, or dairy farming. Fertilizer spread on lawns and farmland during the winter can contribute nutrients to runoff in the springtime. Pet wastes contribute nutrients to runoff in residential areas. Detergents and raw sanitary waste also contribute to nutrient loading.

The action of phosphates and nitrates can be quite different. Although both can be transported by groundwater, phosphorus often combines with fine soil particles and remains locked in the soil until it is either utilized by plant life or eroded away with the soil. In the latter case, the phosphorus will flow along with the soil particles as suspended sediment. Nitrates in the soil remain much more soluble. During the late winter and occasionally in midseason following exceptionally heavy rainfall, nitrates may pass below the root zone into the groundwater. This movement of nitrates into groundwater may cause a public health hazard because high nitrate concentrations in drinking water can cause infant methemoglobinemia (Blue Baby Syndrome).

Under normal conditions, phosphorus and nitrogen are not generally regarded as problem chemicals. However, in excessive amounts, phosphorus and nitrogen present a problem by over-stimulating plant growth within the aquatic environment. When excessive concentrations (especially phosphorus) pass into surface fresh waters, they can contribute to eutrophication in slower moving water bodies and to dense algal growths on substrates within flowing water systems.

The greatest risk of eutrophication is in small agricultural ponds, urban lakes, and impoundments that have retention times of two weeks or more. Under optimal growing conditions, these lake systems can experience chronic and severe eutrophic symptoms such as surface algal scums, water discoloration, strong odors, depressed oxygen levels (as the bloom decomposes), release of toxins, and reduced palatability of fishery resources. High nutrient levels also promote the growth of dense mats of green algae that attach to rocks and cobbles in shallow, unshaded headwater streams. This phenomenon is present in many residential areas with recreational water bodies bordered by extensive, improperly fertilized lawn.

Coastal waters and estuaries in New Jersey also suffer from increased incidences of phytoplankton blooms, e.g., Barnegat Bay has been the site of several algal bloom problems including brown tide. Concern exists that this problem is caused, in part, by inputs from nutrient-enriched fresh waters; however, the relationship between high nutrient levels and algal production is extremely complex and is not fully understood.

4. Pesticides

Pesticides, which include insecticides, herbicides, rodenticides, and fungicides, are among the few toxic substances deliberately introduced to the environment. These substances are used routinely for agricultural purposes and in residential and commercial property maintenance to biochemically affect specific unwanted organisms. However, these substances can produce unintended toxic effects on ecosystems and human life by contaminating soil, water, and air. Numerous acute and chronic effects on humans and other organisms are associated with pesticide exposure. Pesticides can enter an organism through inhalation, ingestion, or skin contact. They have caused decreases in aquatic populations either directly, through damage to the food chain by decreasing reproductive success, or indirectly, by reducing oxygen levels in the water through a reduction in the populations of higher plants and phytoplankton. Some pesticides, such as DDT, dieldrin, and chlordane, are no longer in use but persist in the food chain and in the human body. Other commonly used pesticides, such as malathion, are suspected carcinogens and are hazardous more through direct contact than indirect contact via the food chain.

Pesticides are carried in stormwater from application sites by becoming dissolved or suspended in runoff or by binding to particulate matter carried in runoff. These pesticides can contaminate surface or groundwater through infiltration devices or overflow. The fate and transport of pesticides are dependent on their physical and chemical properties and their chemical interactions with the environment. Processes that determine the path of pesticides in the environment are primarily photolysis (degradation in light), hydrolysis (degradation in the presence of water), and sorption reactions that are dependent on the chemical nature and solubility of the pesticide and the percentage of particulate and organic matter present in the sediment. Some pesticides, such as aldicarb, are highly soluble in water and are easily flushed into aquatic ecosystems or groundwater. Pesticides with low solubility may accumulate in sediments by adhering to particulate matter. Adsorption and absorption increase with the amount of organic matter present. These factors and the resistance to degradation of certain pesticides (expressed as the half-life) increase the persistence of these substances in the environment.

5. Metals

The permissible concentrations of metals in water are established directly by numerical criteria under the surface and groundwater quality standards and indirectly by standards under the Safe Drinking Water Act. Concentrations of metals found in water can have adverse effects upon public health as well as upon aquatic biota. Lead, arsenic, copper, cadmium, mercury, and some forms of chromium are all metals of concern.

Metals can occur naturally in soil or result from human activity. The quantities of metals leaching into water from natural sources are influenced largely by the water's pH. Acid rain and the low pH water often found in swamps may increase the solution of metals into water. Although mercury and copper have been shown to cause serious health problems, lead is of primary public health concern. It has a cumulative, toxic neurological effect and may be particularly harmful to children. One of the principal sources of lead in stormwater runoff has been the tetraethyl lead in gasoline, but pollution from this source is rapidly declining due to stringent federal controls over lead in gasoline.

6. Road Salt

Road salt, primarily composed of sodium chloride (common salt), has the potential to impair land vegetation, water quality, and aquatic ecosystems. This material is commonly used throughout the state as a low-cost substance for melting snow and ice. Road salt entering stormwater runoff generally originates from salt stockpiles or from salt application to roadways and other impervious surfaces. Precipitation falling on salted surfaces creates runoff containing dissolved salt. The increasing amount of urban and suburban development in New Jersey has resulted in increased roadways and other impervious surfaces such as parking lots, which has increased the use of road salt.

The primary problem with road salt is the contamination of ground and surface waters, which may render them unusable or require expensive treatment procedures. Increased sodium chloride concentrations in water create aesthetically displeasing drinking water and interfere with pristine manufacturing processes. High levels of sodium consumed in drinking water can elevate blood pressure and impair kidney function in susceptible individuals.

Because of salt's long residence time, salt water often tends to build up concentration in groundwater. Due to a seasonal effect, the highest levels of chloride ions appear in the summer months. This effect is attributed to the slow movement of groundwater (reacting to winter applications) and high summer evapotranspiration rates.

Excessive salt or saline input to fresh surface waters can cause significant use impairment. The input of highly concentrated saline water into fresh water lakes can retard springtime mixing. The density of the bottom layer of water increases, thereby overriding the normal thermal density gradients responsible for vertical mixing. This saline buildup can decrease oxygen levels and cause high mortality among bottom-dwelling organisms. Increased salt loading to bays and estuaries can alter natural saline concentrations and disrupt shellfish reproduction and fish spawning. Surface water effects are dependent on the concentrations of sodium chloride entering the system, the amount of dilution, and the sensitivity of the aquatic ecosystem.

Aside from contaminating surface and groundwater, high levels of sodium chloride can kill roadside vegetation and corrode infrastructure such as bridges, roads, and stormwater management devices. In addition, some industrial operations can be impaired by an increase in the salinity of intake water.

7. Petroleum Hydrocarbons

Petroleum hydrocarbons in water are considered very harmful to natural biota. In addition, some constituents are carcinogenic and toxic to humans. No numerical criteria exist for petroleum hydrocarbons in ground or surface water quality standards. In both cases and in most waters, the basic criterion is "none noticeable."

Additional requirements for surface water prohibit hydrocarbons on aquatic substrata, along the shore in quantities detrimental to the natural biota, and where they would render waters unsuitable for their designated uses. The same standards are generally applicable to oil and grease, which, except for petroleum hydrocarbons, are not considered especially dangerous. Control efforts are mainly directed toward hydrocarbons.

Although the hydrocarbons harmful to water quality are mostly liquid at ambient temperatures, they are absorbed and adsorbed onto solid particles of sediment so rapidly that they are found mainly as particulates in runoff. Only considerable masses of oil will remain in liquid form in the larger storm drains. Petroleum hydrocarbons are also biodegradable in an aerobic environment, although at a relatively slow rate.

8. Pathogens

Pathogens (viral and bacterial) and non-pathogenic bacteria are found in the intestinal tracts of humans and other warm-blooded animals and are excreted with fecal wastes. A number of human diseases can be transmitted by runoff contaminated by fecal sources. Some well-documented bacterial agents include the *Salmonella* group responsible for typhoid fever, paratyphoid fever, and intestinal fever; the *Shigella* group causing bacillary dysentery; *Vibrio cholerae* responsible for cholera; and *Escherichia coli (E. coli)* causing gastroenteritis. In humans, gastroenteritis is the leading waterborne infectious disease in the United States. Deficient water treatment and groundwater contamination of wells are responsible for most of the outbreaks (65 percent) and cases (63 percent). The ingestion of shellfish harvested from contaminated waters can lead to disease as well.

Human fecal contamination is primarily a sewage treatment problem complicated by cross-connections or interconnections between sanitary and storm sewers, where combined sewer overflows degrade surface waters and where faulty, improperly sized, or improperly located septic systems contaminate groundwater. Animal fecal material from livestock operations, domestic pet populations, and concentrated wildlife populations contaminate surface waters via overland runoff and stormwater sewer discharges. Groundwater contamination occurs in areas with very permeable soils and/or high groundwater tables and where sinkholes, fractured rock, and well casings provide possible entry routes.

It is generally accepted that urban runoff will exceed desired bacterial limits. When considering stormwater contributions to the flow in a combined sewer system, the importance of stormwater control for bacterial water quality should be considered.

While not directly responsible for disease, fecal coliform bacteria have traditionally served as the microbiological indicators for the potential presence of waterborne pathogens. Enterococci appear to be a more accurate indicator than coliform bacteria, especially in saltwater where their resistance time and survival rate is similar to that of pathogenic bacteria. Research is being conducted on the use of bacteriophages as viral indicators. Until regulations are revised, however, the state will continue to rely on traditional indicators (total and fecal coliforms) as well as enterococci.

Compared to other pollutants, bacteria and pathogens have relatively low residence times in the environment. Survival in surface waters varies with environmental factors such as temperature, light intensity, salinity, nutrient levels, bacteriophages and predation, absorption, sedimentation, and the presence of toxic substances.

Bacteria and viruses, when introduced to the subsurface environment, can undergo a natural die-off, be retained in the soil, or be transported to groundwater. Survival rates of both bacteria and viruses decrease with increasing temperature, decreasing soil moisture, and increasing competition with native soil microflora. Bacteria can be effectively retained in soils by the filtering action of fine particle soils with small pore size. The finer the soil grain, the greater its capability to filter out microorganisms. Adsorption, however, is the principal mechanism by which viruses are retained in the soil, and it can be a factor for retaining bacteria. Adsorption may be temporary; viruses may remain on the soil particle and be returned to subsurface flow during intense rainfall.

Groundwater is less likely to be contaminated by bacteria than surface waters. Bacteria and pathogens are generally filtered, adsorbed by soil, or dead before reaching the groundwater.

There is presently limited information that specifically addresses the survivability and transport of bacteria in stormwater runoff. The exact distances bacteria would be transported vary with soil properties, climate, and vegetation.

Parasites are an additional concern under this general category of pollutants. A number of infectious diseases are transmissible to humans via ordinary parasites. Common causes of these diseases are dog and cat parasites such as roundworms and hookworms shed in animal feces. The intimate relationships that household pets have with people, combined with the large pet population, greatly increase the potential for transmission of pathogens. This also appears to be true for bacteria and viruses, many of which have long survival times when infected pet waste is washed into receiving waters via stormwater.

Two relatively common protozoa that cause intestinal disorders in humans are also of great concern. The first is *Cryptosporidium Spp.,* which often causes diarrhea and may be accompanied by fever, abdominal pain, nausea, constipation, and/or weight loss. Most infections occur after contact with infected people. The other is *Giardia Spp.,* which causes many of the same symptoms as cryptosporidiosis. Its major reservoirs appear to be water and food contaminated by infected animals and people. A worrisome feature of these organisms is their resistance to environmental influences and disinfectants.

Stormwater Retention Best Management Practices

"2nd Wave" BMPs

First wave stormwater management BMPs dealt with preventing the type of pollution that contaminates runoff. These BMPs did not affect the traditional collection and conveyance system of stormwater management. Second wave BMPs involve planning and design that reduce runoff and manage stormwater as a resource.

"At the Source" Vs "End of Pipe" Solutions

Traditional stormwater management involves "end of the pipe" design. In this process, stormwater picks up ever increasing amounts of pollutants, greater volume and speed of flow. This "end of pipe" solution results in large volumes of fast moving, contaminated water being discharged through small channels or pipes into the nearest receiving waters (streams, lakes, or oceans).

"At the source" design strives to allow stormwater to remain onsite by infiltrating permeable surfaces. By treating rain water as a resource and allowing it to infiltrate the soil, this strategy greatly reduces the volume, flow and toxicity of any remaining water that does enter the "end of pipe" system.

Conveyance Vs Infiltration Strategies

The conveyance approach to stormwater management seeks to "get rid of the water." This system collects and concentrates runoff through a network of impervious gutters, structures, and underground pipes. A conveyance system must be continually increased in size as it reaches its final outfall because of the constant addition of tributary storm drain systems. Because of its impervious nature, pollutants in the water become more concentrated. When it reaches its outfall, large volumes of highly polluted water are emptied, untreated, into natural water bodies, impairing water quality and reducing beneficial uses.

The infiltration approach to stormwater management seeks to emulate and preserve the natural hydrologic cycle. This system seeks to move stormwater slowly over large permeable surfaces to allow it to percolate into the ground. These permeable surfaces can double as recreational areas during dry weather. Because these systems allow stormwater to infiltrate the soil, overall runoff volumes are reduced and groundwater supplies are more quickly replenished. The slow, natural infiltration process enables the soil to naturally mitigate many of the pollutants found in stormwater. In addition, as it takes longer for water to enter and make its way through the traditional storm drain system, it reduces the speed, volume and pollutant load of the remaining water when it reaches the outfall.

Think Small—80% of Runoff Comes from Small Storms of .5" to 1.25" of Rain

Our current storm drain systems are sized to accommodate the flows from the largest storm cycles. However, 80% of runoff is generated from storms producing only .5" to 1.25" of rain. Infiltration-based stormwater systems are ideal for these smaller, more frequent events. Infiltration systems can incorporate overflow design components that direct the flows from the infrequent, larger storm events to the current "end of pipe" system.

Site Design Considerations

In order to maximize the effectiveness of infiltration type storm water systems, and to minimize the runoff of rain water, the following site design considerations must be kept in mind.

A. Define development envelope & protected areas — Protect existing site features (trees, creeks, and slopes), keep development compact to minimize environmental impact and reduce costs, and retain desirable landscape features.

B. Minimize directly connected impervious areas — Avoid the design of impermeable areas that are directly linked to the storm drain system. Design impermeable areas to drain to permeable soil, shallow retention basins, or soil depressions that can hold the first 1/3" to 1" of rain.

C. Maximize permeability — Maximize the use of landscaped areas or permeable surfacing materials.

D. Maximize choices for mobility — Incorporate design elements that encourage pedestrian use and support existing mass transit options.

E. Use drainage as a design element — Design for the use of water as a site amenity. Properly designed retention or wet ponds can be used as a component of the drainage system while creating a valuable and sought after development amenity.

Stormwater Impact and Regulatory Requirements

The runoff caused by storms is the single largest source of non-point water pollution in the US. Past pollution prevention educational efforts have focused on businesses and the public. While these activities remain important, a new area of stormwater pollution prevention is emerging: designing new developments to allow for the retention and infiltration of stormwater runoff.

The Los Angeles Regional Water Quality Control Board recently passed the Standard Urban Stormwater Mitigation Plan (SUSMP) regulation which requires all new developments built in the Los Angeles area to be designed to treat or retain onsite the first 3/4" of rain that falls in a 24-hour period.

Through the implementation of some new design approaches and the use, where possible, of permeable paving materials, the quantity of stormwater runoff and its resulting quality can be improved. And the new SUSMP regulations can be met.

Viewing rain water as a resource to be captured and conserved rather than a nuisance to be channeled offsite, may require a fundamental change in our thought processes. However, the resulting savings in immediate and long term costs plus the environmental benefit to the Southern California coastal areas are worth the effort.

Information Resources

City of Santa Monica Watershed Management Program
(310) 458-8223 / www.sustainablesm.org

County of Los Angeles Stormwater Program
(888) CLEANLA / dpw.co.la.ca.us/epd/#stormwater

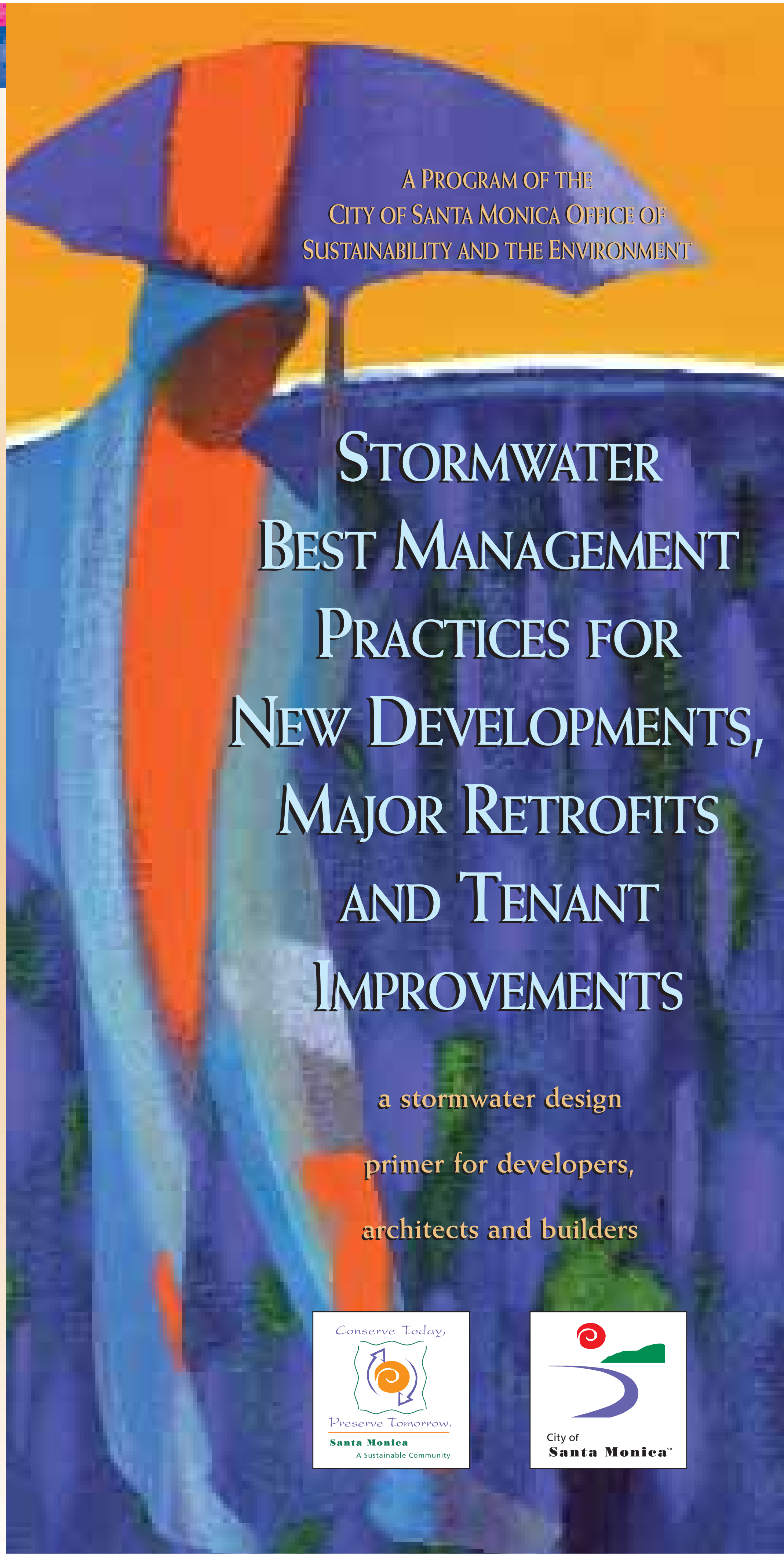
Los Angeles Regional Water Quality Control Board
(213) 576-6600 / www.swrcb.ca.gov/rwqcb4

The Santa Monica Bay Restoration Commission
(213) 576-6615 / www.smbay.org

Illustrations courtesy of "Start at the Source" Bay Area Stormwater Management Agencies Association

Santa Monica BAY Restoration Commission

Brochure originally produced through funding from the Public Involvement and Education Fund of the Santa Monica Bay Restoration Commission and by KJ Services Environmental Consulting



A Program of the City of Santa Monica Office of Sustainability and the Environment

Stormwater Best Management Practices for New Developments, Major Retrofits and Tenant Improvements

a stormwater design primer for developers, architects and builders

Conserve Today, Preserve Tomorrow. Santa Monica A Sustainable Community

City of Santa Monica

Stormwater Design Best Management Practices for Residential, Commercial, and Governmental Developments

A — Permeable Pavements

Permeable pavements are designed to allow for the infiltration of stormwater while still providing a load-bearing surface. While maintaining a surface suitable for walking and driving, permeable pavements contain sufficient void space to allow water to infiltrate into the underlying soil.

Types of Permeable Pavement:

1. Pervious asphalt and concrete.
2. Unit pavers on sand.
3. Granular materials such as gravel, cobbles, and wood mulch.

B — Street Design

Streets (including gutters and sidewalks) account for up to 70% of all the impervious area in a community, having a great impact on stormwater quality. As currently designed most streets are directly connected to an underground conveyance system.

Stormwater quality is improved through the following design options:

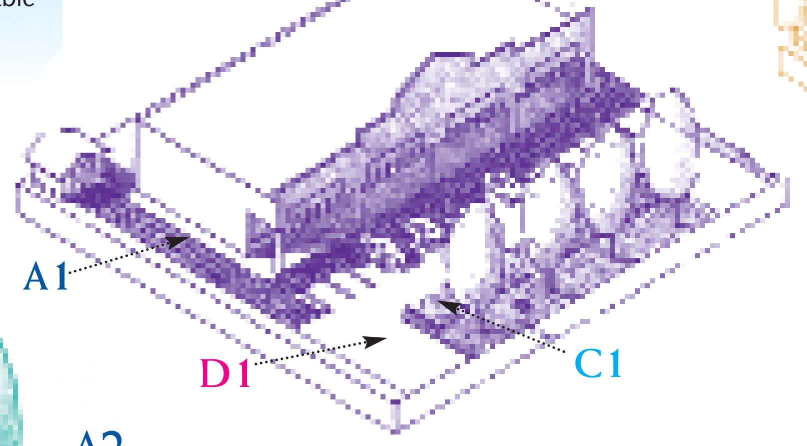
1. Reduced street width.
2. Limited on-street parking.
3. Reduced sidewalk width and placement.
4. Landscaped parkways.
5. Swale drainage systems.
6. Concave medians.
7. Cul-de-sac planting.

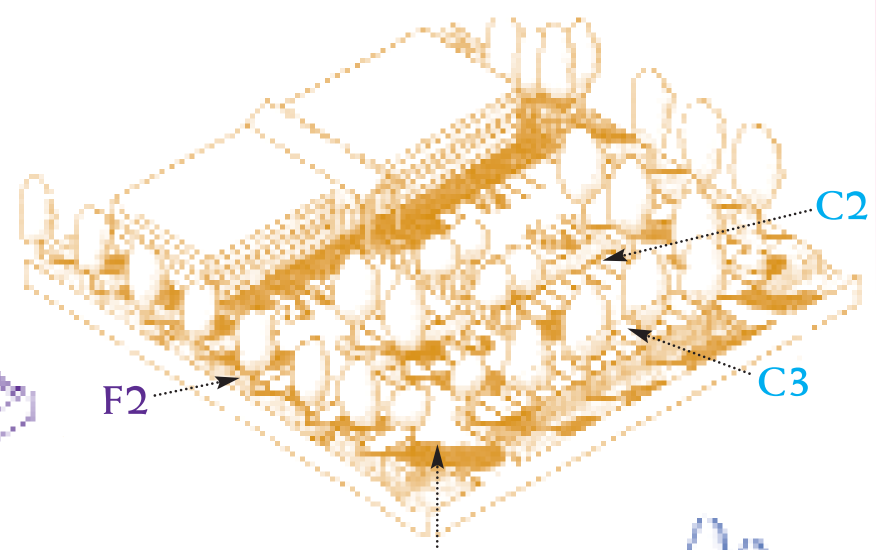
C — Parking Lots

In a typical parking lot, including aisles, curbs, and driveways, 400 square feet is allocated per vehicle (100 cars ≈ 1 acre). All this paved area has an adverse impact on stormwater.

Ideas to help reduce this stormwater impact include:

1. Non-Permeable/Permeable combo parking lots.
2. Parking groves.
3. Permeable pavement parking.





D — Driveways

Driveways can be designed to minimize their impact on stormwater through the creative use of permeable pavements and grading for drainage to landscaped areas.

1. Driveways designed to drain to permeable areas.
2. Crushed aggregate driveways.
3. Unit pavers on sand.
4. Turf block driveways.
5. Paving under wheels only.
6. Flared driveway aprons for 2 or 3 car garages.
7. Temporary RV parking on turf block.

E — Building Design Features

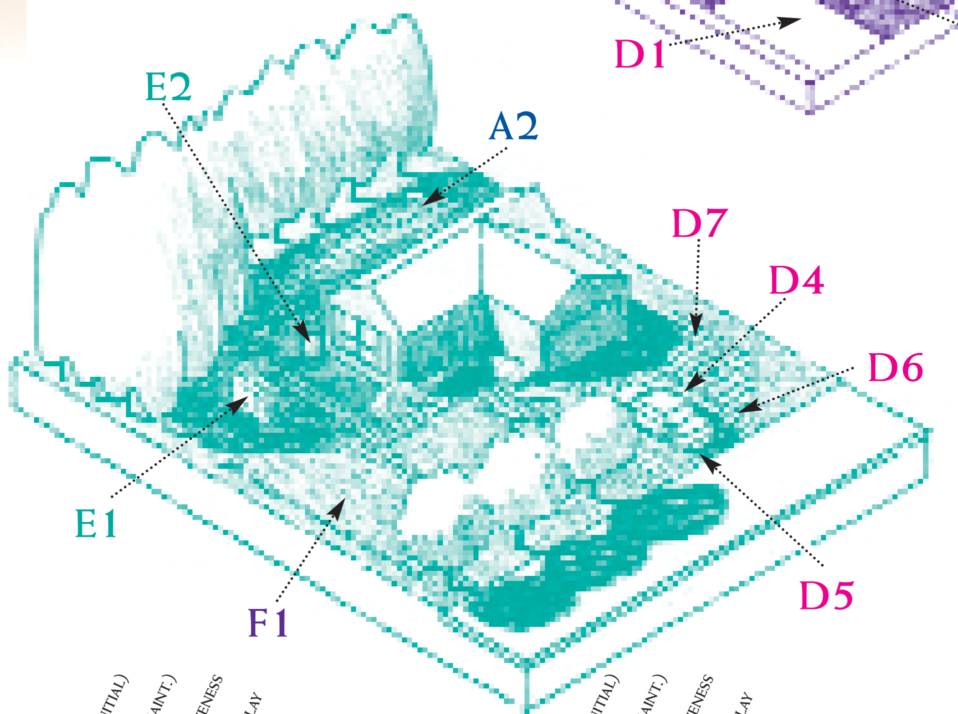
Certain building design features, that can be incorporated into a variety of developments, effectively allow for the retention and infiltration of stormwater.

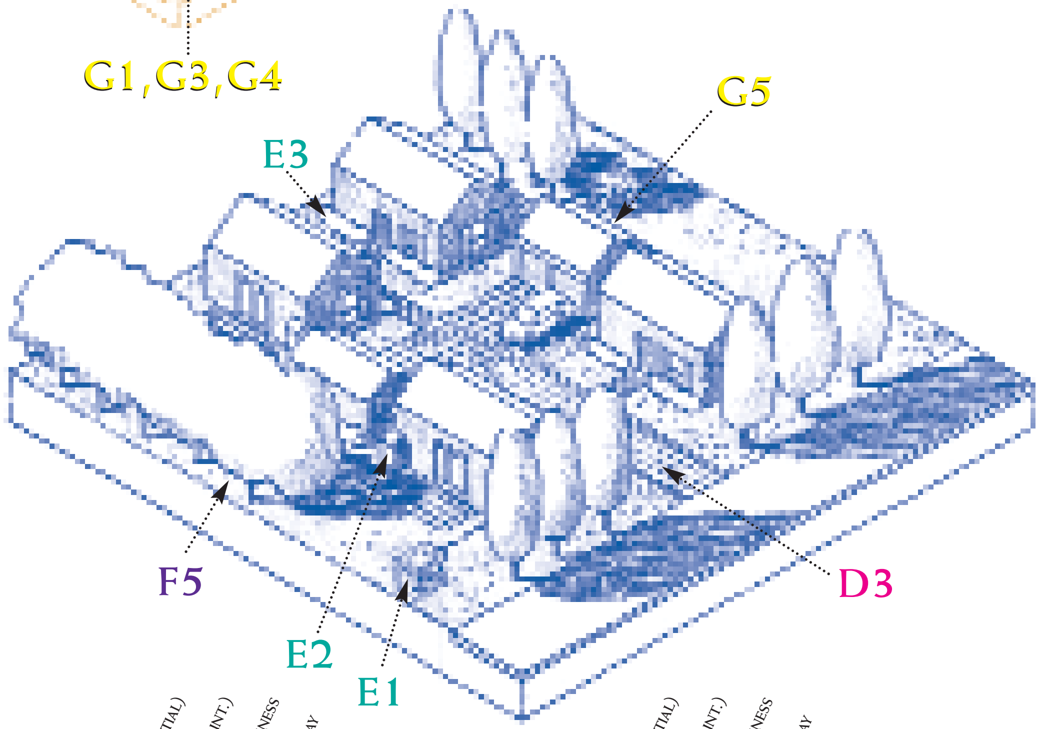
1. Infiltration Pit.
2. Cistern.
3. Foundation planting.

F — Landscaping

The proper use of landscaping, site grading and surface water amenities, such as wet ponds and constructed wetlands, allow for the efficient infiltration of stormwater into underlying soils.

1. Concave lawn areas.
2. Vegetated swales.
3. Dry ponds.
4. Wet ponds.
5. Climate-appropriate plant selection to maximize infiltration and minimize water use.





G — Manufactured Treatment Devices

Where stormwater cannot be treated by onsite infiltration, devices should be used to clean or filter stormwater before it reaches the existing underground conveyance system.

1. Catch basin or inlet inserts/filters.
2. Oil/Water separators.
3. Media filters.
4. Screening-separation devices.
5. Downspout filters.

Legend: ○ Least ◗ ● Most

BMPs Design Details Matrix

This matrix summarizes their initial construction cost, maintenance cost, relative effectiveness at meeting stormwater quality goals, and their suitability for use in expansive, clay soils. Conventional approaches are also evaluated for comparison.

Permeable Pavements	Cost (Initial)	Cost (Maint.)	Effectiveness	OK in Clay
Conventional Asphalt/Concrete	◗	○	○	●
Pervious Concrete	●	●	●	○
Porous Asphalt	●	●	●	○
Turf Block	◗	●	●	◗
Brick	●	◗	◗	◗
Natural Stone	●	◗	◗	◗
Concrete Unit Pavers	●	◗	◗	◗
Crushed Aggregate	○	◗	●	●
Cobbles	○	◗	◗	●

Streets	Cost (Initial)	Cost (Maint.)	Effectiveness	OK in Clay
Conventional Street Standards	●	○	○	●
Access Street: Urban Neo-Traditional Standard	○	○	●	●
Access Street: Rural Standard	○	◗	●	●
Urban Curb/Swale System	◗	◗	●	◗
Rural Swale System	○	◗	●	◗
Dual Drainage System	●	●	●	●
Concave Median	○	○	●	◗
Cul-de-sac	○	○	●	◗

Parking Lots	Cost (Initial)	Cost (Maint.)	Effectiveness	OK in Clay
Conventional Parking Lot	◗	◗	○	●
Combo Parking Lots	○	◗	●	●
Parking Grove	◗	○	●	●
Permeable Pavement Parking	○	◗	●	●

Driveways	Cost (Initial)	Cost (Maint.)	Effectiveness	OK in Clay
Conventional Driveway	○	◗	○	●
Not Directly-Connected Impervious Driveway	○	○	●	◗
Crushed Aggregate	○	◗	●	●
Unit Pavers On Sand	●	◗	◗	◗
Paving Only Under Wheels	○	◗	●	●
Flared Driveways	○	○	●	●
Temporary Parking	○	◗	●	●

Buildings	Cost (Initial)	Cost (Maint.)	Effectiveness	OK in Clay
Conventional Pipe System	●	◗	○	●
Infiltration Pit	○	◗	●	◗
Cistern	●	◗	◗	●
Foundation Planting	○	○	●	◗

Landscape	Cost (Initial)	Cost (Maint.)	Effectiveness	OK in Clay
Conventional Pipe System	●	◗	○	●
Grass/Vegetated Swales	○	◗	●	●
Extended Detention (Dry) Ponds	○	◗	●	●
Wet Ponds	○	●	●	●
Plant Species Selection for Infiltration Areas	○	◗	●	●
Landscape Maintenance for Stormwater Systems	◗	◗	●	●

Gerald Pasek
Board of Directors, President
Rancho Murieta Community Services District
P.O. Box 1050
Rancho Murieta, CA 95683

November 10, 2015

Re: Request for CSD Initiation of Study of Potential Development Impacts on Drinking Water Quality

Dear Director Pasek,

Rancho Murieta is wholly reliant on our three reservoirs, Calero, Chesbro, and Clementia, to meet our drinking and household water use needs. The current Rancho Murieta North development project put forward by Rancho Murieta Properties, LLC, proposes substantial construction of houses, roads, and associated infrastructure in the immediate vicinity of these three drinking water reservoirs. If this proposed development is approved, it will result in a considerable alteration of the landscape around our drinking water supply. Stormwater runoff and other outputs from residential development may contaminate surface water (http://water.epa.gov/polwaste/npdes/stormwater/index.cfm). These potential impacts include:

- Impacts to runoff quantity - development increases impervious surfaces that prevent water infiltration, thus increasing runoff volume, among other impacts;
- Impacts to runoff quality – stormwater falling on paved and other developed surfaces mobilizes and transports a wide variety of contaminants including sediment, metals, petroleum products, pesticides, fertilizers, and pet and wild animal waste.

Development within the basins surrounding the drinking water reservoirs may result in increased volumes of stormwater, potentially containing multiple contaminants originating from newly developed properties. Absent suitable controls integrated into the development plans at the outset, this stormwater may flow into our reservoirs, negatively impacting our drinking water quality, introducing contaminants requiring costly treatment and mitigation.

Since these reservoirs are the only water supply for the entire community, it is imperative that any development that takes place within their catchment basins is done in a way that will not degrade water quality. With the EIR just getting ready to be initiated, we are at the perfect time to develop data that quantifies the potential impacts that proposed development may have on our water quality and that can be used to help guide appropriate mitigation to any impacts identified. Specifically, within the Hydrology and Water Quality section of the CEQA process (http://resources.ca.gov/ceqa/guidelines/), the EIR should determine whether a project would:

- Violate any water quality standards or waste discharge requirements?

- Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff? Or
- Otherwise substantially degrade water quality?

We propose that CSD identify and hire an independent consultant to perform this study. The scope of work for the selected consultant should include not only evaluation of potential impacts of development on water quality in our reservoirs, but also development of mitigation measues that may be integrated into development plans to reduce potential impacts. Because the impetus for this study is the development proposed by Rancho Murieta Properties, LLC, they should provide the funds necessary for the study. However, to maintain independence, CSD should manage and direct the consultant and the study (i.e., with no input from the developer concerning selection of a consultant, study design or analysis, etc.). Development and planning of the water quality study should be coordinated with the Sacramento County Planning department so that once completed, the study and its findings are included in the EIR for the Rancho Murieta North development project.

We believe that this study is critical to ensure that any proposed development is implemented in the most environmentally sound manner that ensures a sustainable, high quality water supply for the Rancho Murieta community.

Respectfully,

Bradley E. Sample, Ph.D.

John Merchant

From: Darlene Gillum
Sent: Thursday, November 12, 2015 3:43 PM
To: 'bsample@ecorisk.com'
Subject: RE: Development related questions

Brad,
Your email and attachments will be included in the November 18, 2015 board meeting packet and agenda. Your letter to the directors requesting a water quality study will also be included.

I have inserted answers to your questions related to the OHWD/Rancho Murieta Groundwater Recharge Project below in red font.

Thanks,

Darlene J. Gillum
General Manager
Rancho Murieta Community Services District
P.O. Box 1050
15160 Jackson Road
Rancho Murieta, CA 95683
Phone: 916-354-3709
Cell: 916-873-5145
Fax: 916-314-3530
Visit us at www.RMCSD.com

From: bsample@ecorisk.com [mailto:bsample@ecorisk.com]
Sent: Wednesday, October 21, 2015 1:25 PM
To: Darlene Gillum
Cc: Mark Pecotich
Subject: Development related questions

Hi Darlene,

I forwarding to you a set of emails that I recently sent to Mark Pecotich in relation to three separate development-related issues. He asked that I pass them on to you so that they could be included as part of the development discussion at this evenings CSD Board meeting. I will try to make it to the meeting, but in case I cannot, I wanted you to have copies that could be included in the record, plus there are attachments with supporting documentation that should be considered. The three topics are as follows:

- **Asbestos -** I've talked to Joelle Inman, planner for the County who put me in touch with Eric Stackhouse who is in charge of mitigation monitoring for the County. It appears that the analytical methods used to test for asbestos in soil in Rancho Murieta are consistent with Air Resources Board guidance. However, I do not think that the method is suitable or appropriate for our situation where excavation will be (is) occurring within a densely populated residential community and adjacent to our water supply. I have talked with Dr. Neumann of the ARB developed the method. She indicated that a revision to the method and guidance is in the works. In the meantime, I will be contacting the Sacramento Metro Air Quality Management District as they are the key agency charged with overseeing naturally occurring asbestos monitoring.

Ultimately we have an issue in that the method that is being used has been shown to have a high likelihood of not detecting asbestos when in fact it is present. Other methods are available that have higher resolution and are more reliable. Given that excavation for development will be located within the center of our community and adjacent to our water supply, I believe that it is essential that we obtain the best information possible before any large scale excavation occurs. I'm hoping that CSD can enter into discussions with both the County and the Developers to ensure that the most appropriate and reliable methods for asbestos analyses are used so that the community can have peace of mind that development will not result in exposure to naturally occurring asbestos.

- **OHWD / Rancho Murieta Groundwater Recharge Project** - was the OHWD / Rancho Murieta Groundwater Recharge Project funded by the state? The District received $500,000 of State grant funds (Proposition 50) through the Regional Water Authority for construction of a groundwater well. Is this project current ongoing? Yes. Also, How does the groundwater well described in this project relate to the GW wells being discuss in support of development? Same or different wells? The groundwater wells related to the Project are the only wells being constructed by the District. Is the project going to undergo a complete EIR in order to fully quantify the potential impacts associated with groundwater extraction? An Initial Study/Mitigated Negative Declaration was completed in March 2014, released for public review/comment in April 2014, and adopted by the Board of Directors in May 2014.

- **Need for a study to evaluate the implications of development on water quality** - The current development plans propose substantial construction of houses, roads, and associated infrastructure in the immediate vicinity of our three drinking water reservoirs. This will result in a considerable alteration of the landscape around our drinking water. There is considerable information that stormwater runoff and other outputs from residential development can result in contamination of drinking water.

  Since these reservoirs are the only water supply for the entire community, it is imperative that any development that takes place within their catchment basins is done in a way that will not degrade water quality. With the EIR just getting ready to be initiated, we are at the perfect time to develop data that quantifies the potential impacts that proposed development may have on our water quality and that can be used to help guide appropriate mitigation to any impacts identified. This study should be conducted using funds from the Developers, but managed and directed by CSD (i.e., with no input from the developer concerning selection of a consultant, study design or analysis, etc.). Once completed, it could be provided to the County for inclusion in the EIR.

If you have any questions, please do not hesitate to contact me. Thanks much!

Brad

Bradley E. Sample, Ph.D.
Principal Scientist
Ecological Risk, Inc.
15036 Magno Ct.
Rancho Murieta, CA 95683
Mobile: 916-801-6440
Phone: 916-354-2255
email: bsample@ecorisk.com

MEMORANDUM

Date: November 9, 2015

To: Board of Directors

From: Darlene J. Gillum, General Manager

Subject: Receive and File 2014-2015 Rancho Murieta Community Services District Annual Audit Report

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RECOMMENDED ACTION

No action - receive and file.

BACKGROUND

Enclosed is the ***draft*** audit report related to the 2014-2015 fiscal year. Mr. Bain will attend the November 18, 2015 Board meeting to present the final audit and to answer any questions of the Board of Directors.

RANCHO MURIETA COMMUNITY SERVICES DISTRICT

FINANCIAL STATEMENTS

JUNE 30, 2015

RANCHO MURIETA COMMUNITY SERVICES DISTRICT

TABLE OF CONTENTS

LARRY BAIN, CPA
AN ACCOUNTING CORPORATION

2148 Frascati Drive, El Dorado Hills, CA 95762 / 916.601-8894
lpbain@sbcglobal.net

INDEPENDENT AUDITOR'S REPORT

To the Board of Directors
Rancho Murieta Community Services District
Rancho Murieta, California

We have audited the accompanying financial statements of each major fund, and the fiduciary fund of the Rancho Murieta Community Services District (District) as of and for the fiscal year ended June 30, 2015, which collectively comprise the District's basic financial statements as listed in the table of contents, and the related notes to the financial statements.

Management's Responsibility for the Financial Statements

Management is responsible for the preparation and fair presentation of these financial statements in accordance with the accounting principles generally accepted in the United States of America; this includes the design, implementation and maintenance of internal controls relevant to the preparation and fair presentation of financial statements that are free from material misstatement, whether due to fraud or error.

Auditors' Responsibility

Our Responsibility is to express an opinion on these financial statements based on our audit. We conducted our audit in accordance with auditing standards generally accepted in the United States of America. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement.

An audit includes performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal controls relevant to the District's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the District's internal control. Accordingly, we express no such opinion. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of significant accounting estimates made by management, as well as evaluating the overall financial statement presentation.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Opinion

In our opinion, the financial statements referred to above present fairly, in all material respects, the respective financial position of each major fund of the Rancho Murieta Community Services District, California, as of June 30, 2015, and the respective changes in financial position and where applicable, cash flows thereof for the fiscal year then ended in conformity with U.S. generally accepted accounting principles.

Other Matters

Required Supplementary Information

Accounting principles generally accepted in the United States of America require that the management's discussion and analysis on pages 3–9 be presented to supplement the basic financial statements. Such information, although not a part of the basic financial statements, is required by the Governmental Accounting Standards Board, who considers it to be an essential part of financial reporting for placing the basic financial statements in an appropriate operational, economic, or historical context. We have applied certain limited procedures to the required supplementary information in accordance with auditing standards generally accepted in the United States of America, which consisted of inquiries of management about the methods of preparing the information and comparing the information for consistency with management's responses to our inquiries, the basic financial statements, and other knowledge we obtained during our audit of the basic financial statements. We do not express an opinion or provide any assurance on the information because the limited procedures do not provide us with sufficient evidence to express an opinion or provide any assurance.

The required supplementary information other than MD&A, as listed in the table of contents, is not a required part of the basic financial statements but is supplementary information required by the Governmental Accounting Standards Board. We have applied certain limited procedures, which consisted principally of inquiries of management regarding the methods of measurement and presentation of the required supplementary information. However, we did not audit the information and express no opinion on it.

Implementation of New Accounting Standards

As disclosed in the Note 1 to the financial statements, the Rancho Murieta Community Services District implemented GASB Statement No. 68, *Accounting and Financial Reporting for Pensions – an amendment of GASB Statement No. 27,* and GASB Statement No. 71, *Pension Transition for Contributions Made Subsequent to the Measurement Date – an amendment of GASB Statement No. 68,* during the fiscal year 2015.

Other Information

We have also issued our report dated October 26, 2015 on our consideration of the District's internal control over financial reporting. That report should be read in conjunction with this report in considering our audit.

The Schedules of Operating Revenues and Operating Expenses for the Water, Sewer, Drainage, Solid Waste and Security Funds, are the responsibility of management and were derived from and relate directly to the underlying accounting and other records used to prepare the basic financial statements. Such information has been subjected to the auditing procedures applied in the audit of the basic financial statements and certain additional procedures, including comparing and reconciling such information directly to the underlying accounting and other records used to prepare the basic financial statements or to the basic financial statements themselves, and other additional procedures in accordance with auditing standards generally accepted in the United States of America and in our opinion, are fairly presented in all material respects in relation to the basic financial statements taken as a whole.

Larry Bain, CPA,
An Accounting Corporation
October 26, 2015

As management of the Rancho Murieta Community Services District (District), we offer readers of the District's financial statements this narrative overview and analysis of the financial activities of the District for the fiscal year ended June 30, 2015. We encourage readers to consider the information presented here in conjunction with the District's financial statements which follow this section.

Financial Highlights

- The assets of the District exceeded its liabilities at the close of the most recent fiscal year by $34,213,436 (net position). Of this amount, $4,651,149 (unrestricted net position) may be used to meet the District's ongoing obligation to customers and creditors.
- The District's total net position increased by $4,322,830 since the close of the prior fiscal year.

Overview of the Basic Financial Statements

This annual financial report consists of four parts: Management's Discussion and Analysis, the Basic Financial Statements, Notes to Basic Financial Statements, and optional Supplementary Information.

This discussion and analysis provides an introduction and brief description of the District's basic financial statements, which include:

- Statement of Net Position
- Statement of Revenues, Expenses and Changes in Net Position
- Statement of Cash Flows

The *Statement of Net Position*, commonly referred to as the Balance Sheet, presents information on all of the District's assets and liabilities, with the difference between the two reported as net position. Over time, increases or decreases in net position may serve as a useful indicator of whether the financial position of the District is improving or deteriorating. The Statement of Net Position also provides the basis for computing rate of return, evaluating the capital structure of the District and assessing the liquidity and financial flexibility of the District.

The *Statement of Revenues, Expenses and Changes in Net Position* reflects all of the current fiscal year's revenues and expenses. All of the current year's revenues and expenses are recorded using the accrual basis of accounting by recognizing revenues in the period they are earned and expenses in the period they are incurred without regard to the timing of the related cash flows. This statement measures the success of the District's operations over the past year and determines whether the District has recovered its costs through its rates, fees and other charges. The District's profitability and creditworthiness can also be determined from this statement.

The *Statement of Cash Flows* provides information about the District's cash receipts and cash payments during the reporting period as well as net changes in cash resulting from operations, non-capital financing, capital and related financing activities, and investing. The statement explains where cash came from and where cash was used and the change in the cash balance during the reporting period.

Overview of the Basic Financial Statements (Continued)

The District's basic financial statements are organized by fund. **Fund Financial Statements** report on groupings of related funds that are used to maintain control over resources that have been segregated for specific activities or objectives. The accounts of the District are organized on the basis of funds, each of which is considered a separate entity. The operations of each fund are accounted for with a separate set of accounts that comprise its assets, liabilities, fund equity, revenues, and expenses. Government resources are allocated to, and accounted for, in individual funds based upon the purposes for which they are to be spent and the means by which spending activities are controlled. The various funds are grouped in these basic financial statements into two broad categories which, in aggregate, include two fund types as follows:

1. PROPRIETARY FUND TYPE

   Enterprise Funds
   Enterprise Funds are used to account for operations (a) that are financed and operated in a manner similar to private business enterprises where the intent of the governing body is that the costs (expenses, including depreciation) of providing goods or services to the general public on a continuing basis be financed or recovered primarily through user charges and special taxes; and (b) where the governing body has decided that periodic determination of revenues earned, expenses incurred, and/or net income is appropriate for capital maintenance, public policy, management control, accountability, or other purposes. Revenues are fully accrued to include unbilled services at fiscal year-end. The District uses enterprise funds to account for the Water, Sewer, Drainage, Solid Waste and Security activities of the District.

2. FIDUCIARY FUND TYPE

   Agency Funds
   Agency Funds are used to account for assets held by the District in a trustee capacity or as an agent for individuals, private organizations, other governmental entities and/or other funds. Since the resources of these funds are not available to support the District's own activities, they are not reflected in the government-wide financial statements.

The basic financial statements can be found on pages 10-18 of this report.

Notes to the financial statements provide additional information that is essential to a full understanding of the data provided in the government-wide and fund financial statements. The notes to the financial statements can be found on pages 19-33 of this report.

Government-Wide Financial Analysis

As noted earlier, net position may serve over time as a useful indicator of a government's financial position. In the case of the District, assets exceeded liabilities by $34,213,436 (net position) at the close of the most recent fiscal year.

Condensed Financial Information
Rancho Murieta Community Services District Net Position

	June 30, 2015	June 30, 2014
Assets		
Current and other assets	$ 10,493,353	$ 11,102,005
Capital Assets - net of accumulated depreciation	29,562,287	19,926,458
Total Assets	40,055,640	31,028,463
Deferred Outflow of Resources	205,863	-
Liabilities		
Other liabilities	3,200,365	1,033,661
Longterm liabilities	2,197,387	104,196
Total Liabilities	5,397,752	1,137,857
Deferred Inflow of Resources	650,315	-
Net Position		
Net investment in capital assets	29,562,287	19,926,458
Unrestricted Net Position	4,651,149	9,964,148
Total Net Position	$ 34,213,436	$ 29,890,606

- The District's total net position increased by $4,322,830. Unrestricted net position decreased $5,312,999 while capital assets, net of accumulated depreciation increased $9,635,829. The large increase in capital assets is primarily due to the Water Treatment Plant #1 (WTP#1) Expansion and Upgrade project, which as of June 30, 2015 had a work-in-process balance of $10,819,268. The CSD also completed its North Security Gate project in fiscal year 2014/2015, which added an additional $239,484 in capital assets. Capital asset depreciation expense during the year was $1,122,339.
- Designated cash and investments, which are designated for capital improvements and replacements, decreased $4,333,690 due to the investment in capital projects.
- Other liabilities increased due to the inter-fund borrowings related to the WTP#1 Expansion and Upgrade and North Security Gate projects, which were $1,418,143 and $108,875, respectively, as of June 30, 2015.
- Long-term liabilities increased by $2.1 million due to changes in pension accounting methods required by Governmental Accounting Standards Board (GASB) Statement #68. These changes are discussed further in the Notes to Basic Financial Statements section of this audit report.

By far the largest portion of the District's net position (86.4%) reflects its investment in capital assets (e.g., land, buildings, machinery, and equipment) (Net Capital Assets $29,562,287 / Total Net Position $34,213,436 = 86.4%). Some of those assets are from contributed capital. The District uses these capital assets to provide services to customers; consequently, these assets are not available for future spending.

Enterprise-type activities – Water, Sewer, Drainage, Solid Waste and Security
Rancho Murieta Community Services District's Changes in Net Position

	June 30, 2015	June 30, 2014
Revenues		
Operating revenues	$ 5,170,340	$ 5,112,857
Nonoperating revenues	1,179,303	1,325,517
CFD #1 Reimbursements	6,765,103	279,978
Total Revenues	13,114,746	6,718,352
Operating Expenses		
Water	1,199,502	1,250,290
Sewer	610,134	704,670
Drainage	136,634	124,830
Security	941,573	928,016
Solid waste	587,796	580,068
Other	1,699,285	2,023,030
Depreciation	1,122,339	1,102,446
Total Operating Expenses	6,297,263	6,713,350
Change in Net Position	6,817,483	5,002
Net Position (restated), Beginning of Fiscal Year	27,422,921	29,885,604
Prior Period Adjustment	(26,968)	
Net Position, End of Fiscal Year	$ 34,213,436	$ 29,890,606

Key elements of the enterprise activities are as follows:

- Operating revenues increased slightly, 1.12%. Water operating revenues increased by $2,967 or 0.16% due to increased project charges. Sewer operating revenues increased by $43,879 or 3.5% due to the 3.79% rate increase adopted for fiscal year 2014/2015. Unadjusted security operating revenues decreased $4,739 or (0.38%) due to a change in the accounting method for the reserve revenues and fewer late charges than in 2013/2014. Drainage operating revenues increased $3,344 or 1.9% and Solid Waste operating revenues increased $12,033 or 1.9%, both due to approved rate increases.
- Non-operating revenues had a net increase of $6,338,991 or 394.8% due to the project reimbursement revenue related to the WTP#1 Expansion and Upgrade project.
- The Water Department collects, treats, and distributes potable drinking water to the Rancho Murieta community. Total Water operating expenses decreased $182,564 or (7.0%). During the current fiscal year, $70,661 of wages and employer burden were allocated to the WTP#1 Expansion and Upgrade project, thereby reducing the Water Department's personnel costs. While expenses associated with Source of Supply were higher than last year, savings were seen in Water Treatment, Transmission & Distribution, and General & Administrative expense categories. Department wide, large savings were seen in repairs & maintenance and conservation-related expenses.
- The Sewer Department collects, treats, and disposes of the Rancho Murieta community waste water. Sewer operating expenses decreased $142,562 or (7.5%). This decrease is primarily due to the re-allocation of resources to the Water Department during the WTP#1 Expansion and Upgrade project. Wages and employer costs were down $175,344 and repairs & maintenance costs were down $21,485 versus the prior year's numbers.

- The Drainage Department provides and maintains the drainage system for Rancho Murieta. Drainage operating expenses decreased $5,661 or (2.7%). This decrease is due to the decrease in allocated Administration expenses this year, versus the prior year.
- Solid Waste services are provided by contract with California Waste Recovery Services (CWRS). CWRS contract charges for the year increased 1.4% (compared with an increase in service revenues of 1.9%). Overall operating expenses for Solid Waste decreased $3,614 or (0.6%). As with the Drainage Department, this decrease is attributable to the decrease in allocated Administrative expenses.
- The Security Department provides Gate and Patrol services. Operating expenses for Gate services decreased $21,636 or (4.2%). This decrease was related to lower employer costs and equipment repairs. Operating expenses for Patrol services increased $35,193 or 8.5%, which was due to increased wages and contract employee costs. General Security operating expenses decreased $92,073 or (23.0%), which was attributable to lower employee costs in both the Security and Administration Departments, as described below.
- The Administration Department covers the remaining staff located in the District's administration building excluding the Director of Field Operations and the Security Chief. However, all general administration costs relating to the Water, Sewer, Drainage, Solid Waste and Security departments are combined with the Administration Department on the Statement of Revenues, Expenses, and Changes in Net Position and are shown as General and Administrative costs. General and Administrative costs decreased $189,942 or (14.9%). This decrease is predominately due to the vacancy in the Controller position for eight months of the year. Legal expenses were $44,953 higher than in 2013/2014, but were offset by savings in consulting expenses of ($40,426).

Capital Assets

	July 1, 2014	Additions	Adjustments /Deletions	June 30, 2015
Depreciable Capital Assets				
Water Transmission	$ 7,326,097	$ 13,256	$ (6,346)	$ 7,333,007
Water Treatment	9,601,754	-	(515,722)	9,086,032
Studies	695,885	-	-	695,885
Collection Facilities	4,236,287	726,335	-	4,962,622
Sewer treatment and disposal	16,040,329	7,782	-	16,048,111
Lake Chesbro Protection	270,020	-	-	270,020
Waste Discharge	549,152	-	-	549,152
Buildings and improvements	817,907	12,349	(10,328)	819,928
Vehicles & Equipment	1,726,662	237,130	(139,444)	1,824,348
Total Depreciable Capital Assets	41,264,093	996,852	(671,840)	41,589,105
Less - Accumulated Depreciation	(23,424,470)	(1,122,338)	156,118	(24,390,690)
Net Depreciable Capital Assets	17,839,623	(125,486)	(515,722)	17,198,415
Non-Depreciable Capital Assets				
Construction in Progress	1,495,145	10,483,171	(206,134)	11,772,182
Land	591,690	-	-	591,690
Total Non-Depreciable Capital Assets	2,086,835	10,483,171	(206,134)	12,363,872
Net Capital Assets	$ 19,926,458	$ 10,357,685	$ (721,856)	$ 29,562,287

Capital Assets (Continued)

The District's investment in capital assets as of June 30, 2015, amounted to $29,562,287 (net of accumulated depreciation). This investment in capital assets included land, buildings, improvements, vehicles, and equipment. The total increase in the District's investment in capital assets for the current fiscal year was $9,635,829 or 48.4%.

Major capital asset events during the current fiscal year included the following:

- Sewer Main Lift Station North Wet Well Rehabilitation (completed)
- North Security Gate Project (completed)
- Water Treatment Plant #1 Expansion and Upgrade Project (Construction in Progress)

Economic Factors and Next Year's Budget and Rates

The Board of Directors adopted the District's 2015/2016 annual budget on June 17, 2015 which provides for the District's operating and capital costs for the 2015/2016 fiscal year. Rancho Murieta, along with the rest of the State of California continues to be under a drought state of emergency, as declared by Governor Jerry Brown on January 1, 2014. While the Rancho Murieta CSD does not fall under the restrictions for an Urban Water District, our community is doing its part to conserve. Residential water conservation was at 20.2% (versus budget) for the fiscal year ended June 30, 2015 and landscape watering continued to be restricted to two days per week as of the start of the new fiscal year. Conservation incentives continue to be offered by the State and local agencies (including Rancho Murieta CSD) so continued conservation is expected to be seen throughout the 2015/2016 fiscal year.

Development will be a focal point for the District in the coming year(s). Rancho Murieta Properties, LLC has submitted development plans to Sacramento County that include the proposed addition of eight residential villages and one commercial site. Within the eight residential villages 827 single-family detached lots are being planned for on roughly 350 net developable acres. Construction on the Retreats West subdivision and on the Murieta Inn began in the 2015/2016 fiscal year. In preparation for the current and future development, the WTP#1 Expansion and Upgrade project is expected to be completed and producing effluent in November 2015. This project increases the plant's potable water production from 1.5 million gallons per day (mgd) to a future capability of 6.0 mgd and upgrades the treatment process to submerged membrane technology. The cost of the WTP#1 Expansion and Upgrade project is projected at $12.8 million and as of June 30, 2015 a total of $10,819,268 in expenditures had been recorded.. Funding for the project is split between the District, previous developers of Murieta South, and the developers of the Murieta Inn and Rancho Murieta North Properties (CRL/RMP). At the request of CRL/RMP, the District formed a Community Facilities District (CFD 2014-1) to finance the CRL/RMP share of the construction. Under CFD 2014-1 tax exempt bonds were sold on January 29, 2015 and provided $4,358,245 of bond revenue for the WTP#1 Expansion and Upgrade project construction. The CFD 2014-1 will assess Mello-Roos taxes on the subject properties beginning in 2017 for repayment to the bond investors. The District is financing its $4.35 million share of the project through inter-fund borrowings of $1.5 million and $500,000 in borrowings from Water Supply Augmentation, with the remainder coming from Water Capital Replacement Reserves. The inter-fund borrowing carries a variable interest rate tied to the California State Treasurer's Local Agency Investment Fund (LAIF), which is reported monthly. The principal balances of the internal borrowings are being repaid through a monthly debt service charge of $6.00 per account/water connection and will be repaid in less than eleven years.

Economic Factors and Next Year's Budget and Rates (Continued)

No new capital projects were added to this year's budget. Projects carried forward from prior years include:

1) Completion of the Water Treatment Plant #1 Expansion and Upgrade
2) Augmentation Well Development
3) Acquisition of a Dump Truck for the Water and Sewer Departments
4) Wastewater Recovery Plant Filter PLC Replacement
5) Main Lift North Generator Replacement; and
6) Granlees Forebay Repairs

The District's rates for water, sewer, drainage, security and solid waste services are reviewed annually by staff and the Board of Directors. For fiscal year 2015/2016, the District increased rates by approximately 5.45% for Water services; 2.67% for Sewer services; 2.0% for both Drainage and Security services; and 0.7% for Solid Waste.

Requests for Information

This financial report is designed to provide a general overview of the Rancho Murieta Community Services District's finances for all those with an interest in the government's finances. Questions concerning any of the information provided in this report or requests for additional financial information should be addressed to the Rancho Murieta Community Services District, General Manager, P.O. Box 1050, Rancho Murieta, CA, 95683.

RANCHO MURIETA COMMUNITY SERVICES DISTRICT

Statement of Net Position - Proprietary Funds
June 30, 2015
(With Comparative Totals for June 30, 2014)

	Major Enterprise Funds		
	Water Fund	Sewer Fund	Drainage Fund
Assets			
Current Assets:			
Cash and investments	$ 1,467,826	$ 649,809	$ 83,087
Accounts receivable	1,422,568	195,539	25,477
Grants receivable	-		
Interest receivable	806	34	6
Prepaid Expenses	40,785	9,462	561
Deposits	20,617	15,741	3,233
Due from other funds		1,418,143	108,875
Due from developers	22,416	7,393	
Total Current Assets	2,975,018	2,296,121	221,239
Capital Assets - net of accumulated depreciation	18,331,882	10,766,626	
Other Assets:			
Cash and investments -designated	2,285,245	1,521,297	270,254
Interest receivable - designated	1,859	790	256
Total Other Assets	2,287,104	1,522,087	270,510
Total Assets	23,594,004	14,584,834	491,749
Deferred Outflows of Resources			
Deferred outflows-pensions	67,317	49,613	9,264
Total Deferred Outflows of Resources	67,317	49,613	9,264
Total Assets and Deferred Outflows of Resources	$ 23,661,321	$ 14,634,447	$ 501,013
Liabilities			
Current Liabilities:			
Accounts payable	$ 1,095,070	$ 53,855	$ 4,578
Accrued payroll	38,510	23,267	5,071
Post retirement medical liability	26,246	18,332	3,404
Deposits	209,346	45	9
Due to others	1,418,143		
Capital lease			
Total Current Liabilities	2,787,315	95,500	13,062
Noncurrent Liabilities:			
Capital lease			
Net pension liability	691,312	509,499	95,135
Compensated absences	27,552	20,218	3,782
Total Noncurrent Liabilities	718,864	529,717	98,917
Total Liabilities	3,506,178	625,216	111,979
Deferred Inflows of Resources			
Deferred inflows-advances	218,150	6,810	1,399
Deferred inflows-pensions	136,737	100,775	18,817
Total Deferred Inflows of Resources	354,887	107,585	20,216
Net Position			
Net investment in capital assets	18,331,882	10,766,626	
Net Position:			
Unrestricted	1,468,373	3,135,019	368,818
Total Net Position	19,800,255	13,901,645	368,818
Total Liabilities, Deferred Inflows of Resources and Net Position	$ 23,661,321	$ 14,634,447	$ 501,013

The accompanying notes are an integral part of these basic financial statements.

		Totals	
Solid Waste Fund	Security Fund	2015	2014
$ 239,383	$ 409,803	$ 2,849,908	$ 1,748,840
58,307	158,596	1,860,487	722,576
		-	52,085
111	256	1,213	712
422	12,745	63,975	81,715
2,650	10,759	53,000	
		1,527,018	
		29,809	54,912
300,873	592,159	6,385,410	2,660,840
	463,779	29,562,287	19,926,458
1,924	26,330	4,105,050	8,438,740
	(12)	2,893	2,425
1,924	26,318	4,107,943	8,441,165
302,797	1,082,256	40,055,640	31,028,463
2,470	77,199	205,863	-
2,470	77,199	205,863	-
$ 305,267	$ 1,159,455	$ 40,261,503	$ 31,028,463
$ 101,651	$ 25,405	$ 1,280,558	$ 263,757
1,272	38,481	106,602	122,330
376	26,332	74,690	85,272
8	30	209,438	541,092
	108,875	1,527,018	
	2,059	2,059	2,233
103,307	201,182	3,200,365	1,014,684
	-	-	2,635
25,369	792,789	2,114,104	-
996	30,735	83,283	101,561
26,365	823,524	2,197,387	104,196
129,672	1,024,706	5,397,752	1,118,880
1,146	4,655	232,160	18,977
5,018	156,808	418,155	-
6,164	161,463	650,315	18,977
	463,779	29,562,287	19,926,458
169,431	(490,493)	4,651,149	9,964,148
169,431	(26,714)	34,213,436	29,890,606
$ 305,267	$ 1,159,455	$ 40,261,503	$ 31,028,463

RANCHO MURIETA COMMUNITY SERVICES DISTRICT

Statement of Revenues, Expenses, and Changes in Net Position
Proprietary Funds
For the Fiscal Year Ended June 30, 2015
(With Comparative Totals for the Fiscal Year Ended June 30, 2014)

	Major Enterprise Funds		
	Water Fund	Sewer Fund	Drainage Fund
Operating Revenues:			
Service charges	$ 1,768,841	$ 1,286,477	$ -
Special taxes			183,566
Other charges	41,300	18,367	573
Total Operating Revenues	1,810,141	1,304,844	184,139
Operating Expenses:			
Source of supply	205,776		
Treatment	468,027		
Transmission and distribution	525,699		
Sewer collection		177,915	
Sewer treatment and disposal		432,219	
Drainage			136,634
Gate services			
Patrol services			
Solid waste			
General and administrative	745,769	527,965	65,221
Depreciation	483,941	608,191	
Total Operating Expenses	2,429,212	1,746,290	201,854
Operating Income (Loss)	(619,071)	(441,446)	(17,716)
Non-operating Revenues (Expenses):			
Taxes	220,291	168,192	34,544
Capital reserve fees	211,306	208,106	
Debt reserve fee	109,143		
Interest revenue	9,736	6,945	986
Rent			
Water augmentation	21,500		
Gain (Loss) on disposal of capital assets			
Refunds and reimbursements			
Interest expense	(3,944)		
Grant revenue			
Miscellaneous	16,341	5,706	974
Total Non-operating Revenues (Expenses)	584,373	388,949	36,504
Special Item			
CFD #1 Project Reimbursement	6,765,103		
Change in Net Position	6,730,405	(52,498)	18,788
Net Position Restated, Beginning of Fiscal Year	13,073,352	13,959,095	350,793
Prior Period Adjustments	(3,502)	(4,952)	(763)
Net Position, End of Fiscal Year	$ 19,800,255	$ 13,901,645	$ 368,818

The accompanying notes are an integral part of these basic financial statements.

		Totals	
Solid Waste Fund	Security Fund	2015	2014
$ 634,554	$ -	$ 3,689,872	$ 3,640,855
	1,183,942	1,367,508	1,366,209
	52,720	112,960	105,792
634,554	1,236,662	5,170,340	5,112,857
		205,776	181,790
		468,027	516,405
		525,699	552,095
		177,915	219,090
		432,219	485,580
		136,634	124,830
	492,015	492,015	513,651
	449,558	449,558	414,365
587,796		587,796	580,068
52,370	307,960	1,699,284	2,023,030
	30,207	1,122,339	1,102,446
640,166	1,279,740	6,297,262	6,713,350
(5,612)	(43,077)	(1,126,922)	(1,600,493)
28,315	114,959	566,301	520,829
	47,820	467,232	454,340
		109,143	298,013
400	813	18,880	16,304
		21,500	
	(24,576)	(24,576)	
	(243)	(4,187)	(387)
	1,988	25,010	36,418
28,715	140,761	1,179,303	1,325,517
		6,765,103	279,978
23,103	97,684	6,817,483	5,002
147,039	(107,358)	27,422,921	29,885,604
(711)	(17,040)	(26,968)	-
$ 169,431	$ (26,714)	$ 34,213,436	$ 29,890,606

RANCHO MURIETA COMMUNITY SERVICES DISTRICT

Statement of Cash Flows
Proprietary Funds
For the Fiscal Year Ended June 30, 2015
(With Comparative Totals for the Fiscal Year Ended June 30, 2014)

	Major Enterprise Funds		
	Water Fund	Sewer Fund	Drainage Fund
Cash Flows from Operating Activities:			
Receipts from customers	$ 556,439	$ 1,315,229	$ 185,614
Payments to employees	(949,411)	(549,900)	(143,364)
Payments to suppliers	(35,321)	(672,631)	(71,959)
Net Cash Provided By (Used In) Operating Activities	(428,293)	92,698	(29,709)
Cash Flows from Non-capital Financing Activities:			
Taxes received	220,291	168,192	34,544
Grants	52,085		
Debt reserve fee	109,143	-	
Miscellaneous	34,339	754	211
Net Cash Provided By (Used In) Non-capital Financing Activities	415,858	168,946	34,755
Cash Flows from Capital and Related Financing Activities:			
Purchase of capital assets	(10,500,315)	(40,437)	
Interfund lending	1,418,143	(1,418,143)	(108,875)
Cash received from sale of assets	-	-	
CFD #1 project reimbursement	6,765,103		
Reduction of debt	(3,944)		
Capital reserve fees	211,306	208,106	
Net Cash Provided By (Used In) Capital and Related Financing Activities	(2,109,707)	(1,250,474)	(108,875)
Cash Flows from Investing Activities:			
Interest received	9,078	6,790	940
Net Cash Provided by Investing Activities	9,078	6,790	940
Net Increase (Decrease) in Cash and Cash Equivalents	(2,113,064)	(982,040)	(102,889)
Cash and Cash Equivalents, July 1	5,866,135	3,153,146	456,230
Cash and Cash Equivalents, June 30	$ 3,753,071	$ 2,171,106	$ 353,341
Reconciliation of Cash and Cash Equivalents to the Statement of Net Position:			
Cash and investments	$ 1,467,826	$ 649,809	$ 83,087
Restricted cash and investments	2,285,245	1,521,297	270,254
Total Cash and Cash Equivalents	$ 3,753,071	$ 2,171,106	$ 353,341

The accompanying notes are an integral part of these basic financial statements.

Solid Waste Fund	Security Fund	Totals 2015	Totals 2014
$ 639,486	$ 1,351,168	$ 4,047,936	$ 5,800,649
(33,352)	(1,081,772)	(2,757,800)	(2,880,498)
(613,049)	(228,501)	(1,621,461)	(2,774,595)
(6,916)	40,895	(331,325)	145,556
28,315	114,959	566,301	520,829
		52,085	-
		109,143	298,013
(711)	(15,052)	19,542	36,418
27,604	99,907	747,071	855,260
	(241,993)	(10,782,745)	(1,271,105)
		(108,875)	-
		-	-
		6,765,103	279,978
	(3,052)	(6,996)	(2,817)
	47820	467,232	454,340
	(197,225)	(3,666,281)	(539,604)
372	734	17,914	16,503
372	734	17,914	16,503
21,060	(55,689)	(3,232,622)	477,715
220,247	491,822	10,187,580	9,709,865
$ 241,307	$ 436,133	$ 6,954,958	$ 10,187,580
$ 239,383	$ 409,803	$ 2,849,908	$ 1,748,840
1,924	26,330	4,105,050	8,438,740
$ 241,307	$ 436,133	$ 6,954,958	$ 10,187,580

RANCHO MURIETA COMMUNITY SERVICES DISTRICT

Statement of Cash Flows
Proprietary Funds
For the Fiscal Year Ended June 30, 2015
(With Comparative Totals for the Fiscal Year Ended June 30, 2014)

	Major Enterprise Funds		
	Water Fund	Sewer Fund	Drainage Fund
Reconciliation of Operating Loss to Net Cash Provided (Used) by Operating Activities			
Operating loss	$ (619,071)	$ (441,446)	$ (17,716)
Noncash items included in operating loss			
Depreciation	483,941	608,191	
Changes in assets and liabilities			
Decrease (increase) in operating assets			
Accounts receivable	(1,158,007)	9,254	1,243
Prepaid expenses	10,923	3,249	1,667
Deposits	(20,617)	(15,741)	(3,233)
Due from others	25,103		
GASB 68 adjustments	(46,202)	(34,051)	(6,358)
Increase (decrease) in operating liabilities			
Accounts payable	1,015,680	(12,789)	(227)
Accrued payroll	7,948	(19,597)	(4,194)
Post retirement medical liability	(3,583)	(2,610)	(466)
Deposit liability	(331,566)	(43)	(9)
Due to others			
Compensated absences	(3,609)	(2,893)	(657)
Deferred revenue	210,768	1,174	241
Net Cash Provided By (Used In) Operating Activities	$ (428,293)	$ 92,698	$ (29,709)

The accompanying notes are an integral part of these basic financial statements.

Solid Waste Fund	Security Fund	Totals 2015	2014
$ (5,612)	$ (43,077)	$ (1,126,922)	$ (1,600,493)
	30,207	1,122,339	1,102,446
4,742	4,857	(1,137,911)	91,320
923	978	17,739	(12,454)
(2,650)	(10,759)	(53,000)	-
		25,103	89,435
(1,695)	(52,984)	(141,290)	-
455	13,683	1,016,801	(125,657)
(1,729)	1,843	(15,728)	50,658
(647)	(3,276)	(10,582)	42,959
(7)	(29)	(331,654)	506,558
	108,875	108,875	-
(893)	(10,226)	(18,278)	305
197	803	213,183	479
$ (6,916)	$ 40,895	$ (331,325)	$ 145,556

Statement of Fiduciary Net Position
June 30, 2015

	PARS Trust Fund	Agency Funds
Assets		
Cash and investments	$ 917,550	$ 932,736
Due from others		1,194,767
Total Assets	$ 917,550	$ 2,127,503
Liabilities		
Due to others	$ -	$ 2,127,503
Total Liabilities		2,127,503
Net Position		
Held in trust for OPEB benefits	917,550	
Total Liabilities and Net Position	$ 917,550	$ 2,127,503

Changes in Fiduciary Net Position-PARS Retirement Fund

Additions:	
Employer contributions	$ 189,012
Total contributions	189,012
Investment income (loss):	
Net adjustment to fair value of investments	15,740
Total Additions (Deductions)	15,740
Change in plan net position	204,752
Net Position:	
Held in trust for OPEB benefits:	
Beginning of year	712,798
End of year	$ 917,550

The accompanying notes are an integral part of these basic financial statements.

Note 1: Significant Accounting Policies

The Rancho Murieta Community Services District (District) was formed in 1982, under California State Government Code 61600 and currently provides water, sewer, drainage, solid waste and security service throughout the Rancho Murieta Community. The District's financial and administrative functions are governed by a five member Board of Directors elected by the voting population within the District.

The accounting policies of the Rancho Murieta Community Services District conform to accounting principles generally accepted in the United States of America as prescribed by the Governmental Accounting Standards Board (GASB) and the American Institute of Certified Public Accountants (AICPA).

A. Reporting Entity

The District's basic financial statements include the operations of all organizations for which the District's Board of Directors exercises oversight responsibility. Oversight responsibility is demonstrated by financial interdependency, selection of governing authority, designation of management, ability to significantly influence operations, and accountability for fiscal matters.

Based upon the aforementioned oversight criteria, the following entities have been included within the reporting entity as blended component units:

Special Assessment Districts **–** The special assessment districts are the Community Facilities District No. 1. and the Community Facilities District No. 2014-1 These Special Assessment Districts were created for the purpose of acquiring, constructing and maintaining water and sewer facilities within the Rancho Murieta boundaries. The District is not obligated to repay debt of the Special Assessment Districts but functions as an agent for the property owners by collecting assessments, forwarding collections to special assessment debt holders, and, if appropriate, begin foreclosures on delinquent property owners. Because of the special financing relationships, the Community Facilities District No. 1 and 2014-1 have been included in the financial statements as fiduciary fund types.

B. Basis of Presentation

The District's basic financial statements are prepared in conformity with accounting principles generally accepted in the United States of America. The Governmental Accounting Standards Board is the acknowledged standard setting body for establishing accounting and financial reporting standards followed by governmental entities in the United States of America.

Fund Financial Statements

The proprietary fund financial statements provide information about the District's funds. Separate statements for each fund category - *proprietary and fiduciary* - are presented. The emphasis of fund financial statements is on major individual funds, each of which is displayed in a separate column. All remaining funds are aggregated and reported as non-major funds.

Proprietary fund financial statements include a Statement of Net Position, a Statement of Revenues, Expenses, and Changes in Net Position, and a Statement of Cash Flows.

Proprietary funds are accounted for using the "*economic resources*" measurement focus and the accrual basis of accounting. Accordingly, all assets and liabilities (whether current or noncurrent) are included on the Statement of Net Position. The Statement of Revenues, Expenses, and Changes in Net Position presents increases (revenues) and decreases (expenses) in total Net Position. Under the accrual basis of accounting, revenues are recognized in the period in which they are earned while expenses are recognized in the period in which the liability is incurred.

Note 1: <u>Significant Accounting Policies (Continued)</u>

B. Basis of Presentation (Continued)

Operating revenues in the proprietary funds are those revenues that are generated from the primary operation of the fund. All other revenues are reported as non-operating revenues. Operating expenses are those expenses that are essential to the primary operations of the fund. All other expenses are reported as non-operating expenses.

Fiduciary funds are used to account for assets held by the District in a trustee capacity or as an agent for individuals, private organizations, other governmental units, and/or other funds. Fiduciary funds use the "economic resources" measurement focus and the accrual basis of accounting.

C. Major Funds

GASB Statement No. 34 defines major funds and requires that the District's major proprietary funds are identified and presented separately in the fund financial statements. All other funds, called non-major funds, are combined and reported in a single column, regardless of their fund-type.

Major funds are defined as funds that have assets, liabilities, revenues, or expenditures/expenses equal to or greater than ten percent of their fund-type total or five percent of all fund-type totals. The District may also select other funds it believes should be presented as major funds. The District reports all of its proprietary funds as major funds.

The District reported the following major proprietary funds:

<u>Water</u>
This fund accounts for the activities of providing water to the residents of the District.

<u>Sewer</u>
This fund accounts for the activities of collecting and treating wastewater of the residents in the District.

<u>Drainage</u>
This fund accounts for the activities of providing drainage to the residents of the District.

<u>Solid Waste</u>
This fund accounts for the activities of collecting solid waste of the residents of the District.

<u>Security</u>
This fund accounts for the activities of providing security to the residents of the District.

The District reports the following additional fund types:

<u>PARS *Trust Fund*</u>
Accounts for activities associated with the District's other post-employment benefits (OPEB) trust fund used for administration of health insurance for retirees.

<u>Agency Fund</u>
The Agency fund accounts for assets held by the District as an agent for other entities.

Note 1: Significant Accounting Policies (Continued)

D. Basis of Accounting

Private-sector standards of accounting and financial reporting issued prior to December 1, 1989, generally are followed in both government-wide financial statements and proprietary funds financial statements to the extent that those standards do not conflict with or contradict guidance of the Governmental Accounting Standards Board. Governments also have the *option* of following subsequent private-sector guidance for their business-type activities and proprietary funds, subject to this same limitation. The government has elected not to follow subsequent private-sector guidance.

E. Budget and Budgeting

Budget integration is employed as a management control device. Budgets are formally adopted by the Board of Directors and take effect the following July 1. The budgets are a management tool and not a legal requirement.

F. Restricted Assets

Restricted assets are financial resources generated for a specific purpose such as construction of improvements and financing of debt obligations. These assets are for the benefit of a distinct group and as such are legally or contractually restricted from an external source.

G. Comparative Data

Comparative total data for the prior fiscal year has been presented in the accompanying basic financial statements in order to provide an understanding of changes in the District's financial position, operations, and cash flows. Certain amounts presented in the prior fiscal year data may have been reclassified in order to be consistent with the current fiscal year.

H. Cash and Cash Equivalents

For purposes of the statement of cash flows, the District considers all highly liquid investments (including restricted assets) with a maturity of three months or less when purchased to be cash equivalents. Amounts held in the State of California Local Agency Investment Fund (LAIF) are considered to be cash and cash equivalents due to their highly liquid nature.

I. Property Taxes

Secured property taxes are levied on January 1 and are payable in two installments on November 1 and February 1, which become delinquent after December 10 and April 10, respectively. Unsecured property taxes are payable in one installment on or before August 31. Sacramento County (County) bills and collects the property taxes and allocates a portion to the District. Property tax revenues are recognized in the fiscal year for which they become available. Available means when due, or past due and receivable within the current period and collected within the current period or expected to be collected soon enough thereafter to be used to pay liabilities of the current period.

The District is under the Teeter Plan and thus can receive 100% of the property tax apportionment each fiscal year, eliminating the need for an allowance for uncollectible tax. The County, in return, receives all penalties and interest. Under the Teeter Plan, the County remits property taxes to the District based on assessments, not on collections, according to the following schedule: 55 percent in December, 40 percent in April, and 5 percent at the end of the fiscal year.

Note 1: Significant Accounting Policies (Continued)

J. Capital Assets

All capital assets are valued at historical cost or estimated historical cost if actual historical cost is not available. Contributed capital assets are recorded at fair value at the date of donation. The District's policy is to capitalize all capital assets with costs exceeding $5,000.

The purpose of depreciation is to spread the cost of capital assets equitably among all users over the life of these assets. The amount charged to depreciation expense each fiscal year represents that year's pro rata share of the cost of capital assets. GASB Statement No. 34 requires that all capital assets with limited useful lives be depreciated over their estimated useful lives. Depreciation is provided using the straight line method which means the costs of the capital asset is divided by its expected useful life in years and the result is charged to expense each year until the capital asset is fully depreciated. The District has assigned the useful lives listed below to capital assets:

Buildings	40 years
Improvements	20-50 years
Equipment	5-15 years

K. Compensated Absences

All earned vacation, which is payable upon termination or retirement, is accrued as compensated absences, in accordance with GASB Statement No. 16. Sick leave benefits are not vested to the employee.

L. Net Position

GASB Statement No. 34 requires that the difference between assets and liabilities be reported as net position. Net position are classified as either invested in capital assets, net of related debt, restricted, or unrestricted.

Net position that are invested in capital assets, net of related debt, consist of capital assets, net of accumulated depreciation, and reduced by the outstanding principal of related debt. Restricted net position is the net position that has external constraints placed on them by creditors, grantors, contributors, laws, or regulations of other governments, or through constitutional provisions or enabling legislation. Unrestricted net position consists of net position that does not meet the definition of invested in capital assets, net of related debt, or restricted net position.

M. Pensions

For purposes of measuring the net pension liability and deferred outflows/inflows of resources related to pensions, and pension expense, information about the fiduciary net position of the District's California Public Employees' Retirement System (CalPERS) plans (Plans) and additions to/deductions from the Plans' fiduciary net position have been determined on the same basis as they are reported by CalPERS. For this purpose, benefit payments (including refunds of employee contributions) are recognized when due and payable in accordance with the benefit terms. Investments are reported at fair value.

N. Deferred Compensation Plan

The District offers its employees a deferred compensation plan created in accordance with Internal Revenue Code Section 457. The plan, available to all employees, permits participants to defer a portion of their salary until future years. The deferred compensation is not available to participants until termination, retirement, death, or unforeseeable emergency. All amounts of compensation deferred under the plan, all property and rights purchased with those amounts, and all income attributed to those amounts, are maintained in a trust. Participants have sole rights under the plan in an amount equal to the fair value of the deferred account for each participant.

Note 1: Significant Accounting Policies (Continued)

O. Use of Estimates

The preparation of financial statements in conformity with accounting principles generally accepted in the United States of America as prescribed by the GASB and the American Institute of Certified Public Accountants (AICPA), requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities, disclosure of contingent assets and liabilities at the date of the financial statements, and the reported amounts of revenues and expenses during the reporting period. Actual results could differ from those estimates.

Note 2: Cash and Investments

Classification

The cash and investments are classified in the financial statements as shown below, based on whether or not their use is restricted under the terms of District debt instruments or District agreements:

Cash and investments	$ 2,849,908
Designated cash and investments	4,105,050
Cash and investments, Statement of Net Assets	6,954,958
Cash and investments, Statement of Fiduciary Net Assets	1,850,286
Total cash and investments	$ 8,805,244

Cash and investments as of June 30, 2015 consist of the following:

Cash on hand	$ 250
Deposits with financial institutions	724,244
Investments	8,080,750
Total cash and investments	$ 8,805,244

A. Investments Authorized by the California Government Code and the District's Investment Policy

The table below identifies the **investment types** that are authorized for the Rancho Murieta Community Services District (District) by the California Government Code (or the District's investment policy, where more restrictive). The table also identifies certain provisions of the California Government Code (or the District's investment policy, where more restrictive) that address **interest rate risk, credit risk,** and **concentration of credit risk**. This table does not address investments of debt proceeds held by bond trustee that are governed by the provisions of debt agreements of the District, rather than the general provisions of the California government Code or the District's investment policy:

Authorized Investment Type	Maximum Maturity	Percentage of Portfolio	Investment in One Issuer
Investment pools authorized under CA Statues governed by Government Code	N/A	None	$40 million
U.S. Treasury Obligations	5 years	None	None
Bank Savings Account	N/A	25%	None
Federal Agencies	5 years	75%	None
Commercial Paper	180 days	20%	None
Negotiable Certificates of Deposit	180 days	20%	None
Re-purchase Agreements	180 days	20%	None
Corporate Debt	5 years	25%	None

Note 2: Cash and Investments (Continued)

B. Investments Authorized by Debt Agreements (Continued)

Investments held by trustees are governed by provisions of the debt agreements, rather than the general provisions of the California Government Code or the District's investment policy. The table below identifies the **investment types** that are authorized for investments held by trustees. The table also identifies certain provisions of these debt agreements that address **interest rate risk, credit risk**, and **concentration of credit risk**.

Authorized Investment Type	Maximum Maturity	Maximum Percentage of Portfolio	Maximum Investment in One Issuer
Investment pools authorized under CA Statues governed by Government Code	N/A	None	$40 million
U.S. Treasury Obligations	5 years	None	None
Bank Savings Account	N/A	25%	None
Federal Agencies	5 years	75%	None
Commercial Paper	180 days	20%	None
Negotiable Certificates of Deposit	180 days	20%	None
Re-purchase Agreements	180 days	20%	None
Corporate Debt	5 years	25%	None
Money Market Accounts	N/A	None	None

C. Disclosures Relating to Interest Rate Risk

Interest rate risk is the risk that changes in market interest rates will adversely affect the fair value of an investment. Generally, the longer the maturity of an investment, the greater the sensitivity of its fair value to changes in market interest rates

Information about the sensitivity of the fair values of the District's investments to market interest rate fluctuations is provided by the following table that shows the distribution of the District's investments by maturity:

		Remaining Maturity (in Months)	
Investment Type	Totals	12 Months or Less	13-48 Months
CAMP*	$ 606,834	$ 606,834	$ -
State Investment Pool*	5,653,847	5,653,847	
PARS Trust*	917,550	917,550	
Money Market*	902,519	902,519	
Totals	$ 8,080,750	$ 8,080,750	$ -

*Not subject to categorization

Note 2: Cash and Investments (Continued)

D. Disclosures Relating to Credit Risk

Generally, credit risk is the risk that an issuer of an investment will not fulfil its obligation to the holder of the investment. This is measured by the assignment of a rating by a nationally recognized statistical rating organization. Presented below is the minimum rating required by (where applicable) the California Government Code, the District's investment policy, or debt agreements, and the actual rating as of fiscal year end for each investment type.

Investment Type	Amount	Minimum Legal Rating	Exempt From Disclosure	Rating as of Fiscal Year End Not Rated
CAMP Investment Pool	$ 606,834	N/A	$ -	$ 606,834
State Investment Pool	5,653,847	N/A	-	5,653,847
Pars Trust	917,550	N/A	-	917,550
Money Market	902,519	N/A	-	902,519
Total investments	$ 8,080,750		$ -	$ 8,080,750

E. Concentration of Credit Risk

The investment policy of the District contains limitations on the amount that can be invested in any one issuer. There are no investments in any one issuer that represent 5% or more of **total District investments.**

F. Custodial Credit Risk

Custodial credit risk for *deposits* is the risk that, in the event of the failure of a depository financial institution, a government will not be able to recover its deposits or will not be able to recover collateral securities that are in the possession of an outside party. The custodial credit risk for *investments* is the risk that, in the event of the failure of the counterparty (e.g. broker-dealer) to a transaction, a government will not be able to recover the value of its investment or collateral securities that are in the possession of another party. The California Government Code and the District's investment policy do not contain legal or policy requirements that would limit the exposure to custodial credit risk for deposits or investments, other than the following provision for deposits; The California Government Code requires that a financial institution secure deposits made by state or local governmental units by pledging securities in an undivided collateral pool held by a depository regulated under state law (unless so waived by the government unit). The fair value of the pledged securities in the collateral pool must equal at least 110% of the total amount deposited by the public agencies. California law also allows financial institutions to secure the District's deposits by pledging first trust deed mortgage notes having a value of 150% of the secured public deposits.

As of June 30, 2015, $347,091 of the District's deposits with financial institutions in excess of federal depository insurance limits was held in public funds collateralized accounts. As of June 30, 2015, the District did not hold investments in investments held by the same broker-dealer (counterparty) that was used by the District to buy the securities:

G. Investment in State Investment Pool

The District is a voluntary participant in the Local Agency Investment Fund (LAIF) that is regulated by the California Government Code under the oversight of the Treasurer of the State of California. The fair value of the District's investment in this pool is reported in the accompanying financial statements at amounts based upon the District's pro-rata share of the fair value provided by LAIF for the entire LAIF portfolio (in relation to the amortized cost of that portfolio). The balance available for withdrawal is based on the accounting records maintained by LAIF, which are recorded on an amortized cost basis.

RANCHO MURIETA COMMUNITY SERVICES DISTRICT
Notes to Basic Financial Statements
June 30, 2015

Note 3: Capital Assets

Capital Assets at June 30, 2015, consist of the following:

Water	Balance July 1, 2014	Additions	Adjustments/ Deletions	Balance June 30, 2015
Depreciable assets:				
Water Transmission	$ 7,326,097	$ 13,256	$ (6,346)	$ 7,333,007
Water Treatment	9,601,754		(515,722)	9,086,032
Studies	695,885		-	695,885
Vehicles and equipment	642,259	3,888	(37,464)	608,683
Subtotal	18,265,995	17,144	(559,532)	17,723,607
Less: Accumulated Depreciation	(10,528,796)	(483,941)	43,811	(10,968,926)
Net Capital Assets	7,737,199	(466,797)	(515,721)	6,754,681
Non-depreciable assets:				
Construction in progress	564,669	10,483,171	515,721	11,563,561
Land	13,640	-	-	13,640
Subtotal	578,309	10,483,171	515,721	11,577,201
Net Capital Assets	$ 8,315,508	$ 10,016,374	$ -	$ 18,331,882
Sewer				
Depreciable assets:				
Collection Facilties	$ 4,236,287	$ 726,335	$ -	$ 4,962,622
Pumping facility	42,763			42,763
Treatment Plant/Facilities	15,997,566	7,782		16,005,348
Vehicles and equipment	672,220	3,598	(25,550)	650,268
Lake Chesbro Protection	270,020			270,020
Waste Discharge	549,152			549,152
Telemetry Building	512,452			512,452
Subtotal	22,280,460	737,715	(25,550)	22,992,625
Less: Accumulated Depreciation	(12,430,030)	(608,190)	25,550	(13,012,670)
Net Capital Assets	9,850,430	129,525	-	9,979,955
Non-depreciable assets:				
Construction in progress	905,900		(697,279)	208,621
Land	578,050	-	-	578,050
Subtotal	1,483,950	-	(697,279)	786,671
Net Capital Assets	$11,334,380	$ 129,525	$ (697,279)	$ 10,766,626
Security				
Depreciable assets:				
Vehicle and equipment	$ 412,183	$ 229,644	$ (76,430)	$ 565,397
Buildings and improvements	305,455	12,349	(10,328)	307,476
Subtotal	717,638	241,993	(86,758)	872,873
Less: Accumulated Depreciation	(465,644)	(30,207)	86,757	(409,094)
Net Capital Assets	251,994	211,786	(1)	463,779
Non-depreciable assets:				
Construction in progress	24,576		(24,576)	-
Subtotal	24,576	-	(24,576)	-
Net Capital Assets	$ 276,570	$ 211,786	$ (24,577)	$ 463,779

Note 4: Long-Term Liabilities

Long-term liabilities activity for the fiscal year ended June 30, 2015, was as follows:

	Balance 7/1/2014	Additions	Retirements	Balance 6/30/2015
Compensated absences	$ 101,561	$ 91,990	$ 110,268	$ 83,283
Net pension liability (note 6)		2,114,104		2,114,104
Total	$ 101,561	$ 2,206,094	$ 110,268	$ 2,197,387

Note 5: Net Position

Net Position is the excess of all the District's assets over all its liabilities, regardless of fund. Net position is divided into three captions under GASB Statement No. 34. These captions apply only to net position, which is determined at the proprietary funds, and fiduciary funds and are described below.

Net Investment in Capital Assets

Net investment in capital assets describes the portion of net position which is represented by the current net book value of the District's capital assets, less the outstanding balance of any debt issued to finance these assets.

Restricted Net Position

Restricted net position consists of constraints placed on net position use through external creditors (such as through debt covenants), grants, contributors, or laws or regulations of other governments or constraints imposed by law through constitutional provisions or enabling legislation which the District cannot unilaterally alter. These principally include connection fees received for use on capital projects and debt service requirements.

Unrestricted Net Position

Unrestricted net position describes the portion of net position which is not restricted as to use.

Note 6: Defined Benefit Pension Cost-Sharing Employer Plan

A. General Information about the Pension Plans

Plan Descriptions – All qualified permanent and probationary employees are eligible to participate in the District's separate Safety (police and fire) and Miscellaneous (all other) Employee Pension Plans, cost-sharing multiple employer defined benefit pension plans administered by the California Public Employees' Retirement System (CalPERS). Benefit provisions under the Plans are established by State statute and District resolution. CalPERS issues publicly available reports that include a full description of the pension plans regarding benefit provisions, assumptions and membership information that can be found on the CalPERS website.

Benefits Provided – CalPERS provides service retirement and disability benefits, annual cost of living adjustments and death benefits to plan members, who must be public employees and beneficiaries. Benefits are based on years of credited service, equal to one year of full time employment. Members with five years of total service are eligible to retire at age 50 with statutorily reduced benefits. All members are eligible for non-duty disability benefits after 10 years of service. The death benefit is one of the following: the Basic Death Benefit, the 1957 Survivor Benefit, or the Optional Settlement 2W Death Benefit. The cost of living adjustments for each plan are applied as specified by the Public Employees' Retirement Law.

Note 6: Defined Benefit Pension Cost-Sharing Employer Plan

The Plans' provisions and benefits in effect at June 30, 2015, are summarized as follows:

Hire date		Prior to January 1, 2013		On or after January 1, 2013
Benefit formula		2% @ 55		2% @ 62
Benefit vesting s chedule		5 years service		5 years service
Benefit payments		monthly for life		monthly for life
Retirement age		50-55		52 - 67
Monthly benefits , as a % of eligible		1.5% to 2%		1.0% to 2%
Required employee contribution rates		8%		6.25%
Required employer contribution rates		13.322%		6.25%

Contributions – Section 20814(c) of the California Public Employees' Retirement Law requires that the employer contribution rates for all public employers be determined on an annual basis by the actuary and shall be effective on the July 1 following notice of a change in the rate. Funding contributions for the Plans are determined annually on an actuarial basis as of June 30 by CalPERS. The actuarially determined rate is the estimated amount necessary to finance the costs of benefits earned by employees during the year, with an additional amount to finance any unfunded accrued liability. The District is required to contribute the difference between the actuarially determined rate and the contribution rate of employees.

For the year ended June 30, 2015, the contributions recognized as part of pension expense for each Plan were as follows:

Contributions-employer	$	202,354
Contributions-employee (paid by employer)	$	27,623

B. Pension Liabilities, Pension Expenses and Deferred Outflows/Inflows of Resources Related to Pensions

As of June 30, 2015, the District reported net pension liabilities for its proportionate shares of the net pension liability of the Plan as follows:

	Proportionate share of Net pension liability	
Miscellanous Plan	$	2,114,104

The District's net pension liability for each Plan is measured as the proportionate share of the net pension liability. The net pension liability of each of the Plans is measured as of June 30, 2014, and the total pension liability for each Plan used to calculate the net pension liability was determined by an actuarial valuation as of June 30, 2013 rolled forward to June 30, 2014 using standard update procedures. The District's proportion of the net pension liability was based on a projection of the District's long-term share of contributions to the pension plans relative to the projected contributions of all participating employers, actuarially determined.

The District's proportionate share of the net pension liability as of June 30, 2013 and 2014 was as follows:

Proportion - June 30, 2013	0.08208%
Proportion - June 30, 2014	0.08554%
Change - Increase (Decrease)	0.00346%

Note 6: Defined Benefit Pension Cost-Sharing Employer Plan

For the year ended June 30, 2015, the District recognized pension expense of $88,688. At June 30, 2015, the District reported deferred outflows of resources and deferred inflows of resources related to pensions from the following sources:

	Deferred Outflows of Resources	Deferred Inflows of Resources
Differences between expected and actual experience	$ -	$ -
Changes of assumptions		
Net difference between projected and actual earnings on pension plan investments	-	(414,301)
Changes in proportion and differences between District contributions and proportionate share of contributions	3,510	(3,854)
District contributions subsequent to the measurement date	202,353	-
Total	$ 205,863	$ (418,155)

$202,353 reported as deferred outflows of resources related to contributions subsequent to the measurement date will be recognized as a reduction of the net pension liability in the year ended June 30, 2016.

Other amounts reported as deferred outflows of resources and deferred inflows of resources related to pensions will be recognized as pension expense as follows:

Measurement Period Ended June 30:	
2016	$ (138,987)
2017	(138,561)
2018	(137,098)
2019	-
2020	-
Thereafter	-

Actuarial Assumptions – The total pension liabilities in the June 30, 2013 actuarial valuations were determined using the following actuarial assumptions:

		Miscellaneous
Valuation Date		June 30, 2013
Measurement Date		June 30, 2014
Actuarial Cost Method		Entry-Age Normal
Actuarial Assumptions:		
Discount Rate		7.50%
Inflation		2.75%
Payroll Growth		3.00%
Projected Salary Increase		3.3% - 14.2% (1)
Investment Rate of Return		7.5% (2)

The underlying mortality assumptions and all other actuarial assumptions used in the June 30, 2013 valuations were based on the results of a January 2014 actuarial experience study for the period 1997 to 2011. Further details of the Experience Study can found on the CalPERS website.

Note 6: Defined Benefit Pension Cost-Sharing Employer Plan

Discount Rate – The discount rate used to measure the total pension liability was 7.50% for each Plan. To determine whether the municipal bond rate should be used in the calculation of a discount rate for each plan, CalPERS stress tested plans that would most likely result in a discount rate that would be different from the actuarially assumed discount rate. Based on the testing, none of the tested plans run out of assets. Therefore, the current 7.50 percent discount rate is adequate and the use of the municipal bond rate calculation is not necessary. The long term expected discount rate of 7.50 percent will be applied to all plans in the Public Employees Retirement Fund (PERF). The stress test results are presented in a detailed report that can be obtained from the CalPERS website.

According to Paragraph 30 of Statement 68, the long-term discount rate should be determined without reduction for pension plan administrative expense. The 7.50 percent investment return assumption used in this accounting valuation is net of administrative expenses. Administrative expenses are assumed to be 15 basis points. An investment return excluding administrative expenses would have been 7.65 percent. Using this lower discount rate has resulted in a slightly higher Total Pension Liability and Net Pension Liability. CalPERS checked the materiality threshold for the difference in calculation and did not find it to be a material difference.

CalPERS is scheduled to review all actuarial assumptions as part of its regular Asset Liability Management (ALM) review cycle that is scheduled to be completed in February 2018. Any changes to the discount rate will require Board action and proper stakeholder outreach. For these reasons, CalPERS expects to continue using a discount rate net of administrative expenses for GASB 67 and 68 calculations through at least the 2017-18 fiscal year. CalPERS will continue to check the materiality of the difference in calculation until such time as we have changed our methodology.

The long-term expected rate of return on pension plan investments was determined using a building-block method in which best-estimate ranges of expected future real rates of return (expected returns, net of pension plan investment expense and inflation) are developed for each major asset class.

In determining the long-term expected rate of return, CalPERS took into account both short-term and long-term market return expectations as well as the expected pension fund cash flows. Using historical returns of all the funds' asset classes, expected compound returns were calculated over the short-term (first 10 years) and the long-term (11-60 years) using a building-block approach. Using the expected nominal returns for both short-term and long-term, the present value of benefits was calculated for each fund. The expected rate of return was set by calculating the single equivalent expected return that arrived at the same present value of benefits for cash flows as the one calculated using both short-term and long-term returns. The expected rate of return was then set equivalent to the single equivalent rate calculated above and rounded down to the nearest one quarter of one percent.

The table below reflects the long-term expected real rate of return by asset class. The rate of return was calculated using the capital market assumptions applied to determine the discount rate and asset allocation. These rates of return are net of administrative expenses.

Note 6: Defined Benefit Pension Cost-Sharing Employer Plan

Asset Class	New Strategic Allocation	Real Return Years 1-10 (1)	Real Return Years 11+ (2)
Global Equity	47.0%	5.25%	5.71%
Global Fixed Income	19.0	0.99	2.43
Inflation Sensitive	6.0	0.45	3.36
Private Equity	12.0	6.83	6.95
Real Estate	11.0	4.5	5.13
Infrastructure and Forestland	3.0	4.5	5.09
Liquidity	2.0	(0.55)	(1.05)

(1) An expected inflation of 2.5% used for this period

(2) An expected inflation of 3.0% used for this period

Sensitivity of the Proportionate Share of the Net Pension Liability to Changes in the Discount Rate – The following presents the District's proportionate share of the net pension liability for each Plan, calculated using the discount rate for each Plan, as well as what the District's proportionate share of the net pension liability would be if it were calculated using a discount rate that is 1-percentage point lower or 1-percentage point higher than the current rate:

	Discount Rate -1% (6.5%)	Current Discount Rate (7.50%	Discount Rate +1% (8.50%)
Misc Tier I	$ 3,460,866	$ 2,113,774	$ 995,816
PEPRA	588	330	116

Note 7: Post-Retirement Health Care Benefits

Plan Description. Rancho Murieta Community Services District's Post-Retirement Healthcare Plan is a single employer defined benefit healthcare plan administered by Public Employees' Retirement System (PERS). PERS provides medical benefits to eligible retirees and their eligible dependents. Medical benefits are also paid to the surviving spouse of an eligible retiree. The District approved post-retirement health insurance benefits for all of its employees under the Public Employees' Medical and Hospital Care Act (PEMHCA). For an employee retiring from the District with 5 or more years of service with a CalPERS agency, the District will contribute the health benefit cost for the retiree and family members up to 100% of the lowest health benefit plan offered by PERS for unrepresented employees and up to 80% of the lowest health plan offered by PERS for represented employees. A retiree with less than 5 complete years of service with a CalPERS agency who retires at the District receives no benefit. The PERS minimum is set by law. The retiree is on the same medical plan as the District's active employees, however monthly rates for coverage of covered active and retired employees are computed separately.

Funding Policy. The contribution requirement of plan members is established by the District's Board of Directors. The 2014-2015 fiscal year annual required contribution is calculated using entry age normal cost (same as CalPERS). For the fiscal year ending June 30, 2015 the District contributed $189,012 towards the unfunded actuarial accrued liability (UAAL). The District made the net contribution for fiscal year end June 30, 2015 directly to health insurance providers totalling $76,440.

Annual OPEB Cost and Net OPEB Obligation. The District's annual other post-employment benefit (OPEB) cost (expense) is calculated based on the annual required contribution of the employer (ARC), an amount actuarially determined in accordance with the parameters of GASB Statement 45. The ARC represents a level of funding that, if paid on an ongoing basis, is projected to cover normal cost each year and amortize any unfunded actuarial liabilities (or funding excess) over a period not to exceed thirty years. The District chose a 30 year period to amortize the unfunded actuarial liability.

Note 7: Post-Retirement Health Care Benefits (Continued)

The following table shows the components of the District's annual OPEB cost for the year, the amount actually contributed to the plan, and changes in the District's net OPEB obligation to the District's Healthcare Plan:

Net OPEB obligation-beginning of year	$ 85,272
Annual OPEB cost current fiscal year	254,870
Less: Employer contribution made to trust	(189,012)
Less: Unreimbursed retiree premium payments made to plan provider	(76,440)
Net employer contribution	(265,452)
Net OPEB obligation-end of year	$ 74,690

Three year disclosure of the District's annual OPEB cost, the percentage of annual OPEB cost contributed to the plan and the net OPEB obligation is presented as follows:

Trend Information for the District OPEB

Fiscal Year Ended	Annual OPEB Cost (AOC)	Percentage of AOC Contributed	Net OPEB Obligation
06/30/13	$ 199,470	100.06%	$ 42,313
06/30/14	251,808	82.93%	85,272
06/30/15	254,870	104.15%	74,690

Funded Status and Funding Progress. As of June 30, 2015, the actuarial accrued liability (AAL) was $2,477,787 and the unfunded actuarial accrued liability (UAAL) for benefits was $1,560,237. Actuarial valuations of an ongoing plan involve estimates of the value of reported amounts and assumptions about the probability of occurrence of events far into the future. Examples include assumptions about future employment, mortality, and the healthcare cost trends. Amounts determined regarding the funded status of the plan and the annual required contributions of the employer are subject to continual revision as actual results are compared with past expectations and new estimates are made about the future. The schedule of funding progress will be presented in the future when multi-year trend information about whether the actuarial value of plan assets is increasing or decreasing over time relative to the actuarial accrued liabilities for benefits is available.

Actuarial Methods and Assumptions. Projections of benefits for financial reporting purposes are based on the substantive plan (the plan as understood by the employer and the plan members) and include the types of benefits provided at the time of each valuation and the historical pattern of sharing of benefit costs between the employer and plan members to that point. The actuarial methods and assumptions used include techniques that are designed to reduce the effects of short-term volatility in actuarial accrued liabilities and the actuarial value of assets, consistent with the long-term perspective of the calculations. In the January 1, 2014, actuarial valuation, the entry age normal cost asset valuation method is used. The actuarial assumptions included a 7.00% discount rate and the normal cost component of the ARC increases 5.5% per year throughout the five year projection. The valuation assumes that 100% of eligible retirees will actually participate in the retiree medical benefit. The annual healthcare cost trend rate for represented employees had an assumed cap of 3% per year and the unrepresented had an assumed premium rate increase of 7.9% beginning January 1, 2013, decreasing approximately .3% per year until reaching an ultimate rate of 5.5 percent. It was assumed salary increases will be 3.25% per annum.

Note 8: Special Assessment District

The Rancho Murieta Community Services District adopted a resolution for the formation of Rancho Murieta Community Services District Community Facilities District No. 2014-1 (Rancho North/Murieta Gardens) ("CFD No. 2014-1"). CFD No. 2014-1 is being formed as part of a financing plan for public infrastructure Facilities and other governmental Facilities to support development of a hotel, commercial, residential and mixed use properties being developed on approximately 828 acres of land within the District boundaries. CFD No. 2014-1. On January 29, 2015 bonds in the amount of $5,960,000 were issued to finance the costs of the Facilities and to finance costs associated with the issuance of bonds. Commencing with the 2014-15 fiscal year a special tax was approved by voters and has been authorized by the Board of Directors to be levied on lots and parcels within CFD No. 2014-1. Proceeds from the Special Tax will be used to repay the bonded indebtedness and associated costs and to pay directly for the acquisition or construction of authorized Facilities.

The amount of special assessment debt at June 30, 2015, is:

Community Facilities District No. 2014-1	$ 5,960,000

Note 9: Restatement of Net Position

Beginning net position was restated because of the implementation of Governmental Accounting Standards Board Statement 68 for defined benefit pension plans. The increase of the prior year net pension liability, deferred inflows and deferred outflows of resources resulted in a $2,467,685 reduction to beginning net position.

Note 10: Revenue Limitation Imposed by California Proposition 218

Proposition 218, which was approved by the voters in November 1996, will regulate the District's ability to impose, increase, and extend taxes and assessments. Any new, increase, or extended taxes and assessments subject to the provisions of Proposition 218, requires voter approval before they can be implemented. Additionally, Proposition 218 provides that these taxes and assessments are subject to voter initiative process and may be rescinded in the future years by the voters.

Note 11: Commitments and Contingencies

Grants

Amounts received or receivable from grant and lending agencies are subject to audit and adjustment by grantor and lending agencies. Any disallowed claims, including amounts already collected, may constitute a liability of the applicable funds. The amount, if any, of expenditures that may be disallowed by the grantor or lender cannot be determined at this time, although the District expects such amounts, if any, to be immaterial.

Commitments

The District had open engineering, construction and professional service contracts as of June 30, 2015, including $1,816,355 for the construction of the new Water Treatment Plant.

RANCHO MURIETA COMMUNITY SERVICES DISTRICT

Schedule of Operating Revenues
Water Fund
For the Fiscal Year Ended June 30, 2015
(With Comparative Totals for the Fiscal Year Ended June 30, 2014)

	2015	2014
Service Charges:		
Water sales - residential	$ 1,598,773	$ 1,602,298
Water sales - commercial	162,069	168,521
Water availability charges	320	340
Water sales - others	7,679	8,704
Total Service Charges	1,768,841	1,779,863
Other Charges:		
Water telephone line contracts	5,636	5,493
Ditch service charge	700	-
District project charges	18,198	1,924
Late charges	12,476	15,440
Water inspection fees	633	-
Transfer fees	3,657	4,454
Total Other Charges	41,300	27,311
Total Operating Revenues	$ 1,810,141	$ 1,807,174

RANCHO MURIETA COMMUNITY SERVICES DISTRICT

Schedule of Operating Expenses
Water Fund
For the Fiscal Year Ended June 30, 2015
(With Comparative Totals for the Fiscal Year Ended June 30, 2014)

	2015	2014
Source of Supply:		
Wages and salaries	$ 21,367	$ 18,602
Employer costs	11,496	11,081
Maintenance and repairs	7,767	4,530
Purchased power	111,346	105,969
Dam inspection costs	39,198	35,328
Chemical	12,998	5,045
Equipment rental	1,604	1,235
Total Source of Supply	205,776	181,790
Treatment:		
Wages and salaries	151,262	167,413
Employer costs	90,725	75,093
Purchased power	73,023	80,288
Chemicals	63,119	89,735
Maintenance and repairs	38,289	72,663
Supplies	5	16
Equipment rental	41,013	8,870
Lab tests	10,591	20,372
Miscellaneous	-	1,955
Total Treatment	468,027	516,405
Transmission and Distribution:		
Wages and salaries	215,850	187,230
Employer costs	96,724	89,839
Water meters	26,286	44,930
Maintenance and repairs	61,721	112,697
Purchased power	45,884	42,064
Equipment rentals	25,936	28,484
Road paving	52,754	39,610
Supplies	544	3,416
Miscellaneous	-	3,825
Total Transmission and Distribution	525,699	552,095
General and Administrative:		
Wages and salaries	209,873	311,883
Employer costs	85,455	160,867
Subtotal General and Administrative	295,328	472,750

RANCHO MURIETA COMMUNITY SERVICES DISTRICT

Schedule of Operating Expenses
Water Fund
For the Fiscal Year Ended June 30, 2015
(With Comparative Totals for the Fiscal Year Ended June 30, 2014)

	2015	2014
Subtotal General and Administrative:	$ 295,328	$ 472,750
Communications	13,748	13,072
Maintenance and repairs	91,274	78,070
Insurance	31,747	21,350
Permits	26,016	18,081
Supplies	12,899	15,922
Directors' meeting and expenses	7,019	8,447
Elections	707	-
Legal and audit	53,373	37,620
Training and safety	5,935	12,607
Vehicle expenses	27,975	22,620
Tools	14,735	9,743
Sacramento Water Authority	6,000	10,836
Miscellaneous	24,781	21,511
Postage	8,251	8,418
Travel and meetings	6,019	5,806
Tuition reimbursement	596	688
Clerical services	39,875	14,074
Consulting services	31,221	34,553
Dues and memberships	14,698	6,954
Uniforms	3,551	4,762
Purchased power	3,314	3,242
Equipment lease	1,083	905
Bad debts	-	-
Water conservation	18,557	48,702
Janitorial and pest control	1,664	8,088
CIA ditch operations	5,403	-
Total General and Administrative	745,769	878,821
Depreciation	483,941	482,665
Total Operating Expenses	$ 2,429,212	$ 2,611,776

RANCHO MURIETA COMMUNITY SERVICES DISTRICT

Schedule of Operating Revenues
Sewer Fund
For the Fiscal Year Ended June 30, 2015
(With Comparative Totals for the Fiscal Year Ended June 30, 2014)

	2015	2014
Service Charges:		
Sewer service - residential	$ 1,164,771	$ 1,123,144
Sewer service - commercial	121,316	114,927
Sewer availability charges	390	400
Total Service Charges	1,286,477	1,238,471
Other Charges:		
Sewer inspection fees	380	-
District project charges	2,719	3,653
Late charges	12,476	15,440
Transfer fees	2,792	3,401
Total Other Charges	18,367	22,494
Total Operating Revenues	$ 1,304,844	$ 1,260,965

RANCHO MURIETA COMMUNITY SERVICES DISTRICT

Schedule of Operating Expenses
Sewer Fund
For the Fiscal Year Ended June 30, 2015
(With Comparative Totals for the Fiscal Year Ended June 30, 2014)

	2015	2014
Collections:		
Wages and salaries	$ 85,887	$ 103,084
Employer costs	42,841	47,425
Maintenance and repairs	27,748	51,687
Purchased power	13,252	12,822
Equipment rental	6,517	1,588
Supplies	1,670	2,484
Miscellaneous	-	-
Total Collections	177,915	219,090
Treatment and Disposal:		
Purchased power	104,005	125,400
Chemicals	41,053	45,811
Wages and salaries	108,315	122,693
Employer costs	55,789	60,220
Lab tests	56,986	35,414
Maintenance and repairs	51,640	84,031
Supplies	1,086	-
Equipment rental	11,890	12,011
Miscellaneous	1,455	-
Total Treatment and Disposal	432,219	485,580
General and Administrative:		
Wages and salaries	137,892	207,932
Employer costs	43,776	108,490
Communications	11,737	11,014
Maintenance and repairs	103,846	69,001
Insurance	24,239	16,301
Vehicle expenses	22,784	22,376
Supplies	9,446	12,760
Directors' meetings and expenses	5,899	6,449
Legal and audit	29,418	16,374
Training and safety	12,270	14,331
Permits	36,270	30,061
Miscellaneous	7,654	12,843
Postage	6,300	6,427
Tools	17,417	9,842
Subtotal General and Administrative	468,948	544,201

RANCHO MURIETA COMMUNITY SERVICES DISTRICT

Schedule of Operating Expenses
Sewer Fund
For the Fiscal Year Ended June 30, 2015
(With Comparative Totals for the Fiscal Year Ended June 30, 2014)

	2015	2014
Subtotal General and Administrative:	$ 468,948	$ 544,201
Travel and meetings	5,099	4,682
Tuition reimbursement	508	118
Clerical Services	30,444	10,745
Consulting	9,526	18,920
Uniforms	3,836	5,271
Dues and memberships	4,583	4,131
Purchased power	2,530	2,475
Janitorial and pest control	1,664	6,545
Equipment lease	827	691
Total General and Administrative	527,965	597,779
Depreciation	608,191	586,403
Total Operating Expenses	$ 1,746,290	$ 1,888,852

RANCHO MURIETA COMMUNITY SERVICES DISTRICT

Schedule of Operating Revenue
Drainage Fund
For the Fiscal Year Ended June 30, 2015
(With Comparative Totals for the Fiscal Year Ended June 30, 2014)

	2015	2014
Special Taxes:		
Drainage service - residential	$ 153,783	$ 150,894
Drainage service - commercial	29,783	29,203
Total Special Taxes	183,566	180,097
Other Charges:		
Transfer fees	573	698
Total Operating Revenues	$ 184,139	$ 180,795

RANCHO MURIETA COMMUNITY SERVICES DISTRICT

Schedule of Operating Expenses
Drainage Fund
For the Fiscal Year Ended June 30, 2015
(With Comparative Totals for the Fiscal Year Ended June 30, 2014)

	2015	2014
Drainage:		
Wages and salaries	$ 66,379	$ 49,914
Maintenance and repairs	19,451	24,618
Purchased power	6,724	9,840
Employer costs	29,970	24,592
Equipment rental	1,844	1,411
Legal and audit	-	-
Chemicals	4,344	2,599
Supplies	1,192	1,744
Improvements	119	-
Permits	5,826	4,852
Uniforms	-	733
Miscellaneous	785	4,527
Total Drainage	136,634	124,830
General and Administrative:		
Wages and salaries	25,036	33,999
Employer costs	7,037	16,675
Clerical expense	6,253	2,207
Communications	591	909
Insurance	4,978	3,348
Maintenance and repairs	7,729	7,417
Vehicle Expenses	8	8
Directors' meeting and expenses	1,212	1,325
Uniforms		
Office supplies	-	-
Legal and audit	5,952	3,258
Postage	1,294	1,320
Consulting services	1,865	9,192
Miscellaneous	1,063	750
Travel and meeting	600	639
Tuition reimbursement	35	24
Memberships	647	732
Training and safety	231	232
Purchased power	520	508
Equipment lease	170	142
Total General and Administrative	65,221	82,685
Total Operating Expenses	$ 201,854	$ 207,515

RANCHO MURIETA COMMUNITY SERVICES DISTRICT

Schedule of Operating Revenues
Solid Waste Fund
For the Fiscal Year Ended June 30, 2015
(With Comparative Totals for the Fiscal Year Ended June 30, 2014)

	2015	2014
Service Charges:		
Solid Waste - residential	$ 634,554	$ 622,521
Total Service Charges	634,554	622,521
Total Operating Revenues	$ 634,554	$ 622,521

RANCHO MURIETA COMMUNITY SERVICES DISTRICT

Schedule of Operating Expenses
Solid Waste Fund
For the Fiscal Year Ended June 30, 2015
(With Comparative Totals for the Fiscal Year Ended June 30, 2014)

	2015	2014
Solid Waste:		
Contract charges	$ 552,778	$ 545,023
E-Waste disposal cost	-	-
Miscellaneous	35,018	35,045
Total Solid Waste	587,796	580,068
General and Administrative:		
Wages and salaries	16,946	27,868
Employer costs	8,765	13,668
Travel-Meetings	492	524
Tuition reimbursement	-	20
Clerical reimbursement	5,125	1,809
Office supplies	977	1,430
Mail machine lease	139	116
Insurance	4,081	2,744
Postage	1,061	1,082
Professional services	9,029	6,963
Utilities	746	658
Maintenance and repairs	2,382	1,964
Consulting	40	2,061
Miscellaneous	1,685	1,719
Directors' meeting and expenses	902	1,086
Total General and Administrative	52,370	63,712
Total Operating Expenses	$ 640,166	$ 643,780

RANCHO MURIETA COMMUNITY SERVICES DISTRICT

Schedule of Operating Revenues
Security Fund
For the Fiscal Year Ended June 30, 2015
(With Comparative Totals for the Fiscal Year Ended June 30, 2014)

	2015	2014
Special Taxes:		
Security service - residential	$ 1,030,651	$ 1,017,538
Security service - commercial	153,291	168,574
Total Special Taxes	1,183,942	1,186,112
Other Charges:		
Late charges	24,953	30,880
Transfer fees	6,808	8,024
Fines and permits	13,160	9,977
Other	7,799	6,408
Total Other Charges	52,720	55,289
Total Operating Revenues	$ 1,236,662	$ 1,241,401

RANCHO MURIETA COMMUNITY SERVICES DISTRICT

Schedule of Operating Expenses
Security Fund
For the Fiscal Year Ended June 30, 2015
(With Comparative Totals for the Fiscal Year Ended June 30, 2014)

	2015	2014
Gate Services:		
Wages and salaries	$ 281,131	$ 277,671
Employer costs	172,089	192,769
Miscellaneous	5,959	2,527
Equipment repairs and maintenance	7,423	19,608
Supplies	8,719	4,471
Communications	4,364	3,667
Janitor and pest controls	3,296	6,541
Purchased power	7,414	2,323
Training and safety	85	1,695
Uniforms	1,535	2,379
Total Gate Services	492,015	513,651
Patrol Services:		
Wages and salaries	245,858	241,924
Employer costs	130,736	122,024
Vehicle fuel	17,460	19,366
Off-duty sheriff patrol	6,262	3,762
Vehicle maintenance	12,895	11,198
Uniforms	1,069	1,206
Miscellaneous	20,216	253
Cellular phone	3,879	3,049
Equipment repairs and maintenance	4,623	4,611
Janitor and pest control	2,645	1,948
Supplies		
Travel/meetings	2,349	4,171
Tuition reimbursement	115	81
Training and safety	1,451	772
Total Patrol Services	449,558	414,365
General and Administrative:		
Wages and salaries	154,454	210,005
Employer costs	21,988	90,528
Clerical services	20,809	7,345
Insurance	16,567	11,142
Legal and audit	31,285	12,108
Supplies	10,647	11,594
Directors' meetings and expenses	4,032	4,408
Training and safety	1,661	1,145
Consulting	3,886	8,368
Uniforms		
Purchased power	1,729	1,692
Subtotal General and Administrative	267,058	358,335

RANCHO MURIETA COMMUNITY SERVICES DISTRICT

Schedule of Operating Expenses
Security Fund
For the Fiscal Year Ended June 30, 2015
(With Comparative Totals for the Fiscal Year Ended June 30, 2014)

	2015	2014
Subtotal General and Administrative:	$ 267,058	$ 358,335
Communications	2,972	3,489
Equipment repairs and maintenance	26,043	24,475
Postage	4,336	4,393
Bad debts	-	-
Travel and meetings	-	-
Miscellaneous	4,831	6,431
Memberships	2,155	2,437
Equipment lease	565	473
Vehicle expenses	-	-
Uniform		
Total General and Administrative	307,960	400,033
Depreciation	30,207	33,378
Total Operating Expenses	$ 1,279,740	$ 1,361,427

RANCHO MURIETA COMMUNITY SERVICES DISTRICT
REQUIRED SUPPLEMENTARY INFORMATION
SCHEDULE OF THE DISTRICT'S PROPORTIONATE
SHARE OF THE NET PENSION LIABILITY
JUNE 30, 2015

Actuarial Valuation Date	District's proportion of the net pension liability (asset)	District's proportionate share of the net pension liability (asset)	District's covered-employee payroll	the net pension liability (asset) (asset) as a percentage of its covered-employee payroll	Plan fiduciary net positior as a percentage of the total pension liability
Miscellaneous 1st tier					
6/30/2014	0.03397%	$2,113,774	$1,745,278	121.11%	79.18%
PEPRA					
6/30/2014	0.00001%	$330	$32,708	1.01%	83.02%

The schedule is presented to illustrate the requirement to show information for 10 years. However, until a full 10-year trend is compiled, only information for those

RANCHO MURIETA COMMUNITY SERVICES DISTRICT
REQUIRED SUPPLEMENTARY INFORMATION
SCHEDULE OF THE DISTRICT'S PROPORTIONATE
SHARE OF THE NET PENSION LIABILITY
JUNE 30, 2015

Actuarial Valuation Date	Contractually required contribution	to the contractually required contribution	Contribution deficiency (excess)	District's covered employees payroll	percentage of covered employee payroll
Miscellaneous 1st tier					
6/30/2014	$215,170	($215,170)	$0	$1,745,278	12.33%
PEPRA					
6/30/2014	$7,065	($7,065)	$0	$32,708	21.60%

The schedule is presented to illustrate the requirement to show information for 10 years. However, until a full 10-year trend is compiled, only information for those years for which information is available is presented.

LARRY BAIN, CPA
AN ACCOUNTING CORPORATION

2148 Frascati Drive, El Dorado Hills, CA 95762 / 916.601-8894
lpbain@sbcglobal.net

INDEPENDENT AUDITOR'S REPORT ON INTERNAL CONTROL OVER FINANCIAL REPORTING

Board of Directors
Rancho Murieta Community Services District
Rancho Murieta, California

We have audited the Financial Statements of the Rancho Murieta Community Services District (District) as of and for the fiscal year ended June 30, 2015, and have issued our report thereon dated October 26, 2015. In our audit report we issued an unqualified opinion. We conducted our audit in accordance with auditing standards generally accepted in the Unites States of America.

Internal Control over Financial Reporting

In planning and performing our audit, we considered District's internal control over financial reporting as a basis for designing our auditing procedures for the purpose of expressing our opinion on the financial statements, but not for the purpose of expressing an opinion on the effectiveness of the District's internal control over financial reporting. Accordingly we do not express an opinion on the effectiveness of the District's internal control over financial reporting.

A deficiency in internal control exists when the design or operation of a control does not allow management or employees, in the normal course of performing their assigned functions, to prevent, or detect and correct misstatements on a timely basis. A material weakness is a deficiency or a combination of deficiencies in internal control, such that there is a reasonable possibility that material misstatement of the entity's financial statements will not be prevented, or detected and corrected on a timely basis.

Our consideration of the internal control over financial reporting was for the limited purpose described in the preceding paragraph and would not necessarily identify all deficiencies in internal control that might be significant deficiencies or material weaknesses and, therefore, there can be no assurance that all such deficiencies have been identified. We did not identify any deficiencies in internal control that we consider to be material weaknesses.

A significant deficiency is a deficiency, or combination of deficiencies, in internal control that is less severe than a material weakness, yet important enough to merit attention by those charged with governance. We consider finding 15-1 in the following schedule of findings to be a significant deficiency in the District's internal control.

Rancho Murieta Community Services District's Response to Findings

The Rancho Murieta Community Services District's separate written response to the significant deficiencies identified in our audit and any follow up for subsequent year corrections has not been subjected to the audit procedures applied in the audit of the financial statements and accordingly, we do not express an opinion on the responses.

Purpose of this Report

The purpose of this report is solely to describe the scope of our testing of internal controls over financial reporting and the result of that testing, and not to provide an opinion on the effectiveness of the District's internal control. This report is an integral part of an audit performed in accordance with auditing standards generally accepted in the United States of America in considering the District's internal control over financial reporting accordingly this report is not suitable for any other purpose.

This report is intended solely for the information and use of the Board of Directors, management, the Sacramento County Auditor Controller's Office and the Controller's Office of the State of California and is not intended to be and should not be used by anyone other than these specified parties.

Larry Bain, CPA,
An Accounting Corporation
October 26, 2015

Deemed to be Significant Deficiencies and Not Material Weaknesses

Finding 15-1: During our audit we noted the tax revenue for the District was posted to the Community Facility District No. 1 fund and then transferred to the District. There was no reason during the 2014-15 fiscal year to run the activity through the Community Facility District. We also noted the District was using the Community Facility District No. 1 (CFD No.1) bank account to record developer activity related to the new wastewater treatment plant. The CFD No. 1 account had a residual balance of $21,906.72 at June 30, 2015 that was remaining from the CFD No. 1 project, furthermore the remaining letter of credit from the CFD No. 1 project from a Developer was being used for the new water treatment plant and these developer deposits were being deposited into the CFD No. 1 bank account and then immediately transferred to a CSD bank account.

Recommendation: We recommend the tax revenue for the District be posted directly to the District tax revenue accounts. If there are any balances that belong to the Community Facility District (CFD) then those amounts should be recorded to the CFD fund. We also recommend the District the District determine where to apply the remaining $21,906.72 cash balance from the CFD No. 1 bank account and close that account. The District should also determine if it is necessary to deposit developer funds for the new water treatment plant into the CFD No. 1 bank account and then immediately transfer them to the District. The District could open a new bank account for the water treatment plant.

AGENDA ITEM 9

(Consider Approval of the Solar Power Project - CEQA Services, Support, and Documentation Proposal)

WILL BE FORTHCOMING

Sacramento LAFCo

SACRAMENTO LOCAL AGENCY FORMATION COMMISSION
1112 I Street, Suite 100 •Sacramento, CA 95814• (916) 874-6458• Fax (916) 874-2939

DATE: October 20, 2015

TO: Special Districts' Selection Committee

FROM: Peter Brundage, Executive Officer

RE: **Selection of Special District Commissioner**
For the Sacramento Local Agency Formation Commission
Term of Office: **January 1, 2016 to December 31, 2019**

Pursuant to the provisions of Section 56332 of the Government Code, the Executive Officer has determined that a meeting of the Special District Selection Committee for the purpose of selecting a Special District Commissioner [Office No. 6 to serve on the Sacramento Local Agency Formation Commission is not feasible. Based on past experience, due to the size of the Special District Selection Committee, it has been difficult to establish a quorum. Therefore, the business of the Special District Selection Committee will be conducted in writing, as provided in the cited section code.

Please see the enclosed Ballot.
Please select one candidate for Special District Commissioner (Office No. 6).

Please return the ballot to the LAFCo office no later than:

3:30 P.M. on WEDNESDAY, DECEMBER 16, 2015
To be valid, selection of a candidate must be done by a majority vote of the governing board of an Independent Special District in an official meeting of that board and certified by the secretary or clerk of the board.

Any ballot received after the date specified above shall not be valid. The candidate who receives the most votes will be determined the winner outright. In the event of a tie, there will be a run-off selection held in the same format as the initial selection. The LAFCo Executive Officer will announce the results of the selection within seven days of the specified date.

If you have questions regarding selection procedures, please contact the Sacramento LAFCo Commission Clerk, Diane Thorpe, at (916) 874-6458.

Very truly yours,
SACRAMENTO LOCAL AGENCY FORMATION COMMISSION

Peter Brundage

Peter Brundage
Executive Office

Ballot

LAFCo Special District Commissioner

Please select **one** candidate

Candidate	
Brian Danzl Cordova Recreation & Park District	☐
Frederick Goethel Galt-Arno Cemetery District	☐
Ron Greenwood (Incumbent) Carmichael Water District	☐
Tim Rosales Arcade Creek Recreation & Park District	☐
Brandon Rose Fair Oaks Recreation & Park District	☐
Michael Seaman Fulton– El Camino Recreation & Park District	☐

Ballot must be received by LAFCo no later than

3:30 pm on Wednesday December 16, 2015

Special Districts must return the ballots to LAFCo by the date specified above. Any ballot received after the specified date shall not be valid. The candidate who receives the most votes will be determined the winner outright. The LAFCo Executive Officer will announce the results of the election within seven days of the specified date.

____

Name of Special District

____

Date of Meeting

____

Signature of Secretary or Clerk of the Board

____

E-mail Address

BRIAN DANZL

2661 Los Amigos Dr, Rancho Cordova, CA 95670 • Home: 916-363-3166 • Cell: 916-826-1470 • Bdanzl@crpd.com

Professional Summary

Self-directed Board member and innovative thinker with a knack for developing creative solutions to complex problems. Seeking a position with the opportunity for new challenges and professional development and advancement.

Skills

- Budgeting and finance
- Negotiations
- Effective public speaker
- Flexible schedule
- Team player
- Organized
- Goal-oriented
- Reliable
- Extensive sports knowledge
- Youth sports coach
- Motivational techniques
- Team building
- Sound judgment
- Youth mentor
- Strong customer focus
- Works well in a team environment
- Strong collaborator
- Creative questioning
- Critical thinking
- Outstanding social skills

Work History

Board Member, 12/2010 to Current
Cordova Recreation and Park District – 2729 Prospect Park Drive, Suite 230, Rancho Cordova, CA 95670

- Represented the park district at community and professional organizational meetings.
- Addressed and resolved neighborhood problems and complaints in a tactful and timely manner.
- Coordinated project activities with other agency partners.

Coach , 09/2008 to Current
Folsom Cordova Unified School District – 1965 Birkmont Drive Rancho Cordova, CA 95742-6407

- Served as the Head Coach for the Girls Tennis team for 6 years.
- Served as the Assistant Coach for the Girls Soccer for 7 years.
- Managed time effectively while traveling for games, attending practice and going to classes.
- Effectively communicated with a diverse group of athletes, coaches and game officials.
- Exhibited excellent teamwork and a strong work ethic by promoting camaraderie.
- Trained for 10 hours per week for upcoming competitions.
- Developed and maintained key relationships with local vendors.
- Attended all practices, meetings and workouts on time.
- Assisted as position team leader for defensive and offensive teams.
- Provided Tennis and Soccer coaching at Cordova High School while developing and mentoring elite athletes.

Teacher, 03/2007 to Current
Home School Teacher – 2661 Los Amigos Dr Rancho Cordova CA 95670

- Developed and taught lessons on relevant children's books, poems, movies and themes to promote student interest.
- Improved student test scores on state math test by 20% in one year period by implementing new curriculum.
- Improved average scores on State Science exam by 12 points.
- Consistently received positive teacher evaluations from students.
- Increased student's English test scores by 14% through private tutoring and special attention.

Electrician, 03/2002 to 03/2007
Rex Moore – 6001 Outfall Circle Sacramento, CA 95828

- Selected the correct products or assist customers in making product selections, based on customers' needs, product specifications, and applicable regulations.
- Worked collaboratively with clients, team members, implementation consultants, and resources across the company to achieve desired results.
- Installed, repaired and tested electrical and electronic systems.
- Installed electrical conduit and wiring for power, controls and lighting.
- Installed electrical and mechanical equipment in accordance with the National Electric Code.
- Disconnected and removed motors and pumps.
- Interpreted blueprints, schematics, drawings and layouts to complete repairs.
- Determined proper methods, equipment and materials to complete cost repairs within budget.
- Tested, troubleshot and calibrated equipment in the shop and in the field.
- Documented all maintenance and repairs performed on equipment.
- Cleaned work sites, including hauling debris and trash, cleaning tools and storing equipment.
- Notified supervisor immediately about equipment problems and breakdowns.

Brian Danzl
page 2

- Completed daily inspections of all electronic equipment.
- Reported all unsafe activities, situations and potential hazards to supervisor.
- Updated and modified components and systems to improve operation.

Education

High School Diploma: 1993
Cordova High School - 2239 Chase Drive Rancho Cordova, CA 95670
- Student government representative

Certificate: Electrical Construction, 2006
Western Electrical Contractors Association - 3695 Bleckely Street, Rancho Cordova, CA 95655
- Coursework in Electron Theory, Ohm's Law and Magnetism
- Conduit Bending Program

CARMICHAEL WATER DISTRICT

7837 Fair Oaks Boulevard
Carmichael, CA 95608
www.carmichaelwd.org

Ron Greenwood
Director, Division 4

District: (916) 483-2452
Cell: (916) 712-4442
Fax: (916) 483-5509

Ron Greenwood Bio (2015)

Ron is currently serving as a **LAFCo Commissioner** representing the Special Districts within Sacramento County and has since 2011. During that time, he has learned continually about the importance of experience and developing relationships. He understands the importance of LAFCo's role in managing and working toward controlled, orderly growth, while still protecting property rights of those most affected. During his time as a LAFCo Commissioner, Ron has been a part of the Folsom annexation of property south of Hwy 50 as well as the proposed sphere of influence proposed for the South County (Elk Grove). As a Carmichael resident for 32 years, Ron has continually served his community in numerous capacities. As an elected official, he has been a director and past president of the **Carmichael Water District** for the past 8 years. As a director for the CWD he has participated in resolving labor issues to the communities benefit, developed requests for proposal (RFPs), and contracts for vendor services. As a Director for the Carmichael Water District, he has represented his community as a **Chair for the Regional Water Authority (RWA)**. In addition he has also served as a **director for the Association of California Water Agency (ACWA)** and its **Joint Powers Insurance Agency (JPIA)**, plus recently served on its nominating committee.

Ron continues to be active throughout his community and the Sacramento region. He currently serves on the **Carmichael Park Foundation**, past President of the **Carmichael Kiwanis Club**, is a Park District Volunteer, member of the **Carmichael Chamber of Commerce**, and served as a founding board member for the **North Area Teen Center**. In addition, he annually attends the Sacramento Region's annual **Cap to Cap** meetings in Washington, D.C. as a delegate for the Water Team working with other delegates and representatives from his region to solve local issues.

Ron has developed a very successful real estate career (23+ years) both as a manager for 8 years and is currently selling residential properties with his wife, Cleo. As a Realtor, Ron is **2015 President of the Sacramento Association of Realtors** (SAR)'s and serves on the Executive Committee, Strategic Planning and Finance Committee, plus Government Relations Committee. Ron also is a **State Director for the California Association of Realtors (CAR)** serving on the Local Government Affairs and Environment Land Use Committees. He is past President and Life Member of SAR's Masters Club.

With a BA degree from the University of Texas at El Paso, Ron brings years of experience, business contacts, and successful leadership. While a tireless, committed, and hardworking advocate for all of the citizens of his community, Ron still takes great pride in his family. Married to his wife, Cleo, for 36 years and have 4 children and 4 grandchildren. They enjoy family outings, backpacking and fly fishing with his son, golf trips, wine outings, cooking, and just spending quality time with his family and close friends.

Ron Greenwood
page 2

DEL PASO MANOR *Water District*

PHONE (916) 487-0419 FAX (916) 487-8534 4268 LUSK DRIVE • SACRAMENTO, CA 95864

October 15, 2015

Sacramento Local Agency Formation Commission
1112 I Street Ste. 100
Sacramento, CA 95814

RE: Nomination for Special District Commission Office No. 6

Dear Commissioners,

The Board of Directors of Del Paso Manor Water District discussed the nomination request for the Special District Commissioner Office No. 6 that expires December 31, 2015. The Board unanimously supports the nomination of Ron Greenwood, Director of Carmichael Water District and incumbent, for the office. In our Boards opinion, he has done an outstanding job representing Special Districts with Sacramento County.

If you should have any questions, please do not hesitate to contact me.

Sincerely,

Debra J. Sedwick

Debra Sedwick
General Manager

Timothy A. Rosales
(916) 475-4900 • Tim.Rosales@gmail.com

QUALIFICATIONS SUMMARY

- More than ten years successful public / government affairs and public relations experience with fifteen years experience in media relations and creative media production.
- Effectively communicate with diverse range of clients, co-workers, direct reports and collaborative teams.
- Excellent management, written and verbal communication, organizational, and strategic planning skills with proven success executing multiple tasks simultaneously in a highly charged, fast-paced agency environment.

EXPERIENCE

The Wayne Johnson Agency — **Sacramento, CA**
Vice President, Public Affairs — **Jan 2005 – present**

- Managed more than eight accounts at the same time including, but not limited to healthcare, energy, education, technology, manufacturing and trade association sectors working in CA, OR, WA, MA, NJ, VT and Washington DC.
- Created and executed multi-million dollar traditional, digital and social media marketing / advertising budgets.
- Collaborated with with federal, state and local government officials, agencies and advocacy organizations on a regular basis to achieve client objectives.
- Led new business pitches and generated new clients, resulting in company growth of 65% over four years. Developed and oversaw client deliverables, measurement and evaluation materials.
- Handled and implemented all community and media relation activities, including crisis communication planning and rapid response plans.
- Studied and implemented quantitative data, consumer and market research and analysis, and public opinion research methodologies.

California State Assembly — **Sacramento San Diego, CA**
Chief of Staff, District Director — **Jan 2001 – Dec 2004**

Assemblymembers George Plescia, Mark Wyland (San Diego) and, Ken Maddox (Central Orange County):

- Directed and delegated all aspects of the State Legislator's policy portfolio, constituent relations, communication and community operations. Managed multiple direct-reports and satellite district office locations.
- Oversaw human resource compliance program, annual office budgets and established staff performance metrics.
- Supervised community relation efforts with civic leaders, chambers of commerce, boards of education, industry and trade groups and regional policy collaborations.
- Planned and executed all statewide, district media including press releases, opinion/editorial content and speech writing.

United States Congress — **Glendale, CA**
Congressional Field Representative / Campaign Aide — **Jan 1999 – Dec 2000**

- Served as district field representative to a member of the U.S. House Commerce and Judiciary Committees.
- Represented the Member of Congress with local community organizations, elected officials, non-profits and local government agencies.
- Oversaw $5 million fundraising campaign effort among high-level donors and created national small donor effort that acquired 30,000 individuals.
- Supervised local and national campaign press communications.

EDUCATION

Drexel University – LeBow College of Business — **Philadelphia, PA**
Master of Business Administration — **2013**
Azusa Pacific University — **Azusa, CA**
Bachelor of Arts, Political Science — **1998**

ACTIVITIES/RECOGNITION

Board Member, Drexel University Alumni Association, Sacramento Chapter
Board of Directors, Arcade Creek Park District
Professional Development Committee, Sacramento Chamber of Commerce MetroEdge
Sacramento Business Journal 40 Under 40, Finalist 2013

Brandon D. Rose

5131 Keana Ct.
Fair Oaks, CA 95628
916-844-5510
brandondrose@hotmail.com

Thank you for consideration as the Special District Commissioner to the Sacramento Local Agency Formation Commission. As fellow governing board members, I know you understand the vital role our special districts serve in Sacramento. Our agencies provide a diverse set of unique services across the County and we are called-on time and time again when our communities are in need. I believe that as special districts, we have our hands on the pulse of our diverse populace. It is critical that our unique voice, insights and interests be strongly represented on the Commission. That is why I consider representing special districts on a regional body such as LAFCO a vitally important role. Please find my professional and academic qualifications as well as dedication to public service below. Once again thank you for your consideration and support.

EDUCATION

Environmental Policy Analysis & Planning, BSc. – 2004
Specialization in City and Regional Planning

University of California, Davis
University of Tasmania, Australia

PUBLIC SERVICE

2008-Current Chair, Board of Directors, Fair Oaks Recreation and Park District

The Fair Oaks Recreation and Park District is an independent special district in Sacramento County with approximately 70 full time and seasonal employees. As an elected member of the Board of Directors and current chair, I work in conjunction with the district administrator to determine long term policy development and strategic planning. As former chair of the Personnel and Management Committee I was responsible for updates to personnel policies as well as negotiations with the employees association and management. As chair of the Finance and Budget Committee, I direct the drafting and approval of the annual budget. In addition, as board chair in 2010, I focused on completion of a long term master plan, which continues to guide district activities today.

2011- Current Chair, Special District Representative, Sacramento County Treasury Oversight Committee

The Special District Representative is elected by the region's local governments to the Sacramento County Treasury Oversight Committee to oversee the County's pooled investment funds, which total approximately $3 billion. Duties include review of the annual investment policy; quarterly review of investments; and causation and review of an annual portfolio audit.

2010-2011 Member, Special District Advisory Committee; Sacramento County Local Agency Formation Commission

This advisory committee provided a forum for valuable information exchange with LAFCO staff.

Brandon Rose
page 2

WORK EXPERIENCE

2007-Current Air Pollution Specialist, California Air Resources Board

Duties in the Mobile Source Control Division include research and analysis of proposed and existing public health regulations, modeling and analysis of air pollution emissions, complex economic analysis of regulatory requirements, drafting of staff reports, creating and updating databases, responding to public inquiries, and providing regulatory training across a spectrum of stakeholders.

2004-2007 Associate Energy Specialist, California Energy Commission

I administered the CECs Pilot Performance-Based Incentive Program, which was a precursor to the State's current renewable energy incentive program. Duties included the drafting of technical policies, study of solar-electric system design and metering, and analysis of generation. I compiled statewide statistics on the amount of grid-connected solar-electric capacity and total number of installations as well as managed the list of photovoltaic generating equipment eligible for the State's rebate program. My duties also included investigations and briefings on relevant program appeals, fraud concerns, and drafting of letters in response to internal and external requests.

2002-2003 Research Assistant IV, UC Davis Geology Department

I conducted fluvial geomorphologic surveying and data collection of Sierra Nevada streams in the Feather River watershed as part of a larger CalFed Bay Delta effort. I then processed the raw data into planform maps and various data tables, while ensuring validity.

1998-2002 Assistant Pool Manager, Sunrise Recreation and Park District

Duties included working with the management team to ensure smooth operation of the aquatic division. I communicated employee concerns to upper management and used my communication skills to relieve workplace tension across a diverse workforce while improving focus. I organized and taught continuing education for staff, provided performance evaluations to instructors and lifeguards, and ensured a safe atmosphere within the facility.

VOLUNTEER EXPERIENCE

2007-Current Chair, Organizational Development Environment Council of Sacramento

This nonprofit strives to achieve regional and community sustainability and a healthy environment for existing and future residents by working proactively with members, member organizations, local government, and community groups. As a Board Member, I work on strategic planning and organizational development to build capacity.

AWARDS & INTERESTS

- State of California Gold Superior Accomplishment Award – 2011; Silver - 2013
- Participant, Young Elected Official Network 2015 National Convening
- Member, Professional Engineers in California Government
- Local Government Operation

Michael J. Seaman
2837 Merrywood Drive
Sacramento, CA 95825
michaeljseaman@gmail.com
916-483-8985 (land) 916-591-0180 (cell)

EXPERIENCE

Board Member
Fulton-El Camino Recreation and Park District
2700 Cottage Way, Arden Arcade, CA 95825
12/1989 – 11/1992 and 12/1998 – present, part time

Local elected official of an independent special district. Set and implement policy, supervise the General Manager and the administration of the facility, recreation and security programs, represent the public. Interact with community groups, other government officials and state Legislators as to management of park facilities, implementation of recreation programs and related services. Approve and implement annual budgets exceeding $2 million. Facilities include 7 parks and 2 community centers. Staff of 14 FTE. Physical plant of $5.7 million. Re-elected to current 4-year term in November 2014. Served as District representative to Sacramento Local Agency Formation Commission Special District Advisory Committee 2004-2006. Served on State Board of California Special Districts Association (CSDA) 2003-2006. CSDA Legislative Committee Chair 2004-2006 and Member 2012-2013.

Snowboard and Ski Instructor
Boreal Mountain Resort (1998-present), Royal Gorge Cross Country (1988-2013) and Eagle Mountain Nordic (1985-1988)
11/1988 – present, part time seasonal

Teach skiing and snowboarding and skiing to resort guests whose skill levels range from beginner to advanced intermediate. As a front-line employee, assist guests and see to the safety and enjoyment of their resort experience. Organize students into groups of like ability and see to their comfort and convenience. Assist rental staff with check-out and return of equipment. Certifications: Professional Ski Instructors of America/American Association of Snowboard Instructors Level II Nordic Track, Level I Snowboard, Level I Alpine, Level I Alpine Senior Specialist.

Affiliate Relations Coordinator
California Lighting Technology Center
University of California, Davis
633 Pena Drive, Davis CA 95618
03/15/2010 – 6/30/2010, part-time limited term

As an in-house contractor, provided customer service to the Center's diverse affiliate membership as well as recruitment and contractual fulfillment services for potential and newly-enrolled affiliates. Advised Center Director and co-Director as to progress and assisted business management staff with affiliate tracking and contract paperwork. Coordinated Center's role in US DOL-funded curriculum for Advanced Lighting Controls Training Program among University's Office of Research, participating CA utilities, National Electrical Contractors Association, International Brotherhood of Electrical Workers and lighting manufacturers. Represented Center at trade shows and exhibits, including Lightfair 2010.

Senior Associate
Mintier Harnisch Planning Consultants
1415 20th Street, Sacramento, CA 95811
07/31/2000 – 12/30/2009, part time contractor

As an independent contractor, provided planning and project services and issues research for clients as needed per contracts. Workload varied depending on contractual arrangements involving research and analysis of issues and potential solutions, writing reports and proposals, making presentations to staff and community groups and meeting with clients and the media. Examples include: Wrote Upland Airport Alternatives for San Francisco International Airport Runway Reconfiguration. Conducted economic development briefing for Mildura, Western Victoria, Australia, via teleconference. Gave presentation at 2003 Annual Meeting of League of California Cities on "Smart Communities as an Economic Development Strategy." Evaluated environmental impacts and land use conflicts of proposed research facility site at Lake Tahoe.

Energy Commission Specialist II (efficiency)
CA Energy Commission 1516 9th St. Sacramento CA 95814
4/28/2005 – 12/30/2009 (retirement) full time permanent

For the Buildings End-use Energy Efficiency Program, developed, organize and managed multi-million dollar portfolio of multi-disciplinary scientific and technical research projects. Processed and administered research contracts, serving as lead technical specialist and prime resource for identifying, analyzing and evaluating R&D issues related to energy conservation and energy demand management opportunities from use of lighting in buildings and from high-performance building facades. Similarly, managed contracts demonstrating energy-efficient building technologies and providing coordination, outreach and education to key audiences. Provided subject matter expertise, evaluated energy policies and programs, prepare and issue written and oral reports, disseminate research findings. Supported and assisted other Buildings Program projects involving appliances, commissioning, HVAC and zero-energy buildings. Presentations included Greenbuild, Ecobuild, West Coast Green, Municipality of Anchorage Streetlighting Symposium, International Assn. of Lighting Designers, American Lighting Association, Green California Summit, National Rural Electrical Cooperative Assn., American Council for an Energy-Efficient Economy, Lighting Research Center, New York State Energy Research & Development Authority, UC/CSU/CCC Sustainability Conference, Butte Sustainability Conference, Behavior Energy & Climate Change Conference.

Associate Park and Recreation Specialist
CA Department of Parks and Recreation, Planning Division
1416 9th Street, Sacramento CA 95814
01/01/2003 – 04/27/2005 full time permanent

Conducted planning studies and related analyses in support of the Division's role in statewide recreation planning, state park system planning, and the provision of technical planning assistance. Assignments included survey data analysis; report writing; web site management; analysis of issues related to recreation trends, alternative camping facilities, facility acquisition, and recreation facility plans; local recreation needs assessment; review of standards for public recreation facilities, and review of CA high speed rail program EIR. Wrote and published "Education Leaders' Opinions of Parks and Recreation: A Survey of California School Superintendents" and "Paying for Parks -- An Overview of Fiscal Resources for Local Park and Recreation Agencies." Made presentations to League of CA Cities, CA Park and Recreation Society, Ca State Park Rangers Assn. and other stakeholders.

Associate Park and Recreation Specialist
CA Department of Parks and Recreation, Office of Grants and Local Services
1416 9th Street, Sacramento CA 95814
12/01/2000 – 12/31/2002 full time permanent

Lead person of multidisciplinary teams in development of guidelines for implementation of local grant programs under the Proposition 12 Park Bond Act of 2000. Developed/monitored schedules, wrote/review texts of draft and final guidelines, conducted focus group meetings and public hearings, prepared correspondence. Authored web pages and PowerPoint presentations. Enterd/analyzed data in data bases and spreadsheets. Administered competitive grants programs, including solicitation of proposals, review of applications, site visits, ranking of applications and processing of awards. Provided technical support and other customer service in person and via telephone and email. Provided contract administration services to grantees.

Senior Transportation Planner
CA Department of Transportation, Operations Division
1120 N Street Sacramento, CA 95814
04/22/1991 – 04/05/2000 full time permanent

• Chief, Special Projects Branch (to 7/96, when Branch was eliminated). Conducted program development, supervision and administration of transportation demand management projects including Transportation Management Association and Guaranteed Ride Home Demonstration Grants and telecommunications mobility (i.e. Smart Communities Program) research contracts.
• Technical Expert (to 11/97) for completion of Smart Communities research, which subsequently become a global model for economic development for the New Economy (Canada and League of Arab States)
• Support staff (11/97-6/98) for a special project to implement a major revision of transportation project funding at the state and local level under SB 45 of 1997.

Michael Seaman
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• Technical Expert (from 6/98) for evaluation and analysis of policies and programs, stewardship of departmental efforts at strategic planning and performance measurement, support to senior management including bill analysis, program review and executive transition.

Staff Air Pollution Specialist
CA Air Resources Board, 1102 Q St. Sacramento, CA 95814
09/21/1981 – 04/19/1991, full time permanent

Technical expert position. Conducted research into effects of growth on air quality and related innovative ways to reduce air emissions using transportation and land use controls, coordinated state air quality goals and programs with 4 local district non-attainment area plans, reviewed budgets and programs for internal consistency, provided analysis of complex, sensitive environmental science and policy issues including: local enforcement of stationary source and areawide pollution abatement rules, air pollution control district subventions, designed process for designation and control of toxic air contaminants and establishment of regulatory and administrative systems under federal Clean Air Act and California Clean Air Act.

College Professor
California State University, Sacramento and National University
Sacramento, CA
09/1982 -05/1987, part time contractor

Adjunct faculty for graduate studies in public administration. Courses designed and presented included Environmental Planning, Urban and Regional Planning, and Private Sector vs. Public Policy.

Staff Services Manager I
CA Solid Waste Management Board, 1020 9th St., Suite 300, Sacramento CA 95814
05/01/1978 – 09/21/1981, full time permanent

• Assistant to Board Chairman. Provided technical scientific and policy program advice, carried out research project on settlement of environmental disputes, obtained settlement of a facility siting dispute, conducted statewide seminar series on planning for infrastructure. Provided peer review advice to State of Colorado solid waste management program.
• Chief, State Planning Section (to 6/81 when Section was eliminated). Supervised professional planning staff. Set up statewide planning process, conducted research, recommended actions to Executive Office and Board. Coordinated with other agencies, including guiding Dept. of Health Services' hazardous waste plan, serving on Geothermal Coordinating Council, working with federal program managers who administered the state's grant under the Resource Conservation and Recovery Act. Produced State Plan for Solid Waste Management and special report on Waste Reduction.

Michael Seaman
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Senior Planner
Clatsop-Tillamook Intergovernmental Council, PO Box 488, Cannon Beach OR
11/1976 – 11/1977, full time

Assistant Director of a Council of Governments. Provided community and environmental planning assistance to cities, counties and ports. Coordinated federal, state and local plans and programs for transportation, land use, environmental management and energy conservation. Assisted local jurisdictions with initial compliance with statewide comprehensive planning law (including extended Goals and Guidelines set imposed in coastal areas). Assisted the Director in support of governing Council and day-to-day administration.

Planner III
Snohomish County Planning Department, County Administration Bldg, Everett, WA
10/1975 – 11/1976, full time

Lead planner for regional water quality planning projects in two North Cascade water basins involving nonpoint water pollution as the national policy set emerged concerning urban, agricultural, forest and other runoff. Wrote work plans, directed data collection effort, conducted analyses, managed consulting contractors, worked with state and federal program managers and funders, coordinated responses of participating local governments, and led sedimentation team. Coordinated basin and county-level data with U.S. Soil Conservation Survey in progress. Participated in enforcement actions against illegal waste disposal sites.

Graduate Student Assistant
S.F. Bay Conservation & Development Commission, 30 Van Ness, San Francisco, CA
11/1974 – 08/1975, part time

Under direction of Staff Engineer, established and coordinated a one-stop permit program for dredging and dredged material disposal projects. Collected data, conducted research and analysis, organized cooperative effort among environmental agencies responsible for control of dredge and fill project impacts, and wrote reports including a Report to the Legislature on the regulation of dredging. This work became a model for land use and environmental permit coordination elsewhere in California state government, including the State Clearinghouse of the Office of Planning and Research.

Naval Officer, US Navy Civil Engineer Corps
NWS Fallbrook Annex, Fallbrook CA and NMCB71, FPO NY 09501
03/1969 – 06/1973, full time

• 3/69-6/71--Staff Officer, Engineering Officer, and Assistant Division Officer of a Mobile Construction Battalion. Built roads and port shore facilities. Operated materials testing program for asphalt and concrete. Coordinated Battalion's disaster

preparedness activities. Supervised military personnel and administered various military operations and readiness functions on two overseas deployments.
• 6/71-6/73--Head of Public Works Department for 8800 acre Naval Station, reporting to Commanding Officer. Responsible for transportation operations, heavy equipment, facility maintenance, utilities, natural resources and base housing. Supervised engineers, maintenance workers, equipment and train operators, drivers, support staff. Coordinated environmental research. Established Naval Wildlife Refuge, protecting endangered Kangaroo Rat. Implemented innovative brush control program that achieved fire suppression goals while also conserving and developing wildlife habitat. Managed dryland pasture for agricultural outlease.

EDUCATION AND ASSOCIATIONS

B. Architecture, Univ. of California, Berkeley, Mar 1969
M. Urban Planning, San Jose State University, May 1975
M. Landscape Arch. (Environmental Planning), Univ. of California, Berkeley, June 1975

Associate Member, American Institute of Architects
Member, Professional Ski Instructors of America/American Assn of Snowboard Instructors

Arden Arcade resident since 1978

October 6, 2015

MEMORANDUM

Date: November 9, 2015

To: Board of Directors

From: Paul Siebensohn, Director of Field Operations

Subject: Consider Adoption of Resolution R2015-14, Accepting Water Line Easement at the Retreats West

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RECOMMENDED ACTION

Adopt Resolution R2015-14, accepting water line easement at the Retreats West.

BACKGROUND

The attached easement is required to grant the District access for the purposes of digging, construction, reconstructing, repairing and forever maintaining drain pipes and inlet and other appurtenances thereto, a water easement over, under and upon that certain property in the County of Sacramento, State of California, described in the attached Water Easement.

Staff recommends adoption.

RESOLUTION NO. R2015-14

A RESOLUTION OF THE BOARD OF DIRECTORS OF THE RANCHO MURIETA COMMUNITY SERVICES DISTRICT ACCEPTING OF EASEMENT

BE IT RESOLVED by the Board of Directors of the Rancho Murieta Community Services District that the District accept the Assignment of Water Easement Rights from Carol Anderson Ward, Manager, The Retreats, LLC, a Delaware Limited Liability Company, dated October 26, 2015, a copy of which is attached (Attachment A);

It is hereby accepted by the Board of Directors on behalf of the District, that the Board of Directors does hereby authorize and consent to the recordation of the Easement, and that the District Secretary is authorized and directed to record the Easement with the Sacramento County Recorder's Office.

PASSED AND ADOPTED this 4th day of November, 2015 by the following vote:

Ayes:
Noes:
Abstain:
Absent:

____
Gerald Pasek, President of the Board
Rancho Murieta Community Services District

Attest:

____
Suzanne Lindenfeld
District Secretary

Recording requested by, and
when recorded return to:

Rancho Murieta Community Services District
P.O. Box 1050
15160 Jackson Road
Rancho Murieta, CA 95683

Portion APN 073-0190-099 SPACE ABOVE THIS LINE FOR RECORDER'S USE

GRANT OF EASEMENT
Water Line Easement

Conveyance to government agency -- exempt from recording fees (Government Code sections 6103 & 27383) and documentary transfer tax (Revenue and Taxation Code section 11922).

The Retreats, LLC, a Delaware Limited Liability Company ("Grantor"), the owner of that certain real property ("Property") located in the unincorporated area of the County of Sacramento, State of California, which is known as Lot "A" as shown on that certain map entitled "The Retreats-West", filed in Book 386 of Maps, Page 3, Sacramento County Official Records, grants to Rancho Murieta Community Services District, a local government agency ("District"), a permanent and non-exclusive easement in gross (the "Easement") over, across and under a strip of the Property as described on the attached Exhibit A and as shown on the attached Exhibit B for the survey, design, installation, construction, excavation, use, operation, maintenance, repair, inspection, expansion, improvement, modification, removal, relocation and replacement of water pipelines and related valves, fittings, equipment, facilities and appurtenances; together with the following rights: (a) to reasonable ingress to, and egress from, the Easement over and across Grantor's lands for such purposes; (b) to temporarily use Grantor's lands contiguous to the Easement as may be necessary during construction-related activities; (c) to trim, cut down, clear away or remove any trees, brush, roots, other vegetation or other obstructions on the Easement that now or in the future may obstruct or interfere with the use of the Easement or access to the Easement area or pose a hazard to District equipment, facilities, employees or contractors; (d) to use gates on the Property in fences that may cross the Easement or that restrict access to the Easement; and (e) to mark the location of underground utilities by suitable markers set and maintained on the land surface above the utility line.

This Easement shall be subject to the following terms and conditions:

1. District shall have the right to use the Easement at any time without prior notice to Grantor as may be necessary or convenient for the purposes and rights described above. The Easement rights may be exercised by District and any of its employees, officers and authorized agents and contractors.

2. Grantor shall not disturb or tamper with any pipeline, valve, fitting, equipment, facility or appurtenance that District may construct or install within the Easement area. Grantor shall not construct any building, structure, or fence, conduct any excavation, grading, drilling, tree planting or other ground-surface alteration, or install any other pipelines or underground utilities on or within the Easement area without the prior written consent of District, which consent shall not be withheld unreasonably.

3. Grantor shall not grant to any third party any easement over, under, upon, across or through the Easement area that would interfere with District's use of its Easement.

4. Grantor shall furnish District with keys to all gates that would otherwise restrict District's access to or within the Easement area.

5. The Easement shall run with the Property and bind, and inure to the benefit of, the successors in interest of Grantor and successors in interest and assigns of District.

6. District shall indemnify, defend, protect and hold harmless Grantor, and its officers, employees and agents, from and against any and all liability, claims, damages, expenses, and costs to the extent caused by a negligent act, error or omission, willful misconduct or violation of law of or by District or its officer, employee or authorized agent or contractor in the exercise of rights granted to District by the Easement, except any loss or damage caused by Grantor's sole negligence, gross negligence, active negligence or willful misconduct.

7. Except for the Easement rights granted to District, Grantor shall continue to have the full use, occupancy and enjoyment of the Property.

Dated: _______, 20__ GRANTOR

____

__________________________________ *[name]*

__________________________________ *[title, if applicable]*

ALL SIGNATURES MUST BE NOTARIZED

ACKNOWLEDGMENT BY NOTARY PUBLIC
[Cal. Civ. Code § 1189]

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of California)
County of ___)

On ___________, 20__, before me, ____________________________________, a notary public, personally appeared ____, who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature ________________________________ (Seal)

RECORDING REQUESTED BY:
Rancho Murieta Community Services District

AND WHEN RECORDED MAIL TO:

Rancho Murieta Community Services District
15160 Jackson Road
Rancho Murieta, CA 95683

Portion APN 073-0190-099

SPACE ABOVE THIS LINE FOR RECORDER'S USE ONLY

WATER EASEMENT

THE RETREATS, LLC, a Delaware Limited Liability Company

does hereby grant to Rancho Murieta Community Services District, for the purposes of digging, constructing, reconstructing, repairing and forever maintaining drain pipes and inlet and other appurtenances thereto, a water easement over, under, and upon that certain property in the County of Sacramento, State of California, described as follows:

Refer to attached EXHIBITS "A" and "B" Water Easement.

Dated this 26th day of October, 2015

Carol Anderson Ward

By:
Title: Manager

By:
Title:

ACCEPTANCE

This is to certify that the interest in real property conveyed in this Water Easement dated ____________, 2015 from (The Retreats, LLC, a Delaware Limited Liability Company) to Rancho Murieta Community Services District is hereby accepted pursuant to the authority conferred by Resolution ______ adopted ____________, 2015.

Rancho Murieta Community Services District

Darlene J. Gillum, General Manager

CALIFORNIA ALL-PURPOSE ACKNOWLEDGMENT

A Notary Public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

STATE OF California)

COUNTY OF Sacramento)

On October 26, 2015 (date) before me, Josh Bruno (name of notary officer), notary public,

personally appeared Carol Anderson Ward (name(s) of signer(s)),

who proved to me on the basis of satisfactory evidence to be the person~~(s)~~ whose name~~(s)~~ is/~~are~~ subscribed to the within instrument and acknowledged to me that ~~he~~/she/~~they~~ executed the same in ~~his~~/her/~~their~~ authorized capacity~~(ies)~~, and that by ~~his~~/her/~~their~~ signature~~(s)~~ on the instrument the person(s), or the entity upon behalf of which the person~~(s)~~ acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

JOSH BRUNO
COMM. # 1989070
NOTARY PUBLIC - CALIFORNIA
SACRAMENTO COUNTY
COMM. EXPIRES SEPT. 18, 2016
MGC1

Josh Bruno
Signature of Notary

-----------OPTIONAL SECTION-----------

CAPACITY CLAIMED BY SIGNER

Though statute does not require the Notary to fill in the data below, doing so may prove invaluable to persons relying on the document.

☐ INDIVIDUAL
☐ CORPORATE OFFICER(S)

Title(s)

☐ PARTNER(S) ☐ LIMITED
☐ GENERAL
☐ ATTORNEY-IN-FACT
☐ TRUSTEE(S)
☐ GUARDIAN/CONSERVATOR
☐ OTHER: ______

SIGNER IS REPRESENTING:
Name of Person(s) or entity(ies)

OPTIONAL SECTION:

DATA REQUESTED HERE IS NOT REQUIRED BY LAW.

TITLE OR TYPE OF DOCUMENT: Water Easement

NUMBER OF PAGES ______ DATE ______

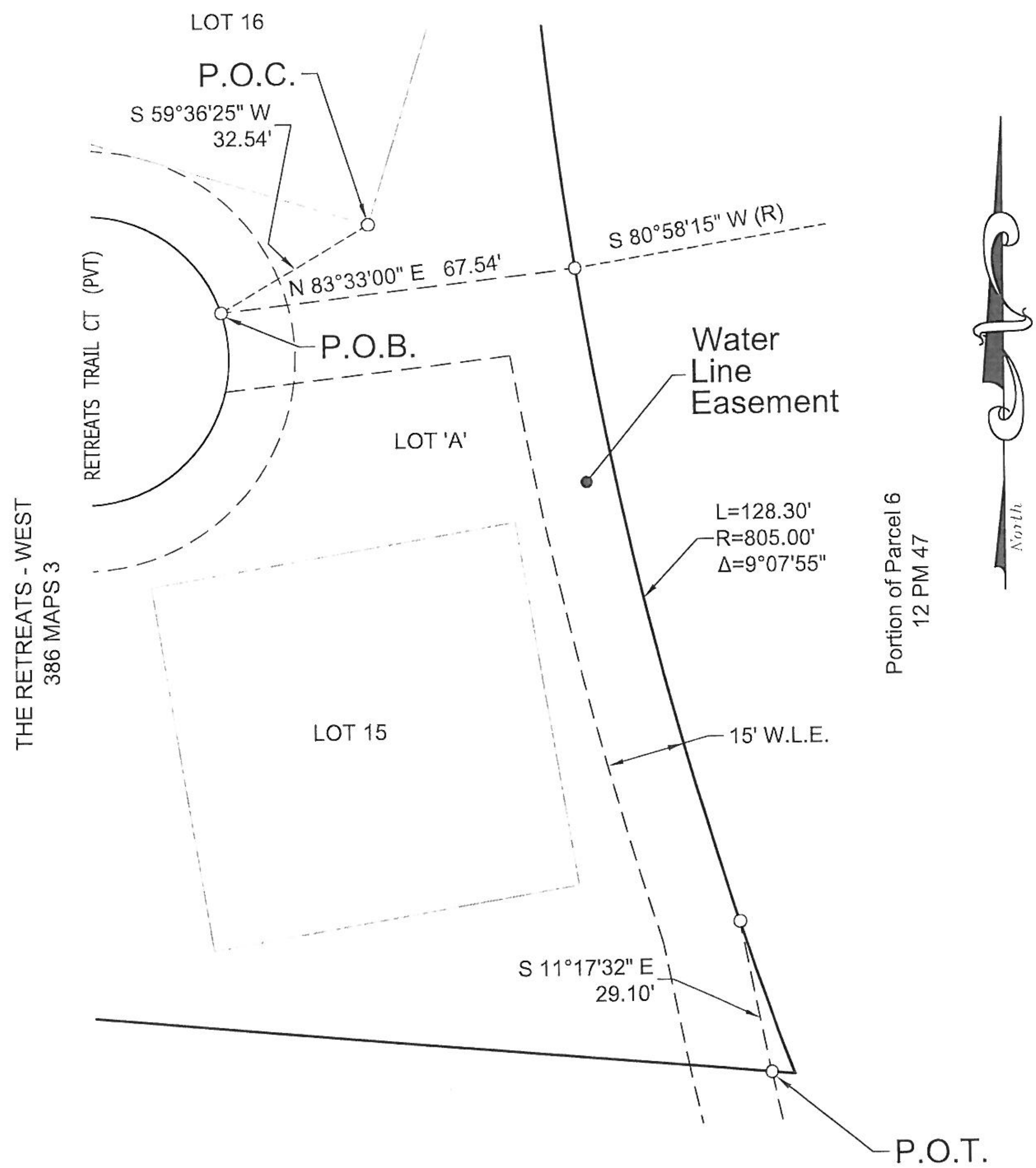
SIGNER(S) OTHER THAN NAMED ABOVE ______

EXHIBIT A
WATER LINE EASEMENT
LEGAL DESCRIPTION

A fifteen (15.00) foot wide Water Line Easement, over, across, and through a portion of Lot 'A' as shown on that certain map entitled 'The Retreats – West', filed in Book 386 of Maps, Page 3, Sacramento County Official Records. The northerly and easterly line of which is described as follows:

Commencing at the most southerly corner of Lot 16 of said map; thence South 59°36'25" West 32.54 feet to a point on the right of way of 'Retreats Trail Court' per said map and the True **Point of Beginning**; thence along said northerly line North 83°33'00" East 67.54 feet to a point on the boundary of said Lot 'A'; thence along said boundary to the left, along the arc of a 805.00 foot radius, non-tangent curve concave to the east, having a central angle of 09°07'55", and an arc length of 128.30 feet; thence leaving said boundary South 11°17'32" East 29.10 feet to a point on the south boundary of said Lot 'A' and the **Point of Termination**. The southerly and westerly lines of said easement to be lengthened or shortened to terminate on the boundary of said Lot 'A' and said right of way.

EXHIBIT 'B'



LEGEND

P.O.C.	POINT OF COMMENCEMENT
P.O.B.	Point of Beginning
P.O.T.	Point of Termination
W.L.E.	Water Line Easement

BAKER-WILLIAMS ENGINEERING GROUP
Engineering / Surveying / Land Planning / Entitlement Processing / GPS Services
6020 Rutland Drive, Suite 19 ~ Carmichael CA 95608
(916) 331-4336 ~ fax (916) 331-4430 ~ office@bwengineers.com

SCALE: 1" = 30'

JOB #: 13-10-049

DATE: Oct., 2015

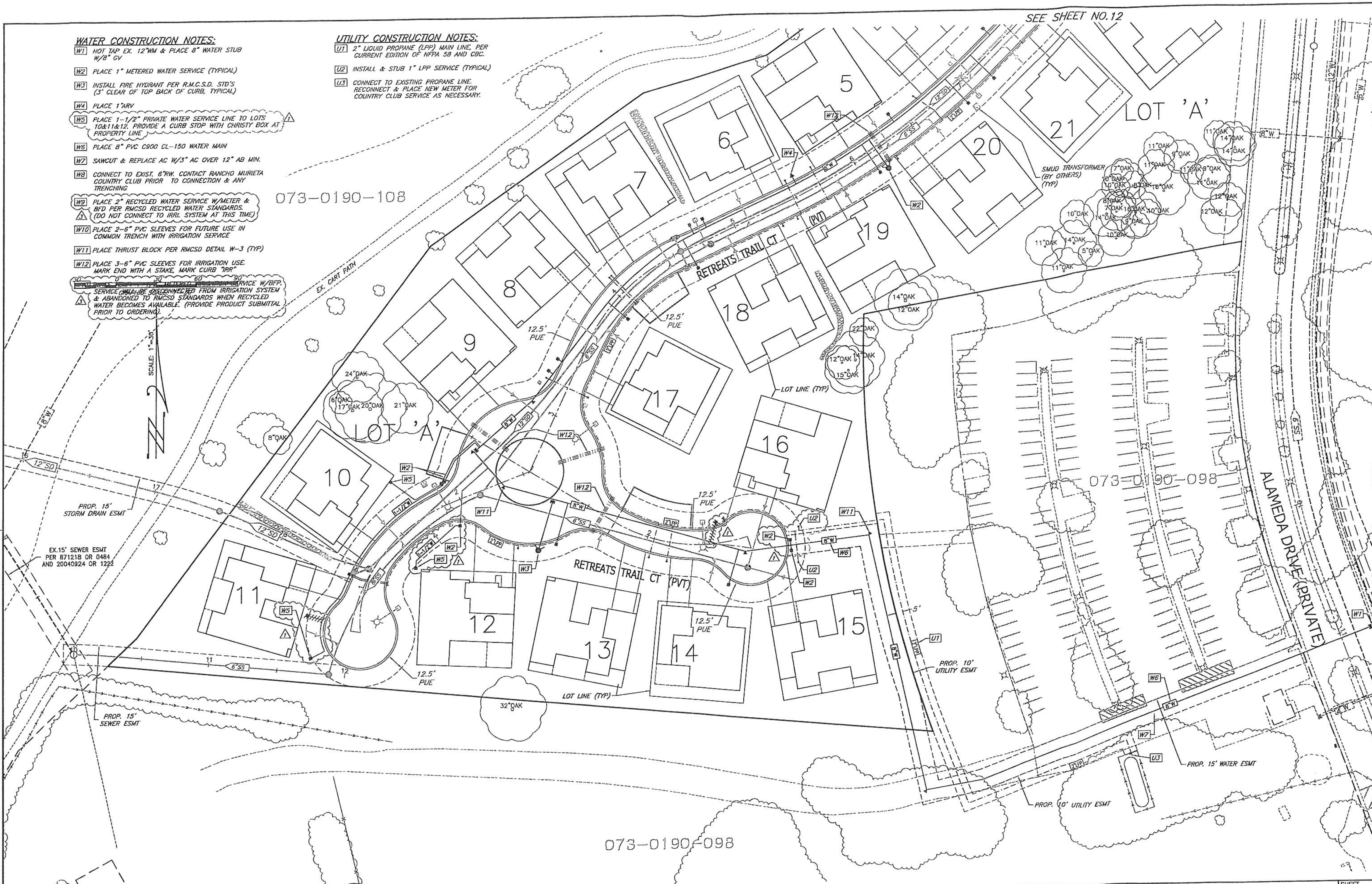
THE RETREATS WEST
ONSITE
WATER LINE EASEMENT
RANCHO MURIETA, CALIFORNIA

WATER CONSTRUCTION NOTES:

- W1 HOT TAP EX. 12"WM & PLACE 8" WATER STUB W/8" GV
- W2 PLACE 1" METERED WATER SERVICE (TYPICAL)
- W3 INSTALL FIRE HYDRANT PER R.M.C.S.D. STD'S (3' CLEAR OF TOP BACK OF CURB, TYPICAL)
- W4 PLACE 1"ARV
- W5 PLACE 1-1/2" PRIVATE WATER SERVICE LINE TO LOTS 10&11&12. PROVIDE A CURB STOP WITH CHRISTY BOX AT PROPERTY LINE 1
- W6 PLACE 8" PVC C900 CL-150 WATER MAIN
- W7 SAWCUT & REPLACE AC W/3" AC OVER 12" AB MIN.
- W8 CONNECT TO EXIST. 6"RW. CONTACT RANCHO MURIETA COUNTRY CLUB PRIOR TO CONNECTION & ANY TRENCHING
- W9 PLACE 2" RECYCLED WATER SERVICE W/METER & BFD PER RMCSD RECYCLED WATER STANDARDS. 3 (DO NOT CONNECT TO IRRI. SYSTEM AT THIS TIME)
- W10 PLACE 2-6" PVC SLEEVES FOR FUTURE USE IN COMMON TRENCH WITH IRRIGATION SERVICE
- W11 PLACE THRUST BLOCK PER RMCSD DETAIL W-3 (TYP)
- W12 PLACE 3-6" PVC SLEEVES FOR IRRIGATION USE. MARK END WITH A STAKE, MARK CURB "IRR"
- W13 ~~PLACE TEMP 1-1/2" METERED IRRIGATION~~ SERVICE W/BFP. SERVICE WILL BE DISCONNECTED FROM IRRIGATION SYSTEM 3 & ABANDONED TO RMCSD STANDARDS WHEN RECYCLED WATER BECOMES AVAILABLE. (PROVIDE PRODUCT SUBMITTAL PRIOR TO ORDERING).

UTILITY CONSTRUCTION NOTES:

- U1 2" LIQUID PROPANE (LPP) MAIN LINE, PER CURRENT EDITION OF NFPA 58 AND CBC.
- U2 INSTALL & STUB 1" LPP SERVICE (TYPICAL)
- U3 CONNECT TO EXISTING PROPANE LINE. RECONNECT & PLACE NEW METER FOR COUNTRY CLUB SERVICE AS NECESSARY.



NO.	DESCRIPTION	ENGR INIT	COUNTY APPROVAL APPROVED BY	DATE
1	REV. WATER SERVICE TO LOTS 11,12,15,16			

benchmark 1B-85 elev. 173.55

2" BRONZE DISC STAMPED "SACRAMENTO CO. DEPT OF PUBLIC WORKS B.M. 1B-85 UMBERGER-PETERS 1978" LOCATED IN TOP OF EAST CONCRETE RAILING, EAST END OF SOUTH ABUTMENT OF CONCRETE BRIDGE ON SCOTT RD. @ CREVIS CK. & APPROXIMATE 0.10 MILE NORTH OF LATROBE RD. SEE LL S-122. LEVELS RUN FROM CO. B.M. 1B-23 NAVD 88 DATUM.

REGISTERED PROFESSIONAL ENGINEER MICHAEL T. ROBERTSON No.39875 Exp.12-31-15 CIVIL STATE of CALIFORNIA

MICHAEL T. ROBERTSON RCE 39875

PLOT DATE: 03-31-14 07-07-14 09-22-14 12-02-14

SCALE horiz: 1"=30' vert: N/A

01/16/15 date

drafted by: S.F.L. designed by: M.T.R. checked by: S.F.L.

715 field book

BAKER-WILLIAMS ENGINEERING GROUP
Engineering / Surveying / Land Planning / Entitlement Processing / GPS Services
6020 Rutland Drive, Suite 19 ~ Carmichael, CA. 95608
(916) 331-4336 ~ fax (916) 331-4430 ~ office@bwengineers.com

WATER & UTILITY PLAN
THE RETREATS - WEST

RANCHO MURIETA SACRAMENTO COUNTY CALIFORNIA

SHEET 11 OF 20 SHEETS

13-10-049 JOB NUMBER

1310049-WAT-PLAN1

MEMORANDUM

Date: November 11, 2015

To: Board of Directors

From: Darlene J. Gillum, General Manager

Subject: Consider Adoption of Resolution R2015-15, Electing to be Subject to Government Code Section 22893 to Establish Health Vesting Requirements for Future Annuitants Under the Pubic Employees Medical and Hospital Care Act with Respect to a Recognized Employee Organization

---

RECOMMENDED ACTION

Adopt Resolution R2015-15, electing to be subject to Government Code Section 22893 to establish health vesting requirements for future annuitants under the Pubic Employees Medical and Hospital Care Act (PEMHCA) with respect to a recognized employee organization.

BACKGROUND

Government Code Section 22893 provides that a contracting agency subject to the Public Employees' Medical and Hospital Care Act may file a Resolution with the Board of the California Public Employees' Retirement System (PERS) to provide a post-retirement health benefits vesting requirement to employees who retire for service in accordance with Government Code Section 22893.

The attached Resolution implements the PEMHCA vesting schedule for retiree medical for all employees hired on or after January 1, 2016. Under the vesting schedule, retirees will be eligible to receive medical benefits on a vesting schedule established in Government Code Section 22893 as follows:

PERS Service Years	Vesting %
<10	0%
10	50%
11	55%
12	60%
13	65%
14	70%
15	75%
16	80%
17	85%
18	90%
19	95%
20	100%

Government Code Section 22893 also establishes the maximum monthly employer contribution to retiree medical premiums as follows for 2016 (this is the amount to which the vesting percent is applied and represents 100% for 20 years of service):

Employee	$ 705.00
Employee +1	$1,343.00
Family	$1,727.00

In comparison, the following contributions are provided to employees under the non-vesting schedule:

	Represented (80% of lowest cost HMO)	**Represented** (80% of Kaiser SR Adv Medicare Supplemental	**Unrepresented** (100% of lowest cost HMO)	**Unrepresented** (100% of Kaiser SR Adv Medicare Supplemental
Employee	$556.09	$237.78	$695.11	$297.23
Employee + 1	$1,112.18	$475.57	$1,390.22	$594.46
Family	$1,445.83	$713.35	$1,807.29	$891.69

Annuitants that participate in a medical plan that has a monthly premium in excess of their maximum monthly employer contribution based on the annuitant's years of PERS service are responsible for paying the excess premium directly to PERS. An annuitant's monthly premium, for a regular healthcare plan or Medicare supplemental plan that is lower than their maximum monthly employer contribution based on the annuitant's years of PERS service is paid 100% by the employer contribution. The annuitant does not receive any cash back for the difference in monthly premium and the maximum employer contribution.

Annually, employees hired before January 1, 2016 can elect to be covered under the vesting schedule. In 2016, represented employees with 17 years of PERS service, 5 of which must be with the District, receive a higher retiree benefit under the vesting schedule than under the District's current retiree benefit of 80% of the lowest cost HMO premium. Once an employee elects the retiree vesting program for medical benefits they cannot revert back to the current District retiree benefit.

Government Code Section 22893 requires that employees covered by an MOU (represented employees) vote on the election of retiree medical vesting. This provision was included in the MOU adopted/ratified by represented employees in March 2015.

Staff recommends adoption.

RESOLUTION NO. R2015-15

A RESOLUTION OF THE BOARD OF DIRECTORS OF THE RANCHO MURIETA COMMUNITY SERVICES DISTRICT ELECTING TO BE SUBJECT TO GOVERNMENT CODE SECTION 22893 TO ESTABLISH HEALTH VESTING REQUIREMENTS FOR FUTURE ANNUITANTS UNDER THE PUBLIC EMPLOYEES' MEDICAL AND HOSPITAL CARE ACT WITH RESPECT TO A RECOGNIZED EMPLOYEE ORGANIZATION

WHEREAS, Government Code Section 22893 provides that a contracting agency subject to the Public Employees' Medical and Hospital Care Act (the "Act") may file a Resolution with the Board of the California Public Employees' Retirement System (PERS) to provide a post-retirement health benefits vesting requirement to employees who retire for service in accordance with Government Code Section 22893; and

WHEREAS, Rancho Murieta Community Services District is a contracting agency under Government Code Section 22920 and subject to the Act for participation by members of the Operating Engineers Local Union No. 3, AFL-CIO; and

WHEREAS, Rancho Murieta Community Services District certifies some employees are represented by a bargaining unit and there is an applicable memorandum of understanding; and

WHEREAS, the credited service of an employee for purposes of determining the percentage of employer contribution applicable under Government Code Section 22893 shall mean service as defined in Government Code Section 20069, except that not less than five (5) years of that service shall be performed entirely with the Rancho Murieta Community Services District; and

WHEREAS, the employer contribution for active employees cannot be less then what is defined in Government Code Section 22892(b);

NOW, THEREFORE BE IT RESOLVED,

a. That Employees first hired on or after the effective date of this Resolution shall be subject to the requirements defined in Government Code Section 22893, except that the employer may, once each year without discrimination, allow all employees who were first employed before Government Code Section 22893 became applicable to the employer to individually elect to be subject to the provisions of Government Code Section 22893, and the employer shall notify the Board which employees have made that election; and be it further resolved

b. That the employer contribution shall be necessary to pay the full cost of his/her enrollment, including the enrollment of family members, in a health benefits plan or plans up to a maximum of the amounts prescribed by

Government Code Section 22893(a)(1), plus Administrative fees and Contingency Reserve assessments; and be it further resolved

c. That the percentage of employer contribution payable for post-retirement health benefits for each annuitant shall be based on the employee's completed years of credited service based upon the table in Government Code Section 22893; and be it further resolved

d. Rancho Murieta Community Services District has fully complied with any and all applicable provisions of Government Code Section 7507 in electing the benefits set forth above; and be it further resolved

e. That the participation of the employees and annuitants of Rancho Murieta Community Services District shall be subject to determination of its status as an "agency or instrumentality of the state or political subdivision of a State" that is eligible to participate in a governmental plan within the meaning of Section 414(d) of the Internal Revenue Code, upon publication of final Regulations pursuant to such Section. If it is determined that Rancho Murieta Community Services District would not qualify as an agency or instrumentality of the state or political subdivision of a State under such final Regulations, the California Public Employees' Retirement System may be obligated, and reserves the right, to terminate the health coverage of all participants of the employer; and be it further resolved

f. That the executive body appoint and direct, and it does hereby appoint and direct, Darlene J. Gillum, General Manager, to file with the Board a verified copy of this resolution, and to perform on behalf of Rancho Murieta Community Services District all functions required of it under the Act; and be it further resolved

g. That coverage under the Act be effective on January 1, 2016.

Adopted at a Regular meeting of the Governing Board at Rancho Murieta Community Services District, this 18th day of November, 2015, by the following vote:

Ayes:
Noes:
Abstain:
Absent:

____
Gerald Pasek, President of the Board
Rancho Murieta Community Services District

Attest:

____
Suzanne Lindenfeld

District Secretary

RANCHO MURIETA COMMUNITY SERVICES DISTRICT

15160 JACKSON ROAD
RANCHO MURIETA, CA 95683
916-354-3700
FAX – 916-354-2082

AGENDA

"Your Independent Local Government Agency Providing
Water, Wastewater, Drainage, Security, and Solid Waste Services"

REGULAR BOARD OF DIRECTORS MEETINGS ARE HELD
3rd Wednesday of Each Month

REGULAR BOARD MEETING
NOVEMBER 18, 2015
Open Session 5:00 p.m.
RMCSD Administration Building – Board Room
15160 Jackson Road
Rancho Murieta, CA 95683

BOARD MEMBERS

Gerald Pasek	President
Betty Ferraro	Vice President
Morrison Graf	Director
Michael Martel	Director
Mark Pecotich	Director

STAFF

Darlene J. Gillum	General Manager
Greg Remson	Security Chief
Paul Siebensohn	Director of Field Operations
Eric Thompson	Controller
Suzanne Lindenfeld	District Secretary

RANCHO MURIETA COMMUNITY SERVICES DISTRICT

REGULAR BOARD MEETING

NOVEMBER 18, 2015

Open Session 5:00 p.m.

All persons present at District meetings will place their cellular devices in silent and/or vibrate mode (no ringing/sound of any kind). During meetings, these devices will be used only for emergency purposes and, if used, the party called/calling will exit the meeting room for conversation. Other electronic and internet enabled devices are to be used in the "silent" mode. Under no circumstances will recording devices or problems associated with them be permitted to interrupt or delay District meetings.

AGENDA

RUNNING TIME

1. **CALL TO ORDER** - Determination of Quorum - President Pasek **(Roll Call)** 5:00

2. **ADOPT AGENDA** (Motion)

3. **SPECIAL ANNOUNCEMENTS AND ACTIVITIES**

4. **COMMENTS FROM THE PUBLIC** 5:05

Members of the public may comment on any item of interest within the subject matter jurisdiction of the District and any item specifically agendized. Members of the public wishing to address a specific agendized item are encouraged to offer their public comment during consideration of that item. With certain exceptions, the Board may not discuss or take action on items that are not on the agenda.

If you wish to address the Board at this time or at the time of an agendized item, as a courtesy, please state your name and address. Speakers presenting individual opinions shall have 3 minutes to speak. Speakers presenting opinions of groups or organizations shall have 5 minutes per group.

5. **CONSENT CALENDAR** (Motion) **(Roll Call Vote)** *(5 min.)* 5:10

All the following items in Agenda Item 5 will be approved as one item if they are not excluded from the motion adopting the consent calendar.

a. Approval of October 21, 2015 Board Meeting Minutes
b. Bills Paid Listing

6. **STAFF REPORTS** (Receive and File)

a. General Manager's Report
b. Administration/Financial Report
c. Security Report
d. Water/Wastewater/Drainage Report

7. **CORRESPONDENCE**

a. Email from Brad Sample, dated October 21, 2015
b. Letter from Brad Sample, dated November 10, 2015

8. **RECEIVE PRESENTATION OF THE DRAFT 2014-2015 ANNUAL AUDIT REPORT BY LARRY BAIN, CPA** (Receive and File) *(15 min.)* — 5:15

9. **CONSIDER APPROVAL OF THE SOLAR POWER PROJECT - CEQA SERVICES, SUPPORT AND DOCUMENTATION PROPOSAL** (Discussion/Action) (Motion) **(Roll Call Vote)** *(5 min.)* — 5:30

10. **CONSIDER SELECTION OF SPECIAL DISTRICT COMMISSIONER FOR THE SACRAMENTO LOCAL AGENCY FORMATION COMMISSION** (Discussion/Action) (Motion) *(5 min.)* — 5:35

11. **CONSIDER ADOPTION OF RESOLUTION R2015-14, ACCEPTING WATER LINE EASEMENT AT THE RETREATS WEST** (Discussion/Action) (Motion) **(Roll Call Vote)** *(5 min.)* — 5:40

12. **CONSIDER ADOPTION OF RESOLUTION R2015-15, ELECTING TO BE SUBJECT TO GOVERNMENT CODE SECTION 22893 TO ESTABLISH HEALTH VESTING REQUIREMENTS FOR FUTURE ANNUITANTS UNDER THE PUBLIC EMPLOYEES' MEDICAL AND HOSPITAL CARE ACT** (Discussion/Action) (Motion) **(Roll Call Vote)** *(5 min.)* — 5:45

13. **RECEIVE SECURITY AD HOC COMMITTEE UPDATE** (Discussion/Action) *(15 min.)* — 5:50
    - **a.** Gate Policy
    - **b.** North Gate Use Agreement
    - **c.** Security Impact Fee Policy
    - **d.** Surveillance Camera Policy

14. **RECEIVE UPDATES** (Discussion/Action) *(15 min.)* — 6:05
    - **a.** Parks Committee
    - **b.** Development - County Notice of Preparation
    - **c.** Recycled Water Project
    - **d.** Ad Hoc Committee Formation

15. **RECEIVE WATER TREATMENT PLANT EXPANSION PROJECT UPDATE** (Discussion/Action) *(5 min.)* — 6:20
    - **a.** Water Treatment Plant Expansion Project Engineering Report

16. **REVIEW AND SELECT CONFERENCE/EDUCATION OPPORTUNITIES** (Discussion/Action) *(5 min.)* — 6:25

17. **REVIEW MEETING DATES/TIMES:**
    Special Board Meeting: December 2, 2015 - open session at 4:00 p.m.
    Joint Security Committee Meeting: December 3, 2015 - 10:00 a.m. at District Office
    Regular Board Meeting: December 16, 2015 - open session at 5:00 p.m.
    Board Goal Workshop: January 13, 2016 - open session at 2:00 p.m.
    Regular Board Meeting: January 20, 2016 - open session at 5:00 p.m.

18. COMMENTS/SUGGESTIONS – BOARD MEMBERS AND STAFF 6:30

In accordance with Government Code 54954.2(a), Directors and staff may make brief announcements or brief reports of their own activities. They may ask questions for clarification, make a referral to staff or take action to have staff place a matter of business on a future agenda.

19. ADJOURNMENT (Motion) 6:35

"In accordance with California Government Code Section 54957.5, any writing or document that is a public record, relates to an open session agenda item and is distributed less than 72 hours prior to a regular meeting, will be made available for public inspection in the District offices during normal business hours. If, however, the document is not distributed until the regular meeting to which it relates, then the document or writing will be made available to the public at the location of the meeting."

Note: This agenda is posted pursuant to the provisions of the Government Code commencing at Section 54950. The date of this posting is November 13, 2015. Posting locations are: 1) District Office; 2) Plaza Foods; 3) Rancho Murieta Association; 4) Murieta Village Association.

MEMORANDUM

Date: November 16, 2015

To: Board of Directors

From: Darlene J. Gillum, General Manager

Subject: Consider Adoption of Resolution R2015-16, CalPERS Employer Paid Member Contribution for Represented Employees

---

RECOMMENDED ACTION

Adopt Resolution R2015-16, amending the amount of Employer Paid Member Contributions (EPMC) to Public Employees Retirement System (PERS) for represented employees from two percent (2%) to one percent (1%), effective January 1, 2016.

BACKGROUND

The current Memorandum of Understanding between the District and Operating Engineers Local 3 (OE-3) for the represented employees increases their member contribution to the employee's PERS share of retirement contribution as follows:

January 1, 2015	5%
January 1, 2016	6%
January 1, 2017	7%

With these changes, the District's Employer Paid Member Contribution (EPMC) is reduced to 2% effective January 1, 2015, 1% effective on January 1, 2016, and 0% effective January 1, 2017.

CalPERS requires this change to be documented by resolution. This resolution covers calendar year 2016. A separate resolution will be required for 2017.

RESOLUTION R2015-16

A RESOLUTION OF THE BOARD OF DIRECTORS OF RANCHO MURIETA COMMUNITY SERVICES DISTRICT AMENDING THE AMOUNT OF EMPLOYER PAID TAX DEFERRING MEMBER CONTRIBUTIONS TO THE PUBLIC EMPLOYEES RETIREMENT SYSTEM (PERS)

WHEREAS, the governing body of the Rancho Murieta Community Services District has the authority to implement, and has implemented, Government Code Section 20691;

WHEREAS, the governing body of the Rancho Murieta Community Services District has a written labor policy or agreement which specifically provides for a portion of the normal member contributions to be paid by the employer;

WHEREAS, one of the steps in the procedures to implement or revise implementation of Section 20691 is the adoption by the governing body of the Rancho Murieta Community Services District of a Resolution to commence payment of Employer Paid Member Contributions (EPMC) or revise the amount of that payment;

WHEREAS, the governing body of the Rancho Murieta Community Services District has identified the following conditions for the purpose of its election to pay a revised EPMC:

- This benefit shall apply to all employees of Group One (Represented)
- This benefit shall consist of paying one percent (1%) of the normal member contributions as EPMC.

WHEREAS, the effective date of this Resolution shall be January 1, 2016.

NOW, THEREFORE, BE IT RESOLVED, that the Board of Directors of the Rancho Murieta Community Services District elects to pay a revised EPMC, as set forth above.

PASSED AND ADOPTED by the Board of Directors of the Rancho Murieta Community Services District at their regular meeting held on this 18th day of November, 2015, by the following roll call vote:

Ayes:
Noes:
Absent:
Abstain:

____
Gerald Pasek, President of the Board
Rancho Murieta Community Services District

[seal]

Attest:

____
Suzanne Lindenfeld, District Secretary

MEMORANDUM

Date: November 16, 2015

To: Board of Directors

From: Darlene J. Gillum, General Manager

Subject: Consider Adoption of Resolution R2015-17, CalPERS Employer Paid Member Contribution for Unrepresented Employees

---

RECOMMENDED ACTION

Adopt Resolution 2015-17, amending the amount of Employer Paid Member Contributions (EPMC) to Public Employees Retirement System (PERS) for unrepresented employees from two percent (2%) to one percent (1%), effective January 1, 2016.

BACKGROUND

The current Memorandum of Understanding between the District and Operating Engineers Local 3 (OE-3) for the represented employees increases their member contribution to the employee's PERS share of retirement contribution as follows:

January 1, 2015	5%
January 1, 2016	6%
January 1, 2017	7%

With these changes, the District's Employer Paid Member Contribution (EPMC) is reduced to 2% effective January 1, 2015, 1% effective on January 1, 2016, and 0% effective January 1, 2017.

CalPERS requires this change to be documented by resolution. This resolution covers calendar year 2016. A separate resolution will be required for 2017.

This Resolution 1015-17 applies the same EPMC reduction to 1% for unrepresented employees effective January 1, 2016.

RESOLUTION 2015-17

A RESOLUTION OF THE BOARD OF DIRECTORS OF RANCHO MURIETA COMMUNITY SERVICES DISTRICT AMENDING THE AMOUNT OF EMPLOYER PAID TAX DEFERRING MEMBER CONTRIBUTIONS TO THE PUBLIC EMPLOYEES RETIREMENT SYSTEM (PERS)

WHEREAS, the governing body of the Rancho Murieta Community Services District has the authority to implement Government Code Section 20691;

WHEREAS, the governing body of the Rancho Murieta Community Services District has a written labor policy or agreement which specifically provides for the normal member contributions to be paid by the employer;

WHEREAS, one of the steps in the procedures to implement Section 20691 is the adoption by the governing body of the Rancho Murieta Community Services District of a Resolution to commence said Employer Paid Member Contributions (EPMC);

WHEREAS, the governing body of the Rancho Murieta Community Services District has identified the following conditions for the purpose of its election to pay EPMC:

- This benefit shall apply to all employees of Group Two (Unrepresented)
- This benefit shall consist of paying one percent (1%) of the normal member contributions as EPMC.

WHEREAS, the effective date of this Resolution shall be January 1, 2016.

NOW, THEREFORE, BE IT RESOLVED, that the Board of Directors of the Rancho Murieta Community Services District elects to pay EPMC, as set forth above.

PASSED AND ADOPTED by the Board of Directors of the Rancho Murieta Community Services District at their regular meeting held on this 18th day of November 2015, by the following roll call vote:

Ayes:
Noes:
Absent:
Abstain:

____
Gerald Pasek, President of the Board
Rancho Murieta Community Services District

[seal]

Attest:

____
Suzanne Lindenfeld, District Secretary

MEMORANDUM

Date: November 13, 2015

To: Board of Directors

From: Darlene J. Gillum, General Manager

Subject: Security Ad Hoc Committee Update – Surveillance Camera Plan

---

RECOMMENDED ACTION

Receive update and provide direction to staff.

BACKGROUND

The attached questionnaire was supplied to each Director on November 12, 2015 to obtain individual input regarding the scope of the District Surveillance Camera Plan. Responses are requested by Monday afternoon, November 16, 2015. A compilation of the responses will be provided at the November 18, 2015 Board Meeting for discussion and staff direction on how to proceed with updating the Surveillance Camera Plan.

The recent recommendations from the Security Ad Hoc committee regarding the District's Surveillance Camera Plan diverts from the currently approved surveillance plan by expanding the District's responsibility to a District-wide camera system, meaning the District accepts responsibility for providing the cameras, the network infrastructure, and repair, maintenance and replacement of the equipment. It also expands the definition of "public access" areas beyond public ingress and egress points to include parking lots, parks, and streets. The following questions are intended to assist the board in making a decision on the expanse of the District surveillance system.

Perceived cost of the surveillance system should not influence your answers to the questions. Once the board's decision is reached, a RFP for the surveillance system can be released to determine the cost of the system and the recommended camera type. Then the determination can be made as to how the District can financially support the surveillance system. Some portion of the surveillance system will be supported by the Security Impact Fees that will be collected from developers upon water permit issuance.

1. Should the District's surveillance system be expanded beyond public ingress and egress points? Ingress and egress points are currently defined as entry and exit points into the RMA (currently monitored by the North and South gate cameras), into the Murieta Village from Murieta Parkway and Lone Pine Drive, into the Murieta Inn parking lot, into the parks, etc.	Yes	No
2. If yes, Should Parking lot interiors be monitored by District supplied cameras? All parking lots would be treated equally to include all existing lots such as parking lots at the FAA building, the Catholic Church, the RMCC, the Country Store, the Plaza, the RMA, the airport, the Murieta Village community building, etc.	Yes	No
Should Parks interiors be included?	Yes	No
Should street cameras within the Murieta Village and RMA be included?	Yes	No
Should the golf courses be included?	Yes	No
3. Provide any additional comments or questions:		

MEMORANDUM

Date: November 13, 2015

To: Board of Directors

From: Darlene J. Gillum, General Manager

Subject: Update – County Notice of Preparation, Control No. PLNP2014-00206

RECOMMENDED ACTION

Receive update.

BACKGROUND

Sacramento County Department of Community Development released the Notice of Preparation of a Draft Environmental Impact Report for Rancho Murieta North, Control Number PLNP2014-00206. The District received the NOP on November 6, 2015 and has thirty days to provide comment. I have prepared a response letter and have sent it to Dick Shanahan for legal review. He is out of the office until November 24, 2015. The District response will be placed on the agenda for the Special Board Meeting tentatively scheduled for December 2, 2015.

Department of
Community Development
Lori A. Moss, Director

RECEIVED
NOV 06 2015
Rancho Murieta
Community Services District

Divisions
Administrative Services
Building Permits & Inspection
Code Enforcement
County Engineering
Economic Development & Marketing
Planning & Environmental Review

DEPARTMENT OF COMMUNITY DEVELOPMENT
Planning and Environmental Review Division
NOTICE OF PREPARATION

NOVEMBER 2, 2015

TO: ALL INTERESTED PARTIES

SUBJECT: NOTICE OF PREPARATION OF A DRAFT ENVIRONMENTAL IMPACT REPORT FOR RANCHO MURIETA NORTH

Sacramento County will be the CEQA Lead Agency for preparation of an Environmental Impact Report (EIR) for a project known as RANCHO MURIETA NORTH. This Notice of Preparation has been sent to responsible and trustee agencies and involved federal agencies pursuant to Section 15082 of the CEQA Guidelines. Agencies should comment on the scope and content of the environmental information that is germane to the agencies' statutory responsibilities in connection with the proposed project. Due to the time limits mandated by State law, your response must be sent at the earliest possible date, but not later than 30 days after receipt of this notice.

The project description, location, and the probable environmental effects are contained in the attached materials and may also be viewed online at: http://www.per.saccounty.net.

Please send your Agency's response to this Notice to:

> Catherine Hack, Environmental Coordinator
> Department of Community Development
> Planning and Environmental Review Division
> 827 7th Street, Room 225, Sacramento, CA 95814
> or via e-mail at: CEQA@saccounty.net.

Your response should include the name of a contact person in your agency.

Agencies with specific questions about the project should contact Shelby Maples, Project Manager, at (916) 874-6323 for further information.

PROJECT TITLE:

RANCHO MURIETA NORTH ZONING ORDINANCE AMENDMENT, REZONE, LARGE LOT TENTATIVE SUBDIVISION MAP, SMALL LOT TENTATIVE SUBDIVISION MAP, USE PERMITS, SPECIAL DEVELOPMENT PERMIT, AND DESIGN REVIEW

CONTROL NUMBER:

PLNP2014-00206

PROJECT PROPONENT(S):

Applicant/Owner:

Rancho Murieta Properties, LLC

Engineer:

Baker-Williams Engineering Group

PROJECT DESCRIPTION AND LOCATION:

The project site includes approximately 772.2 acres located in the Rancho Murieta community. This proposal encompasses the majority of the remaining land within the Rancho Murieta Planned Development. The entitlement request includes a Zoning Ordinance Amendment, a Rezone, large and small lot Tentative Subdivision Maps, Use Permits, a Special Development Permit, and a Design Review.

The existing project site is designated by the Sacramento County General Plan for low density residential (LDR) for the majority of the site, and Public/ Quasi Public (PQP) for an approximately 39.8 acre parcel that the applicant proposes for commercial use. The existing General Plan designations are to remain.

Rancho Murieta was approved in 1969 as a Planned Development and is within the Sacramento County Urban Services Boundary. At present, there are 2,517 existing residential units in the Rancho Murieta Planned Development, including mobile home and condominium units. An interim zoning designation of A-2 (PD) has been used for the majority of the property. The proposed zoning for the subdivisions would be Residential Density RD-4 or RD-5, with other areas zoned for General Commercial (GC) or Open Space (O). An approximately three acre parcel at the southeast corner of Murieta Parkway and Camino De Lago (APN 073-080-007) will be rezoned to a RD-4 designation as a part of the PD Ordinance Amendment, but is not proposed for subdivision at this time. The project will include approximately 299.6 acres of residential development, 432.8 acres of Park/Recreation/Open Space, and 39.8 acres of General Commercial. See Plate NOP-1 for existing and proposed zoning.

The project includes the development of 827 single family homes on RD-4 and RD-5 lots throughout the project site. The lots will be separated into eight villages as a part of the proposed large lot tentative subdivision map. The village sizes range from 42 to 167 lots, with open space/park, street, and utility parcels also included in each village. Table NOP-1 accounts for the number of parcels within each village. The plan also includes an approximately 39.8 acre parcel on the south side of Jackson road which is intended for commercial uses, as well as the three acre parcel at the southeast corner of Murieta Parkway and Camino De Lago intended for use as a community nature, recreation and resource area. The resource area could include such additional features as a map kiosk, picnic area, hiking and biking maps, or wildlife information.

Table NOP-1: Lot Counts by Village

Village	No. Residential Lots	Open space/park parcels	Utility Parcels	Street Lots
"A", see Plate NOP-2	167	10	1	1
"B", see Plate NOP-3	167	9	2	1
"C", see Plate NOP-4	130	5	2	1
"D", see Plate NOP-5	42	3	1	1
"E", see Plate NOP-6 and Plate NOP-7	43	3	2	1
"F", see Plate NOP-8	95	5	2	1
"G", see Plate NOP-9 and Plate NOP-10	53	3	1	1
"H", see Plate NOP-11	130	8	2	1
Total	**827**	**46**	**13**	**8**

Of the 772.2 acres, approximately 432.8 acres will be used for parks, recreation, open space, and trail uses. The development proposes to connect to the existing trail system and develop a complementary trail system throughout the project site. The proposal also includes designated pedestrian trails adjacent to the sidewalk on the community collector streets.

The streets within Rancho Murieta are privately owned and maintained. The project is accessed from Murieta Parkway, which features a gated entrance at Jackson Highway (Highway 16). The proposed network of streets in the project area will include a community collector for the majority of traffic movement, along with neighborhood collector streets and minor residential streets to the individual neighborhoods. As Rancho Murieta is a golf community, the major community collectors will provide separate Neighborhood Electric Vehicle (NEV) access and connectivity, which will also serve as bike paths. Golf carts are commonly utilized in the community, and are allowed on the internal street sections as well as on the paved bike paths. Emergency vehicle access points will be installed where necessary to service the villages.

REQUESTED ENTITLEMENTS

The applicant requests the following entitlements from Sacramento County:

1. A **Zoning Ordinance Amendment** to the Rancho Murieta Planned Development (PD) Ordinance (77-PD-10) to allow the proposed large and small lot tentative subdivision map and associated projects and entitlements, including 827 single-family residential lots, 39.8 acres of general commercial, as well as recreation and open space areas including an approximately 3-acre community nature & resource area. Additionally, the proposed Amendment would reconfigure the open space areas as shown on the approved master plan and alter the densities shown on the approved master plan, including an increase in density from three dwelling units per acre to four and five dwelling units per acre in some areas [RD-4 (PD) (Residential) and RD-5 (PD) (Residential)].
2. A **Rezone** of approximately 772.2 ± gross acres from A-2 (PD) to 230.0 acres of RD-4 (PD) (Residential); 67.1 acres of RD-5 (PD) (Residential); 435.3 acres of Recreation/Open Space (PD); and 39.8 acres of GC (PD) (General Commercial).
3. A large lot **Tentative Subdivision Map** to divide the 772.2 ± gross acre site into 11 large lots consisting of eight (8) "Village" lots, and three (3) parcels for recreation, trails, and open space.
4. Small lot **Tentative Subdivision Maps** to divide the eight (8) "Village" large lot maps into 827 single-family residential lots.
5. A **Use Permit** to allow casitas and accessory dwellings per the proposed Rancho Murieta North Design Guidelines, in accordance with the provisions of the Sacramento County Zoning Code (Title III, Chapter 5, Article 6).
6. A **Special Development Permit** to allow for alternative design, including deviations from required setbacks and height limitations, per the proposed Rancho Murieta North Design Guidelines.
7. **Design Review** to comply with the Sacramento County Design Guidelines.

Project exhibits are located at the end of this Notice of Preparation. Recognizing that it may be difficult to read details on the exhibits at this size, electronic versions of the exhibits are also available for review at the following internet addresses:

http://www.planningdocuments.saccounty.net/

(Search the "Planning Projects Viewer" with the Project Name "Murieta North")

PROJECT OBJECTIVES:

The project applicant has provided the following project objectives:

- Formulate land use planning documents and regulatory approvals for a 772.2-acre portion of the Rancho Murieta Planned Development area as a means of completing build out of the Rancho Murieta community in an orderly manner.
- Accommodate the County's share of future regional population growth anticipated for Rancho Murieta, compatible with surrounding land uses, complements the pattern and intensity of existing development in the Rancho Murieta community, and provide new benefits to the Rancho Murieta community and the County of Sacramento.
- Design a comprehensively planned, residential-based community with a mix of land uses within the Rancho Murieta Planned Development to create a balanced community with approximately 827 new residential units, commercial uses, parks, trails and open space and supporting public/quasi-public uses.
- Satisfy the County's policies, regulations and expectations as defined in the General Plan, the Rancho Murieta Planned Development Ordinance (as amended) and other applicable plans, documents, and programs adopted by the County.
- Plan for infill residential development in an area already designated by the County for urban uses and consistent with the Blueprint and Sustainable Communities Strategy (SCS) adopted by SACOG.
- Plan for approximately 827 residential units to provide housing choices in varying densities to respond to a range of market segments in the Rancho Murieta community.
- Plan for the reuse of the 39-acre site of the Operating Engineers' Apprentice and Journeymen Training Center with commercial /mixed use development complimenting the residential development in the Rancho Murieta community.
- Plan for development density adequate to support existing public infrastructure and utility systems of the Rancho Murieta Community Services District and planned improvements.
- Shape a physical form and character of development that is functional and creates a sense of place to: (1) Create a land use transition and connection from the existing Rancho Murieta community; (2) Organize neighborhoods to be identifiable and walkable, and to incorporate gathering places such as commercial areas, parks and recreational amenities, and (3) provide additional trails and permanent pathways to enhance the existing trail network in the Rancho Murieta community.
- Provide a safe and efficient circulation system that interconnects uses and promotes pedestrian circulation and alternate transportation options. Create a circulation network which complements north/south and east/west circulation routes to benefit the transportation network in the Rancho Murieta community.
- Provide connections via a system of paseos, trails, golf cart paths and Class IA bikeways. Develop a system of golf cart and bikeway facilities to provide an alternative transportation mode and connect with planned existing and planned bikeway facilities within Rancho Murieta.
- Through implementation of arterial and collector street improvement standards, provide the opportunity to coordinate fixed-route bus stops and transit facilities in support of the County's overall transit planning efforts.
- Design a land use plan where the development footprint avoids impacts to habitat, wetland resources and tree canopy to the extent feasible. In consultation with resource agencies, develop a plan which avoids and preserves the highest quality open space and habitat resources on-site.
- Create open space wildlife corridors which contribute connectivity to existing preserves and create greater regional benefit for habitat, resources and open space amenities.
- Plan for long-term growth to be positioned to react to market demand.

ENVIRONMENTAL/LAND USE SETTING:

The project site is located within the Rancho Murieta community planning area. The parcels are located north of State Highway 16 and the Cosumnes River. The existing Rancho Murieta community, which is comprised of approximately 2,517 existing residences, is located primarily to the west and south of the project site. Deer Creek Hills Regional Park bounds the project site to the north. The combined project site totals approximately 772.2 acres, currently zoned A-2(PD).

The project site is largely undeveloped, with a partial trial system throughout. The topography of the project site includes moderately sloped, gently undulating and flat terrain. Elevations range from 130 feet at the Cosumnes River to 305 feet atop Marr Hill, just west of the Clementia Reservoir. Adjacent to the project site are several bodies of water, including the reservoirs Lake Calero, Lake Chesbro, and Lake Clementia; Lake Jean; Bass Lake, and the Cosumnes River.

Undeveloped areas of the project site are vegetated with annual grasses and areas of native oak woodlands. Jurisdictional wetlands are also known to be on site, including vernal pools, wetland swales, seeps, riparian wetlands, and channels. There is high potential for occurrence of several special status species due to presence of habitat in the project site, including but not limited to the known presence of Bald Eagles. Additionally, the project site has been identified as potentially containing cultural resources.

PROBABLE ENVIRONMENTAL EFFECTS/EIR FOCUS:

Project development will convert a majority of the project site to urban uses. A preliminary review of the project and the environmental resources in the study area has resulted in the identification of the potential areas of environmental impact, listed below. Other topic areas may be included if further review and research indicates that inclusion is warranted. As the analyses progress and the extent of impacts to the below categories is determined, appropriate CEQA Alternatives will be identified and included for analysis.

Aesthetics

The EIR will evaluate potential impacts of the proposed project on visual quality and overall aesthetics of the environment. The evaluation will review project impacts to any potential scenic vistas, scenic resources, and the existing visual character and quality of the project site and surrounding environment. The evaluation will be based on field observations, review of local topography, and a select number of visual simulations from selected points of view. .

Air Quality

The EIR will quantify and evaluate potential impacts related to emissions resulting from construction activities and emissions from operational activities of the completed project. These potential short-term and long-term air quality impacts will be quantified using the California Emissions Estimator Model (CalEEMod) and/or other appropriate models.

Biological Resources

The project will be analyzed to identify impacts to biological resources. The analysis will focus on special-status animal and plant species, an evaluation of potential impacts to wetlands and associated wetland species, and an evaluation of impacts to native and non-native trees and oak woodland habitat on the project site. Technical studies will include a special-status species survey that will identify special status species that are observed on the project site or those that are known to exist in the project area. A wetland delineation will identify on-site wetland resources and the EIR will evaluate direct and indirect impacts of the proposed project on those resources. Finally, an arborist report has been requested to evaluate impacts to native and non-native tree resources on the project site. Mitigation measures will address the loss of any native and non-native trees, as appropriate, as well as measures to protect and preserve any protected trees during and after construction.

Climate Change

This chapter will describe and quantify the potential of the Project to result in the emission of greenhouse gases (GHG), both during construction and operation, and compare those emissions to County thresholds. Project GHG emissions will be quantified using CalEEMod.

Cultural Resources

The project site will be examined to determine whether it is sensitive for the presence of cultural resources, including subsurface archeological resources, those of ethnographic importance, and built-environment historical resources. A cultural resource survey has been submitted and will be reviewed by PER staff to determine areas of sensitivity throughout the project site. Additionally, consultation with Native American tribes per AB52 will be conducted. .

Geology, Soils, and Mineral Resources

The proposed project will be evaluated for its potential effects to geologic and soil resources as well as the potential impacts of any geologic and soil hazards to the project and surrounding environment. Underlying soil types and suitability for development will be examined using the Natural Resources Conservation Service Soil Survey for Sacramento County, as well as United States Geological Survey data on the County. A geotechnical engineering study has been prepared for the project site to evaluate the soils found within the project site, and specifically examines the potential for expansive soils within the region.

Hazards and Hazardous Materials

Hazardous materials sites, if any, will be identified in the project vicinity. Data sources may include Envirostor and Geotracker. Project compatibility with any existing hazardous materials sites will be examined, as well as the potential for the project to use, store, or transport hazardous materials. Naturally occurring asbestos (NOA) is known to occur in the project area, and a study to evaluate the presence of asbestos has been requested. Impacts associated with NOA will be evaluated in the Air Quality chapter.

Land Use

The project proposal will be examined to determine consistency with land use policies/ordinances/plans that have been adopted in order to avoid land-use-related environmental effects. The project impact relative to the planned and existing land use environment will also be evaluated. Potential impacts to farmland will be analyzed, as the site is also designated as Grazing Land on the Sacramento County Map of Important Farmland.

Noise

This chapter will analyze whether the project will generate noise in excess of standards or will result in exposure of persons to noise levels in excess of standards established in the Sacramento County General Plan.

Public Services and Utilities

The proposal will be analyzed for its impacts to public services and to determine what will be required to extend service to the project. Services analyzed may include but are not limited to: schools, (Elk Grove Unified School District), water service, solid waste collection service, parks, and sewer service (Rancho Murieta Community Services District), and electric service (Sacramento Municipal Utility District). The proposal's impact on the water supply (Rancho Murieta Community Services District) will also be evaluated. A Water Supply Assessment pursuant to Senate Bill 610 has been requested, to be prepared by the Rancho Murieta Community Services District.

Transportation

This chapter will analyze potential traffic and circulation impacts of the proposed project. A Traffic Impact Study (TIS) will be prepared to examine the effects of proposed project development on area roadways and roadway connections. The TIS will indicate whether or not the project will result in any significant traffic impacts, and will be reviewed by the Sacramento County Department of Transportation and Caltrans for technical adequacy. .

Hydrology and Water Quality

This chapter will describe the existing Rancho Murieta stormwater control system and assess the potential impacts of the Project on that stormwater system. This chapter will also describe the existing watershed and assess the potential for the Project to impact water quality, either as a result of construction (grading and erosion) or operation. Any potential impacts of the Project to the 100-year floodplain will also be discussed. A drainage study has been requested to identify stormwater quality treatment, on-site drainage facilities configuration, and any necessary flood detention as required by the Sacramento County Department of Water Resources.

INTENDED USES OF THE EIR:

The Sacramento County Planning Commission and the Board of Supervisors will use the information contained in the EIR as one of the informational tools necessary to evaluate the proposed project and render a decision to approve or deny the requested entitlements. The EIR will serve as an information document for the general public as well. Responsible agencies may also use the EIR, as needed, for any subsequent discretionary or permitting actions. Based on the potential effects known at this time, responsible agencies may include (but may not be limited to) the United States Army Corps of Engineers, the United States Fish and Wildlife Service, the California Department of Fish and Wildlife, the Rancho Murieta Community Services District, and the California Regional Water Quality Control Board.

ADDITIONAL PERMIT REQUIREMENTS

Additional permitting requirements for the Rancho Murieta North may include but are not limited to Section 401 permitting (Army Corps of Engineers), Section 404 Certification (Regional Water Quality Control Board), and Stream Bed Alteration Permit Section 1600 (California Department of Fish and Wildlife). Each Village ("A" through "H") will be permitted separately.

Plate NOP-1: Rezone Exhibit

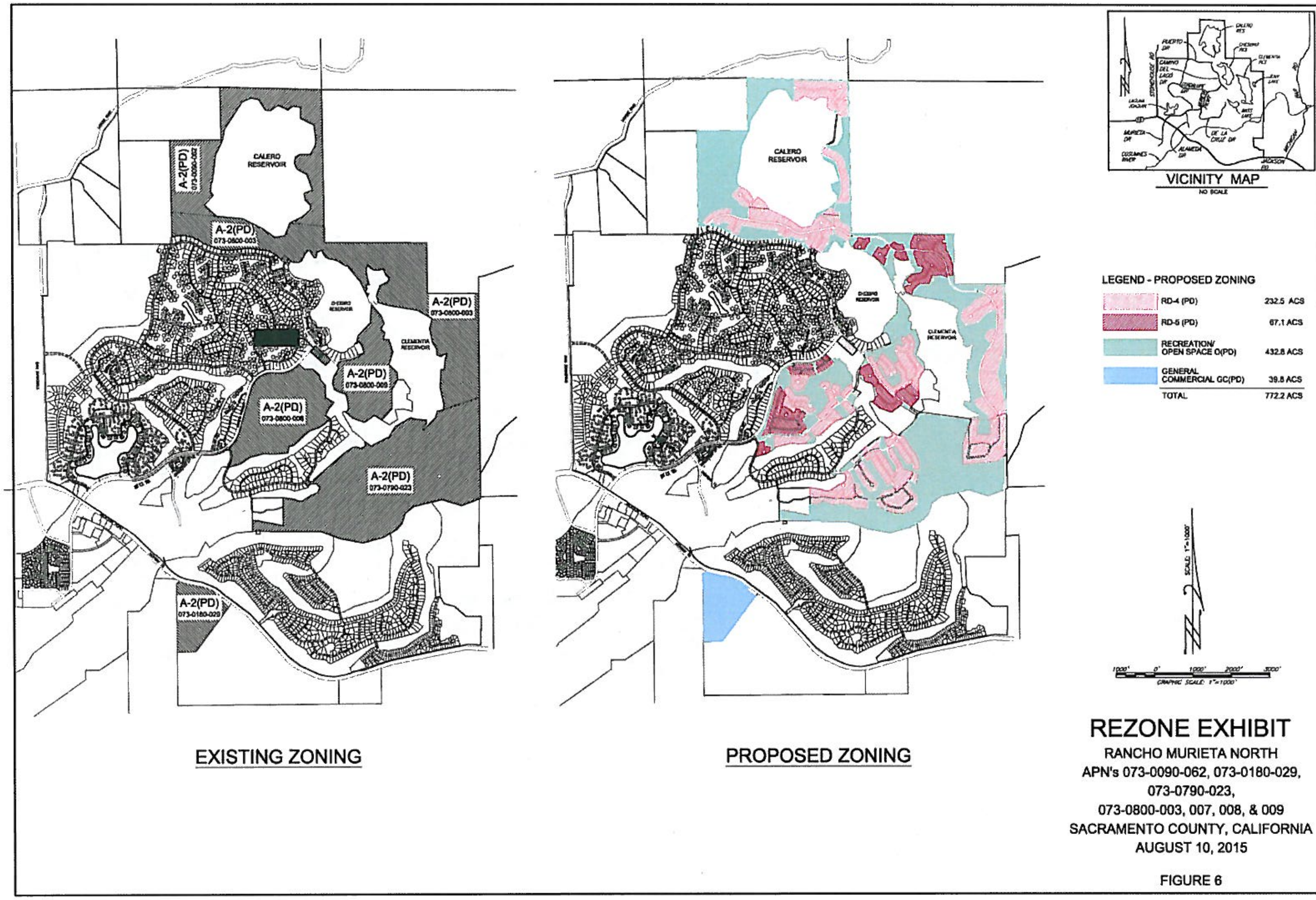


Plate NOP-2: Village "A" Tentative Subdivision Map

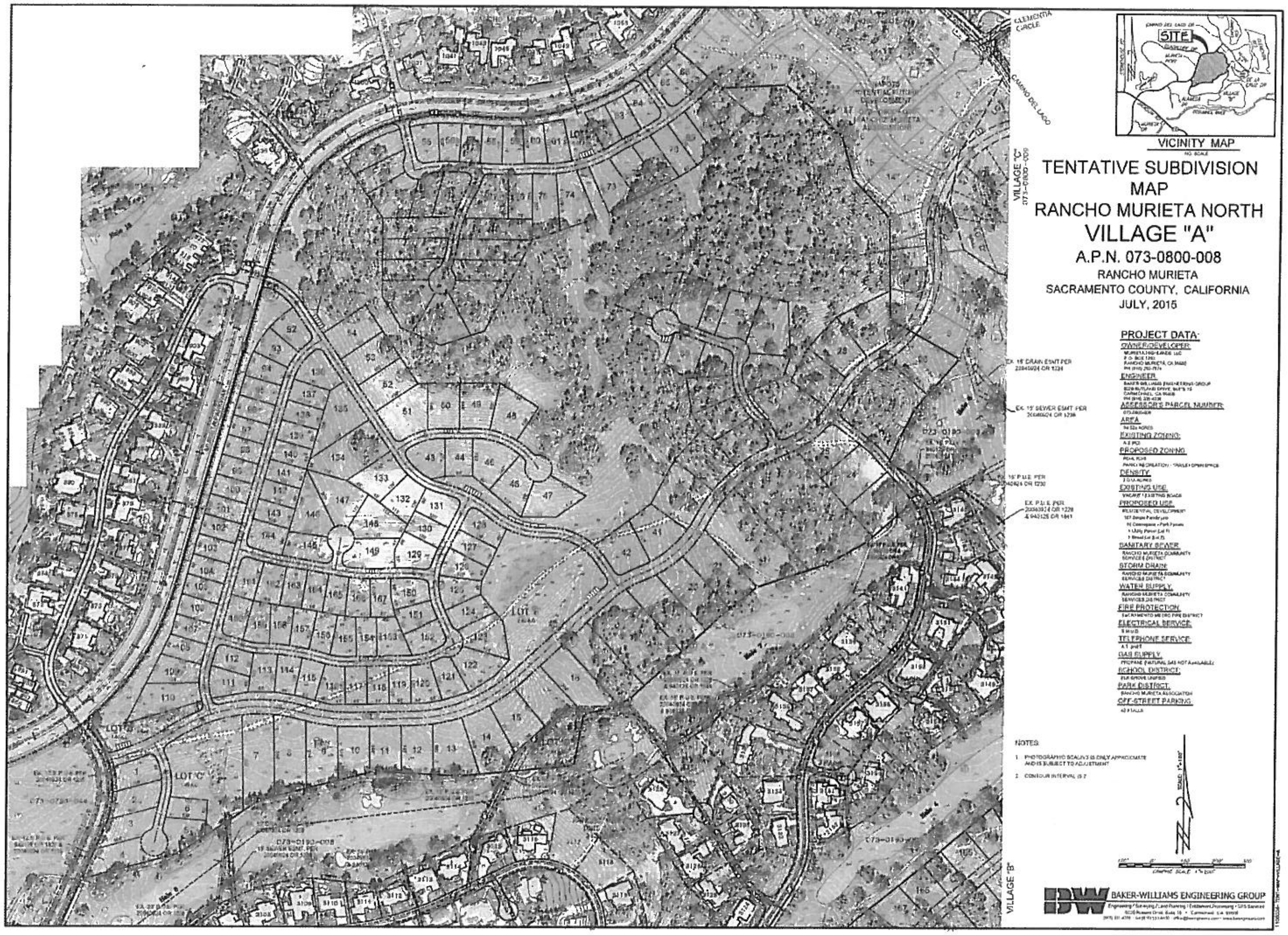


Plate NOP-3: Village "B" Tentative Subdivision Map

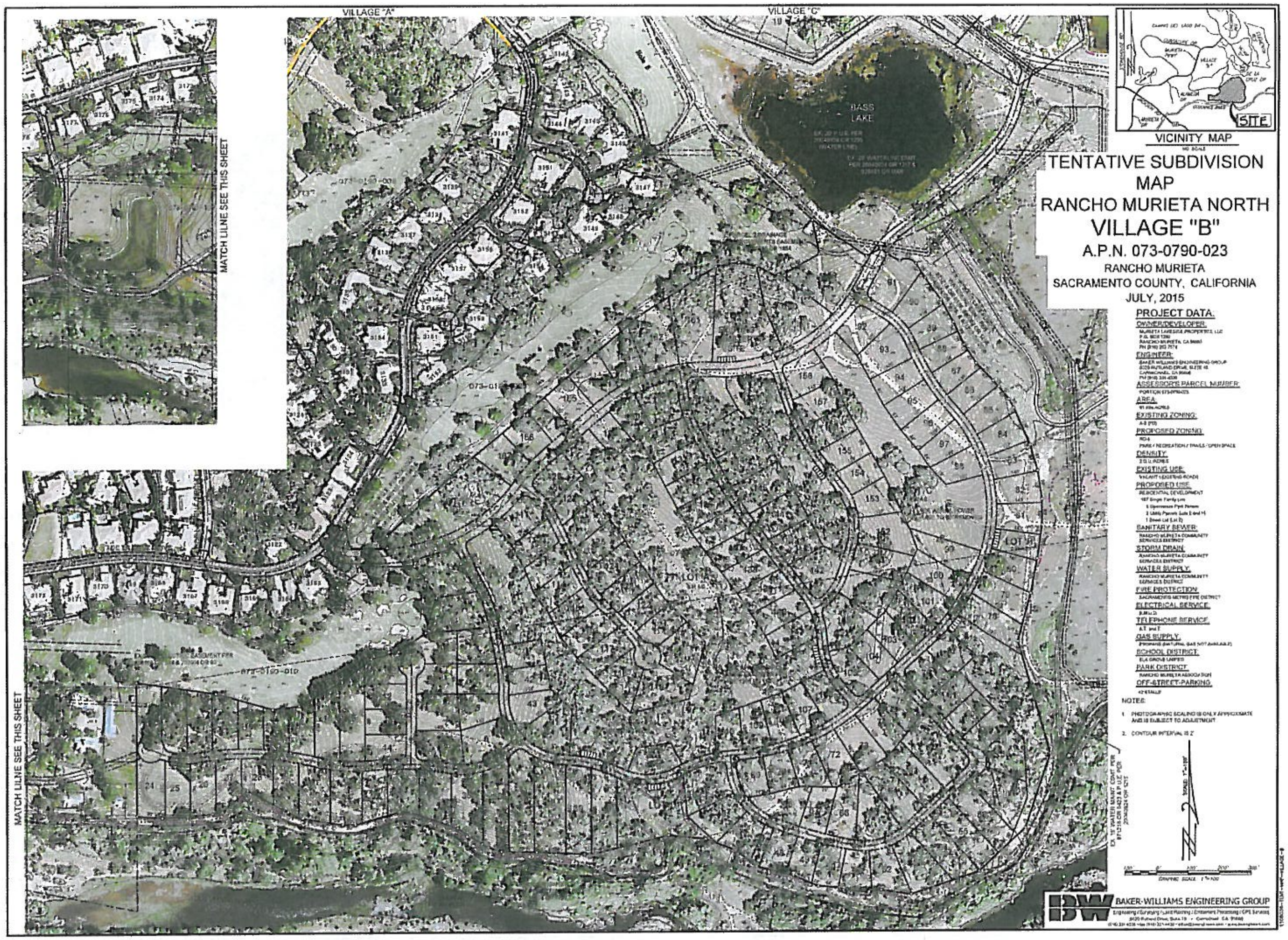


Plate NOP-4: Village "C" Tentative Subdivision Map

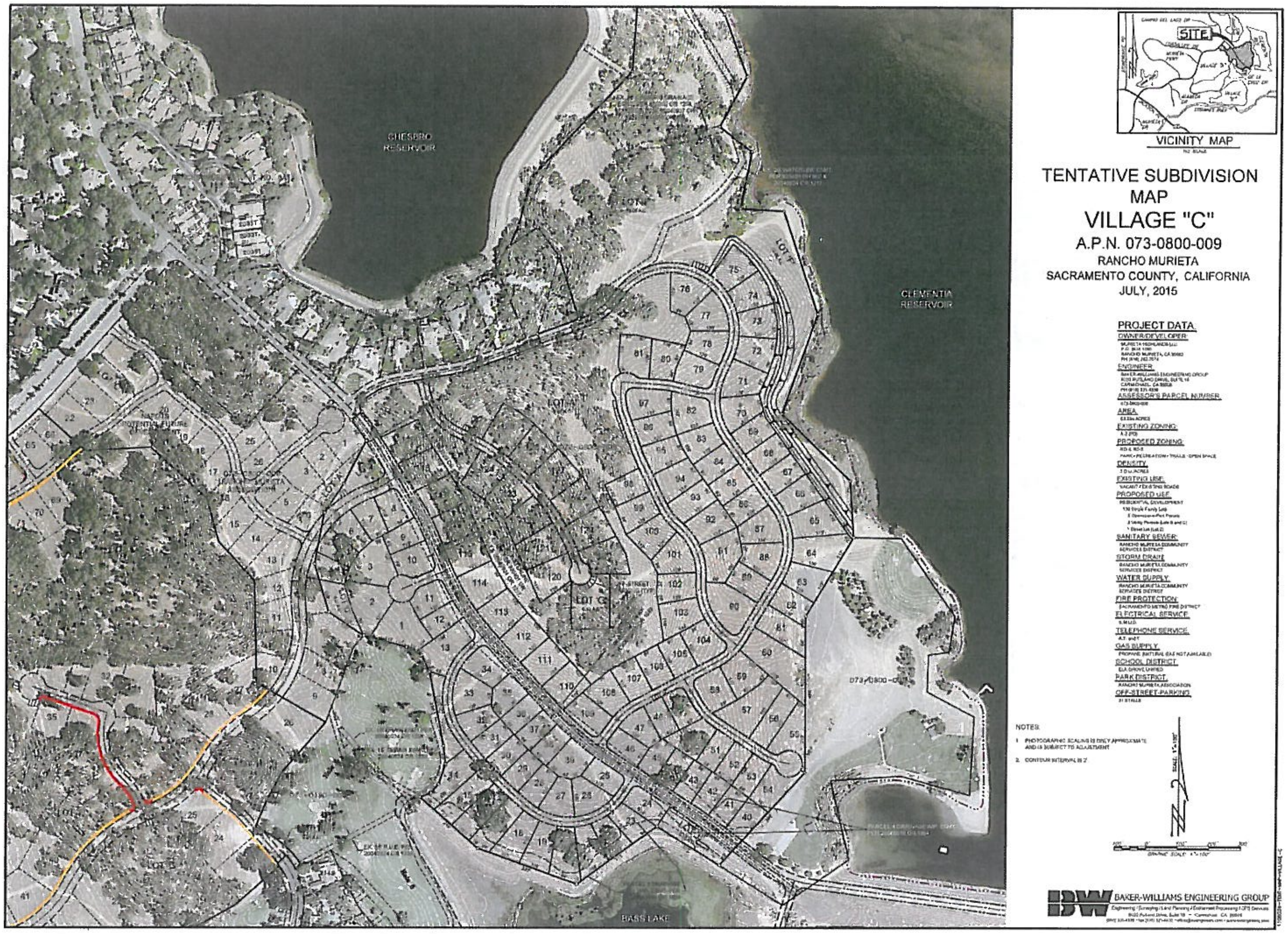


Plate NOP-5: Village “D” Tentative Subdivision Map

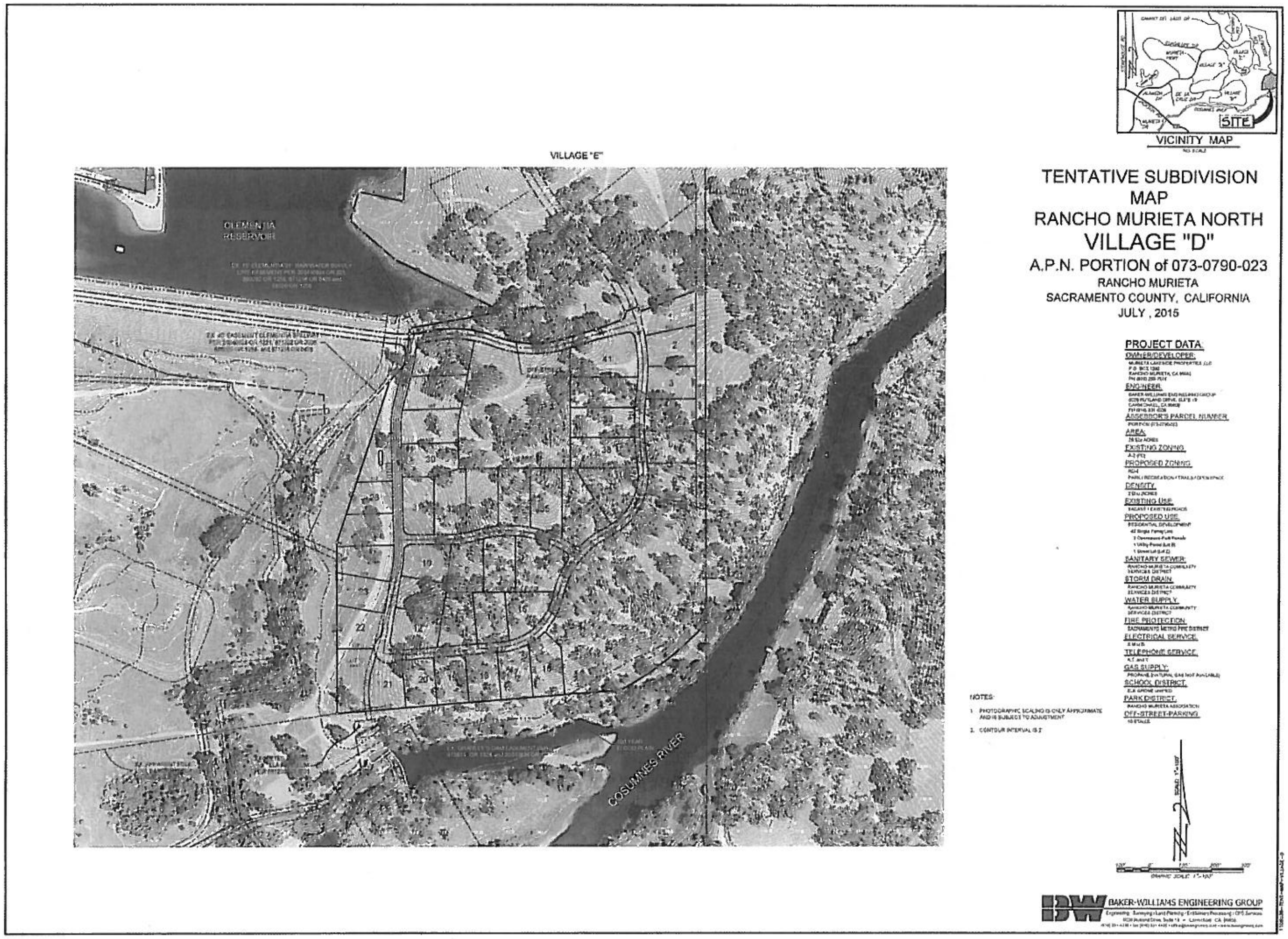


Plate NOP-6: Village "E" Tentative Subdivision Map, Sheet 1

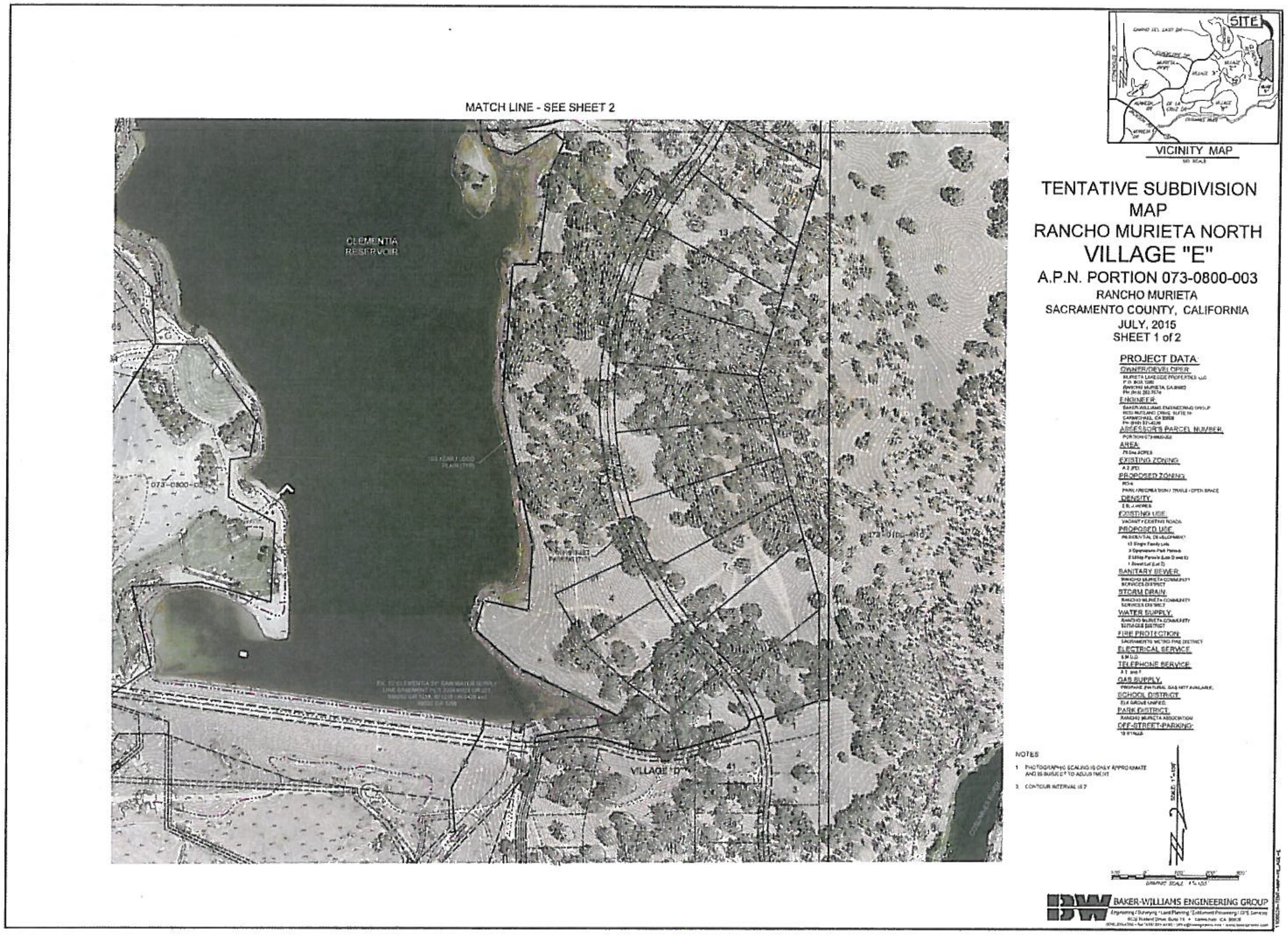


Plate NOP-7: Village "E" Tentative Subdivision Map, Sheet 2

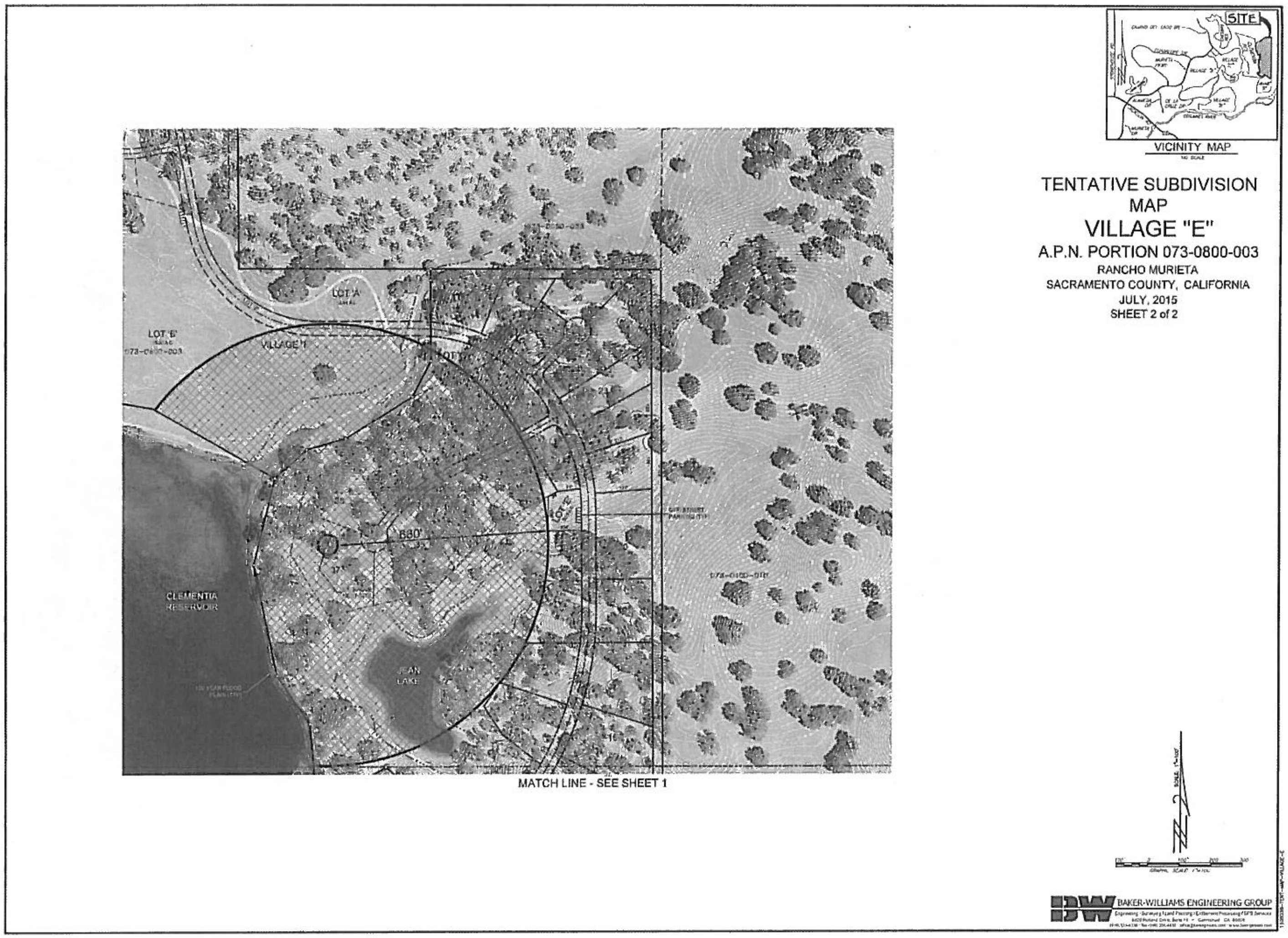


Plate NOP-8: Village "F" Tentative Subdivision Map

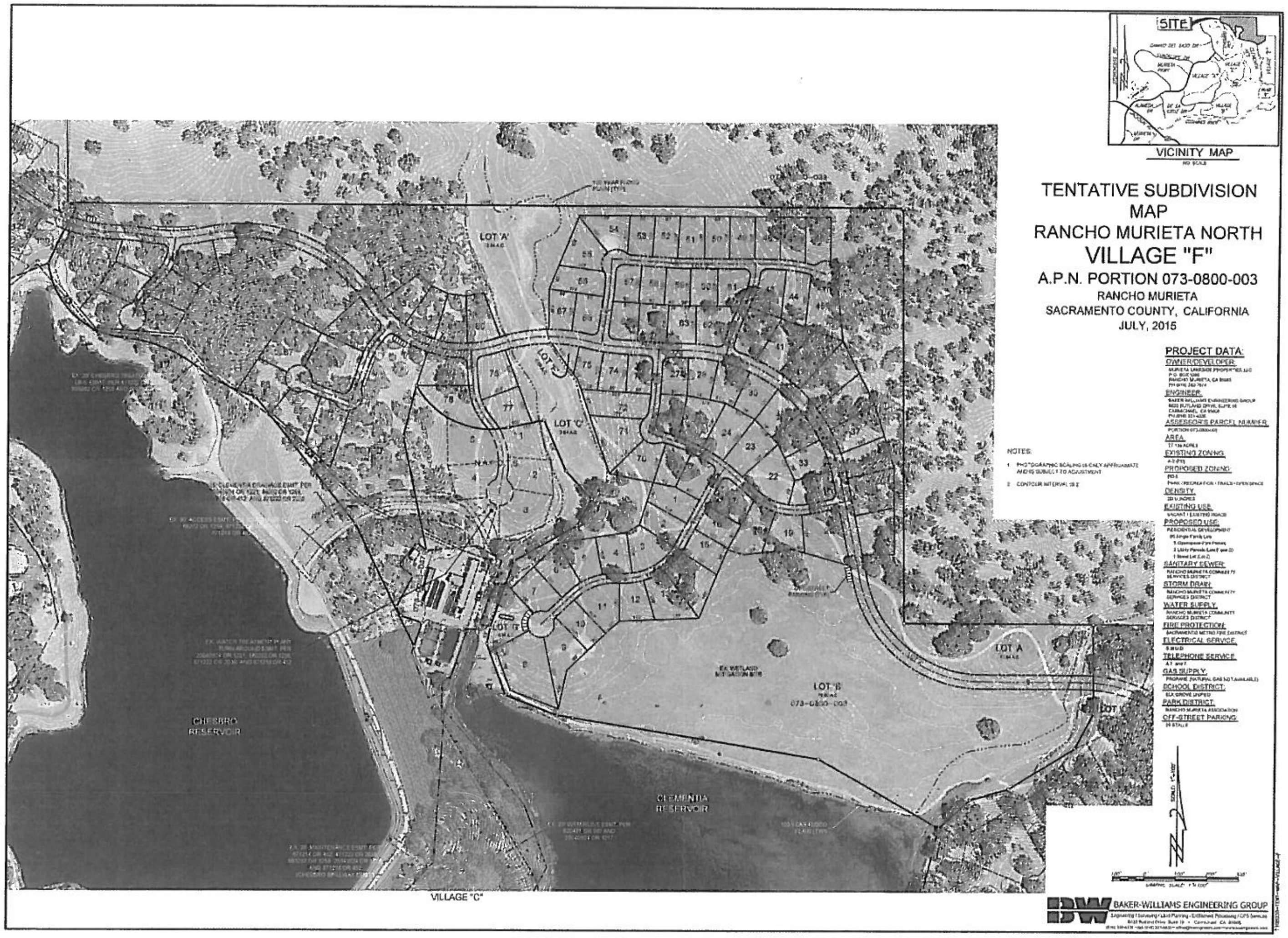


Plate NOP-9: Village "G" Tentative Subdivision Map, Sheet 1

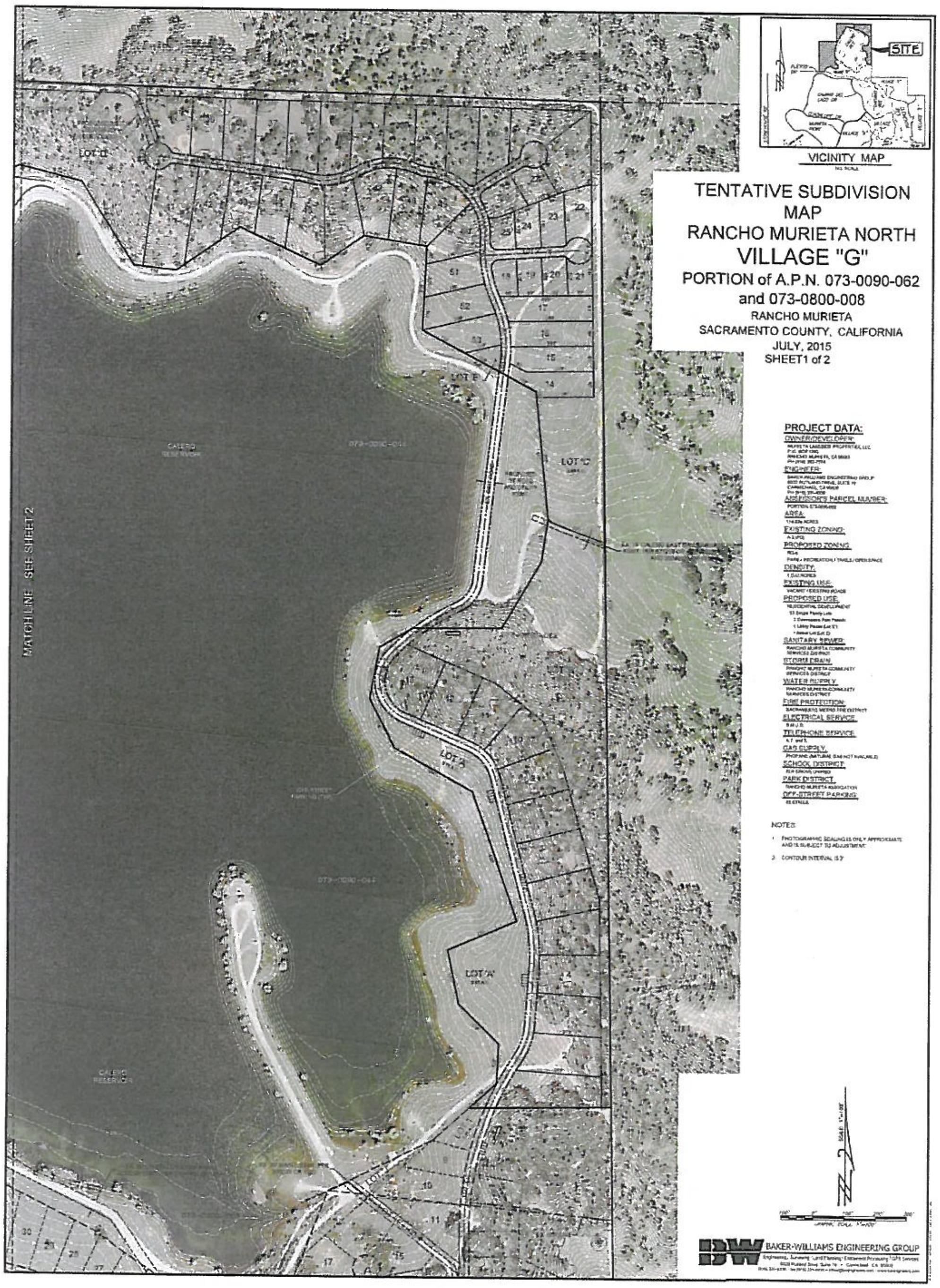


Plate NOP-10: Village "G" Tentative Subdivision Map, Sheet 2

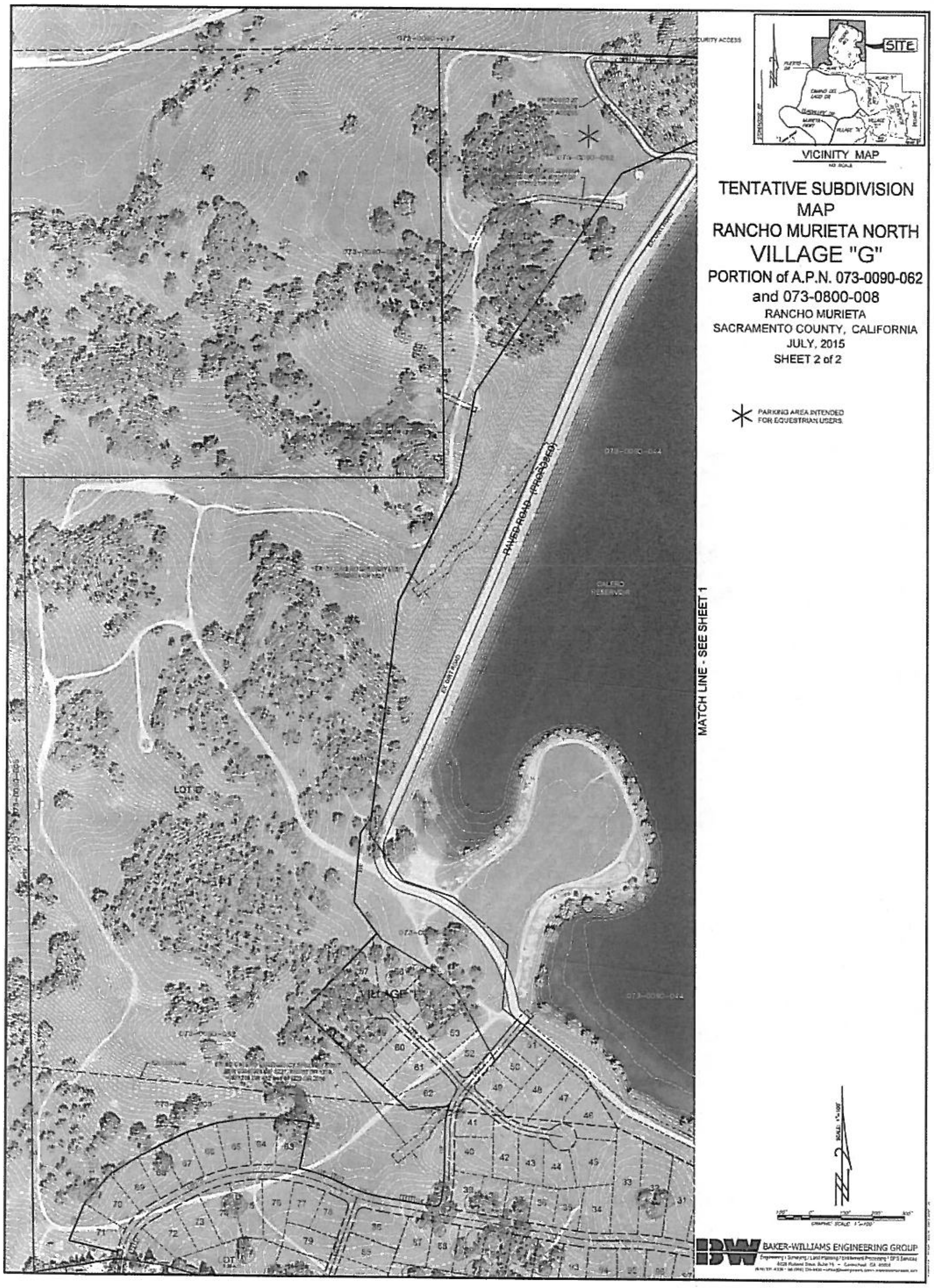
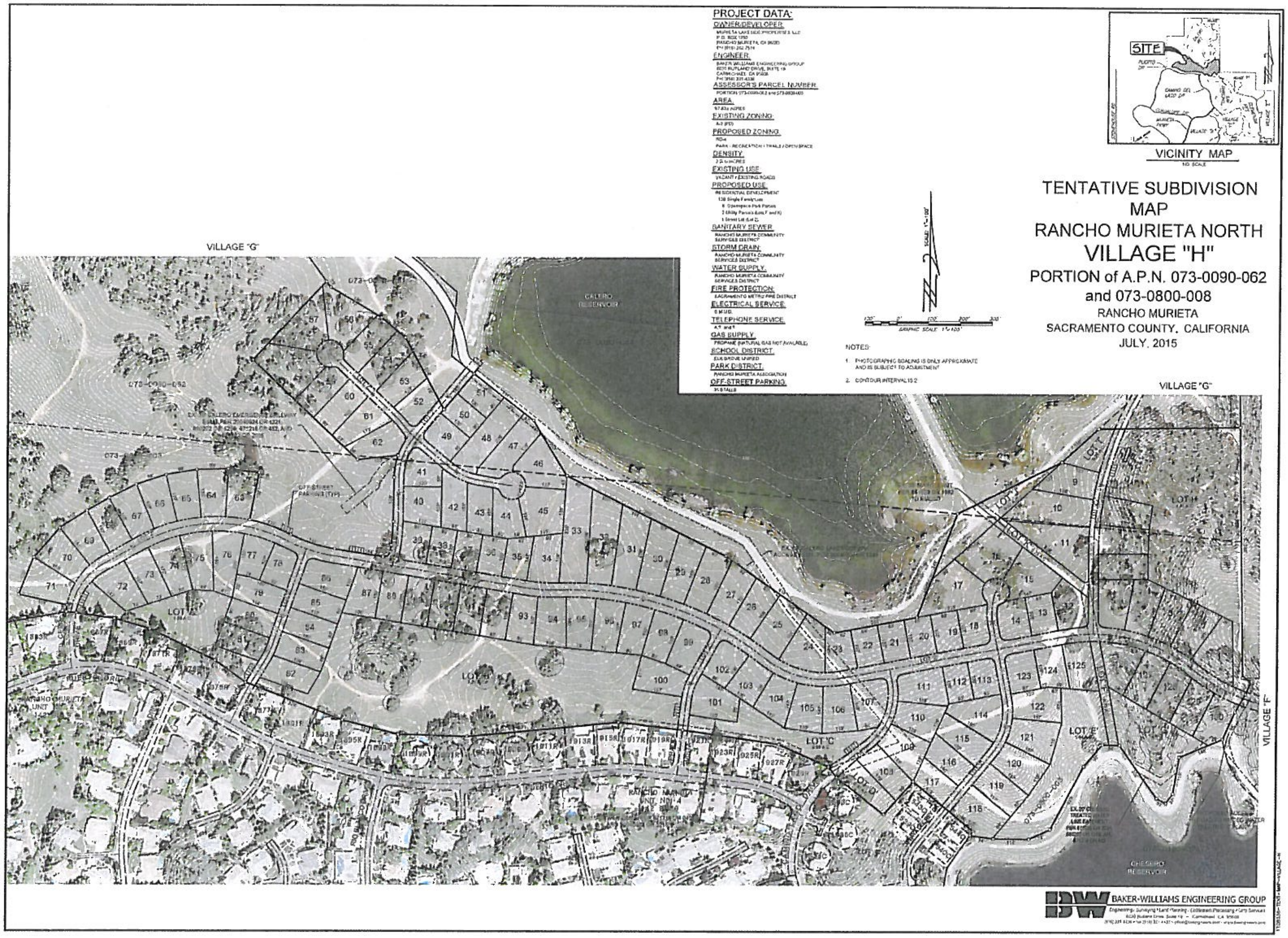


Plate NOP-11: Village "H" Tentative Subdivision Map



MEMORANDUM

Date: November 11, 2015

To: Board of Directors

From: Paul Siebensohn, Director of Field Operations

Subject: Receive Water Treatment Plant Expansion Project Update

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WATER TREATMENT PLANT EXPANSION PROJECT UPDATE

The project is nearing completion. Recent work includes: GE's & TESCO Controls' commissioning activities of dialing in various control set-points, verification of online analytical instruments, flow meters, level sensors, rate of flow controllers, chemical feed systems, alarms, tuning of PID loops, testing of various modes of operation, overall integration between GE and TESCO PLC systems, SCADA control screen layouts and functionality, and operation of components in auto mode. Once these items are been completed, we will begin to have staff trained on how to operate and maintain the system with classroom and hands on training, disinfection of the facility, and operating the facility in auto mode just recirculating water through it. If everything tests out well, the Division of Drinking Water (DDW) will be out to review the facility and issue our authorization to operate. Once issued, we may then begin operation for a 30-day testing and completion of the final punch-list items. We have provided HDR's Water Treatment Plant Expansion Project Engineering Report (attached) to DDW. DDW will use this document in review of their issuing an authorization to operate the facility.

Other work still pending completion is site paving, installation of the bird netting around the canopy structure, installation of a tuning plate on one of the new effluent pumps to bring vibration measurements within specifications, final fencing installation, and siding replacement on Plant #2 once it is taken offline.

Due to limited staffing Thanksgiving week, the facility is tentatively scheduled to be in operation the week of November 30, 2015.

Period ending: October 31, 2015

HARD CONSTRUCTION COSTS *(via Roebbelen)*

Project Construction Summary								Source of Funding		
Contractor	Work Type	Contract Amount	% Billed to Date	Amount Billed to Date	Amount Billed This Month	Contract Amount Remaining	CSD $4.358 million	R&B LOC $4.136 million	CFD 2014 $3.818m Ph 1 $0.540m Ph 2
Roebbelen Construction Management Services	General Conditions	781,205	95%	742,145	-	39,060	262,719	249,361	230,065
River City Painting	Painting	291,000	86%	251,350	-	39,650	88,978	84,454	77,919
GE Technology	Membrane Supplier	2,173,800	93%	2,028,911	-	144,889	704,307	713,767	610,837
JD Pasquetti	Sitework	555,659	63%	349,625	-	206,034	123,767	117,474	108,384
Roebbelen Construction	Fencing	53,640	30%	16,078	-	37,562	5,692	5,402	4,984
KG Walters Construction	Mechanical & Plumbing	4,893,000	100%	4,874,500	-	18,500	1,755,015	1,578,949	1,540,537
Bockmon & Woody Electric	Electrical	2,370,266	98%	2,327,889	-	42,377	824,073	782,171	721,646
Marquee	Fire Protection	42,500	15%	6,375	-	36,125	2,257	2,142	1,976
Total Initial Construction Contracts (with 534,318 Contingency = 11,695,388)		**11,161,070**	**95%**	**10,596,873**	**-**	**564,197**	**3,766,807**	**3,533,719**	**3,296,347**

Change Order Summary

APPROVED CHANGE ORDERS:									
Max Contract Change Order Amount		534,318							
Shared Completed Change Orders (Invoiced/Paid)		324,793					114,977	109,130	100,686
CSD Only Completed Change Orders (Invoiced/Paid)*		95,182					95,182		
Approved Change Orders (Not Invoiced)		53,341							
	Total Completed/Approved CO	**473,316**							
	Amount CO remaining	**61,002**							
PROPOSED CHANGE ORDERS:		2,531							
	Amount CO remaining *(if Proposed COs are approved)*	**58,471**							
OTHER:									
Bay Area Coating Consulting Services	**Contigency amt outside of Roebbelen contract *(approved BOD 11/19/15)*	15,000	91%	13,622	-	1,378	4,822	4,577	4,223
Sholl Construction	**Membrane Sealing contingency amt oustide of Roebbelen contract	4,576	100%	4,576	-	0	1,620	1,538	1,419

** CSD Only Change Orders are in addition to the CSD share of $4.358m*

Total Adjusted Construction Contracts *(hard costs + CO's)*		**11,540,487**				**Total Billed to Date**	**3,983,408**	**3,648,964**	**3,402,674**

SOFT CONSTRUCTION COSTS *(CSD Direct Expenses to be shared equally)*

Service Cost Summary							Source of Funding		
Item	Company/Agency	Estimated Soft Cost	Contract/Actual Soft Cost	Amount Billed to Date	Amount Billed This Month	Contract Amount Remaining	CSD $4.358 million	R&B LOC $4.136 million	CFD 2014 $3.818m Ph 1 $0.540m Ph 2
Preconstruction CM Assistance	Roebbelen CMS	49,049	49,049	49,049		-	17,363	16,480	15,205
Design Engineering	HDR Engineering	240,000	239,982	239,982		-		239,982	
CEQA NOI/MND	HDR Engineering	40,000	71,070	63,559		7,511	5,583	53,088	4,889
Design Geotech	Youngdahl and Associates	3,000	2,600	2,600		-	920	874	806
Construction Engineering Assistance	HDR Engineering	150,000	276,328	243,250		33,078	87,626	78,243	77,380
Special Construction Inspection	Youngdahl and Associates	50,000	45,511	45,511		-	16,111	15,292	14,108
Misc Fees				709		-	251	238	220
SMUD Service	SMUD	5,000	31,632	31,632		-	11,198	10,628	9,806
Generator Permit	Sac County Air Quality Mgmt	5,000	5,000	-		5,000	-		-
State Clearinghouse for CEQA	State of CA	3,000	3,000	-		3,000	-		-
Fish & Wildlife Agency Permits	State of CA	2,000	2,000	921		1,079	326	310	286
Ca Dept Health Review	State of CA	5,000	5,000	-		5,000	-		-
Road Mitigation	RMA	8,000	12,000	12,000		-	4,248	4,032	3,720
CSD Admin, Legal and Engineering	CSD	50,000	50,000	209,675		-	91,707	67,968	50,000
(CFD 2014 Max per FSA = $50K)						-	-		
Total		**610,049**	**793,172**	**898,887**	**-**	**54,668**	**235,333**	**487,135**	**176,420**
	Grand Total (Construction and soft costs)	**12,488,560**		**11,933,933**					

Additional Info

Total Retainage to Date: 454,416

Note: As of September 30, 2015, R&B LOC funding cap had been reached. No further expenditures will be allocated to this funding source

	CSD	R&B LOC	CFD 2014
		**See Note*	
Total Hard/Soft Costs	4,218,741	4,136,099	3,579,094
Less: Funds Received		(3,682,313)	(3,455,475)
Pending Draw Request		(453,786)	0
Total Outstanding Amount		**0**	**123,619**

***CFD 2014-1 Draw Amount Based on Cashflow per FSA*

Change Order Detail *(no changes from prior month)*

Shared Cost Change Orders (Split between CSD/CFD#1/CFD2014-1):

Completed (Shared) Change Orders:

#	Status	Description	Amt	Remaining
0.028	COMPLETE	Bid Div 28 SCADA console Allowance	$ 1,738	$ -
1	COMPLETE	Remove proj contigency from trade contr	$ -	
2	COMPLETE	JDP - Drying bed extension shotcrete	$ 5,648	$ -
3	COMPLETE	KGW/JDP - FM change of material	$ 2,888	$ -
4	COMPLETE	JDP - 2" Conduit for Fiber	$ 26,264	$ -
5	COMPLETE	JDP - CLSM trench at lower yard	$ 3,300	$ -
6	COMPLETE	JDP - drying bed clean out	$ 1,882	$ -
7	COMPLETE	Boring of 2" FM (IBA)	$ -	$ -
8	COMPLETE	RFI #024, replace corroded FCA	$ 6,623	$ -
9	COMPLETE	RFI #009, TW Booster pump station slab	$ 6,029	$ -
10	COMPLETE	ASI #01, check valve/concrete fillet	$ 7,018	$ -
11	COMPLETE	NAOH added slab at tank yard	$ 4,091	$ -
14	COMPLETE	RFI #28, conduit & chem trench vault conflict	$ 11,700	$ -
15	COMPLETE	SWPPP Maintenance	$ -	$ -
16	COMPLETE	16" Water Main Repair	$ 7,000	$ -
17	COMPLETE	Addl gunite for drying bed extension	$ 2,946	$ -
18	COMPLETE	KGW - Door 302 added lockset	$ 345	$ -
19	COMPLETE	Zenon - GE dimension Clar.Support Grate	$ 2,815	$ -
21	COMPLETE	RFI #19, Transformer Relocation	$ 1,542	$ -
23	COMPLETE	Temp Power Switchover	$ 3,070	$ -
24	DELETION	RFI #024, deleted ARV at sta 227+47	$ (5,008)	$ -
26	COMPLETE	SWPPP Maintenance	$ -	$ -
27	DELETION	Upper Tank Yard Pad Prep	$ (492)	$ -
30	COMPLETE	RFI #060, relocate 12" line for stair conflt	$ 1,725	$ -
35	COMPLETE	RFI #041, CIP Line Relocation	$ 5,561	$ -
36	COMPLETE	GE Upgraded Maintenance Table	$ 5,013	$ -
38	COMPLETE	CIP Heater Control MCC	$ 4,415	$ -
39	COMPLETE	FS Structural Consulting	$ 1,093	$ -
40	COMPLETE	Additional Spare Parts	$ 2,600	$ -
42	COMPLETE	RFI#043.1 Flocculation covers	$ 29,745	$ -
43	COMPLETE	RCMS Trailer Power Hookup	$ -	$ -
45	COMPLETE	1" Motorized ball valves for chlorination equip	$ 5,306	$ -
46	COMPLETE	Temp Lab Water Connection (Operations Expense)	$ 4,501	$ -
47	COMPLETE	Generator Pad Size Changes	$ 8,317	$ -
57	COMPLETE	SWPPP Maintenance	$ -	$ -
58	COMPLETE	Temp Filter Trailer Connections (Operations Expense)	$ 90,894	$ -
60	COMPLETE	AER (E) Fan Demo and Plywood Vents	$ 5,860	$ -
61	COMPLETE	Clay Pipe at pump station	$ 6,487	$ -
62	COMPLETE	Unsuitable material under pump station	$ 6,124	$ -
63	COMPLETE	R&R Siding at West Side Plant 1	$ 2,120	$ -
64	COMPLETE	Additional Painting Control Room Ceiling & Walls	$ 2,230	$ -
65	DELETION	Delete control panels & VFD for KGW pumps	$ (9,300)	$ -
69	COMPLETE	RFI #084, Pump Station Bar Beams	$ 286	$ -
70	DELETION	Paint (E) Chlorine Room	$ 3,280	$ -
72	COMPLETE	Modify Crane Stops	$ 4,700	$ -
75	COMPLETE	RFI#037, chemical conduit trench pathway	$ 38,430	$ -
81	COMPLETE	Lightpole at Pump Station	$ 4,104	$ -
83	COMPLETE	Wall opening at backwash basins	$ 4,939	$ -
86	COMPLETE	Pipe gallery valves and bolts replacement	$ 5,360	$ -
87	DELETION	Reverse CE#70 paint (E) chlorine room	$ (3,280)	$ -
89	COMPLETE	RFI#102 Underdrain wall elevation descrpancy	$ 1,240	$ -
90	COMPLETE	2" FM ARV at septic tank	$ 1,483	$ -

93	COMPLETE	Concrete fillet at backwash basin conflick with ladder	$ 659	$ -
94	COMPLETE	RFI#081 Waterstop at wet well	$ 1,185	$ -
95	COMPLETE	TW bell restrain	$ 549	$ -
97	COMPLETE	Slide Gates at flocc basin	$ 10,328	$ -
98	COMPLETE	Clean CCT basin	$ 9,946	$ -
99	COMPLETE	Grating at overflow channel	$ 4,976	$ -
100	COMPLETE	Cable Tray rack in basin (power & signal)	$ 1,823	$ -
102	COMPLETE	IP camera upgrade	$ 456	$ -
106	COMPLETE	Flocculator surrounding concreete uneven	$ 3,966	$ -
107	COMPLETE	Modify flocculation covers for relocated slide gates	$ 4,025	$ -
115	COMPLETE	Phone line from (e) termination board to (N) PLC	$ 3,417	$ -
116	COMPLETE	Generator Slab duck bank conflict	$ 425	$ -
117	COMPLETE	RFI#122 Chemical injectors	$ 2,829	$ -
120	COMPLETE	Generator control peripheral module	$ 2,791	$ -
121	COMPLETE	RFI#110 safety air exhaust valves	$ 1,724	$ -
122	COMPLETE	Plug holes at feed channel pvc	$ 2,142	$ -
125	COMPLETE	RFI#145 gable end canopy supports	$ 11,425	$ -
129	COMPLETE	RFI#139 ACH & CLS chemical diffusers	$ 1,612	$ -
132	COMPLETE	Replace siding ancillary room & flocc basin	$ 3,680	$ -
133	COMPLETE	RFI#133 RW sample pump	$ 4,119	$ -
134	COMPLETE	Retaining Wall at pipe gallery	$ 1,467	$ -
135	COMPLETE	ASI#03 HCL acid fume scrubber	$ 1,701	$ -
136	COMPLETE	RFI#144 Neutralization tank LIT connection	$ 916	$ -
138	COMPLETE	Future pump pad	$ 1,349	$ -
139	COMPLETE	TWPS hatch drain relocation	$ 516	$ -
140	COMPLETE	Membrane covers modify attachment	$ 2,504	$ -
144	COMPLETE	Collapsed shoring hole at TWBPS	$ 3,209	$ -
151	COMPLETE	RFI#130.1 Modify control room ductwork	$ 2,024	$ -
155	COMPLETE	Air compressor switching panel	$ 3,664	$ -
159	COMPLETE	Replacement of 12" FCA in pipe gallery	$ 8,129	$ -
			$ 420,188	**$ -**

Non-Completed (Shared) Change Orders:

#	Status	Description	Amt	Remaining
52	APPROVED	BWW & reject Flow Meters	$ 26,653	$ 26,653
148	PENDING	Replace lamps of (E) light poles with LED	$ 2,531	$ 2,531
154	APPROVED	Plant 1 siding dryrot at roof line & control room window	$ 6,005	$ 6,005
157	APPROVED	Ancillary room (E) soffit opening infill	$ 2,390	$ 2,390
			$ 37,579	**$ 37,579**

CSD-Only Change Orders:

Completed (CSD-Only) Change Orders:

#	Status	Description	Amt	Remaining
25	COMPLETE	Drying Bed cleanout and sand infill (CSD only)	$ 13,482	**$ -**
34	COMPLETE	Plant 2 SLC Ethernet connection (CSD only)	$ 8,527	$ -
			$ 22,009	**$ -**

Non-Completed (CSD-Only) Change Orders:

#	Status	Description	Amt	Remaining
12	APPROVED	Siding Replacement-Hardie Board (CSD only)	$ 91,466	$ 18,293

Engineering Report

Water Treatment Plant Expansion

Rancho Murieta Community Services District

November 10, 2015

REGISTERED PROFESSIONAL ENGINEER
Richard Stratton
NO. C37261
EXP. 6/30/16
STATE OF CALIFORNIA

Prepared under the responsible charge of

Richard Stratton
C37261

2365 Iron Point Road, Suite 300
Folsom, CA 95630

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Chapter 1 - Introduction

Purpose of Report

The purpose of this report is to request a Water System permit amendment for the Rancho Murieta Community Service District's (RMCSD) retrofit to the existing water treatment facility. The retrofit includes modifications to the existing Plant 1 to include membrane filtration for additional treatment capacity of water from the RMCSD's potable supply reservoirs. The District is submitting this Engineering Report to the Division of Drinking Water (DDW) describing how the facility retrofit is designed to comply with the treatment, design, performance, and reliability provisions required pursuant to California and Federal drinking water regulations.

Description of Water System

RMCSD owns and operates the water supply, storage and treatment system that serves the Rancho Murieta Community. The raw water supply is taken from the Cosumnes River at Granlee's Dam and pumped into its potable supply reservoirs Calero, Chesbro and Clementia from November 1 until May 31 of each year within the requirements of water right permit 16762. The stored water is used throughout the year for the needs of the community. In the early 1970's, the first treatment facilities consisted only of chlorination. In 1978, 1.5 million gallons per day (mgd) capacity was constructed to meet the increased demands of development and upgraded treatment requirements. In 1987, a duplicate plant with 2.0 mgd capacity was constructed. The treatment process is comprised of coagulation, sedimentation, followed by filtration and finally disinfection. Both of these plants were retrofitted in 1995 to meet the new Surface Water Treatment Rules. The existing plants have generally operated well and provide a reliable operational capacity of 1.5 mgd and 2.0 mgd respectively with a total capacity of 3.5 mgd.

The current demands are increasing and the District is anticipating additional community growth, including the construction of a new hotel and residential units. These demands have been met with the expansion of the water treatment plant to include the installation of pressure membranes based on the evaluation as part of this basis of design report. The membrane system is installed in the old Plant 1 sedimentation basin and filter building. The existing Plant 2 water system will remain in operation with no changes.

Project Location

The water treatment plant is located in the community of Rancho Murieta in eastern Sacramento County approximately 20 miles east of the City of Sacramento. The plant is located east of the Chesbro Reservoir and the developed portion of the Rancho Murieta community and golf course, and directly north of Clementia Reservoir. Figure 2-1 shows the project location and vicinity.

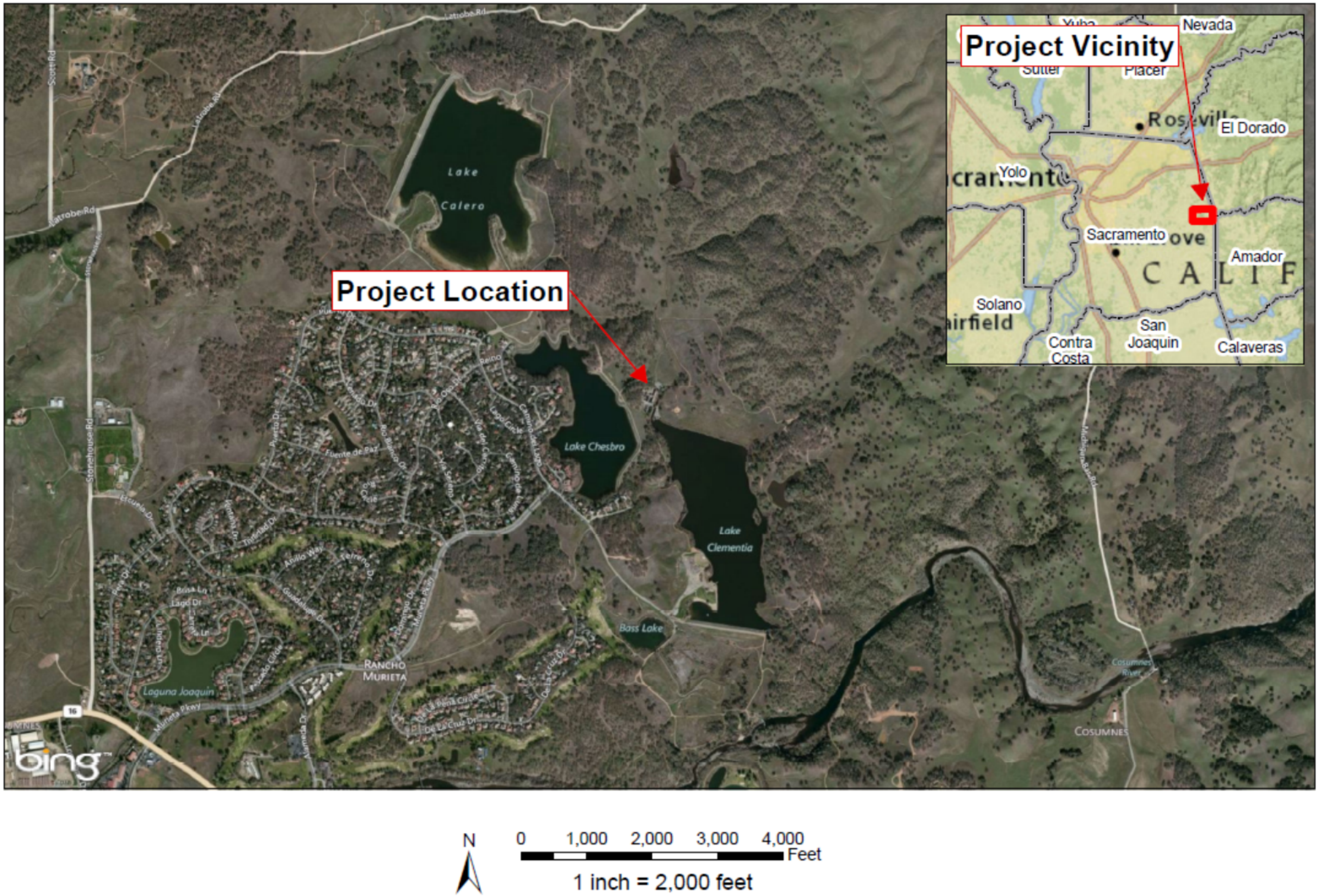

Figure 1. Project Location and Vicinity

Raw Water Quality

The water treatment plant reports were provided from January 2011 through May 2013. These reports were used to extract the raw water quality data, specifically pH and turbidity, as shown in Table 1. Additional water quality data is summarized in Table 2.

Table 1. Raw Water pH and Turbidity Data.

Year	Month	Average Influent pH	Average Influent Turbidity
2011	January	7.933	0.416
	February	8.108	0.489
	March	7.966	0.897
	April	7.724	0.834
	May	7.789	0.655
	June	7.639	0.898
	July	4.447	1.209
	August	7.349	1.201
	September	7.425	1.179
	October	7.657	1.226
	November	7.845	0.605
	December	7.983	0.438
2012	January	7.931	0.762
	February	7.995	0.681
	March	8.022	0.649
	April	7.920	0.594
	May	7.801	0.649
	June	7.794	1.052
	July	7.491	1.517
	August	7.227	1.549
	September	7.523	1.115
	October	7.612	0.868
	November	7.746	0.52
	December	7.781	0.555
2013	January	8.055	0.414
	February	8.120	0.525
	March	7.833	0.584
	April	7.681	0.636
	May	7.505	0.669
	TOTAL AVERAGE	7.652	0.806

Table 2. Raw Water Quality Data Summary

Parameter	Units	Raw Water		
		Average	Maximum	Minimum
Turbidity	NTU	0.8	1.5	0.4
Total Coliform	MPN/100 mL	22.5	350	<1.8
Total Dissolved Solids	Mg/L		<100	
Total Hardness	Mg/L as CaCO3	41	50	37
Alkalinity	Mg/L as CaCO3	43	60	20
pH	--	7.65	8.1	7.3
Color	TCU	20	45	10
TOC	Mg/L	3.2	7.5	1.8
DOC	Mg/L	2.9	4.1	1.5
Temperature	DegC	20	26	5*
* During winter when demand is lower.				

Rancho Murieta Development

Current Demands

The demands on the system are based on demands of three residential areas, commercial, and industrial demands. The residential areas are Rancho Murieta North (North), Murieta South (South), and Murieta Village. Demand is based on lots size with the highest demand going to Estate class lots, which are greater than 12,000 sq. ft. Lots size was further broken down to various sizes based on Exhibit B of the "Water Augmentation Supply Fee – Government Code 66000 Compliance Report." Murieta Village is a manufactured/Mobile Home Community. Demand rates from 2003 were based on the 1990 study, "Drought and Water Supply Issues," by Giberson and Associates as well as current demands from the Integrated Water Management Plan prepared by Brown and Caldwell in 2010.

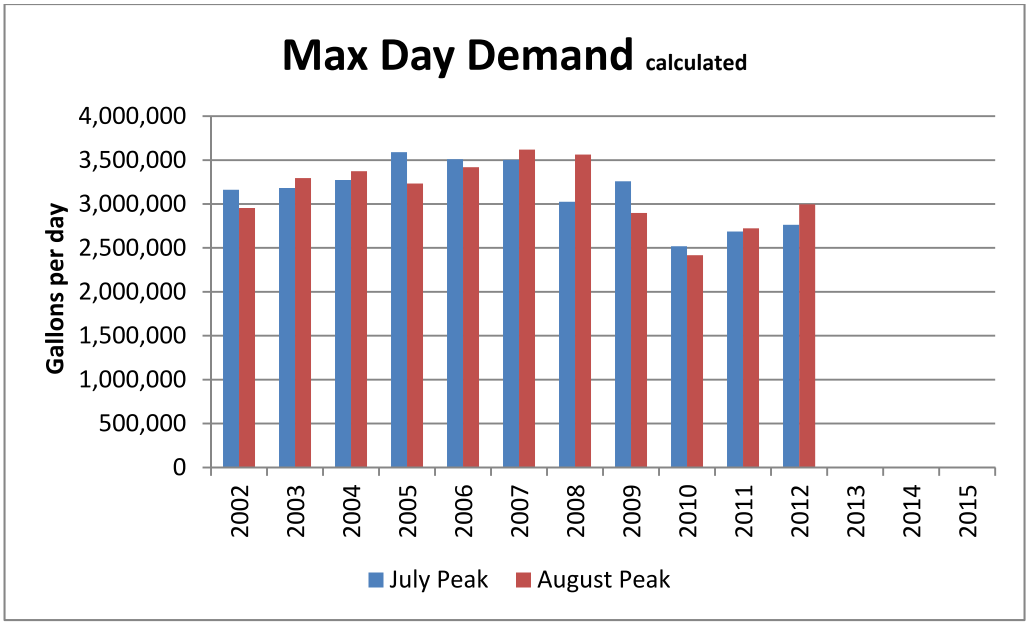

Figure 2. Current Calculated Max Day Demand (Maddaus Water Management)

Based on the data from a few years prior to the current drought, the District estimates that the current "normal conditions" maximum day demand is 3.2 mgd.

Additional information on the current demand provided by the District is included in Table 3. .

Table 3. Development Summary

Development	Lots	Average Day Demand (gpd)	EDU
North Development	1,500	862,100	1,150
North Development Commercial	-	105,300	156
A&S Agmt Allotment (Sept 1986)	246	169,050	246
RMPI Allocation	114	85,500	114
South Development	749	485,350	649
South Development Commercial	-	85,200	98
South Development – Murieta Village, August 1980	189	37,800	51
TOTAL	2,798	1,830,300	2,464

Future Demands

Plans for future development with the District's water service area have reemerged, including the planned construction of a new hotel by Cosumnes Land Company, LLC. Projects include an additional 670 EDUs, 620 of which are residential and the other 50 are commercial units.

Based on the District's projected usage, these additional 670 EDUs will require a treatment capacity of 0.5 mgd.

50 EDUs have been allocated at a usage rate of 750 gpd/EDU for District public projects. Additionally, 15 EDUs at a usage rate of 750 gpd/EDU were assigned for a future school, the site of which is currently planned for a park. This will result in a demand of 0.1 mgd.

Future average daily demands are projected for the development shown in Table 4.

Table 4. Future Increases in Average Daily Demand Summary

Development	Lots	Average Day Demand (gpd)	EDU
Lakeview	99	64,350	86
Residences – East	99	64,350	86
Residences – West	99	64,350	86
Retreats	84	29,400	39
Riverview	140	91,800	123
Gardens I	99	64,350	86
Gardens II	50	37,500	50
TOTAL	670	416,100	557

Based on the determined 2007 – 2012 peaking factor of 2.1 per the Maddaus Water Management Demand Factor Study prepared in 2013, CDPH Title 22 calculations, the maximum day demand (MDD) for the future development is 873,810 gpd.

The current estimated buildout maximum day demand for the entire treatment plant is 6.0 mgd taking into water conservation efforts, greater use of reclaimed water and less growth. Plant 1 has a capacity of 4.0 mgd and Plant 2 has a capacity of 2.0 mgd.

Proposed Retrofit

The retrofit and expansion of the existing water treatment plant includes influent piping to new autostrainers, and modifications to the Plant 1 flash mixer and flocculation basins. The flocculation basins will flow into new membrane tanks with GE Zeeweed 1000 submerged membranes. The membrane system includes permeate, reject, and backwash (backpulse) pumps. The membranes also include new membrane cleaning chemicals (sodium hypochlorite, citric acid, hydrochloric acid and sodium bisulfite) and new chemical storage and feed systems for bulk use chemicals (ACH and NaOH). A plate settler will be used to clarify waste from the backwash, maintenance, and recovery cleans and recycles that water back to the head of the plant, with concentrated solids being sent to waste. New additional flow paced chlorinators inject chlorine into the filtered water prior to the structurally modified chlorine contact basin

(CCB). Two new treated water booster pumps were added to pump the treated water out to the distribution system. Modifications were also made to increase the size of one of the drying beds that receives the underdrain sludge from the plate settler.

Chapter 2 - Regulatory Considerations and Compliance

The quality of the water to be provided by the WTP must meet all existing and proposed regulatory requirements. The Safe Drinking Water Act (SDWA) of 1974 gave the United States Environmental Protection Agency (USEPA) the authority to set standards for contaminants in drinking water supplies. The USEPA established primary regulations for the control of contaminants that affect public health and secondary regulations for compounds that affect the taste, odor, or aesthetics of drinking water. Under the provisions of the SDWA, the California Division of Drinking Water (DDW) has the primary enforcement responsibility. Title 22 of the California Code of Regulations establishes DDW's authority, and stipulates State drinking water quality and monitoring standards. A summary of how the expanded WTP will comply with the current drinking water quality regulations is presented below.

Surface Water Treatment (For compliance with SWTR, IESWTR, LT1ESWTR, LT2ESWTR, Stage 1 and 2 D/DBP Rules)

Process Selection Water Quality Consideration

The water quality in the primary storage reservoirs (Calero and Chesbro) is very stable due to the long detention time in the reservoirs. A discussion of the proposed treatment in relation to the regulatory compliance for key water constituents follows:

- *Microbial Contaminants* - The concentrations of total coliform, E. Coli, and Giardia cysts are all low in the source water dues to the limited access to off-stream reservoirs. Based on testing to date, the Cryptosporidium concentration ion is averages less than 0.075 oocyst/L placing the water in a Bin 1 classification. All of these pathogens or indicator organisms are effectively removed by membrane treatment, which can achieve 4-log removal of protozoa. An additional 0.5 log Giardia reduction is provided in the contact basin with free chlorine disinfection. Virus inactivation (4.0 log) will also be provided by free chorine disinfection in the baffled and expanded Plant 1 chlorine contact basin.
- *Organics and DBPs* -The concentrations of total organic carbon (TOC) in the raw water feed ranges from 1.8 to 7.5 mg/L with and average of 3.2 mg/L. Ongoing aquatic weed and algae management has helped to prevent further increases in TOC and taste and odor (T&O) compounds. Alum or aluminum chlorohydrate (ACH) will be added at the flash mix to help remove reactive TOC and control DBPs. In addition powdered activated carbon can be added for further TOC and T&O compound removal. Both Plant 1 and Plant 2 have been using this strategy for many years to successfully comply with the Stage 1 and Stage 2 Disinfectants/Disinfectant Byproducts Rule D/DBPR. Switching to membranes will not change the effectiveness of this DBP and T&O control strategy.
- *Turbidity* - The turbidity levels in the raw water feed from Chesbro Reservoir are normally below 1.0 nephelometric turbidity units (NTUs). The Plant 1 Membrane

system includes a flocculation basin with a minimum 7 minute detention time. The basin will provide contact time for coagulant reaction for TOC removal. The GE Zenon membrane system is specified to achieve a maximum filtrate turbidity of 0.1 NTU 95 percent of the time and to never exceed 0.5 NTU.

- *Lead and Copper Rule (LCR)* – The plant will continue to add sodium hydroxide and zinc orthophosphate for corrosion control in the distribution system. The installation of membranes will have no impact on the effectiveness of this successful corrosion control strategy.

Staffing Considerations

Technician skills, ability and knowledge are factors associated with the labor requirements of the new facility. Water Treatment Plant operators are certified by the State of California to ensure a minimum degree of skills are available for proper operation of the facility. The District will need to comply with State Water Treatment Plant Operator Certification requirements based on the assigned classification of the new facility. Per California Regulations Related to Drinking Water sub-section 64413.1 in Article 2 of Chapter 15 – Classification of Water Treatment Facilities, (see Appendix F) the facility class designation worksheet places the Rancho Murieta WTP at 49 points classifying the facility as a "T3" plant. The District already has operators on staff that meet this requirement.

Site plan and accessibility

The site plan for the WTP is included in the Construction Drawings that are submitted with this report. The WTP access roads are designed to allow for chemical truck access. The WTP site meets the State and County requirements for fire truck access.

Adequacy of Treatment Plant Capacity to Meet Current and Future Demands

The expanded WTP will provide the needed maximum day capacity for the current and future demands. As described above, the estimated buildout capacity for the Rancho Murieta service area is 6.0 mgd. The new membrane system alone will have a capacity of 4 mgd. With Plant 2 in operation, the total capacity of the plant will be 6 mgd. In the future, an additional 2 mgd of capacity can be added to Plant 1 to provided 6 mgd of membrane capacity. This will allow for decommissioning of Plant 2 once it reaches is useful life.

Compliance with Current Waterworks Standards

The WTP expansion is designed in full compliance with the new Waterworks Standards dated July, 2015.

How Design Addresses Design Criteria of SWTR Section 64658

Explanations of how the design complies with the provisions of Section 64658 of the Surface Water Treatment Rule are presented in Table 3 below.

Table 5. Explanation of Compliance with Section 64658 of the Interim Enhanced Surface Water Treatment Rule

Requirement	Design Features Included for Compliance
(1) Achieve an average daily effluent turbidity goal of 0.2 NTU when using conventional, direct, and diatomaceous earth filtration plants.	The GE Zenon membrane system is specified to achieve a maximum filtrate turbidity of 0.1 NTU 95 percent of the time and to never exceed 0.5 NTU. The system will be tested to confirm performance.
(2) Be free of structural and sanitary hazards.	The WTP meets the sanitary separation requirements because: raw water; sewer lines are completely separate from the potable water system. The chlorine contact basin (CCB) is covered and protected from inflow of contaminated water.
(3) Protect against contamination by backflow.	Backflow preventers (reduced pressure type) are provided at every location required by the plumbing code to isolate potential sources of contamination from the potable water system. Hose bibs are fitted with vacuum breakers. There are no process bypass pipelines included in the design.
(4) Meet the capacity and pressure requirements prescribed in 22 CCR sections 6456264554 and 6456664602.	New booster pumps have been added to provide a firm capacity of 4 mgd from Plant 1. 16-inch diameter transmission mains (< 5 fps at 4 mgd) convey the flow from the plant to the Van Vleck Tank and the Rio Oso Tank.
(5) Provide flow measuring and recording equipment.	Flow measurement is provided on: the raw water feed to Plant 1, at each membrane cell, and the combined filtrate flow to the CCB. Recording of flow is provided within the SCADA system.
(6) Take into consideration the effects of events such as earthquakes, fires, floods, freezing, and sabotage that are reasonably foreseeable.	The plant is located above the 100-year flood plain and not subject to flooding. The structures are designed in accordance with the 2013 California Building and Fire Code which accounts for earthquake forces and provides for protection from fires. Security features at the WTP include: - Perimeter fences - Closed circuit video cameras These features are shown in the design documents.
(7) Provide reasonable access for inspection, maintenance, and monitoring of all unit processes.	The membrane cells are accessible by removing cover plates. A 5-ton bridge crane is provided to allow for removal of membrane cassettes for inspection and maintenance. Piping and valves are accessible from both the front and the back of the cells. Space is provided around all pumps, strainers and other equipment to allow for maintenance.
(8) Provide for filter-to-waste for each filter unit or addition of coagulant chemicals to the water used for backwashing.	This requirement is not applicable to membrane filtration systems.
(9) Provide backwash rates and surface or subsurface wash facilities using air, water or a combination thereof to clean the filter after use to its original condition.	This requirement is not applicable to membrane filtration systems.
(10) Provide solids removal treatment for filter backwash water if it is recycled into the treatment process. Recycled backwash water shall be returned to the headworks of the treatment plant.	A package coagulation, flocculation, plate settler is provided in the design to treat membrane backwash water prior to recycle to the headworks – upstream of the coagulant addition point.
(11) Provide for the future addition of pretreatment facilities in the design of direct filtration, slow sand, or diatomaceous earth filtration plants.	This requirement is not applicable to membrane filtration systems.
(12) Provide disinfection equipment sized for the full range of flow conditions expected and capable of feeding accurately at all flow rates.	Chlorine for disinfection will be provided by 1-ton chlorine containers. For Plant 1, 2 new 200 lb/day chlorinators and 1 new 100 lb/day chlorinator have been added for pre- and post chlorination, respectively. Chlorine residual, temperature, and pH will be monitored before and after the CCB to ensure that the required disinfection CT for 4.0 log

Requirement	Design Features Included for Compliance
	virus and 0.5 log Giardia inactivation is maintained at all times.
(13) Provide for treatment plant operation without frequent shutdowns and startups or rapid changes in filtration rates.	The WTP is fully automated and can run continuously with or without operators present. Because of the storage provided in Chesbro and Calero Reservoirs, the plant can operate at a constant rate to meet daily demands.

CEQA Compliance

A Draft Initial Study / Mitigated Negative Declaration document was prepared for this project. After receiving and responding to comments, the Final was approved by the Rancho Murieta Community Services District board in 2013.

Chapter 3 - Treatment Plant Description

Unit Processes and Plant Layout

Raw water from Chesbro and Clementia Reservoirs enters the treatment plant and after potential pre-oxidation with potassium permanganate addition is strained and then mixed with recycled water clarified with a plate settler. Following coagulant, chlorine, and possibly PAC addition, the raw water passes through the flash mixer and then to the flocculation tanks. After flocculation, the water flows to the membrane basins, from where permeate pumps "pull" water through the submerged membranes and pump the filtered water to the chlorine contact basins. Filtered water is also used to fill the clean-in-place (CIP) tank used for backwash, maintenance, and recovery cleans for the membranes. The neutralized reject and waste from the CIP tank is pumped to the Neutralized CIP Waste Storage Tank from which it is pumped to the sanitary sewer. The rest of the filtered water has chlorine injected prior to a static mixer and passes through the chlorine contact basin and eventually to the treated water booster pumps to be pumped out to the distribution system. Filtered water for the membrane backpulse process is provided from the chlorine contact basin with dedicated Backpulse Pumps. The waste backpulse water is sent to the waste backwash basins and then to the plate settler for recycling to the raw water feed and the underdrain sludge is moved to the drying beds.

The process flow diagram of the water treatment plant is included at the end of this report in Appendix A. Further details on each of these processes are discussed in subsequent Sections below.

Raw Water Pipelines

A 36 inch pipe passes through the dam from Chesbro Reservoir and connects to a 20 inch pipe. This short length of 20 inch pipe has interconnections to Clementia Reservoir and to the Valve Box. The 20 inch pipe increases in size to a 24 inch pipe, which feeds the Plants 1 and 2. Table 6. summarizes the velocities in the plant existing raw water pipelines at the Phase 4 future Maximum Day demand of 6.0 mgd.

Table 6. WTP Raw Water Pipeline Velocities at Build-Out Firm Capacity (6.0 mgd).

Pipe Size	Velocity (feet per second)	Location
36 inch	1.3	From Chesbro Reservoir to WTP
20 inch	4.3	Interconnections to Clementia Reservoir from valve box.
24 inch	3.0	From valve box to Plant 1 and Plant 2.

The raw water pipeline that feeds Plant 1 has been evaluated for a capacity of 6.0 mgd. Table 6. summarizes several pipe velocities at the Phase 4 maximum day and average day flows. Based on these tables, and to reduce pipe velocity at maximum flow, a new 24 inch pipe feeds Plant 1. The 24-inch line will provide sufficient contact time to allow for ozonation of raw water should it be necessary for taste and odor control in the future.

The existing 20 inch raw water pipe downstream of the valve box will be hot-tapped to install a 20 inch tee fitting. The new raw water pipe will be a new 20 inch pipe from the tee connection to the strainers. To accommodate future flows to Plant 2, the RW pipe increases to 24-inch diameter between the strainer discharge manifold and the RW pipe to Plant 1 branches off. The 12-inch pipeline (between the Valve Box and Plants 1 and 2) will continue to feed Plant 2.

Raw Water Screening

The purpose of the screening process is to remove large objects from the water as it enters the plant through a 16-inch inlet pipe. Large objects such as fish, leaves, and debris can affect the water quality and be detrimental to the treatment equipment.

In-line, automatic, motorized self-cleaning strainer screens are installed upstream of the membrane units. This type of screen would use rigid scraper bars to remove solids from the surface of the screen when the screens are rotated. A solids collecting sump is included. The drain from this sump is piped to drain back to Clementia Reservoir. For the membrane system the screen is specified for a maximum of 500 microns. This facility utilizes screens with a mesh size of 1/64 inch (400 microns) perforated opening diameter. Two ACME Engineering Automatic Strainers are in place each with a hydraulic capacity of 4,500 gpm (gallons per minute).

Membrane Filtration

Description

Typical microfiltration and ultrafiltration membranes used in drinking water application are in hollow-fiber configuration. Unlike conventional media filtration that depends on surface chemistry for particulate removal, MF/UF remove contaminants by physical straining (sieving). The membranes remove particulates by physically straining from the water the particles greater than the pore size of the membrane. There are two types of configurations for MF/UF membranes – pressure-driven system with membrane modules mounted in pressure vessels operating under positive pressure and vacuum-driven system with membrane modules submerged in an open basin that operate under vacuum. These membrane systems are typically operated at low (5 to 35 psi) pressures with flux rates between 15 and 75 gallons/ft^2/day (gfd), depending on feed water quality and membrane cleaning regime. Chemical conditioning of the raw-water feed is usually not required except where enhanced organics removal is desired.

The membranes are submerged in a coated concrete tank and the raw water is pulled through the membranes under vacuum by a low NPSH pump. The submerged systems operate at a lower transmembrane pressure than do pressure systems because the maximum vacuum that can be pulled is negative 12.5 psi. Submerged membranes are mounted directly to the manifold rack without a separate pressure vessel. This more open configuration can better handle high solids loads and is why only submerged membranes are used in wastewater applications. Submerged membrane systems require an overhead crane to remove the membrane racks. The anticipated sequence of phasing is shown in Table 7.

Table 7. Membrane Phasing Alternatives[1]

Criteria	Phase 3A	Phase 3B	Phase 3C	Phase 4
	Capacity (mgd)			
Membrane Train 1	1.5	1.75	2.0	2.0
Membrane Train 2	1.5	1.75	2.0	2.0
Membrane Train 3	-	1.75	2.0	2.0
Membrane Train 4	-	-	-	2.0
Total Capacity	3.0	5.25	6.0	8.0
Firm Capacity[2]	1.5	3.5	4.0	6.0

1. Phasing numbering assumes that Phase 1 and Phase 2 exist in the current water treatment plants.
2. Firm capacity is based on one of the trains being out of service for maintenance or performing a backwash or cleaning operation.

Each membrane train includes spaces for cassettes; within those cassettes, there are spaces for modules. The water is pulled through and extracted via dedicated permeate pumps provided by the manufacturer supplier through a 10-inch header on the top of each membrane train. Given the overall dimensions and preliminary layout, both sedimentation basins will be required for the installation of the four membrane trains with permeate pumps. New concrete walls have been constructed to create a water tight basin for the membrane housing. The end of the basin opposite the flocculation area has been converted to a waste water holding tank from the membrane backwash operations.

The previous Plant 1 Sand Filter Basin and Filter Influent Channel were modified for additional chlorine contact time, and the existing Waste Water Holding Basin was converted into a wetwell for membrane backwash supply pumps.

Backwash Generation

The backwash waste basins will receive the backpulse waste (or reject) from the membranes. Neutralized CIP waste will normally be sent to the Neutralized CIP Waste Storage Tank, however, in the event the tank is out of service the neutralized CIP waste can be sent to the waste backwash basins on a temporary basis. Backwash waste pumps will divert the waste through a plate settler for solids removal. The backwash waste basins are of sufficient size to provide equalization, as the recycle of the supernatant from the plate settler to the raw water headworks should not exceed 10% of the total plant flow. Typically, the backpulse waste flow is 5% of the feed flow (95 percent recovery). The basin size is designed around the buildout conditions with considerations for waste as shown in Table 8. Given the criteria, the basins are approximately 16 feet long and 16 feet wide (for each basin) with an 8 feet high water level.

Table 8. GE Estimated Wastewater Generation (per GE Product Data)

Parameter	Phase 3 (4.0 mgd)
Volume of Permeate Used Per Backwash	420 gallons
Total Volume of Wastewater Per Backwash Event	4,114 gallons
Daily Waste Generated from Backwashes	142,715 gallons
Volume of Permeate Used Per Hypochlorite MC	3,694 gallons
Total Volume of Wastewater Per Hypochlorite MC Event	8,332 gallons
Daily Waste Generated from Hypochlorite MC	21,425 gallons
Frequency of Hypochlorite Maintenance Cleans	6/week/train
Volume of Permeate Used Per Acid MC	3,694 gallons
Total Volume of Wastewater Per Acid MC Event	8,332 gallons
Daily Waste Generated from Acid MC	3,571 gallons
Frequency of Acid Maintenance Cleans	1/week/train
Volume of Permeate Used Per Hypochlorite CIP	3,694 gallons
Total Volume of Wastewater Per Hypochlorite CIP	8,332 gallons
Daily Waste Generated from Hypochlorite CIPs	821 gallons
Frequency of Hypochlorite Recovery Cleans	12/year/train
Volume of Permeate Used Per Acid CIP	3,694 gallons
Total Volume of Wastewater Per Acid CIP	8,332 gallons
Daily Waste Generated from Acid CIPs	821 gallons
Frequency of Acid Recovery Cleans	12/year/train

Given the demands of the development first phase of the expansion will require a firm treatment capacity of 3.5 mgd. All of the core facilities will be included in this initial phase, including all the concrete work required for the modified sedimentation basins that will house the new membranes. However, only a portion of the membranes for the future 6.0 mgd buildout firm capacity have been included. Three of the four trains are included in the current installation; each of the three trains has been partially filled with cassettes and modules to reach the desired capacity.

Table 9. GE Zeeweed System First Phase Configuration (2.0 mgd)

Parameter	Quantity
Type of Membrane	Zeeweed 1000
Module Surface Area (sf)	450
Number of Trains	3

Parameter	Quantity
Number of Cassettes per Train	2
Number of Cassette Spaces per Train	2
Number of Modules per Cassette	87
Design Max Instantaneous Flux	30 gfd
Number of Module Spaces per Cassette	96
Maintenance Clean (MC) Protocol	1/day/train
Membrane Integrity Test (MIT) Protocol	1/day/train
Recovery Clean (RC) Protocol	12/year/train sodium hypochlorite followed by citric acid

Membrane Startup and Testing

A membrane startup and testing protocol was developed in coordination with GE and RMCSD to ensure the membranes are ready to begin treating water to design specifications.

Chlorine Contact Basin

Both Plants 1 and 2 have dedicated chlorine contact basins (CCBs). Table 10 summarizes appropriate inactivation criteria for the Plant 1 CCB and the estimated total chlorine contact basin volume required for Phase 3 and Phase 4. The Plant 1 chlorine contact basin is used up to its maximum capacity for Phase 3 (up to about 3 mgd plant capacity). For flows above 3 mgd up to the buildout capacity of 6 mgd, the exiting Plant 1 chlorine contact is not large enough. For this higher flow, the chlorine contact basin and booster pumps at plant 2 would be utilized with a portion of the effluent of Plant #1 flowing to it. The required volume for Phase 4 is shown in the table.

Table 10. Chlorine Contact Basin Inactivation Criteria and Required Contact Basin Volume.

Parameter	Phase 3 Improvements		Phase 4 Improvements	
	Summer	Winter	Summer	Winter
Flow Rate (mgd)	3.5	1.5	6.0	2.6
Average pH	7.5	7.5	7.5	7.5
Minimum Water Temperature (Deg C)	20	5	20	5
Normal Chlorine Residual Dose (mg/L)	1.0	1.0	1.0	1.18
Required Inactivation – Giardia *	0.5	0.5	0.5	0.5
Required CT per EPA Criteria	11.29	31.94	11.29	32.75
Baffling Factor	0.75	0.75	0.75	0.75
Total (gallons)	36,600	44,400	62,710	78.850
Additional (to supplement existing volume)	0	0	Use Plant 2	Use Plant 2

Treated Water Pump Station

The Plant 1 Booster Pumping Station firm capacity meets Phase 3 maximum day demands (up to about 3 mgd). For Phase 4, the booster pumps in Plant 2 will be utilized.

To meet the increased demand, two new pumps are being installed. Each new pump will be sized to match each existing pump's capacity of 780 gpm (1.12 mgd). Similar to the existing pumps, the new pumps will be constant speed pumps. Phase 3 will install one new pump to increase the Plant 1 Booster Pumping Station firm capacity to 2,100 gpm (3.0 mgd).

Table 11 summarizes the improvements needed at the Plant 1 Booster Pumping Station to meet the Phases 3 and 4 maximum day demands. The improvements will maintain the existing distribution system control operation. The Plant 1 booster pumping station feeds Reservoir 1 and 2 through a common line. The controls for the new pumps will also be identical to the existing pumps. The microprocessor will be upgraded to accommodate the future maximum day flows.

Table 11. Recommended Design Criteria for Plant 1 Booster Pumping Station Improvements.

Parameter	Plant 1 Booster Pumping Station Improvements
Total Number of Pumps	
Phase 3 Improvements	5 Total (4 Duty, 1 Standby); 3 Existing and 2 New
Phase 4 Improvements	Use Plant 2 Pumps
Pump Capacity (each)	
Capacity, each	780 gpm at 160 feet TDH
Pumping Station Firm Capacity	
Phase 3 Improvements	3.5 mgd (2,450 gpm)
Phase 4 Improvements	6.0 mgd (2,800 gpm at Plant 1; and 1,400 gpm at Plant 2) 4,200 gpm total

The existing Plant 1 booster pumping station was extended to fit the new pumps and satisfy the recommended Hydraulic Institute standards. The new layout provides a 19.5 feet by 7 feet basin.

Plant Chemical Feed System

The WTP currently utilizes the following bulk chemicals in operations:

- Aluminum Sulfate (48.5%) – primary coagulant for turbidity and TOC removal.
- Zinc Orthophosphate (301) – corrosion inhibitor.
- Sodium Hydroxide (50%) – pH adjustment for corrosion control.
- Polymer (ProPac 9890) – coagulant/coagulant aid.
- Potassium Permanganate – preoxidant for taste and odor control.

- Powder activated carbon (PAC – Darco KB-M) – taste and odor control and TOC removal.
- Chlorine (gas) – for disinfection.
- Aluminum Chlorohydrate (ACH, 24%)

Alum

The alum equipment consists of one 6,000 gallon storage tank and three 10 gal/hr (240 gpd) feed pumps. Alum is added at the rapid mix structure at both Plant 1 and Plant 2. Table 12 presents the range of anticipated alum dosages at the water treatment plant based on current usage.

Table 12. Alum Dosages.

Operating Condition	Alum Dose, mg/L
Minimum	15
Average	20
Maximum	30

Alum usage is based upon a 48.5 percent alum solution. For the Phase 3 expansion, average alum use may be about 130 gal/day between the two plants. The existing storage tank will provide 52 days of storage at the average use rate. The required metering pump capacity for the Phase 3 alum addition at Plant 1 ranges from 1.4 to 7.9 gal/hr.

Aluminum Chlorohydrate (ACH)

ACH will be added to the rapid mix structure of Plant 1. Typically doses for ACH are 1/3 to 1/2 the doses used for alum coagulation (see Appendix). Table 13 presents the range of anticipate ACH dosages at the water treatment plant.

Table 13. Anticipated ACH Dosages.

Operating Condition	ACH Dose, mg/L
Minimum	5
Average	10
Maximum	15

Table 14 presents the anticipated ACH use at Plant 1 based on the dosages given in Table 13. Usage is based upon a 24 percent ACH solution. For the Phase 3 expansion, average ACH use may be about 375 lb/day. Storage of ACH will be provided in a 4,000 gal polyethylene tank, providing 120 days of storage under average dosage conditions. The required metering pump capacity for the Phase 3 ACH addition at Plant 1 ranges from 0.35 to 1.9 gal/hr.

Table 14. Plant 1 ACH Usage.

Design Condition	Usage (gal/day)

Design Condition	Usage (gal/day)
Minimum	4
Average	10.5
Maximum	2.3

Zinc Orthophosphate ($ZnPO_4$)

The zinc orthophosphate ($ZnPO_4$) equipment consists of one 1,400 gallon storage tank and three 1.0 gph feed pumps. $ZnPO_4$ is added for corrosion control in the distribution system at the treated water booster pump station. Table 15 presents the range of existing $ZnPO_4$ dosages at the water treatment plant.

Table 15. Existing Zinc Orthophosphate Dosages.

Operating Condition	$ZnPO_4$ Dose, mg/L
Minimum	2
Average	3.5
Maximum	5

Table 16 presents the anticipated $ZnPO_4$ use based on the dosages given in Table 15. For the Phase 3 expansion the average $ZnPO_4$ use will be 24 gal/day between the two plants. The storage tank will provide 58 days of storage at average use rates. The required metering pump capacity for the Phase 3 ZnPO4 addition at Plant 1 ranges from 0.11 to 0.62 gal/hr. The $ZnPO_4$ metering pumps have a maximum capacity of 1.0 gal/hr.

Table 16. Plant 1 ZnPO4 Usage.

Design Condition	Current Usage (gal/day)	Phase 3 Usage (gal/day)
Minimum	1	3
Average	2	7
Maximum	4	15

Sodium Hydroxide

The WTP currently utilizes 50% sodium hydroxide solution for pH adjustment for corrosion control. The sodium hydroxide is stored in a 2,500 gallon polyethylene storage tank constructed on an exterior concrete pad. To protect the chemical from freezing conditions the tank is heat traced.

Table 17. Anticipated NaOH Dosages.

Operating Condition	ACH Dose, mg/L
Minimum	2
Average	6
Maximum	12

The storage tank will provide 128 days of storage. Two metering pumps are provided for service, each rated at 2.2 gallons per hour which meets the initial 3.0 mgd treatment capacity. As the plant expands, these pumps can be upsized to meet the future conditions.

Powdered Activated Carbon (PAC)

A new PAC feed system is installed to allow for use of PAC to be fed into the flocculation basins ahead of the membrane system. PAC will only be fed when taste and odor is detected in the raw water. The estimated dosage range of PAC, when used, is 2 to 10 mg/L.

Potassium Permanganate

The existing potassium permanganate feed system at the Chesbro Reservoir outlet pipeline will remain in place. It includes the chemical at 7% dosing between 0.5 and 1.0 mg/L. It is stored in 55 lb buckets which last approximately 300 days.

Membrane Chemical Requirements

Chemicals storage and feed systems will be provided for membrane fouling control and clean-in-place (CIP) systems. CIP systems consist of storage tanks and accessories, pumps, tank heaters, control panels, heater and controls, chemical dosing/recirculation systems, interconnecting piping/valves, and instrumentation/electrical.

CIP mix tanks are provided with a 24-inch access way and heater/thermostat for elevating chemical temperature as required. A list of chemicals and their usage rates are presented in Table 18 below.

Table 18. Membrane Cleaning Chemicals and Dosages.

Item	Purpose	Storage Type	Maximum Frequency	Dosage Range
Backwash Cleaning (Sodium Hypochlorite)	Dislodge organic particles	330 gal Tote	30 seconds every 15 minutes	2 mg/L from 12 percent solution
Maintenance Cleaning (Sodium Hypochlorite)	Sustain operational flux	330 gal Tote	20 – 30 minutes per day	10 mg/L Cl_2 from 12 percent solution
Recovery Cleaning (Citric Acid)	CIP – removal of metal hydroxides and carbonates	220 gal Tote	One per month	100 mg/L from 50 percent solution
Recovery Cleaning (Sodium Hypochlorite)	CIP – reduction of biofouling	330 gal Tote	One per month	250 mg/L from 12 percent solution
Neutralization (Sodium Hydroxide)	Neutralize citric acid recovery cleaning	2,500 gal Bulk Tank	One per month	From 20 percent solution
Neutralization (Sodium Bisulfite)	Neutralize sodium hypochlorite recovery cleaning	55 gal Drums	One per month	From 25 percent solution

Chemical storage systems are designed and constructed with containment areas in compliance with the California Building Code (CBC) and California Fire Code (CFC) standards. Tanks with level monitoring systems are utilized for the new ACH and NaOH storage tanks.

Emergency shower and eyewash assemblies are furnished and installed in accordance with United States Occupational Safety and Health (OSHA) and other applicable codes.

Chlorination System

RMCSD uses chlorine gas for disinfection and as a residual disinfectant in the distribution system.

Table 19 presents the Plant 1 chlorine use anticipated for Phase 3. The minimum usage represents the minimum dose at average daily flow; the average use represents the average dose at average daily flow; and the maximum use represents the maximum dose at the current design maximum daily flow of 4 mgd. This a could mean up to 4 mgd from Plant 1 or 2 mgd from each plant.

Table 19. Total Chlorine Usage.

Design Condition	Phase 3 Plant 1 Usage (lb/day)	Current Plant 2 Usage (lb/day)
Minimum	42	28
Average	100	56
Maximum	200	117

Having two 1-ton storage containers connected (one duty and one standby) leaves space for two emptying containers awaiting replacement and/or spare full containers. The installation allows storage of four one ton containers.

Six chlorinators are installed in the new chlorinator room. Table 20 presents the capacities for each of the six chlorinators.

Table 20. Chlorine Feed Design Criteria.

Chlorinator	Capacity, ppd	Rotameter Capacity, ppd
Plant 1 Pre-Chlorination	200	0 – 200
Plant 1 Post-Chlorination	100	0 – 100
Plant 1 Spare	200	0 – 200
Plant 2 Pre-Chlorination	100	0 – 150
Plant 2 Post-Chlorination	50	0 – 100
Plant 2 Spare/Pre-filter	100	0 – 100

Solids Handling System

Water treatment waste solids will come from the membrane reject water that is wasted when a train is backflushed. Additional waste streams include neutralized CIP solution. The membrane waste streams will be stored in backwash waste basins for equalization. Submersible pumps in the backwash waste basins pump the reject water to a plate settler where a small amount of coagulant will be added and the bulk of solids will be removed. The supernatant of the treated reclaimed water will be returned to the influent line to Plant 1 ahead of the rapid mix system. Solids removed in the plate settler will flow by gravity to the drying beds.

The anticipated solids loading for current and future expansions are summarized in Table 21.

Table 21. Anticipated Solids Loading for Current and Future Expansions.

Phase	Total Annual Average Flow	Annual Solids Loading, lbs*
2	1.5 mgd	45,000
3	1.7 mgd	50,900
4	2.85 mgd	85,300
* Based on 82 lb/MG (dry basis) with 20 mg/L alum dose and 0.8 NTU raw water.		

The current solids loading rate is 5.6 lb/sf/yr. At Phase 4, the loading rate would increase to 10.7 lb/sf/yr. Typically, drying beds can be loaded to up to 9 lb/sf/yr in this climate. The drying beds occupy a total area of 9.360 sf which meets the recommended loading rate.

Electrical, Instrumentation, and SCADA Systems

A 1,100 kW standby generator is installed to provide standby power for the whole plant. The generator has a sub-base fuel tank with a fuel capacity of 24 hours and a sound attenuating weatherproof enclosure. The automatic transfer switch is installed in the switchboard enclosure located near the 1600 ampere switchboard.

The present plant control system was replaced with a state-of-the-art SCADA system. The system includes an Allen Bradley 1756 ControlLogix PLC with a central PC-based operator console. The PLCs are distributed with the expectation that the existing Plant 1, Plant 2 and the Membrane Filtration System will each have a PLC. The PLC system will communicate to the central operator console using Ethernet. The operator console will be configured using WonderWare SCADA software.

Operation and Maintenance

Operation and maintenance of the water treatment plant will be covered in the O&M manuals that will be submitted prior to completion of construction. Manufacturer information will be stored on site.

Summary of Process Design Criteria

A summary of the design criteria for the water treatment plant are included as Appendix B to this report in the Treatment Plant Data Sheet.

Appendix A – Process Flow Schematic

NOTES:

1. ALL TABULATED DATA IS FOR GENERAL INFORMATION AND DOES NOT SUPERSEDE REQUIREMENTS IN THE SPECIFICATIONS.
2. FLOW SCHEMATIC IS FOR GENERAL INFORMATIONAL PURPOSES ONLY. P&ID AND PROCESS DRAWINGS TAKE PRECEDENCE OVER THIS DRAWING.

STRAINERS

NO. UNITS	2
FLOW RATE (EACH)	6.0 MGD
INLET/OUTLET DIAMETER	16 INCH
PRESSURE DROP (MAX)	2.0 PSI

MEMBRANES

	CURRENT	FUTURE
NO. TRAINS	3	4
TREATED WATER FLOW RATE (TOTAL MGD)	4.0	6.0
NORMAL FLOW RATE (MGD PER TRAIN)	2.0	2.0
RECOVERY RATE	95%	95%

PROCESS PUMPS

	NO. DUTY + STANDBY	FUTURE	FLOW (GPM)	TDH (FT)	HP (EACH)
PERMEATE (FILTRATE) PUMPS	3	1	1602	34	25
REJECT PUMPS	2	0	2291	25	20
BACKPULSE (BACKWASH) PUMPS	2	0	1613	42	25
WASTE BACKWASH PUMPS	2	0	350	30	7.5
CLEAN-IN-PLACE (CIP) PUMPS	2	0	555	11	5
TREATED WATER BOOSTER PUMPS	5	1	780	160	60
UNDERDRAIN SUMP PUMPS	2	0	60	25	1

PLATE SETTLER

NO TRAINS	1
FLOW RATE	350 GPM
ACTUAL PLATE AREA	2,710
SETTLING AREA	1296 SF
PLATE ANGLE	55°
LOADING RATE	0.4 GPM/SF

BLOWERS

	NO UNITS	FLOW (CFM)	PRESSURE (PSI)	HP (EACH)
AIR BLOWERS	2	250	+5.0	10

PLANT 1 CHLORINE CONTACT TIME

	VALUE
TOTAL VOLUME	105,000 GAL
BAFFLING FACTOR	0.7
DESIGN FLOW	4.0 MGD
CONTACT TIME	26.5 MIN

Issue No.	Description	Date	Drwn.	Chkd.	Resp. Engr.	Proj. Mgr.
0	CONFORMED FOR CONSTRUCTION	06/13/14	JKW	MB	RS	RS

REGISTERED PROFESSIONAL ENGINEER
RICHARD G. STRATTON, JR
NO. 37261
EXP. 6/30/14
CIVIL
STATE OF CALIFORNIA

HDR
HDR Engineering, Inc.

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY.

Project Manager: RICHARD STRATTON
Designed: R. STRATTON
Designed:
Checked:
Drawn: J. WEBB

Rancho Murieta CSD

WATER TREATMENT PLANT EXPANSION

PROCESS SCHEMATIC I

AND DESIGN CRITERIA

Date: JANUARY, 2014
Scale: NTS
Project No.: 08669-211953-028
File Name: 8669-G005.DWG
Drawing No.: G005
Issue: 0

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NOTES:

1. FLOW SCHEMATIC IS FOR GENERAL INFORMATIONAL PURPOSES ONLY. P&ID AND PROCESS DRAWINGS TAKE PRECEDENCE OVER THIS DRAWING.

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Issue No.	Description	Date	Drwn.	Chkd.	Resp. Engr.	Proj. Mgr.
0	CONFORMED FOR CONSTRUCTION	06/13/14	JKW	MB	RS	RS

REGISTERED PROFESSIONAL ENGINEER
RICHARD G. STRATTON, JR
NO. 37261
EXP. 6/30/14
CIVIL
STATE OF CALIFORNIA

HDR
HDR Engineering, Inc.

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY.

Project Manager: RICHARD STRATTON
Designed: R. STRATTON
Designed:
Checked:
Drawn: J. WEBB

Rancho Murieta CSD

WATER TREATMENT PLANT EXPANSION

PROCESS SCHEMATIC II

Date	Project No.	Drawing No.	Issue
JANUARY, 2014	08669-211953-028	G006	0
Scale: NTS	File Name: 8669-G006.DWG		

Appendix B - Treatment Plant Data Sheet

State of California	Department of Health Services

Membrane Filtration Plant Data

System Name:	Rancho Murieta CSD	
System Number:		
Source of Information:	BODR Phase 3 and Project Specifications	
Collected By:		Date: 10/14/2015

Name Of Water Treatment Plant:	Water Plant #1	
Treatment Classification:	Membrane Filtration	
Plant Capacity:	4 MGD	
Design Flow (mgd):	4 MGD	
Maximum Flow (mgd):	4 MGD	
How Is The Flow Measured?	Influent and Effluent Flow Meters	
Flow Variations:	0-4 MGD	
Year Operation Began:	2015	
Frequency Plant Checked:	Daily with continuous instrumnt monitoring	
Raw Water Pumps:	2-60 hp pumps as backup from Clementia; Normally gravity fed from Chesbro	
Type And Method Of Control:	On/Off with clearwell level setpoints	
Capacity Of Each:		
Pump #1 (hp)	(gpm)	(mgd)
Pump #2 (hp)	(gpm)	(mgd)
Pump #3 (hp)	(gpm)	(mgd)
Influent Turbidity Measured Continuously?	Yes- HACH FilterTrak 660	
Excessive Influent Turbidity Alarm?	Yes	
What Turbidity Level Triggers Alarm?	100 NTU	
Automatic Shutdown At High Turbidity?	No shutdown, triggers call out alarm	

State of California **Department of Health Services**

Membrane Filtration Plant Data-(cont'd)

Flash Mixing	
Type:	Rapid Mixer
Number:	0.5 hp
Mixing Energy (G):	700 sec^{-1}
Volume	138 ft^3
Length	5.5 ft
HT SWD	5 ft.
Nominal Mixing Time (sec):	36
Flocculation Basins	
Number Of Basins:	3 basins
Inside Dimensions of Each Stage (LxW in feet):	10'-4" x 12'
Average Water Depth (ft):	12 ft.
Volume Of Each Basin (ft^3):	1450 ft^3
Detention Time (min):	15 min
Type Of Flocculators:	Vertical Paddle
Mixing Energy (G):	47 sec^{-1}
Flocculator Power (Each):	0.5 hp
Flocculator Equipment Failure Alarm?	No
Equalization Basins	
Number Of Basins:	2
Inside Dimensions Of Each Basin (ft x ft):	22' x 16.5'
Average Water Depth (ft):	2-10.5 ft.
Volume Of Each Basin (ft^3):	23,000 gal
Plate Settler	
Number:	1
Effective Settling Area:	1135 sf
Maximum recycle rate:	200 gpm
Settling rate:	0.17 gpm/sf
Maximum solids loading rate:	0.15 lb/sf/day

State of California		Department of Health Services
Membrane Filtration Plant Data-(cont'd)		
Membrane Filtration		
Type of Membrane	Submerged GE ZeeWeed 1000	
Design Elevations		
Inlet max water level:	201 ft	
Inlet min water level:	200 ft	
Basin floor:	191 ft	
Filtrate discharge water level (max clearwell):	202 ft	
Membrane flux:	30 gfd	Maximum instantaneous design flux
Number of Units		
Number of equally sized Units	3	
Module Surface Area	450 sf	
Number of Cassettes per Train	2	
Number of Modules per Cassette	87	
Number of Module Spaces per Cassette	96	
Total Membrane Area Supplied	234,900 sf	
Design Capacity	4 MGD	
Net System Recovery		
Summer design recovery	95%	
Winter design recovery	92%	
Filter Backwash		
What Determines Backwash Interval?	TMP < -6.5 psi	Will be better determined following commissioning
Source Of Backwash Water?	Permeate diverted to CIP tank before the CCB	
Volume of Permeate used per Backwash	420 gal	
Volume Generated per Backwash:	4,114 gal	
Maintenance clean protocol	1/day/train	
Membrane Integrity Test Protocol	1/day/train	
Recovery clean protocol	12/year/train	sodium hypochlorite followed by citric acid
Membrane reject pumps:	2 @ 2291 gpm at 25 ft TDH and 84% efficiency	
Shutoff condition:	0 gpm at 44 ft. TDH	
Backpulse pumps:	2 @ 1613 gpm at 42 ft TDH and 80% efficiency	
Shutoff condition:	0 gpm at 56 ft TDH	

Membrane Filtration Plant Data-(cont'd)

Chlorination Contact Basin		
Volume:	50,000 gal	
Length:Width Ratio:	70:1	
HT SWD (range)	4.9 ft.	
Detention Time (max day)	32 min.	
Baffling Factor	0.75	
Booster Pumps	Weir Floway Vertical Turbine 3-Stage Pump 11JKM	
Number:	3 existing, 2 new	
Capacity, each	1.12 MGD	@160 ft TDH
Firm Capacity	3.5 MGD	
Sand Drying Beds		
Number of cells:	4	
Each bed:		
Length:	50 ft.	
Width:	40 ft.	
Area:	2,000 sf	
Total Area:	8,000 sf	
Sludge loading rate (max allowable):	9 lb/sf/yr	
Sludge loading rate(at design flow):	6.4 lb/sf/yr	
Chemical Data		
Type:	Alum	
Purpose:	Coagulant	
Strength of Chemical Injected (%):	50%	
Rate Injected Into System:	as needed	
Dosage (mg/l):	15 to 30 mg/L	
Typical Usage:	575 lb/day	
Is Chemical Added Continuously?	Yes	
Chemical Data		
Type:	ACH	
Purpose:	Coagulant (Alternative)	
Strength of Chemical Injected (%):	24%	
Rate Injected Into System:	as needed	
Dosage (mg/l):	15 to 40 mg/L	
Typical Usage:	375 lb/day	
Is Chemical Added Continuously?	Yes	

State of California	Department of Health Services

Membrane Filtration Plant Data-(cont'd)

Chemical Data	
Type:	Chlorine
Purpose:	Disinfectant
Strength of Chemical Injected (%):	99.50%
Rate Injected Into System:	as needed
Dosage (mg/l):	4.0-7.0 mg/L
Typical Usage:	200 lb/day
Is Chemical Added Continuously?	Yes
Chemical Data	
Type:	PAC
Purpose:	Taste and Odor Control
Strength of Chemical Injected (%):	-
Rate Injected Into System:	as needed
Dosage (mg/l):	2 to 10 mg/L
Typical Usage:	200 lb/day
Is Chemical Added Continuously?	No
Chemical Data	
Type:	Zinc Orthophosphate
Purpose:	Corrosion control
Strength of Chemical Injected (%):	50%
Rate Injected Into System:	as needed
Dosage (mg/l):	2.0-5.0 mg/L
Typical Usage:	146 lb/day
Is Chemical Added Continuously?	Yes
Chemical Data	
Type:	Sodium Bisulfite
Purpose:	Neutralize sodium hypochlorite recovery cleaning
Strength of Chemical Injected (%):	25%
Rate Injected Into System:	as needed
Dosage (mg/l):	Varies
Typical Usage:	Once per month
Is Chemical Added Continuously?	No
Chemical Data	
Type:	Hydrochloric Acid
Purpose:	Membrane CIP
Strength of Chemical Injected (%):	33%
Rate Injected Into System:	as needed
Dosage (mg/l):	Varies
Typical Usage:	Once per month
Is Chemical Added Continuously?	No

State of California	Department of Health Services
Membrane Filtration Plant Data-(cont'd)	
Chemical Data	
Type:	Citric Acid
Purpose:	CIP - Removal of metal hydroxides and carbonates
Strength of Chemical Injected (%):	50.00%
Rate Injected Into System:	as needed
Dosage (mg/l):	100 mg/L
Typical Usage:	Once per month
Is Chemical Added Continuously?	No
Chemical Data	
Type:	Sodium Hypochlorite
Purpose:	Dislodge particles/sustain operational flux in membranes/Reduction of Biofouling
Strength of Chemical Injected (%):	12.50%
Rate Injected Into System:	as needed
Dosage (mg/l):	2/10 /250mg/L
Typical Usage:	30 seconds every 15 minutes/20-30 mins per day/Once per month
Is Chemical Added Continuously?	No
Chemical Data	
Type:	Sodium Hydroxide
Purpose:	pH adjustment for corrosion control and neutralization
Strength of Chemical Injected (%):	50%
Rate Injected Into System:	as needed
Dosage (mg/l):	2.0-12.0 mg/L
Typical Usage:	112 lb/day
Is Chemical Added Continuously?	Yes
Chemical Data	
Type:	Potassium Permanganate
Purpose:	Oxidizer
Strength of Chemical Injected (%):	7%
Rate Injected Into System:	as needed
Dosage (mg/l):	0.5-1.0 mg/L
Typical Usage:	varies
Is Chemical Added Continuously?	Yes
Chemical Metering Equipment	
Type:	Chemical Dosing Pumps
Make:	ProMinent Sigma 16130 PVT
Model:	3/4" PVC/EPDM
Capacity:	2472 gpm at max backpressure
What Determines Dose Level Used?	pulse- controlled metering from variable flow meters
Are Jar Tests Performed?	No
How Often?	-

State of California		Department of Health Services

Membrane Filtration Plant Data-(cont'd)

Chemical Storage	*Alum*	
Capacity:	6,000 gal	
Type:	Fiberglass	
Days Of Storage:	52 days	Available at average use
Chemical Form When Added To System?	liquid	
Points Of Application:	Prior to Flash Mixer	
Low Level Chemical Alarm Provided?	No	
Chemical Storage	*ACH*	
Capacity:	4,000 gal	
Type:	PE Tank	
Days Of Storage:	120 days	Available at average use
Chemical Form When Added To System?	liquid	
Points Of Application:	Prior to Flash Mixer	
Low Level Chemical Alarm Provided?	Yes, ultrasonic level transmitter	
Chemical Storage	*Zinc Orthophosphate*	
Capacity:	1400 gal	
Type:	Fiberglass	
Days Of Storage:	58 days	Available at average use
Chemical Form When Added To System?	liquid	
Points Of Application:	Chlorine Contact Basin	
Low Level Chemical Alarm Provided?	No	
Chemical Storage	*Chlorine*	
Capacity:	1-ton	
Type:	Steel Container	
Days Of Storage:	10 days	Available at average use
Chemical Form When Added To System?	Gas/Water mixture	
Points Of Application:	At Static Mixer prior to CCB	
Low Level Chemical Alarm Provided?	Yes	
Chemical Storage	*Sodium Bisulfite*	
Capacity:	55 gal	
Type:	drums	
Days Of Storage:	Varies	
Chemical Form When Added To System?	liquid	
Points Of Application:	Backwash Water	
Low Level Chemical Alarm Provided?	No	

Membrane Filtration Plant Data-(cont'd)

Chemical Storage	*Hydrochloric Acid*	
Capacity:	220 gal	
Type:	Tote	
Days Of Storage:	Varies	
Chemical Form When Added To System?	liquid	
Points Of Application:	Backwash Water	
Low Level Chemical Alarm Provided?	Yes	
Chemical Storage	*Citric Acid*	
Capacity:	220 gal	
Type:	Tote	
Days Of Storage:	Varies	
Chemical Form When Added To System?	liquid	
Points Of Application:	Backwash Water	
Low Level Chemical Alarm Provided?	Yes	
Chemical Storage	*Sodium Hypochlorite*	
Capacity:	330 gal	
Type:	Tote	
Days Of Storage:	Varies	
Chemical Form When Added To System?	liquid	
Points Of Application:	Backwash Water	
Low Level Chemical Alarm Provided?	Yes	
Chemical Storage	*Sodium Hydroxide*	
Capacity:	2500 gal	
Type:	PE Tank	
Days Of Storage:	128 days	Available at average use
Chemical Form When Added To System?	liquid	
Points Of Application:	Backwash Water	
Low Level Chemical Alarm Provided?	Yes, ultrasonic level transmitter	
Chemical Storage	*Potassium Permanganate*	
Capacity:	55 lb.	
Type:	Buckets	
Days Of Storage:	~300 days	
Chemical Form When Added To System?	dry mix	
Points Of Application:	Flash mixer	
Low Level Chemical Alarm Provided?	No	

Comments

Appendix C – Chlorine Disinfection Data Sheet

STATE OF CALIFORNIA
DEPARTMENT OF HEALTH SERVICES

CHLORINE DISINFECTION DATA

System Name: Rancho Murieta CSD **No**:

Source of Information: Conformed Drawings / Manufacturer Data

Collected By: System **Date:** 10/14/15

Location:	
Type of Disinfectant Used:	Free Chlorine - gas
Application:	
Water Treated: (raw, filtered, etc.)	Permeate from ultrafiltration membranes
Oxidant Demand Character:	oxidizer
Point of Application:	Flash mix, Post Filtration
Mixing:	Static Mixer
Contact Time: (minutes)	72 min.
Minimum Contact Time Before Residual Test:	51.3 min
How was Contact Time Measured or Determined:	Basin Vol. and clearwell vs. max flow
Water Flow Variation:	
Average Daily:	3.5 MGD
Maximum Daily:	6 MGD
Peak Hourly Flow:	292,000 gph
Machine:	
Make:	Evoqua: Wallace & Tiernan
Type:	V10K Gas Feed Chlorination
Capacity:	15 kg/hr Chlorine (750 ppd)
Condition:	New
Housing: (type)	Wall-mounted junction box indoors
Insulation:	none
Heating:	1 kW heater in storage room
Chemical Added:	
% Available Disinfectant, Form	99.50%
Cylinder or Crock Capacity:	1 ton
Stock on Hand:	2-ton
Safety Features: (Locks, Lighting, Ventilation, etc.)	Locks, lighting, ventilation, leak alarms
Operation and Maintenance:	
Spare Parts on Hand:	Yes
Ability to Make Repairs:	Most/ otherwise outside contracted
Equipment Inspection Frequency:	Daily/ yearly maintenance
Residual Tests:	
Test Made: (DPD, etc.)	DPD
Type of Instrumentation:	ATI online residual chlorine monitor
Continuous/Grab:	Continuous
Where Test Made:	Piping prior to CCB
Type: (Total, Free, Combined, Other)	Total and Free chlorine
Records:	Log sheets and digital output to SCADA
Frequency of Equipment Calibration:	Daily verification
Reliability Features:	Alarms; low, low-low
Auxiliary Power:	Mini Power Center, emergency generator
Automatic Switch-over:	Yes
Condition of Scales: (if any)	Good
Alarms: (if any)	Gas detection, high, low
Defects or Remarks:	

Appendix D – Water Treatment Facility Operator Certification Designation

Rancho Murieta CSD WTP
Plant Classification per Operator Certification Regulations

Number	Criteria	Lodi SWTF	Points
1	Source	Surface water	5
2	Influent Microbiological	1-1000	4
3	Influent Turbidity	<15	0
4	Influent Nitrate/Nitrite	0	0
5	Influent Chemical/Radiological	none	0
6	Filtration Method	Membrane plus recycle	13
7	Other processes for primary MCLs	none	0
8	Other processes for secondary MCLs	T&O	3
9	Corrosion control or fluoridation	corrosion control	3
10	Disinfection method	chlorine	10
11	Oxidation (nor for inactivation)	none	0
12	Other process that alters the water	TOC reduction	3
13	Plant capacity (2 pts/Mgal)	4 mgd	8
		Total	49

Table 64413.1-A. Water Treatment Facility Class Designations

Total Points	Class	
Less than 20	T1	
20 through 39	T2	
40 through 59	**T3**	T3
60 through 79	T4	
80 or more	T5	

Appendix E – Raw Water Quality Data Sheets

Sample Date	Constituent	Result	Detection Level	Reporting Level	Units	Method
12/22/2010 10:30:00	**1,1,1-Trichloroethane**	**ND**	0.18	0.50	µg/L	
01/14/2010 10:30:00	**1,1,1-Trichloroethane**	**ND**	0.18	0.50	µg/L	
12/22/2010 10:30:00	**1,1,2,2-Tetrachloroethane**	**ND**	0.13	0.50	µg/L	
01/14/2010 10:30:00	**1,1,2,2-Tetrachloroethane**	**ND**	0.13	0.50	µg/L	
12/22/2010 10:30:00	**1,1,2-Trichloro-1,2,2-trifluoroethane (Fre**	**ND**	0.15	10	µg/L	
01/14/2010 10:30:00	**1,1,2-Trichloro-1,2,2-trifluoroethane (Fre**	**ND**	0.15	10	µg/L	
12/22/2010 10:30:00	**1,1,2-Trichloroethane**	**ND**	0.098	0.50	µg/L	
01/14/2010 10:30:00	**1,1,2-Trichloroethane**	**ND**	0.098	0.50	µg/L	
12/22/2010 10:30:00	**1,1-Dichloroethane**	**ND**	0.12	0.50	µg/L	
01/14/2010 10:30:00	**1,1-Dichloroethane**	**ND**	0.12	0.50	µg/L	
12/22/2010 10:30:00	**1,1-Dichloroethene**	**ND**	0.092	0.50	µg/L	
01/14/2010 10:30:00	**1,1-Dichloroethene**	**ND**	0.092	0.50	µg/L	
12/22/2010 10:30:00	**1,2,4-Trichlorobenzene**	**ND**	0.092	0.50	µg/L	
01/14/2010 10:30:00	**1,2,4-Trichlorobenzene**	**ND**	0.092	0.50	µg/L	
12/22/2010 10:30:00	**1,2-Dichlorobenzene**	**ND**	0.042	0.50	µg/L	
01/14/2010 10:30:00	**1,2-Dichlorobenzene**	**ND**	0.042	0.50	µg/L	
12/22/2010 10:30:00	**1,2-Dichloroethane**	**ND**	0.054	0.50	µg/L	
01/14/2010 10:30:00	**1,2-Dichloroethane**	**ND**	0.054	0.50	µg/L	EPA 524.2
12/22/2010 10:30:00	**1,2-Dichloroethane-d4**	**13.0**			µg/L	
01/14/2010 10:30:00	**1,2-Dichloroethane-d4**	**9.70**			µg/L	
12/22/2010 10:30:00	**1,2-Dichloropropane**	**ND**	0.057	0.50	µg/L	
01/14/2010 10:30:00	**1,2-Dichloropropane**	**ND**	0.057	0.50	µg/L	
12/22/2010 10:30:00	**1,4-Dichlorobenzene**	**ND**	0.061	0.50	µg/L	
01/14/2010 10:30:00	**1,4-Dichlorobenzene**	**ND**	0.061	0.50	µg/L	
12/22/2010 10:30:00	**4-Bromofluorobenzene**	**10.3**			µg/L	
01/14/2010 10:30:00	**4-Bromofluorobenzene**	**10.9**			µg/L	
12/22/2010 10:30:00	**Aluminum**	**ND**	27	50	µg/L	
01/14/2010 09:40:00	**Aluminum**	**ND**	27	50	µg/L	
12/22/2010 10:30:00	**Antimony**	**ND**	0.57	6.0	µg/L	
01/14/2010 09:40:00	**Antimony**	**ND**	0.57	6.0	µg/L	
12/22/2010 10:30:00	**Arsenic**	**ND**	0.27	2.0	µg/L	
01/14/2010 09:40:00	**Arsenic**	**ND**	0.27	2.0	µg/L	
12/22/2010 10:30:00	**Barium**	**ND**	0.91	100	µg/L	
01/14/2010 09:40:00	**Barium**	**ND**	0.91	100	µg/L	
12/22/2010 10:30:00	**Benzene**	**ND**	0.057	0.50	µg/L	
01/14/2010 10:30:00	**Benzene**	**ND**	0.057	0.50	µg/L	
12/22/2010 10:30:00	**Beryllium**	**ND**	0.43	1.0	µg/L	EPA 200.7
01/14/2010 09:40:00	**Beryllium**	**ND**	0.43	1.0	µg/L	EPA 200.7
08/11/2010 10:54:00	**Bicarbonate as CaCO3**	**23**	0.50	5.0	mg/L	
08/11/2010 11:03:00	**Bicarbonate as CaCO3**	**33**	0.50	5.0	mg/L	
01/22/2010 14:35:00	**Bicarbonate as CaCO3**	**43**	0.50	5.0	mg/L	
01/28/2010 12:10:00	**Bicarbonate as CaCO3**	**43**	0.50	5.0	mg/L	
03/10/2010 10:20:00	**Bicarbonate as CaCO3**	**40**	0.50	5.0	mg/L	
03/17/2010 10:10:00	**Bicarbonate as CaCO3**	**41**	0.50	5.0	mg/L	
04/14/2010 10:40:00	**Bicarbonate as CaCO3**	**40**	0.50	5.0	mg/L	
04/21/2010 11:20:00	**Bicarbonate as CaCO3**	**41**	0.50	5.0	mg/L	
04/28/2010 10:20:00	**Bicarbonate as CaCO3**	**41**	0.50	5.0	mg/L	
05/19/2010 10:12:00	**Bicarbonate as CaCO3**	**41**	0.50	5.0	mg/L	
05/26/2010 11:10:00	**Bicarbonate as CaCO3**	**36**	0.50	5.0	mg/L	
06/16/2010 11:00:00	**Bicarbonate as CaCO3**	**41**	0.50	5.0	mg/L	
06/23/2010 11:28:00	**Bicarbonate as CaCO3**	**42**	0.50	5.0	mg/L	
06/30/2010 17:00:00	**Bicarbonate as CaCO3**	**42**	0.50	5.0	mg/L	
07/14/2010 10:12:00	**Bicarbonate as CaCO3**	**39**	0.50	5.0	mg/L	
07/21/2010 10:28:00	**Bicarbonate as CaCO3**	**40**	0.50	5.0	mg/L	
07/28/2010 10:05:00	**Bicarbonate as CaCO3**	**44**	0.50	5.0	mg/L	
08/25/2010 10:36:00	**Bicarbonate as CaCO3**	**41**	0.50	5.0	mg/L	
09/22/2010 10:47:00	**Bicarbonate as CaCO3**	**43**	0.50	5.0	mg/L	
10/20/2010 11:06:00	**Bicarbonate as CaCO3**	**45**	0.50	5.0	mg/L	
10/28/2010 08:35:00	**Bicarbonate as CaCO3**	**42**	0.50	5.0	mg/L	
11/10/2010 11:31:00	**Bicarbonate as CaCO3**	**44**	0.50	5.0	mg/L	
11/17/2010 10:30:00	**Bicarbonate as CaCO3**	**44**	0.50	5.0	mg/L	
11/24/2010 10:19:00	**Bicarbonate as CaCO3**	**50**	0.50	5.0	mg/L	
12/08/2010 10:29:00	**Bicarbonate as CaCO3**	**45**	0.50	5.0	mg/L	
12/15/2010 11:38:00	**Bicarbonate as CaCO3**	**43**	0.50	5.0	mg/L	

12/22/2010 10:35:00	**Bicarbonate as CaCO3**	**41**	0.50	5.0	mg/L	
05/05/2010 11:42:00	**Bicarbonate as CaCO3**	**44**	0.50	5.0	mg/L	SM2320B
02/04/2010 10:15:00	**Bicarbonate as CaCO3**	**44**	0.50	5.0	mg/L	
07/07/2010 11:05:00	**Bicarbonate as CaCO3**	**40**	0.50	5.0	mg/L	
10/06/2010 10:00:00	**Bicarbonate as CaCO3**	**45**	0.50	5.0	mg/L	
11/03/2010 10:14:00	**Bicarbonate as CaCO3**	**46**	0.50	5.0	mg/L	
12/01/2010 10:18:00	**Bicarbonate as CaCO3**	**43**	0.50	5.0	mg/L	
04/07/2010 11:15:00	**Bicarbonate as CaCO3**	**39**	0.50	5.0	mg/L	
08/04/2010 10:40:00	**Bicarbonate as CaCO3**	**42**	0.50	5.0	mg/L	
03/31/2010 10:50:00	**Bicarbonate as CaCO3**	**37**	0.50	5.0	mg/L	
08/18/2010 10:00:00	**Bicarbonate as CaCO3**	**43**	0.50	5.0	mg/L	
09/01/2010 10:30:00	**Bicarbonate as CaCO3**	**44**	0.50	5.0	mg/L	
09/08/2010 10:43:00	**Bicarbonate as CaCO3**	**44**	0.50	5.0	mg/L	
09/15/2010 10:11:00	**Bicarbonate as CaCO3**	**42**	0.50	5.0	mg/L	
09/29/2010 10:15:00	**Bicarbonate as CaCO3**	**46**	0.50	5.0	mg/L	
10/13/2010 11:15:00	**Bicarbonate as CaCO3**	**44**	0.50	5.0	mg/L	
12/22/2010 10:30:00	**Bicarbonate as CaCO3**	**41**	0.50	5.0	mg/L	
05/12/2010 11:00:00	**Bicarbonate as CaCO3**	**44**	0.50	5.0	mg/L	
08/11/2010 10:45:00	**Bicarbonate as CaCO3**	**44**	0.50	5.0	mg/L	
08/25/2010 11:00:00	**Bicarbonate as CaCO3**	**25**	0.50	5.0	mg/L	
09/01/2010 10:15:00	**Bicarbonate as CaCO3**	**29**	0.50	5.0	mg/L	
02/17/2010 10:05:00	**Bicarbonate as CaCO3**	**40**	0.50	5.0	mg/L	
03/03/2010 10:55:00	**Bicarbonate as CaCO3**	**41**	0.50	5.0	mg/L	
03/05/2010 08:45:00	**Bicarbonate as CaCO3**	**41**	0.50	5.0	mg/L	
03/26/2010 11:24:00	**Bicarbonate as CaCO3**	**43**	0.50	5.0	mg/L	
02/26/2010 10:47:00	**Bicarbonate as CaCO3**	**40**	0.50	5.0	mg/L	
05/26/2010 10:20:00	**Bicarbonate as CaCO3**	**40**	0.50	5.0	mg/L	
06/02/2010 10:45:00	**Bicarbonate as CaCO3**	**38**	0.50	5.0	mg/L	
01/14/2010 10:10:00	**Bicarbonate as CaCO3**	**44**	0.50	5.0	mg/L	
01/14/2010 09:40:00	**Bicarbonate as CaCO3**	**44**	0.50	5.0	mg/L	
12/22/2010 10:30:00	**Boron**	**ND**	4.4	100	µg/L	EPA 200.7
01/14/2010 09:40:00	**Boron**	**ND**	4.4	100	µg/L	EPA 200.7
12/22/2010 10:30:00	**Cadmium**	**ND**	0.17	1.0	µg/L	EPA 200.8
01/14/2010 09:40:00	**Cadmium**	**ND**	0.17	1.0	µg/L	EPA 200.8
12/22/2010 10:30:00	**Calcium**	**8.8**	0.031	1.0	mg/L	200.7/2340B
05/26/2010 10:20:00	**Calcium**	**7.4**	0.031	1.0	mg/L	200.7/2340B
01/14/2010 09:40:00	**Calcium**	**8.3**	0.031	1.0	mg/L	200.7/2340B
12/22/2010 10:30:00	**Carbon tetrachloride**	**ND**	0.092	0.50	µg/L	EPA 524.2
01/14/2010 10:30:00	**Carbon tetrachloride**	**ND**	0.092	0.50	µg/L	EPA 524.2
08/11/2010 10:54:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
08/11/2010 11:03:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
01/22/2010 14:35:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
01/28/2010 12:10:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
03/10/2010 10:20:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
03/17/2010 10:10:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
04/14/2010 10:40:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
04/21/2010 11:20:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
04/28/2010 10:20:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
05/19/2010 10:12:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
05/26/2010 11:10:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
06/16/2010 11:00:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
06/23/2010 11:28:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
06/30/2010 17:00:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
07/14/2010 10:12:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
07/21/2010 10:28:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
07/28/2010 10:05:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
08/25/2010 10:36:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
09/22/2010 10:47:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
10/20/2010 11:06:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
10/28/2010 08:35:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
11/10/2010 11:31:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
11/17/2010 10:30:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
11/24/2010 10:19:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
12/08/2010 10:29:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
12/15/2010 11:38:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
12/22/2010 10:35:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
05/05/2010 11:42:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	SM2320B

02/04/2010 10:15:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
07/07/2010 11:05:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
10/06/2010 10:00:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
11/03/2010 10:14:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
12/01/2010 10:18:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
04/07/2010 11:15:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
08/04/2010 10:40:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
03/31/2010 10:50:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
08/18/2010 10:00:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
09/01/2010 10:30:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
09/08/2010 10:43:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
09/15/2010 10:11:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
09/29/2010 10:15:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
10/13/2010 11:15:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
12/22/2010 10:30:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
05/12/2010 11:00:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
08/11/2010 10:45:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
08/25/2010 11:00:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
09/01/2010 10:15:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
02/17/2010 10:05:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
03/03/2010 10:55:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
03/05/2010 08:45:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
03/26/2010 11:24:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
02/26/2010 10:47:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
05/26/2010 10:20:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
06/02/2010 10:45:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
01/14/2010 10:10:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
01/14/2010 09:40:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	SM2320B
12/22/2010 10:30:00	**Chloride**	**2.7**	0.026	0.50	mg/L	EPA 300.0
05/26/2010 10:20:00	**Chloride**	**2.5**	0.026	0.50	mg/L	EPA 300.0
01/14/2010 09:40:00	**Chloride**	**2.6**	0.026	0.50	mg/L	EPA 300.0
12/22/2010 10:30:00	**Chlorobenzene**	**ND**	0.11	0.50	µg/L	EPA 524.2
01/14/2010 10:30:00	**Chlorobenzene**	**ND**	0.11	0.50	µg/L	EPA 524.2
12/22/2010 10:30:00	**Chromium**	**ND**	9.9	10	µg/L	EPA 200.7
01/14/2010 09:40:00	**Chromium**	**ND**	9.9	10	µg/L	EPA 200.7
12/22/2010 10:30:00	**cis-1,2-Dichloroethene**	**ND**	0.15	0.50	µg/L	EPA 524.2
01/14/2010 10:30:00	**cis-1,2-Dichloroethene**	**ND**	0.15	0.50	µg/L	EPA 524.2
12/22/2010 10:30:00	**cis-1,3-Dichloropropene**	**ND**	0.097	0.50	µg/L	EPA 524.2
01/14/2010 10:30:00	**cis-1,3-Dichloropropene**	**ND**	0.097	0.50	µg/L	EPA 524.2
12/22/2010 10:30:00	**Color**	**ND**		1	Color Units	SM2120B
01/14/2010 09:40:00	**Color**	**ND**		1	Color Units	SM2120B
12/22/2010 10:30:00	**Copper**	**ND**	3.2	50	µg/L	EPA 200.7
01/14/2010 09:40:00	**Copper**	**ND**	3.2	50	µg/L	EPA 200.7
11/10/2010 15:10:00	**E. Coli**	**4.5**	1.8	1.8	MPN/100 mL	
07/21/2010 11:00:00	**E. Coli**	**2.0**	1.8	1.8	MPN/100 mL	
02/04/2010 10:35:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
03/17/2010 10:22:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
04/28/2010 10:30:00	**E. Coli**	**2.0**	1.8	1.8	MPN/100 mL	
06/23/2010 12:34:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
08/18/2010 10:01:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
09/01/2010 11:12:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
09/29/2010 10:11:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
10/13/2010 11:30:00	**E. Coli**	**2.0**	1.8	1.8	MPN/100 mL	
12/08/2010 11:20:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
12/22/2010 10:35:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
03/31/2010 10:40:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	SM 9221
03/03/2010 11:08:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
05/26/2010 11:15:00	**E. Coli**	**1.8**	1.8	1.8	MPN/100 mL	
01/06/2010 10:05:00	**E. Coli**	**2.0**	1.8	1.8	MPN/100 mL	
01/20/2010 11:10:00	**E. Coli**	**2.0**	1.8	1.8	MPN/100 mL	
04/14/2010 10:32:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
06/08/2010 10:52:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
07/07/2010 10:58:00	**E. Coli**	**2.0**	1.8	1.8	MPN/100 mL	
08/04/2010 10:10:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
09/15/2010 10:17:00	**E. Coli**	**1.8**	1.8	1.8	MPN/100 mL	
10/27/2010 10:50:00	**E. Coli**	**1.8**	1.8	1.8	MPN/100 mL	
11/24/2010 10:52:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	

02/17/2010 11:18:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
12/30/2010 09:00:00	**EPN**	**1.64**			µg/L	EPA 507
12/22/2010 10:30:00	**Ethylbenzene**	**ND**	0.090	0.50	µg/L	EPA 524.2
01/14/2010 10:30:00	**Ethylbenzene**	**ND**	0.090	0.50	µg/L	EPA 524.2
11/10/2010 15:10:00	**Fecal Coliforms**	**7.8**	1.8	1.8	MPN/100 mL	
07/21/2010 11:00:00	**Fecal Coliforms**	**2.0**	1.8	1.8	MPN/100 mL	
02/04/2010 10:35:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
03/17/2010 10:22:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
04/28/2010 10:30:00	**Fecal Coliforms**	**2.0**	1.8	1.8	MPN/100 mL	
06/23/2010 12:34:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
08/18/2010 10:01:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
09/01/2010 11:12:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
09/29/2010 10:11:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
10/13/2010 11:30:00	**Fecal Coliforms**	**2.0**	1.8	1.8	MPN/100 mL	
12/08/2010 11:20:00	**Fecal Coliforms**	**2.0**	1.8	1.8	MPN/100 mL	
12/22/2010 10:35:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
03/31/2010 10:40:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	SM 9221
03/03/2010 11:08:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
05/26/2010 11:15:00	**Fecal Coliforms**	**1.8**	1.8	1.8	MPN/100 mL	
01/06/2010 10:05:00	**Fecal Coliforms**	**2.0**	1.8	1.8	MPN/100 mL	
01/20/2010 11:10:00	**Fecal Coliforms**	**4.5**	1.8	1.8	MPN/100 mL	
04/14/2010 10:32:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
06/08/2010 10:52:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
07/07/2010 10:58:00	**Fecal Coliforms**	**2.0**	1.8	1.8	MPN/100 mL	
08/04/2010 10:10:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
09/15/2010 10:17:00	**Fecal Coliforms**	**1.8**	1.8	1.8	MPN/100 mL	
10/27/2010 10:50:00	**Fecal Coliforms**	**1.8**	1.8	1.8	MPN/100 mL	
11/24/2010 10:52:00	**Fecal Coliforms**	**4.0**	1.8	1.8	MPN/100 mL	
02/17/2010 11:18:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
12/22/2010 10:30:00	**Fluoride**	**0.13**	0.0079	0.10	mg/L	EPA 300.0
05/26/2010 10:20:00	**Fluoride**	**ND**	0.0079	0.10	mg/L	EPA 300.0
01/14/2010 09:40:00	**Fluoride**	**ND**	0.0079	0.10	mg/L	EPA 300.0
12/22/2010 10:30:00	**Hardness as CaCO3**	**41**		1.0	mg/L	200.7/2340B
05/26/2010 10:20:00	**Hardness as CaCO3**	**35**		1.0	mg/L	200.7/2340B
01/14/2010 09:40:00	**Hardness as CaCO3**	**37**		1.0	mg/L	200.7/2340B
12/27/2010 14:11:00	**Hexavalent Chromium**	**ND**	0.29	1.0	µg/L	EPA 218.6
08/11/2010 10:54:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
08/11/2010 11:03:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
01/22/2010 14:35:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
01/28/2010 12:10:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
03/10/2010 10:20:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
03/17/2010 10:10:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
04/14/2010 10:40:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
04/21/2010 11:20:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
04/28/2010 10:20:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
05/19/2010 10:12:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
05/26/2010 11:10:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
06/16/2010 11:00:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
06/23/2010 11:28:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
06/30/2010 17:00:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
07/14/2010 10:12:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
07/21/2010 10:28:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
07/28/2010 10:05:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
08/25/2010 10:36:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
09/22/2010 10:47:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
10/20/2010 11:06:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
10/28/2010 08:35:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
11/10/2010 11:31:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
11/17/2010 10:30:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
11/24/2010 10:19:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
12/08/2010 10:29:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
12/15/2010 11:38:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
12/22/2010 10:35:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
05/05/2010 11:42:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	SM2320B
02/04/2010 10:15:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
07/07/2010 11:05:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
10/06/2010 10:00:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	

11/03/2010 10:14:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
12/01/2010 10:18:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
04/07/2010 11:15:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
08/04/2010 10:40:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
03/31/2010 10:50:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
08/18/2010 10:00:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
09/01/2010 10:30:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
09/08/2010 10:43:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
09/15/2010 10:11:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
09/29/2010 10:15:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
10/13/2010 11:15:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
12/22/2010 10:30:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
05/12/2010 11:00:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
08/11/2010 10:45:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
08/25/2010 11:00:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
09/01/2010 10:15:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
02/17/2010 10:05:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
03/03/2010 10:55:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
03/05/2010 08:45:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
03/26/2010 11:24:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
02/26/2010 10:47:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
05/26/2010 10:20:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
06/02/2010 10:45:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
01/14/2010 10:10:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
01/14/2010 09:40:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
05/05/2010 11:42:00	**Iron**	**ND**	6.8	100	µg/L	
02/04/2010 10:15:00	**Iron**	**ND**	6.8	100	µg/L	
07/07/2010 11:05:00	**Iron**	**ND**	6.8	100	µg/L	
10/06/2010 10:00:00	**Iron**	**ND**	6.8	100	µg/L	
11/03/2010 10:14:00	**Iron**	**ND**	6.8	100	µg/L	
12/01/2010 10:18:00	**Iron**	**ND**	6.8	100	µg/L	
04/07/2010 11:15:00	**Iron**	**ND**	6.8	100	µg/L	EPA 200.7
08/04/2010 10:40:00	**Iron**	**ND**	6.8	100	µg/L	
09/01/2010 10:30:00	**Iron**	**ND**	6.8	100	µg/L	
12/22/2010 10:30:00	**Iron**	**ND**	6.8	100	µg/L	
03/05/2010 08:45:00	**Iron**	**100**	6.8	100	µg/L	
06/02/2010 10:45:00	**Iron**	**ND**	6.8	100	µg/L	
01/14/2010 10:10:00	**Iron**	**ND**	6.8	100	µg/L	
01/14/2010 09:40:00	**Iron**	**150**	6.8	100	µg/L	
12/22/2010 10:30:00	**Lead**	**ND**	0.23	5.0	µg/L	EPA 200.8
01/14/2010 09:40:00	**Lead**	**ND**	0.23	5.0	µg/L	EPA 200.8
12/22/2010 10:30:00	**Magnesium**	**4.7**	0.028	1.0	mg/L	200.7/2340B
05/26/2010 10:20:00	**Magnesium**	**4.0**	0.028	1.0	mg/L	200.7/2340B
01/14/2010 09:40:00	**Magnesium**	**4.0**	0.028	1.0	mg/L	200.7/2340B
05/05/2010 11:42:00	**Manganese**	**22**	1.7	10	µg/L	
02/04/2010 10:15:00	**Manganese**	**ND**	0.92	20	µg/L	
07/07/2010 11:05:00	**Manganese**	**60**	0.92	20	µg/L	
10/06/2010 10:00:00	**Manganese**	**ND**	0.92	20	µg/L	
11/03/2010 10:14:00	**Manganese**	**ND**	0.92	20	µg/L	
12/01/2010 10:18:00	**Manganese**	**ND**	0.92	20	µg/L	
04/07/2010 11:15:00	**Manganese**	**ND**	0.92	20	µg/L	EPA 200.7
08/04/2010 10:40:00	**Manganese**	**57**	0.92	20	µg/L	
09/01/2010 10:30:00	**Manganese**	**29**	0.92	20	µg/L	
12/22/2010 10:30:00	**Manganese**	**ND**	0.92	10	µg/L	
03/05/2010 08:45:00	**Manganese**	**ND**	0.92	20	µg/L	
06/02/2010 10:45:00	**Manganese**	**54**	0.92	20	µg/L	
01/14/2010 10:10:00	**Manganese**	**ND**	0.92	20	µg/L	
01/14/2010 09:40:00	**Manganese**	**ND**	0.92	10	µg/L	
12/22/2010 10:30:00	**MBAS as LAS, mol wt 340**	**ND**	0.067	0.10	mg/L	SM5540 C
05/26/2010 10:20:00	**MBAS as LAS, mol wt 340**	**ND**	0.067	0.10	mg/L	SM5540 C
01/14/2010 09:40:00	**MBAS as LAS, mol wt 340**	**ND**	0.067	0.10	mg/L	SM5540 C
12/22/2010 10:30:00	**Mercury**	**ND**	0.15	1.0	µg/L	EPA 245.1
01/14/2010 09:40:00	**Mercury**	**ND**	0.15	1.0	µg/L	EPA 245.1
12/22/2010 10:30:00	**Methyl tert-butyl ether**	**ND**	0.092	3.0	µg/L	EPA 524.2
01/14/2010 10:30:00	**Methyl tert-butyl ether**	**ND**	0.092	3.0	µg/L	EPA 524.2
12/22/2010 10:30:00	**Methylene chloride**	**ND**	0.24	0.50	µg/L	EPA 524.2
01/14/2010 10:30:00	**Methylene chloride**	**ND**	0.24	0.50	µg/L	EPA 524.2

12/22/2010 10:30:00	**Nickel**	**ND**	10	10	µg/L	EPA 200.7
01/14/2010 09:40:00	**Nickel**	**ND**	10	10	µg/L	EPA 200.7
05/26/2010 10:20:00	**Nitrate as N**	**ND**	0.0050	0.50	mg/L	
01/14/2010 10:50:00	**Nitrate as NO3**	**ND**	0.053	0.50	mg/L	
12/22/2010 10:30:00	**Nitrate as NO3**	**ND**	0.021	2.0	mg/L	
02/10/2010 15:30:00	**Nitrate as NO3**	**ND**	0.053	0.50	mg/L	
05/26/2010 10:20:00	**Nitrate as NO3**	**ND**	0.021	2.0	mg/L	
04/14/2010 11:03:00	**Nitrate as NO3**	**ND**	0.053	0.50	mg/L	
07/14/2010 15:35:00	**Nitrate as NO3**	**ND**	0.053	0.50	mg/L	EPA 300.0
10/14/2010 14:12:00	**Nitrate as NO3**	**ND**	0.053	0.50	mg/L	
01/14/2010 09:40:00	**Nitrate as NO3**	**ND**	0.021	2.0	mg/L	
02/10/2010 15:30:00	**Nitrite as N**	**ND**	0.0022	0.10	mg/L	
04/14/2010 11:03:00	**Nitrite as N**	**ND**	0.0022	0.10	mg/L	
07/14/2010 15:35:00	**Nitrite as N**	**ND**	0.0022	0.10	mg/L	
10/14/2010 14:12:00	**Nitrite as N**	**ND**	0.0022	0.10	mg/L	
12/22/2010 10:30:00	**Perchlorate**	**ND**	0.98	4.0	µg/L	EPA 314.0
01/14/2010 10:30:00	**Perchlorate**	**ND**	0.98	4.0	µg/L	EPA 314.0
12/22/2010 10:30:00	**pH**	**7.46**	0.01	0.01	pH Units	SM4500-H B
05/26/2010 10:20:00	**pH**	**7.32**	0.01	0.01	pH Units	SM4500-H B
01/14/2010 09:40:00	**pH**	**7.70**	0.01	0.01	pH Units	SM4500-H B
12/22/2010 10:30:00	**Potassium**	**ND**	0.87	1.0	mg/L	200.7/2340B
05/26/2010 10:20:00	**Potassium**	**ND**	0.87	1.0	mg/L	200.7/2340B
01/14/2010 09:40:00	**Potassium**	**1.0**	0.87	1.0	mg/L	200.7/2340B
12/22/2010 10:30:00	**Selenium**	**ND**	1.1	5.0	µg/L	EPA 200.8
01/14/2010 09:40:00	**Selenium**	**ND**	1.1	5.0	µg/L	EPA 200.8
12/22/2010 10:30:00	**Silver**	**ND**	2.9	10	µg/L	EPA 200.7
01/14/2010 09:40:00	**Silver**	**ND**	2.9	10	µg/L	EPA 200.7
12/22/2010 10:30:00	**Sodium**	**4.5**	0.021	1.0	mg/L	200.7/2340B
05/26/2010 10:20:00	**Sodium**	**4.5**	0.021	1.0	mg/L	200.7/2340B
01/14/2010 09:40:00	**Sodium**	**4.3**	0.021	1.0	mg/L	200.7/2340B
12/22/2010 10:30:00	**Specific Conductance (EC)**	**100**	0.090	1.0	µmhos/cm	EPA 120.1
05/26/2010 10:20:00	**Specific Conductance (EC)**	**90**	0.090	1.0	µmhos/cm	EPA 120.1
01/14/2010 09:40:00	**Specific Conductance (EC)**	**100**	0.090	1.0	µmhos/cm	EPA 120.1
12/22/2010 10:30:00	**Styrene**	**ND**	0.059	0.50	µg/L	EPA 524.2
01/14/2010 10:30:00	**Styrene**	**ND**	0.059	0.50	µg/L	EPA 524.2
12/22/2010 10:30:00	**Sulfate as SO4**	**3.7**	0.010	0.50	mg/L	EPA 300.0
05/26/2010 10:20:00	**Sulfate as SO4**	**4.1**	0.010	0.50	mg/L	EPA 300.0
01/14/2010 09:40:00	**Sulfate as SO4**	**4.0**	0.010	0.50	mg/L	EPA 300.0
12/22/2010 10:30:00	**Tetrachloroethene**	**ND**	0.12	0.50	µg/L	EPA 524.2
01/14/2010 10:30:00	**Tetrachloroethene**	**ND**	0.12	0.50	µg/L	EPA 524.2
12/22/2010 10:30:00	**Thallium**	**ND**	0.11	1.0	µg/L	EPA 200.8
01/14/2010 09:40:00	**Thallium**	**ND**	0.11	1.0	µg/L	EPA 200.8
12/30/2010 09:00:00	**Thiobencarb**	**ND**	0.15	1.0	µg/L	EPA 507
12/22/2010 10:30:00	**Threshold Odor Number**	**ND**		1	T.O.N.	EPA 140.1
01/14/2010 09:40:00	**Threshold Odor Number**	**1**		1	T.O.N.	EPA 140.1
12/22/2010 10:30:00	**Toluene**	**ND**	0.10	0.50	µg/L	EPA 524.2
01/14/2010 10:30:00	**Toluene**	**ND**	0.10	0.50	µg/L	EPA 524.2
12/22/2010 10:30:00	**Toluene-d8**	**9.40**			µg/L	EPA 524.2
01/14/2010 10:30:00	**Toluene-d8**	**8.61**			µg/L	EPA 524.2
08/11/2010 10:54:00	**Total Alkalinity**	**23**	1.0	5.0	mg/L	
08/11/2010 11:03:00	**Total Alkalinity**	**33**	1.0	5.0	mg/L	
01/22/2010 14:35:00	**Total Alkalinity**	**43**	1.0	5.0	mg/L	
01/28/2010 12:10:00	**Total Alkalinity**	**43**	1.0	5.0	mg/L	
03/10/2010 10:20:00	**Total Alkalinity**	**40**	1.0	5.0	mg/L	
03/17/2010 10:10:00	**Total Alkalinity**	**41**	1.0	5.0	mg/L	
04/14/2010 10:40:00	**Total Alkalinity**	**40**	1.0	5.0	mg/L	
04/21/2010 11:20:00	**Total Alkalinity**	**41**	1.0	5.0	mg/L	
04/28/2010 10:20:00	**Total Alkalinity**	**41**	1.0	5.0	mg/L	
05/19/2010 10:12:00	**Total Alkalinity**	**41**	1.0	5.0	mg/L	
05/26/2010 11:10:00	**Total Alkalinity**	**36**	1.0	5.0	mg/L	
06/16/2010 11:00:00	**Total Alkalinity**	**41**	1.0	5.0	mg/L	
06/23/2010 11:28:00	**Total Alkalinity**	**42**	1.0	5.0	mg/L	
06/30/2010 17:00:00	**Total Alkalinity**	**42**	1.0	5.0	mg/L	
07/14/2010 10:12:00	**Total Alkalinity**	**39**	1.0	5.0	mg/L	
07/21/2010 10:28:00	**Total Alkalinity**	**40**	1.0	5.0	mg/L	
07/28/2010 10:05:00	**Total Alkalinity**	**44**	1.0	5.0	mg/L	
08/25/2010 10:36:00	**Total Alkalinity**	**41**	1.0	5.0	mg/L	

09/22/2010 10:47:00	**Total Alkalinity**	**43**	1.0	5.0	mg/L	
10/20/2010 11:06:00	**Total Alkalinity**	**45**	1.0	5.0	mg/L	
10/28/2010 08:35:00	**Total Alkalinity**	**42**	1.0	5.0	mg/L	
11/10/2010 11:31:00	**Total Alkalinity**	**44**	1.0	5.0	mg/L	
11/17/2010 10:30:00	**Total Alkalinity**	**44**	1.0	5.0	mg/L	
11/24/2010 10:19:00	**Total Alkalinity**	**50**	1.0	5.0	mg/L	
12/08/2010 10:29:00	**Total Alkalinity**	**45**	1.0	5.0	mg/L	
12/15/2010 11:38:00	**Total Alkalinity**	**43**	1.0	5.0	mg/L	
12/22/2010 10:35:00	**Total Alkalinity**	**41**	1.0	5.0	mg/L	
05/05/2010 11:42:00	**Total Alkalinity**	**44**	1.0	5.0	mg/L	
02/04/2010 10:15:00	**Total Alkalinity**	**44**	1.0	5.0	mg/L	SM2320B
07/07/2010 11:05:00	**Total Alkalinity**	**40**	1.0	5.0	mg/L	
10/06/2010 10:00:00	**Total Alkalinity**	**45**	1.0	5.0	mg/L	
11/03/2010 10:14:00	**Total Alkalinity**	**46**	1.0	5.0	mg/L	
12/01/2010 10:18:00	**Total Alkalinity**	**43**	1.0	5.0	mg/L	
04/07/2010 11:15:00	**Total Alkalinity**	**39**	1.0	5.0	mg/L	
08/04/2010 10:40:00	**Total Alkalinity**	**42**	1.0	5.0	mg/L	
03/31/2010 10:50:00	**Total Alkalinity**	**37**	1.0	5.0	mg/L	
08/18/2010 10:00:00	**Total Alkalinity**	**43**	1.0	5.0	mg/L	
09/01/2010 10:30:00	**Total Alkalinity**	**44**	1.0	5.0	mg/L	
09/08/2010 10:43:00	**Total Alkalinity**	**44**	1.0	5.0	mg/L	
09/15/2010 10:11:00	**Total Alkalinity**	**42**	1.0	5.0	mg/L	
09/29/2010 10:15:00	**Total Alkalinity**	**46**	1.0	5.0	mg/L	
10/13/2010 11:15:00	**Total Alkalinity**	**44**	1.0	5.0	mg/L	
12/22/2010 10:30:00	**Total Alkalinity**	**41**	1.0	5.0	mg/L	
05/12/2010 11:00:00	**Total Alkalinity**	**44**	1.0	5.0	mg/L	
08/11/2010 10:45:00	**Total Alkalinity**	**44**	1.0	5.0	mg/L	
08/25/2010 11:00:00	**Total Alkalinity**	**25**	1.0	5.0	mg/L	
09/01/2010 10:15:00	**Total Alkalinity**	**29**	1.0	5.0	mg/L	
02/17/2010 10:05:00	**Total Alkalinity**	**40**	1.0	5.0	mg/L	
03/03/2010 10:55:00	**Total Alkalinity**	**41**	1.0	5.0	mg/L	
03/05/2010 08:45:00	**Total Alkalinity**	**41**	1.0	5.0	mg/L	
03/26/2010 11:24:00	**Total Alkalinity**	**43**	1.0	5.0	mg/L	
02/26/2010 10:47:00	**Total Alkalinity**	**40**	1.0	5.0	mg/L	
05/26/2010 10:20:00	**Total Alkalinity**	**40**	1.0	5.0	mg/L	
06/02/2010 10:45:00	**Total Alkalinity**	**38**	1.0	5.0	mg/L	
01/14/2010 10:10:00	**Total Alkalinity**	**44**	1.0	5.0	mg/L	
01/14/2010 09:40:00	**Total Alkalinity**	**44**	1.0	5.0	mg/L	
11/10/2010 15:10:00	**Total Coliforms**	**13**	1.8	1.8	MPN/100 mL	
07/21/2010 11:00:00	**Total Coliforms**	**23**	1.8	1.8	MPN/100 mL	
02/04/2010 10:35:00	**Total Coliforms**	**14**	1.8	1.8	MPN/100 mL	
03/17/2010 10:22:00	**Total Coliforms**	**140**	1.8	1.8	MPN/100 mL	
04/28/2010 10:30:00	**Total Coliforms**	**4.5**	1.8	1.8	MPN/100 mL	
06/23/2010 12:34:00	**Total Coliforms**	**14**	1.8	1.8	MPN/100 mL	
08/18/2010 10:01:00	**Total Coliforms**	**7.8**	1.8	1.8	MPN/100 mL	
09/01/2010 11:12:00	**Total Coliforms**	**33**	1.8	1.8	MPN/100 mL	
09/29/2010 10:11:00	**Total Coliforms**	**4.0**	1.8	1.8	MPN/100 mL	
10/13/2010 11:30:00	**Total Coliforms**	**17**	1.8	1.8	MPN/100 mL	
12/08/2010 11:20:00	**Total Coliforms**	**4.5**	1.8	1.8	MPN/100 mL	
12/22/2010 10:35:00	**Total Coliforms**	**7.8**	1.8	1.8	MPN/100 mL	
03/31/2010 10:40:00	**Total Coliforms**	**21**	1.8	1.8	MPN/100 mL	SM 9221
03/03/2010 11:08:00	**Total Coliforms**	**6.8**	1.8	1.8	MPN/100 mL	
05/26/2010 11:15:00	**Total Coliforms**	**79**	1.8	1.8	MPN/100 mL	
01/06/2010 10:05:00	**Total Coliforms**	**2.0**	1.8	1.8	MPN/100 mL	
01/20/2010 11:10:00	**Total Coliforms**	**13**	1.8	1.8	MPN/100 mL	
04/14/2010 10:32:00	**Total Coliforms**	**11**	1.8	1.8	MPN/100 mL	
06/08/2010 10:52:00	**Total Coliforms**	**6.8**	1.8	1.8	MPN/100 mL	
07/07/2010 10:58:00	**Total Coliforms**	**17**	1.8	1.8	MPN/100 mL	
08/04/2010 10:10:00	**Total Coliforms**	**23**	1.8	1.8	MPN/100 mL	
09/15/2010 10:17:00	**Total Coliforms**	**26**	1.8	1.8	MPN/100 mL	
10/27/2010 10:50:00	**Total Coliforms**	**49**	1.8	1.8	MPN/100 mL	
11/24/2010 10:52:00	**Total Coliforms**	**49**	1.8	1.8	MPN/100 mL	
02/17/2010 11:18:00	**Total Coliforms**	**27**	1.8	1.8	MPN/100 mL	
12/22/2010 10:30:00	**Total Dissolved Solids**	**63**	10	10	mg/L	SM2540C
05/26/2010 10:20:00	**Total Dissolved Solids**	**57**	10	10	mg/L	SM2540C
01/14/2010 09:40:00	**Total Dissolved Solids**	**72**	10	10	mg/L	SM2540C
01/22/2010 14:35:00	**Total Organic Carbon**	**2.8**	0.30	0.30	mg/L	

01/28/2010 12:10:00	**Total Organic Carbon**	**3.5**	0.30	0.30	mg/L	
03/10/2010 10:20:00	**Total Organic Carbon**	**2.8**	0.30	0.30	mg/L	
03/17/2010 10:10:00	**Total Organic Carbon**	**3.0**	0.30	0.30	mg/L	
04/14/2010 10:40:00	**Total Organic Carbon**	**2.9**	0.30	0.30	mg/L	
04/21/2010 11:20:00	**Total Organic Carbon**	**2.9**	0.30	0.30	mg/L	
04/28/2010 10:20:00	**Total Organic Carbon**	**3.5**	0.30	0.30	mg/L	
05/19/2010 10:12:00	**Total Organic Carbon**	**2.8**	0.30	0.30	mg/L	
05/26/2010 11:10:00	**Total Organic Carbon**	**3.0**	0.30	0.30	mg/L	
06/16/2010 11:00:00	**Total Organic Carbon**	**4.1**	0.30	0.30	mg/L	
06/23/2010 11:28:00	**Total Organic Carbon**	**3.0**	0.30	0.30	mg/L	
06/30/2010 11:15:00	**Total Organic Carbon**	**3.4**	0.30	0.30	mg/L	
07/14/2010 10:12:00	**Total Organic Carbon**	**2.6**	0.30	0.30	mg/L	
07/21/2010 10:28:00	**Total Organic Carbon**	**2.3**	0.30	0.30	mg/L	
07/28/2010 10:05:00	**Total Organic Carbon**	**3.2**	0.30	0.30	mg/L	
08/25/2010 10:36:00	**Total Organic Carbon**	**3.6**	0.30	0.30	mg/L	
09/22/2010 10:47:00	**Total Organic Carbon**	**6.0**	0.30	0.30	mg/L	
10/20/2010 11:06:00	**Total Organic Carbon**	**3.0**	0.30	0.30	mg/L	
10/28/2010 08:35:00	**Total Organic Carbon**	**3.0**	0.30	0.30	mg/L	
11/10/2010 11:31:00	**Total Organic Carbon**	**2.6**	0.30	0.30	mg/L	
11/17/2010 10:30:00	**Total Organic Carbon**	**3.8**	0.30	0.30	mg/L	
11/24/2010 10:19:00	**Total Organic Carbon**	**3.2**	0.30	0.30	mg/L	
12/08/2010 10:29:00	**Total Organic Carbon**	**3.1**	0.30	0.30	mg/L	
12/15/2010 11:38:00	**Total Organic Carbon**	**2.9**	0.30	0.30	mg/L	
12/22/2010 10:35:00	**Total Organic Carbon**	**2.7**	0.30	0.30	mg/L	SM5310B
12/29/2010 10:22:00	**Total Organic Carbon**	**3.0**	0.30	0.30	mg/L	
05/05/2010 11:42:00	**Total Organic Carbon**	**2.9**	0.30	0.30	mg/L	
02/04/2010 10:15:00	**Total Organic Carbon**	**3.0**	0.30	0.30	mg/L	
07/07/2010 11:05:00	**Total Organic Carbon**	**3.5**	0.30	0.30	mg/L	
10/06/2010 10:00:00	**Total Organic Carbon**	**3.5**	0.30	0.30	mg/L	
11/03/2010 10:14:00	**Total Organic Carbon**	**2.6**	0.30	0.30	mg/L	
12/01/2010 10:18:00	**Total Organic Carbon**	**2.9**	0.30	0.30	mg/L	
04/07/2010 11:15:00	**Total Organic Carbon**	**3.8**	0.30	0.30	mg/L	
08/04/2010 10:40:00	**Total Organic Carbon**	**2.9**	0.30	0.30	mg/L	
08/18/2010 10:00:00	**Total Organic Carbon**	**4.6**	0.30	0.30	mg/L	
09/01/2010 10:30:00	**Total Organic Carbon**	**2.7**	0.30	0.30	mg/L	
09/08/2010 10:43:00	**Total Organic Carbon**	**3.4**	0.30	0.30	mg/L	
09/15/2010 10:11:00	**Total Organic Carbon**	**3.3**	0.30	0.30	mg/L	
09/29/2010 10:15:00	**Total Organic Carbon**	**2.7**	0.30	0.30	mg/L	
10/13/2010 11:15:00	**Total Organic Carbon**	**3.0**	0.30	0.30	mg/L	
05/12/2010 11:00:00	**Total Organic Carbon**	**4.4**	0.30	0.30	mg/L	
08/11/2010 10:45:00	**Total Organic Carbon**	**3.2**	0.30	0.30	mg/L	
02/17/2010 10:05:00	**Total Organic Carbon**	**2.9**	0.30	0.30	mg/L	
03/03/2010 10:55:00	**Total Organic Carbon**	**3.4**	0.30	0.30	mg/L	
03/05/2010 08:45:00	**Total Organic Carbon**	**2.3**	0.30	0.30	mg/L	
03/26/2010 11:24:00	**Total Organic Carbon**	**2.9**	0.30	0.30	mg/L	
02/26/2010 10:47:00	**Total Organic Carbon**	**3.4**	0.30	0.30	mg/L	
06/02/2010 10:45:00	**Total Organic Carbon**	**2.7**	0.30	0.30	mg/L	
01/14/2010 10:10:00	**Total Organic Carbon**	**3.3**	0.30	0.30	mg/L	
12/22/2010 10:30:00	**Total Trihalomethanes (THM)**	**ND**	0.50	0.50	µg/L	
01/14/2010 10:30:00	**Total Trihalomethanes (THM)**	**ND**	0.50	0.50	µg/L	
12/22/2010 10:30:00	**trans-1,2-Dichloroethene**	**ND**	0.13	0.50	µg/L	
01/14/2010 10:30:00	**trans-1,2-Dichloroethene**	**ND**	0.13	0.50	µg/L	
12/22/2010 10:30:00	**trans-1,3-Dichloropropene**	**ND**	0.12	0.50	µg/L	EPA 524.2
01/14/2010 10:30:00	**trans-1,3-Dichloropropene**	**ND**	0.12	0.50	µg/L	
12/22/2010 10:30:00	**Trichloroethene**	**ND**	0.11	0.50	µg/L	
01/14/2010 10:30:00	**Trichloroethene**	**ND**	0.11	0.50	µg/L	
12/22/2010 10:30:00	**Trichlorofluoromethane**	**ND**	0.20	5.0	µg/L	
01/14/2010 10:30:00	**Trichlorofluoromethane**	**ND**	0.20	5.0	µg/L	
12/22/2010 10:30:00	**Turbidity**	**0.64**	0.036	0.50	NTU	EPA 180.1
01/14/2010 09:40:00	**Turbidity**	**0.57**	0.036	0.50	NTU	EPA 180.1
12/22/2010 10:30:00	**Vanadium**	**ND**	0.44	3.0	µg/L	EPA 200.8
01/14/2010 09:40:00	**Vanadium**	**ND**	0.44	3.0	µg/L	EPA 200.8
12/22/2010 10:30:00	**Vinyl chloride**	**ND**	0.17	0.50	µg/L	EPA 524.2
01/14/2010 10:30:00	**Vinyl chloride**	**ND**	0.17	0.50	µg/L	EPA 524.2
12/22/2010 10:30:00	**Xylenes (total)**	**ND**	0.30	0.50	µg/L	EPA 524.2
01/14/2010 10:30:00	**Xylenes (total)**	**ND**	0.30	0.50	µg/L	EPA 524.2
12/22/2010 10:30:00	**Zinc**	**ND**	9.3	50	µg/L	EPA 200.7

01/14/2010 09:40:00	**Zinc**	**ND**	9.3	50	µg/L	EPA 200.7

Sample Date	Constituent	Result	Detection Level	Reporting Level	Units	Method
12/07/2011 10:30:00	**1,1,1-Trichloroethane**	**ND**	0.18	0.50	µg/L	
12/07/2011 10:30:00	**1,1,2,2-Tetrachloroethane**	**ND**	0.13	0.50	µg/L	
12/07/2011 10:30:00	**1,1,2-Trichloro-1,2,2-trifluoroethane (Fre**	**ND**	0.15	10	µg/L	
12/07/2011 10:30:00	**1,1,2-Trichloroethane**	**ND**	0.098	0.50	µg/L	
12/07/2011 10:30:00	**1,1-Dichloroethane**	**ND**	0.12	0.50	µg/L	
12/07/2011 10:30:00	**1,1-Dichloroethene**	**ND**	0.092	0.50	µg/L	
12/07/2011 10:30:00	**1,2,4-Trichlorobenzene**	**ND**	0.092	0.50	µg/L	EPA 524.2
12/07/2011 10:30:00	**1,2-Dichlorobenzene**	**ND**	0.042	0.50	µg/L	
12/07/2011 10:30:00	**1,2-Dichloroethane**	**ND**	0.054	0.50	µg/L	
12/07/2011 10:30:00	**1,2-Dichloroethane-d4**	**12.4**			µg/L	
12/07/2011 10:30:00	**1,2-Dichloropropane**	**ND**	0.057	0.50	µg/L	
12/07/2011 10:30:00	**1,4-Dichlorobenzene**	**ND**	0.061	0.50	µg/L	
12/07/2011 10:30:00	**4-Bromofluorobenzene**	**11.1**			µg/L	
12/07/2011 10:30:00	**Aluminum**	**ND**	27	50	µg/L	EPA 200.7
12/07/2011 10:30:00	**Antimony**	**ND**	0.57	6.0	µg/L	EPA 200.8
01/12/2011 07:50:00	**Arsenic**	**ND**	0.27	2.0	µg/L	EPA 200.8
12/07/2011 10:30:00	**Arsenic**	**ND**	0.27	2.0	µg/L	EPA 200.8
05/04/2011 10:40:00	**Atrazine**	**ND**	0.14	0.50	µg/L	EPA 507
12/07/2011 10:30:00	**Barium**	**ND**	0.91	100	µg/L	EPA 200.7
12/07/2011 10:30:00	**Benzene**	**ND**	0.057	0.50	µg/L	EPA 524.2
12/07/2011 10:30:00	**Beryllium**	**ND**	0.43	1.0	µg/L	EPA 200.7
01/13/2011 10:30:00	**Bicarbonate as CaCO3**	**44**	0.50	5.0	mg/L	
01/18/2011 09:24:00	**Bicarbonate as CaCO3**	**45**	0.50	5.0	mg/L	
02/08/2011 10:34:00	**Bicarbonate as CaCO3**	**43**	0.50	5.0	mg/L	
01/26/2011 10:43:00	**Bicarbonate as CaCO3**	**61**	0.50	5.0	mg/L	
02/16/2011 10:36:00	**Bicarbonate as CaCO3**	**43**	0.50	5.0	mg/L	
02/23/2011 10:55:00	**Bicarbonate as CaCO3**	**43**	0.50	5.0	mg/L	
03/02/2011 10:28:00	**Bicarbonate as CaCO3**	**44**	0.50	5.0	mg/L	
03/09/2011 10:58:00	**Bicarbonate as CaCO3**	**45**	0.50	5.0	mg/L	
03/16/2011 10:50:00	**Bicarbonate as CaCO3**	**41**	0.50	5.0	mg/L	
03/23/2011 10:50:00	**Bicarbonate as CaCO3**	**42**	0.50	5.0	mg/L	
03/30/2011 09:54:00	**Bicarbonate as CaCO3**	**42**	0.50	5.0	mg/L	
04/13/2011 10:40:00	**Bicarbonate as CaCO3**	**36**	0.50	5.0	mg/L	
04/20/2011 15:15:00	**Bicarbonate as CaCO3**	**42**	0.50	5.0	mg/L	
04/27/2011 11:05:00	**Bicarbonate as CaCO3**	**40**	0.50	5.0	mg/L	
05/04/2011 10:45:00	**Bicarbonate as CaCO3**	**41**	0.50	5.0	mg/L	
05/12/2011 10:29:00	**Bicarbonate as CaCO3**	**38**	0.50	5.0	mg/L	
05/18/2011 10:05:00	**Bicarbonate as CaCO3**	**40**	0.50	5.0	mg/L	
05/25/2011 10:34:00	**Bicarbonate as CaCO3**	**41**	0.50	5.0	mg/L	SM2320B
06/08/2011 11:07:00	**Bicarbonate as CaCO3**	**42**	0.50	5.0	mg/L	
06/30/2011 08:55:00	**Bicarbonate as CaCO3**	**40**	0.50	5.0	mg/L	
07/21/2011 11:02:00	**Bicarbonate as CaCO3**	**46**	0.50	5.0	mg/L	
12/15/2011 14:41:00	**Bicarbonate as CaCO3**	**52**	0.50	5.0	mg/L	
06/01/2011 10:25:00	**Bicarbonate as CaCO3**	**42**	0.50	5.0	mg/L	
07/06/2011 10:34:00	**Bicarbonate as CaCO3**	**42**	0.50	5.0	mg/L	
09/07/2011 10:47:00	**Bicarbonate as CaCO3**	**40**	0.50	5.0	mg/L	
10/05/2011 10:36:00	**Bicarbonate as CaCO3**	**44**	0.50	5.0	mg/L	
12/07/2011 10:40:00	**Bicarbonate as CaCO3**	**43**	0.50	5.0	mg/L	
02/02/2011 10:59:00	**Bicarbonate as CaCO3**	**42**	0.50	5.0	mg/L	
01/05/2011 11:02:00	**Bicarbonate as CaCO3**	**41**	0.50	5.0	mg/L	
04/20/2011 15:20:00	**Bicarbonate as CaCO3**	**43**	0.50	5.0	mg/L	
08/03/2011 10:58:00	**Bicarbonate as CaCO3**	**45**	0.50	5.0	mg/L	
11/02/2011 10:56:00	**Bicarbonate as CaCO3**	**45**	0.50	5.0	mg/L	
04/06/2011 10:50:00	**Bicarbonate as CaCO3**	**40**	0.50	5.0	mg/L	
08/20/2011 09:03:00	**Bicarbonate as CaCO3**	**43**	0.50	5.0	mg/L	
12/07/2011 10:30:00	**Bicarbonate as CaCO3**	**45**	0.50	5.0	mg/L	
05/04/2011 12:00:00	**Biochemical Oxygen Demand**	**170**	2.0	3.0	mg/L	SM5210B
12/07/2011 10:30:00	**Boron**	**ND**	4.4	100	µg/L	EPA 200.7
09/12/2011 11:23:00	**Bromide**	**ND**	0.012	0.10	mg/L	EPA 300.0
09/12/2011 11:22:00	**Bromide**	**ND**	0.012	0.10	mg/L	EPA 300.0
12/07/2011 10:30:00	**Cadmium**	**ND**	0.17	1.0	µg/L	EPA 200.8
12/07/2011 10:30:00	**Calcium**	**9.3**	0.031	1.0	mg/L	200.7/2340B
12/07/2011 10:30:00	**Carbon tetrachloride**	**ND**	0.092	0.50	µg/L	EPA 524.2
01/13/2011 10:30:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
01/18/2011 09:24:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
02/08/2011 10:34:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	

01/26/2011 10:43:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
02/16/2011 10:36:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
02/23/2011 10:55:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
03/02/2011 10:28:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
03/09/2011 10:58:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
03/16/2011 10:50:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
03/23/2011 10:50:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
03/30/2011 09:54:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
04/13/2011 10:40:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
04/20/2011 15:15:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
04/27/2011 11:05:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
05/04/2011 10:45:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
05/12/2011 10:29:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
05/18/2011 10:05:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
05/25/2011 10:34:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	SM2320B
06/08/2011 11:07:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
06/30/2011 08:55:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
07/21/2011 11:02:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
12/15/2011 14:41:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
06/01/2011 10:25:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
07/06/2011 10:34:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
09/07/2011 10:47:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
10/05/2011 10:36:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
12/07/2011 10:40:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
02/02/2011 10:59:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
01/05/2011 11:02:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
04/20/2011 15:20:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
08/03/2011 10:58:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
11/02/2011 10:56:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
04/06/2011 10:50:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
08/20/2011 09:03:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
12/07/2011 10:30:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
12/07/2011 10:30:00	Chloride	2.7	0.026	0.50	mg/L	EPA 300.0
12/07/2011 10:30:00	Chlorobenzene	ND	0.11	0.50	µg/L	EPA 524.2
12/07/2011 10:30:00	Chromium	ND	0.28	10	µg/L	EPA 200.8
12/07/2011 10:30:00	cis-1,2-Dichloroethene	ND	0.15	0.50	µg/L	EPA 524.2
12/07/2011 10:30:00	cis-1,3-Dichloropropene	ND	0.097	0.50	µg/L	EPA 524.2
12/07/2011 10:30:00	Color	ND		1	Color Units	SM2120B
12/07/2011 10:30:00	Copper	ND	3.2	50	µg/L	EPA 200.7
05/25/2011 10:34:00	E. Coli	<1.8	1.8	1.8	MPN/100 mL	
06/08/2011 11:05:00	E. Coli	<1.8	1.8	1.8	MPN/100 mL	
06/22/2011 10:48:00	E. Coli	<1.8	1.8	1.8	MPN/100 mL	
07/20/2011 10:47:00	E. Coli	1.8	1.8	1.8	MPN/100 mL	
07/06/2011 10:36:00	E. Coli	2.0	1.8	1.8	MPN/100 mL	
08/03/2011 11:02:00	E. Coli	2.0	1.8	1.8	MPN/100 mL	
11/09/2011 10:39:00	E. Coli	7.8	1.8	1.8	MPN/100 mL	
10/12/2011 11:00:00	E. Coli	<1.8	1.8	1.8	MPN/100 mL	
05/11/2011 10:59:00	E. Coli	6.1	1.8	1.8	MPN/100 mL	
01/19/2011 10:42:00	E. Coli	<1.8	1.8	1.8	MPN/100 mL	
02/16/2011 10:45:00	E. Coli	2.0	1.8	1.8	MPN/100 mL	
03/02/2011 10:42:00	E. Coli	2.0	1.8	1.8	MPN/100 mL	SM 9221
03/16/2011 11:00:00	E. Coli	7.8	1.8	1.8	MPN/100 mL	
03/30/2011 10:56:00	E. Coli	1.8	1.8	1.8	MPN/100 mL	
04/13/2011 10:42:00	E. Coli	<1.8	1.8	1.8	MPN/100 mL	
04/27/2011 11:10:00	E. Coli	2.0	1.8	1.8	MPN/100 mL	
08/31/2011 10:35:00	E. Coli	2.0	1.8	1.8	MPN/100 mL	
09/14/2011 10:35:00	E. Coli	<1.8	1.8	1.8	MPN/100 mL	
09/28/2011 10:59:00	E. Coli	2.0	1.8	1.8	MPN/100 mL	
11/23/2011 11:00:00	E. Coli	2.0	1.8	1.8	MPN/100 mL	
12/07/2011 10:38:00	E. Coli	<1.8	1.8	1.8	MPN/100 mL	
12/21/2011 11:15:00	E. Coli	<1.8	1.8	1.8	MPN/100 mL	
08/17/2011 10:57:00	E. Coli	<1.8	1.8	1.8	MPN/100 mL	
10/26/2011 11:00:00	E. Coli	<1.8	1.8	1.8	MPN/100 mL	
05/04/2011 10:40:00	EPN	1.29			µg/L	EPA 507
12/07/2011 10:30:00	EPN	3.27			µg/L	EPA 507
12/07/2011 10:30:00	Ethylbenzene	ND	0.090	0.50	µg/L	EPA 524.2
05/25/2011 10:34:00	Fecal Coliforms	<1.8	1.8	1.8	MPN/100 mL	
06/08/2011 11:05:00	Fecal Coliforms	<1.8	1.8	1.8	MPN/100 mL	

06/22/2011 10:48:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
07/20/2011 10:47:00	**Fecal Coliforms**	**3.7**	1.8	1.8	MPN/100 mL	
07/06/2011 10:36:00	**Fecal Coliforms**	**2.0**	1.8	1.8	MPN/100 mL	
08/03/2011 11:02:00	**Fecal Coliforms**	**2.0**	1.8	1.8	MPN/100 mL	
11/09/2011 10:39:00	**Fecal Coliforms**	**13**	1.8	1.8	MPN/100 mL	
10/12/2011 11:00:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
05/11/2011 10:59:00	**Fecal Coliforms**	**6.1**	1.8	1.8	MPN/100 mL	
01/19/2011 10:42:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
02/16/2011 10:45:00	**Fecal Coliforms**	**2.0**	1.8	1.8	MPN/100 mL	
03/02/2011 10:42:00	**Fecal Coliforms**	**2.0**	1.8	1.8	MPN/100 mL	SM 9221
03/16/2011 11:00:00	**Fecal Coliforms**	**7.8**	1.8	1.8	MPN/100 mL	
03/30/2011 10:56:00	**Fecal Coliforms**	**1.8**	1.8	1.8	MPN/100 mL	
04/13/2011 10:42:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
04/27/2011 11:10:00	**Fecal Coliforms**	**4.5**	1.8	1.8	MPN/100 mL	
08/31/2011 10:35:00	**Fecal Coliforms**	**4.5**	1.8	1.8	MPN/100 mL	
09/14/2011 10:35:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
09/28/2011 10:59:00	**Fecal Coliforms**	**4.5**	1.8	1.8	MPN/100 mL	
11/23/2011 11:00:00	**Fecal Coliforms**	**2.0**	1.8	1.8	MPN/100 mL	
12/07/2011 10:38:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
12/21/2011 11:15:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
08/17/2011 10:57:00	**Fecal Coliforms**	**2.0**	1.8	1.8	MPN/100 mL	
10/26/2011 11:00:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
12/07/2011 10:30:00	**Fluoride**	**ND**	0.0079	0.10	mg/L	EPA 300.0
12/07/2011 10:30:00	**Hardness as CaCO3**	**42**	1.0	1.0	mg/L	200.7/2340B
01/13/2011 10:30:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
01/18/2011 09:24:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
02/08/2011 10:34:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
01/26/2011 10:43:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
02/16/2011 10:36:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
02/23/2011 10:55:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
03/02/2011 10:28:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
03/09/2011 10:58:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
03/16/2011 10:50:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
03/23/2011 10:50:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
03/30/2011 09:54:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
04/13/2011 10:40:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
04/20/2011 15:15:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
04/27/2011 11:05:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
05/04/2011 10:45:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
05/12/2011 10:29:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
05/18/2011 10:05:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
05/25/2011 10:34:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	SM2320B
06/08/2011 11:07:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
06/30/2011 08:55:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
07/21/2011 11:02:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
12/15/2011 14:41:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
06/01/2011 10:25:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
07/06/2011 10:34:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
09/07/2011 10:47:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
10/05/2011 10:36:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
12/07/2011 10:40:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
02/02/2011 10:59:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
01/05/2011 11:02:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
04/20/2011 15:20:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
08/03/2011 10:58:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
11/02/2011 10:56:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
04/06/2011 10:50:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
08/20/2011 09:03:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
12/07/2011 10:30:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
03/02/2011 10:28:00	**Iron**	**ND**	6.8	100	µg/L	
05/04/2011 10:45:00	**Iron**	**ND**	6.8	100	µg/L	
06/01/2011 10:25:00	**Iron**	**ND**	6.8	100	µg/L	
07/06/2011 10:34:00	**Iron**	**ND**	6.8	100	µg/L	
09/07/2011 10:47:00	**Iron**	**ND**	6.8	100	µg/L	
10/05/2011 10:36:00	**Iron**	**ND**	6.8	100	µg/L	
12/07/2011 10:40:00	**Iron**	**ND**	6.8	100	µg/L	EPA 200.7
02/02/2011 10:59:00	**Iron**	**ND**	6.8	100	µg/L	
01/05/2011 11:02:00	**Iron**	**ND**	6.8	100	µg/L	

08/03/2011 10:58:00	**Iron**	**ND**	6.8	100	µg/L	
11/02/2011 10:56:00	**Iron**	**ND**	6.8	100	µg/L	
04/06/2011 10:50:00	**Iron**	**ND**	6.8	100	µg/L	
12/07/2011 10:30:00	**Iron**	**ND**	6.8	100	µg/L	
12/07/2011 10:30:00	**Lead**	**ND**	0.23	5.0	µg/L	EPA 200.8
12/07/2011 10:30:00	**Magnesium**	**4.4**	0.028	1.0	mg/L	200.7/2340B
03/02/2011 10:28:00	**Manganese**	**ND**	0.92	20	µg/L	
05/04/2011 10:45:00	**Manganese**	**ND**	0.92	20	µg/L	
06/01/2011 10:25:00	**Manganese**	**14**	1.7	10	µg/L	
07/06/2011 10:34:00	**Manganese**	**44**	1.7	10	µg/L	
09/07/2011 10:47:00	**Manganese**	**72**	1.7	10	µg/L	
10/05/2011 10:36:00	**Manganese**	**ND**	0.92	20	µg/L	
12/07/2011 10:40:00	**Manganese**	**ND**	1.7	10	µg/L	EPA 200.7
02/02/2011 10:59:00	**Manganese**	**ND**	0.92	20	µg/L	
01/05/2011 11:02:00	**Manganese**	**ND**	0.92	20	µg/L	
08/03/2011 10:58:00	**Manganese**	**170**	0.92	20	µg/L	
11/02/2011 10:56:00	**Manganese**	**25**	0.92	20	µg/L	
04/06/2011 10:50:00	**Manganese**	**ND**	0.92	20	µg/L	
12/07/2011 10:30:00	**Manganese**	**ND**	0.92	10	µg/L	
12/07/2011 10:30:00	**MBAS as LAS, mol wt 340**	**ND**	0.067	0.10	mg/L	SM5540 C
12/07/2011 10:30:00	**Mercury**	**ND**	0.15	1.0	µg/L	EPA 245.1
12/07/2011 10:30:00	**Methyl tert-butyl ether**	**ND**	0.092	3.0	µg/L	EPA 524.2
12/07/2011 10:30:00	**Methylene chloride**	**ND**	0.24	0.50	µg/L	EPA 524.2
12/07/2011 10:30:00	**Nickel**	**ND**	10	10	µg/L	EPA 200.7
10/14/2011 09:45:00	**Nitrate as NO3**	**ND**	0.053	0.50	mg/L	EPA 300.0
12/07/2011 10:30:00	**Nitrate as NO3**	**ND**	0.021	2.0	mg/L	EPA 300.0
10/14/2011 09:45:00	**Nitrite as N**	**ND**	0.0022	0.10	mg/L	EPA 300.0
12/07/2011 10:30:00	**Perchlorate**	**ND**	0.98	4.0	µg/L	EPA 314.0
12/07/2011 10:30:00	**pH**	**7.64**	0.01	0.01	pH Units	SM4500-H B
12/07/2011 10:30:00	**Potassium**	**ND**	0.87	1.0	mg/L	200.7/2340B
12/07/2011 10:30:00	**Selenium**	**ND**	1.1	5.0	µg/L	EPA 200.8
12/07/2011 10:30:00	**Silver**	**ND**	2.9	10	µg/L	EPA 200.7
12/07/2011 10:30:00	**Sodium**	**5.4**	0.021	1.0	mg/L	200.7/2340B
12/07/2011 10:30:00	**Specific Conductance (EC)**	**99**	0.090	1.0	µmhos/cm	EPA 120.1
12/07/2011 10:30:00	**Styrene**	**ND**	0.059	0.50	µg/L	EPA 524.2
12/07/2011 10:30:00	**Sulfate as SO4**	**3.3**	0.010	0.50	mg/L	EPA 300.0
12/07/2011 10:30:00	**Tetrachloroethene**	**ND**	0.12	0.50	µg/L	EPA 524.2
12/07/2011 10:30:00	**Thallium**	**ND**	0.11	1.0	µg/L	EPA 200.8
12/07/2011 10:30:00	**Thiobencarb**	**ND**	0.15	1.0	µg/L	EPA 507
12/07/2011 10:30:00	**Threshold Odor Number**	**1**		1	T.O.N.	EPA 140.1
12/07/2011 10:30:00	**Toluene**	**ND**	0.10	0.50	µg/L	EPA 524.2
12/07/2011 10:30:00	**Toluene-d8**	**9.00**			µg/L	EPA 524.2
01/13/2011 10:30:00	**Total Alkalinity**	**44**	1.0	5.0	mg/L	
01/18/2011 09:24:00	**Total Alkalinity**	**45**	1.0	5.0	mg/L	
02/08/2011 10:34:00	**Total Alkalinity**	**43**	1.0	5.0	mg/L	
01/26/2011 10:43:00	**Total Alkalinity**	**61**	1.0	5.0	mg/L	
02/16/2011 10:36:00	**Total Alkalinity**	**43**	1.0	5.0	mg/L	
02/23/2011 10:55:00	**Total Alkalinity**	**43**	1.0	5.0	mg/L	
03/02/2011 10:28:00	**Total Alkalinity**	**44**	1.0	5.0	mg/L	
03/09/2011 10:58:00	**Total Alkalinity**	**45**	1.0	5.0	mg/L	
03/16/2011 10:50:00	**Total Alkalinity**	**41**	1.0	5.0	mg/L	
03/23/2011 10:50:00	**Total Alkalinity**	**42**	1.0	5.0	mg/L	
03/30/2011 09:54:00	**Total Alkalinity**	**42**	1.0	5.0	mg/L	
04/13/2011 10:40:00	**Total Alkalinity**	**36**	1.0	5.0	mg/L	
04/20/2011 15:15:00	**Total Alkalinity**	**42**	1.0	5.0	mg/L	
04/27/2011 11:05:00	**Total Alkalinity**	**40**	1.0	5.0	mg/L	
05/04/2011 10:45:00	**Total Alkalinity**	**41**	1.0	5.0	mg/L	
05/12/2011 10:29:00	**Total Alkalinity**	**38**	1.0	5.0	mg/L	
05/18/2011 10:05:00	**Total Alkalinity**	**40**	1.0	5.0	mg/L	
05/25/2011 10:34:00	**Total Alkalinity**	**41**	1.0	5.0	mg/L	SM2320B
06/08/2011 11:07:00	**Total Alkalinity**	**42**	1.0	5.0	mg/L	
06/30/2011 08:55:00	**Total Alkalinity**	**40**	1.0	5.0	mg/L	
07/21/2011 11:02:00	**Total Alkalinity**	**46**	1.0	5.0	mg/L	
12/15/2011 14:41:00	**Total Alkalinity**	**52**	1.0	5.0	mg/L	
06/01/2011 10:25:00	**Total Alkalinity**	**42**	1.0	5.0	mg/L	
07/06/2011 10:34:00	**Total Alkalinity**	**42**	1.0	5.0	mg/L	
09/07/2011 10:47:00	**Total Alkalinity**	**40**	1.0	5.0	mg/L	
10/05/2011 10:36:00	**Total Alkalinity**	**44**	1.0	5.0	mg/L	

12/07/2011 10:40:00	**Total Alkalinity**	**43**	1.0	5.0	mg/L	
02/02/2011 10:59:00	**Total Alkalinity**	**42**	1.0	5.0	mg/L	
01/05/2011 11:02:00	**Total Alkalinity**	**41**	1.0	5.0	mg/L	
04/20/2011 15:20:00	**Total Alkalinity**	**43**	1.0	5.0	mg/L	
08/03/2011 10:58:00	**Total Alkalinity**	**45**	1.0	5.0	mg/L	
11/02/2011 10:56:00	**Total Alkalinity**	**45**	1.0	5.0	mg/L	
04/06/2011 10:50:00	**Total Alkalinity**	**40**	1.0	5.0	mg/L	
08/20/2011 09:03:00	**Total Alkalinity**	**43**	1.0	5.0	mg/L	
12/07/2011 10:30:00	**Total Alkalinity**	**45**	1.0	5.0	mg/L	
05/25/2011 10:34:00	**Total Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
06/08/2011 11:05:00	**Total Coliforms**	**6.8**	1.8	1.8	MPN/100 mL	
06/22/2011 10:48:00	**Total Coliforms**	**22**	1.8	1.8	MPN/100 mL	
07/20/2011 10:47:00	**Total Coliforms**	**9.3**	1.8	1.8	MPN/100 mL	
07/06/2011 10:36:00	**Total Coliforms**	**13**	1.8	1.8	MPN/100 mL	
08/03/2011 11:02:00	**Total Coliforms**	**13**	1.8	1.8	MPN/100 mL	
11/09/2011 10:39:00	**Total Coliforms**	**23**	1.8	1.8	MPN/100 mL	
10/12/2011 11:00:00	**Total Coliforms**	**17**	1.8	1.8	MPN/100 mL	
05/11/2011 10:59:00	**Total Coliforms**	**4.0**	1.8	1.8	MPN/100 mL	
01/19/2011 10:42:00	**Total Coliforms**	**1.8**	1.8	1.8	MPN/100 mL	
02/16/2011 10:45:00	**Total Coliforms**	**13**	1.8	1.8	MPN/100 mL	
03/02/2011 10:42:00	**Total Coliforms**	**6.8**	1.8	1.8	MPN/100 mL	SM 9221
03/16/2011 11:00:00	**Total Coliforms**	**7.8**	1.8	1.8	MPN/100 mL	
03/30/2011 10:56:00	**Total Coliforms**	**9.3**	1.8	1.8	MPN/100 mL	
04/13/2011 10:42:00	**Total Coliforms**	**3.7**	1.8	1.8	MPN/100 mL	
04/27/2011 11:10:00	**Total Coliforms**	**4.5**	1.8	1.8	MPN/100 mL	
08/31/2011 10:35:00	**Total Coliforms**	**11**	1.8	1.8	MPN/100 mL	
09/14/2011 10:35:00	**Total Coliforms**	**12**	1.8	1.8	MPN/100 mL	
09/28/2011 10:59:00	**Total Coliforms**	**110**	1.8	1.8	MPN/100 mL	
11/23/2011 11:00:00	**Total Coliforms**	**11**	1.8	1.8	MPN/100 mL	
12/07/2011 10:38:00	**Total Coliforms**	**4.5**	1.8	1.8	MPN/100 mL	
12/21/2011 11:15:00	**Total Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
08/17/2011 10:57:00	**Total Coliforms**	**120**	1.8	1.8	MPN/100 mL	
10/26/2011 11:00:00	**Total Coliforms**	**11**	1.8	1.8	MPN/100 mL	
12/07/2011 10:30:00	**Total Dissolved Solids**	**69**	10	10	mg/L	SM2540C
09/16/2011 08:31:00	**Total Kjeldahl Nitrogen**	**0.27**	0.040	0.20	mg/L	SM4500-NH3C
09/23/2011 08:32:00	**Total Kjeldahl Nitrogen**	**0.36**	0.040	0.20	mg/L	SM4500-NH3C
09/30/2011 08:15:00	**Total Kjeldahl Nitrogen**	**0.33**	0.040	0.20	mg/L	SM4500-NH3C
10/07/2011 08:44:00	**Total Kjeldahl Nitrogen**	**0.26**	0.040	0.20	mg/L	SM4500-NH3C
10/14/2011 05:52:00	**Total Kjeldahl Nitrogen**	**0.65**	0.040	0.20	mg/L	SM4500-NH3C
10/21/2011 05:57:00	**Total Kjeldahl Nitrogen**	**0.31**	0.040	0.20	mg/L	SM4500-NH3C
10/28/2011 05:51:00	**Total Kjeldahl Nitrogen**	**0.38**	0.040	0.20	mg/L	SM4500-NH3C
01/13/2011 10:48:00	**Total Organic Carbon**	**3.4**	0.54	1.0	mg/L	
01/18/2011 09:24:00	**Total Organic Carbon**	**3.0**	0.54	1.0	mg/L	
01/21/2011 14:49:00	**Total Organic Carbon**	**3.8**	0.54	1.0	mg/L	
01/28/2011 11:12:00	**Total Organic Carbon**	**2.8**	0.54	1.0	mg/L	
02/08/2011 10:34:00	**Total Organic Carbon**	**3.5**	0.54	1.0	mg/L	
01/26/2011 10:43:00	**Total Organic Carbon**	**2.9**	0.54	1.0	mg/L	
02/16/2011 10:36:00	**Total Organic Carbon**	**3.0**	0.30	0.30	mg/L	
02/23/2011 10:55:00	**Total Organic Carbon**	**3.1**	0.30	0.30	mg/L	
03/02/2011 10:29:00	**Total Organic Carbon**	**3.3**	0.30	0.30	mg/L	
03/09/2011 10:58:00	**Total Organic Carbon**	**3.3**	0.30	0.30	mg/L	
03/16/2011 10:50:00	**Total Organic Carbon**	**2.8**	0.30	0.30	mg/L	
03/23/2011 10:50:00	**Total Organic Carbon**	**3.1**	0.30	0.30	mg/L	
03/30/2011 09:54:00	**Total Organic Carbon**	**3.8**	0.30	0.30	mg/L	
04/13/2011 10:40:00	**Total Organic Carbon**	**3.9**	0.30	0.30	mg/L	
04/20/2011 15:15:00	**Total Organic Carbon**	**4.0**	0.30	0.30	mg/L	
04/27/2011 11:05:00	**Total Organic Carbon**	**3.4**	0.30	0.30	mg/L	
05/04/2011 10:45:00	**Total Organic Carbon**	**3.4**	0.30	0.30	mg/L	
05/12/2011 10:29:00	**Total Organic Carbon**	**3.8**	0.30	0.30	mg/L	
05/18/2011 10:05:00	**Total Organic Carbon**	**3.2**	0.30	0.30	mg/L	
05/25/2011 10:34:00	**Total Organic Carbon**	**3.2**	0.30	0.30	mg/L	
06/08/2011 11:07:00	**Total Organic Carbon**	**3.3**	0.30	0.30	mg/L	
06/30/2011 08:55:00	**Total Organic Carbon**	**3.0**	0.30	0.30	mg/L	
07/21/2011 11:03:00	**Total Organic Carbon**	**3.4**	0.30	0.30	mg/L	
08/17/2011 10:53:00	**Total Organic Carbon**	**3.3**	0.30	0.30	mg/L	
12/15/2011 14:41:00	**Total Organic Carbon**	**4.0**	0.30	0.30	mg/L	
12/15/2011 14:51:00	**Total Organic Carbon**	**3.2**	0.30	0.30	mg/L	
06/01/2011 10:25:00	**Total Organic Carbon**	**3.3**	0.30	0.30	mg/L	

07/06/2011 10:34:00	**Total Organic Carbon**	**3.8**	0.30	0.30	mg/L	
09/07/2011 10:47:00	**Total Organic Carbon**	**3.4**	0.30	0.30	mg/L	
10/05/2011 10:36:00	**Total Organic Carbon**	**3.4**	0.30	0.30	mg/L	
12/07/2011 10:40:00	**Total Organic Carbon**	**2.7**	0.30	0.30	mg/L	
02/02/2011 10:59:00	**Total Organic Carbon**	**3.0**	0.30	0.30	mg/L	
01/05/2011 11:02:00	**Total Organic Carbon**	**2.7**	0.30	0.30	mg/L	
04/20/2011 15:20:00	**Total Organic Carbon**	**3.3**	0.30	0.30	mg/L	
08/03/2011 10:58:00	**Total Organic Carbon**	**3.5**	0.30	0.30	mg/L	
11/02/2011 10:56:00	**Total Organic Carbon**	**3.3**	0.30	0.30	mg/L	
04/06/2011 10:50:00	**Total Organic Carbon**	**3.9**	0.30	0.30	mg/L	
04/06/2011 11:00:00	**Total Organic Carbon**	**2.1**	0.30	0.30	mg/L	SM5310B
08/20/2011 09:03:00	**Total Organic Carbon**	**3.1**	0.30	0.30	mg/L	
01/13/2011 10:32:00	**Total Organic Carbon, Dissolved**	**3.1**	0.54	1.0	mg/L	
01/18/2011 09:24:00	**Total Organic Carbon, Dissolved**	**3.9**	0.54	1.0	mg/L	
01/21/2011 14:49:00	**Total Organic Carbon, Dissolved**	**3.5**	0.54	1.0	mg/L	
01/28/2011 11:12:00	**Total Organic Carbon, Dissolved**	**3.2**	0.54	1.0	mg/L	
02/08/2011 10:34:00	**Total Organic Carbon, Dissolved**	**4.2**	0.54	1.0	mg/L	
01/26/2011 10:43:00	**Total Organic Carbon, Dissolved**	**2.8**	0.54	1.0	mg/L	
02/16/2011 10:36:00	**Total Organic Carbon, Dissolved**	**3.1**	0.54	1.0	mg/L	
02/23/2011 10:55:00	**Total Organic Carbon, Dissolved**	**3.0**	0.54	1.0	mg/L	
03/02/2011 10:29:00	**Total Organic Carbon, Dissolved**	**4.0**	0.54	1.0	mg/L	
03/09/2011 10:58:00	**Total Organic Carbon, Dissolved**	**3.3**	0.54	1.0	mg/L	
03/16/2011 10:50:00	**Total Organic Carbon, Dissolved**	**2.9**	0.54	1.0	mg/L	
03/23/2011 10:50:00	**Total Organic Carbon, Dissolved**	**2.9**	0.54	1.0	mg/L	
03/30/2011 09:54:00	**Total Organic Carbon, Dissolved**	**3.6**	0.54	1.0	mg/L	
04/13/2011 10:40:00	**Total Organic Carbon, Dissolved**	**3.8**	0.54	1.0	mg/L	
04/20/2011 09:10:00	**Total Organic Carbon, Dissolved**	**3.7**	0.54	1.0	mg/L	
04/20/2011 10:50:00	**Total Organic Carbon, Dissolved**	**3.5**	0.54	1.0	mg/L	
04/27/2011 11:05:00	**Total Organic Carbon, Dissolved**	**3.3**	0.54	1.0	mg/L	
05/04/2011 10:45:00	**Total Organic Carbon, Dissolved**	**3.0**	0.54	1.0	mg/L	
05/12/2011 10:29:00	**Total Organic Carbon, Dissolved**	**3.7**	0.54	1.0	mg/L	
05/18/2011 10:05:00	**Total Organic Carbon, Dissolved**	**3.2**	0.54	1.0	mg/L	
05/25/2011 10:34:00	**Total Organic Carbon, Dissolved**	**3.3**	0.54	1.0	mg/L	
06/08/2011 11:07:00	**Total Organic Carbon, Dissolved**	**3.5**	0.54	1.0	mg/L	
07/21/2011 11:03:00	**Total Organic Carbon, Dissolved**	**3.1**	0.30	0.30	mg/L	
08/17/2011 10:53:00	**Total Organic Carbon, Dissolved**	**3.4**	0.54	1.0	mg/L	
12/15/2011 14:41:00	**Total Organic Carbon, Dissolved**	**3.1**	0.30	0.30	mg/L	
12/15/2011 14:51:00	**Total Organic Carbon, Dissolved**	**3.4**	0.30	0.30	mg/L	
06/01/2011 10:25:00	**Total Organic Carbon, Dissolved**	**3.5**	0.54	1.0	mg/L	
07/06/2011 10:34:00	**Total Organic Carbon, Dissolved**	**3.2**	0.54	1.0	mg/L	
09/07/2011 10:47:00	**Total Organic Carbon, Dissolved**	**3.4**	0.30	0.30	mg/L	
10/05/2011 10:36:00	**Total Organic Carbon, Dissolved**	**3.7**	0.30	0.30	mg/L	
12/07/2011 10:40:00	**Total Organic Carbon, Dissolved**	**2.5**	0.30	0.30	mg/L	
02/02/2011 10:59:00	**Total Organic Carbon, Dissolved**	**3.1**	0.30	0.30	mg/L	
08/03/2011 10:58:00	**Total Organic Carbon, Dissolved**	**3.1**	0.30	0.30	mg/L	
11/02/2011 10:56:00	**Total Organic Carbon, Dissolved**	**3.6**	0.30	0.30	mg/L	
01/10/2011 14:40:00	**Total Organic Carbon, Dissolved**	**2.8**	0.54	1.0	mg/L	
04/06/2011 10:50:00	**Total Organic Carbon, Dissolved**	**3.5**	0.54	1.0	mg/L	
08/20/2011 09:03:00	**Total Organic Carbon, Dissolved**	**3.3**	0.30	0.30	mg/L	
09/16/2011 08:31:00	**Total Phosphorus as P**	**ND**	0.023	0.050	mg/L	
09/23/2011 08:32:00	**Total Phosphorus as P**	**ND**	0.023	0.050	mg/L	
09/30/2011 08:15:00	**Total Phosphorus as P**	**0.064**	0.023	0.050	mg/L	
10/07/2011 08:44:00	**Total Phosphorus as P**	**ND**	0.023	0.050	mg/L	SM4500-P E
10/14/2011 05:52:00	**Total Phosphorus as P**	**ND**	0.023	0.050	mg/L	
10/21/2011 05:57:00	**Total Phosphorus as P**	**ND**	0.023	0.050	mg/L	
10/28/2011 05:51:00	**Total Phosphorus as P**	**ND**	0.023	0.050	mg/L	
05/04/2011 12:00:00	**Total Suspended Solids**	**190**	2.0	5.0	mg/L	SM2540D
12/07/2011 10:30:00	**Total Trihalomethanes (THM)**	**ND**	0.50	0.50	µg/L	EPA 524.2
12/07/2011 10:30:00	**trans-1,2-Dichloroethene**	**ND**	0.13	0.50	µg/L	EPA 524.2
12/07/2011 10:30:00	**trans-1,3-Dichloropropene**	**ND**	0.12	0.50	µg/L	EPA 524.2
12/07/2011 10:30:00	**Trichloroethene**	**ND**	0.11	0.50	µg/L	EPA 524.2
12/07/2011 10:30:00	**Trichlorofluoromethane**	**ND**	0.20	5.0	µg/L	EPA 524.2
12/07/2011 10:30:00	**Turbidity**	**0.53**	0.036	0.50	NTU	EPA 180.1
01/13/2011 10:32:00	**UV-absorbing organics**	**1.3**		1.0	L/mg-m	None
01/13/2011 10:32:00	**UV-absorbing organics**	**0.039**		0.0050	1/cm	SM 5910B
01/18/2011 09:24:00	**UV-absorbing organics**	**1.1**		1.0	L/mg-m	None
01/18/2011 09:24:00	**UV-absorbing organics**	**0.041**		0.0050	1/cm	SM 5910B
01/21/2011 14:49:00	**UV-absorbing organics**	**0.046**		0.0050	1/cm	SM 5910B

01/28/2011 11:12:00	**UV-absorbing organics**	**1.4**		1.0	L/mg-m	None
01/28/2011 11:12:00	**UV-absorbing organics**	**0.044**		0.0050	1/cm	SM 5910B
02/08/2011 10:34:00	**UV-absorbing organics**	**1.0**		1.0	L/mg-m	None
02/08/2011 10:34:00	**UV-absorbing organics**	**0.043**		0.0050	1/cm	SM 5910B
01/26/2011 10:43:00	**UV-absorbing organics**	**1.6**		1.0	L/mg-m	None
01/26/2011 10:43:00	**UV-absorbing organics**	**0.045**		0.0050	1/cm	SM 5910B
02/16/2011 10:36:00	**UV-absorbing organics**	**1.3**		1.0	L/mg-m	None
02/16/2011 10:36:00	**UV-absorbing organics**	**0.042**		0.0050	1/cm	SM 5910B
02/23/2011 10:55:00	**UV-absorbing organics**	**1.4**		1.0	L/mg-m	None
02/23/2011 10:55:00	**UV-absorbing organics**	**0.042**		0.0050	1/cm	
03/02/2011 10:29:00	**UV-absorbing organics**	**0.043**		0.0050	1/cm	
03/09/2011 10:58:00	**UV-absorbing organics**	**0.042**		0.0050	1/cm	
03/16/2011 10:50:00	**UV-absorbing organics**	**0.039**		0.0050	1/cm	
03/23/2011 10:50:00	**UV-absorbing organics**	**0.041**		0.0050	1/cm	
03/30/2011 09:54:00	**UV-absorbing organics**	**0.045**		0.0050	1/cm	
04/13/2011 10:40:00	**UV-absorbing organics**	**0.037**		0.0050	1/cm	
04/20/2011 09:10:00	**UV-absorbing organics**	**0.040**		0.0050	1/cm	
04/20/2011 10:50:00	**UV-absorbing organics**	**0.039**		0.0050	1/cm	
04/27/2011 11:05:00	**UV-absorbing organics**	**0.041**		0.0050	1/cm	
05/04/2011 10:45:00	**UV-absorbing organics**	**0.036**		0.0050	1/cm	SM 5910B
05/12/2011 10:29:00	**UV-absorbing organics**	**0.036**		0.0050	1/cm	
05/18/2011 10:05:00	**UV-absorbing organics**	**0.041**		0.0050	1/cm	
05/25/2011 10:34:00	**UV-absorbing organics**	**0.042**		0.0050	1/cm	
06/08/2011 11:07:00	**UV-absorbing organics**	**0.040**		0.0050	1/cm	
08/17/2011 10:53:00	**UV-absorbing organics**	**0.038**		0.0050	1/cm	
12/15/2011 14:41:00	**UV-absorbing organics**	**0.053**		0.0050	1/cm	
12/15/2011 14:51:00	**UV-absorbing organics**	**0.055**		0.0050	1/cm	
06/01/2011 10:25:00	**UV-absorbing organics**	**0.039**		0.0050	1/cm	
07/06/2011 10:34:00	**UV-absorbing organics**	**0.037**		0.0050	1/cm	
09/07/2011 10:47:00	**UV-absorbing organics**	**0.036**		0.0050	1/cm	
10/05/2011 10:36:00	**UV-absorbing organics**	**0.039**		0.0050	1/cm	
12/07/2011 10:40:00	**UV-absorbing organics**	**0.057**		0.0050	1/cm	SM 5910B
02/02/2011 10:59:00	**UV-absorbing organics**	**1.4**		1.0	L/mg-m	None
02/02/2011 10:59:00	**UV-absorbing organics**	**0.042**		0.0050	1/cm	SM 5910B
08/03/2011 10:58:00	**UV-absorbing organics**	**0.041**		0.0050	1/cm	SM 5910B
11/02/2011 10:56:00	**UV-absorbing organics**	**0.042**		0.0050	1/cm	SM 5910B
01/10/2011 14:40:00	**UV-absorbing organics**	**1.6**		1.0	L/mg-m	None
01/10/2011 14:40:00	**UV-absorbing organics**	**0.043**		0.0050	1/cm	SM 5910B
04/06/2011 10:50:00	**UV-absorbing organics**	**0.038**		0.0050	1/cm	SM 5910B
08/20/2011 09:03:00	**UV-absorbing organics**	**0.038**		0.0050	1/cm	SM 5910B
03/02/2011 10:29:00	**UV-absorbing organics (SUVA)**	**1.1**		1.0	L/mg-m	
03/09/2011 10:58:00	**UV-absorbing organics (SUVA)**	**1.3**		1.0	L/mg-m	
03/16/2011 10:50:00	**UV-absorbing organics (SUVA)**	**1.3**		1.0	L/mg-m	
03/23/2011 10:50:00	**UV-absorbing organics (SUVA)**	**1.4**		1.0	L/mg-m	
03/30/2011 09:54:00	**UV-absorbing organics (SUVA)**	**1.3**		1.0	L/mg-m	
04/13/2011 10:40:00	**UV-absorbing organics (SUVA)**	**ND**		1.0	L/mg-m	
04/20/2011 09:10:00	**UV-absorbing organics (SUVA)**	**1.1**		1.0	L/mg-m	
04/20/2011 10:50:00	**UV-absorbing organics (SUVA)**	**1.1**		1.0	L/mg-m	
04/27/2011 11:05:00	**UV-absorbing organics (SUVA)**	**1.2**		1.0	L/mg-m	
05/04/2011 10:45:00	**UV-absorbing organics (SUVA)**	**1.2**		1.0	L/mg-m	
05/12/2011 10:29:00	**UV-absorbing organics (SUVA)**	**ND**		1.0	L/mg-m	
05/18/2011 10:05:00	**UV-absorbing organics (SUVA)**	**1.3**		1.0	L/mg-m	
05/25/2011 10:34:00	**UV-absorbing organics (SUVA)**	**1.3**		1.0	L/mg-m	None
06/08/2011 11:07:00	**UV-absorbing organics (SUVA)**	**1.1**		1.0	L/mg-m	
08/17/2011 10:53:00	**UV-absorbing organics (SUVA)**	**1.1**		1.0	L/mg-m	
12/15/2011 14:41:00	**UV-absorbing organics (SUVA)**	**1.7**		1.0	L/mg-m	
12/15/2011 14:51:00	**UV-absorbing organics (SUVA)**	**1.6**		1.0	L/mg-m	
06/01/2011 10:25:00	**UV-absorbing organics (SUVA)**	**1.1**		1.0	L/mg-m	
07/06/2011 10:34:00	**UV-absorbing organics (SUVA)**	**1.1**		1.0	L/mg-m	
09/07/2011 10:47:00	**UV-absorbing organics (SUVA)**	**1.1**		1.0	L/mg-m	
10/05/2011 10:36:00	**UV-absorbing organics (SUVA)**	**1.1**		1.0	L/mg-m	
12/07/2011 10:40:00	**UV-absorbing organics (SUVA)**	**2.3**		1.0	L/mg-m	
08/03/2011 10:58:00	**UV-absorbing organics (SUVA)**	**1.3**		1.0	L/mg-m	
11/02/2011 10:56:00	**UV-absorbing organics (SUVA)**	**1.2**		1.0	L/mg-m	
04/06/2011 10:50:00	**UV-absorbing organics (SUVA)**	**1.1**		1.0	L/mg-m	
08/20/2011 09:03:00	**UV-absorbing organics (SUVA)**	**1.2**		1.0	L/mg-m	
12/07/2011 10:30:00	**Vanadium**	**ND**	0.44	3.0	µg/L	EPA 200.8
12/07/2011 10:30:00	**Vinyl chloride**	**ND**	0.17	0.50	µg/L	EPA 524.2

12/07/2011 10:30:00	**Xylenes (total)**	**ND**	0.30	0.50	µg/L	EPA 524.2
12/07/2011 10:30:00	**Zinc**	**ND**	9.3	50	µg/L	EPA 200.7

Sample Date	Constituent	Result	Detection Level	Reporting Level	Units	Method
12/05/2012 10:50:00	**1,1,1-Trichloroethane**	**ND**	0.18	0.50	µg/L	
12/05/2012 10:50:00	**1,1,2,2-Tetrachloroethane**	**ND**	0.13	0.50	µg/L	
12/05/2012 10:50:00	**1,1,2-Trichloro-1,2,2-trifluoroethane (F**	**ND**	0.15	10	µg/L	
12/05/2012 10:50:00	**1,1,2-Trichloroethane**	**ND**	0.098	0.50	µg/L	
12/05/2012 10:50:00	**1,1-Dichloroethane**	**ND**	0.12	0.50	µg/L	
12/05/2012 10:50:00	**1,1-Dichloroethene**	**ND**	0.092	0.50	µg/L	
12/05/2012 10:50:00	**1,2,4-Trichlorobenzene**	**ND**	0.092	0.50	µg/L	EPA 524.2
12/05/2012 10:50:00	**1,2-Dichlorobenzene**	**ND**	0.042	0.50	µg/L	
12/05/2012 10:50:00	**1,2-Dichloroethane**	**ND**	0.054	0.50	µg/L	
12/05/2012 10:50:00	**1,2-Dichloroethane-d4**	**11.8**			µg/L	
12/05/2012 10:50:00	**1,2-Dichloropropane**	**ND**	0.057	0.50	µg/L	
12/05/2012 10:50:00	**1,4-Dichlorobenzene**	**ND**	0.061	0.50	µg/L	
12/05/2012 10:50:00	**4-Bromofluorobenzene**	**10.3**			µg/L	
12/05/2012 10:58:00	**Aluminum**	**ND**	27	50	µg/L	EPA 200.7
12/05/2012 10:58:00	**Antimony**	**ND**	0.57	6.0	µg/L	EPA 200.8
12/05/2012 10:58:00	**Arsenic**	**ND**	0.27	2.0	µg/L	EPA 200.8
12/05/2012 10:58:00	**Barium**	**ND**	0.91	100	µg/L	EPA 200.7
12/05/2012 10:50:00	**Benzene**	**ND**	0.057	0.50	µg/L	EPA 524.2
12/05/2012 10:58:00	**Beryllium**	**ND**	0.43	1.0	µg/L	EPA 200.7
01/04/2012 10:43:00	**Bicarbonate as CaCO3**	**44**	0.50	5.0	mg/L	
08/01/2012 11:05:00	**Bicarbonate as CaCO3**	**47**	0.50	5.0	mg/L	
06/06/2012 10:04:00	**Bicarbonate as CaCO3**	**37**	0.50	5.0	mg/L	
11/07/2012 10:42:00	**Bicarbonate as CaCO3**	**48**	0.50	5.0	mg/L	
05/02/2012 08:40:00	**Bicarbonate as CaCO3**	**45**	0.50	5.0	mg/L	
12/05/2012 10:35:00	**Bicarbonate as CaCO3**	**42**	0.50	5.0	mg/L	
04/25/2012 10:45:00	**Bicarbonate as CaCO3**	**48**	0.50	5.0	mg/L	
02/01/2012 11:15:00	**Bicarbonate as CaCO3**	**45**	0.50	5.0	mg/L	SM2320B
10/03/2012 11:30:00	**Bicarbonate as CaCO3**	**46**	0.50	5.0	mg/L	
07/03/2012 11:08:00	**Bicarbonate as CaCO3**	**48**	0.50	5.0	mg/L	
04/04/2012 10:30:00	**Bicarbonate as CaCO3**	**42**	0.50	5.0	mg/L	
09/05/2012 11:08:00	**Bicarbonate as CaCO3**	**42**	0.50	5.0	mg/L	
03/07/2012 11:10:00	**Bicarbonate as CaCO3**	**42**	0.50	5.0	mg/L	
12/05/2012 10:58:00	**Bicarbonate as CaCO3**	**50**	0.50	5.0	mg/L	
12/26/2012 11:10:00	**Biochemical Oxygen Demand**	**350**	2.0	3.0	mg/L	SM5210B
10/03/2012 11:16:00	**Biochemical Oxygen Demand**	**250**	2.0	3.0	mg/L	SM5210B
12/05/2012 10:58:00	**Boron**	**ND**	4.4	100	µg/L	EPA 200.7
12/05/2012 10:58:00	**Cadmium**	**ND**	0.17	1.0	µg/L	EPA 200.8
12/05/2012 10:58:00	**Calcium**	**10**	0.031	1.0	mg/L	200.7/2340B
12/05/2012 10:50:00	**Carbon tetrachloride**	**ND**	0.092	0.50	µg/L	EPA 524.2
01/04/2012 10:43:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
08/01/2012 11:05:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
06/06/2012 10:04:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
11/07/2012 10:42:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
05/02/2012 08:40:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
12/05/2012 10:35:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
04/25/2012 10:45:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
02/01/2012 11:15:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	SM2320B
10/03/2012 11:30:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
07/03/2012 11:08:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
04/04/2012 10:30:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
09/05/2012 11:08:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
03/07/2012 11:10:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
12/05/2012 10:58:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
12/05/2012 10:58:00	**Chloride**	**2.7**	0.026	0.50	mg/L	EPA 300.0
12/05/2012 10:50:00	**Chlorobenzene**	**ND**	0.11	0.50	µg/L	EPA 524.2
12/05/2012 10:58:00	**Chromium**	**ND**	0.28	10	µg/L	EPA 200.8
12/05/2012 10:50:00	**cis-1,2-Dichloroethene**	**ND**	0.15	0.50	µg/L	EPA 524.2
12/05/2012 10:50:00	**cis-1,3-Dichloropropene**	**ND**	0.097	0.50	µg/L	EPA 524.2
12/05/2012 10:58:00	**Color**	**ND**		1	Color Units	SM2120B
12/05/2012 10:58:00	**Copper**	**ND**	0.15	50	µg/L	EPA 200.8
08/01/2012 11:20:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
11/07/2012 10:38:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
08/29/2012 10:40:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
02/29/2012 11:05:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	

06/20/2012 10:52:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
03/14/2012 08:31:00	**E. Coli**	**4.5**	1.8	1.8	MPN/100 mL	
03/28/2012 11:05:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
08/15/2012 10:37:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
06/06/2012 10:48:00	**E. Coli**	**4.5**	1.8	1.8	MPN/100 mL	
04/11/2012 11:08:00	**E. Coli**	**2.0**	1.8	1.8	MPN/100 mL	
07/18/2012 10:36:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
09/26/2012 10:45:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
10/24/2012 10:59:00	**E. Coli**	**4.5**	1.8	1.8	MPN/100 mL	SM 9221
12/19/2012 10:50:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
04/25/2012 11:00:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
12/05/2012 11:05:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
01/18/2012 11:15:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
05/09/2012 10:25:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
05/23/2012 11:42:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
10/10/2012 10:29:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
07/04/2012 09:04:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
11/21/2012 10:55:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
01/04/2012 10:56:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
09/12/2012 11:10:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
02/01/2012 11:28:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
02/15/2012 11:10:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
12/05/2012 10:50:00	**EPN**	**3.16**			µg/L	EPA 507
12/05/2012 10:50:00	**Ethylbenzene**	**ND**	0.090	0.50	µg/L	EPA 524.2
08/01/2012 11:20:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
11/07/2012 10:38:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
08/29/2012 10:40:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
02/29/2012 11:05:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
06/20/2012 10:52:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
03/14/2012 08:31:00	**Fecal Coliforms**	**7.8**	1.8	1.8	MPN/100 mL	
03/28/2012 11:05:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
08/15/2012 10:37:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
06/06/2012 10:48:00	**Fecal Coliforms**	**4.5**	1.8	1.8	MPN/100 mL	
04/11/2012 11:08:00	**Fecal Coliforms**	**2.0**	1.8	1.8	MPN/100 mL	
07/18/2012 10:36:00	**Fecal Coliforms**	**4.5**	1.8	1.8	MPN/100 mL	
09/26/2012 10:45:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
10/24/2012 10:59:00	**Fecal Coliforms**	**7.8**	1.8	1.8	MPN/100 mL	SM 9221
12/19/2012 10:50:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
04/25/2012 11:00:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
12/05/2012 11:05:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
01/18/2012 11:15:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
05/09/2012 10:25:00	**Fecal Coliforms**	**2.0**	1.8	1.8	MPN/100 mL	
05/23/2012 11:42:00	**Fecal Coliforms**	**4.0**	1.8	1.8	MPN/100 mL	
10/10/2012 10:29:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
07/04/2012 09:04:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
11/21/2012 10:55:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
01/04/2012 10:56:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
09/12/2012 11:10:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
02/01/2012 11:28:00	**Fecal Coliforms**	**2.0**	1.8	1.8	MPN/100 mL	
02/15/2012 11:10:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
12/05/2012 10:58:00	**Fluoride**	**ND**	0.0079	0.10	mg/L	EPA 300.0
12/05/2012 10:58:00	**Hardness as CaCO3**	**47**	1.0	1.0	mg/L	200.7/2340B
01/04/2012 10:43:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
08/01/2012 11:05:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
06/06/2012 10:04:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
11/07/2012 10:42:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
05/02/2012 08:40:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
12/05/2012 10:35:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
04/25/2012 10:45:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
02/01/2012 11:15:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	SM2320B
10/03/2012 11:30:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
07/03/2012 11:08:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
04/04/2012 10:30:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
09/05/2012 11:08:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
03/07/2012 11:10:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
12/05/2012 10:58:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
01/04/2012 10:43:00	**Iron**	**ND**	6.8	100	µg/L	

08/01/2012 11:05:00	**Iron**	**ND**	6.8	100	µg/L	
06/06/2012 10:04:00	**Iron**	**ND**	6.8	100	µg/L	
11/07/2012 10:42:00	**Iron**	**ND**	6.8	100	µg/L	
05/02/2012 08:40:00	**Iron**	**ND**	6.8	100	µg/L	
12/05/2012 10:35:00	**Iron**	**ND**	6.8	100	µg/L	
02/01/2012 11:15:00	**Iron**	**ND**	6.8	100	µg/L	EPA 200.7
10/03/2012 11:30:00	**Iron**	**ND**	6.8	100	µg/L	
07/03/2012 11:08:00	**Iron**	**ND**	6.8	100	µg/L	
04/04/2012 10:30:00	**Iron**	**ND**	6.8	100	µg/L	
09/05/2012 11:08:00	**Iron**	**ND**	6.8	100	µg/L	
03/07/2012 11:10:00	**Iron**	**ND**	6.8	100	µg/L	
08/08/2012 16:00:00	**Iron**	**ND**	6.8	100	µg/L	
12/05/2012 10:58:00	**Iron**	**ND**	6.8	100	µg/L	
12/05/2012 10:58:00	**Lead**	**ND**	0.23	5.0	µg/L	EPA 200.8
12/05/2012 10:58:00	**Magnesium**	**5.1**	0.028	1.0	mg/L	200.7/2340B
01/04/2012 10:43:00	**Manganese**	**ND**	0.92	20	µg/L	
08/01/2012 11:05:00	**Manganese**	**260**	0.92	20	µg/L	
06/06/2012 10:04:00	**Manganese**	**ND**	0.92	20	µg/L	
11/07/2012 10:42:00	**Manganese**	**ND**	0.92	20	µg/L	
05/02/2012 08:40:00	**Manganese**	**ND**	0.92	20	µg/L	
12/05/2012 10:35:00	**Manganese**	**ND**	0.92	20	µg/L	
02/01/2012 11:15:00	**Manganese**	**ND**	0.92	20	µg/L	EPA 200.7
10/03/2012 11:30:00	**Manganese**	**27**	0.92	20	µg/L	
07/03/2012 11:08:00	**Manganese**	**29**	0.92	20	µg/L	
04/04/2012 10:30:00	**Manganese**	**ND**	0.92	20	µg/L	
09/05/2012 11:08:00	**Manganese**	**ND**	0.92	20	µg/L	
03/07/2012 11:10:00	**Manganese**	**58**	0.92	20	µg/L	
08/08/2012 16:00:00	**Manganese**	**190**	0.92	20	µg/L	
12/05/2012 10:58:00	**Manganese**	**ND**	0.92	20	µg/L	
12/05/2012 10:58:00	**MBAS as LAS, mol wt 340**	**ND**	0.067	0.10	mg/L	SM5540 C
12/05/2012 10:58:00	**Mercury**	**ND**	0.15	1.0	µg/L	EPA 245.1
12/05/2012 10:50:00	**Methyl tert-butyl ether**	**ND**	0.092	3.0	µg/L	EPA 524.2
12/05/2012 10:50:00	**Methylene chloride**	**ND**	0.24	0.50	µg/L	EPA 524.2
12/05/2012 10:58:00	**Nickel**	**ND**	10	10	µg/L	EPA 200.7
10/15/2012 10:45:00	**Nitrate as NO3**	**ND**	0.053	0.50	mg/L	
04/16/2012 09:10:00	**Nitrate as NO3**	**0.72**	0.053	0.50	mg/L	
01/17/2012 09:30:00	**Nitrate as NO3**	**ND**	0.053	0.50	mg/L	
08/08/2012 11:00:00	**Nitrate as NO3**	**ND**	0.053	0.50	mg/L	
12/05/2012 10:58:00	**Nitrate as NO3**	**ND**	0.021	2.0	mg/L	EPA 300.0
08/08/2012 11:00:00	**Nitrate/Nitrite as N**	**ND**	55	400	µg/L	
10/15/2012 10:45:00	**Nitrite as N**	**ND**	0.0022	0.10	mg/L	
04/16/2012 09:10:00	**Nitrite as N**	**ND**	0.0022	0.10	mg/L	
01/17/2012 09:30:00	**Nitrite as N**	**ND**	0.0022	0.10	mg/L	
08/08/2012 11:00:00	**Nitrite as N**	**ND**	0.0022	0.10	mg/L	
12/05/2012 10:50:00	**Perchlorate**	**ND**	0.98	4.0	µg/L	EPA 314.0
12/05/2012 10:58:00	**pH**	**7.37**	0.01	0.01	pH Units	SM4500-H B
12/05/2012 10:58:00	**Potassium**	**1.5**	0.87	1.0	mg/L	200.7/2340B
12/05/2012 10:58:00	**Selenium**	**ND**	1.1	5.0	µg/L	EPA 200.8
12/05/2012 10:58:00	**Silver**	**ND**	0.070	10	µg/L	EPA 200.8
12/05/2012 10:58:00	**Sodium**	**5.3**	0.021	1.0	mg/L	200.7/2340B
12/05/2012 10:58:00	**Specific Conductance (EC)**	**110**	0.090	1.0	µmhos/cm	EPA 120.1
12/05/2012 10:50:00	**Styrene**	**ND**	0.059	0.50	µg/L	EPA 524.2
12/05/2012 10:58:00	**Sulfate as SO4**	**3.1**	0.010	0.50	mg/L	EPA 300.0
12/05/2012 10:50:00	**Tetrachloroethene**	**ND**	0.12	0.50	µg/L	EPA 524.2
12/05/2012 10:58:00	**Thallium**	**ND**	0.11	1.0	µg/L	EPA 200.8
12/05/2012 10:50:00	**Thiobencarb**	**ND**	0.15	1.0	µg/L	EPA 507
12/05/2012 10:58:00	**Threshold Odor Number**	**ND**		1	T.O.N.	EPA 140.1
12/05/2012 10:50:00	**Toluene**	**ND**	0.10	0.50	µg/L	EPA 524.2
12/05/2012 10:50:00	**Toluene-d8**	**9.36**			µg/L	EPA 524.2
01/04/2012 10:43:00	**Total Alkalinity**	**44**	1.0	5.0	mg/L	
08/01/2012 11:05:00	**Total Alkalinity**	**47**	1.0	5.0	mg/L	
06/06/2012 10:04:00	**Total Alkalinity**	**37**	1.0	5.0	mg/L	
11/07/2012 10:42:00	**Total Alkalinity**	**48**	1.0	5.0	mg/L	
05/02/2012 08:40:00	**Total Alkalinity**	**45**	1.0	5.0	mg/L	
12/05/2012 10:35:00	**Total Alkalinity**	**42**	1.0	5.0	mg/L	
04/25/2012 10:45:00	**Total Alkalinity**	**48**	1.0	5.0	mg/L	SM2320B
02/01/2012 11:15:00	**Total Alkalinity**	**45**	1.0	5.0	mg/L	

10/03/2012 11:30:00	**Total Alkalinity**	**46**	1.0	5.0	mg/L	
07/03/2012 11:08:00	**Total Alkalinity**	**48**	1.0	5.0	mg/L	
04/04/2012 10:30:00	**Total Alkalinity**	**42**	1.0	5.0	mg/L	
09/05/2012 11:08:00	**Total Alkalinity**	**42**	1.0	5.0	mg/L	
03/07/2012 11:10:00	**Total Alkalinity**	**42**	1.0	5.0	mg/L	
12/05/2012 10:58:00	**Total Alkalinity**	**50**	1.0	5.0	mg/L	
08/01/2012 11:20:00	**Total Coliforms**	**13**	1.8	1.8	MPN/100 mL	
11/07/2012 10:38:00	**Total Coliforms**	**13**	1.8	1.8	MPN/100 mL	
08/29/2012 10:40:00	**Total Coliforms**	**4.5**	1.8	1.8	MPN/100 mL	
02/29/2012 11:05:00	**Total Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
06/20/2012 10:52:00	**Total Coliforms**	**2.0**	1.8	1.8	MPN/100 mL	
03/14/2012 08:31:00	**Total Coliforms**	**13**	1.8	1.8	MPN/100 mL	
03/28/2012 11:05:00	**Total Coliforms**	**2.0**	1.8	1.8	MPN/100 mL	
08/15/2012 10:37:00	**Total Coliforms**	**2.0**	1.8	1.8	MPN/100 mL	
06/06/2012 10:48:00	**Total Coliforms**	**22**	1.8	1.8	MPN/100 mL	
04/11/2012 11:08:00	**Total Coliforms**	**2.0**	1.8	1.8	MPN/100 mL	
07/18/2012 10:36:00	**Total Coliforms**	**33**	1.8	1.8	MPN/100 mL	
09/26/2012 10:45:00	**Total Coliforms**	**4.5**	1.8	1.8	MPN/100 mL	
10/24/2012 10:59:00	**Total Coliforms**	**23**	1.8	1.8	MPN/100 mL	
12/19/2012 10:50:00	**Total Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	SM 9221
04/25/2012 11:00:00	**Total Coliforms**	**7.8**	1.8	1.8	MPN/100 mL	
12/05/2012 11:05:00	**Total Coliforms**	**7.8**	1.8	1.8	MPN/100 mL	
01/18/2012 11:15:00	**Total Coliforms**	**4.0**	1.8	1.8	MPN/100 mL	
05/09/2012 10:25:00	**Total Coliforms**	**6.8**	1.8	1.8	MPN/100 mL	
05/23/2012 11:42:00	**Total Coliforms**	**4.5**	1.8	1.8	MPN/100 mL	
10/10/2012 10:29:00	**Total Coliforms**	**11**	1.8	1.8	MPN/100 mL	
07/04/2012 09:04:00	**Total Coliforms**	**4.5**	1.8	1.8	MPN/100 mL	
11/21/2012 10:55:00	**Total Coliforms**	**4.5**	1.8	1.8	MPN/100 mL	
01/04/2012 10:56:00	**Total Coliforms**	**4.0**	1.8	1.8	MPN/100 mL	
09/12/2012 11:10:00	**Total Coliforms**	**17**	1.8	1.8	MPN/100 mL	
02/01/2012 11:28:00	**Total Coliforms**	**2.0**	1.8	1.8	MPN/100 mL	
02/15/2012 11:10:00	**Total Coliforms**	**4.5**	1.8	1.8	MPN/100 mL	
12/05/2012 10:58:00	**Total Dissolved Solids**	**62**	10	10	mg/L	SM2540C
01/04/2012 10:43:00	**Total Organic Carbon**	**3.5**	0.30	0.30	mg/L	
08/01/2012 11:05:00	**Total Organic Carbon**	**3.3**	0.30	0.30	mg/L	
06/06/2012 10:04:00	**Total Organic Carbon**	**4.2**	0.30	0.30	mg/L	
11/07/2012 10:42:00	**Total Organic Carbon**	**2.0**	0.30	0.30	mg/L	
05/02/2012 08:40:00	**Total Organic Carbon**	**3.3**	0.30	0.30	mg/L	
12/05/2012 10:35:00	**Total Organic Carbon**	**3.7**	0.30	0.30	mg/L	
04/25/2012 10:45:00	**Total Organic Carbon**	**2.9**	0.30	0.30	mg/L	
02/01/2012 11:15:00	**Total Organic Carbon**	**3.3**	0.30	0.30	mg/L	
10/03/2012 11:30:00	**Total Organic Carbon**	**7.5**	0.30	0.30	mg/L	
07/03/2012 11:08:00	**Total Organic Carbon**	**3.1**	0.30	0.30	mg/L	
04/04/2012 10:30:00	**Total Organic Carbon**	**1.8**	0.30	0.30	mg/L	
09/05/2012 11:08:00	**Total Organic Carbon**	**6.2**	0.30	0.30	mg/L	
03/07/2012 11:10:00	**Total Organic Carbon**	**3.3**	0.30	0.30	mg/L	
01/04/2012 10:43:00	**Total Organic Carbon, Dissolved**	**3.0**	0.30	0.30	mg/L	SM5310B
08/01/2012 11:05:00	**Total Organic Carbon, Dissolved**	**3.0**	0.30	0.30	mg/L	
06/06/2012 10:04:00	**Total Organic Carbon, Dissolved**	**3.9**	0.54	1.0	mg/L	
11/07/2012 10:42:00	**Total Organic Carbon, Dissolved**	**1.8**	0.54	1.0	mg/L	
05/02/2012 08:40:00	**Total Organic Carbon, Dissolved**	**2.7**	0.54	1.0	mg/L	
12/05/2012 10:35:00	**Total Organic Carbon, Dissolved**	**2.7**	0.30	0.30	mg/L	
04/25/2012 10:45:00	**Total Organic Carbon, Dissolved**	**2.5**	0.30	0.30	mg/L	
02/01/2012 11:15:00	**Total Organic Carbon, Dissolved**	**3.4**	0.30	0.30	mg/L	
10/03/2012 11:30:00	**Total Organic Carbon, Dissolved**	**3.2**	0.30	0.30	mg/L	
07/03/2012 11:08:00	**Total Organic Carbon, Dissolved**	**3.0**	0.54	1.0	mg/L	
04/04/2012 10:30:00	**Total Organic Carbon, Dissolved**	**1.4**	0.30	0.30	mg/L	
09/05/2012 11:08:00	**Total Organic Carbon, Dissolved**	**4.8**	0.30	0.30	mg/L	
03/07/2012 11:10:00	**Total Organic Carbon, Dissolved**	**3.4**	0.30	0.30	mg/L	
03/14/2012 09:30:00	**Total Phosphorus as P**	**ND**	0.023	0.050	mg/L	SM4500-P E
03/14/2012 09:30:00	**Total Phosphorus as P**	**78**	2.5	5.0	mg/kg	SM4500-P E
12/26/2012 11:10:00	**Total Suspended Solids**	**600**	2.0	5.0	mg/L	SM2540D
10/03/2012 11:16:00	**Total Suspended Solids**	**86**	2.0	5.0	mg/L	SM2540D
12/05/2012 10:50:00	**Total Trihalomethanes (THM)**	**ND**	0.50	0.50	µg/L	EPA 524.2
12/05/2012 10:50:00	**trans-1,2-Dichloroethene**	**ND**	0.13	0.50	µg/L	EPA 524.2
12/05/2012 10:50:00	**trans-1,3-Dichloropropene**	**ND**	0.12	0.50	µg/L	EPA 524.2
12/05/2012 10:50:00	**Trichloroethene**	**ND**	0.11	0.50	µg/L	EPA 524.2

12/05/2012 10:50:00	**Trichlorofluoromethane**	**ND**	0.20	5.0	µg/L	EPA 524.2
12/05/2012 10:58:00	**Turbidity**	**0.68**	0.036	0.50	NTU	EPA 180.1
01/04/2012 10:43:00	**UV-absorbing organics**	**0.058**		0.0050	1/cm	
08/01/2012 11:05:00	**UV-absorbing organics**	**0.079**		0.0050	1/cm	
06/06/2012 10:04:00	**UV-absorbing organics**	**0.073**		0.0050	1/cm	
11/07/2012 10:42:00	**UV-absorbing organics**	**0.043**		0.0050	1/cm	
05/02/2012 08:40:00	**UV-absorbing organics**	**0.092**		0.0050	1/cm	
12/05/2012 10:35:00	**UV-absorbing organics**	**0.061**		0.0050	1/cm	
04/25/2012 10:45:00	**UV-absorbing organics**	**0.12**		0.0050	1/cm	SM 5910B
02/01/2012 11:15:00	**UV-absorbing organics**	**0.045**		0.0050	1/cm	
10/03/2012 11:30:00	**UV-absorbing organics**	**0.051**		0.0050	1/cm	
07/03/2012 11:08:00	**UV-absorbing organics**	**0.10**		0.0050	1/cm	
04/04/2012 10:30:00	**UV-absorbing organics**	**0.049**		0.0050	1/cm	
09/05/2012 11:08:00	**UV-absorbing organics**	**0.048**		0.0050	1/cm	
03/07/2012 11:10:00	**UV-absorbing organics**	**0.049**		0.0050	1/cm	
01/04/2012 10:43:00	**UV-absorbing organics (SUVA)**	**1.9**		1.0	L/mg-m	
08/01/2012 11:05:00	**UV-absorbing organics (SUVA)**	**2.6**		1.0	L/mg-m	
06/06/2012 10:04:00	**UV-absorbing organics (SUVA)**	**1.8**		1.0	L/mg-m	
11/07/2012 10:42:00	**UV-absorbing organics (SUVA)**	**2.4**		1.0	L/mg-m	
05/02/2012 08:40:00	**UV-absorbing organics (SUVA)**	**3.4**		1.0	L/mg-m	
12/05/2012 10:35:00	**UV-absorbing organics (SUVA)**	**2.3**		1.0	L/mg-m	
04/25/2012 10:45:00	**UV-absorbing organics (SUVA)**	**4.7**		1.0	L/mg-m	None
02/01/2012 11:15:00	**UV-absorbing organics (SUVA)**	**1.3**		1.0	L/mg-m	
10/03/2012 11:30:00	**UV-absorbing organics (SUVA)**	**1.6**		1.0	L/mg-m	
07/03/2012 11:08:00	**UV-absorbing organics (SUVA)**	**11**		1.0	L/mg-m	
04/04/2012 10:30:00	**UV-absorbing organics (SUVA)**	**3.6**		1.0	L/mg-m	
09/05/2012 11:08:00	**UV-absorbing organics (SUVA)**	**1.0**		1.0	L/mg-m	
03/07/2012 11:10:00	**UV-absorbing organics (SUVA)**	**1.5**		1.0	L/mg-m	
12/05/2012 10:58:00	**Vanadium**	**ND**	0.44	3.0	µg/L	EPA 200.8
12/05/2012 10:50:00	**Vinyl chloride**	**ND**	0.17	0.50	µg/L	EPA 524.2
12/05/2012 10:50:00	**Xylenes (total)**	**ND**	0.30	0.50	µg/L	EPA 524.2
12/05/2012 10:58:00	**Zinc**	**ND**	9.3	50	µg/L	EPA 200.7

Sample Date	Constituent	Result	Detection Level	Reporting Level	Units	Method
07/22/2013 11:28:00	**1,2-Dibromo-3-chloropropane**	**ND**	0.0027	0.010	µg/L	EPA 504.1
07/22/2013 11:28:00	**2,4,5-T**	**ND**	0.030	1.0	µg/L	
07/22/2013 11:28:00	**2,4,5-TP (Silvex)**	**ND**	0.028	1.0	µg/L	EPA 515.1
07/22/2013 11:28:00	**2,4-D (2,4-Dichlorophenoxyacetic acid)**	**ND**	0.032	10	µg/L	
07/22/2013 11:28:00	**2,4-DCAA**	**1.33**			µg/L	
07/22/2013 11:28:00	**Aldrin**	**ND**	0.011	0.075	µg/L	EPA 508
12/04/2013 10:25:00	**Aluminum**	**ND**	27	50	µg/L	EPA 200.7
12/04/2013 10:25:00	**Antimony**	**ND**	0.57	4.0	µg/L	EPA 200.8
12/04/2013 10:25:00	**Arsenic**	**ND**	0.27	2.0	µg/L	EPA 200.8
12/04/2013 10:25:00	**Barium**	**ND**	0.91	100	µg/L	EPA 200.7
07/22/2013 11:28:00	**Bentazon**	**ND**	0.025	2.0	µg/L	EPA 515.1
12/04/2013 10:25:00	**Beryllium**	**ND**	0.43	1.0	µg/L	EPA 200.7
01/02/2013 11:00:00	**Bicarbonate as CaCO3**	**46**	0.50	5.0	mg/L	
02/06/2013 11:17:00	**Bicarbonate as CaCO3**	**42**	0.50	5.0	mg/L	
03/06/2013 13:20:00	**Bicarbonate as CaCO3**	**46**	0.50	5.0	mg/L	
03/29/2013 15:09:00	**Bicarbonate as CaCO3**	**45**	0.50	5.0	mg/L	
04/03/2013 10:30:00	**Bicarbonate as CaCO3**	**42**	0.50	5.0	mg/L	
04/23/2013 10:45:00	**Bicarbonate as CaCO3**	**42**	0.50	5.0	mg/L	
05/01/2013 11:11:00	**Bicarbonate as CaCO3**	**45**	0.50	5.0	mg/L	
06/05/2013 10:22:00	**Bicarbonate as CaCO3**	**39**	0.50	5.0	mg/L	
07/03/2013 10:40:00	**Bicarbonate as CaCO3**	**45**	0.50	5.0	mg/L	
08/07/2013 10:31:00	**Bicarbonate as CaCO3**	**46**	0.50	5.0	mg/L	SM2320B
09/04/2013 10:52:00	**Bicarbonate as CaCO3**	**45**	0.50	5.0	mg/L	
10/02/2013 00:00:00	**Bicarbonate as CaCO3**	**48**	0.50	5.0	mg/L	
11/04/2013 12:03:00	**Bicarbonate as CaCO3**	**45**	0.50	5.0	mg/L	
11/06/2013 10:48:00	**Bicarbonate as CaCO3**	**46**	0.50	5.0	mg/L	
11/13/2013 08:44:00	**Bicarbonate as CaCO3**	**48**	0.50	5.0	mg/L	
11/14/2013 09:20:00	**Bicarbonate as CaCO3**	**49**	0.50	5.0	mg/L	
11/21/2013 08:39:00	**Bicarbonate as CaCO3**	**45**	0.50	5.0	mg/L	
12/04/2013 10:25:00	**Bicarbonate as CaCO3**	**51**	0.50	5.0	mg/L	
12/04/2013 10:32:00	**Bicarbonate as CaCO3**	**45**	0.50	5.0	mg/L	
12/04/2013 10:25:00	**Boron**	**ND**	4.4	100	µg/L	EPA 200.7
12/04/2013 10:25:00	**Cadmium**	**ND**	0.17	1.0	µg/L	EPA 200.8
12/04/2013 10:25:00	**Calcium**	**7.6**	0.031	1.0	mg/L	200.7/2340B
01/02/2013 11:00:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
02/06/2013 11:17:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
03/06/2013 13:20:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
03/29/2013 15:09:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
04/03/2013 10:30:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
04/23/2013 10:45:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
05/01/2013 11:11:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
06/05/2013 10:22:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
07/03/2013 10:40:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
08/07/2013 10:31:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	SM2320B
09/04/2013 10:52:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
10/02/2013 00:00:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
11/04/2013 12:03:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
11/06/2013 10:48:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
11/13/2013 08:44:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
11/14/2013 09:20:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
11/21/2013 08:39:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
12/04/2013 10:25:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
12/04/2013 10:32:00	**Carbonate as CaCO3**	**ND**	0.50	5.0	mg/L	
07/22/2013 11:28:00	**Chlordane**	**ND**	0.099	0.10	µg/L	EPA 508
12/04/2013 10:25:00	**Chloride**	**2.7**	0.10	0.50	mg/L	EPA 300.0
07/22/2013 11:28:00	**Chlorothalonil**	**ND**	0.0083	5.0	µg/L	EPA 508
12/04/2013 10:25:00	**Chromium**	**ND**	9.9	10	µg/L	EPA 200.7
12/04/2013 10:25:00	**Color**	**ND**		1	Color Units	SM2120B
04/23/2013 10:45:00	**Copper**	**ND**	0.26	50	µg/L	EPA 200.7
12/04/2013 10:25:00	**Copper**	**ND**	3.2	50	µg/L	EPA 200.7
07/22/2013 11:28:00	**Dalapon**	**ND**	0.00062	10	µg/L	EPA 515.1
07/22/2013 11:28:00	**Decachlorobiphenyl**	**0.227**			µg/L	EPA 508
07/22/2013 11:28:00	**Dicamba**	**ND**	0.034	1.5	µg/L	EPA 515.1
07/22/2013 11:28:00	**Dieldrin**	**ND**	0.011	0.020	µg/L	EPA 508
07/22/2013 11:28:00	**Dinoseb**	**ND**	0.022	2.0	µg/L	EPA 515.1
01/02/2013 10:55:00	**E. Coli**	**7.8**	1.8	1.8	MPN/100 mL	

01/16/2013 10:50:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
01/30/2013 10:55:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
02/13/2013 11:05:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	SM 9221
02/27/2013 10:48:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
03/13/2013 11:23:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
03/26/2013 15:15:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
04/03/2013 11:10:00	**E. Coli**	**Absent**	0.0	0.0	N/A	SM 9223
04/11/2013 13:18:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
04/24/2013 10:52:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
05/08/2013 11:12:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
05/22/2013 11:04:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
06/05/2013 10:20:00	**E. Coli**	**2.0**	1.8	1.8	MPN/100 mL	
06/19/2013 12:15:00	**E. Coli**	**2.0**	1.8	1.8	MPN/100 mL	
07/17/2013 11:05:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
07/31/2013 10:33:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
08/28/2013 10:56:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	SM 9221
09/12/2013 10:46:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
09/25/2013 10:50:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
10/09/2013 11:14:00	**E. Coli**	**2.0**	1.8	1.8	MPN/100 mL	
10/23/2013 10:55:00	**E. Coli**	**21**	1.8	1.8	MPN/100 mL	
11/06/2013 11:10:00	**E. Coli**	**11**	1.8	1.8	MPN/100 mL	
11/20/2013 10:50:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
12/04/2013 10:45:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
12/18/2013 10:40:00	**E. Coli**	**<1.8**	1.8	1.8	MPN/100 mL	
07/22/2013 11:28:00	**Endrin**	**ND**	0.011	0.10	µg/L	EPA 508
12/04/2013 10:25:00	**EPN**	**2.39**			µg/L	EPA 507
07/22/2013 11:28:00	**Ethylene dibromide**	**ND**	0.00080	0.020	µg/L	EPA 504.1
01/02/2013 10:55:00	**Fecal Coliforms**	**7.8**	1.8	1.8	MPN/100 mL	
01/16/2013 10:50:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
01/30/2013 10:55:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
02/13/2013 11:05:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
02/27/2013 10:48:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
03/13/2013 11:23:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
03/26/2013 15:15:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
04/11/2013 13:18:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
04/24/2013 10:52:00	**Fecal Coliforms**	**4.5**	1.8	1.8	MPN/100 mL	
05/08/2013 11:12:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
05/22/2013 11:04:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
06/05/2013 10:20:00	**Fecal Coliforms**	**4.5**	1.8	1.8	MPN/100 mL	SM 9221
06/19/2013 12:15:00	**Fecal Coliforms**	**2.0**	1.8	1.8	MPN/100 mL	
07/17/2013 11:05:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
07/31/2013 10:33:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
08/28/2013 10:56:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
09/12/2013 10:46:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
09/25/2013 10:50:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
10/09/2013 11:14:00	**Fecal Coliforms**	**2.0**	1.8	1.8	MPN/100 mL	
10/23/2013 10:55:00	**Fecal Coliforms**	**21**	1.8	1.8	MPN/100 mL	
11/06/2013 11:10:00	**Fecal Coliforms**	**11**	1.8	1.8	MPN/100 mL	
11/20/2013 10:50:00	**Fecal Coliforms**	**2.0**	1.8	1.8	MPN/100 mL	
12/04/2013 10:45:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
12/18/2013 10:40:00	**Fecal Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
12/04/2013 10:25:00	**Fluoride**	**ND**	0.045	0.10	mg/L	EPA 300.0
07/22/2013 11:28:00	**gamma-BHC (Lindane)**	**ND**	0.000070	0.20	µg/L	EPA 508
12/04/2013 10:25:00	**Hardness as CaCO3**	**38**	1.0	1.0	mg/L	200.7/2340B
07/22/2013 11:28:00	**Heptachlor**	**ND**	0.010	0.010	µg/L	
07/22/2013 11:28:00	**Heptachlor epoxide**	**ND**	0.010	0.010	µg/L	EPA 508
07/22/2013 11:28:00	**Hexachlorobenzene**	**ND**	0.0092	0.50	µg/L	
07/22/2013 11:28:00	**Hexachlorocyclopentadiene**	**ND**	0.0040	1.0	µg/L	
01/02/2013 11:00:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
02/06/2013 11:17:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
03/06/2013 13:20:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
03/29/2013 15:09:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
04/03/2013 10:30:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
04/23/2013 10:45:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
05/01/2013 11:11:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
06/05/2013 10:22:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
07/03/2013 10:40:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
08/07/2013 10:31:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	SM2320B

09/04/2013 10:52:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
10/02/2013 00:00:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
11/04/2013 12:03:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
11/06/2013 10:48:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
11/13/2013 08:44:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
11/14/2013 09:20:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
11/21/2013 08:39:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
12/04/2013 10:25:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
12/04/2013 10:32:00	**Hydroxide as CaCO3**	**ND**	0.50	5.0	mg/L	
01/02/2013 11:00:00	**Iron**	**470**	6.8	100	µg/L	
02/06/2013 11:17:00	**Iron**	**ND**	6.8	100	µg/L	
03/06/2013 13:20:00	**Iron**	**ND**	6.8	100	µg/L	
04/03/2013 10:30:00	**Iron**	**ND**	6.8	100	µg/L	
05/01/2013 11:11:00	**Iron**	**ND**	6.8	100	µg/L	
06/05/2013 10:22:00	**Iron**	**ND**	6.8	100	µg/L	
07/03/2013 10:40:00	**Iron**	**ND**	6.8	100	µg/L	EPA 200.7
08/07/2013 10:30:00	**Iron**	**ND**	6.8	100	µg/L	
09/04/2013 10:52:00	**Iron**	**ND**	6.8	100	µg/L	
09/11/2013 10:50:00	**Iron**	**ND**	6.8	100	µg/L	
10/02/2013 00:00:00	**Iron**	**ND**	6.8	100	µg/L	
11/06/2013 10:48:00	**Iron**	**ND**	6.8	100	µg/L	
12/04/2013 10:25:00	**Iron**	**ND**	6.8	100	µg/L	
12/04/2013 10:32:00	**Iron**	**ND**	6.8	100	µg/L	
12/04/2013 10:25:00	**Lead**	**ND**	0.23	5.0	µg/L	EPA 200.8
12/04/2013 10:25:00	**Magnesium**	**4.6**	0.028	1.0	mg/L	200.7/2340B
01/02/2013 11:00:00	**Manganese**	**ND**	0.92	20	µg/L	
02/06/2013 11:17:00	**Manganese**	**ND**	0.92	20	µg/L	
03/06/2013 13:20:00	**Manganese**	**ND**	0.92	20	µg/L	
04/03/2013 10:30:00	**Manganese**	**ND**	0.92	20	µg/L	
05/01/2013 11:11:00	**Manganese**	**ND**	0.92	20	µg/L	
06/05/2013 10:22:00	**Manganese**	**ND**	0.92	20	µg/L	
07/03/2013 10:40:00	**Manganese**	**24**	0.92	20	µg/L	EPA 200.7
08/07/2013 10:30:00	**Manganese**	**63**	0.92	20	µg/L	
09/04/2013 10:52:00	**Manganese**	**67**	0.92	20	µg/L	
09/11/2013 10:50:00	**Manganese**	**27**	0.92	20	µg/L	
10/02/2013 00:00:00	**Manganese**	**ND**	0.92	20	µg/L	
11/06/2013 10:48:00	**Manganese**	**ND**	0.92	20	µg/L	
12/04/2013 10:25:00	**Manganese**	**ND**	0.92	20	µg/L	
12/04/2013 10:32:00	**Manganese**	**ND**	0.92	20	µg/L	
12/04/2013 10:25:00	**MBAS as LAS, mol wt 340**	**ND**	0.067	0.10	mg/L	SM5540 C
12/04/2013 10:25:00	**Mercury**	**ND**	0.15	1.0	µg/L	EPA 245.1
07/22/2013 11:28:00	**Methoxychlor**	**ND**	0.0069	10	µg/L	EPA 508
12/04/2013 10:25:00	**Nickel**	**ND**	0.070	10	µg/L	EPA 200.8
01/14/2013 09:03:00	**Nitrate as NO3**	**ND**	0.053	0.50	mg/L	
07/15/2013 10:13:00	**Nitrate as NO3**	**ND**	0.053	0.50	mg/L	
12/04/2013 10:25:00	**Nitrate as NO3**	**ND**	0.044	2.0	mg/L	EPA 300.0
01/14/2013 09:03:00	**Nitrite as N**	**ND**	0.0022	0.10	mg/L	
07/15/2013 10:13:00	**Nitrite as N**	**ND**	0.0022	0.10	mg/L	
07/22/2013 11:28:00	**Pentachlorophenol**	**ND**	0.035	0.20	µg/L	EPA 515.1
12/04/2013 10:25:00	**Perchlorate**	**ND**	1.2	4.0	µg/L	EPA 314.0
12/04/2013 10:25:00	**pH**	**7.26**	0.01	0.01	pH Units	SM4500-H B
07/22/2013 11:28:00	**Picloram**	**ND**	0.025	1.0	µg/L	EPA 515.1
07/22/2013 11:28:00	**Polychlorinated Biphenyls (Total PCBs)**	**ND**	0.090	0.50	µg/L	EPA 508
12/04/2013 10:25:00	**Potassium**	**1.1**	0.87	1.0	mg/L	200.7/2340B
07/22/2013 11:28:00	**Propachlor**	**ND**	0.0060	0.50	µg/L	EPA 508
12/04/2013 10:25:00	**Selenium**	**ND**	1.1	5.0	µg/L	EPA 200.8
12/04/2013 10:25:00	**Silver**	**ND**	2.9	10	µg/L	EPA 200.7
12/04/2013 10:25:00	**Sodium**	**5.2**	0.021	1.0	mg/L	200.7/2340B
04/23/2013 10:45:00	**Specific Conductance (EC)**	**110**	0.090	1.0	µmhos/cm	EPA 120.1
12/04/2013 10:25:00	**Specific Conductance (EC)**	**120**	0.090	1.0	µmhos/cm	EPA 120.1
12/04/2013 10:25:00	**Sulfate as SO4**	**2.8**	0.079	0.50	mg/L	EPA 300.0
07/22/2013 11:28:00	**Tetrachloro-meta-xylene**	**0.206**			µg/L	EPA 508
12/04/2013 10:25:00	**Thallium**	**ND**	0.11	1.0	µg/L	EPA 200.8
12/04/2013 10:25:00	**Thiobencarb**	**ND**	0.40	1.0	µg/L	EPA 507
12/04/2013 10:25:00	**Threshold Odor Number**	**1**		1	T.O.N.	EPA 140.1
01/02/2013 11:00:00	**Total Alkalinity**	**46**	1.0	5.0	mg/L	
02/06/2013 11:17:00	**Total Alkalinity**	**42**	1.0	5.0	mg/L	
03/06/2013 13:20:00	**Total Alkalinity**	**46**	1.0	5.0	mg/L	

03/29/2013 15:09:00	**Total Alkalinity**	**45**	1.0	5.0	mg/L	
04/03/2013 10:30:00	**Total Alkalinity**	**42**	1.0	5.0	mg/L	
04/23/2013 10:45:00	**Total Alkalinity**	**42**	1.0	5.0	mg/L	
05/01/2013 11:11:00	**Total Alkalinity**	**45**	1.0	5.0	mg/L	
06/05/2013 10:22:00	**Total Alkalinity**	**39**	1.0	5.0	mg/L	
07/03/2013 10:40:00	**Total Alkalinity**	**45**	1.0	5.0	mg/L	
08/07/2013 10:31:00	**Total Alkalinity**	**46**	1.0	5.0	mg/L	SM2320B
09/04/2013 10:52:00	**Total Alkalinity**	**45**	1.0	5.0	mg/L	
10/02/2013 00:00:00	**Total Alkalinity**	**48**	1.0	5.0	mg/L	
11/04/2013 12:03:00	**Total Alkalinity**	**45**	1.0	5.0	mg/L	
11/06/2013 10:48:00	**Total Alkalinity**	**46**	1.0	5.0	mg/L	
11/13/2013 08:44:00	**Total Alkalinity**	**48**	1.0	5.0	mg/L	
11/14/2013 09:20:00	**Total Alkalinity**	**49**	1.0	5.0	mg/L	
11/21/2013 08:39:00	**Total Alkalinity**	**45**	1.0	5.0	mg/L	
12/04/2013 10:25:00	**Total Alkalinity**	**51**	1.0	5.0	mg/L	
12/04/2013 10:32:00	**Total Alkalinity**	**45**	1.0	5.0	mg/L	
01/02/2013 10:55:00	**Total Coliforms**	**11**	1.8	1.8	MPN/100 mL	
01/16/2013 10:50:00	**Total Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
01/30/2013 10:55:00	**Total Coliforms**	**<1.8**	1.8	1.8	MPN/100 mL	
02/13/2013 11:05:00	**Total Coliforms**	**4.5**	1.8	1.8	MPN/100 mL	SM 9221
02/27/2013 10:48:00	**Total Coliforms**	**4.0**	1.8	1.8	MPN/100 mL	
03/13/2013 11:23:00	**Total Coliforms**	**13**	1.8	1.8	MPN/100 mL	
03/26/2013 15:15:00	**Total Coliforms**	**6.1**	1.8	1.8	MPN/100 mL	
04/03/2013 11:10:00	**Total Coliforms**	**Absent**	0.0	0.0	N/A	SM 9223
04/11/2013 13:18:00	**Total Coliforms**	**41**	1.8	1.8	MPN/100 mL	
04/24/2013 10:52:00	**Total Coliforms**	**4.5**	1.8	1.8	MPN/100 mL	
05/08/2013 11:12:00	**Total Coliforms**	**2.0**	1.8	1.8	MPN/100 mL	
05/22/2013 11:04:00	**Total Coliforms**	**4.0**	1.8	1.8	MPN/100 mL	
06/05/2013 10:20:00	**Total Coliforms**	**7.8**	1.8	1.8	MPN/100 mL	
06/19/2013 12:15:00	**Total Coliforms**	**350**	1.8	1.8	MPN/100 mL	
07/17/2013 11:05:00	**Total Coliforms**	**140**	1.8	1.8	MPN/100 mL	
07/31/2013 10:33:00	**Total Coliforms**	**17**	1.8	1.8	MPN/100 mL	
08/28/2013 10:56:00	**Total Coliforms**	**7.8**	1.8	1.8	MPN/100 mL	SM 9221
09/12/2013 10:46:00	**Total Coliforms**	**13**	1.8	1.8	MPN/100 mL	
09/25/2013 10:50:00	**Total Coliforms**	**7.8**	1.8	1.8	MPN/100 mL	
10/09/2013 11:14:00	**Total Coliforms**	**33**	1.8	1.8	MPN/100 mL	
10/23/2013 10:55:00	**Total Coliforms**	**110**	1.8	1.8	MPN/100 mL	
11/06/2013 11:10:00	**Total Coliforms**	**79**	1.8	1.8	MPN/100 mL	
11/20/2013 10:50:00	**Total Coliforms**	**110**	1.8	1.8	MPN/100 mL	
12/04/2013 10:45:00	**Total Coliforms**	**6.8**	1.8	1.8	MPN/100 mL	
12/18/2013 10:40:00	**Total Coliforms**	**2.0**	1.8	1.8	MPN/100 mL	
12/04/2013 10:25:00	**Total Dissolved Solids**	**53**	10	10	mg/L	SM2540C
01/02/2013 11:00:00	**Total Organic Carbon**	**3.8**	0.30	0.30	mg/L	
01/02/2013 11:05:00	**Total Organic Carbon**	**2.3**	0.30	0.30	mg/L	
02/06/2013 11:17:00	**Total Organic Carbon**	**3.1**	0.30	0.30	mg/L	
02/06/2013 11:24:00	**Total Organic Carbon**	**1.8**	0.30	0.30	mg/L	
03/06/2013 13:20:00	**Total Organic Carbon**	**5.9**	0.30	0.30	mg/L	
03/06/2013 13:24:00	**Total Organic Carbon**	**1.1**	0.30	0.30	mg/L	
03/29/2013 15:09:00	**Total Organic Carbon**	**2.6**	0.30	0.30	mg/L	
04/03/2013 10:30:00	**Total Organic Carbon**	**2.4**	0.30	0.30	mg/L	
04/03/2013 10:34:00	**Total Organic Carbon**	**1.8**	0.30	0.30	mg/L	
04/03/2013 10:36:00	**Total Organic Carbon**	**1.8**	0.30	0.30	mg/L	
05/01/2013 11:11:00	**Total Organic Carbon**	**2.5**	0.30	0.30	mg/L	
06/05/2013 10:22:00	**Total Organic Carbon**	**3.4**	0.30	0.30	mg/L	
06/05/2013 10:27:00	**Total Organic Carbon**	**1.3**	0.30	0.30	mg/L	
07/03/2013 10:40:00	**Total Organic Carbon**	**2.7**	0.30	0.30	mg/L	
08/07/2013 08:50:00	**Total Organic Carbon**	**2.8**	0.30	0.30	mg/L	
09/04/2013 10:52:00	**Total Organic Carbon**	**2.7**	0.30	0.30	mg/L	
10/02/2013 00:00:00	**Total Organic Carbon**	**3.2**	0.30	0.30	mg/L	
10/29/2013 10:17:00	**Total Organic Carbon**	**2.6**	0.30	0.30	mg/L	
11/04/2013 08:53:00	**Total Organic Carbon**	**2.4**	0.54	1.0	mg/L	
11/06/2013 10:48:00	**Total Organic Carbon**	**3.6**	0.30	0.30	mg/L	
11/13/2013 08:52:00	**Total Organic Carbon**	**3.3**	0.30	0.30	mg/L	
11/14/2013 07:39:00	**Total Organic Carbon**	**2.6**	0.30	0.30	mg/L	
11/21/2013 08:48:00	**Total Organic Carbon**	**2.7**	0.30	0.30	mg/L	
12/04/2013 10:32:00	**Total Organic Carbon**	**3.2**	0.30	0.30	mg/L	
12/04/2013 10:35:00	**Total Organic Carbon**	**1.8**	0.30	0.30	mg/L	SM5310B
12/04/2013 10:40:00	**Total Organic Carbon**	**1.7**	0.30	0.30	mg/L	

01/02/2013 11:00:00	**Total Organic Carbon, Dissolved**	**3.0**	0.30	0.30	mg/L	
02/06/2013 11:17:00	**Total Organic Carbon, Dissolved**	**2.4**	0.30	0.30	mg/L	
03/06/2013 13:20:00	**Total Organic Carbon, Dissolved**	**5.9**	0.30	0.30	mg/L	
03/29/2013 15:09:00	**Total Organic Carbon, Dissolved**	**2.7**	0.30	0.30	mg/L	
04/03/2013 10:30:00	**Total Organic Carbon, Dissolved**	**2.6**	0.30	0.30	mg/L	
05/01/2013 11:11:00	**Total Organic Carbon, Dissolved**	**2.7**	0.30	0.30	mg/L	
06/05/2013 10:22:00	**Total Organic Carbon, Dissolved**	**3.0**	0.54	1.0	mg/L	
07/03/2013 10:40:00	**Total Organic Carbon, Dissolved**	**2.6**	0.54	1.0	mg/L	
08/07/2013 10:27:00	**Total Organic Carbon, Dissolved**	**2.9**	0.54	1.0	mg/L	
09/04/2013 10:52:00	**Total Organic Carbon, Dissolved**	**2.9**	0.30	0.30	mg/L	
10/02/2013 00:00:00	**Total Organic Carbon, Dissolved**	**3.5**	0.54	1.0	mg/L	
10/29/2013 10:17:00	**Total Organic Carbon, Dissolved**	**2.7**	0.30	0.30	mg/L	
11/04/2013 08:53:00	**Total Organic Carbon, Dissolved**	**2.6**	0.54	1.0	mg/L	
11/04/2013 12:03:00	**Total Organic Carbon, Dissolved**	**4.1**	0.54	1.0	mg/L	
11/06/2013 10:48:00	**Total Organic Carbon, Dissolved**	**2.9**	0.30	0.30	mg/L	
11/13/2013 08:44:00	**Total Organic Carbon, Dissolved**	**2.8**	0.30	0.30	mg/L	
11/13/2013 08:52:00	**Total Organic Carbon, Dissolved**	**2.4**	0.30	0.30	mg/L	
11/14/2013 07:39:00	**Total Organic Carbon, Dissolved**	**2.4**	0.30	0.30	mg/L	
11/14/2013 09:20:00	**Total Organic Carbon, Dissolved**	**2.7**	0.30	0.30	mg/L	
11/21/2013 08:39:00	**Total Organic Carbon, Dissolved**	**2.5**	0.30	0.30	mg/L	
11/21/2013 08:48:00	**Total Organic Carbon, Dissolved**	**2.8**	0.30	0.30	mg/L	
12/04/2013 10:32:00	**Total Organic Carbon, Dissolved**	**2.9**	0.30	0.30	mg/L	
07/22/2013 11:28:00	**Toxaphene**	**ND**	0.12	1.0	µg/L	EPA 508
12/04/2013 10:25:00	**Turbidity**	**ND**	0.036	0.50	NTU	EPA 180.1
01/02/2013 11:00:00	**UV-absorbing organics**	**0.045**		0.0050	1/cm	
02/06/2013 11:17:00	**UV-absorbing organics**	**0.058**		0.0050	1/cm	
03/06/2013 13:20:00	**UV-absorbing organics**	**0.17**		0.0050	1/cm	
03/29/2013 15:09:00	**UV-absorbing organics**	**0.070**		0.0050	1/cm	
04/03/2013 10:30:00	**UV-absorbing organics**	**0.049**		0.0050	1/cm	
05/01/2013 11:11:00	**UV-absorbing organics**	**0.042**		0.0050	1/cm	
06/05/2013 10:22:00	**UV-absorbing organics**	**0.051**		0.0050	1/cm	
07/03/2013 10:40:00	**UV-absorbing organics**	**0.057**		0.0050	1/cm	
08/07/2013 10:27:00	**UV-absorbing organics**	**0.041**		0.0050	1/cm	SM 5910B
09/04/2013 10:52:00	**UV-absorbing organics**	**0.048**		0.0050	1/cm	
10/02/2013 00:00:00	**UV-absorbing organics**	**0.019**		0.0050	1/cm	
11/04/2013 12:03:00	**UV-absorbing organics**	**0.040**		0.0050	1/cm	
11/06/2013 10:48:00	**UV-absorbing organics**	**0.036**		0.0050	1/cm	
11/13/2013 08:44:00	**UV-absorbing organics**	**0.048**		0.0050	1/cm	
11/14/2013 09:20:00	**UV-absorbing organics**	**0.042**		0.0050	1/cm	
11/21/2013 08:39:00	**UV-absorbing organics**	**0.040**		0.0050	1/cm	
12/04/2013 10:32:00	**UV-absorbing organics**	**0.057**		0.0050	1/cm	
01/02/2013 11:00:00	**UV-absorbing organics (SUVA)**	**1.5**		1.0	L/mg-m	
02/06/2013 11:17:00	**UV-absorbing organics (SUVA)**	**2.4**		1.0	L/mg-m	
03/06/2013 13:20:00	**UV-absorbing organics (SUVA)**	**2.9**		1.0	L/mg-m	
03/29/2013 15:09:00	**UV-absorbing organics (SUVA)**	**2.6**		1.0	L/mg-m	
04/03/2013 10:30:00	**UV-absorbing organics (SUVA)**	**1.9**		1.0	L/mg-m	
05/01/2013 11:11:00	**UV-absorbing organics (SUVA)**	**1.5**		1.0	L/mg-m	
06/05/2013 10:22:00	**UV-absorbing organics (SUVA)**	**1.7**		1.0	L/mg-m	
07/03/2013 10:40:00	**UV-absorbing organics (SUVA)**	**2.2**		1.0	L/mg-m	
08/07/2013 10:27:00	**UV-absorbing organics (SUVA)**	**1.4**		1.0	L/mg-m	None
09/04/2013 10:52:00	**UV-absorbing organics (SUVA)**	**1.6**		1.0	L/mg-m	
10/02/2013 00:00:00	**UV-absorbing organics (SUVA)**	**ND**		1.0	L/mg-m	
11/04/2013 12:03:00	**UV-absorbing organics (SUVA)**	**ND**		1.0	L/mg-m	
11/06/2013 10:48:00	**UV-absorbing organics (SUVA)**	**1.2**		1.0	L/mg-m	
11/13/2013 08:44:00	**UV-absorbing organics (SUVA)**	**1.7**		1.0	L/mg-m	
11/14/2013 09:20:00	**UV-absorbing organics (SUVA)**	**1.6**		1.0	L/mg-m	
11/21/2013 08:39:00	**UV-absorbing organics (SUVA)**	**1.6**		1.0	L/mg-m	
12/04/2013 10:32:00	**UV-absorbing organics (SUVA)**	**2.0**		1.0	L/mg-m	
12/04/2013 10:25:00	**Vanadium**	**ND**	0.44	3.0	µg/L	EPA 200.8
12/04/2013 10:25:00	**Zinc**	**ND**	9.3	50	µg/L	EPA 200.7

Sample Date	Constituent	Result	Detection Level	Reporting Level	Units	Method
12/09/2014 14:05:00	1,1,1-Trichloroethane	ND	0.18	0.50	µg/L	
12/09/2014 14:05:00	1,1,2,2-Tetrachloroethane	ND	0.13	0.50	µg/L	
12/09/2014 14:05:00	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND	0.15	10	µg/L	
12/09/2014 14:05:00	1,1,2-Trichloroethane	ND	0.098	0.50	µg/L	
12/09/2014 14:05:00	1,1-Dichloroethane	ND	0.12	0.50	µg/L	
12/09/2014 14:05:00	1,1-Dichloroethene	ND	0.092	0.50	µg/L	
12/09/2014 14:05:00	1,2,4-Trichlorobenzene	ND	0.092	0.50	µg/L	EPA 524.2
12/09/2014 14:05:00	1,2-Dichlorobenzene	ND	0.042	0.50	µg/L	
12/09/2014 14:05:00	1,2-Dichloroethane	ND	0.054	0.50	µg/L	
12/09/2014 14:05:00	1,2-Dichloroethane-d4	12.1			µg/L	
12/09/2014 14:05:00	1,2-Dichloropropane	ND	0.057	0.50	µg/L	
12/09/2014 14:05:00	1,4-Dichlorobenzene	ND	0.061	0.50	µg/L	
12/09/2014 14:05:00	4-Bromofluorobenzene	11.2			µg/L	
04/25/2014 11:31:00	Alachlor	ND	0.19	1.0	µg/L	EPA 507
12/09/2014 14:00:00	Aluminum	ND	27	50	µg/L	EPA 200.7
12/09/2014 14:00:00	Antimony	ND	0.57	4.0	µg/L	EPA 200.8
12/09/2014 14:00:00	Arsenic	ND	0.27	2.0	µg/L	EPA 200.8
12/09/2014 14:00:00	Barium	ND	0.91	100	µg/L	EPA 200.7
12/09/2014 14:05:00	Benzene	ND	0.057	0.50	µg/L	EPA 524.2
12/09/2014 14:00:00	Beryllium	ND	0.43	1.0	µg/L	EPA 200.7
01/02/2014 10:24:00	Bicarbonate as CaCO3	44	0.50	5.0	mg/L	
02/05/2014 11:05:00	Bicarbonate as CaCO3	49	0.50	5.0	mg/L	
04/02/2014 10:40:00	Bicarbonate as CaCO3	48	0.50	5.0	mg/L	
04/11/2014 14:45:00	Bicarbonate as CaCO3	46	0.50	5.0	mg/L	
05/07/2014 10:55:00	Bicarbonate as CaCO3	46	0.50	5.0	mg/L	
06/04/2014 11:02:00	Bicarbonate as CaCO3	47	0.50	5.0	mg/L	SM2320B
07/02/2014 11:10:00	Bicarbonate as CaCO3	44	0.50	5.0	mg/L	
08/06/2014 10:36:00	Bicarbonate as CaCO3	47	0.50	5.0	mg/L	
10/01/2014 10:55:00	Bicarbonate as CaCO3	47	0.50	5.0	mg/L	
11/05/2014 15:40:00	Bicarbonate as CaCO3	44	0.50	5.0	mg/L	
12/09/2014 14:00:00	Bicarbonate as CaCO3	40	0.50	5.0	mg/L	
12/09/2014 14:00:00	Boron	ND	4.4	100	µg/L	EPA 200.7
12/09/2014 14:00:00	Cadmium	ND	0.17	1.0	µg/L	EPA 200.8
12/09/2014 14:00:00	Calcium	9.5	0.031	1.0	mg/L	200.7/2340B
12/09/2014 14:05:00	Carbon tetrachloride	ND	0.092	0.50	µg/L	EPA 524.2
01/02/2014 10:24:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
02/05/2014 11:05:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
04/02/2014 10:40:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
04/11/2014 14:45:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
05/07/2014 10:55:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
06/04/2014 11:02:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	SM2320B
07/02/2014 11:10:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
08/06/2014 10:36:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
10/01/2014 10:55:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
11/05/2014 15:40:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
12/09/2014 14:00:00	Carbonate as CaCO3	ND	0.50	5.0	mg/L	
12/09/2014 14:00:00	Chloride	3.1	0.051	0.50	mg/L	EPA 300.0
12/09/2014 14:05:00	Chlorobenzene	ND	0.11	0.50	µg/L	EPA 524.2
12/09/2014 14:00:00	Chromium	ND	9.9	10	µg/L	EPA 200.7
12/09/2014 14:05:00	cis-1,2-Dichloroethene	ND	0.15	0.50	µg/L	EPA 524.2
12/09/2014 14:05:00	cis-1,3-Dichloropropene	ND	0.097	0.50	µg/L	EPA 524.2
12/09/2014 14:00:00	Color	ND		1	Color Units	SM2120B
12/09/2014 14:00:00	Copper	ND	3.2	50	µg/L	EPA 200.7
01/02/2014 10:16:00	E. Coli	2.0	1.8	1.8	MPN/100 mL	
01/15/2014 10:56:00	E. Coli	2.0	1.8	1.8	MPN/100 mL	
01/29/2014 10:56:00	E. Coli	<1.8	1.8	1.8	MPN/100 mL	
02/12/2014 10:52:00	E. Coli	2.0	1.8	1.8	MPN/100 mL	
03/12/2014 10:28:00	E. Coli	2.0	1.8	1.8	MPN/100 mL	
03/26/2014 11:00:00	E. Coli	2.0	1.8	1.8	MPN/100 mL	
04/08/2014 10:40:00	E. Coli	2.0	1.8	1.8	MPN/100 mL	
04/23/2014 11:01:00	E. Coli	<1.8	1.8	1.8	MPN/100 mL	
05/07/2014 10:58:00	E. Coli	<1.8	1.8	1.8	MPN/100 mL	
05/21/2014 10:55:00	E. Coli	2.0	1.8	1.8	MPN/100 mL	
06/04/2014 11:00:00	E. Coli	7.8	1.8	1.8	MPN/100 mL	
06/18/2014 11:02:00	E. Coli	<1.8	1.8	1.8	MPN/100 mL	
07/02/2014 11:08:00	E. Coli	2.0	1.8	1.8	MPN/100 mL	SM 9221
07/16/2014 11:00:00	E. Coli	<1.8	1.8	1.8	MPN/100 mL	

07/30/2014 11:15:00	**E. Coli**	<1.8	1.8	1.8	MPN/100 mL	
08/13/2014 11:10:00	**E. Coli**	2.0	1.8	1.8	MPN/100 mL	
08/27/2014 11:22:00	**E. Coli**	<1.8	1.8	1.8	MPN/100 mL	
09/10/2014 11:07:00	**E. Coli**	2.0	1.8	1.8	MPN/100 mL	
09/24/2014 10:49:00	**E. Coli**	<1.8	1.8	1.8	MPN/100 mL	
10/08/2014 11:15:00	**E. Coli**	4.5	1.8	1.8	MPN/100 mL	
10/22/2014 11:08:00	**E. Coli**	2.0	1.8	1.8	MPN/100 mL	
11/12/2014 10:58:00	**E. Coli**	4.0	1.8	1.8	MPN/100 mL	
11/19/2014 10:16:00	**E. Coli**	13	1.8	1.8	MPN/100 mL	
12/03/2014 10:43:00	**E. Coli**	2.0	1.8	1.8	MPN/100 mL	
12/17/2014 11:10:00	**E. Coli**	4.5	1.8	1.8	MPN/100 mL	
04/25/2014 11:31:00	**EPN**	2.50			µg/L	EPA 507
12/09/2014 14:00:00	**EPN**	2.51			µg/L	EPA 507
12/09/2014 14:05:00	**Ethylbenzene**	ND	0.090	0.50	µg/L	EPA 524.2
01/02/2014 10:16:00	**Fecal Coliforms**	2.0	1.8	1.8	MPN/100 mL	
01/15/2014 10:56:00	**Fecal Coliforms**	2.0	1.8	1.8	MPN/100 mL	
01/29/2014 10:56:00	**Fecal Coliforms**	<1.8	1.8	1.8	MPN/100 mL	
02/12/2014 10:52:00	**Fecal Coliforms**	2.0	1.8	1.8	MPN/100 mL	
03/12/2014 10:28:00	**Fecal Coliforms**	2.0	1.8	1.8	MPN/100 mL	
03/26/2014 11:00:00	**Fecal Coliforms**	2.0	1.8	1.8	MPN/100 mL	
04/08/2014 10:40:00	**Fecal Coliforms**	2.0	1.8	1.8	MPN/100 mL	
04/23/2014 11:01:00	**Fecal Coliforms**	<1.8	1.8	1.8	MPN/100 mL	
05/07/2014 10:58:00	**Fecal Coliforms**	<1.8	1.8	1.8	MPN/100 mL	
05/21/2014 10:55:00	**Fecal Coliforms**	2.0	1.8	1.8	MPN/100 mL	
06/04/2014 11:00:00	**Fecal Coliforms**	7.8	1.8	1.8	MPN/100 mL	
06/18/2014 11:02:00	**Fecal Coliforms**	<1.8	1.8	1.8	MPN/100 mL	
07/02/2014 11:08:00	**Fecal Coliforms**	2.0	1.8	1.8	MPN/100 mL	SM 9221
07/16/2014 11:00:00	**Fecal Coliforms**	<1.8	1.8	1.8	MPN/100 mL	
07/30/2014 11:15:00	**Fecal Coliforms**	<1.8	1.8	1.8	MPN/100 mL	
08/13/2014 11:10:00	**Fecal Coliforms**	4.5	1.8	1.8	MPN/100 mL	
08/27/2014 11:22:00	**Fecal Coliforms**	<1.8	1.8	1.8	MPN/100 mL	
09/10/2014 11:07:00	**Fecal Coliforms**	2.0	1.8	1.8	MPN/100 mL	
09/24/2014 10:49:00	**Fecal Coliforms**	<1.8	1.8	1.8	MPN/100 mL	
10/08/2014 11:15:00	**Fecal Coliforms**	4.5	1.8	1.8	MPN/100 mL	
10/22/2014 11:08:00	**Fecal Coliforms**	2.0	1.8	1.8	MPN/100 mL	
11/12/2014 10:58:00	**Fecal Coliforms**	4.0	1.8	1.8	MPN/100 mL	
11/19/2014 10:16:00	**Fecal Coliforms**	13	1.8	1.8	MPN/100 mL	
12/03/2014 10:43:00	**Fecal Coliforms**	2.0	1.8	1.8	MPN/100 mL	
12/17/2014 11:10:00	**Fecal Coliforms**	4.5	1.8	1.8	MPN/100 mL	
12/09/2014 14:00:00	**Fluoride**	0.11	0.032	0.10	mg/L	EPA 300.0
12/09/2014 14:00:00	**Hardness as CaCO3**	44	1.0	1.0	mg/L	200.7/2340B
11/18/2014 14:15:00	**Hexavalent Chromium**	ND	0.46	1.0	µg/L	EPA 218.6
01/02/2014 10:24:00	**Hydroxide as CaCO3**	ND	0.50	5.0	mg/L	
02/05/2014 11:05:00	**Hydroxide as CaCO3**	ND	0.50	5.0	mg/L	
04/02/2014 10:40:00	**Hydroxide as CaCO3**	ND	0.50	5.0	mg/L	
04/11/2014 14:45:00	**Hydroxide as CaCO3**	ND	0.50	5.0	mg/L	
05/07/2014 10:55:00	**Hydroxide as CaCO3**	ND	0.50	5.0	mg/L	
06/04/2014 11:02:00	**Hydroxide as CaCO3**	ND	0.50	5.0	mg/L	SM2320B
07/02/2014 11:10:00	**Hydroxide as CaCO3**	ND	0.50	5.0	mg/L	
08/06/2014 10:36:00	**Hydroxide as CaCO3**	ND	0.50	5.0	mg/L	
10/01/2014 10:55:00	**Hydroxide as CaCO3**	ND	0.50	5.0	mg/L	
11/05/2014 15:40:00	**Hydroxide as CaCO3**	ND	0.50	5.0	mg/L	
12/09/2014 14:00:00	**Hydroxide as CaCO3**	ND	0.50	5.0	mg/L	
01/02/2014 10:24:00	**Iron**	ND	6.8	100	µg/L	
02/05/2014 11:05:00	**Iron**	ND	6.8	100	µg/L	
04/02/2014 10:40:00	**Iron**	ND	6.8	100	µg/L	
05/07/2014 10:55:00	**Iron**	ND	6.8	100	µg/L	
06/04/2014 11:02:00	**Iron**	ND	6.8	100	µg/L	
07/02/2014 11:10:00	**Iron**	ND	6.8	100	µg/L	EPA 200.7
08/06/2014 10:36:00	**Iron**	ND	6.8	100	µg/L	
10/01/2014 10:55:00	**Iron**	200	6.8	100	µg/L	
11/05/2014 15:40:00	**Iron**	ND	6.8	100	µg/L	
12/09/2014 14:00:00	**Iron**	ND	6.8	100	µg/L	
12/09/2014 14:00:00	**Lead**	ND	0.23	5.0	µg/L	EPA 200.8
12/09/2014 14:00:00	**Magnesium**	4.9	0.028	1.0	mg/L	200.7/2340B
01/02/2014 10:24:00	**Manganese**	ND	1.7	10	µg/L	
02/05/2014 11:05:00	**Manganese**	ND	1.7	10	µg/L	
04/02/2014 10:40:00	**Manganese**	ND	0.92	20	µg/L	
05/07/2014 10:55:00	**Manganese**	50	0.92	20	µg/L	EPA 200.7

06/04/2014 11:02:00	**Manganese**	71	0.92	20	µg/L	EPA 200.7
07/02/2014 11:10:00	**Manganese**	170	0.92	20	µg/L	
08/06/2014 10:36:00	**Manganese**	58	0.92	20	µg/L	
10/01/2014 10:55:00	**Manganese**	600	0.92	20	µg/L	
11/05/2014 15:40:00	**Manganese**	ND	0.92	20	µg/L	EPA 200.7
12/09/2014 14:00:00	**Manganese**	ND	0.92	20	µg/L	EPA 200.7
12/09/2014 14:00:00	**MBAS as LAS, mol wt 340**	ND	0.067	0.10	mg/L	SM5540 C
12/09/2014 14:00:00	**Mercury**	ND	0.15	1.0	µg/L	EPA 245.1
12/09/2014 14:05:00	**Methyl tert-butyl ether**	ND	0.092	3.0	µg/L	EPA 524.2
12/09/2014 14:05:00	**Methylene chloride**	ND	0.24	0.50	µg/L	EPA 524.2
12/09/2014 14:00:00	**Nickel**	ND	0.070	10	µg/L	EPA 200.8
01/14/2014 08:20:00	**Nitrate as NO3**	ND	0.053	0.50	mg/L	
04/14/2014 11:10:00	**Nitrate as NO3**	0.78	0.053	0.50	mg/L	
07/14/2014 10:30:00	**Nitrate as NO3**	0.88	0.053	0.50	mg/L	
10/14/2014 08:10:00	**Nitrate as NO3**	0.71	0.053	0.50	mg/L	
12/09/2014 14:00:00	**Nitrate as NO3**	ND	0.068	2.0	mg/L	EPA 300.0
01/14/2014 08:20:00	**Nitrite as N**	ND	0.0022	0.10	mg/L	
04/14/2014 11:10:00	**Nitrite as N**	ND	0.0022	0.10	mg/L	
07/14/2014 10:30:00	**Nitrite as N**	ND	0.0022	0.10	mg/L	
10/14/2014 08:10:00	**Nitrite as N**	ND	0.0022	0.10	mg/L	
12/09/2014 14:00:00	**Perchlorate**	ND	1.2	4.0	µg/L	EPA 314.0
12/09/2014 14:00:00	**pH**	7.78	0.01	0.01	pH Units	SM4500-H B
12/09/2014 14:00:00	**Potassium**	1.1	0.87	1.0	mg/L	200.7/2340B
12/09/2014 14:00:00	**Selenium**	ND	1.1	5.0	µg/L	EPA 200.8
12/09/2014 14:00:00	**Silver**	ND	2.9	10	µg/L	EPA 200.7
12/09/2014 14:00:00	**Sodium**	5.2	0.021	1.0	mg/L	200.7/2340B
12/09/2014 14:00:00	**Specific Conductance (EC)**	120	0.090	1.0	µmhos/cm	EPA 120.1
12/09/2014 14:05:00	**Styrene**	ND	0.059	0.50	µg/L	EPA 524.2
12/09/2014 14:00:00	**Sulfate as SO4**	4.0	0.052	0.50	mg/L	EPA 300.0
12/09/2014 14:05:00	**Tetrachloroethene**	ND	0.12	0.50	µg/L	EPA 524.2
12/09/2014 14:00:00	**Thallium**	ND	0.11	1.0	µg/L	EPA 200.8
12/09/2014 14:00:00	**Thiobencarb**	ND	0.40	1.0	µg/L	EPA 507
12/09/2014 14:00:00	**Threshold Odor Number**	ND		1	T.O.N.	EPA 140.1
12/09/2014 14:05:00	**Toluene**	ND	0.10	0.50	µg/L	EPA 524.2
12/09/2014 14:05:00	**Toluene-d8**	9.08			µg/L	EPA 524.2
01/02/2014 10:24:00	**Total Alkalinity**	44	1.0	5.0	mg/L	
02/05/2014 11:05:00	**Total Alkalinity**	49	1.0	5.0	mg/L	
04/02/2014 10:40:00	**Total Alkalinity**	48	1.0	5.0	mg/L	
04/11/2014 14:45:00	**Total Alkalinity**	46	1.0	5.0	mg/L	
05/07/2014 10:55:00	**Total Alkalinity**	46	1.0	5.0	mg/L	
06/04/2014 11:02:00	**Total Alkalinity**	47	1.0	5.0	mg/L	SM2320B
07/02/2014 11:10:00	**Total Alkalinity**	44	1.0	5.0	mg/L	
08/06/2014 10:36:00	**Total Alkalinity**	47	1.0	5.0	mg/L	
10/01/2014 10:55:00	**Total Alkalinity**	47	1.0	5.0	mg/L	
11/05/2014 15:40:00	**Total Alkalinity**	44	1.0	5.0	mg/L	
12/09/2014 14:00:00	**Total Alkalinity**	40	1.0	5.0	mg/L	
01/02/2014 10:16:00	**Total Coliforms**	4.5	1.8	1.8	MPN/100 mL	
01/15/2014 10:56:00	**Total Coliforms**	4.5	1.8	1.8	MPN/100 mL	
01/29/2014 10:56:00	**Total Coliforms**	<1.8	1.8	1.8	MPN/100 mL	
02/12/2014 10:52:00	**Total Coliforms**	17	1.8	1.8	MPN/100 mL	
03/12/2014 10:28:00	**Total Coliforms**	6.8	1.8	1.8	MPN/100 mL	
03/26/2014 11:00:00	**Total Coliforms**	13	1.8	1.8	MPN/100 mL	
04/08/2014 10:40:00	**Total Coliforms**	13	1.8	1.8	MPN/100 mL	
04/23/2014 11:01:00	**Total Coliforms**	2.0	1.8	1.8	MPN/100 mL	
05/07/2014 10:58:00	**Total Coliforms**	<1.8	1.8	1.8	MPN/100 mL	
05/21/2014 10:55:00	**Total Coliforms**	4.5	1.8	1.8	MPN/100 mL	
06/04/2014 11:00:00	**Total Coliforms**	23	1.8	1.8	MPN/100 mL	
06/18/2014 11:02:00	**Total Coliforms**	49	1.8	1.8	MPN/100 mL	
07/02/2014 11:08:00	**Total Coliforms**	7.8	1.8	1.8	MPN/100 mL	SM 9221
07/16/2014 11:00:00	**Total Coliforms**	22	1.8	1.8	MPN/100 mL	
07/30/2014 11:15:00	**Total Coliforms**	4.5	1.8	1.8	MPN/100 mL	
08/13/2014 11:10:00	**Total Coliforms**	4.5	1.8	1.8	MPN/100 mL	
08/27/2014 11:22:00	**Total Coliforms**	9.2	1.8	1.8	MPN/100 mL	
09/10/2014 11:07:00	**Total Coliforms**	220	1.8	1.8	MPN/100 mL	
09/24/2014 10:49:00	**Total Coliforms**	11	1.8	1.8	MPN/100 mL	
10/08/2014 11:15:00	**Total Coliforms**	33	1.8	1.8	MPN/100 mL	
10/22/2014 11:08:00	**Total Coliforms**	33	1.8	1.8	MPN/100 mL	
11/12/2014 10:58:00	**Total Coliforms**	22	1.8	1.8	MPN/100 mL	
11/19/2014 10:16:00	**Total Coliforms**	13	1.8	1.8	MPN/100 mL	

12/03/2014 10:43:00	**Total Coliforms**	4.5	1.8	1.8	MPN/100 mL	
12/17/2014 11:10:00	**Total Coliforms**	17	1.8	1.8	MPN/100 mL	
12/09/2014 14:00:00	**Total Dissolved Solids**	72	10	10	mg/L	SM2540C
01/02/2014 10:16:00	**Total Organic Carbon**	2.6	0.30	0.30	mg/L	
02/05/2014 11:05:00	**Total Organic Carbon**	2.5	0.30	0.30	mg/L	
04/02/2014 10:40:00	**Total Organic Carbon**	2.8	0.30	0.30	mg/L	
04/02/2014 11:00:00	**Total Organic Carbon**	0.82	0.30	0.30	mg/L	
04/11/2014 14:45:00	**Total Organic Carbon**	2.7	0.30	0.30	mg/L	
05/07/2014 10:55:00	**Total Organic Carbon**	3.1	0.30	0.30	mg/L	
06/04/2014 11:02:00	**Total Organic Carbon**	2.5	0.30	0.30	mg/L	
07/02/2014 11:10:00	**Total Organic Carbon**	2.8	0.30	0.30	mg/L	
08/06/2014 10:36:00	**Total Organic Carbon**	2.4	0.30	0.30	mg/L	
08/06/2014 10:45:00	**Total Organic Carbon**	1.7	0.30	0.30	mg/L	
08/06/2014 10:48:00	**Total Organic Carbon**	0.86	0.30	0.30	mg/L	SM5310B
10/01/2014 10:55:00	**Total Organic Carbon**	2.9	0.30	0.30	mg/L	
11/05/2014 15:40:00	**Total Organic Carbon**	2.6	0.54	1.0	mg/L	
01/02/2014 10:16:00	**Total Organic Carbon, Dissolved**	2.8	0.30	0.30	mg/L	
02/05/2014 11:05:00	**Total Organic Carbon, Dissolved**	2.3	0.30	0.30	mg/L	
04/02/2014 10:40:00	**Total Organic Carbon, Dissolved**	2.8	0.54	1.0	mg/L	
04/11/2014 14:45:00	**Total Organic Carbon, Dissolved**	3.0	0.30	0.30		
05/07/2014 10:55:00	**Total Organic Carbon, Dissolved**	2.5	0.54	1.0	mg/L	
06/04/2014 11:02:00	**Total Organic Carbon, Dissolved**	2.6	0.30	0.30	mg/L	
08/06/2014 10:36:00	**Total Organic Carbon, Dissolved**	2.2	0.54	1.0	mg/L	
10/01/2014 10:55:00	**Total Organic Carbon, Dissolved**	2.9	0.30	0.30	mg/L	
11/05/2014 15:40:00	**Total Organic Carbon, Dissolved**	2.9	0.54	1.0	mg/L	SM 5310B
12/09/2014 14:05:00	**Total Trihalomethanes (THM)**	ND	0.50	0.50	µg/L	EPA 524.2
12/09/2014 14:05:00	**trans-1,2-Dichloroethene**	ND	0.13	0.50	µg/L	EPA 524.2
12/09/2014 14:05:00	**trans-1,3-Dichloropropene**	ND	0.12	0.50	µg/L	EPA 524.2
12/09/2014 14:05:00	**Trichloroethene**	ND	0.11	0.50	µg/L	EPA 524.2
12/09/2014 14:05:00	**Trichlorofluoromethane**	ND	0.20	5.0	µg/L	EPA 524.2
12/09/2014 14:00:00	**Turbidity**	0.63	0.036	0.50	NTU	EPA 180.1
01/02/2014 10:16:00	**UV-absorbing organics**	0.045		0.0050	1/cm	
02/05/2014 11:05:00	**UV-absorbing organics**	0.043		0.0050	1/cm	
04/02/2014 10:40:00	**UV-absorbing organics**	0.046		0.0050	1/cm	
04/11/2014 14:45:00	**UV-absorbing organics**	0.046		0.0050	1/cm	
05/07/2014 10:55:00	**UV-absorbing organics**	0.045		0.0050	1/cm	
06/04/2014 11:02:00	**UV-absorbing organics**	0.050		0.0050	1/cm	SM 5910B
07/02/2014 11:10:00	**UV-absorbing organics**	0.060		0.0050	1/cm	
08/06/2014 10:36:00	**UV-absorbing organics**	0.047		0.0050	1/cm	
10/01/2014 10:55:00	**UV-absorbing organics**	0.061		0.0050	1/cm	
11/05/2014 15:40:00	**UV-absorbing organics**	0.060		0.0050	1/cm	
01/02/2014 10:16:00	**UV-absorbing organics (SUVA)**	1.6		1.0	L/mg-m	
02/05/2014 11:05:00	**UV-absorbing organics (SUVA)**	1.9		1.0	L/mg-m	
04/02/2014 10:40:00	**UV-absorbing organics (SUVA)**	1.6		1.0	L/mg-m	
04/11/2014 14:45:00	**UV-absorbing organics (SUVA)**	1.6		1.0	L/mg-m	
05/07/2014 10:55:00	**UV-absorbing organics (SUVA)**	1.8		1.0	L/mg-m	
06/04/2014 11:02:00	**UV-absorbing organics (SUVA)**	2.0		1.0	L/mg-m	None
07/02/2014 11:10:00	**UV-absorbing organics (SUVA)**	2.6		1.0	L/mg-m	
08/06/2014 10:36:00	**UV-absorbing organics (SUVA)**	1.9		1.0	L/mg-m	
10/01/2014 10:55:00	**UV-absorbing organics (SUVA)**	2.1		1.0	L/mg-m	
11/05/2014 15:40:00	**UV-absorbing organics (SUVA)**	2.1		1.0	L/mg-m	
12/09/2014 14:00:00	**Vanadium**	ND	0.44	3.0	µg/L	EPA 200.8
12/09/2014 14:05:00	**Vinyl chloride**	ND	0.17	0.50	µg/L	EPA 524.2
12/09/2014 14:05:00	**Xylenes (total)**	ND	0.30	0.50	µg/L	EPA 524.2
12/09/2014 14:00:00	**Zinc**	ND	9.3	50	µg/L	EPA 200.7

CONFERENCE/EDUCATION SCHEDULE

Date: November 13, 2015

To: Board of Directors

From: Suzanne Lindenfeld, District Secretary

Subject: Review Upcoming Conference/Education Opportunities

This report is prepared in order to notify Directors of upcoming educational opportunities. Directors interested in attending specific events or conferences should contact me to confirm attendance for reservation purposes. The Board will discuss any requests from Board members desiring to attend upcoming conferences and approve those requests as deemed appropriate.

Board members must provide brief reports on meetings that they have attended at the District's expense. (AB 1234).

The upcoming conferences/educational opportunities include the following:

CALIFORNIA SPECIAL DISTRICT ASSOCIATION (CSDA)

Required Ethics Compliance Training AB1234	November 18, 2015	Webinar

GOLDEN STATE RISK MANAGEMENT ASSOCIATION (GSRMA)

No Information Currently Available on Upcoming Conferences.

ASSOCIATION OF CALIFORNIA WATER AGENCIES (ACWA)

2015 Annual Fall Conference	December 1-4, 2015	Indian Wells

AMERICAN WATER WORKS ASSOCIATION (AWWA)

No Information Currently Available on Upcoming Conferences.