

*Protecting Our Water Environment*



*Metropolitan Water Reclamation District of Greater Chicago*

***MONITORING AND RESEARCH  
DEPARTMENT***

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*Monitoring and Research Department*

*2013*

*Annual Report*

**Monitoring and Research Department**  
**Thomas C. Granato, Director**

*October 2014*

Metropolitan Water Reclamation District of Greater Chicago  
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MONITORING AND RESEARCH DEPARTMENT

2013

ANNUAL REPORT

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## DISCLAIMER

The mention of trade names of specific products does not constitute endorsement of them by the Metropolitan Water Reclamation District of Greater Chicago.

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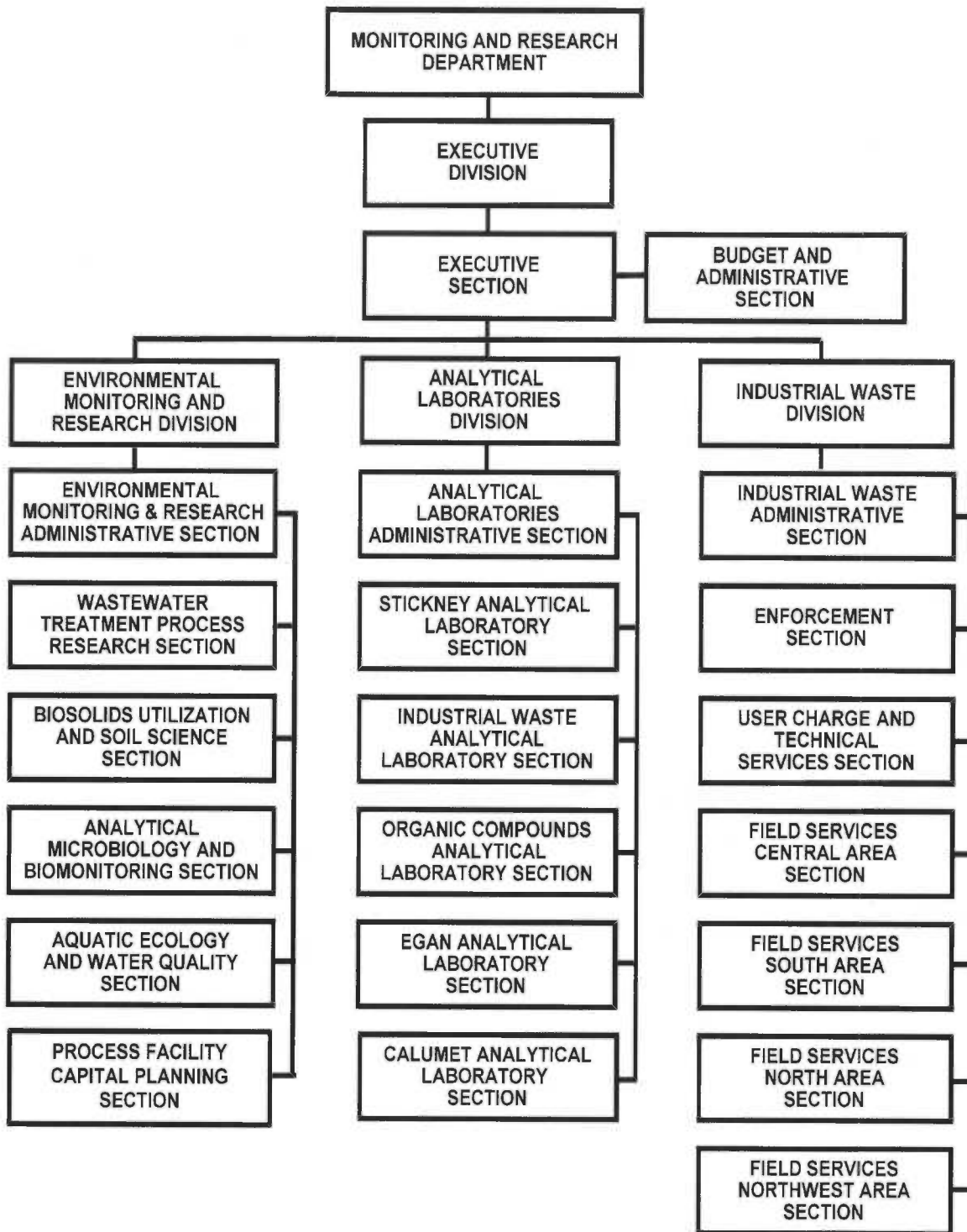
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**MONITORING AND RESEARCH DEPARTMENT  
ORGANIZATION CHART FOR 2013**





## ENSURING FINANCIAL STABILITY

The Monitoring and Research (M&R) Department's 2013 budget appropriation was \$27,162,900, an increase of \$1,485,400, or 5.8 percent from 2012. Approximately 87 percent, or \$23,658,700, was appropriated for salary and wages, and the remaining appropriation of \$3,504,200 was used to fund acquisition of equipment, supplies, and services to operate M&R's laboratories, technical support projects, and environmental and industrial monitoring programs. The M&R Department has continuously sought to make improvements to its business practice and to maintain a clear focus on its mission. As a result, M&R has decreased the number of budgeted positions it houses in 10 of the past 13 years, dropping from 355 positions in 2000 to 286 by the end of 2013.

### User Charge Program

The M&R Department generates an important revenue stream through recovery of operations, maintenance, and replacement costs incurred from providing treatment to discharges from Commercial, Industrial, and Tax-Exempt Users of the sewerage system, and the costs of administering the Metropolitan Water Reclamation District of Greater Chicago's (District) Pretreatment and User Charge Programs. The User Charge Program assesses charges to recover costs that are beyond those recovered through payment of *ad valorem* property taxes based on the volume of water discharged and the concentration of waste it contains. In 2013, the M&R Department completed a two-year Blue Ribbon Panel process with representatives of the industrial and tax-exempt user communities. As a result of the process, user charges will become more consistent and predictable and administrative cost recovery will become more efficient. The 2013 User Charge revenue was \$54,007,347.

TABLE 1: FIVE-YEAR TREND IN USER CHARGE REVENUE INCLUDING 2013

Year	User Charge Receipts
2009	\$48,253,267
2010	\$48,666,789
2011	\$48,614,202
2012	\$77,743,336
2013	\$54,007,347

In 2013, M&R administered 3,626 accounts. Of these accounts, 1,310 (775 Commercial-Industrial and 535 Tax-Exempt Users) were processed manually. M&R conducted 1,324 inspection and sampling events, and processed 2,661 reports and filings to reconcile User Charge liabilities for these manual accounts. The remaining 2,316 accounts, which are all Tax-Exempt

Users, were approved by M&R for automated processing. The M&R Department remains vigilant in identifying and classifying new users, and in 2013, 398 new Large Commercial-Industrial and Tax-Exempt Users and 72 Small Nonresidential Commercial-Industrial User accounts were created.

Through its industrial surveillance program, M&R maintains records of loadings that result from discharge of wastewater from all user accounts. In addition to formulating the basis for user charge billing, this information is also useful for long-term capital planning. These data are maintained in M&R's Pretreatment Information Management System (PIMS) database.

Section 7f of the District's User Charge Ordinance makes provision for automated filing and clearing of User Charge accounts. An additional 215 users were placed on automatic billing in 2013, bringing the total now to 2,767. This reduces costs for the District and the Users. In 2013, M&R also identified 520 Users who were eligible for reduced reporting and self-monitoring requirements under Sections 7g, 7h, and 7i of the Ordinance, which reduces the District's oversight costs and the User's cost for determining their User Charges.

### **Optimizing Business Practice**

The M&R Department provides quality control data to the Maintenance and Operations Department (M&O) for various materials purchased by the District, which allows verification that contract requirements are met. These materials, such as lubricants, sodium hypochlorite, bisulfites, bioxides, polymers, and ferric chloride, are used for such purposes as operating plant machinery, disinfection, odor control, and biosolids processing.

The M&R Department is committed to automating and streamlining its business practice. During 2013, consultants began work with staff from M&R and the Information Technology Department to upgrade the Laboratory Information Management System (LIMS) to increase data processing and reporting, and to enhance data acquisition from automated instruments. The upgrade should be completed during 2014.

Implementation of the new PIMS is expected to be completed in its entirety by 2014. This updated and enhanced PIMS will enable M&R to maintain its industrial waste program data in a single database and increase staff efficiency. Separate User Charge/Finance Department modules were integrated and brought online in the PIMS in December 2013. These modules will streamline the assessment, invoicing, and collection of User Charges, penalties and noncompliance enforcement charges, as well as simplify calculation methods where feasible. The M&R Department will streamline its programs through implementation of electronic industrial user reporting and electronic management of District and industrial user records and correspondence.

M&R has been working with the IT Department to create geographical information system (GIS) layers for its industrial and tax-exempt user databases to facilitate more efficient inspection, surveillance, and sampling and to conduct forensic operation during facility upset event. The M&R GIS will also be useful for future planning, including identification of potential

water reuse corridors. In 2013, M&R updated the list of users and updated flagging of users in significant noncompliance.

## **DEVELOPING ALL EMPLOYEES**

The M&R Department is committed to providing continuing education and professional development to all of its employees. The M&R Department conducts a monthly environmental issues and research seminar series at the Lue-Hing Research and Development Complex, which is video-conferenced to five other facilities and is archived in streaming on-line video format through the web portal.

The M&R Seminar Series is approved by the Illinois Society of Professional Engineers for professional development credits and is available to all employees and the local community. In 2013, attendance at the Lue-Hing Research and Development Complex Auditorium and the Main Office Board Room was 1,956 and video conferencing was expanded to the John E. Egan and James C. Kirie WRPs.

Employees in M&R benefited from attendance at 54 local, regional, and national professional society meetings and workshops (Appendix AI) and often participated on the meeting programs as speakers, session chairs and moderators, or committee chairs or members. The M&R Department also economizes where possible by providing its employees access to webinars which are presented by the Water Environment Federation, Water Environment Research Foundation, United States Environmental Protection Agency (USEPA), American Chemical Society, and others.

The M&R Department administers the District's Radiation Safety Program, including maintaining a Radioactive Material License issued to the District by the Illinois Emergency Management Agency, Division of Nuclear Safety, assuring that activities are conducted according to the license conditions and regulations. The M&R Department also maintains a Chemical Hygiene Plan for its laboratories and conducts bacteriological monitoring of drinking water sampled from various District facilities to ensure the safety of drinking water to District employees.

## **IMPROVING PUBLIC IMAGE**

The M&R Department engages in activities to benefit the public and in the process strives to improve the District's image. The major activities include odor monitoring, the Biosolids Controlled Solids Distribution Program, and maintaining native prairie landscapes.

The District conducts an Odor Monitoring Program to minimize or eliminate odor nuisance to the communities surrounding its facilities. During 2013, M&R in collaboration with M&O, monitored unit processes at the District's wastewater treatment facilities as well as biosolids drying areas for odors. Extreme odor conditions were reported to the respective plant managers. An annual summary report of monitoring results was generated.

The District is committed to reducing the odors generated in its collection systems. The M&R Department undertook a full-scale field study during 2013 to evaluate the effectiveness of injecting calcium nitrate solution at multiple locations in the Upper Des Plaines interceptor system to mitigate the odors and minimizing the corrosion in sewer conduits. Results of this monitoring study will be reported in 2014, and M&R will continue to partner with M&O to address odors across the District's service area.

In 2013, M&R staff made 29 presentations at conferences and meetings, published 18 papers in conference proceedings or peer-reviewed journals, and the department published 51 numbered reports, which are available on the District's website.

The District conducts a biosolids Controlled Solids Distribution Program under a permit issued by the Illinois Environmental Protection Agency (IEPA). Under this program, exceptional quality air-dried biosolids are used as a soil amendment and fertilizer in the Chicago metropolitan area. During 2013, M&R staff worked with 35 biosolids users to ensure regulatory compliance and help them derive economic and agronomic benefits from biosolids use. The M&R staff conducted a Sustainability workshop and distributed promotional materials to park districts, school districts, golf courses, and other land managers to expand the program and make the public aware of the benefits of utilizing biosolids.

TABLE 2: MARKETING EFFORTS ARE INCREASING LOCAL BIOSOLIDS USE UNDER THE CONTROLLED SOLIDS DISTRIBUTION PROGRAM

	2006	2007	2008	2009	2010	2011	2012	2013
<b>No. of Users*</b>								
Total	12	37	35	39	43	60	48	35
New (1 <sup>st</sup> Time)	10	35	16	11	10	20	11	13
Repeat Users	2	2	19	28	33	40	37	22
<b>Biosolids Qty. -- (dry tons)</b>								
Total	1,900	4,800	4,000	6,274	6,863	7,279	11,050	6,231
Large Users -- (>1,000 DT)			16,000**					

\* Not all customers use biosolids every year.

\*\* Construction at Highlands GC (10,000 DT), and reclamation at Miller Meadows (4,000 DT) and USX (2,000 DT).

The M&R Department conducted marketing activities and technical support on projects in the Chicago metropolitan area where 6,231 dry tons of biosolids were used as a soil conditioner or fertilizer topdressing on various sites, including 4 schools/athletic fields, 53 parks, 5 golf courses, and 2 landscaping companies.

## BE ENVIRONMENTALLY RESPONSIBLE

The M&R Department works in partnership with the M&O and Engineering Departments to ensure regulatory compliance of its operations and to seek to continually increase the efficiency of the District's treatment processes to bring about progressive and sustainable improvement of the aquatic, terrestrial, and atmospheric environment in the District's service area and beyond.

### Industrial Waste Pretreatment Program

The M&R Department is committed to stopping pollution at its source by operating an effective Industrial Waste Pretreatment and Source Control Program in full compliance with all federal and state statutes. During 2013, the administration of the District's Industrial Waste Pretreatment Program required the issuance or renewal of Discharge Authorizations for 73 Significant Industrial Users; the review of 695 Continued Compliance Reports; and 9 Spill Prevention, Containment, and Countermeasure Plans. As a result of the Industrial Waste Pretreatment Program, the District's biosolids continue to exceed the minimum requirements that define Exceptional Quality in the USEPA's federal regulations.

TABLE 3: COMPARISON OF 2013 AVERAGE Cd, Hg, AND Pb, CONCENTRATIONS IN STICKNEY AND CALUMET WATER RECLAMATION PLANTS BIOSOLIDS WITH USEPA EXCEPTIONAL QUALITY CONCENTRATION LIMITS

	Cd	Hg	Pb
	-----mg/Kg-----		
USEPA Limit	39	17	300
Calumet	7	0.89	68
Stickney	5	0.98	100

During 2013, M&R conducted 3,050 inspections associated with administering the District's Sewage and Waste Control Ordinance and randomly sampled and analyzed 825 of the 1,453 chemical toilet disposals at the Stickney WRP. In 2013, M&R issued 94 Cease and Desist Orders to Industrial Users who were found to be in significant noncompliance with the District's Industrial Waste Pretreatment Program requirements. In accordance with the public participation requirements of the Pretreatment Program, the identity of 33 significant violators of the program in 2013 will be published in 2014.

TABLE 4: FIVE-YEAR TREND IN ENFORCEMENT ACTIVITIES  
INCLUDING YEAR 2013

Year	Cease and Desist Orders	Board Orders	Legal Actions
2009	88	1	0
2010	82	3	0
2011	87	0	0
2012	118	0	0
2013	94	0	0

The M&R Department provided first response services for hazardous materials emergencies and complaints of pollution by conducting 158 investigations in response to requests from federal, state and local agencies, municipalities, and private citizens; 43 investigations were conducted in response to self-reported industrial activities; and 23 investigations were conducted in response to requests from M&O in 2013.

As a result of the District's Industrial Pretreatment Program, all of the biosolids produced by the District met the highest quality criteria in USEPA's Part 503 Regulation and the WRP effluents met all National Pollutant Discharge Elimination System (NPDES) permit limits for regulated industrial pollutants.

### Environmental Monitoring Program

**Surface and Groundwater.** The M&R Department monitors the effectiveness of District operations in improving the environment, and documents compliance with state and federal regulations and operating permits. In 2013, M&R collected and analyzed approximately 1,200 water quality samples from the District area waterways. The Analytical Laboratories at the Egan WRP analyzed 12,340 metals on 837 samples in 2013 in support of this study. The M&R Department also successfully met the NPDES permit requirements for continuous dissolved oxygen monitoring and completed a chlorophyll survey of the Chicago, Calumet, and Des Plaines River Systems.

The M&R Department's Environmental Monitoring and Research Division (EM&RD) collected fish at 17 stations in the Chicago River System and Tinley Creek. The sampled fish were identified, weighed and measured for length, and examined for parasites and disease. The fish data is provided to the IEPA for their use in preparing the Illinois 305(b) assessment report.

A summary of the Ambient Water Quality Data, Continuous Dissolved Oxygen Monitoring Data and Biological Survey Data for the local waterways is reported annually and is available to the public on the District website.



In 2013, 442 samples from 108 Tunnel and Reservoir Plan (TARP) groundwater monitoring wells for the deep tunnels and two reservoirs were collected and analyzed. Based on the monitoring results, M&R compiled six annual monitoring reports for the four TARP tunnel systems including Mainstream, Calumet, Des Plaines and Upper Des Plaines, and two reservoirs including the Gloria Alitto Majewski Chicagoland Underflow Plan Reservoir and the Thornton Transitional Reservoir to meet operating permit requirements of these facilities. The groundwater elevation in 43 observation wells was also recorded bi-weekly and included in these reports. The reports were submitted to IEPA.

M&R also conducts groundwater monitoring at seven biosolids management facilities, including the Hanover Park Fischer Farm in accordance with permits issued by the IEPA. In 2013, 28 monitoring reports were submitted to the IEPA.

**Air.** M&R provides compliance monitoring and reporting support to M&O for the District's Clean Air Act Permits. At the Egan WRP, M&R performed monthly monitoring of hydrogen sulfide levels at the facility's compressor room in compliance with its Federally Enforceable State Operating Permit. The M&R Department also calculated the Hazardous Air Pollutant emissions from the liquid stream of the all the District's WRPs, except the Egan WRP, as required by its Title V Air Quality Permit. Annual hazardous air pollutant emissions were calculated using a computer model and submitted to M&O for reporting to the IEPA. Additionally, as part of the IEPA's Environmental Emissions Reduction Market System, an Annual Hazardous Air Pollutants Report was filed. During 2013, M&R also conducted odor monitoring at the District's biosolids drying areas in compliance with the IEPA permits for operation of the drying areas.

### **Analytical Laboratories**

The Analytical Laboratories Division (ALD) has five National Environmental Laboratory Accreditation Program (NELAP) accredited laboratories, generating accurate, reliable, and defensible data for samples from various District functional programs. The laboratories are audited internally by the M&R Quality Assurance Coordinator annually and by the IEPA biennially. The laboratories are also audited annually by the Chemical Hygiene Officer for compliance with fire and safety requirements. In 2013, the total number of analyses performed by the laboratories was 1,364,606.

The Analytical Microbiology and Biomonitoring Section has five state-of-the-art laboratories: Analytical Bacteriology Laboratory; Molecular Microbiology Laboratory; Parasitology Laboratory; Virology Laboratory; and Wastewater Microbiology Laboratory that provide high quality microbiological monitoring and research support services for various District functional programs. These specialized laboratories conducted a total of 4,291 microbial analyses in 2013. The Analytical Bacteriology Laboratory is certified by the Illinois Department of Public Health.

The ALD of M&R maintained its NELAP accreditation by adhering to the strict standards established by The NELAP Institute. The Bacteriology Laboratory of the EM&RD maintained its certification by the Illinois Department of Public Health. The accreditation and certification ensure that all results generated by the M&R laboratories are accurate, reliable and defensible.

### **Treatment Process Control and Optimization**

The M&R Department monitors the liquid and solids process trains daily at multiple critical control points for each of the seven WRPs to inform process control and to improve operations and the quality of effluents and biosolids. This includes chemical and microbiological monitoring including characterization of changes in microbial communities associated with operations performance metrics to assess process stability and provide early warning of process upset such as appearance of excess filamentous bacteria in mixed liquor. A total of 553 activated sludge samples were analyzed for microbial characterization. No whole effluent toxicity tests (WET) with fish (*Pimephales promelas*) and daphnids (*Ceriodaphnia dubia*) which are required by NPDES permits during various permit periods, were conducted in 2013, but DMR-QA test for demonstrating the qualification of conducting WET tests was conducted and successfully passed.

In 2013, M&R provided the support to address treatment operation upset at the Stickney WRP. This support included chemical analyses of influent, mixed liquor and effluent samples and evaluation of microbial floc, ammonia oxidizing bacteria and nitrite oxidizing bacteria in activated sludge, as well as microbial respiratory testing. The information generated was used to determine the potential causes, provide recommendations to restore the treatment operation conditions and monitoring the progress of system recovery. The M&R Department also provided emergency support to the Egan WRP in response to a fecal coliform exceedance in August 2013 by conducting intensive post-exceedance monitoring to ensure that the effluent NPDES permit limits would be met.

The M&R Department provided emergency support to the Stickney WRP during a treatment operation upset by conducting intensive chemical and biological analyses and testing.

TABLE 5: TOTAL NUMBER OF ANALYSES PERFORMED BY THE MONITORING AND RESEARCH DEPARTMENT'S NELAP ACCREDITED LABORATORIES IN 2013

Program	Nutrients	Oxygen Demands	Metals	Solids	Organic Compounds	Others	Program Total
4652 Liquid Monitoring*	156,691	70,615	83,657	69,508	17,550	76,539	474,560
TARP Reservoirs	360	0	166	40	0	244	810
Treatment Facilities	156,331	70,615	83,491	69,468	17,550	76,295	473,750
4653 Solids Monitoring	11,319	219	22,232	137,517	6,927	19,429	197,643
4666 Sewage & Waste Control	3,703	45	339,726	1,457	28,413	9,760	383,104
4663 User Charge	0	31,972	0	9,476	0	18,547	59,995
4671 Lake Michigan	791	467	190	583	3,318	1,222	6,571
4672 Waterways	5,285	859	27,213	1,872	48,343	6,890	90,462
4674 Groundwater	6,225	1,695	9,347	919	0	4,357	22,543
4681 Assistance to M&O	6,415	486	5,687	2,166	4,204	8,604	27,562
4682 Assistance to Others	610	458	515	222	0	688	2,493
4684 Engineering	30,337	5,003	3,427	3,318	0	2,432	44,517
4690 Operations & Research	7,043	2,913	36,665	1,771	2,829	3,935	55,156
Total Group	228,419	114,732	528,659	228,809	111,584	152,403	1,364,606

\* 4652 Liquid Monitoring is the sum of TARP and Treatment Facilities.

TABLE 6: TOTAL NUMBER OF ANALYSES PERFORMED BY THE MONITORING AND RESEARCH DEPARTMENT'S ANALYTICAL MICROBIOLOGY LABORATORY IN 2013

Program	Total Coliform/Fecal Coliform/E. Coli/HPC <sup>1</sup>	Pathogens <sup>2</sup>	Other <sup>3</sup>
4652 Liquid Monitoring	701	735	--
4653 Solids Monitoring	85	120	115
4666 Sewage & Waste Control	8	4	--
4671 Lake Michigan (Bypass)	158	--	--
4672 Waterways	347	--	6
4674 Groundwater	489	--	--
4681 Assistance to M&O	9	--	1,389
4682 Assistance to Others	394	61	60
4690 Operations & Research	396	--	112
Total	2,587	137	1,567

<sup>1</sup> HPC = Heterotrophic Plate Count.

<sup>2</sup> Includes *Salmonella*, *enteric virus*, and *Ascaris ova* (Helminth Ova).

<sup>3</sup> Includes filament, ammonia oxidizing bacteria (AOB), nitrite oxidizing bacteria (NOB), and phosphorus accumulating organism (PAO).

### Provide Technical Assistance to Other Departments and Agencies

**Polymer Studies.** The District's dewatering polymer chemical costs are in excess of \$5,000,000. The M&R Department is working with M&O to optimize post-digestion centrifuge operations at the Stickney WRP with respect to reducing polymer consumption. The study findings concluded that lower polymer use can be achieved through adjusting and optimizing the current centrifuge operations. The M&R Department prepared a centrifuge operational guidance manual and procedures based on this concept for use by M&O and plans to conduct a full-scale implementation study, and developed a semi-automatic approach to operate the centrifuges in order to further reduce polymer consumption and increase efficiency of the dewatering operations. This strategy will be explored in 2014 as a first step towards a fully automated polymer control system. Additionally, M&R conducted polymer quality control testing

throughout the year to verify the consistency of polymer quality and provided M&O the summary of results monthly.

**Disinfection Study.** In 2013, M&R continued an investigation of the disinfection process at the Egan WRP during dry and wet weather conditions. The study was undertaken to prevent violations of the Egan WRP NPDES permit for fecal coliform. A full-scale process evaluation was completed in order to determine the impact of turbidity, suspended solids, and transient conditions on the disinfection process. The M&R Department will provide recommendations for process control improvements in 2014.

**Aeration Diffuser Evaluation.** The Egan WRP replaced the original, 1975-installed aeration diffuser plates in the South Aeration Battery in 2012. The M&R Department conducted off-gas testing in 2011 and 2013 to determine the oxygen transfer efficiencies of the new diffuser plates relative to the replaced plates. A data report presenting the results will be provided in 2014.

**New Technology Evaluation.** In 2013, M&R investigated the effectiveness of three different chemical formulations from two different vendors for potential future use in mitigating collection system odors. One of the formulations may progress to a full-scale pilot test in 2014.

Due to plant capacity limitations associated with the ammonia-rich centrate recycle stream, the Egan WRP routinely conveys its ammonia-rich centrate recycle stream to the Terrence J. O'Brien (O'Brien) WRP for treatment. It appears that this is creating odors in the Kirie WRP service area and while the Egan centrate is en route to the O'Brien WRP and is leading to corrosion of the sewers. The M&R Department evaluated a partial nitrification/deammonification sequencing batch reactor suspended growth process (Demon®) in a pilot study for five months starting in 2012 and ending in 2013 under normal operating and stress conditions at the Egan WRP to evaluate its ability to remove ammonia from the ammonia-rich centrate for odor control using anammox bacteria. The pilot study demonstrated the effectiveness of the Demon® process for removing 90% ammonia-nitrogen from the centrate with the addition of supplemental alkalinity. Technical support is currently being provided for the full-scale implementation of a moving bed biofilm reactor technology called Anita Mox™ using anammox bacteria.

In 2013, the District received the Excellence in Innovation Award from the Water Environmental Research Foundation for its role in piloting innovative shortcut nitrogen removal technology and hosting a national workshop to foster information and data exchange with other wastewater utilities.

**Support Energy Neutral Initiatives.** The District has set a goal of achieving energy neutrality within 10 years. An important component in achieving this goal is to maximize use of anaerobic digestion capacity to generate methane biogas. The M&R Department provided critical

review and comments for the Energy Neutral Initiatives. This included gas production and digester capacity analyses for both the Calumet and Stickney WRPs along with evaluation and estimation of numerous external wastes for suitability to supplement District digestion systems. Additionally, a preliminary analysis of criteria for acceptable high strength wastes, as well as digester pretreatment technologies, was performed. The M&R Department is supporting the development of a trucked high-strength waste program.

As a part of M&O's polymer contract procurement process, M&R conducted bench-scale polymer testing followed by full-scale testing. The test results helped M&O to purchase the most cost-effective product for Hanover Park's sludge thickening operations.

**Stormwater Management.** In support of the Engineering Department Stormwater Management Program, M&R continued its collaboration with the United States Geological Survey in 2013 to evaluate the effect of green infrastructure Best Management Practices (BMPs) such as permeable pavements, bioswales, planters on stormwater flow, and pollutant load reduction in the Sustainable Streetscape Project located on West Cermak Road between South Halsted Street and South Ashland Avenue, and South Blue Island Avenue between South Ashland Avenue and South Western Avenue. Collection of baseline and partial construction data of precipitation, combined sewer flow, groundwater levels, wastewater quality, and groundwater quality has now been completed. Post-construction monitoring was started in 2013, with the goal to evaluate the effectiveness of BMPs.

In addition, M&R completed the investigation on performance and evaluation of three different permeable pavements on stormwater flow and pollutant load reduction relative to a control parking lot at the Stickney WRP. A final project report was published in 2013, M&R Report No. 13-49.

**Phycoremediation.** In support of the Engineering Department, M&R continued to provide support on the evaluation of phycoremediation-based technologies for nutrient recovery from side streams at some of the District's WRPs. The M&R Department also developed a technical paper on theoretical evaluation of phycoremediation technologies for the Engineering Department.

**Process Facility Planning.** The M&R Department's newly formed Process Facility Capital Planning (Planning) Section led an inter-departmental task force including staff from the Engineering and M&O Departments to evaluate planned improvements to preliminary and primary treatment at the Westside portion of the Stickney WRP, specifically replacing existing skimming tanks with aerated grit tanks and Imhoff tanks with some form of primary treatment. For preliminary treatment, the task force determined that the aerated grit facility, as designed, could be reduced in size, that there was no need for a building to house the facility, and that a conveyor screw was the most ideal grit removal technology based on operating, maintenance and economic factors. For primary treatment, the task force performed a modified triple bottom line analysis that considered economic, technology, and social/ environmental factors to evaluate

alternatives ranging from no primary treatment to chemically enhanced primary treatment. From this analysis, the task force determined that nine conventional, circular primary settling tanks with the ability to bypass directly to secondary treatment, if needed, were the best alternative for replacing the existing Imhoff tanks.

**Asset Management.** In 2013, M&R also led another interdepartmental task force to perform the evaluation of the replacement/rehabilitation of the D799 Electrical Substation at the Stickney WRP. The task force investigated options to address reliability and safety concerns at the substation. Three viable alternatives, refurbishment, retrofit, and complete replacement of the switchgear and components were evaluated using a modified triple bottom line analysis similar to the Westside preliminary and primary treatment evaluation. The final evaluation matrix developed by the task force identified complete replacement using the construction fund as the ideal option for D799. The task force also recommended combining the M&O-led cable replacement contract with the switchgear replacement to gain efficiencies in contract administration, work execution, and fewer plant shutdowns.

An interdepartmental task force led by M&R's Planning group conducted a comprehensive engineering evaluation of the capital improvements to preliminary and primary treatment at the West Side portion of the Stickney WRP and provided critical information to the District's Executive team for decisions that could potentially save \$90 million in capital investment.

**Phosphorus Task Force.** The M&R Department, in conjunction with the Engineering and M&O Departments, formed a Phosphorus Task Force in order to assess and implement biological phosphorus removal and recovery at four District WRPs. The M&R Department has been conducting a full-scale enhanced biological phosphorus removal (EBPR) study in Battery D at the Stickney WRP using existing infrastructure. The process was implemented by creating anoxic, anaerobic, and aerobic zones in the battery, which would favor the growth of phosphate accumulating organisms and luxury uptake of phosphate. Process improvement included adjusting the air input to the different zones, equalizing the recycle flow from the lagoons, and reducing the organic removal from the primary treatment process to add additional carbon to the EBPR process. Due to the success in the test battery, EBPR was implemented in the remaining three batteries at the Stickney WRP. Process optimization and evaluation of infrastructure needs will continue in 2014.

In 2013, Battery A at the Calumet WRP was converted to the EBPR process to mimic the Stickney WRP process. The M&R Department has been conducting monitoring of this battery along with a control, Battery B. Also, M&R supported a comprehensive evaluation of carbon needs and technologies for improving the EBPR process at the plant. The M&R Department plans to conduct a pilot test using a sequencing batch reactor in 2014 to address process improvement and infrastructure needs at the Calumet WRP.

An initial evaluation for implementing the EBPR process at the Kirie WRP was performed through an analysis of historical plant influent data and laboratory-scale tests in 2013.

An EBPR demonstration test is planned in two aeration tanks starting in 2014. At the Kirie WRP, mechanical mixers and in-stream baffles would be added to the existing aeration tanks and evaluated during the test. Additionally, the impact of generating carbon in the EBPR process will be evaluated through three different fermentation alternatives including RAS sidestream fermentation, mixed liquor sidestream fermentation, and mixed liquor inline fermentation.

As part of the Phosphorus Task Force, M&R assisted in reviewing the Best and Final Offers regarding technologies to recover phosphorus from the Stickney WRP post digester centrifuge centrate stream. An upflow fluidized bed reactor and struvite harvest technology was selected in 2013. The M&R Department will continue to provide technical, laboratory, and data-collection support in 2014 for this selected technology.

**Addressing Odor Issues.** The M&R Department performed a pilot study with respect to potentially receiving a high strength sodium sulfate waste in the Calumet interceptor system to be discharged by an industry. This study examined the effect on odor generation in the interceptor and at the plant, microbiology in the secondary treatment process and digester gas production. The results of this study and areas of concern will be addressed in the discharge authorization for this facility.

Three process buildings at the Egan WRP are expected to undergo modifications to improve odor control. The M&R Department performed a baseline odor characterization of these buildings in 2013. A post-modification evaluation will be performed in the future to verify the effectiveness of new odor control measures.

**Assistance to Outside Agencies.** M&R has been providing assistance to oversight agencies studying and controlling the migration of invasive aquatic species for decades. In 2013, M&R assisted the United States Fish and Wildlife Service with electro-fishing and netting to investigate the presence of Asian Carp in the Des Plaines River near Lemont and Willow Springs. No Asian Carp were found.

In April of 2013, M&R began collecting and analyzing water samples from a sampling location on Buffalo Creek for the Buffalo Creek Clean Water Partnership. Sampling continued through October and will continue for one more year in April of 2014.

The M&R Department assisted with the collection of sediment from locations in the CAWS for a project that is being conducted by the University of Iowa, Indiana University, and the USEPA. The study involves testing sediments for chemicals that are used to make materials flame retardant.

The M&R Department provided in-kind support to an Illinois Institute of Technology (IIT) project, which is funded by the National Science Foundation. The project involves cyber physical systems in which intelligent sensor networks and software are applied to achieve more efficient and effective operations by providing real-time response for wastewater treatment. The IIT project is being conducted at the Calumet WRP. The M&R Department provided plant data



for the creation of a process model, technical support, and aided in the collection of monitoring data.

**Technical Support for Biosolids Program.** The M&R Department provides technical support to the District's Biosolids Farmland Application Program in which biosolids are applied by a contractor as a fertilizer for production of row crops in nearby counties. Technical support includes implementing a Public Relations Program and review and approval of fields for biosolids application. The activities conducted during 2013 included the following:

- Review of 330 field information packages to evaluate suitability for land application of biosolids.
- Field inspections in response to public complaints regarding land application activities.
- Presentations at a field day organized by the land application contractor.
- Establishment of two demonstration plots at the farmers' fields in Kendall and LaSalle Counties to compare performance of biosolids with commercial fertilizers for production of row crops for promoting the Biosolids Farmland Application Program.

### **Applied Research to Achieve Operational Improvement and Cost Reductions**

**Biosolids.** Since 1973, the District has been conducting a corn fertility experiment on calcareous mine spoil at the Fulton County site. The purpose of this experiment is to evaluate the effect of long-term applications of anaerobically digested biosolids on crop yields, crop chemical composition, and mine spoil chemical composition. The experiment was designed to simulate biosolids application to fields at the site at agronomic and reclamation rates, and to provide information that can be used for management of biosolids and crops. In 2011, new plots were established at the Fulton County site to develop a robust data set based on modern high quality biosolids produced after the District's industrial pretreatment program was fully implemented. During 2013, soil and plant tissue samples were collected from the plots for analysis.

The occurrence of perfluorinated compounds (PFCs) in biosolids and the potential risk of transport of these compounds through the food chain is an emerging issue to the sustainability of the practice of biosolids application to farmlands. The District collaborated with the USEPA to collect data on the uptake of PFCs in crops for an evaluation of exposure risks to humans. As part of this collaboration, the District also conducted a field study and generated samples of vegetable crops grown in biosolids-amended soil. The soil and edible plant tissue samples of vegetable crops were submitted to the USEPA for analysis of PFCs. A report summarizing the concentrations of PFCs detected in the edible portions of vegetable crops will be prepared in 2014.

**Resource Recovery.** The District is committed to recovering phosphorus, a non-renewable resource, from the sewage and urban runoff it receives at its WRPs. To achieve this, the District has committed to deploying enhanced biological phosphorus removal and sidestream recovery. During 2013, M&R also conducted a study on the sources of phosphorus in influent wastewater. This study included a review of sampling and analysis of a few industries focusing on the O'Brien and Calumet WRPs' service area. The M&R Department also formed a Phosphorus Source Control Task Force, which is taking measures to partner with industry for source P-reduction. This task force has prepared a letter to industries inviting them to partner with the task force to explore opportunities for source control and recovery.

It is believed that some industrial sectors are promising candidates for phosphorus source control and resource recovery and that this will provide a benefit to the industries, the District, and the water environment. The M&R Department is currently evaluating this through an industrial survey and surveillance study.

**Mainstream Short-Cut Nitrogen Removal.** A technology review of short-cut nitrogen removal approaches to reduce aeration energy in mainstream secondary treatment was initiated in 2013. Two approaches, nitritation/denitritation and partial nitritation/deammonification, have been considered pertinent to the District's existing infrastructure and treatment processes. Research study on this subject will continue in 2014 and laboratory and field pilot testing will be identified, designed, and planned to determine how these approaches can tie into the EBPR processes at District facilities.

**Aquatic Environment.** The M&R Department continued to investigate the potential for endocrine active compounds to enter the area waterways and assess the impact to the aquatic biota. In 2013, the District collaborated with St. Cloud State University to conduct on-site exposure experiments at the Calumet WRP. The experiments involved the use of a mobile trailer that was set up with a flow through design to expose fathead minnows to various concentrations of the final effluent. After 12 days of continuous exposure, the fathead minnows were analyzed at various biological endpoints to look for biological effects from exposure to WRP effluents. Results of these studies will be available in 2014.

The M&R Department began a two-year study involving four off-channel slips located in the South Branch of the Chicago River. This study will identify which slip or slips are most utilized by fish and benthic macroinvertebrates, and determine what features make a slip more productive. Dissolved oxygen profiling, fish and macroinvertebrate sampling, and habitat quality assessments were conducted during 2013.

The M&R Department began a seven-year Microbiome Project in 2013 in collaboration with Argonne National Laboratory to get information on the microbial sources in the CAWS that can be used to better interpret and understand water quality in the CAWS.

In 2013, M&R began a seven-year Microbiome Project in collaboration with Argonne National Laboratory to get information on the microbial source in the CAWS that can be used to guide decisions on water quality in the CAWS. This study will track the microbial sources in the CAWS and will aid in evaluating the impact of future disinfection activities and TARP reservoir operations on CAWS water quality. The study will be conducted in three phases. The years 2013–2014 will represent the pre-disinfection baseline condition, the years 2015–2017 will represent the completion of the TARP Thornton Reservoir and implementation of disinfection, and the years 2018–2019 will represent the completion of Phase I of the TARP McCook Reservoir and post-disinfection. Argonne National Laboratory is using the metagenomics approach to identify the sources of microorganisms in the CAWS. In 2013, M&R provided water and sediment samples for analysis during the recreation season.

In 2013, M&R conducted monitoring and research in the North Shore Channel and North Branch Chicago River to evaluate the potential to automate control of Lake Michigan diversion water to optimize water quality. Also in 2013, M&R initiated an evaluation of the Devon Avenue sidestream aeration station to determine whether its relocation would result in improved water quality in the upper Chicago River System.

## LOOKING AHEAD

In 2014, M&R will continue its organizational redesign by initiating a restructuring of its Industrial Waste Division to provide geographically focused, unified service centers to administer its ordinances. It is envisioned that this will entail redividing the District's service area into fewer regions, developing account administrators to handle all ordinances that apply to each industrial account and develop better coordination and partnership between account administration and field surveillance operations. These steps, in combination with continued development of the PIMS computerized system for maintaining records and automating data analysis, correspondence and business flow, will result in reduced program administrative costs. The M&R Department will continue to support the attainment of the goals of the District's strategic plan in 2014 and beyond.

The M&R Department will contribute to developing all employees in 2014 by continuing to offer its monthly seminar series, maintaining its chemical hygiene plan, and increasing access to webinars and web-based training. During 2014, M&R will be also proactive in taking advantage of any relevant training opportunities to meet the twenty-four hours professional development training for employees.

In 2014, M&R will continue to contribute to developing a better understanding of water quality in the CAWS by continuing: its microbial source tracking study with Argonne National Laboratory, the completion of a 3-dimensional hydrodynamic and water quality model with the University of Illinois, and its ambient water quality monitoring to characterize conditions prior to the TARP reservoir completion.

In 2014, M&R workgroups will develop guidelines for document generation and management redesign to streamline the documentation process, and migrate more fully to a completely digital, or electronic, business flow.

In 2014, the newly formed Process Facility Capital Planning Section will lead a District-wide effort of developing a long-term capital plan, addressing future capital needs based on projected regulatory requirements, community expectation and District major initiatives. This section will also lead the development of the District's Biosolids Master Plan, perform WRP Master Plan updates, initiate an Odor Master Plan for all District facilities, and conduct capital project evaluation for the Capital Improvement Program before engineering design. The M&R Department will initiate a capital improvement project vetting process for the District and facilitate the process in 2014.

In 2014, M&R will contribute to improving the District's public image by continuing outreach and education to the public to promote the Biosolids Program by participating in public meetings, and by developing informational materials and presentations on the District's mission, operational achievements, and water quality improvements. The M&R Department will also continue working with M&O to move to full-scale production of a value-added product by co-composting biosolids and wood chips for distribution under the Controlled Solids Distribution Program.

# **APPENDIX I**

## APPENDIX I

### MEETINGS AND SEMINARS 2013

#### January 2013

American Institute of Chemical Engineers, 5<sup>th</sup> Annual Midwest Regional Conference, Chicago, Illinois.

DuPage River Salt Creek Workgroup, Annual Meeting (and follow-up meetings throughout the year), Downers Grove, Illinois.

Illinois Water Environment Association and the Illinois Section of the Central States Water Environment Association, 2013 Government Affairs, Willowbrook, Illinois.

Midwest American Institute of Chemical Engineers, 2013 Annual Meeting, Chicago, Illinois.

Midwest Water Analyst Association, Winter Expo 2013 (and follow-up meetings throughout the year), Kenosha, Wisconsin.

Water Environment Research Federation, 8<sup>th</sup> Annual Research Forum, Chicago, Illinois.

#### February 2013

Asian Carp Regional Coordinating Committee, Technical and Policy Workgroup Meeting (and follow-up meetings throughout the year), Chicago, Illinois.

Industrial Water, Waste, and Sewage Group Meeting (and follow-up meetings throughout the year), Chicago, Illinois.

Michigan State University Workshops: 100-year Study and Quantitative Microbial Risk Assessment, Chicago, Illinois.

#### March 2013

American Academy of Environmental Engineers Conference, Washington, D.C.

Illinois Chapter of the American Fisheries Society, Annual Meeting, Whittington, Illinois.

Illinois Association of Water Pollution Control Operators Conference, Springfield, Illinois.

Illinois Section of the American Water Works Association and Illinois Water Environment Association, WaterCon 2013, Joint Conference and Expo, Springfield, Illinois.

Illinois Statewide Nutrient Reduction Strategy Workgroup Meeting (and follow-up meetings throughout the year), Springfield, Illinois.

## APPENDIX I

### MEETINGS AND SEMINARS 2013 (CONTINUED)

National Partnership for Environmental Technology Education Conference, Greenville, South Carolina.

The Conservation Foundation 4<sup>th</sup> Beyond the Basics: Stormwater Best Management Practices Seminar, Woodridge, Illinois.

United States Environmental Protection Agency, Region 5 Headquarters Training Session for Illinois Beaches Implementation Tool, Chicago, Illinois.

#### April 2013

Agilent Technologies, Agilent LC Master Class Seminar, Schaumburg, Illinois.

Illinois Nutrient Research and Education Council Meeting, Champaign, Illinois.

#### May 2013

American Society for Microbiology, 2013 Meeting, Denver, Colorado.

Illinois Association of Wastewater Agencies, Technical Committee Meeting (and follow-up meetings throughout the year), Utica, Illinois.

Illinois Environmental Protection Agency, Nutrient Stakeholders Workgroup Meetings (and follow-up meetings throughout the year), Springfield, Illinois.

Lake County North Branch Chicago River Planning Committee Meeting, Deerfield, Illinois.

National Association of Clean Water Agencies, National Pretreatment and Pollution Prevention Seminar, Portland, Oregon.

Winnebago County Local Emergency Planning Committee, Midwest Emergency Preparedness Seminar, Rockford, Illinois.

#### June 2013

United States Department of Agriculture, W-2170 Committee Meeting, Denver, Colorado.

Wastewater Operator Hands-on Training on Online Process Instrumentation for Activated Sludge Monitoring, Delafield, Wisconsin.

Water Environment Federation Activated Sludge on it's 100<sup>th</sup> Birthday: Challenges and Opportunities, Easton, Massachusetts.

## APPENDIX I

### MEETINGS AND SEMINARS 2013 (CONTINUED)

Water Environment Federation/International Water Association Nutrient Removal and Recovery 2013, Vancouver, British Columbia, Canada.

#### July 2013

Chicago Area Waterway System, Use Attainability Analysis, Illinois Pollution Control Board Hearing (and follow-up meetings throughout the year), Chicago, Illinois.

Ecological Restoration Conference, Schaumburg, Illinois.

Hach, Hach Analytical Training Workshop, Oakbrook, Illinois.

Peregrine Lake Homeowners Association Meeting, Palatine, Illinois.

PerkinElmer, PerkinElmer INTOUR 2013, Chicago, Illinois.

#### August 2013

American Waterworks Association, Illinois Section, Meter Symposium, Countryside, Illinois.

Fox Valley Operator Association Conference, Carpentersville, Illinois.

#### September 2013

Algae Biomass 7<sup>th</sup> Annual Summit, Orlando, Florida.

Illinois Emergency Management Agency Conference, Springfield, Illinois.

Illinois Water Environment Association 2013 Nutrient Removal and Reuse Workshop, Addison, Illinois.

Nature Conservancy Great Rivers Partnership; Upper Mississippi River Basin Meeting, Moline, Illinois.

#### October 2013

Agilent Technologies, Agilent QQQ LC/MS User Workshop, Wood Dale, Illinois.

Great Lakes Beach Association Conference, Sheboygan, Wisconsin.



## APPENDIX I

### MEETINGS AND SEMINARS 2013 (CONTINUED)

Illinois Water Environment Association Seminar, Loves Park, Illinois.

iPACS (internet POTW Administrative and Compliance System), User Group Conference, North Brunswick, New Jersey.

Midwest Water Analysts Association Meeting, Milwaukee, Wisconsin.

Society for Ecological Restoration, 5<sup>th</sup> World Conference, Madison, Wisconsin.

Water Environment Federation and Water Environment Research Foundation Mainstream Deammonification and Shortcut TN Removal: Innovation and Implementation, Chicago, Illinois.

Water Environment Federation Challenges with Nutrients-Troubleshooting and Optimizing Nutrient Removal, Chicago, Illinois.

Water Environment Federation, Technical Exhibition and Conference 2013, Chicago, Illinois.

#### **November 2013**

Air and Waste Management Association, Lake Michigan States Section, 2013 Air Quality Management Conference, Oak Brook, Illinois.

Illinois Water Environment Association and Central States Water Environment Association Biosolids Seminar, Stickney, Illinois.

Industrial Water, Waste and Sewage Group Meeting, Chicago, Illinois.

The Society of Environmental Toxicology and Chemistry North America Conference, Nashville, Tennessee.

#### **December 2013**

Illinois Association of Environmental Laboratories, Midwest Environmental Stakeholders Summit, Chicago, Illinois.

# **APPENDIX II**

## APPENDIX II

### PRESENTATIONS 2013

#### January 2013

“Challenges to Planning Effective Management of Wet Weather Events Including Sustainability, Affordability, and Dependability.” Presented at the Water Environment Research Federation, 8<sup>th</sup> Annual Research Forum, Chicago, Illinois, by T. C. Granato. PP

“Deammonification for Sidestream Treatment: Process Mechanisms and Pilot Test Results from the Egan Water Reclamation Plant.” Presented at the Midwest American Institute of Chemical Engineers Annual Meeting, Chicago, Illinois, by J. Kozak. PP

“Globally Harmonized System of Classification and Labeling of Chemicals: An Introduction.” Presented at the Midwest Water Analyst Association, Winter Expo Meeting 2013, Kenosha, Wisconsin, by R. Polis. PP

“Preliminary Assessment of Chemical Analysis and Toxicity of Sediment in the Chicago Area Waterway System.” Presented at the Midwest Water Analyst Association, Winter Expo Meeting 2013, Kenosha, Wisconsin, by D. Gallagher. PP

#### February 2013

“Microbial Assessment of Biological Nutrient Removal.” Presented at the 5<sup>th</sup> Annual American Institute of Chemical Engineers Midwest Regional Conference, Chicago, Illinois, by G. Rijal. PP

“Phosphorus Removal and Recovery Initiatives at the Metropolitan Water Reclamation District of Greater Chicago.” Presented at the Northwestern University Department of Civil and Environmental Engineering Bi-Weekly Seminar, Evanston, Illinois, by J. Kozak. PP

#### March 2013

“Land Application of Biosolids: Federal and Illinois State Regulations.” Presented at the National Partnership for Environmental Technology and Education/HAZMAT Refresher Workshop, Greenville, South Carolina, by P. Lindo. PP

“Primary Effluent Chlorination.” Presented at the Illinois Section of the American Water Works Association and Illinois Water Environment Association, WaterCon 2013, Joint Conference and Expo, Springfield, Illinois, by D. Bernstein. PP

“Sidestream Nitrogen Removal at the John E. Egan Water Reclamation Plant by DEMON<sup>®</sup> Process.” Presented at the Illinois Section of the American Water Works Association and Illinois Water Environment Association, WaterCon 2013, Joint Conference and Expo, Springfield, Illinois, by D. Qin. PP

## APPENDIX II

### PRESENTATIONS 2013 (Continued)

“Using a Mobile Laboratory to Assess Estrogenicity in Water Reclamation Plant Effluents, Experimental Design & Procedure.” Presented at the Illinois Section of the American Water Works Association and Illinois Water Environment Association, WaterCon 2013, Joint Conference and Expo, Springfield, Illinois, by J. Vick. PP

#### April 2013

“Developing a Wastewater Microbiology Laboratory Program.” Presented at the Illinois Association of Water Pollution Control Operators Conference, Springfield, Illinois, by A. Glymph-Martin. PP

#### May 2013

“Enumeration of Ammonia and Nitrite Oxidizing Bacteria in the Metropolitan Water Reclamation District of Greater Chicago’s Stickney Water Reclamation Plant Using the Molecular Gene Probe Method.” Presented at the American Society for Microbiology 113<sup>th</sup> General Meeting, Denver, Colorado, by G. Rijal. PS

“MWRDGC’s Environmental Monitoring in the North Branch Chicago River Watershed.” Presented to the Lake County North Branch Chicago River Planning Committee, Deerfield, Illinois, by J. Wasik. PP

#### June 2013

“Sidestream Nitrogen Removal at the John E. Egan Water Reclamation Plant by DEMON<sup>®</sup> Process.” Presented at Water Environment Federation/International Water Association Nutrient Removal and Recovery 2013 Conference, Vancouver, British Columbia, Canada, by H. Zhang. PP

“Water Quality Within the Chicago Area Waterway System, Where Are We Today and Where Are We Headed?” Presented at the Midwest Water Analysts Association, Spring Meeting 2013, Chicago, Illinois, by T. Minarik. PP

#### July 2013

“The Impact of Sanitation on Chicago’s Geography.” Presented at the Chicago State University, Chicago, Illinois, by D. Bernstein. PP

## APPENDIX II

### PRESENTATIONS 2013 (Continued)

#### August 2013

“What do the Bugs Indicate about the Health of the Treatment Process?” Presented at the Fox Valley Operator Association Mini Conference, Carpentersville, Illinois, by A. Glymph-Martin. PP

#### September 2013

“Biosolids: Beneficial & Sustainable Management.” Presented at the 2013 Sustainability Workshop, Midlothian, Illinois, by K. Kumar. PP

“Phosphorus Removal and Recovery Initiatives.” Presented at the Illinois Water Environment Association Nutrient Removal and Recovery Workshop, Addison, Illinois, by J. Kozak. PP

“Resource Recovery and Utilization from Waste Water.” Presented at the Stewart Environmental Inc. Field Day, Sheridan, Illinois, by K. Kumar. PP

“Sustainability of Biosolids Land Application.” Presented at the Stewart Environmental Inc. Field Day, Sheridan, Illinois, by K. Kumar. PP

#### October 2013

“A Laboratory Program for Wastewater Microbiology.” Presented at the Illinois Water Environment Association Plant Operations Seminar, Loves Park, Illinois, by A. Glymph-Martin. PP

“Activated Sludge and Biological Nutrient Removal Process Control: Hands-on in the Real World - Wastewater Microbiology Session.” Presented at the Water Environment Federation Annual Conference, Schaumburg, Illinois, by A. Glymph-Martin. PP

“Collimated Beam Testing and Ultraviolet Dosage Rates: How They Can Lower Costs as Shown in the O’Brien Water Reclamation Plant Ultraviolet Disinfection Project.” Presented at the Water Environment Federation, Technical Exhibition and Conference 2013, Chicago, Illinois, by J. Moran-Andrews. PP

“Pathogens for the 21<sup>st</sup> Century: Assays, Indicators and Fate Workshop.” Presented at the Water Environment Federation, Technical Exhibition and Conference 2013, Chicago, Illinois, by G. Rijal, R. Gore, and H. Shukla. PP

“Performance of Sustainable Streetscapes in Chicago.” Presented at the Water Environment Federation, Technical Exhibition and Conference 2013, Chicago, Illinois, by K. Kumar. PP

## APPENDIX II

### PRESENTATIONS 2013 (Continued)

#### November 2013

“Annual User Update.” Presented at the Industrial Water Waste and Sewage Group Meeting, Chicago, Illinois, by T. C. Granato. PP

“MWRD Initiative to Co-Compost Biosolids and Wood Chips to Produce a Value-Added Product.” Presented at the Illinois Water Environment Association Biosolids Seminar, Cicero, Illinois, by L.S. Hundal. PP

“Resource Recovery from Waste Water.” Presented at the Illinois Water Environment Association Biosolids Seminar, Cicero, Illinois, by K. Kumar. PP

#### December 2013

None

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\* PP=Available as PowerPoint Presentation  
PS=Poster Presentation

# **APPENDIX III**

## APPENDIX III

### PAPERS PUBLISHED IN 2013

Blaine, A. C., C. D. Rich, L. S. Hundal, C. Lau, M. A. Mills, K. M. Harris, and C. P. Higgins, "Uptake of Perfluoroalkyl Acids into Edible Crops via Land Applied Biosolids: Field and Greenhouse Studies." *Environmental Science and Technology*, 47:14062-14069, 2013.

Broadhurst, C. L., R. L. Chaney, A. P. Davis, A. Cox, K. Kumar, R. D. Reeves, and C. E. Green, "Growth and Cadmium Phytoextraction by Swiss Chard, Maize, Rice, *Noccaea Caerulescens* and *Alyssum Murale* in pH Adjusted Biosolids Amended Soils." *International Journal of Phytoremediation*, Accepted (DOI: 10.1080/15226514.2013.828015), 2013.

Hundal, L.S., "Restoring Ecological Health to Your Land." *Journal of Environmental Quality*, 42(1):293-293, 2013.

Martinovic-Weigelt D., T. Minarik, E. Curran, J. Marchuk, M. Pazderka, E. Smith, R. Goldenstein, C. Miresse, T. Matlon, M. Schultz, and H. Schoenfuss, "Environmental Estrogens in an Urban Aquatic Ecosystem: I. Spatial and Temporal Occurrence of Estrogenic Activity in Effluent-Dominated Systems." *Environment International*, 61: 127 -137.

Oladeji O. O., G. Tian, A. Cox, T. C. Granato, C. O'Connor, Z. Abedin, and R. I. Pietz, "Effect of Long Term Application of Biosolids for Mine Land Reclamation on Groundwater Chemistry: Nitrogen, Phosphorus, and Other Qualities." *Journal of Environmental Quality*, 42(1):94-102, 2013.

Schultz M., T. Minarik, D. Martinovic-Weigelt, E. Curran, S. Bartell, and H. Schoenfuss, "Environmental Estrogens in an Urban Aquatic Ecosystem: II. Biological Effects." *Environment International*, 61: 138 – 149.

Singh, A., S. Gupta, K. Kumar, S. Gupta, Y. Chander, A. Gupta, and R. Saxena, "Quantitative Analysis of Conjugated and Free Estrogens in Swine Manure: Solutions to Overcome Analytical Problems due to Matrix Effect." *Journal of Chromatography*, A 1305: 203-212, 2013.

Thangarajan R, N. S. Bolan, G. Tian, R. Naidu, and A. Kunhikrishnan, "Role of Organic Amendments Application on Greenhouse Gas Emission from Soil." *Science of the Total Environment*, 465: 72–96, 2013.

Tian G., A. J. Franzluebbbers, T. C. Granato, A. Cox and C. O'Connor, "Stability of Soil Organic Matter Under Long-Term Biosolids Application." *Applied Soil Ecology*, 64: 223-227, 2013.



# **APPENDIX IV**

**APPENDIX IV  
METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO  
MONITORING AND RESEARCH DEPARTMENT 2013 SEMINAR SERIES**

- January 18, 2013** *Using Biosolids to Restore and Revitalize Soil Ecosystem Services to Degraded Soil in the Calumet Region*  
Professor Nick Basta, Soil and Environmental Chemistry, Ohio State University, Columbus, Ohio
- February 22, 2013** *Challenges of Relocating Metropolitan Water Reclamation District of Greater Chicago Interceptor near Wacker Drive*  
Mr. Brad Bacilek, Resident Project Manager, Alfred Benesch & Company, Chicago, Illinois
- April 5, 2013** *Implementation and Operation of Enhanced Biological Removal at the Metropolitan Wastewater Treatment Plant (St. Paul, Minnesota)*, Mr. George Sprouse, Manager of the Process Engineering Group, Metropolitan Council Environmental Services, St. Paul, Minnesota
- April 26, 2013** *Los Angeles County Sanitation Districts' Odor Control Practices*  
Mr. Rob Morton, Supervising Engineer, Sanitation Districts of Los Angeles County, Whittier, California
- May 24, 2013** *Nutrient Removal at the Metro Wastewater Reclamation District in Denver*  
Mr. Jim McQuarrie, Metro Wastewater Reclamation District, Denver, Colorado
- June 28, 2013** *Plant and Animal Survey of Woodlands and Wetlands on 25 Metropolitan Water Reclamation District of Greater Chicago Properties*  
Mr. Irwin Polls, Ecological Monitoring and Assessment, Chicago, Illinois
- July 26, 2013** *Adaptive Watershed Management to Achieve the Designated Use for Aquatic Life: Salt Creek and the Upper DuPage River*  
Mr. Stephen McCracken, Program Manager, DuPage River Salt Creek Workgroup, Naperville, Illinois
- August 23, 2013** *Components of a Successful Biosolids Composting Facility-A Case Study*  
Ms. Lorrie Loder, Director of Product Marketing at Synagro, Orange County, California
- September 27, 2013** *Regulation of Phosphorus Fertilizer Application to Turf in Minnesota: History and Environmental Implications*  
Professor Carl Rosen, Department Head of Soil, Water, and Climate, University of Minnesota, Twin Cities, Minnesota
- October 25, 2013** *Controlling Infiltration and Inflow into Sewer Systems within the Metropolitan Water Reclamation District of Greater Chicago, Ms. Maureen Durkin, Supervising Civil Engineer, Engineering Department, Metropolitan Water Reclamation District of Greater Chicago (District), Chicago, Illinois*
- November 22, 2013** *Moving Towards Effluent Disinfection at the District's Terrence J. O'Brien (formerly North Side) and Calumet Water Reclamation Plants,*  
Mr. Ed Brosius, Supervising Civil Engineer, Engineering Department, District, Chicago, Illinois
- December 13, 2013** *Evaluation of the Impact of Lake Discretionary Diversion on Water Quality of the Chicago Area Waterways System*  
Professor Charles Steven Melching, Marquette University, Department of Civil and Environmental Engineering, Milwaukee, Wisconsin

**RESERVATIONS REQUIRED (at least 24 hours in advance); PICTURE ID REQUIRED FOR PLANT ENTRY**  
**CONTACT: Dr. Heng Zhang, Assistant Director of Monitoring and Research, EM&R Division, (708) 588-4264 or (708) 588-4059**  
**LOCATION: Stickney Water Reclamation Plant, Lue-Hing R&D Complex, 6001 West Pershing Road, Cicero, IL 60804; TIME: 1:30 P.M.**  
**NOTE: These seminars are eligible for Professional Development Credits/CEUs**

# **APPENDIX V**

**APPENDIX V**

**MONITORING AND RESEARCH DEPARTMENT NUMBERED REPORTS PUBLISHED  
DURING 2013**

<b>Report No.</b>	<b>Report Title</b>	<b>Author(s)</b>	<b>Date</b>	<b>Organization or Conference</b>
2013-1	Controlled Solids Distribution Report, Fourth Quarter 2012	M&R Department Oladeji, O.	February 2013	Illinois Environmental Protection Agency (IEPA)
2013-2	Annual Biosolids Management Report for 2012	M&R Department Lindo, P.	February 2013	United States Environmental Protection Agency Region 5
2013-3	122 <sup>nd</sup> and Stony Island Solids Management Area Monitoring Report, Fourth Quarter 2012	M&R Department Lindo, P.	March 2013	IEPA
2013-4	Calumet East Solids Management Area Monitoring Report, Fourth Quarter 2012	M&R Department Lindo, P.	March 2013	IEPA
2013-5	Calumet West Solids Management Area Monitoring Report, Fourth Quarter 2012	M&R Department Lindo, P.	March 2013	IEPA
2013-6	Harlem Avenue Solids Management Area Monitoring Report, Fourth Quarter 2012	M&R Department Lindo, P.	March 2013	IEPA
2013-7	Lawndale Avenue Solids Management Area Monitoring Report, Fourth Quarter 2012	M&R Department Lindo, P.	March 2013	IEPA
2013-8	Ridgeland Avenue Solids Management Area Monitoring Report, Fourth Quarter 2012	M&R Department Lindo, P.	March 2013	IEPA
2013-9	Hanover Park Water Reclamation Plant Fischer Farm Monitoring Report, Fourth Quarter 2012	M&R Department Lindo, P.	March 2013	IEPA

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<b>Report No.</b>	<b>Report Title</b>	<b>Author(s)</b>	<b>Date</b>	<b>Organization or Conference</b>
2013-10	Controlled Solids Distribution Report, First Quarter 2013	M&R Department Oladeji, O.	May 2013	IEPA
2013-11	Hanover Park Water Reclamation Plant Fischer Farm Monitoring Report, Fourth Quarter 2012	M&R Department Lindo, P.	May 2013	IEPA
2013-12	122 <sup>nd</sup> and Stony Island Avenue Solids Management Area Monitoring Report, First Quarter 2013	M&R Department Lindo, P.	May 2013	IEPA
2013-13	Calumet East Solids Management Area Monitoring Report, First Quarter 2013	M&R Department Lindo, P.	February 2013	IEPA
2013-14	Calumet West Solids Management Area Monitoring Report, First Quarter 2013	M&R Department Lindo, P.	May 2013	IEPA
2013-15	Harlem Avenue Solids Management Area Monitoring Report, First Quarter 2013	M&R Department Lindo, P.	May 2013	IEPA
2013-16	Lawndale Avenue Solids Management Area Monitoring Report, First Quarter 2013	M&R Department Lindo, P.	May 2013	IEPA
2013-17	Ridgeland Avenue Solids Management Area Monitoring Report, First Quarter 2013	M&R Department Lindo, P.	May 2013	IEPA
2013-18	Tunnel and Reservoir Plan Calumet Tunnel System Annual Groundwater Monitoring Report for 2012	M&R Department Lindo, P.	July 2013	IEPA
2013-19	Tunnel and Reservoir Plan Des Plaines Tunnel System Annual Groundwater Monitoring Report for 2012	M&R Department Lindo, P.	July 2013	IEPA

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<b>Report No.</b>	<b>Report Title</b>	<b>Author(s)</b>	<b>Date</b>	<b>Organization or Conference</b>
2013-20	Tunnel and Reservoir Plan Gloria Alitto Majewski Chicagoland Underflow Plan Reservoir Water Quality Monitoring Wells Annual Groundwater Monitoring Report for 2012	M&R Department Lindo, P.	July 2013	IEPA
2013-21	Tunnel and Reservoir Plan Mainstream Tunnel System Annual Groundwater Monitoring Report for 2012	M&R Department Lindo, P.	July 2013	IEPA
2013-22	Tunnel and Reservoir Plan Thornton Transitional Flood Control Reservoir Water Quality Monitoring Wells Annual Groundwater Monitoring Report for 2012	M&R Department Lindo, P.	July 2013	IEPA
2013-23	Tunnel and Reservoir Plan Upper Des Plaines Tunnel System Annual Groundwater Monitoring Report for 2012	M&R Department Lindo, P.	July 2013	IEPA
2013-24	Continuous Dissolved Oxygen Monitoring in Chicago Area Wadeable Streams During 2012	M&R Department Wasik, J., T. Minarik, D. Gallagher and J. Vick	July 2013	IEPA
2013-25	Radiological Monitoring of the Raw Sewage, Final Effluent, Sludge and Biosolids of the Metropolitan Water Reclamation District of Greater Chicago 2012 Annual Report	M&R Department Khalique, A.	August 2013	Internal Report
2013-26	Control Solids Distribution Report for Second Quarter 2013	M&R Department Oladeji, O.	August 2013	IEPA

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<b>Report No.</b>	<b>Report Title</b>	<b>Author(s)</b>	<b>Date</b>	<b>Organization or Conference</b>
2013-27	122 <sup>nd</sup> and Stony Island Avenue Solids Management Area Monitoring Report, Second Quarter 2013	M&R Department Lindo, P.	August 2013	IEPA
2013-28	Calumet East Solids Management Area Monitoring Report, Second Quarter 2013	M&R Department Lindo, P.	September 2013	IEPA
2013-29	Calumet West Solids Management Area Monitoring Report, Second Quarter 2013	M&R Department Lindo, P.	August 2013	IEPA
2013-30	Harlem Avenue Solids Management Area Monitoring Report, Second Quarter 2013	M&R Department Lindo, P.	August 2013	IEPA
2013-31	Lawndale Avenue Solids Management Area Monitoring Report, Second Quarter 2013	M&R Department Lindo, P.	August 2013	IEPA
2013-32	Ridgeland Avenue Solids Management Area Monitoring Report, Second Quarter 2013	M&R Department Lindo, P.	August 2013	IEPA
2013-33	Hanover Park Water Reclamation Plant Fischer Farm Monitoring Report, Second Quarter 2013	M&R Department Lindo, P.	August 2013	IEPA
2013-34	Ambient Water Quality Monitoring in the Chicago, Calumet, and Des Plaines River Systems: A Summary of Biological, Habitat, and Sediment Quality During 2009	M&R Department Wasik, J., T. Minarik, D. Gallagher, J. Vick and N. Kollias	August 2013	IEPA
2013-35	Continuous Dissolved Oxygen Monitoring in the Deep-Draft Chicago Waterway System During 2012	M&R Department Wasik, J., T. Minarik, D. Gallagher and J. Vick	August 2013	IEPA

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<b>Report No.</b>	<b>Report Title</b>	<b>Author(s)</b>	<b>Date</b>	<b>Organization or Conference</b>
2013-36	Sidestream Nitrogen Removal at the John E. Egan Water Reclamation Plant by DEMON <sup>®</sup> Process	M&R Department Qin, D., J. Kozak, H. Zhang and T. Granato	September 2013	IEPA
2013-37	Odor Monitoring Program at the Metropolitan Water Reclamation District of Greater Chicago's Solids Drying and Solids Processing Facilities During 2012	M&R Department Oskouie, A.	September 2013	IEPA
2013-38	The Development of Biosolids Compost in Chicago	M&R Department Tian, G.	October 2013	
2013-39	Monitoring and Research 2012 Annual Report	M&R Department Granato, T., H. Zhang and A. Cox	October 2013	Internal Report
2013-40	2012 Annual Summary Report Water Quality Within the Waterways System of the Metropolitan Water Reclamation District of Greater Chicago	M&R Department Abedin, Z.	November 2013	IEPA
2013-41	122 <sup>nd</sup> and Stony Island Avenue Solids Management Area Monitoring Report, Third Quarter 2013	M&R Department Lindo, P.	November 2013	IEPA
2013-42	Calumet East Solids Management Area Monitoring Report, Third Quarter 2013	M&R Department Lindo, P.	November 2013	IEPA
2013-43	Calumet West Solids Management Area Monitoring Report, Third Quarter 2013	M&R Department Lindo, P.	November 2013	IEPA
2013-44	Harlem Avenue Solids Management Area Monitoring Report, Third Quarter 2013	M&R Department Lindo, P.	November 2013	IEPA



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<b>Report No.</b>	<b>Report Title</b>	<b>Author(s)</b>	<b>Date</b>	<b>Organization or Conference</b>
2013-45	Lawndale Avenue Solids Management Area Monitoring Report, Third Quarter 2013	M&R Department Lindo, P.	November 2013	IEPA
2013-46	Ridgeland Avenue Solids Management Area Monitoring Report, Third Quarter 2013	M&R Department Lindo, P.	November 2013	IEPA
2013-47	Hanover Park Water Reclamation Plant Fischer Farm Monitoring, Third Quarter 2013	M&R Department Lindo, P.	November 2013	IEPA
2013-48	Controlled Solids Distribution Report, Third Quarter 2013	M&R Department Oladeji, O.	November 2013	IEPA
2013-49	Performance of Permeable Pavements Installed at the Employee Parking Lot at the Stickney Water Reclamation Plant	M&R Department Kumar, K., J. Kozak, J. Vick, C. Robertson, A. Cox and H. Zhang	December 2013	Internal Report
2013-50	Environmental, Monitoring and Research Division 2012 Annual Report	M&R Department Zhang, Z. and A. Cox	December 2013	Internal Report
2013-51	Report of the Fulton County Environmental Protection System for 2013	M&R Department Tian, G.	December 2013	IEPA