Memorandum

MIAMI-DADE COUNTY

Date: October 7, 2008

To: Honorable Chairman Bruno A. Barreiro and Members, Board of County Commissioners

Agenda Item No. 8(R)(1)(E)

From: George M. Burgess, County Manager

Subject: Resolution approving Supplement Joint Funding Agreement No. A02 between the Miami-Dade County and the U.S. Geological Survey in the amount of $750,000

RECOMMENDATION

It is recommended that the Board of County Commissioners adopt the attached resolution approving supplement Joint Funding Agreement (JFA) No. A02 (Attachment A) between Miami-Dade County and U.S. Geological Survey (USGS) to analyze organic wastewater compounds, antibiotics, hormones and pharmaceuticals in wastewater, drinking water, canals and groundwater for the purpose of completing a groundwater recharge project in at the County's South District Wastewater Treatment Plant (SDWWTP). This project is a requirement of the 20-Year Water Use Permit issued to the County by the South Florida Water Management District on November 15, 2007.

SCOPE OF AGENDA ITEM

The impact of this agenda item is countywide in nature.

FISCAL IMPACT/FUNDING SOURCE

The fiscal impact to the County for this supplement JFA is $750,000 to be funded by wastewater connection charges and Miami-Dade Water and Sewer Department (WASD) operating revenues. The original JFA No. 08E0FL208014 (Attachment B) was approved by the Board on January 10, 2008 in the amount of $240,000 to be equally split between WASD and the Department of Environmental Resource Management (DERM), bringing the County's total contribution to $990,000.

The supplement JFA also includes a contribution from the USGS in the amount of $120,837, bringing the total cost of this groundwater recharge project to $1,110,837. The reasons for the increase in the project cost are detailed below. The County is funding more than USGS because the project is a requirement of the County's 20-Year water Use Permit.

TRACK RECORD/MONITOR

The original project task dealing with background conditions will continue to be monitored by DERM. The Deputy Director for Regulatory Compliance and Capital Improvements will monitor the two additional tasks included in this amendment. The USGS is a federal agency that is regarded as the national expert in the field of groundwater studies. The USGS is the only agency with the ability to analyze for all the required micro constituents and is recognized as the expert in micro constituent analysis.

BACKGROUND

The groundwater recharge project at the SDWWTP involves discharging highly treated wastewater into the ground at the Metrozoo with a twofold objective; to recharge the Biscayne Aquifer and to offset pumpage from the South Miami Heights Wellfield for the 20 million gallons per day South Miami Heights Water Treatment Plant being built in the future. In order to complete this project, it requires the collection of water quality samples from the ground and from canals, analysis for micro constituents including pharmaceuticals, antibiotics, and hormones, and sampling of raw and finished water at all of WASD's water treatment plants. This information is necessary to establish baseline conditions and to establish the treatment effectiveness and efficiency of alternative treatment technologies that will be incorporated into the design of the South District Water Reclamation Facility in conformance with the Water Use Permit requirements.

The original scope of work for the January 2008 agreement was restricted to an assessment of background conditions in selected wastewater treatment plant effluents, effluent discharge locations, and groundwater locations. This information is needed by DERM to assess current conditions and to provide a basis for future regulation. This supplement agreement is for additional monitoring work that is necessary to complete the design of the South District Water Reclamation Facility ($750,000) and to provide a baseline assessment of unregulated compounds (such as pharmaceuticals) that could be present in drinking water sources and treated drinking water ($250,000). The additional funding being provided by USGS ($120,837) is for equipment that is needed to support all three project tasks.

for S. Torriente
Assistant County Manager

MEMORANDUM

(Revised)

TO:	Honorable Chairman Bruno A. Barreiro and Members, Board of County Commissioners	**DATE:**	October 7, 2008
FROM:	R. A. Cuevas, Jr. County Attorney	**SUBJECT:**	Agenda Item No. 8(R)(1)(E)

Please note any items checked.

_____ **"4-Day Rule" ("3-Day Rule" for committees) applicable if raised**

_____ **6 weeks required between first reading and public hearing**

_____ **4 weeks notification to municipal officials required prior to public hearing**

_____ **Decreases revenues or increases expenditures without balancing budget**

_____ **Budget required**

_____ **Statement of fiscal impact required**

_____ **Bid waiver requiring County Manager's written recommendation**

_____ **Ordinance creating a new board requires detailed County Manager's report for public hearing**

_____ **Housekeeping item (no policy decision required)**

_____ **No committee review**

Approved _____ Mayor
Veto _____
Override _____

Agenda Item No. 8(R)(1)(E)
10-7-08

RESOLUTION NO. _____

RESOLUTION APPROVING A JOINT FUNDING AGREEMENT BETWEEN MIAMI-DADE COUNTY AND U.S. GEOLOGICAL SURVEY ("USGS") TO STUDY ORGANIC WASTEWATER COMPOUNDS, ANTIBIOTICS, HORMONES AND PHARMACEUTICALS IN WASTEWATER, DRINKING WATER, CANALS, AND GROUNDWATER IN MIAMI-DADE COUNTY IN AMOUNT NOT TO EXCEED $750,000

WHEREAS, this Board desires to accomplish the purposes outlined in the accompanying memorandum, a copy of which is incorporated herein by reference,

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF COUNTY COMMISSIONERS OF MIAMI-DADE COUNTY, FLORIDA, that the County Mayor or County Mayor's designee is hereby authorized, for and on behalf of Miami-Dade County, to execute the Joint Funding Agreement between Miami-Dade County and the U.S. Geological Survey in an amount not to exceed $750,000, in substantially the form attached hereto and made a part hereof; and to exercise the provisions contained therein.

The foregoing resolution was offered by Commissioner , who moved its adoption. The motion was seconded by Commissioner and upon being put to a vote, the vote was as follows:

Bruno A. Barreiro, Chairman
Barbara J. Jordan, Vice-Chairwoman

Jose "Pepe" Diaz	Audrey M. Edmonson
Carlos A. Gimenez	Sally A. Heyman
Joe A. Martinez	Dennis C. Moss
Dorrin D. Rolle	Natacha Seijas
Katy Sorenson	Rebeca Sosa
Sen. Javier D. Souto	

The Chairperson thereupon declared the resolution duly passed and adopted this 7th day of October, 2008. This resolution shall become effective ten (10) days after the date of its adoption unless vetoed by the Mayor, and if vetoed, shall become effective only upon an override by this Board.

MIAMI-DADE COUNTY, FLORIDA
BY ITS BOARD OF
COUNTY COMMISSIONERS

HARVEY RUVIN, CLERK

By:_____
Deputy Clerk

Approved by County Attorney as
to form and legal sufficiency:

Henry N. Gillman

Attachment A

July 30, 2008
FL016
08E0FL208014

MIAMI-DADE COUNTY

SUPPLEMENTAL JOINT FUNDING AGREEMENT NO. A02
FOR AN INVESTIGATION OF WATER RESOURCES

THIS AGREEMENT supplements the Joint Funding Agreement for water resources investigations to provide for no change in the contribution from USGS and an increase of $750,000.00 in the contribution from Miami-Dade County, as well as a new end date for the period of performance.

Paragraph 2a of the agreement is hereby changed to read as follows:

(a) $120,837.00 by the party of the first part during the period
January 01, 2008 to June 30, 2010

Paragraph 2b of the agreement is hereby changed to read as follows:

(b) $990,000.00 by the party of the second part during the period
January 01, 2008 to June 30, 2010

U.S. GEOLOGICAL SURVEY
DUNS #: 137784026

BY: _____

TITLE: DIRECTOR, FISC

DATE: 7/30/08

MIAMI-DADE COUNTY

BY: _____

TITLE: _____

DATE: _____

BY: _____

TITLE: _____

DATE: _____

ORGANIC WASTEWATER COMPOUNDS, ANTIBIOTICS, HORMONES, AND PHARMACEUTICALS IN WASTEWATER, DRINKING WATER, CANALS, AND GROUNDWATER IN MIAMI-DADE COUNTY

USGS, FLORIDA INTEGRATED SCIENCE CENTER, FORT LAUDERDALE, FL
JULY 08, 2008

ORGANIC WASTEWATER COMPOUNDS, ANTIBIOTICS, HORMONES, AND PHARMACEUTICALS IN WASTEWATER, CANALS, AND GROUNDWATER IN MIAMI-DADE COUNTY

Introduction and Background

Artificial recharge using treated wastewater, or reclaimed water, is becoming a widely utilized management technique to recharge aquifers in Florida and other parts of the U.S. (York et al. 2002; U.S. Environmental Protection Agency 2004; St. Johns River Water Management District 2006). Miami-Dade County, Florida operates three regional wastewater treatment facilities (North, Central and South Districts) that primarily dispose of treated effluent to ocean outfalls or by deep well injection into the saline, confined Boulder Zone of the Lower Floridan aquifer. To date, the reuse of highly treated wastewater has been limited in Miami-Dade County. Miami-Dade County, however, is seeking to increase the amount of wastewater reused from its regional wastewater treatment plants, and is actively pursuing reuse plans for aquifer recharge, irrigation, and wetland rehydration. Prescription and non-prescription pharmaceuticals, human and veterinary antibiotics, personal care products, and reproductive hormones, are present in treated wastewater effluent, and have been detected in surface and ground waters near known sources of these constituents in the U.S. and other parts of the world. For simplicity, these compounds will be referred to as pharmaceuticals and other wastewater organics throughout the remainder of this document. Several studies have confirmed the presence of these compounds in wastewater effluent. Sando et. al. (2005) measured approximately 50-60 pharmaceuticals and other wastewater organics in treated wastewater effluent in South Dakota, and Lietz and Meyer (2006) reported that approximately 30-35 pharmaceuticals and other wastewater organics were present in treated effluent from Miami-Dade County, Florida. These compounds also have been detected in surface waters that receive wastewater discharges, and some of these constituents may be sufficiently mobile to be transported to the ground water. Kolpin et al. (2002) detected approximately 80 pharmaceuticals and other wastewater organics in water from streams in the U.S. near known contaminant sources. Cordy et. al. (2004) determined in a laboratory study that some pharmaceuticals and other wastewater organics, including carbamazapine, sulfamethoxazole, benzophenone, 5-methyl-1H-benzotriazole, N-N-diethyltoluamide (DEET), tributylphosphate, and tri(2-chloroethyl) phosphate, may potentially reach the ground water. Studies by Heberer et. al. (2004) and Barnes et. al. (2004) also indicated that selected constituents, such as carbamazapine, DEET, and tri(2-chloroethyl) phosphate, may be transported within the ground water system. Katz and Griffin (2008) detected carbamazepine, sulfamethoxazole, and DEET in ground water beneath a sprayfield in northern Florida that applied treated municipal wastewater to the land surface. Heberer et. al. (2004) detected carbamazapine and several other pharmaceuticals in public supply wells which were transported from a nearby stream by bank filtration. Barnes et. al. (2004) detected approximately 20 pharmaceuticals and other wastewater organics, including DEET, at wells downgradient from a municipal landfill, which suggested some of these constituents may be transported in the ground water system.

Pharmaceuticals and other wastewater organics present in the environment may have adverse effects on human and ecological health. The effects on human and ecological health have not yet been fully evaluated (Kinney et. al., 2006), and no guidelines have been established regarding acceptable concentrations of these constituents in the environment. Adverse effects, however, are suspected because some pharmaceuticals are designed to modulate endocrine and immune systems, and these compounds may potentially act as endocrine disruptors in the environment (Ankley et al., 1998; Daughton and Ternes, 1999). Stream studies have documented that native bacterial populations display resistance to antibiotics (Daughton and Ternes, 1999), which may make illnesses more difficult to treat. The effects of some of the compounds are expected to be subtle and may not be observed until a substantial impact has occurred (Daughton and Ternes, 1999).

Across the United States, there is a rapidly growing awareness of the occurrence of pharmaceuticals and other wastewater organics in the nations drinking water supply. Stackelberg et al. (2004) confirmed that conventional drinking water treatment (DWT) plants do not completely remove organic compounds when they are detected in source raw waters. Miami-Dade County receives the majority of its drinking water supply from the Biscayne and upper Floridan Aquifers which could be contaminated from surface water sites and direct wastewater injection. If the County is actively pursuing reuse plans, it is important to determine the occurrence of pharmaceuticals and other wastewater organics in raw water sources and to determine the removal efficiencies of their DWT plants.

Problem Statement

Pharmaceuticals and other wastewater organics present in wastewater discharged to the land surface in Miami-Dade County may be transported to the highly transmissive Biscayne aquifer, and ultimately to potable water wells or sensitive coastal and surface water ecosystems. Furthermore, pharmaceuticals and other wastewater organics that have been transported to ground water from surface water sites or direct injection may not be completely removed by DWT facilities and may be present in the drinking water supply for Miami-Dade County.

Purpose and Scope

The purposes of phase 1 of this project are to assess the occurrence of pharmaceuticals and other organic wastewater compounds in ground and surface waters of Miami-Dade County, evaluate the removal efficiencies for these constituents of seven DWT facilities in the County, and to determine the occurrence of these constituents in the seven DWT facilities finished waters. Detections of these constituents in the finished waters likely indicate that they will be present in the drinking water supply for Miami-Dade County.

The purposes of phase 2 of this project are to further assess the occurrence of pharmaceuticals and other organic wastewater compounds, including NDMA and 1,4-Dioxane, in treated effluent produced at Miami-Dade County's South District WWTP,

determine the fate of these constituents through the pilot plant, and determine which process within the pilot plant is the most effective at removing these constituents.

Approach

For phase 1 of this study, water samples will be collected from seven DWT facilities in the County and from a creek which is located above a wellfield that provides one of the plants with a portion of its raw water. The seven plants selected for this study get their raw waters from a range of sources and employ a range of treatment processes. Grab samples of raw and finished waters will be collected from the seven DWT facilities. These data will provide information on the removal of these constituents through the drinking water treatment process and their presence, persistence, and distribution in the drinking water supply. Water samples from a site on Snapper Creek will be collected to determine the presence of these constituents in a surface water body within the County. This site will be located on Snapper Creek wellfield. Stream-bottom sediment samples from that site will also be analyzed to determine concentrations of pharmaceuticals and other wastewater compounds. Any constituents present in the Snapper Creek bottom sediments could be an indication of their long term presence in the water.

For Phase 2 of this study, water samples will be collected from the influent and effluent at the South District facility, as well as five locations within the pilot plant. Locations within the pilot plant include deep bed filter influent, deep bed filter effluent, membrane filter/Ultrafiltration (MF/UF) effluent, reverse osmosis (RO) product, and RO concentrate. The sites selected for sampling will be sampled to define which pharmaceuticals and other wastewater organics are present, and determine the removal efficiencies of the various processes. The types and concentrations of pharmaceuticals and other wastewater organics likely differ at different times of the year. To account for this, samples will be taken once a month for six consecutive months. Samples will also be collected on a 5-day cycle and analyzed for NDMA and 1,4-Dioxane.

Water samples will be collected and analyzed to determine concentrations of a broad suite of pharmaceuticals and other wastewater organics, N-Nitrosodimethylamine (NDMA), 1,4-Dioxane, and pesticides. NDMA is a potential human carcinogen which may be formed when wastewater is disinfected. 1,4-Dioxane is also a potential human carcenagen and is highly soluble in groundwater, does not readily bind to soils, and readily leaches to groundwater. It is also resistant to naturally occurring biodegradation processes. Grab water samples will be collected from the wastewater facility during the daily high-flow period, which usually corresponds to 7:30 AM. These data will provide information on the presence and distribution of these constituents and their removal during the wastewater treatment processes. This approach may not permit quantification of the removal of all constituents present in the wastewater, and some compounds likely will be detected in wastewater effluent samples that were not detected in influent. Lietz and Meyer (2006) determined more pharmaceuticals and other wastewater organics were present in treated wastewater samples compared to the influent, and Kroening (2004) determined more constituents were present in conventionally treated drinking water samples compared to the river water source. Both studies attributed the higher number of

detections in the treated waters to the removal of matrix interference or solubility changes due to matrix conditions.

A suite of approximately 220 constituents, including pharmaceuticals, pesticides, and other wastewater organics (tables 1 through 5) will be analyzed in the water samples. Water samples analyzed according to Zaugg et al. (in press) also will include a library screen of non-target analytes to maximize detection of all compounds of interest. Analyses for organic wastewater compounds and prescription and non-prescription drugs will be performed at the USGS National Water-Quality Laboratory (NWQL) in Denver, Colorado. Organic wastewater compounds will be analyzed in unfiltered samples using gas chromatography/mass spectrometry according to Zaugg et al. (in press). The analytical schedule for unfiltered wastewater organics samples contains most of the analytes previously measured by Lietz and Meyer (2006), and offer lower reporting limits when compared to the filtered method. Analysis of unfiltered samples also will permit detection of any wastewater organics that may by sorbed onto suspended sediment particles. Prescription and non-prescription drugs will be analyzed in filtered samples using high performance liquid chromatography/mass spectrometry according to Cahill et al. (2004). Human and veterinary antibiotics and hormones will be analyzed in filtered samples at the USGS Organic Geochemistry Laboratory in Lawrence, Kansas. Antibiotics will be determined using high performance liquid chromatography/mass spectrometry according to Kolpin et al. (2002). The hormone 17-beta-estradiol will be analyzed in filtered samples using an Enzyme-linked Immunosorbent Assay (ELIZA) kit.

A suite of approximately 80-100 pharmaceuticals, antibiotics, and other wastewater organics will be analyzed in stream bottom sediments. Pharmaceuticals and organic wastewater constituents to be analyzed are listed in tables 6 and 7. Pharmaceuticals will be analyzed by LC/MS as described by Kinney et. al. (2006), and wastewater organics will be analyzed by GC/MS as described by Burkhardt et. al. (2006).

The USGS NWQL is NELAC accredited by the Florida State Department of Health for the suite of compounds listed in table 5. There is no accreditation for the other compounds for two reasons. The remaining compounds are not on the accrediting agency's list of compounds, and there are no performance test samples available for this suite of analytes.

Water samples will be collected according to USGS protocol (Wilde et al., 2006) to prevent contamination and minimize degradation of organic compounds. All sampling equipment will be constructed of inert materials; such as teflon, glass, or stainless steel; to minimize sample contamination. Samples requiring filtration will be filtered through a 0.7-micron nominal pore size filter that was precombusted at 450 degrees Celsius to remove all organic residues. As part of the equipment decontamination procedure, all sampling equipment will be rinsed with pesticide-grade methanol to remove any organic compounds sorbed onto the equipment. Samples collected for analysis of compounds such as antibiotics, personal care products, and pharmaceuticals, are susceptible to contamination because these compounds are ubiquitous in daily use. To minimize sample contamination, field personnel will avoid or minimize contact with products containing

caffeine, DEET, fragrances, over-the-counter medications, sunscreen, and tobacco. Some of the analyzed compounds degrade in the presence of chlorinated water, such as finished waters and wastewater effluent. To prevent degradation and maximize constituent recoveries, water samples collected for analysis of pharmaceuticals, organic wastewater constituents, and antibiotics will be preserved with pH 7 buffer and ascorbic acid.

Quality Assurance

Field blank, replicate, and matrix spike samples will be prepared to document the bias and precision of the data and constituent recoveries. Field blank samples will be prepared to quantify the amount of contamination bias during each sampling event, using water certified by the USGS to be free of the analytes in tables 1-5. A replicate sample in each matrix will be collected to quantify the precision in the data, and water samples in each matrix will be spiked for the constituents listed in tables 1, 2, 4, and 5. Spike solutions are not readily available to USGS field personnel for the remaining analytes.

Products

The methods and results of this study will be released to Miami-Dade County once all the data has been checked.

Personnel and Funding

The project would be conducted by a part-time GS-15 Research Hydrologist with experience in water-quality investigations. A GS-11 Hydrologic technician and GS-9 Hydrologist will assist in data-collection activities. Project costs will total $750,000 and will be contributed by Miami-Dade County. Distribution of costs shown below:

Phase	Number of Samples	Cost
1	25	$250,000
2	50-60	$500,000

Project Timeline

The study will be conducted over a 1 ½ year period, beginning on. July 1, 2008 and ending on June 30, 2010. Scheduling of tasks is shown below:

Task	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
Site Reconnaissance						
Phase 1 DWT sampling						
Phase 2 WWTP sampling						
Review water-quality data						

References

Ankley, G.; Francis, E.; Gray, E.; Kavlock, R.; McMaster, S.; Reese, D.; Sayles, G.; Sergeant, A.; and Vallero, D., 1998, Research plan for endocrine disruptors: U.S. EPA Office of Research and Development, Research Triangle Park, North Carolina.

Barnes, K.K.; Christenson, S.C.; Kolpin, D.W.; Focazio, M.J.; Furlong, E.T.; Zaugg, S.D.; Meyer, M.T.; and Barber, L.B.; 2004, Pharmaceuticals and other waste water constituents within in leachate plume downgradient of a municipal landfill: Ground Water Monitoring and Remediation, vol. 24, p. 119-126.

Burkhardt, M.R., Zaugg, S.D., Smith, S.G., and ReVello, R.C., 2006, Determination of wastewater compounds in sediment and soil by pressurized solvent extraction, solid-phase extraction, and capillary-column gas chromatography/mass spectrometry: U.S. Geological Survey Techniques and Methods, book 5, chap B2, 33p.

Cahill, J.D.; Furlong, E.T.; Burkhardt, M.R.; Kolpin, D.W.; and Anderson, L.R., 2004, Determination of pharmaceutical compounds in surface- and ground-water samples by solid-phase extraction and high-performance liquid chromatography—electrospray ionization mass spectrometry: Journal of Chromatography A, vol. 1041, p. 171-180.

Conn, K.E., Barber, L.B., Brown, G.K., and Siegrist, R.L., 2006, Occurrence and fate of organic contaminants during onsite wastewater treatment: Environmental Science and Technology, vol. 40, p. 7358-7366.

Cordy, G.E.; Duran, N.L.; Bouwer, H.; Rice, R.C.; Furlong, E.T.; Zaugg, S.D.; Meyer, M.T.; Barber, L.B.; and Kolpin, D.W., 2004, Do pharmaceuticals, pathogens, and other organic waste water compounds persist when waste water is used for recharge?: Ground Water Monitoring and Remediation, vol. 24, p. 58-69.

Daughton, C.G., and Ternes, T.A., 1999, Pharmaceuticals and personal care products in the environment—Agents of subtle change: Environmental Health Perspectives, vol. 107, suppl. 6, p. 907-938.

Glassmeyer, S.T.; Furlong, E.T.; Kolpin, D.W.; Cahill, J.D.; Zaugg, S.D.; Werner, S.L.; Meyer, M.T.; and Kryak, D.D., 2005, Transport of chemical and microbial compounds from known wastewater discharges—Potential for use as indicators of human fecal contamination: Environmental Science and Technology, vol. 39, p. 5157-5169.

Heberer, T., Mechlinkski, A., Fanck, B., Knappe, A., Massmann, G., Pekdeger, A., and Fritz, B., 2004, Field studies on the fate and transport of pharmaceutical residues in bank filtration: Ground water monitoring and remediation, vol. 24, p. 70-77.

Katz, B.G., and Griffin, D.W., 2008, Using chemical and microbiological indicators to track the possible movement of contaminants from the land application of reclaimed municipal wastewater in a karstic springs basin: Environmental Geology, Published online, Environ Geol., DOI 10.1007/s00254-007-1033-y.

Kinney, C.A., Furlong, E.T., Werner, S.L., and Cahill, J.D., 2006, Presence and distribution of wastewater-derived pharmaceuticals in soil irrigated with reclaimed water: Environmental Toxicology and Chemistry, vol. 25, p. 317-326.

Kolpin, D.W., Furlong, E.T., Meyer, M.T., Thurman, E.M., Zaugg, S.D., Barber, L.B., and Buxton, H.T., 2002, Pharmaceuticals, hormones, and other organic wastewater constituents in U.S. streams, 1999-2000—A National reconnaissance: Environmental Science and Technology, vol. 26, p. 1202-1211.

Kroening, S.E., 2004, Streamflow and water-quality characteristics at selected sites of the St. Johns river in Central Florida, 1933 to 2002: U.S. Geological Survey Scientific Investigations Report 2004-5177, 102 p.

Lietz, A.C., and Meyer, M.T., 2006, Evaluation of emerging contaminants of concern at the South District Wastewater Treatment Plant based on seasonal events, Miami-Dade County, Florida, 2004: U.S. Geological Survey Scientific Investigations Report 2006-5240, 38 p.

Sando, S.K., Furlong, E.T., Gray, J.L., Meyer, M.T., and Bartholomay, R.C., 2005, Occurrence of organic wastewater compounds in wastewater effluent and the Big Sioux River in the Upper Big Sioux River Basin, South Dakota, 2003-2004: U.S. Geological Survey Scientific Investigations Report 2005-5249, 108 p.

Scheytt, T.; Grams, S.; Rejman-Rasinski, E.; Heberer, T.; and Stan, H., 2001, Pharmaceuticals in groundwater—Clofibric acid beneath sewage farms south of Berlin, Germany: In Daughton, C.G. & Jones-Lepp, T.L. (eds.): Pharmaceuticals and personal care products in the environment—Scientific and regulatory issues. ACS Symposium Series 791, p. 84-99, ACS/Oxford University Press.

Seiler, R.L.; Zaugg, S.D.; Thomas, J.M.; and Howcraft, D.L., 1999, Caffeine and pharmaceuticals as indicators of waste water contamination in wells: Ground Water, vol. 37, p. 405-410.

Stackelberg P.E.; Furlong E.T.; Meyer M.T.; Zaugg S.D.; Henderson A.K.; and Reissman D.B., Persistence of pharmaceutical compounds and other organic wastewater contaminants in a conventional drinking-water-treatment plant, Science of the Total Environment 329 (2004) (1–3), p. 99.

Weigel, S.; Kuhlmann, J.; and Hühnerfuss, H., 2002, Drugs and personal care products as ubiquitous pollutants—Occurrence and distribution of clofibric acid, caffeine, and DEET in the North Sea: The Science of the Total Environment, vol. 295, p. 131-141.

Zaugg, S.D., Smith, S.G., and Schroeder, M.P., in press, Determination of wastewater compounds in whole water by continuous liquid-liquid extraction and capillary-column

gas chromatography/mass spectrometry: U.S. Geological Survey Techniques and Methods, book 5, chap. B4.

Zaugg, S.D.; Smith, S.G.; Schroeder, M.P.; Barber, L.B.; and Burkhardt, M.R., 2002, method of analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of wastewater compounds by polystyrene-divinylbenzene solid-phase extraction and capillary-column gas chromatography/mass spectrometry: U.S. Geological Survey Water-Resources Investigations Report 01-4186, 37 p.

Table 1. Organic wastewater compounds analyzed in water samples, method reporting levels, and possible sources or uses of compounds.

[Values shown in micrograms per liter]

Compound	Method reporting level	Possible sources or uses of compound
Acetophenone	0.2	Fragrance in detergent, tobacco
Acetyl-hexamethyl-tetrahydro-naphthalene (AHTN)	0.2	Musk fragrance
3-*tert*-Butyl-4-hydroxyanisole (BHA)	0.2	Antioxidant, general preservative
Anthracene	0.2	Wood preservative, component of tar, diesel, crude oil
Anthraquinone	0.2	Used in manufacture of dye/textiles, seed treatment, bird repellant
Atrazine	0.2	Herbicide
Benzo[*a*]pyrene	0.2	Regulated polycyclic aromatic hydrocarbon, used in cancer research
Benzophenone	0.2	Fixative for perfumes and soaps
Hexahydrohexamethyl cyclopentabenzopyran (HHCB)	0.2	Musk fragrance
5-Methyl-1H-benzotriazole	1.6	Antioxidant in antifreeze and deicers
1,4-Dichlorobenzene	0.2	Moth repellant, fumigate, deodorant
Bisphenol A	0.4	Used in manufacture of polycarbonate resins, antioxidant
Bromacil	0.2	General use pesticide
Bromoform	0.2	Wastewater ozination by-product, military explosives
Caffeine	0.2	Beverages, diuretic
Camphor	0.2	Flavor, odorant, ointments
Carbaryl	0.2	Insecticide, crop and garden uses
Carbazole	0.2	Insecticide, manufacture of dyes, explosives, lubricants
Chlorpyrifos	0.2	Insecticide, domestic pest and termite control
Cholesterol	0.8	Fecal indicator, plant sterol
Triethyl citrate (ethyl citrate)	0.2	Cosmetics, pharmaceuticals
Cotinine	0.8	Primary nicotine metabolite
3 Beta-coprostanol	0.8	Carnivore fecal indicator
para-Cresol	0.2	Wood preservative
Diazinon	0.2	Insecticide, nonagricultural uses, ants, flies
Dichlorvos	0.2	Insecticide, pet collars, flies
2,2',4,4'-Tetrabromodiphenyl ether	0.2	
Fluoranthene	0.2	Component of coal tar and asphalt
Indole	0.2	Pesticide inert ingredient, fragrance in coffee
3-Methyl-1H-indole (skatol)	0.2	Fragrance, stench in feces, coal tar
Isoborneol	0.2	Fragrance in perfumes, disinfectants
3,4-Dichlorophenyl isocyanate	2	
Isophorone	0.2	Solvent for lacquer, plastic, oil, silicon, resin
Isopropylbenzene (cumene)	0.2	Manufacture of phenol/acetone, fuels, and paint thinner
Isoquinoline	0.2	Flavors and fragrances
d-Limonene	0.2	Fungicide, antmicrobial, antiviral, fragrance in aerosols
Menthol	0.2	Cigarettes, cough drops, liniment, mouthwash

Compound	Method reporting level	Possible sources or uses of compound
Metalaxyl	0.2	Herbicide, fungicide, mildew, blight, pathogens, golf/turf
Methyl salicylate	0.2	Liniment, food, beverage, ultraviolet-absorbing lotion
Metolachlor	0.2	Herbicide, indicator of agricultural drainage
Naphthalene	0.2	Fumigant, moth repellent
2,6-Dimethylnaphthalene	0.2	Present in diesel fuel, kerosene
1-Methylnaphthalene	0.2	Gasoline, diesel fuel, crude oil
2-Methylnaphthalene	0.2	Gasoline, diesel fuel, crude oil
4-Cumylphenol	0.2	Nonionic detergent metabolite
para-Nonylphenol (total)	1.6	Nonionic detergent metabolite
monoethoxy-Nonylphenol	2.0	Nonionic detergent metabolite
4-Nonylphenol diethoxylates	3.2	Nonionic detergent metabolite
4-*n*-Octylphenol	0.2	Nonionic detergent metabolite
4-*tert*-Octylphenol	0.2	Nonionic detergent metabolite
4-Octylphenol diethoxylates	0.32	Nonionic detergent metabolite
4-octylphenol monoethoxylates	1.0	Nonionic detergent metabolite
Pentachlorophenol	0.8	Herbicide, fungicide, wood preservative, termite control
Phenanthrene	0.2	Explosives, tar, diesel fuel, crude oil
Phenol	0.2	Disinfectant
Tributyl phosphate	0.2	Plasticizer, resin, wax, finish, roofing paper
bis(2-ethylhexyl) phthalate	2	
Diethyl phthalate	0.2	
Triphenyl phosphate	0.2	Plasticizer, resin, wax, finish, roofing paper
Tris(2-butoxyethyl) phosphate	0.2	Flame retardant
Tris(2-chloroethyl) phosphate	0.2	Plasticizer, flame retardant
Tris(dichloroisopropyl) phosphate	0.2	Flame retardant
Prometon	0.2	Herbicide, applied prior to blacktop
Pyrene	0.2	Component of coal tar and asphalt
beta-Sitosterol	0.8	Plant sterol
beta-Stigmastanol	0.8	Plant sterol
N,N-diethyl-*meta*-toluamide (DEET)	0.2	Mosquito repellent
Tetrachloroethylene	0.4	Solvent, degreaser, veterinary anthelminthic
Triclosan	0.2	Disinfectant, antimicrobial

Table 2. Pesticides analyzed in water samples and method reporting limits.

[Values shown in micrograms per liter]

Compound	Method reporting level
1_Napthol	0.088
2-Chloro-2,6-diethylacetanalide	0.007
2-Ethyl-6-methylaniline	0.010
3,4-Dichloroaniline	0.005
4-Chloro-2-methylphenol	0.005
Acetochlor	0.006
Alachlor	0.005
2,6-Diethylaniline	0.006
Atrazine	0.007
Azinphos-methyl	0.050
Azinphos-methyl-oxon	0.042
Benfluralin	0.010
Carbaryl	0.041
Chlorpyrifos	0.005
Chlorpyrifos, oxygen analog	0.056
cis-Permethrin	0.006
Cyfluthrin	0.053
Cypermethrin	0.046
Dacthal	0.003
2-Chloro-4-isopropylamino-6-amino-s-triazine (CIAT)	0.014
Diazinon	0.005
Diazinon, oxygen analog	0.006
Dichlorvos	0.013
Dicrotophos	0.084
Dieldrin	0.009
Dimethoate	0.006
Ethion	0.016
Ethion monoxon	0.021
Fenamiphos	0.029
Fenamiphos sulfone	0.053
Fenamiphos sulfoxide	0.040
Desulfinylfipronil amide	0.029

Compound	Method reporting level
Fipronil sulfide	0.013
Fipronil sulfone	0.024
Desulfinylfipronil	0.012
Fipronil	0.016
Fonofos	0.005
Hexazinone	0.026
Iprodione	0.026
Isofenphos	0.011
Malaoxon	0.039
Malathion	0.027
Metalaxyl	0.007
Methidathion	0.009
Parathion-methyl	0.015
Metolachlor	0.006
Metribuzin	0.028
Myclobutanil	0.033
Paraoxon-methyl	0.019
Pendimethalin	0.022
Phorate	0.055
Phorate oxygen analog	0.027
Phosmet	0.008
Phosmet oxon	0.051
Prometon	0.010
Prometryn	0.006
Propyzamide	0.004
Simazine	0.005
Tebuthiuron	0.016
Terbufos	0.017
Terbufos oxygen analog sulfone	0.045
Terbuthylazine	0.008
Tribufos	0.035
Trifluralin	0.009

Table 3. Human and veterinary antibiotics analyzed in water samples and method reporting limits.

[Values shown in micrograms per liter]

Compound	Method reporting level
Carbamazapine	0.005
Ibuprofen	0.050
Azithromycin	0.005
Erythromycin	0.008
Erythromycin-H_2O	0.008
Roxithromycin	0.005
Tylosin	0.005
Virginiamycin	0.005
Ciprofloxacin	0.005
Lomefloxacin	0.005
Norfloxacin	0.005
Ofloxacin	0.005
Sarafloxacin	0.005
Enrofloxacin	0.005
Sulfachloropyridazine	0.005
Sulfadiazine	0.050
Sulfadimethoxine	0.005
Sulfamethazine	0.005
Sulfamethoxazole	0.005
Sulfathiazole	0.020
Chlorotetracycline	0.010
Epi-chlorotetracycline	0.010
Iso-chlorotetracycline	0.010
Epi-iso-chlorotetracycline	0.010
Doxycycline	0.010
Oxytetracycline	0.010
Epi-oxytetracycline	0.010
Tetracycline	0.010
Epi-tetracycline	0.010
Lincomycin	0.005
Trimethoprim	0.005
Chloramphenicol	0.010
Ormetoprim	0.005

Table 4. Prescription and non-prescription pharmaceuticals analyzed in water samples and method reporting limits.

[Values shown in micrograms per liter]

Compound	Method reporting level
1,7-dimethylxanthine	0.144
Codeine	0.015
Caffeine	0.016
Thiabendazole	0.011
Albuterol (Salbutamol)	0.023
Acetaminophen	0.036
Cotinine	0.014
Dehydronifedipine	0.015
Carbamazapine	0.011
Trimethoprim	0.013
Warfarin	0.012
Diphenhydramine	0.015
Sulfamethoxazole	0.064
Diltiazem	0.016
Ibuprofen	0.042
Ranitidine	0.013
Cimetidine	0.012
Fluoxetine	0.014
Gemfibrozil	0.013
Erythromycin	0.009
Azithromycin	0.004
Miconazole	0.018
Metformin	N/D

Table 5. Semivolatile organic compounds analyzed in water samples and method reporting limits.

[Values shown in micrograms per liter]

Compound	Method reporting level
Dibenz[a,h]anthracene	0.70
Chyrsene	0.33
bis(2-chloroisopropyl) ether	0.38
2,4-dimethylphenol	0.37
4,6-dinitro-2-methylphenol	0.77
4-bromophenylphenylether	0.36
4-chlorophenyl phenyl ether	0.34
Fluorene	0.33
Acenaphthene	0.28
Acenaphthylene	0.30
Anthracene	0.39
Benz[a]anthracene	0.26
1,2,4-trichlorobenzene	0.41
Hexachlorobenzene	0.30
1,3-dichlorobenzene	0.57
Nitrobenzene	0.21
1,2-dichlorobenzene	0.49
1,4-dichlorobenzene	0.53
Benzidine	1000
3,3'-dichlorobenzidine	0.65
Benzo[a]pyrene	0.33
Benzo[b]fluoranthene	0.40
Benzo[ghi]perylene	0.64
Benzo[k]fluoranthene	0.45
bis(2-chloroethyl) ether	0.30
Hexachlorobutadiene	0.46
Hexachlorocyclopentadiene	0.52
N-nitrosodi-n-propylamine	0.82
N-nitrosodimethylamine (NDMA)	0.33

Compound	Method reporting level
N-nitrosodiphenylamine	0.81
Hexachloroethane	0.66
Fluoranthene	0.30
1,2-diphenylhydrazine	0.30
Indeno[1,2,3-cd]pyrene	0.56
Isophorone	0.60
4-chloro-3-methylphenol	0.55
bis(2-chloroethoxy)methane	0.35
Naphthalene	0.32
2-chloronaphthalene	0.38
Phenanthrene	0.32
Phenol	0.44
2,4,5-trichlorophenol	0.31
2,4-dichlorophenol	0.39
2,4-dinitrophenol	0.80
2-chlorophenol	0.42
2-nitrophenol	0.30
4-nitrophenol	0.51
Pentachlorophenol	0.87
bis(2-ethylhexyl) phthalate	1.05
Butylbenzyl phthalate	1.26
Di-n-butyl phthalate	0.87
Diethyl phthalate	0.61
Dimethyl phthalate	0.59
Di-n-octyl phthalate	1.86
Pyrene	0.35
2,4-dinitrotoluene	0.43
2,6-dinitrotoluene	0.43

Table 6. Organic wastewater compounds analyzed in sediment samples and method reporting levels.

[Values shown in micrograms per kilogram]

Compound	Method reporting level
Acetophenone	150
Acetyl-hexamethyl-tetrahydro-naphthalene (AHTN)	50
3-*tert*-Butyl-4-hydroxyanisole (BHA)	150
Anthracene	50
Anthraquinone	50
Atrazine	100
Benzo[*a*]pyrene	50
Benzophenone	50
Hexahydrohexamethyl cyclopentabenzopyran (HHCB)	50
Bisphenol A	50
Bromacil	500
Camphor	50
Carbazole	50
Chlorpyrifos	50
Cholesterol	250
Triethyl citrate (ethyl citrate)	0.2
Cotinine	0.8
3 Beta-coprostanol	500
para-Cresol	250
Diazinon	50
2,2',4,4'-Tetrabromodiphenyl ether	50
1,4-dichlorobenzene	50
Fluoranthene	50
Indole	100
3-Methyl-1H-indole (skatol)	50
Isoborneol	50
Isophorone	50
Isopropylbenzene (cumene)	100
Isoquinoline	100
d-Limonene	50

Compound	Method reporting level
Menthol	50
Metolachlor	50
Naphthalene	50
2,6-Dimethylnaphthalene	50
1-Methylnaphthalene	50
2-Methylnaphthalene	50
4-Cumylphenol	50
para-Nonylphenol (total)	500
4-Nonylphenol diethoxylates	1000
4-Nonylphenol	750
4-*n*-Octylphenol	50
4-*tert*-Octylphenol	50
4-Octylphenol diethoxylates	50
4-octylphenol monoethoxylates	250
Phenanthrene	50
Phenol	50
Tributyl phosphate	50
bis(2-ethylhexyl) phthalate	250
Diethyl phthalate	100
Triphenyl phosphate	50
Tris(2-butoxyethyl) phosphate	150
Tris(2-chloroethyl) phosphate	100
Tris(dichloroisopropyl) phosphate	100
Prometon	50
Pyrene	50
beta-Sitosterol	500
beta-Stigmastanol	500
N,N-diethyl-*meta*-toluamide (DEET)	100
Triclosan	50

Table 7. Prescription and non-prescription pharmaceutical compounds analyzed in sediment samples and method reporting levels.

[Values shown in micrograms per kilogram]

Compound	Method reporting level
Cotinine	1.30
Salbutamol	1.09
Cimetidine	0.88
Acetaminophen	0.76
1,7-dimethylxanthine	2.03
Trimethoprim	1.47
Diltiazem	1.48
Fluoxetine	2.17
Warfarin	1.26
Gemifibrozil	5.46
Caffeine	1.33
Sulfamethoxazole	1.58
Dehydronifedipine	1.69
Codeine	1.32
Thiabendazole	1.04
Diphenhydramine	1.35
Erythromycin	1.66
Carbamazapine	1.65
Miconazole	0.97

Table 8. Hormone compounds

[Values shown in micrograms per liter]

Compound	Method reporting level
17-beta-Estradiol	0.05

Table 9. VOC compounds

[Values shown in micrograms per liter]

Compound	Method reporting level
1,4-Dioxane	2

ORIGINAL

Attachment B

Form 9-1366
(Oct. 2005)

U.S. Department of the Interior
U.S. Geological Survey
Joint Funding Agreement

Customer #:	FL016
Agreement #:	08E0FL208014
Project #:	8-2080-CVB00
TIN #:	59-6000573
Fixed Cost Agreement	☑ Yes ☐ No

FOR
WATER RESOURCES INVESTIGATION

THIS AGREEMENT is entered into as of the 1st day of October, 2007, by the U.S. GEOLOGICAL SURVEY, UNITED STATES DEPARTMENT OF THE INTERIOR, party of the first part, and the MIAMI-DADE COUNTY, party of the second part.

1. The parties hereto agree that subject to availability of appropriations and in accordance with their respective authorities there shall be maintained in cooperation AN INVESTIGATION OF ORGANIC WASTEWATER COMPOUNDS, ANTIBIOTICS, HORMONES, AND PHARMACEUTICALS IN WASTEWATER, CANALS, AND GROUNDWATER IN MIAMI-DADE COUNTY, herein called the program. The USGS legal authority is 43 USC 36C; 43 USC 50; and 43 USC 50b.
2. The following amounts shall be contributed to cover all of the cost of the necessary field and analytical work directly related to this program. 2(b) includes In-Kind Services in the amount of $0.00.

by the party of the first part during the period

(a) $0.00 January 01, 2008 **to** June 30, 2009

by the party of the second part during the period

(b) $240,000.00 January 01, 2008 **to** June 30, 2009

(c) Additional or reduced amounts by each party during the above period or succeeding periods as may be determined by mutual agreement and set forth in a written amendment between the parties.

(d) The performance period may be changed by mutual agreement and set forth in a written amendment between the parties.

3. The costs of this program may be paid by either party in conformity with the laws and regulations respectively governing each party.
4. The field and analytical work pertaining to this program shall be under the direction of or subject to periodic review by an authorized representative of the party of the first part.
5. The areas to be included in the program shall be determined by mutual agreement between the parties hereto or their authorized representatives. The methods employed in the field and office shall be those adopted by the party of the first part to insure the required standards of accuracy subject to modification by mutual agreement.
6. During the course of this program, all field and analytical work of either party pertaining to this program shall be open to the inspection of the other party, and if the work is not being carried on in a mutually satisfactory manner, either party may terminate this agreement upon 60 days written notice to the other party.
7. The original records resulting from this program will be deposited in the office of origin of those records. Upon request, copies of the original records will be provided to the office of the other party.

Form 9-1366 continued	U.S. Department of the Interior U.S. Geological Survey Joint Funding Agreement	Customer #: Agreement #: Project #: TIN #:	FL016 08E0FL208014 8-2080-CVB00 59-6000573

8. The maps, records, or reports resulting from this program shall be made available to the public as promptly as possible. The maps, records, or reports normally will be published by the party of the first part. However, the party of the second part reserves the right to publish the results of this program and, if already published by the party of the first part shall, upon request, be furnished by the party of the first part, at costs, impressions suitable for purposes of reproduction similar to that for which the original copy was prepared. The maps, records, or reports published by either party shall contain a statement of the cooperative relations between the parties.

9. USGS will issue billings utilizing Department of the Interior Bill for Collection (form DI-1040). Billing documents are to be rendered **QUARTERLY**. Payments of bills are due within 60 days after the billing date. If not paid by the due date, interest will be charged at the current Treasury rate for each 30 day period, or portion thereof, that the payment is delayed beyond the due date. (31 USC 3717; Comptroller General File B-212222, August 23, 1983).

U.S. Geological Survey
United States
Department of the Interior

USGS Point of Contact

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Signatures

By _____ Date 2/12/08
Name: Dr. Barry Rosen
Title: Acting DOI/USGS/FISC Director

By _____ Date _____
Name:
Title:

MIAMI-DADE COUNTY

Customer Point of Contact

Name: Julie Baker
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Miami, FL 33136-3912
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Signatures

By _____ Date 2/5/08
Name: Alex Munoz
Title: Assistant County Manager

By _____ Date 2/5/2008
Name: HARVEY RUVIN, CLERK
Title: Deputy Clerk

COUNTY COMMISSION SEAL DADE COUNTY FLORIDA