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Program Overview

Metro Wastewater Reclamation District (Metro District) applies biosolids to their properties near Deer Trail, Colorado. These biosolids applications could affect the quality of water in alluvial and bedrock aquifers, streambed sediments, soils, and crops. Water quality can be directly affected through:

- Contaminated recharge water, or
- Infiltration of water through contaminated soils or sediments (remobilization).

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USGS

The U.S. Geological Survey is a science organization that provides the Nation with reliable, impartial information to describe and understand the Earth. The national USGS home page: <http://www.usgs.gov>

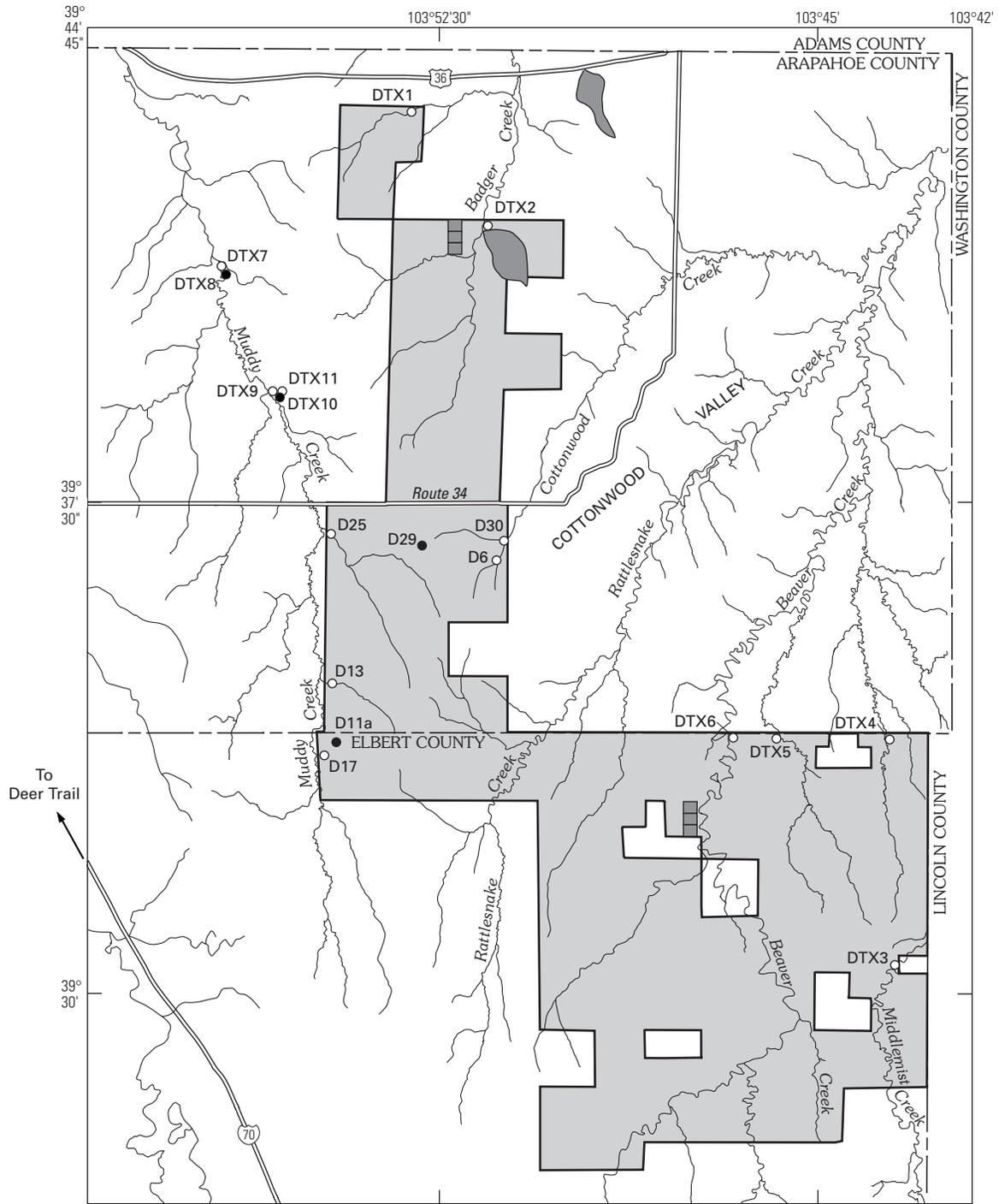
This USGS program:

Internet address for precipitation data at wells DTX2, D25, DTX5 (South Platte River Basin):
http://co.water.usgs.gov/rt-cgi/gen_tbl_pg_mt
or <http://nwis-colo.cr.usgs.gov/>

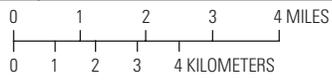
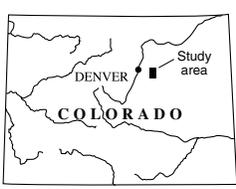
Internet address for quarterly reports:
<http://co.water.usgs.gov/projects>



USGS attended a meeting of the Expanded Monitoring Program stakeholders, which was held March 13, 2001, at the courthouse in Kiowa, Colorado (Elbert County). The focus of this meeting was a discussion of monitoring possibilities related to biosolids issues.



To Deer Trail



- EXPLANATION**
- Metro Wastewater Reclamation District property
 - Streambed-sediment sampling area
 - USGS alluvial monitoring well
 - USGS bedrock monitoring well
 - Soil-sampling area

USGS Expanded Monitoring Program sites and Metro District's biosolids-application properties near Deer Trail, Colorado

Program Overview

Continued from page 1

Water quality can be indirectly affected through:

- Plowing that mobilizes or changes subsurface chemical constituents, or
- Contributions to natural processes such as nitrification.

Contaminated ground water or surface water could contaminate:

- Other aquifers, such as bedrock water-supply aquifers or alluvial aquifers,
- Other surface-water bodies (ponds or streams), or
- Streambed sediments.

Biosolids must meet metals and radioactivity regulations, or else agronomic loading rates will be incorrect and soils could be overloaded. Soil quality could either be improved by biosolids applications through increased nutrients and organic matter, or degraded through excessive nutrients or metals.

The U.S. Geological Survey (USGS) has designed and begun a new monitoring program to address concerns from a stakeholder group about the biosolids and the quality of the environment in the vicinity of the biosolids-application areas. The new USGS monitoring program near Deer Trail is referred to as the "USGS Expanded Monitoring Program" and began in January 1999.

This monitoring program is distinct from, but builds on, another USGS program that monitored shallow groundwater quality on the Metro District Central Farm from 1993-1998. The new program (1999-2005) considers environmental-quality issues for shallow and deep ground water, surface water (bed sediments), biosolids, soils, and crops. The new expanded monitoring program includes all three Metro District properties (North, Central, and South Farms) and related private-property locations. Both programs, however, use USGS and Metro District funds. In addition, the new monitoring program also uses funds from the North Kiowa Bijou Ground Water Management District. Both programs are designed, carried out, and interpreted independently by USGS, and quality-assured USGS data and reports will be released to the public and the Metro District at the same time. By definition and design, all USGS monitoring programs are independent and unbiased.

The objectives of the new Expanded Monitoring Program are to: (1) Evaluate the combined effects of biosolids applications, land use, and natural processes on alluvial aquifers, the bedrock aquifer, streambed sediments, soils, and crops by comparing chemical data to

- State or Federal regulatory limits,
- Data from a site where biosolids are not applied (a control site), or
- Earlier data from the same site (trends).

(2) Monitor biosolids for metals and radioactivity, and compare the concentra-

tions with regulatory limits. (3) Determine the aquifer hydrology in this area.

The approach is unique for each component of the Expanded Monitoring Program. However, appropriate USGS methods and technologies will be applied to each component.

Quarterly reports such as this one will be distributed to the stakeholders and other concerned people, as well as available to the general public on the Internet (<http://co.water.usgs.gov>). Each quarterly report will summarize progress from the previous quarter and plans for the current quarter; chemical data will be included every other quarter. A USGS report will be prepared annually and made available after each year of the monitoring program: the reports will include data for that year, any interpretations for that year, and statistical analysis for the data to date. A comprehensive USGS report will be prepared and available after five years of monitoring that includes complete statistical analyses and interpretations. In addition, the USGS will meet with the stakeholders once a year to discuss the Expanded Monitoring Program results and to consider possible changes to the Expanded Monitoring Program.

Questions & Answers

Q: Does the USGS have rainfall data for the Metro District biosolids-application property near Deer Trail?

A: Yes, the USGS monitored rainfall at two wells as part of the previous monitoring program during 1996-1998. The USGS currently monitors rainfall at three wells (D25, DTX2, and DTX5) on the Metro District properties and at one offsite location (DTX10) as part of the USGS Expanded Monitoring Program (1999-present). Data for most of these sites have been available to the public on the Internet (see page 1 for current Internet address); data for all sites are contained in the draft reports in preparation by the USGS.

Q: Why are the original two well sites no longer monitored for rainfall?

A: The rain gages are only part of the continuous-recorder instrumentation used by the USGS. The instrumentation was removed from the original two well sites and moved to other locations for the expanded program to provide better spatial coverage (sites DTX2 and DTX5) and to answer specific hydrologic questions (sites D25 and DTX10).

Alluvial Ground Water

Approach

Six new monitoring wells were installed near the Metro District property boundaries in the major alluvial aquifers. These six wells plus five existing USGS monitoring wells will be sampled approximately quarterly for full inorganic chemistry and annually for radioactivity. Data will be reviewed and statistically tested for exceedance of regulatory limits and for trends.

Progress Last Quarter (January--March 2001)

Ground-water levels were measured January 6-8, February 6, and March 5, 2001. Ground water was sampled for chemistry January 3-9, 2001. Ground-water data were compiled, reviewed, and released in the previous Quarterly Report in March 2001. Monitoring approaches were discussed with stakeholders at a March 13, 2001, meeting in Kiowa, Colorado.

Plans for the Current Quarter (April--June 2001)

Ground-water levels will be measured the first week of each month. Ground water will be sampled in early April, weather permitting. Data will be compiled and reviewed. The 2000 annual report will be started.

Bedrock Ground Water

Approach

Structure maps of the bedrock aquifer were compiled and used to determine locations for two sets of new, clustered wells (one or two alluvial wells and one nearby dual-completion bedrock well comprise each cluster).

The well clusters were installed where both the Muddy Creek alluvial aquifer and the Laramie-Fox Hills aquifer are present (along the margin of the bedrock aquifer) near the Metro District properties. One site continuously records water levels and precipitation at the well cluster and has two alluvial wells screened at different lithologies. Water-level data from each well cluster will be used to determine aquifer hydrology and interaction at those two locations. The two bedrock wells (DTX8, DTX10), along with an existing USGS bedrock well (D29), will be sampled approximately quarterly for full inorganic chemistry and annually for radioactivity. Data will be reviewed and statistically tested for exceedance of regulatory limits and for trends. The structure maps are included in the interpretive report prepared for the 1993-1999 monitoring program.

Progress Last Quarter (January--March 2001)

Ground-water levels were measured January 6-8, February 6, and March 5, 2001. Ground water was sampled for chemistry January 3-9, 2001. Ground-water data were compiled, reviewed, and released in the previous Quarterly Report in March 2001. Monitoring approaches were discussed with stakeholders at a March 13, 2001, meeting in Kiowa, Colorado. The first draft of the USGS interpretive report containing the bedrock-aquifer structure maps was completed and turned in for the first of many reviews.

Plans for the Current Quarter (April--June 2001)

Ground-water levels will be measured the first week of each month. Ground water will be sampled in early April, weather permitting. Data will be compiled and reviewed. The 2000

Continued on page 5



The USGS water-quality samples are analyzed at the new USGS Water Quality Laboratory at the Denver Federal Center.

Bedrock Ground Water

Continued from page 4

annual report will be started. Revisions from the first review will be completed for the interpretive report containing the structure maps.

Surface-Water Sediments

Approach

Surface-water contamination is a concern for the stakeholders, but streams flow off the Metro District properties only during runoff when sur-



After sampling, paperwork is completed for each water sample and the samples are packed inside clean plastic bags on ice inside clean coolers for the short trip across the Denver Federal Center to the laboratory.



The USGS water samples are delivered in person (not shipped) to the laboratory staff for analysis.

face-water sampling is impractical. Therefore, possible surface-water contamination from metals will be evaluated by sampling stream-bed sediments soon after storms. Two small drainage basins were selected for similar characteristics but different land use—one drainage in a biosolids-application field and another drainage in a farmed field (not on the Metro District properties) that does not receive biosolids. Weather permitting, downstream loca-



After the water samples are delivered to the laboratory, the login staff at the laboratory enter the sample information into the computer system and add a barcode label to each sample bottle. During peak times last year, this laboratory received as many as 400 samples in a single day.

tions in each of the two drainage basins will be sampled after the same storms as many as four times per year for inorganic constituents (including metals, total nitrogen, and total phosphorous) and organic carbon, and one time per year for radioactive constituents. Data will be reviewed and statistically tested

to determine if concentrations are significantly different between the two drainage basins.

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Surface-Water Sediments

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Progress Last Quarter (January--March 2001)

The site was carefully monitored for runoff-producing precipitation, but the instruments indicated that precipitation was insufficient to produce runoff needed for sampling. Data were compiled, reviewed, and released in the previous Quarterly Report in March 2001. Monitoring approaches were discussed with stakeholders at a March 13, 2001, meeting in Kiowa, Colorado.

Plans for Current Quarter (April--June 2001)

USGS will continue to monitor the site for runoff-producing precipitation. Sampling may take place, depending on the weather. Data will be compiled

and reviewed. The 2000 annual report will be started.

Biosolids

Approach

Biosolids samples will be collected by Metro District staff as a 24-hour composite from the Metro District plant and analyzed by USGS. Biosolids will be sampled and analyzed once each quarter during most of the program, and once each month for six months when the Lowry Landfill Superfund Site water transfer begins. Data will be reviewed and compared to Federal regulatory limits.

Progress Last Quarter (January--March 2001)

The last of a series of six monthly samplings of biosolids occurred in Jan-

uary 2001, and sampling will continue on a quarterly basis for the remainder of the year. As usual, the biosolids sample was a 24-hour composite from the conveyor belt at the Metro facility. The material was placed in two acid-washed, one-gallon plastic bottles and transported to the USGS in Denver. There, the sample was air-dried then ground to less than 150 micrometers. Chemical analyses were initiated on the January (2001) biosolids sample. Biosolids data were compiled, reviewed, and released in the previous Quarterly Report in March 2001. Monitoring approaches were discussed with stakeholders at a March 13, 2001, meeting in Kiowa, Colorado.

Plans for Current Quarter (April--June 2001)

All chemical data from the monthly sampling of biosolids (August 2000-

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Mary Sue Liss is the Elbert County liaison with the USGS Expanded Monitoring Program. Mary Sue maintains the mailing list and mails out notices of stakeholder meetings. Please feel free to contact Mary Sue regarding any mailing-list issues.

Biosolids

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January 2001) will be compiled and reviewed. The 2000 annual report will be started. The next quarterly biosolids sample will be collected and submitted for chemical analysis.



USGS staff check the function of the submersible sampling pump in a clean tube of water before sampling well D29, which is a deep well that easily pumps dry and causes problems with the pump.

Soils

Approach

One site was selected for characterizing and monitoring the chemical composition of soil on the Metro District property in Arapahoe County, and one site was selected on the Metro District property in Elbert County. Each

site consists of three 20-acre (933 feet by 933 feet) fields separated by 100-foot buffer zones. The center 20-acre field at each site has biosolids applied after the initial soil sampling. The other two 20-acre fields at each site will not have biosolids applied and will be used as “control” fields to monitor the natural variability of soil composition for the duration of the study. All three 20-acre fields at each site will be farmed in the normal fashion and have crops planted and harvested. Soils from each of the six fields were sampled before biosolids were applied to the two center fields and will be sampled again after each harvest. Samples will be analyzed for arsenic, cadmium, copper, lead, mercury, molybdenum, nickel, selenium, zinc, plutonium, and gross alpha and beta activity. Data will be examined after 5 years to determine if concentration has changed with time.

Progress Last Quarter (January--March 2001)

Soil samples that were collected from the Elbert County sites November 29-December 1, 2000, were dried. Data were compiled, reviewed, and released in the previous Quarterly Report in March 2001. Monitoring approaches were discussed with stakeholders at a March 13, 2001, meeting in Kiowa, Colorado.

Plans for Current Quarter (April--June 2001)

A combination of weather conditions and prior commitments prevented the soil sampling at the Arapahoe County sites during January-March 2001, but this sampling will be done before the end of June 2001. At that time, both the Elbert County samples and the Arapahoe County samples will be submitted for chemical analysis. Data will be compiled and reviewed. The 2000 annual report will be started.

Crops

Approach

Crops from each of the six 20-acre soil-monitoring fields will be chemically analyzed after harvest. Analyses will include arsenic, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, and zinc.

Progress Last Quarter (January--March 2001)

Chemical analyses of the wheat and millet samples from the Elbert and Arapahoe County soil sites were completed.

Plans for Current Quarter (April--June 2001)

Data will be compiled and reviewed. The 2000 annual report will be started.

Contact Mary Sue Liss (see page 8) to get on the mailing list or have the mailing list corrected

If you have questions about the Expanded Monitoring Program, please contact Tracy Yager (see page 8). Commonly asked questions will be included in each Quarterly Report.

Definitions

Alluvial aquifer—Unconsolidated (uncemented) sediments and gravels in current or historic stream channels or floodplains that contain significant amounts of ground water.

Bedrock aquifer—Water contained in the fractures or pore spaces of rock formations that is of sufficient quantity to yield water to wells. In many cases, bedrock aquifers underlie soil or other uncemented materials.

Biosolids—Solid organic matter recovered from a sewage-treatment process that meets regulatory criteria for beneficial use, such as for fertilizer. Metro District applies Grade I, Class B biosolids at Deer Trail. Regulations require that land-applied biosolids must meet or exceed Grade II, Class B. Grade I exceeds Grade II.

Radionuclides—A radioactive atom characterized by a given number of neutrons and protons in its nucleus. For example, plutonium concentrations include plutonium-238 or plutonium-239, which are specific isotopes.

Runoff--The rain that hits the ground and flows over the land surface into drainages instead of infiltrating into the soil. Runoff can wash particles of soil, rock, plants, and biosolids from the land surface into the drainages.

Stakeholder—Any person or group (including the Metro District) interested in or concerned about the Expanded Monitoring Program.

Structure map—In this program, a map that uses contour lines to show the altitude of the top and bottom of stratigraphic (geologic) units that could contain the Laramie-Fox Hills aquifer to indicate the location of the aquifer in the vicinity of the study area.

Contacts

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(*email*: DHumble@mwr.dst.co.us)

Elbert County: Mary Sue Liss, 303-621-3144
(*email*: elconurse@bewellnet.com)

State Biosolids Coordinator: Lori Tucker, 303-692-3613

U.S. Environmental Protection Agency: Bob Brobst, 303-312-6129

***2nd annual stakeholder
meeting
was held September 21, 2000, in
Agate, Colorado. Call Tracy Yager
or Mary Sue Liss for more
information.***

Prepared by Tracy Yager and Dave Smith, June 2001, in cooperation with Metro Wastewater Reclamation District

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