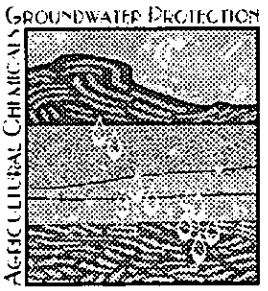
ANNUAL REPORT FOR 2002

STATUS OF IMPLEMENTATION OF SENATE BILL 90-126 THE AGRICULTURAL CHEMICALS AND GROUNDWATER PROTECTION ACT

Colorado Department of Agriculture
Colorado State University Cooperative Extension
Colorado Department of Public Health and Environment



www.ag.state.co.us/DPI/GroundWater/home.html

Colorado Department of Agriculture
Colorado State University Cooperative Extension
Colorado Department of Public Health and Environment

Executive Summary

Status of Implementation of Senate Bill 90-126
The Agricultural Chemicals and Groundwater Protection Act

In the annual report for 2001, several goals for 2002 were identified by the cooperating agencies. The progress made toward each of the goals is detailed in the following pages.

Memoranda of Understanding

Memoranda of Understanding as provided in Section 25-8-205.5 (3)(f) and (g) of the Act have been signed for fiscal year 2003 between the Colorado Department of Agriculture and: 1) Colorado State University Cooperative Extension, and 2) the Colorado Department of Public Health and Environment. The program objectives for 2003 are stated on pages five through six.

Colorado Department of Agriculture

Storage Regulations

Section 25-8-205.5 (3)(b) of the Agricultural Chemicals and Groundwater Protection Act requires the Commissioner of Agriculture to develop regulations where pesticides and fertilizers are stored or handled in quantities that exceed the established thresholds. Pesticide and fertilizer facility inspections continued in 2002.

Pesticide Management Plan

EPA is developing a program that would require states to produce management plans for pesticides thought to be significant hazards to groundwater. If a state wants to allow continued use of any of the pesticides identified, it must produce an EPA-approved management plan specific to that pesticide. EPA concurred on Colorado's Generic Pesticide Management Plan (PMP) in March of 2000. This generic plan will be used as a model to produce the pesticide specific plans.

Waste Pesticide Disposal

MSE Environmental Inc., the private contractor, conducted another "Chemsweep" program in 2002.

Advisory Committee

The advisory committee continues to be an integral part of the implementation of this program by providing input from the many facets of the agricultural community and the general public that they represent (Appendix V). The committee met once during 2002.

Legislation

During the 2002 Legislative session, HB 02-1329 was passed which transferred the authority for monitoring agricultural chemicals in groundwater from the Colorado Department of Public Health and Environment to the Colorado Department of Agriculture.

Colorado State University

Education and Communication

Communication is a vital component of the program. Information is provided to individuals and organizations using agricultural chemicals as well as the general public through: written fact sheets; publications; newsletters; over the web (http://www.colostate.edu/Depts/SoilCrop/extension/WQ/); and through radio shows, mass media, press releases, and presentations at meetings throughout the state.

Ongoing BMP Development and Education

Colorado State University Cooperative Extension (CSUCE) has worked with the CDA to develop Best Management Practices for Colorado farmers, landowners, and commercial agricultural chemical applicators. Because of the site-specific nature of groundwater protection, the chemical user must ultimately determine the BMPs adopted for use at the local level. The local perspective is also needed to evaluate the feasibility and economic impact of these practices. The SB 90-126 Advisory Committee has recommended that a significant level of input be received at the local level prior to adoption of recommended BMPs.

Demonstration Sites and Field Days

The groundwater program at CSUCE works with crop producers, their advisors, fertilizer dealers, USDA NRCS, commodity groups, and local county Extension faculty, to demonstrate and evaluate new and existing production tools that may improve producer profitability and help protect groundwater. Field demonstration work in 2002 centered around helping growers improve water management to deal with the water shortages due to the drought.

Colorado Department of Public Health and Environment

In 2002, the program completed the eighth year of a long term monitoring effort initiated in the South Platte alluvial aquifer from Brighton to Greeley. From June through August 2002, 62 wells in the long-term network were sampled. Nitrogen analysis indicated that 68% of the monitoring wells and 69% of the irrigation wells exceeded the

nitrate drinking water standard of 10 mg/L. Pesticide results for the monitoring well portion of the network revealed six pesticides, Atrazine, 2,4-D, Hexazinone, Metolachlor, Picloram, and Simazine present in the Weld County monitoring well samples. The breakdown product of Atrazine (Deethyl Atrazine) was also detected. Atrazine was present in 32% and Deethyl Atrazine in 47% of the wells. Metolachlor was detected in 32% of the wells, Hexazinone, Picloram, Simazine, and 2,4-D were each detected in one well. Detection levels ranged from 0.09 for Picloram to 4.83 ug/L (ppb) for DEA. No pesticide was detected at a level that exceeds the applicable standard.

Wet Mountain Valley, Custer County, Colorado Regional Monitoring

The 2002 monitoring program included a regional groundwater quality study for the Wet Mountain Valley, Custer County, Colorado. The sampling area includes that portion of the Wet Mountain Valley located within Custer County, Colorado.
The sampling project utilized 58 privately owned domestic wells to collect the groundwater samples.

In the 2002 survey, one well exceeded the EPA drinking water standard of 10 mg/L for nitrate, at 11.6 mg/L. (Figure 2). Ten wells (17%) tested below the detection level of 0.1 mg/L. The majority of wells testing positive for nitrate (69%), were below 2.5 mg/l.

The pesticide analysis performed on the samples collected analyzed for 47 compounds. The pesticide data revealed one well testing positive for the pesticide Picloram but not exceeding the applicable EPA drinking water standard.

Aquifer Vulnerability Study Summary

In addition to monitoring groundwater for the presence of agricultural chemicals, the SB 90-126 Program is required to determine the likelihood that an agricultural chemical will enter the groundwater. In the process of writing the generic Pesticide Management Plan (PMP), the staff at CDA, CSU and CDPHE has studied various types of vulnerability analysis. In 1999, the legislature approved additional funding for a project to develop a method to determine aquifer vulnerability to both pesticides and nitrate statewide. In 2002, work continued toward this goal. Upon completion of the project, the program will be able to determine groundwater vulnerability to agricultural chemicals statewide.

Objectives for 2003 Determined

The following objectives for 2003 have been established:

- Continue production of a report on water quality status in Colorado based on data collected in previous years;
- Continue the implementation of localized BMPs for irrigated crops in the South Platte River Basin;
- Continue demonstration plots in the South Platte River area for displaying improved nitrogen, pesticide, and water management to farmers;
- Coordinate with other agencies and non-governmental organizations to deal with water quality issues throughout the state;
- Continue BMP education work in vulnerable groundwater areas of Colorado;
- Continue the distribution of BMP materials on the economic considerations of BMP adoption for nutrient and pest management;
- Continue to develop and update educational resource materials for groundwater education;
- Publish, distribute, and display on the web, urban BMPs to encourage improved agricultural chemical and water management in urban areas;
- Continue to hold in-service training for chemical applicators, agency personnel, etc.;
- Participate in the Certified Crop Advisor program;
- Continue performing inspections of facilities requiring compliance with containment regulations;
- Continue to provide information on and enforcement of the containment rules and regulations;
- Continue collection and analysis of groundwater samples for pesticides and nitrates on a regional scale;

- Continue the long term monitoring program in Weld County by collecting and analyzing groundwater samples for pesticides and nitrates;
- Evaluate and validate the sensitivity analysis and vulnerability models developed for Colorado groundwater;
- Analyze data and publish results of BMP survey;
- Continue disseminating information on the Act and groundwater protection to special interest groups in Colorado;
- Continue publishing and distributing fact sheets;
- Continue using the display board to provide information on the program at trade shows and professional meetings;
- Update the rules and regulations for bulk storage and mixing and loading facilities;
- Cooperate with the USGS on phase 2 of the South Platte NAWQA;
- Collaborate with the USGS on groundwater monitoring in the Northern High Plains NAWQA;
- Continue work on the monitoring well installation project;
- Prepare bulletin on pesticide fate and transport;
- Participate in USDA PDP program; and
- Begin work on producing a web-based pesticide and groundwater information tool.

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APPENDIX I

2002 Annual Report
Colorado Department of Agriculture

Rules and Regulations for Agricultural Chemical Bulk Storage Facilities and Mixing and Loading Areas

Section 25-8-205.5 (3)(b) of the Agricultural Chemicals and Groundwater Protection Act requires the Commissioner of Agriculture to develop regulations where pesticides and fertilizers are stored or handled in quantities that exceed the established thresholds. These regulations were adopted in July 1994 and became effective September 30, 1994. The law mandated at least a three-year phase-in period for the regulations. As a result of comments prior to and at the public hearings, a graduated phase-in schedule was adopted.

Regulation of pesticide secondary containment/storage facilities and mixing and loading pads, and for liquid fertilizer tanks greater than 100,000 gallons (one of three prescribed methods of leak detection must be utilized unless secondary containment is in place) began on September 30, 1997. Regulation of fertilizer secondary containment/storage facilities and mixing and loading pads began on September 30, 1999. Compliance is required by:

- **September 30, 2004** for secondary containment for fertilizer storage tanks with a capacity greater than 100,000 gallons.

During 2002, facilities were visited to provide information and answer specific questions regarding the rules and regulations for bulk storage and mixing/loading facilities. This educational process aids individuals in determining first, whether or not compliance with the regulations is required and second, what specifically must be accomplished to meet the requirements.

Pesticide and fertilizer facility inspections continued in 2002. A total of 25 pesticide secondary containment structures and 46 mixing/loading pads were inspected. A total of 60 fertilizer secondary containment structures and 60 mixing/loading pads were also inspected. Four leak detection inspections were conducted for facilities storing fertilizer in tanks larger than 100,000 gallons. In addition, 57 follow-up inspections were conducted to correct problems noted in previous facility inspections. One Cease and Desist Order and one Violation Notice were issued during 2002; modifications were needed at some sites. In addition, 58 follow-up inspection orders were issued for problems at facilities that were not serious enough at this time to warrant a Cease and Desist Order or Violation notice. Inspection of pesticide and fertilizer facilities will be ongoing during 2003.

One requirement of the regulations is that the facility design be signed and sealed by an engineer registered in the state of Colorado; or the design be from a source approved by the commissioner and available for public use. The Colorado Department of Agriculture (CDA) in conjunction with Dr. Lloyd Walker, extension agricultural engineer with Colorado State University Cooperative Extension, produced a set of plans that meet the second criteria. The document is entitled, Agricultural Chemical Bulk Storage and Mix/Load Facility Plans for Small to Medium-Sized Facilities. The plans are available from Colorado State University or

CDA free of charge. The Colorado Department of Agriculture, in conjunction with CSU, finished developing a set of generic plans for steel containment facilities to compliment the previously mentioned publication which focuses only on concrete.

Copies of the complete regulations and a summary sheet that contains a checklist to allow individuals to determine if the regulations apply to their operation are also available from CSU, CDA, or via the internet at www.ag.state.co.us/DPI/GroundWater/home.html.

Pesticide Registration and Groundwater Protection

The program continues to review products for registration in Colorado which have groundwater label advisories. As in previous years, Balance herbicide was registered for use in Colorado for 2002 after extensive review. A decision regarding re-registration is expected to be made in early 2003.

Pesticide Management Plan

In October of 1991, the EPA released their Pesticides and Ground-Water Strategy. The document describes the policies, management programs, and regulatory approaches that the EPA will use to protect the nation's groundwater resources from risk of contamination by pesticides. It emphasizes prevention over remedial treatment. The centerpiece of the Strategy is the development and implementation of Pesticide Management Plans (PMPs) for pesticides that pose a significant risk to groundwater resources.

The EPA will require a PMP for a specific pesticide if: (1) the Agency concludes from the evidence of a chemical's contamination potential that the pesticide "may cause unreasonable adverse effects to human health or the environment in the absence of effective local management measures; and (2) the Agency determines that, although labeling and restricted use classification measures are insufficient to ensure adequate protection of groundwater resources, national cancellation would not be necessary if the State assumes the management of the pesticide in sensitive areas to effectively address the contamination risk. If the EPA invokes the PMP approach for a pesticide, its legal sale and use would be restricted to States with an EPA-approved PMP.

EPA published the proposed rule for Pesticide Management Plans on June 26, 1996. As stated in previous year's reports, comments on the proposed rule were submitted under the signature of the Commissioner of Agriculture, Director of Colorado State University Cooperative Extension, and the Executive Director of the Colorado Department of Public Health and the Environment. These comments were printed in the 1996 report. To date, EPA has not published the final rule. It is uncertain when the document will be completed and what will be included based on the comments submitted.

In 1996, a complete draft of the generic Pesticide Management Plan was finished and provided to EPA for their informal review. If Colorado can complete and receive concurrence from EPA on a generic plan, it should be much easier for a pesticide specific plan to be approved once the proposed rule is finalized. A redrafted, general Pesticide Management Plan based on EPA's comments on previous versions was submitted in January 1998. Comments on this version were received from EPA in April 1998, and Colorado then submitted a document final

in August 1998 for formal review and concurrence. Two subsequent documents were submitted to EPA based on comments received, the last being in January of 2000. EPA concurred on Colorado's Generic Pesticide Management Plan (PMP) in March of 2000.

One of the more significant issues regarding the PMP involves EPA's demand for a sensitivity analysis/vulnerability assessment map of the state in a Geographic Information System (GIS) format, by which to determine where to focus education and monitoring activities. In late 1995, a small EPA grant was obtained to perform a sensitivity analysis pilot project for the northeastern part of the state. This work was completed in 1996 and provided to EPA. EPA reacted favorably to the project and provided funding for a statewide sensitivity analysis, which was completed in 1998. This information has been published in an 8 page fact sheet titled Relative Sensitivity of Colorado Groundwater to Pesticide Impact. This publication assesses aquifer sensitivity based on 4 primary factors: conductivity of exposed aquifers; depth to water table; permeability of materials overlaying aquifers; and availability of recharge for the transport of contaminants. These factors were selected because they incorporate the best data currently available for the entire state and incorporate important aspects of Colorado's unique climate and geology.

In 1999, the SB 90-126 program was given spending authority to begin an aquifer vulnerability project to compliment and improve the existing aquifer sensitivity map. Work on one project on aquifer vulnerability to pesticides was completed June 30, 2001 with the Colorado School of Mines. Another related project titled *Probability of Detecting Atrazine/Desethyl-atrazine and Elevated Concentrations of Nitrate in Ground Water* in Colorado, done in conjunction with the United States Geological Survey (USGS) was completed in 2002. Future work is currently being planned based upon funding availability.

Waste Pesticide Disposal

In 1995, CSU Cooperative Extension operated a pilot waste pesticide collection program in Adams, Larimer, Boulder, and Weld Counties. The purpose of this type of program is to provide pesticide users an opportunity to dispose of banned, canceled, or unwanted pesticides in an economical and environmentally sound manner. Part of the funding for the program was provided by an EPA Nonpoint Source 319 grant. The program was a success. Approximately 17,000 lbs. of waste pesticides from 67 participants were collected and safely disposed.

Based on the success of this pilot program, CDA was asked to continue a program that could collect and dispose of waste pesticides in other areas of the state. However, CDA currently has no statutory authority or funding to operate such a program. In light of this, two alternatives were discussed as a way for a waste pesticide collection program to continue. The first was for CDA to seek statutory authority and funding from the Legislature to operate a state-run program. The second was to determine if a private program, operated by a hazardous waste handling company, was possible.

The EPA and the Colorado Department of Public Health and Environment made the possibility of continuing a waste pesticide disposal program significantly easier by the passage of the Universal Waste Rule (UWR) in late 1995. The UWR was developed to encourage disposal of products identified as universal wastes by relaxing the regulations in the Resource

Conservation and Recovery Act (RCRA) and therefore making it easier to properly dispose of these products. Waste pesticides were defined in the rule as a universal waste.

CDA spoke to hazardous waste contractors to determine if they would be interested in attempting to collect and dispose of waste pesticides as a private program. One company, MSE Environmental Inc., stated they would be interested. Discussions were initiated with the company and it appeared it would be possible for MSE to operate a private program at a reasonable cost to the participants. The collection and disposal costs for participants would be between $2.25 and $2.65 a pound.

Based on this information, it was determined that the private program option would be pursued since the possibility of getting legislation passed was slim. Furthermore, the time required for legislation to be passed would considerably delay the operation of a program.

After numerous issues were addressed, MSE targeted two areas of the state to initiate the program, the San Luis Valley and six counties in northeastern Colorado. Registration for participants was set to begin in early 1997, with a scheduled collection of pesticides set for mid-March 1997. This program was very successful. Over 10,500 lbs. of waste pesticides were collected from 33 participants. The cost to participants was $2.65 per pound.

Based on the success of this program, MSE conducted a statewide collection program in November 1997. Over 23,000 lbs. of waste pesticides were collected from 75 participants; again the cost was $2.65 per pound. Subsequent programs are as follows:

Year	Pesticides Collected (lbs.)	Number of Participants
1998	0	0
1999	19,792	47
2000	0	0
2001	13,486	34
2002	8,762	33

Legislation

During the 2002 Legislative session, HB 02-1329 was passed which transferred the authority for monitoring agricultural chemicals in groundwater from the Colorado Department of Public Health and Environment to the CDA. In addition, one FTE was transferred to CDA to perform the monitoring duties. The CDPHE responsibility remains to analyze and interpret groundwater monitoring data to determine if agricultural chemicals are present at levels which meet or exceed water quality standards.

APPENDIX II

2002 Annual Report
Colorado State University Cooperative Extension

Summary of Accomplishments:

- Conducted educational programs throughout Colorado on SB 90-126 and issues related to agricultural chemicals and groundwater quality. Groups addressed include commercial applicators, chemical dealers, weed districts, crop consultants, crop and livestock producers, agency personnel, and urban chemical users.

- Produced newsletter articles, press releases, fact sheets, technical papers, radio and other mass media articles on ground water protection in Colorado.

- Conducted training related to the Colorado Best Management Practices Manual. Distributed booklets to Colorado citizens covering nutrient, pesticide, irrigation, manure, pesticide record keeping, and private water well management.

- Cooperated with the Colorado Corn Growers Association (CCGA) to develop and demonstrate BMPs appropriate for corn production for the final year of their EPA 319 program.

- Produced an 88-page corn production guide, Best Management Practices for Colorado Corn, XCM-574A for the CCGA EPA 319 program (Appendix IV). Will be printed in early 2003.

- Cooperated with county Extension agents on nitrogen and irrigation management demonstrations on farmer fields throughout Colorado. These demonstrations focused primarily on using atmometers and Water Mark® sensors for irrigation scheduling and the PSNT for predicting the need for in-season nitrogen applications to corn.

- Created a database and began analyzing data from a state-wide Irrigated Crop Production Survey to assess the current level of BMP adoption by Colorado producers. The survey was mailed in late November 2001.

- Worked on the Certified Crop Advisors Program in Colorado; including revising the state performance objectives, conducting the state exam and working with the national exam review committee.

- Collaborated with Colorado staff of the Natural Resources Conservation Service to publish a Colorado Nitrogen Leaching Index (CONLI) Risk Assessment for use by farmers, consultants, and NRCS field staff.

- Cooperated with the USGS to develop and refine a groundwater vulnerability map for assessing nitrate and atrazine contamination potential for Colorado.

- Maintained a CSU Extension Water Quality Website to disseminate BMP information via the Internet.

- Cooperated with CSU faculty at the Mountain Meadow Research Station to publish the findings from a research project to compare phosphorus (P) runoff from meadows fertilized under different application timings.

- Published a revised series of four fact sheets on the web to educate Colorado homeowners on BMPs for urban pesticide and fertilizer use (see appendix). These fact sheets are entitled:
  Homeowner's Guide to Protecting Water Quality and the Environment XCM-223
  Homeowner's Guide to Pesticide Use Around the Home and Garden XCM-220
  Homeowner's Guide: Alternative Pest Management for the Lawn & Garden XCM-221
  Homeowner's Guide to Fertilizing Your Lawn and Garden XCM-222

- Distributed the revised Pesticide Record books for Private Applicators (Appendix IV).

- Distributed a booklet of BMPs specifically for greenhouse growers in Colorado entitled: "Pollution Prevention for Colorado Greenhouses."

- Distributed a 20 minute instructional video entitled "Best Management Practices for Colorado Agriculture."

- Worked to coordinate efforts of the Agricultural Chemicals and Groundwater Protection program with other state and federal programs in Colorado.

- Assisted the Colorado Department of Agriculture in sampling the Weld County Monitoring network by training and supervising a CSU student-hourly employee who conducted the sampling in 2002.

- Conducted statistical analysis of irrigation well sampling results from the long-term Weld County Monitoring network to determine if trends in Triazine herbicides or nitrate-nitrogen exist in this data set.

- Assisted County Cooperative Extension faculty, consultants, and growers in dealing with the severe drought conditions in 2002. This assistance included help with decisions on abandonment of irrigated acres, soil moisture monitoring for planting decisions, and improved water management advice for limited irrigation supplies.

Ongoing BMP Development and Education

Colorado State University Cooperative Extension (CSUCE) has worked with the Colorado Department of Agriculture to develop Best Management Practices for Colorado farmers, landowners, and commercial agricultural chemical applicators. Because of the site-specific nature of groundwater protection, the chemical user must ultimately determine the BMPs adopted for use at the local level. The local perspective is also needed to evaluate the feasibility and economic impact of these practices. The SB 90-126 Advisory Committee has recommended that a significant level of input be received at the local level prior to adoption of recommended BMPs.

Colorado State University Cooperative Extension has compiled a broad set of BMPs encompassing nutrient, pest, and water management that has been used as a template for local committees. These documents were published in a notebook form in 1995 that are updated as needed and expanded to include additional guidelines.

Cooperative Extension piloted the local BMP development process in the San Luis Valley and in the Front Range area of the South Platte Basin. The local working committees consist of a small group of producers, consultants, and chemical applicators. Both of these groups have produced BMPs for nutrient and irrigation management - the most serious problem in their respective areas. In 1995, the Shavano SCD worked with local Extension agents and producers to develop a set of practices appropriate for the West Slope entitled "Best Management Practices for the Lower Gunnison Basin." During 1996, a fourth local BMP work group was initiated in the lower South Platte Basin. They published their findings in a bulletin entitled "Best Management Practices for the Lower South Platte River Basin." Although most of these work groups have not been active since finishing their local BMP publications, these guides continue to be distributed at the local and state level. The S. Platte BMP workgroup in the Front Range area continues to be active and now meets every other year to review current groundwater quality data and discuss research, education, and regulatory issues affecting groundwater in their area.

Building on these efforts, a crop specific BMP, Best Management Practices for Colorado Corn was finalized in 2002. This publication was produced with support from the Colorado Corn Growers and should be available to growers in the spring of 2002. This BMP covers corn production from hybrid selection to harvest with an emphasis on stewardship and protecting water quality.

Evaluation of BMP Adoption

A mailed crop production survey was conducted during the last week of November, 2001 to measure the progress of our educational efforts related to SB 90-126. This survey was mailed to 3,260 irrigating crop producers. To date, 1,298 (40%) producers have responded with 37% of the responses being usable. The primary objective of this survey was to learn the adoption rate of nutrient, pesticide, and irrigation BMPs among Colorado producers. Results from returned surveys were entered into a database in 2002 and are being analyzed. These results will be used to focus the groundwater program on the

geographical and topical areas that need higher adoption rates to protect water quality. Because we conducted a similar survey in 1997, we can use the 2001 survey to measure progress in our educational efforts since that time. The results of this survey will be published in a technical report and fact sheets. We will encourage other CSU faculty and CE agents, NRCS staff, water and soil conservation districts, and others to use the survey information to focus groundwater protection resources in deficient areas.

Field Demonstration and Research

Field demonstration work in 2002 centered around helping growers improve water management to deal with the water shortages due to the drought. CSUCE loaned atmometers (ETgages) to county agents, consultants, and individual farmers. ETgages are useful for simple and effective irrigation scheduling. Soil moisture monitoring devices (Water Mark®) were also demonstrated to interested growers. Research continued on irrigation water nitrate crediting at two sites in Weld County. Four continuous years of research has been conducted at one of these sites and these results are useful in convincing growers to adopt this BMP when using nitrate enriched ground water.

Education and Communication

Communication is a vital component of the program. Numerous methods are used to provide information to individuals and organizations using agricultural chemicals as well as the general public. We continue to provide written fact sheets and publications with information on the program and distribute at meetings, conferences, and trade shows. Also, a display board is being utilized at conferences and trade shows to provide information on the program. Information on groundwater protection is continually being presented to the public through radio shows, mass media, press releases, and presentations at meetings throughout the state. Presentations on how the program works, past and present water quality projects, and plans for future projects with request for local input are made at every opportunity. In 2002, presentations were made at several major meetings and small local groups throughout the state. We consider this type of outreach an important part of the customer service component of the program.

We continue to make information available over the internet. Several locations including the CSU Cooperative Extension web site (http://www.ext.colostate.edu), the CSU Cooperative Extension Water Quality web site (http://www.colostate.edu/Depts/SoilCrop/extension/WQ/), and the Agricultural Chemicals and Groundwater Protection Program web site (http://www.ag.state.co.us/dpi/GroundWater/home.html), provide information on BMPs.

APPENDIX III

Colorado Department of Agriculture &
Colorado Department of Public Health and Environment
Ground Water Monitoring Program
2002 Annual Report

Summary of Accomplishments:

- Completed a ground water monitoring project in Custer County Colorado. Fifty-seven wells, located throughout the Wet Mountain Valley aquifer system were sampled for a broad range of analytes. This data set will be used as input to a GIS based modeling process to determine the vulnerability of this type of area to agricultural chemical contamination.

- Continued the long term monitoring project in the Weld County portion of the South Platte River Basin, a high priority watershed for SB 90-126 efforts. This year the program sampled nineteen (19) monitoring wells and forty-three (43) irrigation wells.

- Cooperated in a joint project with the U S Geological Survey, NAWQA program for the High Plains in an assessment of pesticides in the vadose zone overlying the Ogallala Aquifer.

- Assisted in the planning and design of a project between the Ag Chemicals Program, the State Engineers Office, and local Groundwater Management Districts to continue a long-term ground water quality monitoring project in the High Plains of Colorado.

- Completed the joint project with the U. S. Geological Survey to develop a GIS based statistical approach to ground water vulnerability for pesticide contamination.

- Collaborated with Colorado State University researchers on the development of a statewide aquifer sensitivity map and vulnerability model for nitrate.

- Collaborated with the Department of Agriculture Standards Laboratory to revise and refine the laboratory analysis used on all ground water samples.

- Continued the project to automate data retrieval and report production utilizing the Access database for the entire program's ground water data storage and retrieval needs.

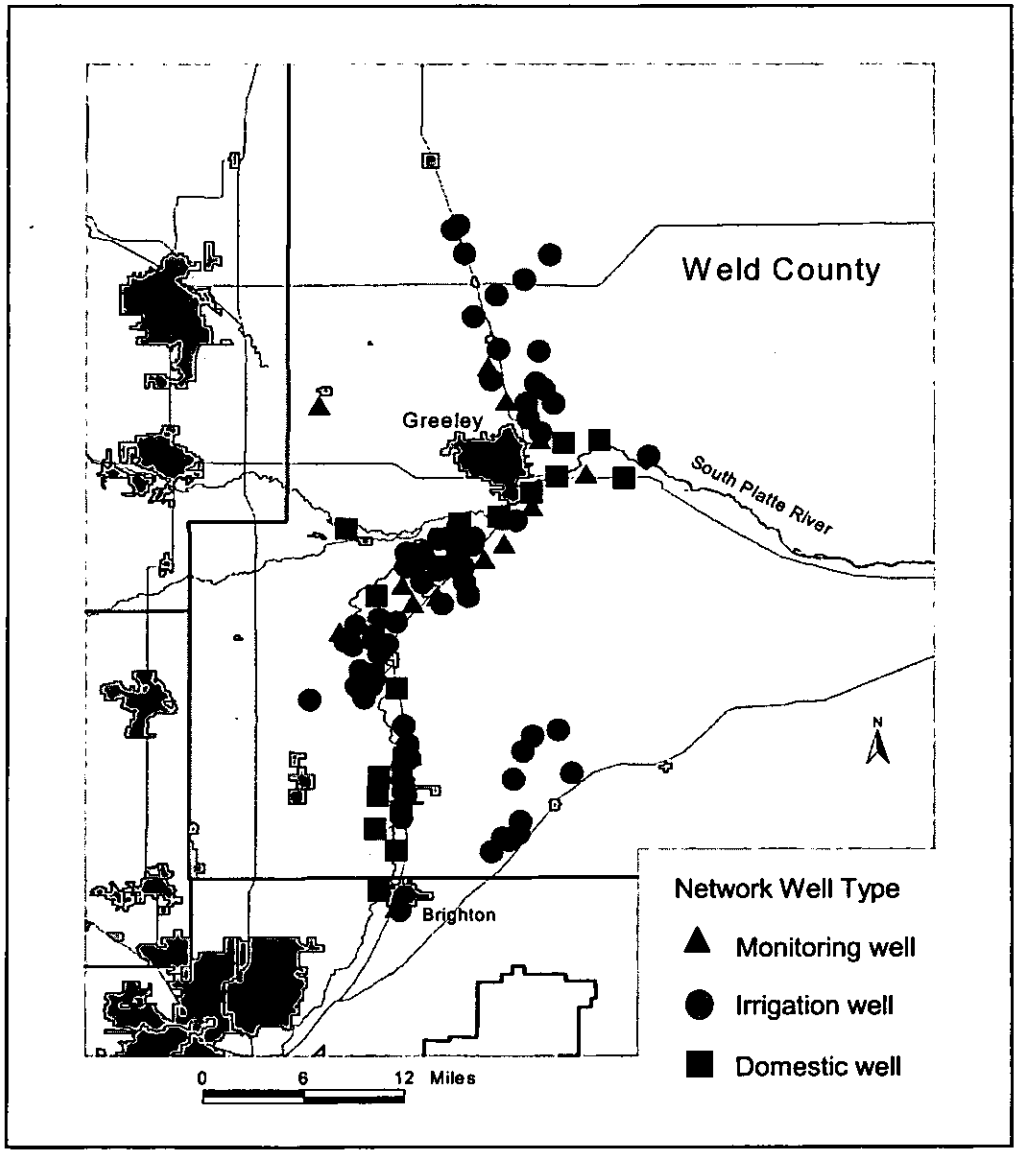
Addressed groups throughout Colorado on SB 90-126 and issues related to agricultural chemicals and groundwater quality. Groups addressed include chemical dealers, groundwater management districts, crop and livestock producers, and agency personnel.

- Cooperated with the Colorado Corn Growers Association in their BMP's for corn production project.

- Distributed fact sheets and reports on Colorado groundwater quality to interested parties and fielded question by phone and e-mail to Colorado citizens.
- Cooperated with county Extension agents on disseminating information about Colorado groundwater quality.
- Worked to coordinate efforts of the Agricultural Chemicals and Groundwater Protection program with other state and federal programs in Colorado.
- Cooperated and provided assistance to the South Platte BMP workgroup.
- Evaluated the pesticide survey data to extract information needed to improve laboratory analysis.

Weld County Long Term Monitoring

In 2002, the program completed the eighth year of a long-term monitoring effort in the South Platte alluvial aquifer from Brighton to Greeley. The long-term monitoring network was established in 1995 and is a combination of three types of wells designed to sample a complete cross-section of the aquifer (Figure 1). The network well types are: a) Twenty (20) dedicated monitoring wells operated by the Central Colorado Water Conservancy District; b) Sixty (60) irrigation wells and c) Eighteen (18) domestic wells first sampled in 1992. The monitoring and irrigation wells are sampled each year, the domestic wells every three years.



From June through August 2002, 62 wells in the long-term network were sampled. All wells were analyzed for nitrate-nitrite as nitrogen. The 19 monitoring wells were analyzed for the complete suite of 47 pesticides listed in Table 4. The pesticide analysis for the 43 irrigation wells was an immuno assay screen for the triazine herbicides.

Nitrogen analysis indicated that 68% of the monitoring wells and 69% of the irrigation wells exceeded the nitrate

FIGURE 1 - Location and type of well comprising the Weld County, Colorado long term monitoring network.

drinking water standard of 10 mg/L. In the monitoring wells, nitrate levels varied over a broader range, with the highest median value. The monitoring wells sample the upper most zone (10 feet) of the aquifer. The irrigation wells recorded a narrower range in nitrate levels and a significantly less median value. The differences are expected due to the different zones of the aquifer sampled by each well set, as the irrigation wells sample the entire saturated zone. Table 1, below, lists the summary statistics for both sets of wells.

TABLE 1 - Summary statistics for the Weld County nitrate monitoring results, 2002.

Weld County Nitrate Monitoring			
	Monitoring wells		Irrigation wells
Mean	27.7		18.1
Median	22.1		17.3
Standard Deviation	23.6		11.5
Minimum	2.54		< 0.01
Maximum	89.4		44.5
# Wells sampled	19		36*
Note: all values are Nitrate as N (mg/L), except # wells			

* 43 wells were sampled but laboratory problems resulted in only 36 reported analysis.

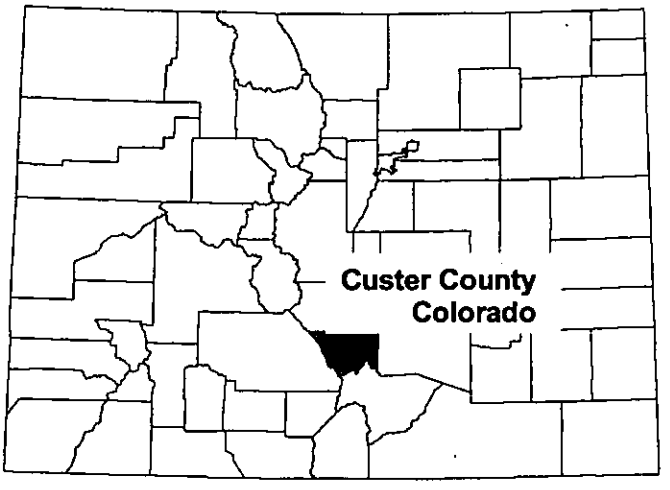
Pesticide results for the monitoring well portion of the network revealed six pesticides, Atrazine, 2,4-D, Hexazinone, Metolachlor, Picloram, and Simazine present in the Weld County monitoring well samples. The breakdown product of Atrazine, (Deethyl Atrazine) was also detected. Atrazine was present in 32% and Deethyl Atrazine in 47% of the wells. Metolachlor was detected in 32% of the wells, Hexazinone, Picloram, Simazine, and 2,4-D were each detected in one well. Detection levels ranged from 0.09 for Picloram to 4.83 ug/L (ppb) for DEA. No pesticide was detected at a level that exceeds the applicable standard.

The triazine herbicide screen used on the irrigation wells detects any pesticide in the triazine family, which includes Atrazine, Simazine, Cyanazine, Deethyl Atrazine, Deisopropyl Atrazine, and Prometone. The results are calibrated in units of Atrazine equivalent but may be actually composed of one or more of the components. In 2002, triazine herbicides were detected in 63% of the irrigation wells. Levels ranged from 0.06 ug/L to 0.50 ug/L (ppb).

Brad Austin of CDA sampled the monitoring wells in Weld County during June 2002. Program staff at CSUCE, sampled the irrigation wells in Weld County, July through August 2002. Field sampling procedures followed the protocol developed by the ground water quality monitoring working group of the Colorado nonpoint task force.

Wet Mountain Valley, Custer County, Colorado Regional Monitoring

The 2002 monitoring program included a regional groundwater quality study for the Wet Mountain Valley, Custer County, Colorado. The sampling area includes that portion of the Wet Mountain Valley located within Custer County, Colorado.



The Wet Mountain Valley is an intermountain basin located approximately 50 miles west of Pueblo, Colorado. The valley is aligned northwest southeast, bounded by the Sangre de Cristo Mountains on the southwest and the Wet Mountains on the northeast. The valley has a semi-arid climate with less than 16 inches per year of rainfall on the valley floor, which exceeds 8,000 feet in elevation.

Except for a boom and bust mining period in the late 1800s through the early 1900s, agriculture has been the mainstay of the valley's economy. Recently, tourism and retirement living have begun to gain an increasing share of the valley's economy. This influx of people and the resulting development is a major concern for local government planning and the basis for evaluating the valley's water resources, both quantity and quality.

The principal aquifer in the Wet Mountain Valley is found in the saturated basin-fill sediments occupying the central portion of the valley. These sediments are estimated to be at least 6,700 feet deep. Secondary aquifers occur throughout the adjacent Wet Mountains in fractured crystalline rocks. Volcanic debris and ash deposits in and adjacent to the valley may contain local deposits of ground water but the high mineral content of these deposits would create high dissolved solids concentrations.

The valley fill alluvium contains the major available supply of ground water in the area covered by this study. Depths to water range from less than 10 feet over broad areas of the valley floor to over 100 feet near the margins of the valley. Ground water flow directions are generally to the northwest, and levels have remained stable in recent years. The majority of the recent development is in the fractured bedrock foothills areas on the western slope of the Wet Mountains. In this area, wells must reach to considerably greater depths than in the valley floor to produce the required flows. Depths on the order of 300 to 500 feet are not uncommon in this region.

Recharge to the aquifers occurs along the perimeter of the valley through surface runoff from the surrounding mountains, directly by infiltration of rainfall and snowmelt, and in the valley floor as deep percolation of excess applied irrigation water. Ground water return flows that augment the flow of Texas and Grape Creeks and consumptive losses, due to evaporation and evapotranspiration are the principle losses of ground water from the valley.

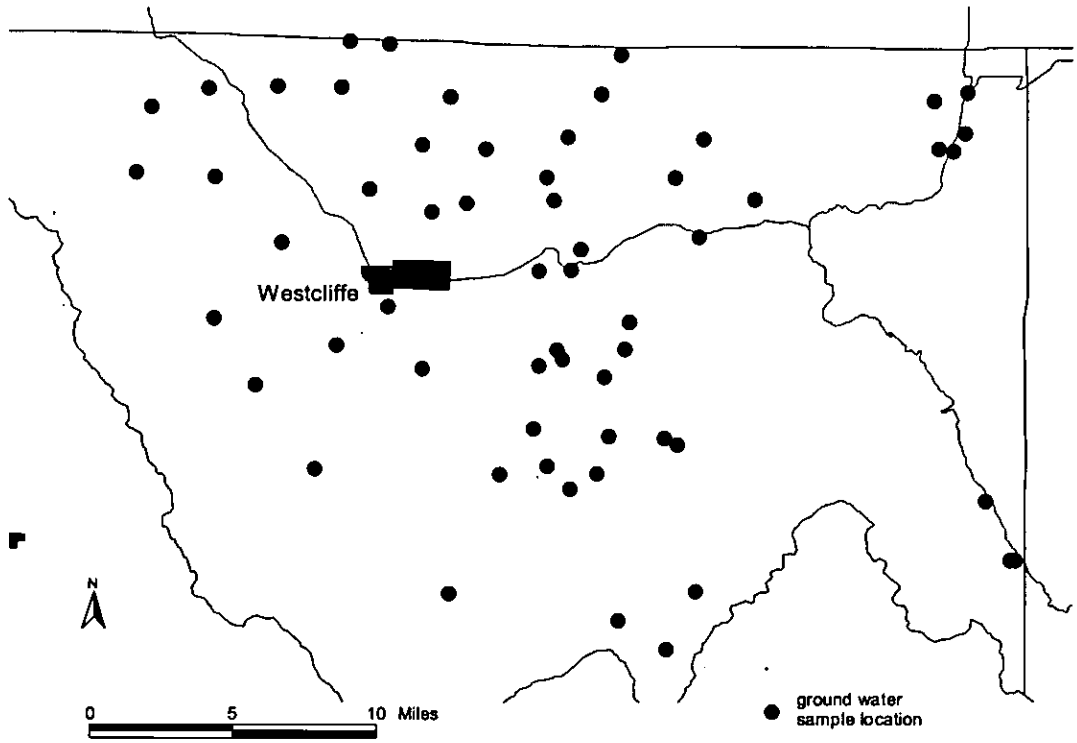


FIGURE 2 - Location of domestic wells sampled in the Wet Mountain Valley, Custer County, Colorado regional ground water quality study.

The sampling project utilized 58 privately owned domestic wells (Figure 2) to collect the groundwater samples. The well network was assembled for this project as a joint effort between the program, USGS Pueblo sub-district, and Custer County. All wells were sampled for the basic water quality constituents, dissolved metals, nitrate and forty-seven pesticides. In all cases, existing wells were used. Most of these wells were privately owned and permitted as domestic wells. Well coverage is not uniformly distributed as efforts were concentrated in those areas representative of recent development, but all geographic and geohydrologic areas are represented in the survey. The domestic wells sampled in this survey were also utilized by the USGS Pueblo Sub-District office in their water supply study for Custer County.

Brad Austin (CDA) was the field personnel responsible for the sampling in July through August 2002. Field sampling procedures followed the protocol developed by the ground water quality monitoring working group of the Colorado non-point task force. Well samples were analyzed for basic water quality and dissolved metals at the Colorado State University water-testing laboratory. The Colorado Department of Agriculture, Standards Laboratory performed the laboratory analysis for nitrate, and pesticides. The complete analysis performed on all samples, along with laboratory methods and reporting limits for each analyte is presented in Table 4. Temperature and conductivity were measured in the field as part of the well purging process.

Analysis of the nitrate data indicates that ground water in the majority of the area sampled does show minor levels of nitrate contamination. It cannot be determined from this analysis the source of the nitrate, but our experience in other areas of the state combined with the land uses would suggest possible residual septic system waste products.

In the 2002 survey, one well exceeded the EPA drinking water standard of 10 mg/L for nitrate, at 11.6 mg/L. (Figure 3). Ten wells (17%) tested below the detection level of 0.1 mg/L. The majority of wells testing positive for nitrate (69%), were below 2.5 mg/l. In Figure 3 below, we see that in eighty-six percent (86%) of the wells sampled, the nitrate concentration falls in the range from below the detection limit (0.1 mg/l) to one quarter of the maximum allowable level. In ninety six percent (96%) of the samples, the nitrate concentration is less than one half the maximum limit for drinking water. Nitrate levels show no geographic regional trend but tend to be slightly higher in the foothills of the Wet Mountains (Figure 4). This distribution appears to be most associated with those areas were large mountain sub-division developments have recently occurred.

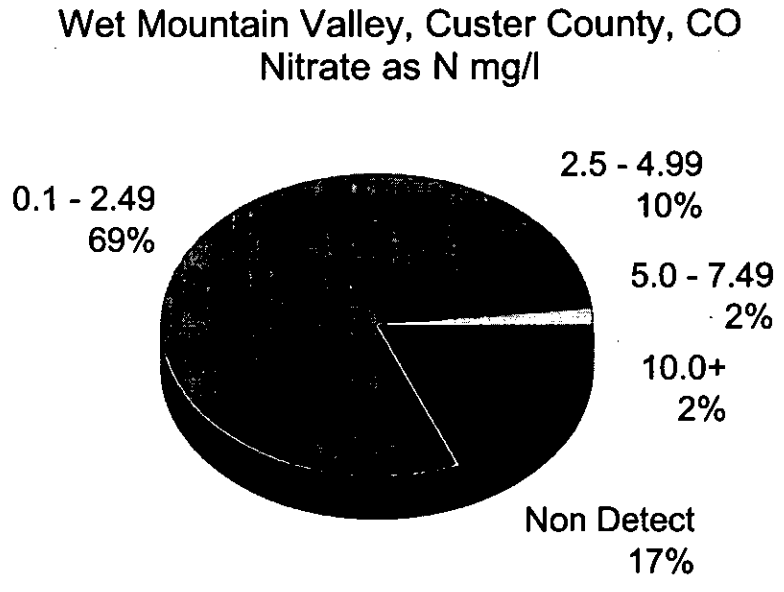


FIGURE 3 - Breakdown of nitrate levels for 58 domestic wells sampled in Custer County, Colorado, 2002.

A map (Figure 4) prepared on a geographic information system (GIS) shows the location of the wells and the nitrate results graphed in Figure 3. Wells on the map have been color coded according to the nitrate level measured in the well. Wells represented in blue are below the detection level of 0.1 mg/l. The wells in cyan have nitrate levels ranging from just above the laboratory detection level of 0.1 mg/L up to 2.49 mg/l, the wells in green range from 2.5 to 4.99 mg/l. Wells in yellow indicate nitrate present in the sample at or greater than one half the standard (5.0 mg/L) but less than 7.5 mg/L. Wells presented in red indicate nitrate levels exceeding the EPA drinking water standard of 10 mg/l.

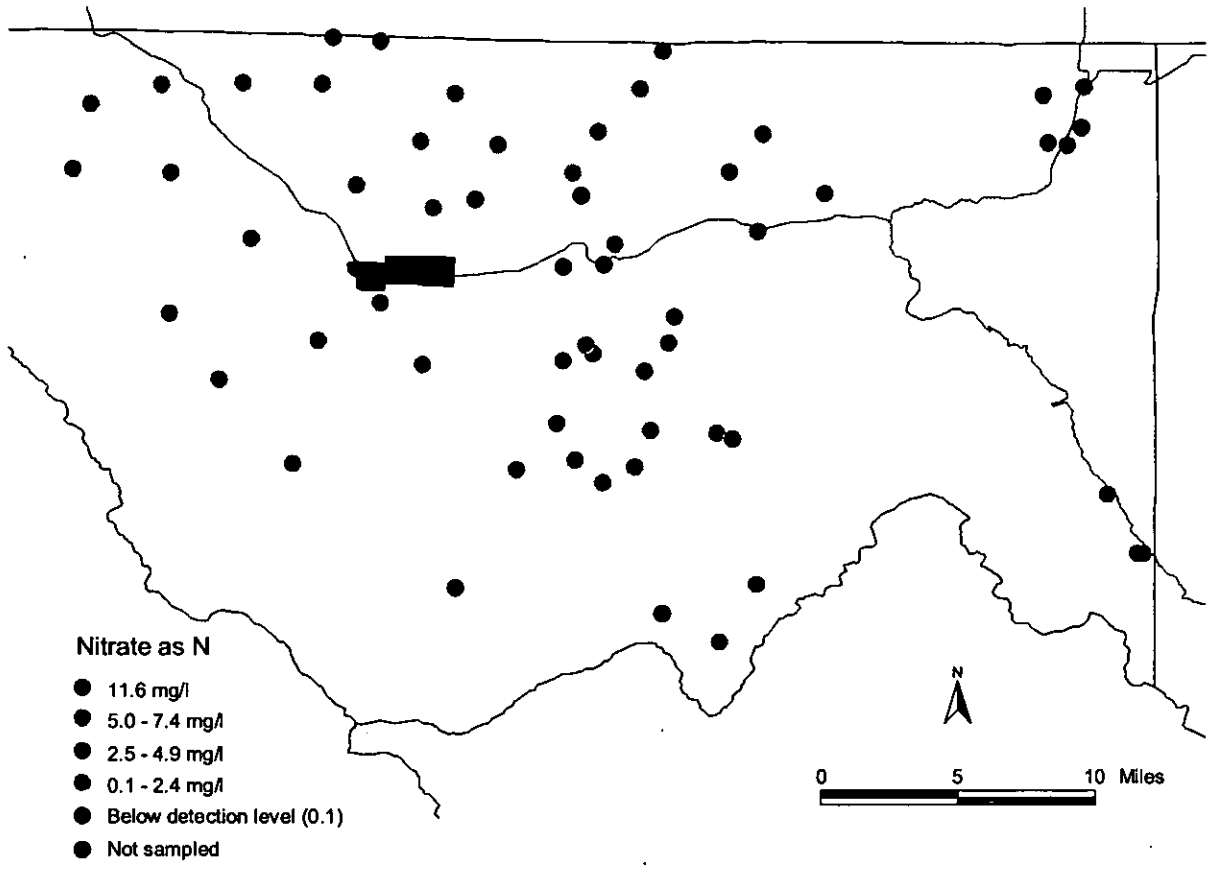


FIGURE 4 - Location of domestic wells sampled in the Wet Mountain Valley, Custer County, Colorado and their corresponding nitrate as nitrogen value.

Table 2 below presents summary statistics for nitrate as nitrogen for the fifty-eight domestic wells sampled in the Wet Mountain valley in 2002.

TABLE 2 - Summary statistics for Nitrate as N results, Custer County, 2002

Summary Statistics	2002 Nitrate
Mean	1.15
Median	0.64
Minimum	0.05
Maximum	11.68
Standard Deviation	1.88
# wells sampled	58

This project also collected and analyzed for the basic water quality ions (Table 4) commonly found in ground water. The data revealed no deviations from expected values. Because of the hard rock mining history of the area, samples were also analyzed for dissolved metals. No anomalous values were found in this analysis.

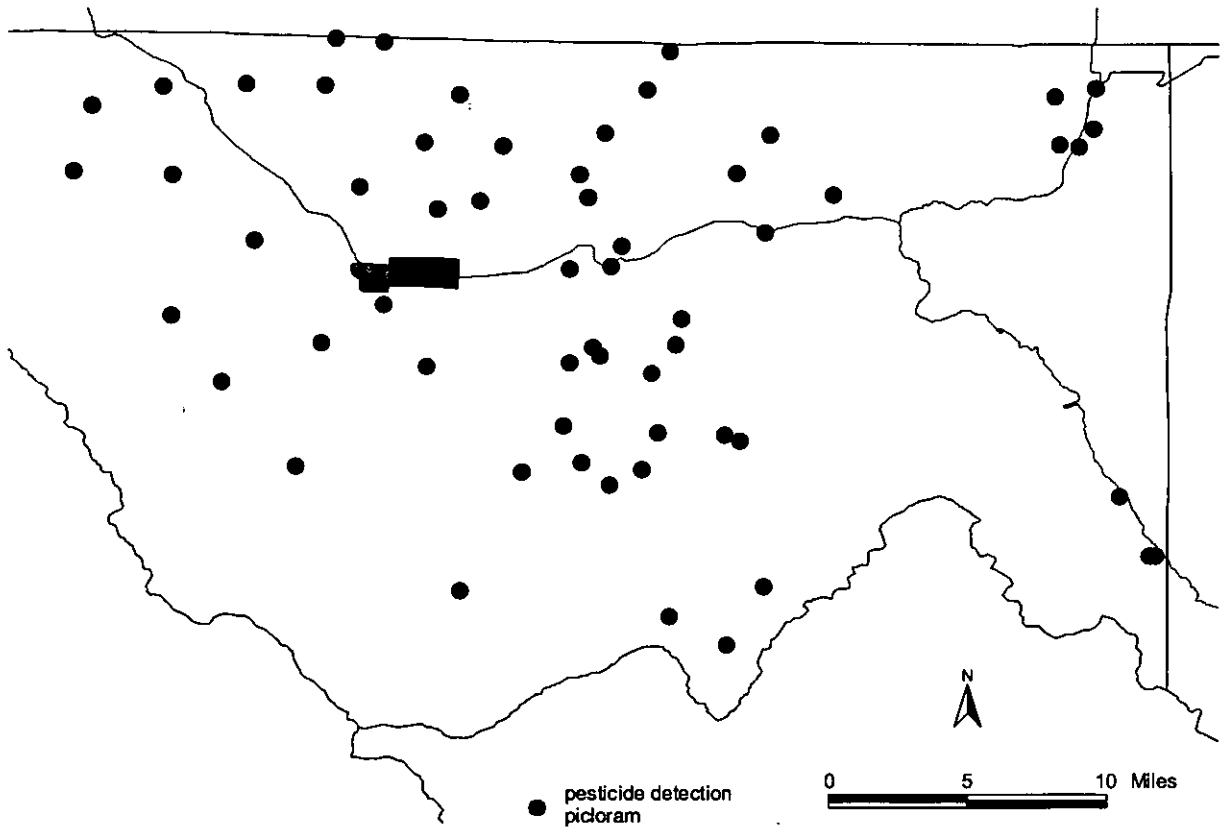


FIGURE 5 - Location of pesticide detection. Map showing the location and type of pesticide detected in domestic wells sampled in Custer County, Colorado, 2002.

The pesticide analysis performed on the samples collected in 2002 analyzed for 47 compounds. The pesticide data revealed one well testing positive for the pesticide Picloram in this study. The location of the Picloram detection is plotted in Figure 5. The herbicide Picloram is commonly used on pastureland for control of noxious weeds. There was no occurrence of pesticide detection at a level higher than the applicable EPA drinking water standard.

The monitoring program included sample collection, laboratory analysis, data analysis, and storage. This survey, while not exhaustive, does cover the major hydrologic regions of the Wet Mountain valley and should function well as a baseline for future ground water quality monitoring in this area.

Table 4 - Laboratory Methods and Detection Levels

Colorado Department of Agriculture Standards Laboratory

PESTICIDE ANALYSIS

Pesticide Trade Name	Pesticide Common Name	Pesticide Use	Chemical Type	EPA Method	MDL (ug/L)
Harness	Acetachlor	Herb	acetoalinide	525.1	0.1
Lasso	Alachlor	Herb	OrganoCL	525.1	0.1
AAtrex	Atrazine	Herb	Triazine	525.1	0.1
	Deethyl Atrazine		Triazine	525.1	0.2
	Deisopropyl Atrazine		Triazine	525.1	0.2
Balan	Benfluralin	Herb	OrganoFL	525.1	0.2
Hyvar	Bromacil	Herb	uracil	525.1	0.4
Captane	Captan	Fungi	carboximide	525.1	1.4
Lorsban	Chlorpyrifos	Insect	OrganoPH	525.1	0.1
Bladex	Cyanazine	Herb	Triazine	525.1	0.2
Dacthal	DCPA	Herb	phthalic acid	525.1	0.1
Dazzel	Diazinon	Insect	OrganoPH	525.1	0.2
Barrier	Dichlobenil	Herb	nitrile	525.1	0.1
Cygon	Dimethoate	Insect	OrganoPH	525.1	0.5
	p,p-DDT	Insect	OrganoCL	525.1	0.4
	Endrin	Insect	OrganoCL	525.1	0.3
	Heptachlor	Insect	OrganoCL	525.1	0.6
	Heptachlor epoxide	Insect	OrganoCL	525.1	0.8
Velpar	Hexazinone	Herb	Triazine	525.1	0.1
Gamma-mean	Lindane	Insect	OrganoCL	525.1	0.1
Malathion	Malathion	Insect	OrganoPH	525.1	0.1
Ridomil	Metalaxyl	Fungi	acylalanine	525.1	0.2
Marlate	Methoxychlor	Insect	OrganoCL	525.1	0.9
Dual	Metolachlor	Herb	acetamide	525.1	0.1
Sencor	Metribuzin	Herb	Triazine	525.1	0.5
Prowl	Pendimethalin	Herb	dinitroaniline	525.1	1.2
Primatol	Prometon	Herb	triazine	525.1	0.1
Princep	Simazine	Herb	triazine	525.1	0.2
Treflan	Trifluralin	Herb	OrganoFL	525.1	0.3
Weed B Gone	2,4-D	Herb	PhenoxyAcid	515.2	0.03
Stinger	Clopyralid	Herb	PicolinicAcid	515.2	0.07
Banvel	Dicamba	Herb	BenzoicAcid	515.2	0.05
Kilprop	MCPP	Herb	PhenoxyAcid	515.2	0.06
Agritox	MCPA	Herb	PhenoxyAcid	515.2	0.02
Tordon	Picloram	Herb	PicolinicAcid	515.2	0.17
Turflon	Triclopyr	Herb	PicolinicAcid	515.2	0.01

Table 4, continued - Laboratory Methods and Detection Levels

Colorado Department of Agriculture Standards Laboratory

PESTICIDE ANALYSIS

Pesticide Trade Name	Pesticide Common Name	Pesticide Use	Chemical Type	EPA Method	MDL (ug/L)
Temik	Aldicarb	Insect	Carbamate	531.1	1.0
	Aldicarb sulfone		Carbamate	531.1	2.0
	Aldicarb sulfoxide		Carbamate	531.1	2.0
Sevin	Carbaryl	Insect	Carbamate	531.1	2.0
Furadan	Carbofuran	Insect	Carbamate	531.1	1.5
	3-Hydroxycarbofuran		Carbamate	531.1	2.0
	Methiocarb	Insect	Carbamate	531.1	4.0
Lannate	Methomyl	Insect	Carbamate	531.1	1.0
	1-Naphthol		Carbamate	531.1	1.0
DPX	Oxamyl	Insect	Carbamate	531.1	2.0
Baygon	Propoxur	Insect	Carbamate	531.1	1.0

INORGANIC ANALYSIS	EPA Method	MDL (mg/L)
Nitrate/Nitrite as N	300	0.1

Table 4, continued - Laboratory Methods and Detection Levels

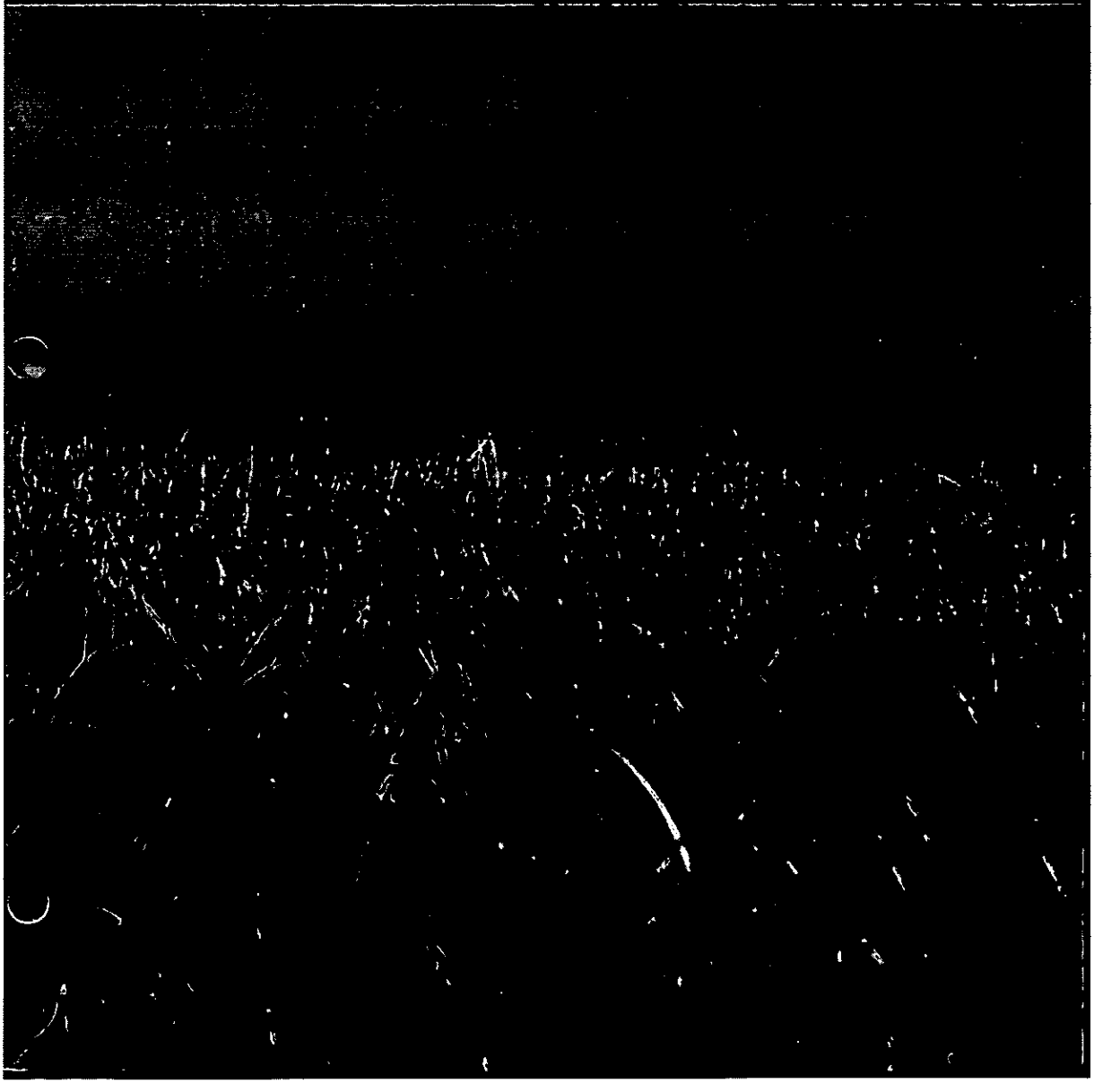
Colorado State University Soils Laboratory

MINERALS AND DISSOLVED METALS ANALYSIS

Basic Water Quality Parameters	Method	Reporting Limit (mg/L)
Boron	EPA 200.0	0.01
Bicarbonate	APHA 2320B	0.1
Calcium	EPA 200.0	0.1
Carbonate	APHA 2320B	0.1
Chloride	EPA 300.0	0.1
Magnesium	EPA 200.0	0.1
Nitrate	EPA 300.0	0.1
pH	EPA 150.1	0.1 pH unit
Sodium	EPA 200.0	0.1
Specific conductance (TDS)	EPA 120.1	1.0 uS/cm
Sulfate	EPA 300.0	0.1
Potassium	EPA 200.0	0.1
Alkalinity, total	Titration	1.0
Solids, Total Dissolved	Gravimetric	10.0
Hardness, total as $CaCO_3$	Calculation	1.0
Dissolved Metals		
Aluminum	EPA 200.0	0.1
Barium	EPA 200.0	0.01
Cadmium	EPA 200.0	0.01
Chromium	EPA 200.0	0.01
Copper	EPA 200.0	0.01
Iron	EPA 200.0	0.01
Manganese	EPA 200.0	0.01
Nickel	EPA 200.0	0.01
Molybdenum	EPA 200.0	0.01
Phosphorous, total	EPA 200.0	0.1
Zinc	EPA 200.0	0.01

APPENDIX IV

Best Management Practices for Colorado Corn



homeowner's GUIDE

To Pesticide Use Around the Home and Garden

XCM-220

Pesticides can serve a useful purpose around the home and garden by reducing some of the problems we face from pests. But they can harm our drinking water supplies if handled improperly.

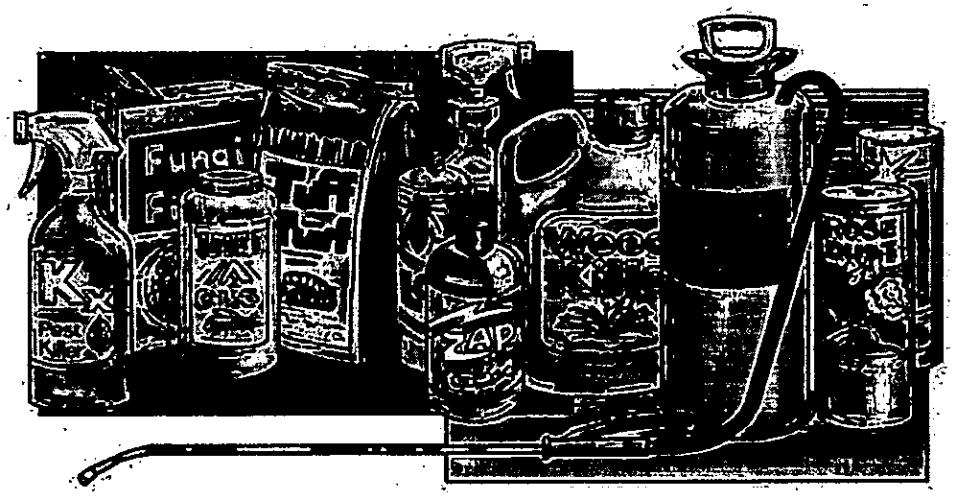
Pesticides include insect killers (insecticides), weed killers (herbicides), and fungus killers (fungicides). The ingredients that make these chemicals toxic to pests also can be harmful to people and animals, and in some cases, they can also contaminate water supplies.

This can happen even when pesticides are used according to the label. Water contamination is costly to remedy, and homeowners who use pesticides need to follow some common sense guidelines to avoid these unintended consequences.

Before You Buy a Pesticide

Pest-free homes and gardens are expensive, impractical, and environmentally unsound. The urge for a chemical "quick fix" for every problem around the home should be re-evaluated. Instead, maintaining weeds or garden insects at non-damaging levels is a more realistic goal. Allowing low levels of pests to survive will actually help maintain a population of natural enemies.

There are a number of strategies homeowners can use to manage pests without chemicals. Evaluate all your options such as non-toxic sprays, biological controls, changes in cultural practices, or even doing nothing before you purchase a chemical. In some



Colorado State University Cooperative Extension

Putting Knowledge to Work

homeowner's GUIDE

Alternative Pest Management for the Lawn and Garden

XCM-221

A pest-free lawn and garden may sound ideal, but is it really? Maintaining the perfect urban landscape often results in a reliance on pesticides that can lead to environmental and human health problems.

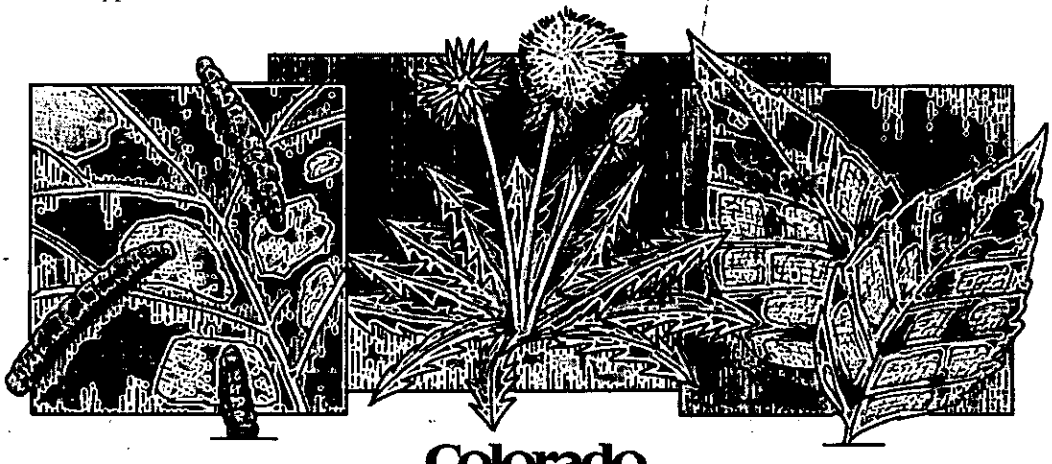
Many homeowners are turning to pesticide alternatives as they re-evaluate the consequences of their not-so-ideal landscaping.

Fortunately, there are many biological processes that work to keep pests in a natural balance. The 'ideal' garden is one with vigorous plants and protected natural enemies of certain annoying pests. The conventional approach—of applying pesticides routinely, or at the first sign of any pest—is replaced with a lower input emphasis on nature at its best.

An alternative approach is not the answer to all problems every time. But when it works, it is an ideal way to address pest problems while helping protect our water supplies.

The principles of this alternative approach include:

- Learning more about plants and their pests.
- Selecting landscape and garden plant varieties that are resistant to pests.
- Rotating annual garden plants to reduce the buildup of pests.
- Inspecting plants frequently for the presence both of pests and beneficial organisms.
- Determining if control measures are really necessary before taking action.
- Selecting methods that are least disruptive to natural controls and least hazardous to the environment.



Colorado State University Cooperative Extension

Putting Knowledge to Work

GUIDE

To Pesticide Use Around the Home and Garden

XCM-220

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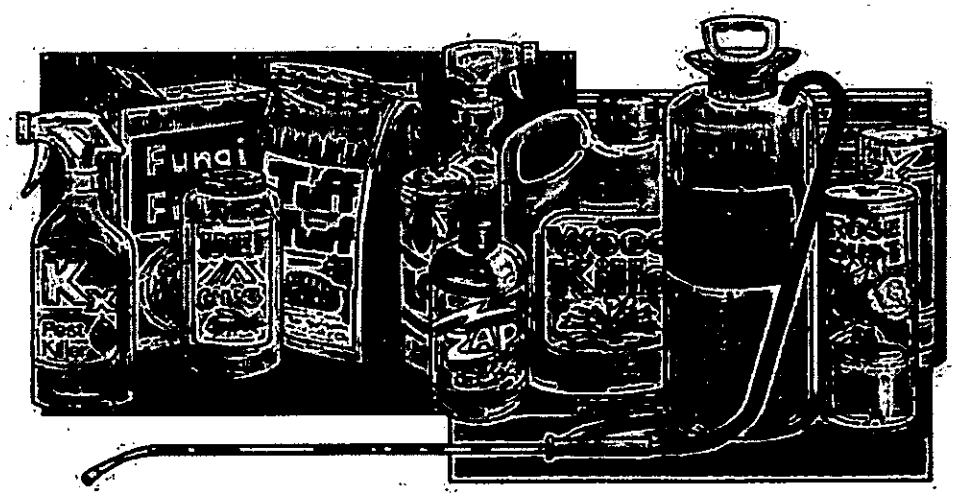


Colorado State University Cooperative Extension

Putting Knowledge to Work

homeowner's GUIDE

To Protecting Water Quality and the Environment

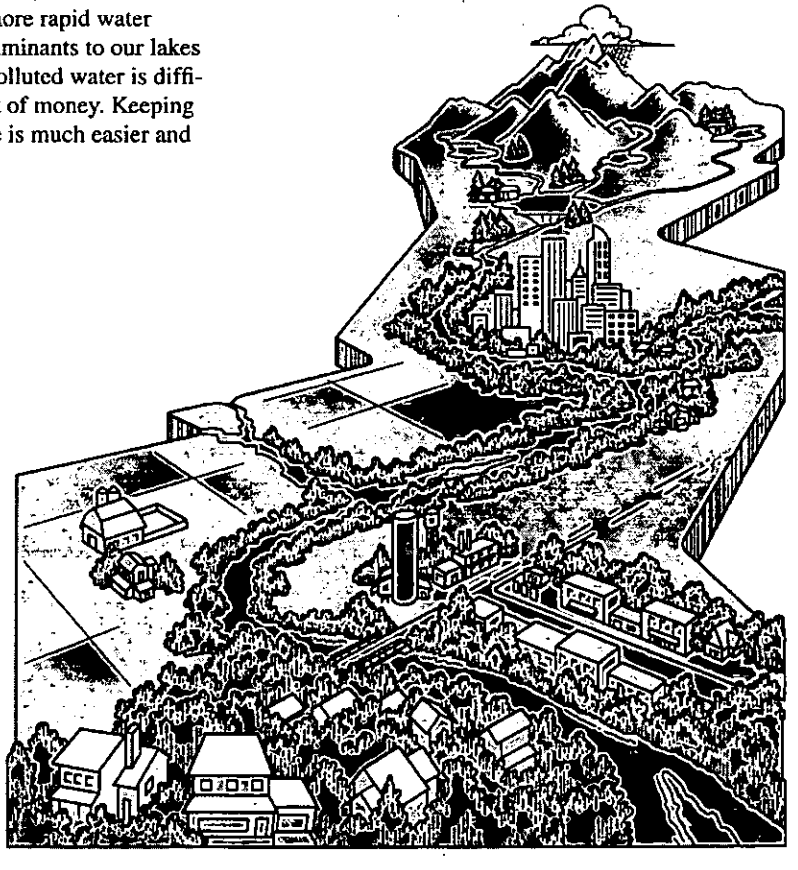
XCM-223

It's a fact of modern life - many of our activities have altered the natural cycles of water movement and purification that give us clean water. And while our individual homes may contribute only small amounts of pollutants, they add up to bigger problems downstream.

The watershed in which you live probably consists of houses, businesses and undeveloped land. The water from this area drains to a creek or river. As cities develop and streets are paved, the loss of natural vegetation results in much more rapid water runoff. This runoff carries contaminants to our lakes and streams. Cleaning up this polluted water is difficult and can cost taxpayers a lot of money. Keeping our water clean in the first place is much easier and cheaper.

In the Home

The typical home contains an amazing assortment of cleaning products, paints, solvents, oils, fertilizers and pest control products. If used according to their labels, they can make our lives easier. But many of these products fall within the Environmental Protection Agency's definition of hazardous substances because they can catch fire, explode, corrode or because they are toxic.



Colorado State University Cooperative Extension

Putting Knowledge to Work

Colorado State University Cooperative Extension

AGRICULTURAL CHEMICALS GROUNDWATER PROTECTION

Pesticide Record Book

for Private Applicators

CROP YEARS 2003-2004

APPENDIX V

AGRICULTURAL CHEMICALS AND GROUNDWATER PROTECTION ACT
ADVISORY COMMITTEE
(Revised 2/03)

Water Quality Control Commission

Mr. Robert Sakata
662 Rose Dr.
Brighton, CO 80601
(303) 659-8675
rtsakata@aol.com
Original Appointment: 1991

General Public

Ms. Barbara Fillmore
18150 North Elbert Road
Elbert, CO 80106
(H) (303) 648-9972
(W) (303) 648-9897
bjfillmore@aol.com
Original Appointment: 1997

Mr. John Stout
8782 Troon Village Pl.
Lone Tree, CO 80124
(303) 708-1841
jstout@mines.edu
Original Appointment: 1998

Commercial Applicators

Mr. Steven D. Geist
Swingle Tree Co.
8585 East Warren Avenue
Denver, CO 80231
(303) 337-6200
sgeist@swigletree.com
Original Appointment: 1994

Mr. Darrel Mertens
Aero Applicators, Inc.
P.O. Box 535
Sterling, CO 80741
(970) 522-1941
aero@kci..net
Original Appointment: 2003

Green Industry

Mr. Eugene Pielin
GMK Horticulture
2768 Crestview Ct.
Loveland, CO 80538
(970) 669-0248
GMKHort@aol.com
Original Appointment: 1999

Mr. John Wolff
Grand Lake Golf Course
P.O. Box 590
Grand Lake, CO 80447
(970) 627-3429
Original Appointment: 1998

Ag Chemical Suppliers

Mr. Anthony Duran
American Pride Coop
P.O. Box 98
Henderson, CO 80640
(303) 659-3643
aduran@americanpridecoop.com
Original Appointment: 1998

Mr. Wayne Gustafson
Agland, Inc.
155 Oak Drive
Eaton, CO 80615
(970) 454-4004
Wgustafson@aglandinc.com
Original Appointment: 1991

Producers

Mr. Lanny Denham
2070 57.25 Road
Olathe, CO 81425
(970) 323-5461
pdenham@gwe.net
Original Appointment: 1996

Mr. Steven Eckhardt
343 South 4th St.
La Salle, CO 80645
(970) 539-0443
steckhar@aol.com
Original Appointment: 1997

Mr. John Hardwick
24700 County Road 19
Vernon, CO 80755
(970) 332-4211
(no email address)
Original Appointment: 1991

Mr. Dave Latta
38002 Co. Rd. N
Yuma, CO 80759
(970) 848-5861 x 222
dlatta@conagrabeef.com
Original Appointment: 2001

Mr. Mike Mitchell
1588 E. Rd. 6 N.
Monte Vista, CO 81144
(719) 852-3060
Original Appointment: 1991

Mr. Don Rutledge
10639 County Road 30
Yuma, CO 80759
(970) 848-2549
djrutledg@hotmail.com
Original Appointment: 1995

Mr. Max Smith
48940 County Road X
Walsh, CO 81090
(719) 324-5743
cmsmith@rural-com.com
Original Appointment: 1994

Mr. Leon Zimbelman, Jr.
0949 WCR G7
Keenesburg, CO 80643
(303) 732-4662
pufarms@concentric.net
Original Appointment: 1993