# Boulder Environmental Management Audit

An Assessment of the Operations of the

Parks and Recreation Department
City Parks Division and the

Public Works Department
Transportation Division
Transportation Maintenance Group

Focusing on Integrated Pesticide Management
And Water Conservation

April 30, 2001
Final Report

PKM Design Group, Inc.
In conjunction with

EME Solutions, Inc.
and
Nature's Design

# Executive Summary

This report contains the findings and recommendations of an environmental management audit conducted on the operations of the Boulder Parks and Recreation Department Parks Division and the Public Works Department Transportation Maintenance Division, concentrating on urban parks, forestry and the City's practice in maintaining its street medians and bikeways. The specific practices evaluated included pesticide use and water conservation. The audit was prompted, in part, by the City's initiative to implement an Environmental Management System (EMS). The EMS effort will contribute to achieving the City Council's Year 2000/2001 Environmental Goal, "To enact and pursue city policies that cause the Boulder community to become a nationwide environmental leader among communities. The City will be a role model of exemplary environmental practices."

The City of Boulder retained a team of consultants headed by Patricia K. Miers of PKM Design Group (the Consultants) to conduct the audit. The Consultants compared Boulder's policies and practices to accepted best management practices and to Integrated Pest Management (IPM) programs in 14 other cities that are acknowledged leaders in IPM and to water conservation approaches in six other leading comparable communities.

The Consultants found that the city staff has had a long-standing focus on reducing the use of pesticides and has a strong water conservation ethic. The Consultants have identified a number of findings and recommendations that, when implemented, will allow the city to become a role model of exemplary environmental practices. In general, the Consultants recommend that the city establish quantitative targets for water conservation and IPM that will be consistent with the City Council's 2000/2001 Environmental Goal. The quantitative targets should incorporate a requirement for continuous improvement, including a plan to phase out the more toxic pesticides and a plan to implement landscape design, construction, renovation, and maintenance practices that serve the needs of the community and are sustainable (i.e., use no more water than necessary, pest-resistant).

The Consultants specifically recommend that the city staff develop a management system that supports implementation of City Council's Environmental Goal and the quantitative targets. The management system will set clear, quantitative and department-specific expectations; encourage communications among departments that must collaborate to achieve the targets; establish accountability for meeting the expectations; and assure that each staff department has the financial resources, relevant information, and the time, training, and authority to meet the expectations. Finally, the management system will include a periodic review of the progress toward the goals and a periodic opportunity to revise the goals as appropriate in keeping with the City Council's Environmental Goal.

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# 1.0 Introduction

## *1.1 Brief History of Environmental Policies*

The City of Boulder (the City) has a well-justified reputation for environmental stewardship. One of the first efforts to preserve the natural environment was the purchase of Chautauqua Park at the foot of Flagstaff Mountain through a bond issue in 1898. Since that time, Boulder has developed an extensive system of city parks and open space and has undertaken substantive efforts to integrate concern for the environment into all of its municipal responsibilities.

Boulder adopted a residential growth management ordinance in 1977 and participated in the adoption of the Boulder Valley Comprehensive Plan in 1978. The Office of Environmental Affairs was established in 1982, and the Environmental Advisory Board was chartered in 1992. The City of Boulder's Water Conservation Office was established in May 1992. The City of Boulder first adopted its Integrated Pest Management (IPM) policy in 1993.

The City Council, various boards and city staff continue to be proactive. The City of Boulder Office of Environmental Affairs in partnership with other governmental agencies and the business community have formed the PACE (Partners for a Clean Environment) program. PACE is an award-winning[1] voluntary, non-regulatory program that offers free pollution prevention education and technical assistance to Boulder County businesses. In the First Quarter of 2000, the City Council adopted environmental sustainability as one of its four 2000/2001 Council Goals. The Council has provided its support to the development of an Environmental Management System (EMS)[2] pilot program. Additionally in 2000, the new position of Deputy City Manager for Environmental Services was created to oversee and coordinate the departments of Open Space/Real Estate (now Open Space/Mountain Parks), Parks and Recreation, Public Works, Planning and the Office of Environmental Affairs.

## *1.2 Goals and Objectives -- Why the Audit Was Conducted*

The City of Boulder retained a team of consultants headed by Patricia K. Miers of PKM Design Group (the Consultants) to conduct an environmental management audit on the operations of the City's Parks and Recreation Department's Parks Division, concentrating on urban parks and forestry, as well as the City's maintenance practices in its street medians and bikeways. The information gathered is intended to support the development and/or revision of water conservation and integrated pest management plans as part of the City's initiative to implement an Environmental Management System. The EMS effort is a response to City Council's Year 2000/2001 Environmental Goal, "To enact and pursue city policies that cause the Boulder community to become a nationwide environmental leader among communities. The City will be a role model of exemplary environmental practices."

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[1] Winner of the 1997 Governor's Smart Growth and Development Award for Efficient, Environmental Solutions for Businesses

[2] As defined in this document, Environmental Management System (EMS) is a continual cycle of planning, implementing, reviewing and improving City activities to meet the City Council's goal of Environmental Sustainability.

*1.3 Goals and Objectives of Water Conservation and IPM Policies*
In conducting the scope of work, it became useful to develop a draft statement of goal for the Water Conservation and Integrated Pest Management policies. This draft statement was reviewed by the Boulder City Staff, and discussed with City Council at the February 13th, 2001 Study Session. Proposed findings and recommendations are consistent with the intent of the City Council.

A working draft of that statement is presented below:

Draft Environmental Water Conservation and IPM Goals:

*The goal of the water conservation and IPM policies is to manage the public lands so they can function for their intended purposes in a healthy, sustainable and environmentally sound manner. Specifically these policies are intended to:*

- *Use the minimum amount of water necessary to sustain existing landscapes and urban forestry assets while moving toward a more sustainable landscape in appropriate areas such as medians and passive use areas in parks*
- *Institute design and maintenance standards for landscaped areas that promote healthy plants and trees, reducing the need for pesticide use. Where the health of the urban landscape is threatened by disease, weed or insect infestation, the standard IPM hierarchy will be followed*
- *Enhance aesthetic enjoyment, and (to the extent practical) minimize maintenance requirements and overall costs.*

*1.4 Audit Methodology*

The audit conducted by the Consultants consisted of:

1) Reviews of previous studies, reports, and minutes from key meetings regarding resource use policies and practices in Boulder's urban parks.
2) Over 35 extensive interviews with City staff and contractors.
3) Reviews of current environmental management policies as they relate to water conservation and integrated pest management in City parks and medians.
4) Visual inspection of a representative sample of properties within the scope of work, including observation and documentation of the general condition of the properties, their suitability for their intended purposes, irrigation efficacy, aesthetics, the presence of high water usage plantings or contours, and current noxious weed/pest problems. Note that due to the timing of the project, these inspections were conducted during the winter and accordingly may have overlooked some issues that are only observable during the growing season.
5) Extensive research and over 30 interviews regarding municipal Integrated Pest Management programs. This research was done via telephone interviews, website searches, and by reviewing hardcopy documents provided by the communities. It included an analysis of the effectiveness of the programs, with specific consideration given to the

implications of the various IPM policy options on plant species in Boulder's urban parks and medians. Ultimately 14 communities were selected for inclusion in this report.

6) Research available from EPA, Bio-Integral Resource Center, National IPM Network, Pesticide Action Network and other sources on pesticide use and toxicity. See Appendix A, Definitions, for more complete explanations of toxicity levels.
7) Research into feasible water conservation practices considering Boulder's climate and the status of the existing irrigation system.
8) Telephone interviews and website searches regarding water conservation practices of eight other Colorado Front Range cities.

### *1.5 How this Report is Organized*

This report is organized into the following sections:

1.0 *Introduction.*
Provides introductory information on the history of environmental management in Boulder, the purpose of the audit and the audit methodology.

2.0 *Current Status.*
Provides information on the current state of environmental management, specifically addressing the environmental management system, the integrated pest management program and water conservation.

3.0 *Boulder Citizen Public Concerns.*
Provides input from the citizens of Boulder with respect to environmental management, water conservation and pesticide use.

4.0 *Benchmark Cities Research.*
Provides information on pesticide use and water conservation from other municipalities.

5.0 *Findings and Draft Recommendations.*
Provides the Consultants' findings and draft recommendations.

6.0 *City Council Study Session*
Provides summary and questions raised with additional information requested.

7.0 *Public Awareness Strategy.*
Suggested tools for outreach.

8.0 *Performance Measures*
Information on implementation strategies

9.0 *Conclusion*

10.0 *Bibliography*

# 2.0 Current State of Environmental Management

*2.1 How the City is Organized from an Environmental Standpoint*

2.1.1 Council and Boards

The City of Boulder is governed by an elected City Council, presided over by the Mayor elected by the council from among their number. The City Council appoints members to the twenty-one Boards and Commissions. The four Boards most relevant to the current audit are: the Parks and Recreation Advisory Board, the Water Resources Advisory Board, Environmental Advisory Board and the Transportation Advisory Board.

Each of the Boards (the Parks and Recreation Advisory Board, the Water Resources Advisory Board, Environmental Advisory Board and the Transportation Advisory Board) have specific responsibilities detailed in the Chapter 3, Boards and Commissions of Title 2, Government Organization of the Boulder Revised Code. The relevant sections are excerpted in Appendix B, Board Responsibilities.

2.1.2 City Staff

The City Staff reports to the City Manager, who is retained by the City Council to conduct the affairs of the City. The city charter states that it is the council's intent that the City Manager has appropriate discretion in determining the structure of the city government. The City is organized into various departments and offices. Figure 1 shows a simplified City Organization Chart. The departments relevant to the Consultants' scope of work are shown in greater detail; those that are not relevant are omitted.

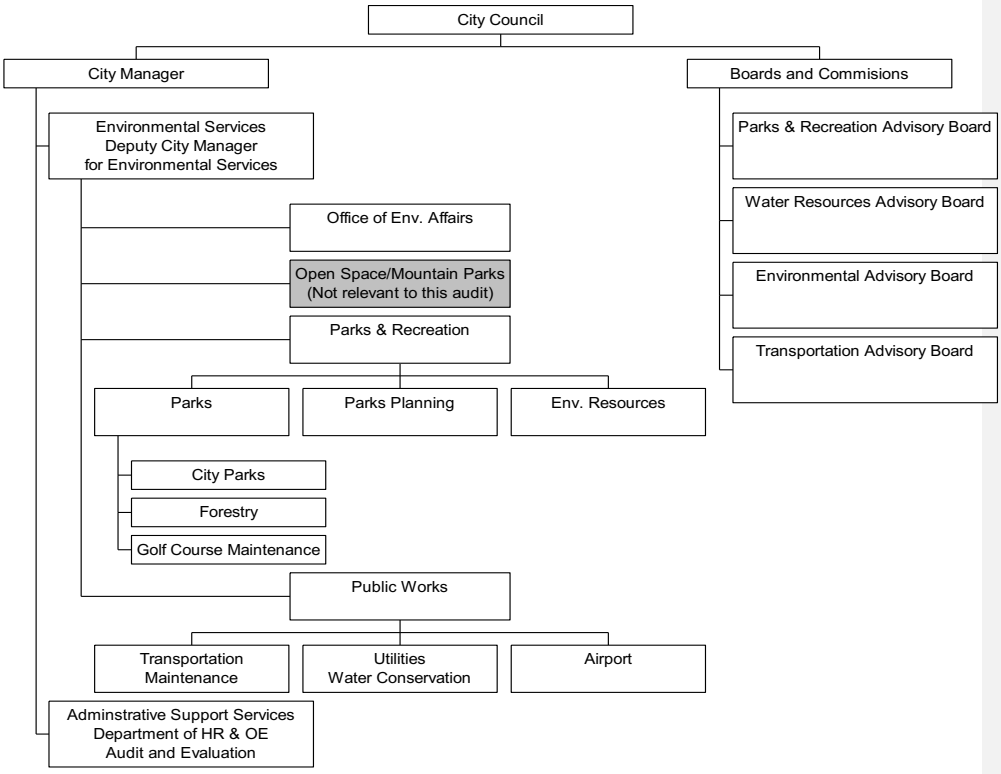
While the administrative services functions consume some raw materials (paper, electricity, office supplies) and can select environmentally responsible actions (for example, encouraging recycling and carpooling), they have less potential to impact the environment than large operational departments that manage land or provide services to the Citizens of Boulder. For example, Parks and Recreation, Streets, and Utilities all have significant potential to affect the environment. Most of the departments with the greatest potential to affect the environment are organized in the Environmental Services Business Group.

2.1.3 Environmental Committees and Task Forces

In addition to the general organization shown in Figure 1, the City often establishes interdisciplinary committees and task forces to accomplish specific goals. Two examples are the subcommittee working on the Council's 2000/2001 Goal of Environmental Sustainability, which has representatives from city staff as well as City Council and the task force working on the draft Environmental Management System for the Public Works Department (see section 2.2, below).

## Figure 2 Organization Excerpt

This organization chart is not complete.
It contains only those departments relevant to the Consultants' Scope of Work



*2.2 The Draft Environmental Management System*

The City Council has provided its support to the development of an Environmental Management System (EMS) pilot program. The task force has been assembled to develop a pilot EMS for the Public Works Department. This task force includes members of the Office of Environmental Affairs as well as Public Works, and initially has had the support of a 1/5 time professional from the U. S. Environmental Protection Agency. The team members have all received training in Environmental Management Systems and have established a process for identifying opportunities to improve their operations using EMS approaches.

A draft document entitled "Pollution Prevention Plan September 2000" describes the structure of the initiative, current projects and future plans. The task team meets regularly to review progress on the current initiatives and discuss prospective initiatives.

Actually developing an EMS that becomes integrated into the way the City conducts its operations is a complex undertaking. Boulder has made several important strides in this direction:

- Partnering with the U. S. EPA to develop the EMS.
- Training more than 30 city employees in Environmental Management Systems.
- Beginning with a pilot program in the Public Works Department. Of particular note are: strong management commitment from the department, and the fact that it is the City's largest department and has responsibilities with complex environmental impacts.
- The Office of Environmental Affairs and the many staff members of the Public Works Department involved developed a good process for setting tactical objectives, which included the active participation of employees from each level of management, and the selection of concrete goals.

*2.3 How the Departments Studied Approach General Landscape Maintenance*

2.3.1 Public Works

*Streets and Bikeways Maintenance*

The Streets and Bikeways Maintenance group manages approximately 200 acres of land and 29 miles of bikeways. Within these areas, there are over 325 medians, turn islands, street frontages, pocket parks, bikepaths and tunnels. In addition, the airport property is under the management of this department. The Public Works Department maintains a list of their properties called the "Inventory of Medians in the City of Boulder, 4/3/92" and a corresponding photographic inventory of most of the medians in existence during 1992.

Landscapes vary widely in the medians, from the newly constructed medians on Lee Hill Road that consist of a xeriscape design (trees, shrubs, perennials, no turf) to the older medians with more traditional landscape design (deciduous trees, spruce, junipers, irrigated turf) in the Inca/Mohawk/Caddo and Mapleton Hill neighborhoods. Broadway, 55th, parts of Pearl Street and the Arapahoe Road corridor landscapes have been upgraded with concrete aprons, trees, shrubs, mulch and no turf. Foothills Parkway is mostly irrigated turf, with trees and some junipers. The roadside right-of-way areas consist of steep irrigated turf. In the Goss-Grove area, streets have been vacated and turned into pocket parks; these are still maintained by Public Works. These parks are primarily turf and trees.

All landscape maintenance operations are done in-house except for 35 acres of irrigated turf management which is contracted out. Transportation Maintenance maintains trees from the ground to arm's height. Forestry maintains trees above that height.

*Airport*
The Boulder Airport property has a large amount of asphalt surrounded by a non-irrigated open field with a sparse stand of native grass infested by noxious weeds. Because there are cracks in the asphalt, invasive weeds come up through the asphalt.

### 2.3.2 Parks and Recreation

*Parks*
The Parks and Recreation Department manages approximately 433 acres in urban parks including 41 playgrounds, 6 swimming pools, and over 75 individual parks or managed areas. The Parks Division owns and operates an irrigation centralized controller system (see Water Conservation section) to improve operations and provide monitoring of water use. The Parks Division performs all landscape maintenance in-house except fertilization 4 lead maintenance workers, 26 permanent staff and 36 seasonal employees).

Since 1995 approximately 369 additional acres have been acquired by Parks. This includes Valmont City Park and the Area III site for future recreational needs. In addition, the recreational facility sites include the golf course, the reservoir developed recreational area, Stazio Fields, and Pleasant View Fields and the Mapleton Fields. Total of recreational facility lands is 273 acres.

Parks currently categorizes its parks maintenance standard into three levels of care:

*Mode I:* State of the art maintenance applied to a high quality diverse landscape. Usually associated with high traffic urban areas such as public plaza, mall, governmental grounds or high visitation parks.

*Mode II:* High level maintenance-associated with well-developed park areas with reasonably high visitation.

*Mode III:* Moderate level maintenance-associated with locations involving moderate to low levels of development, moderate to low levels of vegetation or are associated with other agencies that can't afford a higher intensity of maintenance due to budget restrictions.

Parks properties vary in character from 30+-year-old parks to recently upgraded parks to new facilities. Some examples include:

> *Older Parks*
> Melody, Catalpa and Pine View Parks. All of these parks are over 30 years old. They are small urban pocket parks providing passive recreation opportunities and buffering in single-family residence neighborhoods. They are primarily turf, with some trees and shrub masses. Irrigation controllers are mechanical (not on the centralized controller system).

*Recently Upgraded Parks*
Scott Carpenter, North Boulder and Beach Parks have been recently upgraded. Scott Carpenter and North Boulder Parks are large, with active recreation and large areas of turf for casual sports activities. There is a substantial amount of shrub massing, flowerbeds, and trees. Beach Park is a smaller urban pocket park with some active recreation and turf area primarily for buffer. These parks have upgraded irrigation systems (except for some lateral lines and sprinkler heads), and are now on the centralized controller system.

*New Parks*
Foothills Park is a completely new community park site. This is a large park with expansive areas of open turf for sports activities, a playground and community garden area. Once completed, there will be perennial and shrub areas, as well as trees. There are several small steep turf areas. The irrigation system was designed and built to be on the centralized controller system.

*Pleasant View Soccer Field*
The Pleasant View Soccer Field is approximately 7 years old and encompasses 54 acres, with over half in turf. There is a fair amount of "natural" area, largely left undisturbed. The athletic fields (turf areas) were grown from seed on a sand subsoil base with a bluegrass/rye mix. The rye was mowed short to give bluegrass a chance to thrive. The resulting turf is 80% bluegrass that is overseeded with rye when needed.

*The Pearl Street Mall and Downtown Municipal Areas*
These areas are high use and high visibility. They are maintained in the Mode I level of maintenance, meaning daily inspection, a high number of seasonal flowerbeds, and state of the art maintenance practices.

*Flatirons Golf Course*
The golf course encompasses 135 acres, from highly maintained turf, to wooded naturalized areas. Management practices are designed to enhance and sustain the environment for the golfer as well as the wildlife that share the property.

*Forestry*
The Forestry Division consists of four full-time personnel and four seasonal workers and is responsible for tree maintenance of urban park trees and street trees in the public rights-of-ways.

Specialty areas of maintenance include Andrews Arboretum and the city tree nursery. The Forestry Division does not have a program to chemically treat street trees, as is the case for park trees. There is a program to allow property owners to contract out this service from certified arborists with the City's authorization and guidance.

In-house staff conduct a planting program each spring. Formerly, this division had a planting vs. removal ratio of 2:1. As a result of budget cuts, the current replacement ratio is less than 1:1. The removal and pruning of park and street trees 11" in diameter and over is contracted out. In-house staff regularly removes and provides corrective pruning for park trees less than

11" in diameter. For the larger population of street trees less than 11" in diameter, staff provides maintenance as time allows. Property owners often assist in maintenance of street trees. An updated Geographic Information System (GIS) re-inventory of street trees throughout the City will be completed by end of summer 2001. Park tree re-inventory is scheduled for the fall of 2001.

*2.4 How the Departments Studied Approach Integrated Pest Management*

2.4.1 Introduction

*Regulatory Status.* The City of Boulder currently has a Pesticide Ordinance in place (Section 6-10-1 B.R.C. 1981); it requires residents to be notified when and where pesticides are used. It does not prohibit or limit the use of pesticides (although the City has internal policies in place that do limit their use. See below). The ordinance focuses on local and municipal concerns of storage, disposal, spill, water and sewer system, landlord-tenant, employee notification, and nuisance concerns not addressed by federal and state law. The following are defined as pesticides: *Herbicides, nematocides, insecticides, rodenticides, fungicides, plant regulators, defoliants and desiccants.*

Deodorizers, bleaching agents, disinfectants, cleaning agents, fertilizer and plant nutrients are *not* considered pesticides. Other relevant ordinances include: #4683 for Weed Control, #4731 on Protection of Trees and Plants, and #4719 on Animals, specifically Legislative Intent, Part 6-1-1 (d) on the protection of black-tailed prairie dogs. Ordinance 4683 governing Weed Control states that the City Council shall be the local advisory board for all state and local noxious weed statutes, ordinances and regulations. See Appendix C, Related City Ordinances, for more complete information.

2.4.2 City Integrated Pest Management Policy

In 1993, the City adopted an Integrated Pest Management Policy that provides procedural guidelines for an IPM program, emphasizes the overall goal of reducing or eliminating, where possible, the use of chemicals to control pests. This policy sets forth departmental obligations to:

- Develop departmental/divisional IPM plans
- Submit an annual IPM Report
- Create an interdepartmental IPM review group
- Inform all contractors of the City's policy and its guidelines

See Appendix E for a more thorough discussion of the IPM Hierarchy and pest control strategies.

Generally, the City has reduced its use of pesticides since the adoption of the IPM Policy. The most toxic of chemicals, Category I pesticides, are rarely used and the use of the less toxic Category II pesticides has been greatly reduced. Reported use of pesticides has declined from 1999 to 2000 in the following City of Boulder Annual IPM department reports:

- Athletic Fields – from 10.5 liquid gallons to 8.25 (-22%)
- City Forestry – from 39.7 liquid gallons to 15.2 (-62%)
- Streets/Bikeways – from 24.5 liquid gallons to 19.63 (-20%)

2.4.3 Interdepartmental IPM Review Group

An interdepartmental IPM review group was formed after the IPM policy was adopted, see Appendix D, City of Boulder Integrated Pest Management Policy. This group is the principal force in accomplishing the goals of the IPM policy. It is chaired by staff person from the Office of Environmental Affairs, who also collects annual IPM report data and prepares the annual report for review with City Council. This individual has considerable technical expertise, but has no official oversight authority.

This interdepartmental group primarily exchanges information and helps each other problem-solve current pest issues. Currently, and contrary to the IPM policy, there are no departmental/division-specific IPM plans, nor has the group reviewed or evaluated each other's IPM plans. See below for a discussion of current plans to establish departmental or division-specific IPM plans.

There is an annual report prepared by all division IPM coordinators with representation from Public Works, Parks, Median/Bikeway Maintenance, Open Space/Mountain Parks, Water Utilities, Housing Authority and Facilities. Reporting has been conducted since the policy was adopted by the city. This report is a resource for summarizing IPM methods used. The report is organized by division, geographic area, type of method used, target species and area treated. For chemical applications, the product trade name, active ingredient, target pest, quantity of product and geographic location are also provided. The Toxicity Category (as defined by U.S. EPS in 40 CFR 156.10 (h)(1)) of each chemical is not reported here.

Most divisions report consistently, with some minor exceptions. Outside contractors have not followed the same reporting method as in-house staff and have provided inconsistent or unclear information. Although contractors are notified of the City's IPM policy, the reporting for Foothills Parkway and the Airport are incomplete. They do not include non-chemical pest control methods; additionally, the reporting units are inconsistent with City reports.

Potential goals for 2001 include development of division-specific management plans, development of best management practices, and further development of guidelines and policy update. In addition, the group will be soliciting a member from the Parks Board and/or Environmental Advisory Board to attend their regularly scheduled meetings. This will provide the Board member a better understanding of implementation concerns.

2.4.4 IPM within Public Works

Currently there is not an IPM plan specific to the Public Works Medians and Bikeways. Three in-house staff members, operating under one pesticide application license, conduct integrated Pest Management for the majority of these properties. There are two exceptions: contractors conduct the pest management in Foothills Parkway and for weed control at the airport. Any method of weed control at the airport, (i.e.: mechanical, biological, or chemical) must be approved by the Federal Aviation Administration (FAA).

The main pest controlled by this division is weeds. Foxtail, crabgrass, and thistle are the main targets of IPM. Nuisance weeds are normally handled by cultivation, hand pulling, flaming, mulching, and planting desirable plant groupings. Noxious weeds are spot-sprayed with

Glyphosate[3] (product name is Roundup®) in planting beds and cracks in pavement. In irrigated turf areas, broadleaf herbicide Dimethylamine (product name is Lesco Three-way®) is applied in blanket applications, as determined by the contractor.

Other methods used in specific situations:

- Medians: Those without irrigated turf are spot sprayed as determined by staff.
- Foothills Parkway: Irrigated turf areas are contracted to an outside landscape maintenance company.
- Turnabouts: Those without irrigated turf are spot sprayed as determined by staff.
- Underpasses: Those without irrigated turf (the majority) are spot sprayed as determined by staff.
- Bikeways: In compliance with a transportation clearance standard, a six-foot strip along each side of all bikeways is mowed twice a year. This mowing contributes to weed control.
- Unimproved areas: Mowed twice a year, no chemical application.
- Pocket parks: Beds are spot sprayed as determined by staff, turf gets blanket application.
- City yards (5050 Pearl): Beds are spot sprayed as determined by staff, turf gets blanket application.
- City Airport: Current control methods are to mow the field containing noxious weeds. A sub-contractor also comes once a year in spring and sprays a 6-8 ft wide strip along all edges of asphalt with herbicide. No consideration of alternative IPM methods has been documented. In 1999, Imazthapyr and Diuron (trade name Sahara®) and Glyphosate (trade name Roundup Pro®) were used. In 2000, Gramoxone and Vanquish® were tried.

2.4.5 IPM in Parks and Recreation, Parks Division

Currently, there is not a departmental or divisional IPM plan. IPM is independently conducted by the crew assigned to a particular location. Except for the turf areas of the playing fields, there has been no broadleaf weed killer applied in the parks for several years. Prior to application of pesticides in any park, chemically sensitive citizens are specifically notified, in addition to the signage notifying the public in general. There are currently 8 – 10 people who have identified themselves as chemically sensitive.

It is the policy of Parks and Recreation that natural solutions to wildlife problems are always employed in preference to chemical means. For instance, the Foothills Golf Course has found that leaving the rough grasses longer discourages overpopulation by geese. Any pesticide used to manage wildlife (like field mice) must be approved by the Director of Boulder Parks and Recreation.

In addition, Parks Planning (in consultation with the Forestry Division) selects trees for park development that are not highly susceptible to insect infestations or disease.

Methods used in specific locations include:

[3] The Toxicity Categories of these products are not provided here, because the pesticide's toxicity is dependent on the application strength.

- *Athletic Complexes*
  Weeds in the turf areas of athletic fields are the only pest that is chemically managed in these parks. The fields are blanket treated routinely with Dimethylamine (trade name Amine 4-2-4-D®) and the fence lines are sprayed with Glyphosate (Roundup®).

- *Pleasant View Soccer Fields*
  Methyl Bromide or Roundup® was used during the athletic field construction and germination process. Since completion of construction, this park has been pesticide/herbicide free. Organic fertilizer keeps the turf in high quality condition; weeds that do invade are hand pulled or mowed. Although no precise quantitative data are available, this park has higher maintenance costs for both labor and water than the other athletic fields that are not pesticide free.

- *Flatirons Golf Course*
  General practices include testing the soil twice a season. A well-designed fertilizer program is implemented based on those findings. Irrigation is by non-potable water from the Howard ditch. Water is tested at least yearly, and the runoff from the golf course is cleaner than the water applied to it. All tree maintenance is performed by the golf course staff or contracted to a private company and closely monitored.

  A botanist checks the site annually for noxious weeds. Scotch thistle was discovered at the last inspection. Because it was early in the growing season, the weeds were pulled and the ground was cultivated and re-seeded. Endorphite enhanced rye grass seed is used for reseeding or overseeding. This variety is more disease resistant than normal rye. Biological controls such as ladybeetles and praying mantis have been used when appropriate, but final results are not yet available.

  When pesticides are deemed necessary they are judiciously applied. About 2000 square feet (far less than 1%) out of the entire 135-acre site is treated with pentamethalin in early spring for crabgrass. Areas are then spot-treated as needed later in the spring. Golf course personnel also spot-spray for broadleaf weeds with 2,4-D (Tri-Ester Herbicide®). PCMB (FF2 14-3-3®) is used on approximately 4 acres for winter snow mold. They also spray the immature pines with Permethrin (trade name Dragnet®) for Zimmerman moth.

- *Forestry Division*
  The biggest pest problems currently faced by Forestry are: European Elm scale on American Elm; Kermes scale on Pin Oaks and Red Oaks; Zimmerman pine moth on Austrian, Ponderosa and Scotch Pines; Lilac ash borer and Brown-headed ash sawfly on Green and White Ash trees; Douglas-fir tussock moth on Colorado Blue Spruce; and spider mites on Honey locust.

  The Forestry Division works closely with Colorado State University to monitor problems region-wide, as well as locally. Representatives of this division stay current with pest management through their membership in the Front Range Urban

Forestry Council's Insect and Disease Committee. Some staff members also write articles for the Colorado Tree Coalition website on "Tree Pest of the Month." Other sources of up-to-date information include subscribing to the CSU PestTalk e-mail discussion group, the PestTalk newsletter and the Green Scene newsletter.

Based on this knowledge, they recommend species that are pest resistant and drought tolerant for their annual in-house planting program. In controlling pest problems in City trees, Forestry employs the threshold principle: insect populations are closely monitored and chemical control is initiated only after pests reach damaging levels. Mechanical, cultural and biological controls are used first when available and feasible. Preferred methods include target pruning American Elms to reduce bark beetle populations, manual pest removal, pruning, mulching, spraying with water, and even wrapping the trunk with duct tape with the sticky side out to capture ash sawfly larvae. Pesticides are used only to protect trees that will die without treatment. The main pesticide currently applied aerially is insecticidal soap. According to Dr. Whitney Cranshaw at Colorado State University, insecticidal soap is a low toxicity pesticide that is almost identical to hand soap. Whenever pesticides must be used, soil injection and/or trunk injection are used rather than aerial application. This reduces pesticide drift and avoids direct public contact.

- *Horticulture*
  A staff of two horticulturists plus seasonal help manage the nuisance and noxious weeds in the flowerbeds, tree rings and shrub beds in Boulder Parks. They also plant and maintain the seasonal flowers. IPM methodology is closely followed. Cultivation (turning the soil), soil amendment, mulching, hand pulling and weed whipping are used whenever possible to manage weeds. Crop rotation within the flowerbeds prevents soil born problems like tobacco budworm. Pruning, pulling or cutting diseased plants and hand picking insects (caterpillars, potato beetle) prevent outbreaks of pest problems. Cultural methods include planting the right plants in the right places (sun, water, etc.), correct spacing at planting, and choosing disease resistant plants. Biological controls include Bacillus thuringiensis (Bt) for cabbageworm, iron phosphate for slugs, and experimentation with new products that are less toxic, or non-toxic, such as using corn gluten meal as a pre-emergent treatment. Spot spraying on an as-needed basis with Roundup® is used to keep the weeds under control in the warmer months.

- *Environmental Resource Division*
  The Environmental Resource Division manages undeveloped lands that are outside the scope of this audit. For completeness, they are mentioned briefly here: The Boulder Reservoir is surrounded by non-irrigated grass. A knapweed infestation at the Reservoir was addressed by burning, then spot-spraying the remaining weeds, followed by overseeding. The Coot Lake Property contains a created wetlands west of Coot lake. A purple loosestrife infestation (an aggressive plant that crowds out native plants used by wildlife for food and shelter) has been addressed using biocontrol measures. No pesticides are used on the site. The Papini property contains bottom land that is hayed, and an upland prairie dog relocation site. When this site was restored, knapweed was controlled by burning, and spot herbicide use.

*2.5 How the Departments Studied Approach Water Conservation*

2.5.1 General Information

In November of 1990, City Council conceptually approved the implementation of an expanded water conservation program as recommended in the "Treated Water Master Plan". This program was devised largely to defer the costs of expanding the Boulder Reservoir Water Treatment Plant. Ordinance 5426 (enacted in 1991) implemented Municipal Water Conservation Measures designed to encourage water conservation for outside water use on public property. The goal was to inventory and reduce the amount of water used for irrigation purposes. Untreated water use was not included in this program.

In 1992, after consultation with the water-using departments, the Utilities Division developed a method for determining a fixed amount of water that each department would be allowed to use without charge. The water use reporting system is based on actual readings of the city water meters from city water mains that irrigate the landscaping on city properties. City water meters are read approximately quarterly.

The water allocation for all public irrigated landscaped areas city-wide is based on the assumed number of gallons per square foot to sustain Kentucky Bluegrass in a given 20-week growing season. This number has been established throughout the landscape industry (for typical Front-Range conditions) to be 18 gallons per square foot per year. In 1996, the City reduced the allocation to 75% of this amount, or 13.5 gallons per square foot per year. If a department exceeds its water allocation in any year (for any reason), it is charged for the excess at Block 2 rates ($2.05/thousand gallons).

Currently, it is estimated by the Utilities Division that approximately $300,000 is spent annually on treated water for landscape irrigation of city property. This money is consolidated in the overall utilities budget. It is not billed to Public Works Median and Bikeways Maintenance Department or the Parks and Recreation Department. Only when they exceed the agreed-upon allocation in a given year do they pay for water and then only for the amount of the excess.

2.5.2 Public Works Transportation Maintenance

In 1998, the Public Works Department identified the following goal: "To develop a plan that identifies high water use and high maintenance medians and landscaped rights-of-way and to implement water conservation methods and capital improvement projects to reduce future excess water use and to lower maintenance demands" (excerpted from City Street Medians and Bikeway Irrigation and Landscape Guidelines, written in 1998, but never adopted).

*Current Irrigation Technology*

There is no master irrigation controller system or city-wide standard irrigation controller for Public Works. Some medians use Rainbird ESP controllers, some Irritrol dial controllers. They are contemplating converting to Rainmaster with sensors but would like to test at 5050 Pearl Street (maintenance yard) before installing these system-wide.

Typically the irrigation heads that are used system-wide are Hunter or Rainbird. These are good standard irrigation heads for water conservation. Recently Public Works has been testing Netafim in various applications. This system of underground irrigation piping with no

above ground emitting heads (rather like “leaky pipe”) works very well for ground covers and perennial areas, but is less effective for shrub areas. The maintenance staff has put in some test sites using Netafim under turf areas as well. There have been problems with the pipe not staying buried, but so far, the turf looks the same as the turf irrigated with pop-up heads (above-ground irrigation). If Netafim is determined to be a good alternative in the long term, it may be an effective water conservation technique.

Most medians are serviced by a 2 ¾” tap from the city water main. Each has its own water meter. Irrigation times are controlled by a digital clock (except Xeriscape medians, which have no irrigation). Some medians have been upgraded to eliminate the use of irrigated turf, and only have a drip system in place (underground irrigation). Most are being upgraded from atmospheric type to pressure-induced vacuum breakers.

*Foothills Parkway*
Foothills Parkway is a large and highly visible landscaped transportation corridor. Each service line off the city water main has a meter installed. The entire system is controlled by 40 clocks/timers. Foothills’ total water use has been under the allotment of 13.5 gallons per square foot per year each year since 1998. Foothills has an excellent reporting system in place for meter reading, water used, and reasons for overage. It is currently the best reporting system in the City.

*Staffing*
There are two maintenance workers who maintain and improve medians and landscape rights-of-way. There is one additional staff person who does small landscape improvements to existing medians, sometimes including irrigation. All large irrigation construction is contracted out.

Each irrigation person schedules watering using their own judgment, but all are aware of public input, current weather conditions, and basic water conservation principles. Most irrigate at night, no more that 3 times a week during the summer months. Stopping the irrigation system in case of rain, a blown head or mainline break requires manual intervention.

2.5.3 Water Conservation Practices in the Parks System
The water allocation of 13.5 gallons per square foot adopted in 1996 was based on allocations calculated separately for each park. This separate allocation was discontinued shortly thereafter by mutual agreement between Parks and the Utilities Division, as it did not allow the Parks Department the discretion to apply extra water to a park with new plantings or other special needs. Since this administrative change in the allocation scheme, the Parks Department has consistently operated within their assigned water allocation, with the exception of dry years.

*Current Irrigation Technology*
The Parks Division has a Motorola master-controlled irrigation system. System-wide, Parks is about 70% on the Motorola system. Typically these are the larger, heavily used parks in the system. The 30% that are not on the Motorola system are the smaller and older “pocket parks”.

Irrigation schedules for the Motorola system are input into the system based on the judgment of the irrigation personnel in the field responsible for each individual park. Because the system is currently set up on "time" not on "flow", it is not utilizing its capability to automatically shut down a zone or mainline when there is a problem detected by the master controller. Irrigation schedules for each individual park not on the system are also based on the judgment of the personnel in the field. Field personnel are responsive to public input, weather conditions, and basic water conservation principles.

Aquacraft, Inc. completed a detailed analysis of the Parks Division's water use in March of 2000 for the Public Works Utilities Department. Consumption data for 1997, 1998 and 1999 were studied. The results showed:

- Only 34.8% of parks had good data in terms of verified square footage of irrigated area, and accurate meter readings.
- Calculations based on this 34.8% revealed that on average, Parks is quite close to the allocation of 13.5 gallons per square foot.
- An analysis of each individual park showed that 60% (of the 34.8%) exceeded the 13.5 gallons per square foot.
- 33% of this group exceeded the original allocation of 18 gallons per square foot in each of the three years studied.

*Flatirons Golf Course*
This city property is not on the Motorola master system. It uses nonpotable water from ditch rights from the Howard ditch that runs through the property. Currently the golf course uses 35-40 million gallons per year, only 50% of calculated evapotranspiration (ET) demand. It has a holding pond and irrigation ditch water is pumped into it to feed the irrigation system. Wetting agents are injected into the sprinkler system to aid in water absorption.

2.5.4 Water Conservation Practices in Use in the Parks Planning Stage
The Parks Planning staff work independently of the Parks Maintenance staff, with some plan reviews conducted by the Horticultural Staff and irrigation design completed by the Parks Irrigation and Construction Manager.

*Current Parks Design Approach*
Park development plans follow Best Management Practices for storm water quality and erosion control. In addition, park designers are attempting to include the development of raw water irrigation systems at the future Valmont Park and at Foothills Community Park to reduce the need for potable water. Their design philosophy includes:

- Utilize drip irrigation for shrub and perennial beds and water-efficient heads for turf
- Minimize steep slopes to reduce water runoff
- Practice xeriscape principles by planning comprehensively, grouping plants according to similar water needs, reducing impractical turf areas, improving soils with amendments, using mulches and irrigating efficiently
- Consult with Horticulture to select plants that are disease-resistant and adaptable in terms of water needs upon establishment

There is no system-wide quantitative objective for parks planning that specifically addresses water conservation. A site review process exists during which the staff members analyze each prospective park site individually. This includes several standard reports: wetlands inventory, wildlife habitat, and an environmental hazards study. Staff also sends soil samples to CSU for analysis; for the last 8 to 10 years staff has generally specified 3 cubic yards of compost per 1000 square feet tilled to a depth of 6 to 8 inches (an industry minimum standard). However, the soil preparation budget is frequently reduced prior to construction, so the parks are actually installed with less compost. In general, the Staff Horticulturists also review plans for sustainable plant types and groupings. In some circumstances, a debriefing session is held on a park after construction is complete to give designers feedback on the strengths and weaknesses of design. This does not occur on every project.

Bluegrass is used in most new parks in sod or seed form for the majority of turf areas that get high foot traffic. Native grasses are considered for non-active use areas.

A demonstration garden was designed and installed to provide public education on xeriscape planting options. In addition, the staff continues to experiment with various drought resistant grass species to test their durability in certain types of use. See Section 6.0, City Council Study Session, 6.2.4. Turfgrass Alternatives.

*Irrigation System Designs for New Parks*
Irrigation systems for newly developed parks are designed by the Parks Construction and the Irrigation Construction and Maintenance Manager, in cooperation with planning staff. (Inclusion in the overall master controller system is not precluded.) Irrigation planning staff systematically replace outdated and inefficient irrigation systems, recycling used parts when possible. Planning staff also designs all renovations to existing parks.

*Ditch Water*
The City obtains ditch rights whenever possible. This allows the use of nonpotable water for landscape irrigation in those areas where ditch rights have been obtained. Ditch water as an irrigation supply is not predictable, nor always available. Sites that use ditch water also require a back-up tap to City water. Flatirons Golf Course (approximately 130 acres) and Watson Park (32 acres) are currently served 100% by ditch water. Foothills Community Park (8 acres) is partially served by ditch water. Martin Park (8.4 acres) needs a pump system (estimated at a cost of $35,000-$40,000) in order to be operational. Valmont City Park is also planned to receive some ditch water when it is developed (up to 70 acres).

# 3.0 Boulder Citizen Public Concerns

This section contains information on the opinions and concerns of Boulder citizens. There are two sources of information. First, in April of 2000 citizens receiving utility bills were given the opportunity to respond to the Earth Day 2000 Survey. Second, the City Staff hears from citizens who contact them (usually by telephone) with concerns or comments about various issues, including pesticide use and water conservation. The Transportation Division maintains the only formal record of citizen complaint calls found through this audit. City employees form impressions of the opinions held by that segment of the population calling.

Neither of these sources of information can be considered representative of Boulder's population as a whole. In fact, it must be assumed there is an inherent bias in each. Those citizens who participate are self-selected, and may be those who feel most strongly about the issues.

*3.1 Earth Day 2000 Survey*

In April of 2000 an "Earth Day 2000" survey of Boulder citizens was conducted regarding their preferences on a wide range of environmental issues. The total number of responses was 1125, or 4% of citizens. At the request of the Office of Environmental Affairs, the Audit and Evaluation Division ranked the responses. Note that due to the design of the questionnaire as well as the response rate, the results of this survey should not be considered scientifically valid.

The following is a listing of #1 ranked problems with the associated percentage of respondents:

- 29% Increase use of native grasses/drought tolerant shrubs/restore wetlands
- 17% Test site to test pesticide ban and evaluate alternatives (high use areas)
- 12% Restrict water on medians even if grass turns brown
- 12% Use of "environmentally preferable" products

The following is a summary of public comments on the use of pesticides:

| Against use of Pesticides | For use of Pesticides |
|---|---|
| Neighborhood awareness of pesticide impacts | Control weeds in Open Space |
| Ban pesticides | Use weed killer on dandelions |
| Stop using pesticides | Eradicate poison ivy on trails |
| Use flame on thistle | Kill weeds on public property |
| Reduce pesticide use | Stop weeds from spreading from public to private |
| Ban all "polluting" chemicals | |
| Ban all pesticides | Kill dandelions in parks |

Verbatim citizen comments on pest management. Note: these have not been edited:

- Convert medians and "edges" of public land into native grass and wildflowers to limit transfer of potential weed species from public to private land. Use natives as buffer strips between public lands using IPM techniques and private property.
- Utilize pesticide-free methods on public property except for invasive, noxious weeds and potentially hazardous plants such as poison ivy.
- Control dandelions by converting medians and edges to natives and using pesticide-free methods for large areas of public land
- Ban Level 1, Ban/Restrict Level 2, Restrict Level 3 categories of pesticide on public land
- Utilize existing pesticide-free park (Pleasant View Soccer Fields) as demonstration area to continue pesticide ban and test alternative methods
- Plan and design new construction of medians and roadsides to be pesticide-free as a means of testing and demonstrating pesticide ban

*3.2 Related Issues Addressed in 1999 Citizen Survey*

In 1999, a survey of Boulder Citizens was conducted. Complete results of the survey can be found at www.ci.boulder.co.us/hroe/a&e/cs99ad~1.htm. The survey was conducted through 3000 questionnaires mailed to Boulder citizens in the Spring of 1999; 1200 questionnaires were returned for a response rate of 40%.

*3.3 Comments from City Staff on Public Concerns*

Citizen calls come directly to various city staff. While the following data are anecdotal, they are from city staff members who are on the receiving end of direct communications from citizens, and should not be disregarded. There is not presently a tracking system in the Parks Department to measure the number of calls or to determine the disposition of each.

The City Parks Manager notes that he receives far more complaints about the condition of the parks (dandelions, etc.) than about use of pesticides. Each May he receives 100 – 150 calls complaining of dandelions in the parks.

The Forestry Division receives more calls from the public wanting trees sprayed to save them than people advocating minimal pesticide use.

Transportation Maintenance has instituted a complaint/call log and maintenance hot line to track calls from the public. Each call is logged. If appropriate, a management task is generated, assigned a task number, and tracked to resolution. From 1999 to date (February 2001), two weed complaints and five sprinkler complaints were received.

# 4.0 Benchmark Cities Research

*4.1 Pesticide Use: Summary Results from Other Leading Communities*

A study of other communities was conducted to compare their pest management policies with those in the City of Boulder. Early in the project, the PKM Design Group, Inc. team met with a joint session of the Parks and Recreation Advisory Board and the Environmental Advisory Board. At that time, the Board members provided important guidance on the types of communities they were interested in comparing with Boulder. The cities selected for review were included because they have been recognized by the U.S. EPA for pioneering efforts in integrated pest management; they were known to Board Members or city staff for their exemplary efforts; or they had similar characteristics (climate, size or area of developed park lands managed) to Boulder. See Appendix F for a matrix comparing Boulder's program to other communities, brief community program summaries and copies of available IPM policies and programs.

Of nineteen communities researched, only two cities (Arcata, CA, and Berkeley, CA.) were actually "pesticide-free". Arcata is a small (12-square mile) community, located adjacent to a redwood forest. Unlike Boulder, it is landscaped primarily with native plant species. Mark Andre, Arcata's Deputy Director of Environmental Services, explained that they have relatively minor pest problems. However, when non-native species die, they are actively replaced with native species. They employ habitat modification and mechanical techniques to manage the few problems they experience. The City of Berkeley has relatively few pest problems as well. The climate is very mild compared with Boulder, allowing many introduced species to thrive there. The major problem they face is weed control. This has been a very labor-intensive effort for Berkeley. A large number of volunteers (>60) are deployed to keep the weeds at levels acceptable to the public. The community is united in maintaining their "pesticide-free" status and is willing to accept the consequences. According to Jerry Cook, Berkeley's City Forester, the community has lowered its expectations for how their public landscapes look. Berkley's urban forestry budget is twice the size of Boulder's, but maintains a significantly lower tree population.

Cities often referred to as "pesticide-free" such as Buffalo, New York and San Francisco, California have IPM programs that allow a number of pesticide exemptions. The majority of cities approached their pesticide reduction plans through a gradual phase-out, most often taking 3 years to get to their ultimate goal. During these phase-outs, the cities review the impacts to their staffs and landscape assets to determine how to proceed in the following year. Buffalo, San Francisco, Carrboro, Ann Arbor and Madison all have developed processes for allowing emergency pesticide exemptions after all other methods have been exhausted. They actively pursue alternatives to pesticides, updating their IPM plans on an annual basis.

Similarities between Boulder's IPM program and the best of the benchmark cities is summarized as follows:

- There is a written IPM policy.
- An annual IPM report is prepared.
- Some public areas are pesticide-free.

- The public is notified prior to pesticide applications.

Primary differences between Boulder's IPM program and those of the best of the benchmark communities are as follows. In the best of the benchmark communities:

- An individual or board has been charged with oversight authority for the IPM program.
- There are department-specific IPM implementation plans.
- There are policies that restrict pesticides by Toxicity Category.
- Pesticide use is not left to the discretion of the maintenance staff.

The following sections contain a brief program summary of some of the leaders in IPM:

4.1.1 Buffalo, New York
From interview and information sent by Andy Rabb, City Forester

The *Buffalo Pest Management Board* is made up of citizen volunteers appointed by the Common Council, the Mayor and the City's Environmental Management Commission. The board has tight control over the IPM program and the use of pesticides. It began as a reactive and crisis-based entity and has evolved into a proactive group that recently authored a *Pesticide Sunset Ordinance* that was adopted by the Buffalo Common Council. The Pesticide Sunset Ordinance was patterned after the San Francisco Sunset Law in which pesticides are phased out beginning with Toxicity Category I (Danger) and working toward a total ban on all pesticides except for limited exemptions. Exemptions and emergency waivers exist for use of pesticides in emergency situations. Pesticides are being phased out in one-year increments. Category I pesticides were prohibited as of September 1, 1999; Category II were prohibited September 1, 2000; all pesticides will be prohibited as of September 1, 2001. The City does not fund a full or part-time IPM Specialist.

4.1.2 Carrboro, North Carolina
From interview and information sent by Allen Spalt, Director, Agricultural Resources Center

The City implemented a *Least Toxic IPM Policy* in 1999 that includes the preparation of an IPM Manual for specific situations. An IPM Coordinator will develop the manual and oversee the activities of the town staff. A three to five-year phase-out of pesticides is planned with a determination in 2002 to see if total elimination of Toxicity Category I, II, and III is possible. The goal is to phase out conventional pesticides except for urgent and non-routine situations that may require pesticides. The IPM Coordinator has been instrumental in implementing the program, and maintains oversight authority on the use of pesticides and other control strategies. The Coordinator reviews each department's written IPM plans, making a determination on whether they meet city goals or not. The IPM Coordinator must approve all requests for exemptions to the IPM policy.

4.1.3 Davis, California
From interview with Jacques DeBra, Public Works Utility Program and PESP website information at www.epa.gov/oppbppd1/PESP/strategies/old_strategies/davis.htm

In 1991, an *IPM Technical Advisory Committee* was established. Current members include weed scientists, a state IPM representative, a plant pathologist and a landscape contractor. This committee was formed to assist the Parks and Open Space staff with IPM issues. A full-

time IPM Specialist was initially hired and then consolidated with an Environmental Resource Specialist position. Between 1988 and 1997 the use of Toxicity Category I and II pesticides was significantly reduced and is projected to further decrease by 15% in the next five years. The City of Davis is a partner in the EPA's PESP program and has received positive coverage on EPA's website.

4.1.4 Santa Cruz, California
From interview with Kirk Lenington, Resource Ecologist/IPM Coordinator:

Each city department is required to submit an *IPM Implementation Plan* for approval by the city *IPM Coordinator*. The IPM Coordinator assists the city staff, makes recommendations to the City Manager and reviews submitted pesticide exemption requests. The stated goal was to eliminate all Toxicity Category I and II pesticides by January 2000. Pesticide use is still an option as exemptions can be granted by the City Manager after review by the IPM Coordinator.

4.1.5 San Francisco, California
From interview with Debbie Raphael, Pesticide Program Director and other sources listed in the Bibliography:

In 1996, the city passed an *IPM Ordinance* that eliminated Toxicity Category I pesticides as of January 1, 1997, with Toxicity Category II banned one year later in January 1, 1998 and finally Toxicity Category III pesticides banned in January 2000. Limited use pesticides, exemptions for emergencies, and an approved list as submitted by city departments are examples of the types of methods used by the city to allow the limited use of certain pesticides despite the ban. The city has a *Department of Environment* that is responsible for enforcement of the IPM Ordinance (there are no penalties for noncompliance so the enforcement capability is very weak). A *Technical Advisory Committee* is made up of people from the 7 major city departments, pest control companies, IPM experts, public interest advocates, and staff from the Department of the Environment and the County Agricultural Commissioner's office. The city does employ a full-time citywide IPM Coordinator who oversees the IPM program for the entire city. In addition, each of the 80 city departments appoints one person to serve as an IPM Coordinator or contact person within their department.

*4.2 Water Conservation in Leading Comparable Communities*

As part of this audit, several other communities were contacted to determine their water conservation practices. Because water use is strongly affected by the local climate and evapotranspiration rates, the communities chosen are similar to Boulder in these respects. Additionally, they are communities that are considered leaders in good conservation practice.

4.2.1 Arvada, Colorado
Interview with Michael McDonnell, Parks Maintenance Division:

The City of Arvada passed a Water Fund Tax earmarked for upgrading irrigation systems in existing parks citywide on a five-year plan. They operate a Motorola centralized computer controller, and currently 90% of their parks are on the system. They regulate water use with the system based on flow, which is the most efficient way to use the controller, not on minutes. They utilize weather stations to monitor existing conditions.

Another way they are increasing watering efficiency is to increase the size of the water tap on the city water main for each individual park. This allows more water delivery in a shorter period of time, which allows the City to water during evening and early morning hours, when evaporation rates are low.

Arvada has a Computerized Irrigation Technician on staff, a full time position filled by someone trained and qualified to program, upgrade software, and manage the Motorola system. Additional duties include conducting staff training sessions in Water Auditing (determining the precise amount of water needed to sustain a landscape based on ET, water absorption, plant types, slope, soil conditions, exposure, etc.) on individual parks, and designing irrigation for new parks. This person develops the watering program for new and existing parks, based on various plant needs, soil conditions, slope, exposure, etc., with input from field staff.

According to McDonnell, the citizens of Arvada seem to have bought into the idea of reduced water use, and accept the fact that turf areas may be duller in color, and have some brown spots during the hottest months of the season. He also notes that it is their experience that the newer strains of Kentucky Bluegrass are more drought resistant, and can take more foot traffic than the Fescue /Rye blends currently touted as drought resistant.

4.2.2 Aurora, Colorado

The City of Aurora's Ordinance No. 2000-132 addresses water conservation on private property within the city limits. All owners or occupants must obtain a lawn permit from the City of Aurora before installing or enlarging any cool season lawn. Pursuant to the ordinance, lawns are limited in size, soil preparation must be performed, and rain shut-off devices installed with the irrigation systems on large lots. Warm season, or drought tolerant turf areas are exempt from limitation.

Section 138-190 addresses the waste of water. Any continuous watering of lawns, pooling of water or the flowing of water into the storm drainage facility, because of faulty irrigation equipment or any other reason, or the watering of an impervious surface (sidewalk or driveway) is strictly prohibited and subject to fine.

*Interview with Jeff Prink, Parks Maintenance Supervisor, North side Irrigation:*

Aurora has two Motorola Master controller systems in use with one full-time staff member (irrigation maintenance specialist) assigned to each system. They receive data from weather stations located around the city to automatically adjust watering cycles and to water more efficiently. Medians that have irrigated turf are on the Motorola system. Part of the staff members' job description is to manage the programming, check alarms monitored by the system, and troubleshoot field units, as well as perform other general irrigation maintenance.

Aurora's Utility Department funds half the cost of the upgrades and maintenance of the Motorola system and the Parks Department funds the other half (through a water conservation trust fund). Annually, all central controller users submit a "wish list" for improvements to the system.

The Parks Department must pay for its water use, which perhaps is the strongest incentive for water conservation.

4.2.3 Ft. Collins, Colorado

*Interview with Virgil Taylor, Manager of Parks Projects and Cemeteries:*

Ft. Collins Parks and Median Division uses the water meter for each site to analyze water use. Their goal is to use less than the ET rate for each site. There is not a computerized central control system in place. At the end of each year, staff looks at ways to improve water conservation. Because the Parks Department must pay for all of its water use, incentive to conserve is high.

As parks and medians are renovated, areas not used for sports fields or active recreation are converted to dryland native landscapes, watered only to establish initial growth. Soil amendment is always part of the construction process.

The majority of parks over 10 acres utilize raw water from ditches and lakes. The City works with the school district to share water when there are parks and school sites adjacent to each other. The City provides ditch water for both sites when it is available, and the school site provides water from a water tap for both sites when the ditches aren't running.

Ft. Collins uses Fescue turf in its newer parks.

4.2.4 Greeley, Colorado

*Interview with Steve Augerot, Parks Planner:*

The Parks Department maintains all landscaping (parks and streets) for the City of Greeley except for Fire Stations. They have approximately 300 acres of bluegrass irrigated turf in a total of 450 acres of landscaping. Greeley has no centralized controller system but all new and renovated parks are being constructed so that they can go on to such a system when one is purchased.

In the past seven years, Greeley's Utility Department has installed water meters on all their public landscape sites. Over the last three years the Parks Department has conducted water audits on every zone of every sprinkler system city wide. With the use of "tipping buckets" to capture irrigation water as the system runs, they now know the true gallons per minute of each zone. Working with the Northern Colorado Water Conservation District, they have installed a local weather station that calculates the ET rate during the growing season and reports the findings weekly. Combining the information from these three sources into a spreadsheet calculation, the irrigation staff adjusts the watering programs so that water conserved. Augerot estimates that the Parks Department is using 30% less water than it did seven years ago.

Greeley uses bluegrass in irrigated turf situations because it holds up under high traffic. In new construction, they always add 4 cubic yards of compost per 1000 square feet, although Augerot notes that Greeley has very good native soil conditions. As discussed in Section 2.5.3, Boulder specifies only 3 cubic yards of compost per 1000 square feet.

4.2.5 Longmont, Colorado
*Interview with Rob Chapman, Arterial Irrigation Supervisor:*

Longmont's Parks Department maintains all city parks and streetscapes (arterials) in the city. They have a centralized controller system (Eicon) that irrigates all property city wide. By the summer season, all properties will be up and running on "flow" (not "time"). There is an Irrigation Technician whose full time duties are to maintain and upgrade the centralized system. A water auditing program will begin this summer.

Irrigation staff checks each site weekly for problems and repairs them quickly. Watering is done in the late evening and early morning hours when ET rates are low and winds have died down. Zones that are on slopes are watered on short cycles multiple times to prevent run-off. Longmont does not use ET rates to program watering schedules, rather it uses the judgment of the irrigation staff. However, with the centralized system it is easy to "dial the water up or down" to react to weather conditions.

In newly constructed and renovated parks and arterials, strict guidelines for water conservation are followed. Soil amendments are required, irrigated turf is not planted on steep slopes or narrow strips, and plant material is grouped according to watering needs. The irrigated turf of choice for Longmont is a Brome/Fescue mix for everything except sports fields (which are bluegrass).

4.2.6 Westminster, Colorado
*Interview with Steve Vourcy, Parks Foreman:*

The Parks Department maintains all landscaping in Westminster. Some areas are sub-contracted out, but irrigation schedules are set by staff for the contractor. Parks pays the Utility Department for all its water use.

Westminster is considering converting to a centralized controller system and so far one site is set up for it. All sites have rain sensors. In the summer, someone from irrigation staff is on call for irrigation problems that arise at night when the systems are watering.

The irrigation staff uses a software program developed by Aqua Engineering that is based on historical ET data. Staff inputs the square footage watered by each zone and the GPM (gallons per minute) rate of delivery and the program calculates the watering schedule.

Several parks sites and golf course sites are going to effluent water for irrigation, which is roughly 1/3 the cost of potable water. This is treated but non-potable water that comes from the wastewater treatment plant, and is piped back to lakes and ponds to be used for irrigation only.

In newly constructed and renovated parks and streetscapes, strict City guidelines are followed. Soil amendment is required, as Westminster has a problem with high salt content in its native soil.

# 5.0 Findings and Recommendations

*5.1 Definitions of Findings and Recommendations*

The following sections contain the findings of the audit. The findings are the Consultants' opinion based on their investigation, expertise, and knowledge of state of the art practices. The findings are numbered sequentially and generally fall into three types:

- ☺ *Existing good practices.* In some cases, the existing management practices are already congruent with Boulder's goal of being a model of exemplary environmental practices.
- 😐 *Exceptions to Boulder's stated policies.* These are current practices that are inconsistent with the policies as adopted.
- ✪ *Opportunities to adopt improved policies and practices.* During the course of the audit, the Consultants identified opportunities to improve practices in order to become congruent with Boulder's goal "To enact and pursue city policies that cause the Boulder community to become a nationwide environmental leader among communities. The city will be a role model of exemplary environmental practices." These opportunities arise in comparing Boulder's practices to 1) those of other cities contacted for this audit, and 2) best practices known to the Consultants.

For each finding, a preliminary recommendation is made.

*5.2 Environmental Management System Findings and Recommendations*

While the Environmental Management System itself is not a focus of this audit, the information arising out of the audit is intended to support the development of water conservation and integrated pest management plans as part of the City's initiative to implement an Environmental Management System (EMS).

#1 ***Finding:*** ☺ Public Works EMS Pilot demonstrates environmental commitment.
Making a commitment to develop an EMS is a strong positive step toward the Council's goal of becoming a nationwide leader among communities. Only a few communities in the United States are ahead of Boulder in this regard. The process of employee involvement and training has been particularly inclusive and effective.
***Recommendation:*** Continue with the development and implementation of the EMS.

#2 ***Finding:*** ✪ Use the lessons learned from the pilot to implement the EMS.
While the draft pilot plan contains many action-oriented and tactical approaches that will reduce the environmental impacts of Public Works operations, it lacks many of the strategic elements that would be expected in an EMS.
***Recommendation:*** Assure that the EMS does not impose new responsibilities layered on top of existing processes. Rather, its design should arise out of revisiting (and if necessary) revamping the way each department conducts its core responsibilities. Environmental management considerations should be incorporated into each department's cycle of planning, budgeting, implementing, reviewing and improving. Many of the most significant environmental improvements are made during the design and planning process, and this should be an especially strong area of focus. Most

importantly, metrics for measuring performance should be established and integrated into the department's accountability systems. For example, are there environmental considerations incorporated in human resource systems? Are environmental issues incorporated into the budgeting cycle, into the capital planning process? Is it acceptable to challenge the water allocation system if it doesn't support the city's environmental goals?

*5.3 Parks Department Landscape Construction, Renovation, and Maintenance*

#3 ***Finding:*** ✪ Maintenance and planning communication is inadequate. Strengthen communication to better understand and coordinate challenges facing both groups.

***Recommendation:*** Create a feedback loop among parks planning and maintenance staff. Implement a process to open lines of communication between parks planners, all landscape architects and designers working on new projects and the landscape and irrigation maintenance staff who will be ultimately responsible for the project. Include contractors as necessary. This should consist of:

a) Two semi-annual work sessions (late fall, early spring) between the designers and the maintenance staff on general problems.
b) A meeting during the design process on every new project and renovation. Incorporate input from the staff experts on IPM, irrigation, maintenance and design prior to construction. Meeting notes should be documented and included in the project's permanent file.
c) A post-construction field visit to review implementation and follow-up with yearly reviews (for 2-3 years after construction) to monitor success of the project.

#4 ***Finding:*** 😐 Standard landscape design guidelines not fully implemented. The City of Boulder Design and Construction Standards, effective November 16, 2000, Chapters 3 and 10, for construction in public rights-of-way and public easements are not always followed when parks are constructed or renovated. These standards were developed for the work within city rights-of-ways, and are not consistently enforced or followed by the City's own staff. Title 9, Land Use Regulation, Section 9-3.3-2 (m) Water Conservation, also refers to water conservation practices required for development within the City. The standards and regulations are the requirements applied to private developers and for City projects within the public right-of-way and public easements. They are intended to be a guide for private property and other public lands such as parks. *See Finding #21 for related issue.*

***Recommendation***: The City staff should hold themselves accountable to the same (or higher) standards as are applied to contactors.

a) In-house staff should adopt these standards and review them annually to ensure congruence with the City's sustainability goals.
b) Use hardy native and adapted species (including turf) that reduce water use and pesticide/herbicide use. Incorporate the principles of Xeriscape in the guidelines.
c) Reduce irrigated turf where feasible, and eliminate turf on slopes that are greater than 3:1 and/or south-facing and in narrow strips (<10').

#5 ***Finding:*** 😐 Soil preparation is sometimes inconsistent with good practice.
Soil preparation in new and renovated parks is sometimes not consistent with good practice. It is generally accepted in the landscape industry that soil preparation produces healthier plants that will need less water and attract fewer pests. In his book , *Pests of the West*, (Fulcrum Publishing), 1998, Dr. Whitney Cranshaw discusses the importance of proper soil conditioning. Dr Cranshaw states that this nurtures "plants to grow vigorously, with minimal stress, as well as arming them to avoid or outgrow many disease and insect pest problems."
***Recommendation***: Assure that soil preparation is included in all designs and protect the budget item for proper soil preparation as the designs are constructed. Test soil for texture and pH; determine the best soil amendment for each individual site considering the soil characteristics and the planned landscape.

#6 ***Finding:*** ✪ Landscape maintenance personnel lack an up-to-date manual.
A maintenance manual defining the 3 modes or levels of maintenance exists, but does not contain detailed information.
***Recommendation***:
a) Develop a maintenance manual covering watering techniques proven to conserve water and cultivate healthy annuals, perennials, shrubs and trees. List alternative techniques to herbicide/pesticide use for pest problems.
*b)* Keep manual updated, seeking input from the design/maintenance team and IPM interdepartmental group.
*c)* Use the maintenance manual as a training guide for seasonal workers.

#7 ***Finding:*** ✪ Landscape and irrigation staff lack some cross-training.
***Recommendation***:
a) Increase on-going water conservation training for existing staff.
b) Make time in department meetings for sharing best practices among work groups.
c) Provide training for landscape and irrigation staff in Water Auditing (determining the precise amount of water needed to sustain a landscape based on evapotranspiration rate (ET), water absorption, plant types, slope, soil conditions, exposure, etc.)

#8 ***Finding:*** ✪ Irrigation design reviews are not always conducted.
***Recommendation***:
a) All new irrigation design, and renovations of existing irrigation systems should go through an approval process that ensures state of the art, water conserving irrigation equipment is being utilized.
b) A written recommendation of ideal watering increments for each zone should be developed with each design, and conveyed to the maintenance staff when the landscape is completed. This document should not be based solely on the manufacturers' recommendations. Rather, it should be determined based on historical ET data, the type of landscape, the slope, soil, and exposure conditions of each zone. Consideration for time of year when the plantings are being established should be incorporated. Any significant variance by the maintenance staff from the written watering schedule should require approval by the designer.

*5.4 Transportation Median Division*
*Landscape Construction, Renovation, and Maintenance*

#9 ***Finding:*** ✪ Communication between maintenance and planning is insufficient.
***Recommendation:*** Communication between transportation landscape maintenance and transportation planning should be strengthened, to learn strengths and weaknesses of a design after it is constructed or renovated. Implement a process to open lines of communication between all designers working on new projects and the maintenance staff who will be ultimately responsible for the project. This should consist of:
a) Two semi-annual work sessions (late fall, early spring) between the transportation planners and the maintenance staff on general problems.
b) A meeting between project designers and maintenance staff during the design process on every new project and renovation. Incorporate input from staff experts on IPM, irrigation, maintenance and design prior to construction. Decisions on design should be documented and included in the project's permanent file.
a) A post-construction field visit one year after installation to review implementation and monitor success of the project.

#10 ***Finding:*** 😐 Design guides don't always consider water conservation & IPM.
A set of draft guidelines have been prepared, but have not been adopted.
***Recommendation:***
a) Incorporate water conservation principles and IPM considerations in the design guidelines.
b) Adopt design guidelines as the standard for future projects.

#11 ***Finding:*** ✪ Landscape maintenance personnel lack an up-to-date manual.
***Recommendation***: *See Finding #6 under Parks.*
a) Develop a maintenance manual covering watering techniques proven to conserve water and cultivate healthy plants. List alternative techniques to herbicide/pesticide use for pest problems.
*b)* Keep manual updated, perhaps along with the design/maintenance team meetings and IPM meetings mentioned above.

#12 ***Finding:*** ✪ Landscape and irrigation staff lack some cross-training.
***Recommendation***: *See Finding #7 under Parks.*
a) Increase water conservation training for existing staff.
b) Make time in department meetings for sharing best practices among work groups.
c) Provide training for landscape and irrigation staff in Water Auditing (determining the precise amount of water needed to sustain a landscape based on ET, water absorption, plant types, slope, soil conditions, exposure, etc.)

#13 ***Finding:*** 😐 Irrigation design reviews are not always conducted.
***Recommendation***: *See Finding #8.*
a) All new irrigation design, and renovations of existing irrigation systems should go through an approval process that ensures state of the art, water conserving irrigation equipment is being utilized.
b) A written recommendation of ideal watering increments for each zone should be developed with each design, and conveyed to the maintenance staff when the

landscape is completed. This document should not be based solely on the manufacturers' recommendations. Rather, it should be determined based on historical ET data, the type of landscape, the slope, soil, and exposure conditions of each zone. Consideration for time of year when the plantings are being established should be incorporated. Any significant variance by the maintenance staff from the written watering schedule should require approval by the designer.

*5.5 Integrated Pest Management Findings and Recommendations*

#*14* ***Finding:*** ☺ The IPM Program compares favorably with Benchmark Cities.
The City's IPM Program is not unlike IPM programs in many other environmentally conscious communities in the United States. In Boulder as in many of these Benchmark Cities, chemical pest management is used only when the health of a highly-valued plant is threatened and other alternatives are not available or feasible.
***Recommendation***: Interview IPM coordinators from San Francisco and Buffalo to understand on-going impacts of their pesticide phase-outs. Apply this knowledge to the revision of the IPM Policy (Finding #15) and to the development of well-informed and researched approach to pest management within each department (Finding #16).

#15 ***Finding:*** ✪ There are opportunities to upgrade the IPM policy.
Currently, the city uses pesticides on an exception-only basis; however, interpretation of the policy is left to individual staff members. The City's current IPM policy neither addresses Toxicity Categories nor contains quantitative objectives.
***Recommendation***:
Establish a task team to revise the IPM policy. The Interdepartmental IPM Group, Public Works, Parks and Open Space, and the Office of Environmental Affairs should provide input. Review the information from the benchmark cities. Determine a strategic, quantitative goal for pest management and update the IPM policy to include it. The goal should be detailed regarding the definition and restriction of use of specific pesticides. The task team should consider banning specific pesticides and/or toxicity categories to address the concerns raised by the City Council and Board members. The bans should have a specific timeframe for implementation and a method for reviewing potential impacts to the urban forest, golf course, park and median properties. *A gradual phase-out approach similar to those found in San Francisco and Buffalo is discussed in Section 6.0, City Council Study Session.*

#16 ***Finding:*** ✪ Department-specific IPM objectives are not clearly defined.
***Recommendation:*** Develop obtainable, quantifiable objectives by department for pesticide use based on the city's goal (established in response to finding #15). For each objective:

- Ensure those responsible for achieving the individual objectives have the authority and resources (i.e.: time, training, budget, relevant information) to achieve their objective
- Provide something positive (i.e. budgetary perks, Federal grants, employee recognition in a press release and/or bonuses, etc.) to individuals responsible for meeting the individual objectives, not just something negative associated with missing the objective.

#17 ***Finding:*** 😐 Inadequate IPM plans exist at the department level.
The current IPM policy states that each department will have its own IPM plan.
***Recommendation***: Develop departmental implementation plans tied into the department-specific goals (finding #16).

a) Annual written departmental plans should be developed to address implementation based on these objectives.
b) Annual review of these plans should be conducted to evaluate effectiveness and address updates in IPM technical knowledge.

#18 ***Finding:*** ✪ Accountability for the IPM program is inadequate.
***Recommendation:*** Implement a performance measurement system for IPM.

a) Implement a single city-wide program for monitoring and reporting performance as compared to the quantitative objectives.
b) Ensure the Interdepartmental IPM Group collects and reviews annual performance reports.
c) Periodically hire an independent IPM specialist to audit the reports.
d) The City IPM Coordinator should present the findings in graphical form to demonstrate progress. Care should be taken to assure that reporting is consistent from one department to the next and includes pesticides applied by outside contractors.

#19 ***Finding:*** ✪ IPM coordination with adjacent governments is not complete.
The City needs to strengthen IPM coordination with surrounding government entities (University of Colorado, Boulder County, Boulder Valley School District, etc).
***Recommendation***: The IPM Coordinator should hold periodic (perhaps quarterly) intergovernmental meetings with adjacent jurisdictions to build consensus on IPM strategies and to coordinate public outreach.

#20 ***Finding:*** ✪ The IPM Coordinator lacks official oversight authority.
***Recommendation:*** Formally establish an IPM Coordinator Position. This individual would act as a liaison between city department IPM representatives, department directors and the City Manager's office. She or he will need to have an understanding of pest biology, pest identification and a thorough knowledge of IPM strategies. There are several approaches to give this role the authority required to make it effective. Duties would include:

- monitoring compliance with the City's IPM Policy;
- reporting on IPM results and progress to the City Staff, the City Council and the public;
- maintaining a centralized data base on the City's pest problems and IPM methods used;
- holding periodic (perhaps monthly) IPM meetings with department representatives;
- organizing annual staff IPM training.
- seeking outside technical expertise to enhance the knowledge base within the City
- maintaining an updated list of alternatives for banned pesticides;

- overseeing a public awareness and public education program addressing private IPM methods and strategies as well as the city's IPM program;
- developing a working relationship with IPM coordinators from adjacent governing entities by holding regularly scheduled meetings for information sharing and agreeing upon a cohesive strategy public outreach strategy.

#21. ***Finding:*** ✪ Landscape standards in use do not consider IPM.
The City of Boulder Design and Construction Standards, effective November 16, 2000, do not include IPM in Section 3.06 (B) Maintenance of Landscaping, nor does the Land Use Regulation refer to IPM. *See Finding #4.*
***Recommendation:*** Modify Design and Construction Standards and Land Use Regulations to include IPM in accordance with the strategic goal. Staff responsible for input on the current standards should review these annually and update them periodically as IPM philosophies change. The modifications should include:

- The use of hardy "native" and adapted plants (including turf) that will reduce pesticide/herbicide use.
- Implementation of soil preparation to create a healthier foundation for growing environments.
- Reduction in areas planted in landscapes that are not sustainable.

#22. ***Finding:*** ☺ Pesticide notification practice exceeds requirements.
Current pesticide notification practice exceeds requirements in most cases.
***Recommendation:*** Coordinate notification efforts between departments to maintain a consistent process and increase awareness through additional postings on the City's website or through a hotline.

#23 ***Finding:*** ✪ IPM training is informal, and inconsistent for seasonal workers.
***Recommendation:*** Comprehensive training should be provided to all those involved with the design and management of parklands, bikeways and medians.
a) All seasonal workers should take an IPM class prior to conducting pest control in the course of their duties.
b) Annual update training should be required for those who have already taken the initial comprehensive training. Instruction on how to respond to the public when asked questions during maintenance activities should be included.

#24 ***Finding:*** ✪ Pesticides can be purchased without limitation.
Currently, any city employee with a purchasing card may buy a pesticide. While employees are aware of pesticide use and reporting requirements, the lack of control over this function is inconsistent with Boulder's IPM approach.
***Recommendation:*** Consider the development of a citywide pest control contract to consolidate both procurement and contractor performance. *Samples of these types of contracts are available through the City of Santa Monica, CA and Santa Clara County, CA.*

#25 ***Finding:*** ✪ The city lacks a mechanism for annual IPM program updates.
Develop a mechanism for updating the City's IPM Program annually.

***Recommendation:*** The EPA's Pesticide Environmental Stewardship Program (PESP) partnership program merits investigation. PESP publicly recognizes partners that demonstrate their commitment to environmental stewardship and achieve progress in reducing pesticide use while cost-effectively managing pests. Partners are required to prepare an IPM strategy with a goal-oriented approach that is updated annually. Joining the EPA's PES) would demonstrate a commitment to pesticide risk reduction. Additionally, the program assigns an EPA Liaison who shares updated information on EPA policies, programs and procedures.

#26 ***Finding:*** ✪ The IPM program lacks a public awareness component.
***Recommendation:*** Strengthen the public awareness program for IPM. Disseminate information on a website or hotline regarding current IPM practices being conducted by city staff or city-hired contractors. *See Section 7.0, Public Awareness Strategy for more detail.*

#27 ***Finding:*** ✪ The Annual IPM report lacks certain details.
The Annual IPM report lacks certain details such as pesticide toxicity levels and control method rationale.
***Recommendation:***
a) Document the pesticide toxicity level for each application.
*b)* Explain why a particular chemical/method was chosen. Use the data gathered to help set future goals and provide information to the public.

#28 ***Finding:*** ✪ The pruning rotation for park and street trees is insufficient.
***Recommendation:***
The pruning rotation places undue stress on the urban forest.
a) Increase rotational pruning of all sizes of city park trees to every 7 years to improve structure, remove deadwood, and mechanically remove some insect populations before they become a major problem.
b) Increase the rotational pruning schedule for street trees to every 8 years for all sizes of trees in lieu of every 10. This will improve structure, reduce sight clearance problems, remove deadwood, reduce potential liability, and mechanically remove some insect populations. As a whole, this practice would reduce insect and disease problems, thus reducing the need for pesticide applications.

#29 ***Finding:*** 😐 The current tree replacement program is not sustainable.
The current program is inadequate to sustain the population, causing a decline in the overall number of city trees in Boulder's urban forest.
***Recommendation:***
a) In order to sustain the tree population, the replacement ratio should be increased by a minimum of 50% per year. A 2:1 replacement ratio would ensure a sustainable urban forest, proactively removing high maintenance trees, while planting more disease and pest-resistant varieties.
b) Species diversity is also critical. No single tree species should comprise more than 10% of the total tree population. This prevents massive urban forest mortality due to insect or disease epidemics (i.e. gypsy moth, Dutch Elm disease, etc.). *Currently, the Boulder urban forest has several trees that comprise over 10% of the total tree population.*

#30 ***Finding:*** ☺ Foothills Golf Course exemplifies sound IPM strategies.
The Foothills Golf Course is well-managed. Sound IPM strategies are consistently employed.
***Recommendation:*** Consider becoming a part of the Audubon Cooperative Sanctuary Program of Audubon International. The approach to the Audubon program is to promote sound land management and conservation of natural resources, incorporating every aspect of the use of Best Management Practices and IPM. It encourages the superintendent to take a leadership role in conservation projects and be recognized for those efforts. Under this program, management staff should work towards gaining certification in environmental planning, public involvement, IPM, wildlife food enhancement, wildlife cover enhancement, water conservation and water enhancement. These certifications promote and document good stewardship of the golf course.

*5.6 Water Conservation Findings and Recommendations*

#31 ***Finding:*** ✪ The water conservation program lacks an overall objective.
***Recommendation.*** Establish a task team that will develop the objective for water conservation. Some important aspects of this to consider are:

- Use the minimum amount of water necessary to sustain existing landscapes and urban forestry assets.
- Design and construct new landscapes using Xeriscape principles
- Renovate landscapes which require excessive water

#32 ***Finding:*** ✪ The current water allocation system metric is flawed.
The current water allocation system does not encourage water conservation.
***Recommendation:*** Once the overall water conservation objective is identified, develop a metric or means of measuring continuing progress toward the overall objective. A good performance metric should:

- Produce timely, quantifiable and specific data
- Be within the control of the person or group being measured
- Be modified if it produces the wrong behavior
- Meet the expectations of the public
- Be reproducible
- Be understandable

#33 ***Finding:*** 😐 The system for measuring water use is inadequate.
The spreadsheet produced by the Public Works Utility Billing Department showing all meters of the landscape areas, the amount used in various periods, square footage of the irrigated area, and a goal number is inaccurate for quantifying water usage, and ultimately tracking water savings.
***Recommendation:***

- Verify and correct the actual landscape areas watered off each individual meter.
- Verify and correct the actual square footage, separating out the irrigated turf from the shrub beds and hardscape.
- Capture interpretative information such as mainline breaks, or newly laid sod to offer explanation for variances in water use.

- Read the meters on a monthly (or regularly agreed-upon) basis during the growing season.

#34 ***Finding:*** ✪ Maintenance staff has limited incentive to conserve water.
***Recommendation:*** Once the irrigation spreadsheet is viable, use the information available to design incentives for maintenance staff to conserve water.

#35 ***Finding:*** ☺ Water meters are being converted to remote read.
The Utilities Division is in the process of converting all water meters citywide to remote read (meter can be read by a handheld radio device rather than having to open and enter the meter pit).
***Recommendation:*** Once the conversion of meters to remote reads is complete on a site, Public Works Utilities should provide Parks and Medians with handheld remote reading devices. This will help irrigation staff to prevent overwatering because they can read the meters as needed.

#36 ***Finding:*** 😐 The irrigation control system is not fully implemented.
The Motorola Master Controller system used by the Parks Department is an invaluable tool for water management. It allows centralized management of citywide systems, and quick reaction to weather conditions and localized problems. However, the system has never been fully implemented city-wide.
***Recommendation:*** Upgrade the Motorola Master Controller. In order for this to be an effective management tool, the following needs to occur:

a) Create a full time staff position: Irrigation Computer Technician. This position would be fully trained and qualified to manage the upgrade of the Motorola system to 100% operation, manage the program once the system is complete, work with irrigation staff to develop proper watering programs for each site, and work with planning staff on new and renovated irrigation plans. This individual would explore new technology to incorporate into the system, conduct training sessions with other staff in water auditing and in the proper use of the Motorola.
b) Complete the hardware installation in the parks that already have the system so that the system tracks water flow. This in turn would replace the need for the meter reading system in these parks. The Parks staff could track for themselves the water usage and spot problems in a much more timely manner.
c) Bringing the parks not already on line into the system.
d) Note: we strongly recommend that the staff position be created and filled first, so that this individual can manage the system upgrades. If this position is not created, we do not recommend that the upgrades to the system be implemented.

*See Appendix G, City of Boulder Parks, Radio Controlled Irrigation Upgrade and Costs for more specific information.*

#37 ***Finding:*** 😐 Irrigated turf in medians is inconsistent with water conservation.
Medians provide safety by separating lanes of traffic and make urban traffic corridors more attractive. These objectives can be accomplished without the use of irrigated turf, which is hard to water efficiently when surrounded by pavement.
***Recommendation:***

a) Over time, eliminate irrigated turf in medians. As medians are renovated, eliminate irrigated turf, and any need for above ground irrigation. Use mulched beds with trees, shrubs, ground covers, and perennial flowers that are low water using. Irrigate only with drip or other underground emitting type irrigation.
b) In medians that are too wide for mulched beds, use non-irrigated native grasses: either a low growing seed mix that would be mowed 3-4 times per year, or a mass planting of a low growing ornamental type grass such as blue fescue grass that would never be mowed.

#38 ***Finding:*** ✪ Irrigated turf maintenance is not as efficient as possible.
Irrigated turf maintenance is less efficient when conducted by more than one division.
***Recommendation:*** After irrigated turf has been eliminated from medians, transfer maintenance responsibility of areas that will remain permanently as irrigated turf such as "pocket parks" and certain underpass areas to the Parks Department. Public Works' Medians/Bikeways Department could then concentrate on the specialized maintenance of underground irrigation and native type landscapes in medians and bikepaths.

#39 ***Finding:*** ✪ Foothills Parkway is a significant renovation opportunity.
***Recommendation:*** As one of the most visible big water using areas in Boulder, Foothills is a prime target for renovation to a more sustainable landscape. Implement the following recommendations:

a) Eliminate irrigated turf from the medians (the islands between traffic lanes) altogether. Renovate with shrubs, ground covers, and non-irrigated native grasses while saving the existing trees. Convert existing irrigation systems to underground irrigation such as drip.
b) Replace the irrigated turf along roadsides with a low growing drought tolerant NON-irrigated seed mix. Irrigation zones for these areas should be abandoned. Drip irrigation should be installed to run off the existing systems for the existing plantings (trees and shrubs) that are dependent on water. (These plantings have been watered with spray heads). Additional drought tolerant shrub masses should be added over time.
c) Convert the area of the bikepath that runs between Baseline and Colorado Avenue to non irrigated native landscape, as are other bikepaths throughout the City.
d) Renovate interchanges with sustainable landscaping. The large interchange areas at Baseline, Table Mesa/South Boulder Road should remain as mowed irrigated turf until all other areas are converted. These areas should be treated as separate design projects, with a low water use landscape designed and installed over time. These areas are good targets for demonstrating to the public innovative, sustainable landscaping with new technology and methods incorporated to minimize water and pesticide/herbicide use.

# 6.0 City Council Study Session

*6.1 Summary*

A study session among the City Council, the Parks and Recreation Advisory Board (PRAB), the Environmental Advisory Board (EAB) and the Water Resources Advisory Board (WRAB) was held on February 13, 2001. It included a presentation by the consultant, PKM Design Group, on the environmental management audit with findings to date. The discussion was intended to provide staff with policy guidance on the direction of the Water Conservation and Integrated Pest Management (IPM) programs for urban landscapes managed by the Parks & Recreation and Public Works departments.

ATTENDEES:

City Council
Will Toor – Mayor, Don Mock – Deputy Mayor, Dan Corson, Tom Eldridge , Spense Havlick, Rich Lopez, Lisa Morzel, Francoise Poinsatte, Gordon Riggle

Environmental Advisory Board
Bill LeBlanc, Randall Weiner

Parks and Recreation Advisory Board
Pam Hoge , Ed Von Bleichert

Water Resources Advisory Board
Cal Youngberg

The questions posed to City Council included:

1. *The goal of the city's water conservation and IPM policies is to manage public lands so they can function for their intended purposes in a healthy, sustainable and environmentally sound manner.*

2. *The overall goal for water conservation is to use the minimum amount of water necessary to sustain existing landscapes and urban forestry assets while moving toward a more sustainable landscape (i.e. xeriscape) in appropriate areas such as medians and passive use areas in parks.*

3. *The overall goal of the IPM program, as it relates to public urban landscapes, is to have design and maintenance standards for landscaped areas that promote healthy plants and trees, reducing the need for pesticide use. In circumstances where the health of the urban landscape is threatened by disease, weed or insect infestation, the standard IPM hierarchy is followed. Standard practice within the City is to use the lowest impact treatment, with pesticide use as a last resort.*

General**:** A brief overview of the audit goals and objectives were presented. The methodology was also described. Boulder's current approach to water conservation and integrated pest

management was discussed, marking the strengths and weaknesses. The IPM Benchmarking was summarized, noting the communities of San Francisco, Buffalo and Santa Cruz as leaders in integrated pest management. Opportunities were presented including obtaining guidance from City Council and the Boards on which direction they want to take the water conservation and IPM goals, while modifying city systems to reflect changes in direction. Finally, preliminary recommendations were presented focusing on strengthening policy, upgrading outdated landscapes and irrigation equipment, improving water measuring systems and focusing attention on prevention, rather than treatment of pest problems.

*6.2 Specific Requests*
The following sections contain the Consultants' response to various specific requests.

6.2.1 Pesticide Phase-Out
This section was prepared in response to a request for a proposed scenario for a pesticide phase out. In most of the communities researched, pesticide phase-outs were conducted over a period of 3 years on average. This allowed staff adequate time to research alternative methods of pest control prior to the ban, and to assess the impacts during the season following ban. San Francisco and Buffalo both used a 3-year phase-out model, where the initial ban included Toxicity Level 1 pesticides. In order to prepare for the impact of the ban, implementation did not begin immediately. Rather, each staff had at least six months to prepare. The second ban included Toxicity Level II pesticides, which involved more of an impact on their resources. Both communities developed pesticide exemption lists for urgent and non-routine situations that may require pesticides. See Appendix E, IPM Hierarchy Approaches, for more information on how these programs were implemented.

Possible Scenario of a Pesticide Phase-Out for the City of Boulder:

*Year 1 - Eliminate the use of Toxicity Level 1 Pesticides*

*Note: Currently Parks does not use any Toxicity Level 1 pesticides. The three major tree contractors in Boulder (Boulder Tree, Hayes and Green Plan) also do not use any Toxicity Level 1 pesticides on city right-of-way trees.*

After the first year's growing season is over, staff should review its impacts. If needed, modifications to next year's plan would be made. Staff then should research alternatives for Toxicity Level II pesticides, and develop the following year's range of potential treatments.

A reduced-risk list of pesticides for use as a last resort after non-chemical methods fail to manage pest problems should be developed. A framework for evaluating these products should include environmental and human health hazard coupled with an analysis of how the chemical would be used, and the availability of affordable non-chemical or less-toxic alternatives. A toxicologist could be consulted to determine the relative hazard of the pesticides submitted by staff divisions for consideration. These products could also be further categorized into One-Time Use or Limited Use, where limitations could be determined depending on the level of concern for human exposure. The list should be agreed upon by members of the Interdepartmental IPM Group, the IPM Coordinator, department managers, City Council and Boards prior to authorization for use.

*Year 2 – Eliminate the use of Toxicity Level II Pesticides*

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*Note: Forestry only contracts the use of Toxicity Level II Pesticides as a trunk injection. The three major contractors in Boulder (Boulder Tree, Hayes and Green Plan) use Toxicity Level II only as trunk/soil injections or Biopesticides (Neem) on city right-of-way properties.*

City staff should continue to monitor pest problems, record any exempted or limited-use pesticide applications. Each application record should include:

- The target pest
- The type and quantity of pesticide used
- The site of the pesticide application
- The date pesticide was used
- The name of pesticide applicator
- The application equipment used

All of these records shall be made available to the public through the IPM Coordinator.

The annual IPM report will be supplemented with the following information:

- Pesticides used, their toxicity level, the amount used and why they were chosen for use over other non-toxic methods
- Total pesticide use
- Comparison of this year's pesticide use to that of previous years and to established quantitative objectives
- Major pest problems facing the each area where pesticides are used
- Detailed account of non-toxic alternatives used
- Review of Toxicity Level II ban and its impact on budget, labor, and public perceptions of landscape (See 7.0 Public Awareness Strategy)

*Year 3 – Eliminate Toxicity Level III Pesticides*

The Interdepartmental IPM Group, IPM Coordinator, and department managers should first review the impacts detailed in Year 2's Annual IPM Report to determine whether the City is ready to move on to the elimination of Level III pesticides. A presentation should be made to City Council and the Boards on the results of Year 2's ban as detailed in the Annual Report. If there are major problems associated with the ban of Level II pesticides, these need to be overcome prior to proceeding with the next level. Once these concerns can be resolved, a review of the Level III pesticides should take place with submittals of any exemptions by each staff division to the Interdepartmental IPM Group, IPM Coordinator, and department managers. The framework for pesticide evaluation set up during Year 1 should be followed.

It is highly recommended that the city consider the experience of Buffalo and San Francisco in implementing their pesticide bans. Many Toxicity Level III tools are currently being used by the City and it may take more than one year to research and develop alternatives. There will also be enforcement challenges as homeowners and other owners of private land contract for pesticide applications on city right-of-way trees. There is a risk of the private community

increasing pesticide use to compensate for less pesticide use by City staff and contractors. Prior to phasing out of Toxicity Level III pesticides, it is highly recommended that the city actively notify and educate the public on the phase-out. A unified effort with other government entities would also make this more effective within the community.

6.2.2 Possible Pesticide Exemptions

Appendix E, IPM Hierarchy of Approaches, describes how some of the communities researched address pesticide exemptions. For the City of Boulder, possible exemptions may include those effective, low toxicity level pesticides with no public exposure:

- Trunk/soil injections (no public contact)
- Pesticides listed as a Biopesticide by EPA (used on organically grown produce)
- Permethrin (Zimmerman Pine Moth control)
- Glyphosate (spot treatment for weeds at airport runway/taxiway edges, medians)
- M-Pede insecticidal soap (Ash sawfly control)
- Merit (Imidacloprid) (Soil injection for Kermes scale)

6.2.3 Impacts from Chemical Ban

Imposing a ban on the use of all chemical pesticides without considering its various ramifications would be inconsistent with an EMS approach. The decision to use or ban chemical pesticides should arise from revisiting and then revamping the way each department conducts its core responsibilities. Careful consideration of each department's cycle of planning, budgeting, and implementation of its duties is necessary before a ban is imposed. The goal of sustaining public lands for the use they were intended incorporated into the thought process by considering:

- Whether the increase of weeds in the parks, the shrub beds and flowerbeds, the cracks in the pavement and in medians will change the aesthetic perception of Boulder as a welcoming and well-kept community.
- Will the increase in mortality in the urban forest create negative environmental impacts such as increasing heat islands within the city and increasing pollution?
- Will the increased need for labor, transportation and equipment needs that would follow actually cause more environmental damage than the current level of pesticide use?

The City of Boulder has an excellent, environmentally-conscious staff who are dedicated to public service and landscape maintenance. Allowing this staff to research and develop a pesticide reduction scenario as described in 6.1.1 of this audit will encourage staff input and cooperation with the program.

6.2.4 Turf Replacement Alternatives

A request was made to investigate alternative types of grasses for playing fields and parks that may be more drought tolerant. According to Dr. Tony Koski of Colorado State University, there has been tremendous progress made in the development of better-suited turf species for this environment in the last 20 years. Many of the parks and medians in the City of Boulder were developed more than 20 years ago with turfgrasses that do not recover quickly from high traffic or that require excessive quantities of water to keep them green.

Proper selection of turf species and/or cultivars is important and should be suited to the specific site. Often thin or poorly growing turf is a sign of old varieties, a previously sunny area becoming shady over time due maturing shade trees, improper fertilization or irrigation, compacted soil, excess thatch or pre-emergent herbicide injury. The following issues need to be addressed for each site where turf replacement may be considered:

- What is the intended use of the turf?
- What is the desired quality level?
- How much maintenance can be provided and what is the availability of resources?
- Are there soil or water problems?
- Is there shade?
- Is there a history of pest problems?
- What is the availability of seed or sod in the selected species?

Below, Figure 1 compares the most commonly used turf species in Colorado developed by Dr. Tony Koski.

**Figure 1** Comparison of Tall Fescue, Buffalograss and Kentucky Bluegrass

| Characteristic | Tall Fescue | Buffalograss | Kentucky Bluegrass |
|---|---|---|---|
| Native to Colorado | No | Yes | No |
| Leaf Texture | Somewhat coarser, soft | Very fine, soft | Fine, soft |
| Color | Light to dark green | Light green to blue green | Light to dark green |
| Length of Green Season | Long – March to December | Short – May to September | Long – March to December |
| Mowing Requirement | More frequent | Infrequent/none | Less often than Fescue |
| Fertilizer Requirement | Lower | Very low | Higher |
| Iron Chlorosis | Infrequent | Infrequent | More frequent |
| Disease Problems | Infrequent | Almost none | More frequent |
| Insect Problems | Almost none | Almost none | More frequent |
| Traffic Tolerance | Good | Fair | Good |
| Recuperative Potential | Poor to fair | Good to excellent | Good to excellent |
| Thatch Formation | Little (slow to form)/none | Generally not a problem | Can be excessive |
| Compaction Tolerance | Fair | Very Good | Good |
| Heat/Cold Tolerance | Excellent | Excellent | Excellent |
| Shade Tolerance | Good/Excellent | Poor to fair | Poor to fair |
| Salt Tolerance | Very good | Fair | Poor to fair |
| Sod Availability/Cost | Less available/higher cost | Less common/highest cost | Very common/low cost |
| Irrigation Requirement | Often lower than bluegrass, but can be the same or higher | Very low to none required | Low to high, depending on soil |

As illustrated, there are many advantages and disadvantages to the various types of turfgrass depending on their intended use. Dr. Koski does recommend using improved varieties of Kentucky Bluegrass for sports field applications. Its ability to recover quickly from frequent wear and tear, the wide availability in both sod and seed, and softer texture make it preferable over Tall Fescue. A mix of 50-100% of Aggressive type blended with 0-50% of Northern Latitude type Kentucky Bluegrass would be recommended. The Aggressive types are very dense turf with excellent lateral growth and strength providing superior wear tolerance. Recently developed cultivars that are hardier include A-34, Limousine, Mystic, Touchdown and Princeton 104. Northern Latitude types include Alpine, America, Eclipse, Glade, Midnight, Blacksburg, Opal, Indigo, Nugget, Apex and Unique.

For areas with less intense foot traffic, such as passive park areas, the Mid-Atlantic varieties of Kentucky Bluegrass provide excellent drought-tolerant capabilities. Livingston and SR 2000 are two cultivars Dr. Koski recommends. These species reduce watering requirements by over 50% due to their deep rooting capabilities. They often perform well in shade, which may be ideal for some of the older Boulder parks with mature trees. Turf-type tall fescue could also be used in these circumstances, with Adobe, Coronado, Eldorado, Lexus, Rebel 3D and Titan cultivars.

Although Buffalograss is native, has excellent heat and drought resistance, few disease and insect problems and requires only infrequent mowing, it is a warm-season grass with a very short growing season (late May to first frost). It does not do well in shade, and won't tolerate heavy foot traffic; however, for those applications where these constraints aren't a factor, the Bison cultivar of Buffalograss would be a good choice for a more sustainable turf.

# 7.0 Public Awareness Strategy

*Promotional Tactics*

A multi-tiered public awareness plan would provide the City of Boulder with many options to get the message of water conservation and reduced pesticide use out to local constituents. Combining efforts with PACE, CSU Cooperative Extension, University of Colorado, Boulder Valley School District and Boulder County would be beneficial. The following recommendations are divided into 3 categories: Low cost/easy to implement; Moderate cost/more involved to implement; and Higher cost/most involved to implement.

*7.1 Low Cost/Easy to Implement (<$1,000 per item)*

- Public interest announcements, media personalities delivering the water conservation/IPM message. Convey information on preventive measures to take during times when pest/disease outbreaks are prevalent
- Open forums for the public at key locations at the beginning and end of growing seasons
- Coordination with public interest groups and local environmental groups to solicit input on departmental plans
- Articles or columns in the Daily Camera and/or other local publications by city staff on current pest issues. (Some staff are already writing articles; perhaps these articles could be reprinted in publications with larger audiences.)
- Continue notification efforts with signage at all pesticide application sites

*7.2 Moderate Cost/More involved to implement ($1,000 - $5,000 per item)*

- Should City Council adopt a pesticide phase-out program, develop and distribute a brochure to explain this modified direction to the general public
- Distribution of practical, easy to understand and up-to-date pest fact sheets on IPM options and pest management questions. Fact sheets on current problems in the Boulder area should be developed by the IPM Coordinator in consultation with CSU Cooperative Extension.
- Work with CSU Cooperative Extension Service to set up a booth at the local farmer's market to provide educational materials and newsletter updates on pest management
- Become a member of the EPA's PESP (Pesticide Environmental Stewardship Program) to develop a mechanism for updating the City's IPM program annually. Program information is posted to their website and publicly recognized to further demonstrate to the public a commitment to pesticide risk reduction. The City's website could provide a link to the PESP website. Cost associated with this effort would be for the IPM Coordinator to spend a minimum of 40 hours preparing report to EPA.
- Solicit volunteer groups to assist the City with pest monitoring, exclusion and prevention techniques. Cost would include staff coordination and training efforts, estimated at a minimum of 80 person hours per year.

*7.3 Higher Cost/Most involved to implement (>$5,000)*

- Install a permanent IPM kiosk or bulletin board at various city offices (not just the environmental office) to display IPM updates/fact sheets

- Convey information through the city website and other computer-based technologies directed to the general public, including an “IPM Chat Room” to post pest-related questions, receive information on training dates, download IPM pest fact sheets, obtain the City’s current IPM prevention schedule and connect to other IPM links
- Create an IPM “hotline” for citizens to call for information on current practices and to get common questions answered. Cost would involve a special phone line set up with menu for common questions and/or current IPM methods being used on site. Also would include weekly updates by IPM Coordinator at 4 hours per week.
- Conduct on-site surveys at various locations for public opinion on changes implemented – strive to reach the *users* of the facilities, i.e. active recreational users vs. passive users. In order to reach a broad cross-section of the public, this would need to be conducted seasonally over the course of 9-12 months, possibly with multi-year input.
- Sponsor a public education forum on alternative pest management methods with hands-on demonstrations, group assignments and question and answer panel discussions. City IPM managers and local or regional IPM experts could be included on the panel.

It would be most worthwhile if the City implemented a variety of techniques to reach the largest audience. Budget and labor restrictions will dictate the methods chosen, and not all may be successful. Varying conditions such as timing of an event, location of a bulletin board, visibility of an article or availability of staff will affect the success of implementation. Most importantly, all of these suggestions would involve additional coordination, direction and support from management and staff.

# 8.0 Performance Measures

One of the outcomes of this audit is to assist in the development of system-wide performance measures which focus on results and accomplishments of the established water conservation and pesticide reduction goals. Until the City of Boulder knows where they want to go, they cannot manage for results. A performance measure is an indicator which conveys information on the level of success of public programs or activities. Performance measures can occur at any of the three basic levels: broad (societal) goals, obtainable government objectives, and program achievements.

*8.1 Broad (Societal) Goals*
By establishing broad goals in water conservation and pesticide reduction, Boulder has set forth its vision of itself as role model of exemplary environmental practices.

*8.2 Obtainable Government Objectives*
While broad goals often require the coordination of many governmental jurisdictions, and other entities, obtainable government objectives refer to goals for which Boulder itself can strive for and where effectiveness can be measured. Examples include:

- *Reduce* the total amount of pesticides applied through the application of the IPM hierarchy, taking into consideration economic realities, and the promotion of healthy landscapes
- *Control* the rate, method and type of chemicals applied
- *Establish* a water allocation system based on evapotranspiration rates and needs of the existing landscape
- *Reduce* non-sustainable public landscapes

*8.3 Program Achievements*
At the lowest level of the objectives hierarchy, program achievements measure the accomplishments of individual work groups. These accomplishments should help Boulder achieve one or more of its obtainable objectives. Examples include:

- Develop and implement divisional IPM plans
- Educate all maintenance staff on IPM and water conservation strategies
- Inventory high maintenance landscapes and develop a plan for conversion to sustainable landscapes
- Improve water use data
- Plant more pest resistant or stress tolerant cultivars
- Control pests culturally, biologically and/or mechanically
- Use soil testing and plant tissue analysis to help determine nutritional requirements
- Evaluate results in an on-going process

*8.4 Measuring Results*
Once objectives and program achievements are defined, they can be tracked for their effectiveness and presented to the public. Performance should also be linked to budgets, providing departmental and individual incentives. Two areas of importance are discussed below:

8.4.1. Reduce the total amount of pesticides applied

Successful performance for this objective will be measured by a reduction in the amount and toxicity of pesticides used by each of the divisions. This reduction can be further broken down into toxicity categories for tracking purposes. The amount of reduction, along with alternative methods for pest control will need to be documented in the departmental IPM plans.

In combination with this overall reduction, the economic threshold that the City of Boulder is willing to accept for public landscapes needs to be defined and distributed to maintenance staff, so they have a yardstick by which to accomplish their mission. For example, a passive use park might be allowed to have up to 25 weeds per 100 square feet before it reaches the level where action must be taken or the use of the park will decline. Thresholds will be different for ballfields, golf course greens, passive use park areas and roadway right-of-ways.

Thresholds for pest problems also need to be set for each type of area managed; chemical treatments should only be used when these are exceeded. This requires daily scouting for pests by personnel trained to recognize pest problems at an early stage. Information on the biology of insect problems common to Boulder should be included in the IPM plans. Thresholds may also be based on the previous history of infection at the site. Similarly, weed problems can be handled with the same objective in mind.

Monitoring programs for pest and weed problems must focus on two objectives: the *functional* objective to determine if any functional impact is occurring at the area; and the *IPM* objective, to determine if pest populations are building to a point where some form of control will be required. Some items need to be monitored more often than others, even daily if possible, such as soil moisture, disease incidence, weed infestation and leaf insects. Other regular monthly inspections could be conducted on the soil profile to identify the presence of fungi, compaction, and effectiveness of the irrigation system. Use impacts could be recorded through staff observation and public comments. Detailed records should be kept to continually evaluate the results.

8.4.2. Revise the water allocation system

Performance measures for this objective are currently being discussed by a group of task teams set up in a meeting facilitated by this audit team. The ultimate objective of the performance measures will be to identify performance measures that will encourage each work group to contribute to the “design, construction, maintenance and, where necessary, conversion, of landscapes to meet their intended purpose while moving toward a more sustainable landscape (i.e. using no more water than necessary, pest-resistant).”

The task teams are addressing three areas:

1. Inventory existing land parcels and
    a. Reach consensus on their intended purpose. That is: athletic field, passive recreation, etc.
    b. Develop landscape guidelines suitable to each category of purpose.
    c. Consider a triage program to be implemented in the event of a water emergency.

2. Consider a financial system that will support maintenance of existing assets and modifications as necessary to replace and renovate land parcels with landscaping inappropriate to its agreed upon purpose.
3. Consider a management system approach for the parks irrigation system.

Each task team is charged to:

- Write a statement of the objective of the task team
- Identify the data gaps preventing development of an appropriate performance metric
- Develop a plan for gathering the data (specifying the resources that will be required to execute the plan)

The ultimate objective will be to develop work-group specific performance metrics for water conservation. The city employees convened agreed that a good performance metric will:

1. Measure the right thing (“Qualifiable”)
2. Be within the control of the person or group being measured
3. Not a “set up” for failure
4. Be quantifiable and specific
5. Be modified if it produces the wrong behavior
6. Meet the expectations of “The Public” (There are many publics to consider here.)
7. Be reproducible
8. Be understandable
9. Be timely, (i.e.: provide information soon enough to change course if necessary)
10. Be fair

# 9.0 Conclusion

The Consultants reviewed the IPM and water conservation policies and practices of the City's Parks and Recreation Department Parks Division and the Public Works Transportation Maintenance Division. The Consultants prepared this report after receiving direction from the Parks and Recreation Advisory Board and from a Study Session before the City Council and representatives of the Environmental Advisory Board, Parks and Recreation Advisory Board, Transportation Advisory Board and Water Resources Advisory Board.

The Consultants found that the city staff has a strong water conservation ethic and has had a long-standing focus on reducing the use of pesticides. The Consultants have identified a number of findings and recommendations that, when implemented, will allow the city to meet its goal of becoming "a role model of exemplary environmental practices."

To implement many of these recommendations, the City must first focus on *getting accurate baseline data*, particularly in the areas of current water use and the actual cost of existing maintenance activities. Once accurate baseline data is collected, the City will have a better picture of where they currently stand with these issues. Quantitative goal setting will be more meaningful, giving the staff a starting point from which to compare future activities.

Secondly, *many of the recommendations involve an increase in budget, labor or both*. Either additional funding needs to be obtained, existing services reduced or a proactive volunteer campaign launched to implement many of the suggestions in this audit. In some cases, staff may have to change the way they do their jobs, requiring additional training and exposure to new ideas and technology. Without upper management support, the recommendations will be difficult to achieve, resulting in failure and resentment of those individuals required to do more with less.

Finally, *actively engaging the public to inform them on current practices, provide educational tools and solicit their views* on how Boulder can improve the way public landscapes serve its users must be done on a continuous basis. The City will have to make important choices on where the priorities for landscape sustainability should be directed.

The Consultants recommend that the city develop clear, quantitative goals related to IPM and water conservation. The goals should include continuous improvement component. To achieve the goals, the Consultants recommend that the city implement the planned environmental management system. In implementing the EMS, each city department involved will identify department-specific targets; collaborate with other departments which impact its ability to achieve the targets, establish accountability for meeting the targets; and assure that each individual understands how to conduct his or her responsibilities in a way that contributes to achieving the department's target and has adequate resources to conduct his or her responsibilities in this way. The types of resources required may include financial resources, relevant information, adequate time, appropriate training, and sufficient authority. Finally, the EMS will include a periodic review of the progress toward the goals and an opportunity to revise the goals as appropriate in keeping with the City Council's Environmental Goal.

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